

Organizations with Power-Hungry Agents

Wouter Dessein and Richard Holden*

preliminary draft – do not cite or circulate without permission.

November 14, 2016

Abstract

We analyze a model of hierarchies in organizations where neither decisions themselves nor the delegation of decisions are contractible, and where power-hungry agents derive a private benefit from making decisions. Agents are probabilistically informed about the optimal action and maximize their private benefits as well as the payoffs of the activities assigned to them. Lower-level managers are more specialized and therefore internalize fewer externalities.

We study delegation decisions and optimal organizational design in this environment. A designer may remove intermediate layers of the hierarchy (eliminate middle managers) or de-integrate an organization by removing top layers (eliminate top managers). We show that stronger preferences for power result in smaller, more de-integrated hierarchies. Our key insight is that hoarding of decision rights is especially severe at the top of the hierarchy. As a result, even a top manager who is a better stand-alone decision-maker than the middle and lower-level managers below him, may add negative value to a hierarchy. In contrast to standard delegation models, the uncertainty surrounding decisions and the magnitude of incentive conflicts of lower-level managers have a non-monotonic impact on the value of top and middle managers.

*Dessein: Columbia Business School. email: wd2179@gsb.columbia.edu. Holden: UNSW Australia Business School. email: richard.holden@unsw.edu.au. Holden acknowledges support from the Australian Research Council (ARC) Future Fellowship FT130101159.

1 Introduction

Hayek (1945) famously argued that decisions are best made by agents who have relevant, local information.¹ Taking this information to be exogenous, and in the absence of any private benefits or agency conflicts, this immediately delivers a clear theory of the internal structure of organizations—in particular, to whom decision rights should optimally be allocated.

Following from this fundamental observation, a large literature has studied the *optimal design* of organizations both in the presence of agency costs, and without them.² This has deepened our understanding of how organizations—especially firms—are structured, how decision rights are allocated, how effectively information is communicated internally, and what decisions are ultimately made.

Relative to this large literature, an innovation of this paper is to consider organizations that are partially designed by managers *themselves*. In particular, we consider managers who are *power hungry* in the sense that they get rents from making decisions themselves, rather than delegating them to a subordinate. We show that this framing can lead to quite different outcomes than the traditional approach. For instance, hoarding of decision-rights has important implications for the size and scope of organizations. While larger “power rents” results in excessive centralization for a given hierarchical organization and firm size, the presence of more power-hungry managers also tends to result in a de-layering of the organization and in smaller, more de-integrated firms. Hence, while an across-the-board increase in decision rents results in smaller and flatter organizations in a number of natural benchmark cases, the impact on the centralization of decision-making tends to be ambiguous.

Our model considers an organization involved in a set of activities, each of which

¹As he put it: “If we can agree that the economic problem of society is mainly one of rapid adaptation to changes in the particular circumstances of time and place, it would seem to follow that the ultimate decisions must be left to the people who are familiar with these circumstances, who know directly of the relevant changes and of the resources immediately available to meet them.”

²Early important contributions include Chandler (1962) who emphasized the link between a firm’s organization structure and the strategy it pursues; Marschak and Radner (1972) introduced the formal analysis of working in teams, leading an entire literature on “team theory”. The importance of agency costs in organizational design was first noted by Berle and Means (1932), and these have played an important role in much of the organizational economics literature as they have in corporate finance in thinking about the private benefits of control and the optimal structure of voting rights.

requires an action to be undertaken and each of which is assigned to a hierarchy of managers. Managers are probabilistically informed about the optimal decision, and can delegate to lower-level managers. The organization faces two types of agency problems. The first is familiar from the delegation literature.³ Managers are biased when taking an action and delegation therefore entails a loss of control. Concretely, as in Alonso, Dessein and Matouschek (2008) and Rantakari (2008), managers are assigned a subset of the organization's activities and do not internalize externalities on activities not assigned to them. Importantly, lower-level managers are assigned a smaller set of activities and are therefore more biased. Only the top manager makes unbiased decisions as she is assigned all of the organization's activities. The top manager is also assigned the initial decision right for each activity. One can think of a delegation hierarchy consisting of a CEO, followed by a division manager, a sub-division manager, a department manager, with each subsequent manager being assigned a subset of the activities of his superior.

The second agency problem is novel, and concerns the delegation of the decision itself. Managers are power hungry in that they earn a private benefit if they, themselves, take the decision. As a result, delegation decisions are subject to moral hazard. We think of decisions as complex and multi-dimensional with some aspects of the decision affecting organizational payoffs and other aspects affecting private (even psychological) benefits of managers. As we discuss below, there is also a fast-growing experimental literature which demonstrates how decision rights carry an *intrinsic value*, beyond their instrumental benefits for achieving certain outcomes (e.g. Bartling, Fehr and Herz, 2014). This literature shows how individuals are willing to sacrifice expected earnings to retain control and finds a substantial under-delegation of decision-rights.

The tools of the organization designer are very limited in our model. In the spirit of the incomplete contracting literature⁴, neither decisions nor the delegation of decisions are contractible. Moreover, managers do not respond to monetary incentives. The organization designer, however, can remove *layers of management* to avoid managers from hoarding decision rights. For example, she can remove the CEO or top manager so that the initial decision right is delegated by default to the next layer of management.

³See, for example, Aghion and Tirole (1997), Dessein (2002), Alonso, Dessein and Matouschek (2008) and Rantakari (2008).

⁴The pioneering contributions are Grossman and Hart (1986) and Hart and Moore (1990). See Aghion and Holden (2011) and Dessein (2015) for an overview of the ensuing literature.

Alternatively, she can delay the hierarchy by removing intermediate layers of middle-management. In the limit, only the lowest-level manager remains, who is assumed to be perfectly informed about the optimal decision, but ignores any externalities with other activities. This limit corresponds to a set of de-integrated, stand-alone activities. Equivalently, additional layers of management can be interpreted as increased integration of activities. Similarly, the absence of a top manager can be interpreted as the de-integration of one large hierarchy into a set of smaller, independent hierarchies. Section 2.3 discusses how our model can be re-interpreted in terms of asset ownership, where control (access or ownership) of activity-specific, division-specific or organization-wide assets conveys authority over activities.

Our model sheds light on two important questions. First, what is the optimal number of layers in a hierarchy? When do middle managers – whose role it is to internalize externalities between various activities – destroy value? Second, what is the optimal size or scope of the organization? Concretely: when does integrating two sets of activities by putting them under common control of a top manager add value or destroy value?

In the absence of decision rents, additional layers always improve outcomes and, similarly, integrating disjoint sets of activities always adds value. Naturally, the presence of power-hungry managers may overturn this conclusion. Indeed, uninformed middle or top managers may then hoard decision rights, preventing better-informed lower-level managers from taking informed, albeit somewhat biased, decisions. Our setup thus gives a rather direct answer to Williamson's selective intervention puzzle: why is integration not always value-increasing? By assumption, selective intervention is subject to a moral hazard problem in our model: managers may intervene and centralize decision-making even when delegation is optimal. In this sense, more power-hungry managers decrease the value of managers at all hierarchical levels.

More surprisingly, our model shows that the inefficient hoarding of power tends to be more severe at the top of the organization. While all layers of a hierarchy are valuable when preferences for power are weak, under certain regularity conditions, layers at the top are the first to be removed when preferences for power become stronger. Consider, for example, a three-layered hierarchy with (potentially) a top manager, a middle-level manager and a worker. A sufficient condition for the middle layer to be valuable is that

the middle manager is a better decision-maker than the worker (i.e. in expectation she takes better decisions than the worker). Counter-intuitively, the latter is not true for the top manager. Indeed, the top manager may strictly reduce value even when she is a better decision-maker than both middle manager and worker. To see this, assume that the worker is twice as biased as the middle manager, but also perfectly informed about the best decision to be taken. Note that in this example, the bias of the middle manager from the perspective of top manager is identical to the bias of the worker from the perspective of the middle manager. At the same time, the worker is much more likely to be informed about the optimal decision than the middle manager. It follows that an uninformed middle manager is more likely to delegate to the worker, than an uninformed top manager is willing to delegate to the middle manager. Moreover, the top manager may even be less willing to delegate directly to the worker given the latter's double bias. As a result, for intermediate preferences for power, the top manager rarely delegates, whereas an uninformed middle manager would almost always delegate. Even though the top manager may be a better decision-maker in isolation (without the possibility of delegation), she may be no match for an efficient team of middle manager and worker. The lone top manager is then optimally removed by the organization designer because of an unwillingness to delegate to admittedly inferior lower-level managers.

More generally, in an N-layer hierarchy where (1) all managers are equally good decision-makers in isolation, (2) all managers enjoy the same deterministic decision rent and (3) the bias of managers increases linearly as we move down the hierarchy, we show that the top managers of the hierarchy are removed one by one starting with the highest level manager as the decision rent increases.

Beyond comparative statics with respect of the magnitude of decision rents – which generally result in smaller, more de-layered organizations – we show that the value of both top and middle managers tends to be non-monotonic in the uncertainty surrounding the decision and in the bias and expertise of their subordinates. Intuitively, while say an increase in the bias of subordinates makes a superior more valuable, this also makes it more likely that the latter will inefficiently hoard decision rights. As a result, a manager is least likely to be valuable for intermediate values of bias and expertise of her subordinate. This yields the counter-intuitive result that an increase in externalities between activities may initially result in fewer layers of management and less central-

ization. This finding shows how preferences for power may reverse a standard result in the delegation literature (see, e.g., Alonso, Dessein and Matouschek, 2008)

A final implication of empirical relevance is the extent to which decision-rents result in decision-making becoming more or less centralized. While, by assumption, power-hungry managers are biased towards too much centralization, the optimal size of a hierarchy also tends to be smaller when decision-rents are larger. This is consistent with the observation that firms and hierarchies in developing economies (where decision rents are arguably larger) tend to be both smaller and more centralized (Bloom, Sadun, Van Reenen (2102), Bloom et al. (2013) and Hsieh and Klenow (2014)). Thus, an increase in decision rents may increase the likelihood that agents at the bottom of the hierarchy make decisions.

One open question is whether firm owners (e.g. boards) or managers decide on the size of the hierarchy. In our model, the only conflict between firm owners and the top manager concerns the value of the top manager herself. Indeed, there is complete alignment as to which layers should be ‘active’ or present below the top manager. At the same time, one insight of our paper is that hoarding of decision rights is most extreme at the top of the organization. As a result, if the board is captured by top management, then inefficient organizations are likely to prevail where headquarters decrease total firm value because of their reluctance to delegate.

1.1 Related Literature

Our paper connects to a number of literatures. Rather than give an exhaustive overview we will highlight how our work differs from a selected number of papers.

Literature on hierarchies The paper perhaps closest to ours is Hart and Moore (2005), who analyze a model of the design of hierarchies in a setting where agents perform different tasks (coordination versus specialization). Like us, decisions are non contractible, and like us their model speaks to the optimal degree of decentralization. The key assumption they make, however, is that decisions are made hierarchically: the senior person in the hierarchy who “has an idea” about a decision makes it. Agents never actively choose whether or not to delegate. In this setting, they study when, for a given number

of agents, generalists (or coordinators) should be senior to specialists. Unlike ours, their model does not speak to the optimal number of hierarchical layers in an organization.

Also closely related to our paper is Aghion and Tirole (1997) who consider a setting where there are two agents, one of whom has “formal authority” to make a decision.⁵ The agents, however, are probabilistically informed about a decision and the likelihood depends on privately costly, non-contractible effort. They show that the agent who has formal authority may not have “real authority”, in the sense that she will not take the actual decision very frequently because she optimally puts in little effort to having an idea. This is likely to occur if, for instance, the two agents have highly congruent preferences about which projects to pursue. Like us, they have an incomplete contracting model of hierarchies. Unlike us, however, they focus on *ex ante* incentives for effort rather than delegation of decision rights in a multi-layer hierarchy.

The two papers above focus on the role of hierarchies in making decisions when information is dispersed and agents have conflicting preferences. Other models in this class of decision hierarchies include Dessein (2002), Alonso, Dessein and Matouschek (2008), Rantakari (2008), Hart and Holmstrom (2010) and Dessein, Garicano and Gertner (2010).⁶ Decentralization or ‘removing the top layer’ in a decision hierarchy may be optimal because centralization results in a distortion of information (Dessein, 2002), demotivates information acquisition (Aghion and Tirole, 1997) or because the top-manager is biased (Hart and Holmstrom, 2010). Unlike in our model, however, the principal or top manager is always valuable if she is, on average, a better decision-maker than the agent. Together with Hart and Moore (2005), our paper is also novel in offering a theory of multi-layered hierarchies with more than two layers.

Another strand of literature focuses instead on how hierarchies facilitate the division of labor in information processing or problem solving (Radner 1993, Bolton and Dewatripont, 1994, and Garicano, 2000).⁷ While this approach allows the study of large, multi-layered organizations, communication costs (such as delay) rather than incentive

⁵Baker, Gibbons and Murphy (1999) analyze a repeated-game version of Aghion and Tirole (1997) and show how the desire to build a reputation can sustain delegation to a subordinate even when it is not an equilibrium in the one-shot game.

⁶Harris and Raviv (2002) and Alonso, Dessein and Matouschek (2015) study decision hierarchies in a team theoretical setting where there are no incentive conflicts, but where communication is limited.

⁷See Garicano and Van Zandt (2013) for a comprehensive review of this literature.

conflicts determine the optimal organizational structure.⁸

Literature on preferences for power Social psychologists have long argued that power is a basic human need. Power is one of five *need categories* in Murray (1938)'s system of needs. In his human motivation theory, David McClelland (1961, 1975) proposes that most people are consistently motivated by one of three basic desires: the need for affiliation (or being liked by others), the need for achievement, and the need for authority or power. The intrinsic value of autonomy is also at the center of the self-determination theory of Deci and Ryan (1985). In economics, private benefits of control and preferences for power play a central role in the corporate finance literature (e.g. Aghion and Bolton, 1992, Hart and Moore, 1995, and Dyck and Zingales, 2004) and the organizational economics literature (Aghion and Tirole, 1997).⁹

Perhaps the cleanest evidence that decision rights carry an *intrinsic value*, beyond their instrumental benefits for achieving certain outcomes, is presented in an experimental paper by Bartling, Fehr and Herz (2014). They develop an approach which rules out alternative explanations based on regret and ambiguity aversion, and show that the intrinsic value of decision rights is both significant (on average 17 percent of the monetary payoffs associated with a decision¹⁰) and correlated across individuals and game parameterizations. Interestingly, higher stakes are associated with proportionally higher intrinsic values. These results confirm similar findings in Owens, Grossman and Fackler (2014), who also find that individuals are willing to sacrifice expected earnings to retain control,¹¹ and Fehr, Herz and Wilkening (2013), who find a significant under-delegation of decision rights from principals to agents in settings where delegation is clearly optimal.¹² Evidence on the private benefits of autonomy can also be found in the entrepreneurship literature. Non-pecuniary motives such as the desire “to be one’s own

⁸Calvo and Wellisz (1978) emphasize the role of hierarchies in monitoring effort. Their focus is on explaining wage differentials across layers, rather than organizational structure.

⁹In those literatures, control may either convey tangible benefits or be more ‘psychic’ in nature. Both interpretations are consistent with our model.

¹⁰Bartling et al. compare the certainty equivalents of delegation lotteries and non-delegation lotteries, as all decisions are risky.

¹¹They find that the average participant is willing to sacrifice 8 percent to 15 percent of expected earnings in order to control their own payoff.

¹²See also Sloof and von Siemens (2016), who point to overconfidence and an “illusion of control” as a source of preferences for power.

boss” are a major self-reported driver of the decision to enter self-employment (Pugsley and Hurst, 2011) and entrepreneurs typically forego substantial earnings when becoming self-employed (Hamilton, 2000, and Moskowitz and Vissing-Jorgensen, 2002).

1.2 Outline

The paper proceeds as follows. Section 2 outlines the model, derives the expected payoffs for different decision-makers and information structures, and discusses some of our modeling assumptions. Section 3 analyzes a three-layered hierarchy consisting of a top manager, a middle manager and a worker. Most of our key insights are easily illustrated in this simple setting. Section 4, focuses on the special (but very tractable) case where the private benefits of power are deterministic and identical for all managers. This limit case allows us to provide very precise comparative statics, as well as a generalization of our key result to $N > 3$ layers. Section 5 extends the model along various dimensions. Section 6 concludes by discussing some empirical implications of our model and future avenues of research. In the Appendix we provide a micro-foundation of our payoff structure, and also provide proofs of results omitted in the body of the paper.

2 General Statement of the Problem

2.1 Delegation Hierarchies

Consider an organization engaged in a set of activities $x_s \in X$. Each activity x_s is associated with an action choice $a_s \in A$ and generates a payoff $\pi_s(\theta_s, \mathbf{a})$ where $\mathbf{a} = (a_s)$ is the organization’s action profile and θ_s is an activity-specific shock which represents the uncertainty about the optimal action a_s to take. Section 2.2 discusses the properties of $\pi_s(\theta_s, \mathbf{a})$ in more detail. Each activity x_s is assigned to a hierarchy of managers

$$h(x_s) = \{m_0(x_s), m_1(x_s), \dots, m_N(x_s)\}$$

Each manager $m_j(x_s)$ observes θ_s with independent probability $p_j \in [0, 1]$. Abusing notation, we denote $m_j = m_j(x_s)$ unless confusion is possible. The initial decision-right

over a_s is owned by manager m_0 . An uninformed m_0 , however, may choose to delegate the decision right about a_s to a lower-level manager $m_j \in h(x_s)$. When delegated authority, manager m_j either selects a_s or delegates authority over a_s to manager m_k with $k > j$. Section 2.3 discusses the above assumptions in more detail, including how decision rights over activities can be conveyed through control over activity-specific, division-specific and organization-wide assets.

Managerial Preferences: Managers maximize the payoffs of the activities assigned to them when choosing a_s . Lower-level managers (higher indices) are more specialized and, therefore, more biased. Formally, let $D(m_j) \subset X$ be the set of activities assigned to manager m_j , then $D(m_j(x_s)) \subset D(m_i(x_s))$ whenever $i < j$. We further posit that $D(m_0) = X$ whereas $D(m_N) = \{x_s\}$. We can think of activities being partitioned into divisions, sub-divisions and so on, with $m_j(x_s)$ being the manager of the level j (sub)division to which x_s belongs. This interpretation is consistent with higher-level manager having priority in the delegation hierarchy. Managerial preferences when choosing a_s are taken as exogenous but can be viewed as stemming from career concerns, the ability of managers to divert a fraction of the profits of activities assigned to them, or the intrinsic reward managers experience when these activities are successful.

Managers are power-hungry in that they derive a private benefit from choosing a_s . This private benefit can be viewed as the intrinsic value of making a decision (as in Bartling, Fehr and Hertz, 2014). Alternatively, one can think of a_s as a complex, multi-dimensional action with some aspects of a_s affecting organizational payoffs and other aspects affecting private (even psychological) benefits of managers. We denote by $r_j = r_j(x_s)$ the private benefits to manager m_j associated with action a_s . If m_j chooses a_s , then the rent r_j is i.i.d. with c.d.f $F(\cdot)$ on support $[0, R]$ or $[0, \infty)$. If m_j does not choose a_s , then $r_j = 0$. All decision rent draws are stochastically independent and are private information. Section 4 considers the special case where r_j is deterministic (and identical) for all managers.

When deciding whether or not to delegate a_s to manager $m_l \in h(x_s)$, manager m_j takes into account the equilibrium strategies of other managers $m_i \in h(x_s)$, and behaves as if she maximizes the sum of her private benefits r_j and the expected payoffs of the activities $x_k \in D(m_j)$ assigned to her.

Organization Design: Neither decisions themselves, nor the delegation of decisions are contractible. Moreover, managers do not respond to monetary incentives. The organization designer, however, can remove *layers of management*. Abusing notation, we denote the optimal hierarchy by $h^* \equiv h^*(x_s)$ where $m_i \in h^*$ if and only if layer i is part of the optimal hierarchy. If $m_0 \notin h^*$, then the initial decision right over a_s is allocated to the highest-level manager $m_i \in h^*$. Without loss of generality, we assume that $m_N \in h^*$. Hence, the smallest possible hierarchy is $h^* = \{m_N\}$. Agent m_N can be interpreted as a worker who operates activity x_s . As we discuss in Section 2.3, given that manager m_0 is the only manager who is assigned all activities $x_s \in X$, removing m_0 can be viewed as a de-integration decision.

2.2 Expected payoffs

We now state (expected) profits of the organization under different scenarios regarding who is informed and who makes the decision. To simplify the analysis, we assume that while the choice of a_s affects the payoffs $\pi_k(\theta_k, \mathbf{a})$ of an activity $x_k \neq x_s$, the optimal choice of a_s only depends on θ_s and not on the action profile \mathbf{a}_{-s} . Without loss of generality, we therefore focus our discussion and analysis on one generic activity x_s and associated action a_s , taking the action profile \mathbf{a}_{-s} as given.

Let $\Pi(m_j)$ denote the expected *organizational payoffs* of all activities $x_k \in X$ when an *informed manager* $m_j \in h(x_s)$ chooses a_s and let Π^* denote the first-best expected payoffs (both for some given action profile \mathbf{a}_{-s}). Since manager m_0 maximizes the payoffs of all activities, it follows that $\Pi(m_0) = \Pi^*$.

Appendix A posits a quadratic “hit-the-state” payoff specification for $\pi_s(\theta_s, \mathbf{a})$ which results in intuitive expressions for expected profits and which we will maintain throughout the paper. When an informed manager m_j selects a_s this specification implies that

$$\Pi(m_j) = \Pi^* - \sum_{k=1}^j \mu_k,$$

where the terms $\mu_1 + \dots + \mu_j$ are the payoff losses due to externalities which are not internalized by manager m_j . Note that decision-making by an (informed) manager m_j results

Organizational/ m_0 Pay-offs (informed DM)

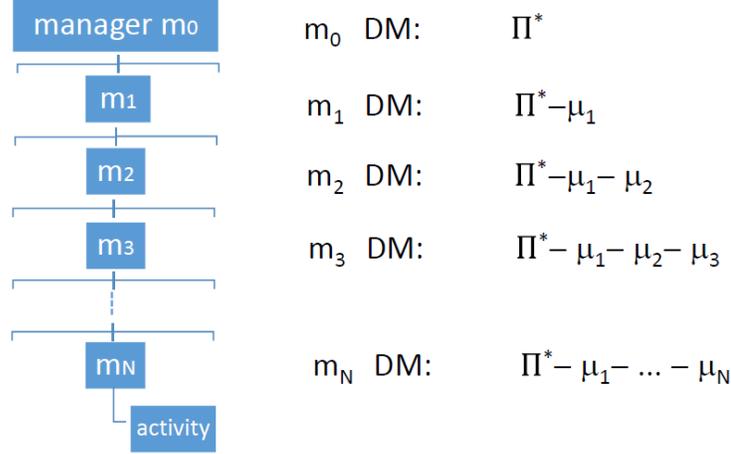


Figure 1 – Expected organizational payoffs when an informed manager m_i is decision-maker (DM).

in larger losses the lower the level of the decision-maker (the larger is j). In particular, relative to manager m_{j-1} , decision-making by manager m_j results in an additional loss of μ_j . Hence μ_j characterizes the externalities which are internalized by manager m_{j-1} but not by m_j . When an *uninformed manager* m_j selects a_s , our quadratic payoff specification results in expected organizational payoffs

$$\Pi(m_j) - \sigma^2,$$

where σ^2 is linear in the variance of the task-specific shock θ_s . Hence σ^2 reflects the uncertainty surrounding the optimal choice of a_s .

When deciding whether or not to delegate to manager m_j , middle manager m_i only cares about the expected payoffs of the activities $x_k \in D(m_i)$ assigned to her. Let $\Pi_i(m_j)$ denote the *expected payoffs of all the activities* $x_k \in D(m_i)$ when an *informed manager* m_j with $j \geq i$ chooses a_s . Denoting $\Pi_i(m_i) \equiv \Pi_i^*$ our payoff specification implies that

$$\Pi_i(m_j) = \Pi_i^* - \sum_{k=i+1}^j \mu_k.$$

Organizational/ m_0 Pay-offs (un-informed DM)

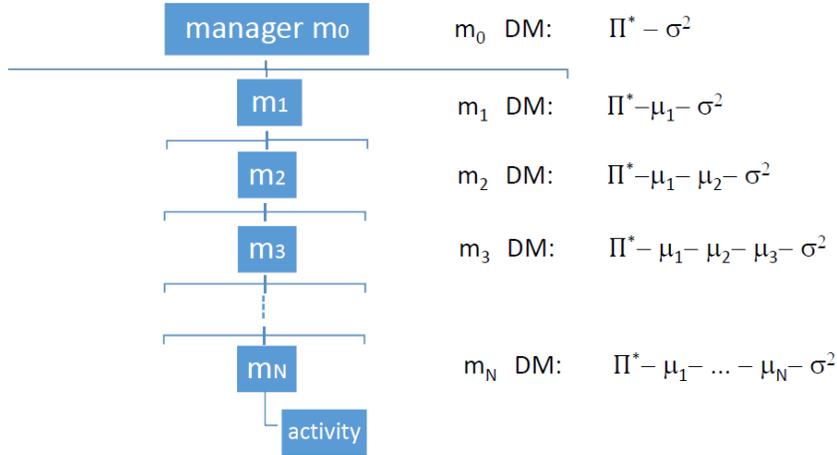


Figure 2 – Expected organizational payoffs when an uninformed manager m_i is decision-maker (DM)

Instead, when an uninformed manager m_j chooses a_s , those payoffs equal $\Pi_i(m_j) - \sigma^2$. Note that since $i \geq 1$, the payoff loss to middle manager i from delegating to an informed manager j is only $\mu_{i+1} + \dots + \mu_j$ whereas the same loss is $\mu_1 + \dots + \mu_j$ to manager m_0 .

2.3 Delegation hierarchies: discussion

Delegation hierarchies, asset ownership and de-integration: While alternative interpretations are possible, following the literature on incomplete contracts (Grossman and Hart (1986), Hart and Moore (1990)), one can think of decision rights in our model being conveyed through control or ownership of assets. Consider a number of activities $x_s \in X$, each of which is associated with a three-layer delegation hierarchy

$$h(x_s) = \{m_0(x_s), m_1(x_s), m_2(x_s)\}.$$

The discussion which follows can easily be generalized for N -layered hierarchies. Each activity x_s requires, at the minimum, the use of an activity-specific asset $A_s \in \Omega_2$ which is operated by a worker $m_2(x_s)$. The organization, however, has the option to integrate

its activities in a number of divisions $D = \{D_1, \dots, D_N\}$ by letting activities belonging to the same division $D_i \in D$ use a common asset $A_i \in \Omega_1$. While this divisional asset does not directly affect payoffs, such integration allows the organization to convey the decision right over a_s to manager $m_1(x_s)$ who operates this asset. Finally, independent of whether its activities are integrated into divisions or not, the organization can employ an organization-wide asset A_0 which is required to operate all divisional assets $A_i \in \Omega_1$ (if ‘active’) and all activity-specific assets $A_s \in \Omega_2$. This type of organization-wide integration therefore allows the organization to assign the decision rights over the full action profile a to a single manager m_0 . Conversely, removing manager m_0 in a delegation hierarchy is equivalent to a de-integration decision, where one hierarchy is replaced by several smaller hierarchies (if divisional assets are being used) or by a set of stand-alone assets (if no divisional assets are in use).

Formal versus real authority: In our delegation hierarchy, the initial decision-right over a_s is owned by manager m_0 , the “top manager”. One can think of this as m_0 having *formal authority* in the sense of Aghion and Tirole (1997). An uninformed m_0 , however, may choose to delegate or “loan” the decision rights about a_s to a middle manager or worker $m_j \in h(x_s)$. One can view this as the delegation of “real authority” where an uninformed boss optimally refrains from overturning the actions of her subordinate.

As in Aghion and Tirole, but unlike in Dessein (2002), we implicitly assume that the activity x_s is sufficiently complex so that observing the choice of a_s by a middle manager or worker does not reveal the state of nature θ_s .¹³ Hence, in the absence of re-delegation, the top manager has no commitment problem when “loaning” or “delegating” a decision right to a middle manager. Ex ante, a top manager optimally allows a middle manager to re-delegate a decision right to the worker (see Section 3). Ex post, however, the top manager may have an incentive to reclaim the decision right if she observes re-delegation. Our model therefore implicitly assumes that a top manager cannot observe whether a decision is being re-delegated or not.¹⁴ Alternatively, if who makes the final decision is observable, then the top manager must be able to build a reputation for not

¹³Similarly, the choice of a_s by a subordinate does not reveal whether or not this subordinate was informed.

¹⁴Consistent with this assumption of non observability, it is often lamented that middle managers claim “ownership” for actions and accomplishments which are mainly achieved by their subordinates.

renewing on delegation decisions, as in Baker, Gibbons and Murphy (1999).

3 General Analysis

For most of our analysis, we will consider a setting where $N = 2$ so that $h = \{m_0, m_1, m_2\}$. With $N = 2$, one can think of m_0 as the top manager or CEO, m_1 as a middle manager (e.g. a division manager) and m_2 as a worker.

In this environment there are four possible organization designs. The first is a *three-layer hierarchy* where a CEO sits above a middle manager, who in turn sits above a worker. We denote this organization $h^* = \{m_0, m_1, m_2\}$. A second possibility is an *integrated two-layered hierarchy* where, relative to the first organization, the middle manager is removed so that the CEO sits directly above the worker i.e. $h^* = \{m_0, m_2\}$. A third possibility is a *non-integrated two-layer hierarchy* where middle managers sit above workers and the CEO is removed i.e. $h^* = \{m_1, m_2\}$. Finally, it is possible to have *stand-alone activities*, where there is only the worker in the organization i.e. $h^* = \{m_2\}$.

In this paper, we study the consequences of managers inefficiently holding on to authority. To make this analysis relevant, we make the following assumption which implies that delegation is efficient:

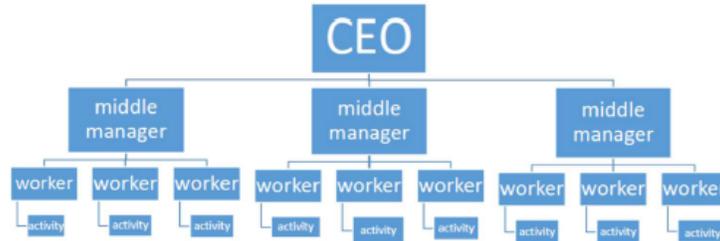
Assumption A1:

$$p_i \Pi(m_i) + (1 - p_i)(\Pi(m_i) - \sigma^2) > \Pi(m_{i-1}) - \sigma^2 \quad i = 1, 2 \quad (\text{A1})$$

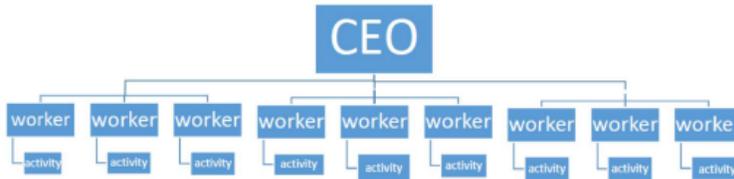
Assumption A1 guarantees that in the absence of preferences for power, an uninformed top manager m_0 is willing to delegate to the next-level manager m_1 . Similarly, Assumption A1 implies that manager m_0 prefers that an uninformed m_1 delegates to m_2 rather than that m_1 makes an uninformed decision. Moreover, since $\Pi(m_2) - \Pi(m_1) = \Pi_1(m_2) - \Pi_1(m_1)$, also an uninformed manager m_1 is then willing to delegate to m_2 if she has no preferences for power. In sum, Assumption A1 guarantees that delegation of decision-rights by an uninformed manager to the next layer in the hierarchy is both optimal and will occur provided managers have no preferences for power.

To simplify the exposition, we further assume that the bias in decision-making in-

Three-layered hierarchy



Two-layered integrated hierarchy



Two-layered non-integrated hierarchy



Stand-alone activities (non-hierarchy)



Figure 3 – Four possible organization designs.

Organizational Pay-offs (informed DM)

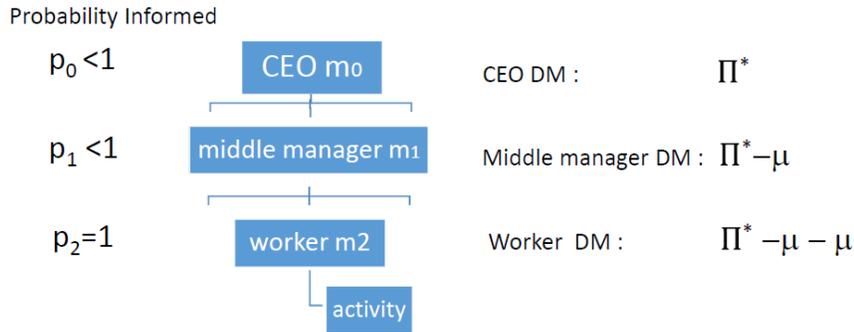


Figure 4 – Expected organizational payoffs in a three-layer hierarchy given A2, when an informed manager $m_i \in \{m_0, m_1, m_2\}$ is decision-maker (DM).

creases linearly as one moves down the hierarchy and that m_2 is perfectly informed:

Assumption A2: $\mu_1 = \mu_2 = \mu$ and $p_2 = 1$

3.1 Benchmark: no preferences for power

We begin with a natural benchmark case in which managers do not have preferences for power. It is then straightforward to establish:

Proposition 1. *If there are no preferences for power, the optimal organization is $h^* = \{m_0, m_1, m_2\}$.*

Under this organizational design the top manager m_0 holds the initial decision right over a_s . If m_0 is uninformed then she delegates to the division manager m_1 . Similarly, if m_1 has been delegated the decision right by m_0 , and she is uninformed herself, then m_1 delegates to the worker m_2 .

The top manager faces a relatively simple trade-off between the costs and benefits of delegation. The benefits of delegating to the division manager are that the division manager may: (a) become informed; or (b) delegate to the worker—who we have assumed is always informed. The costs of delegation are, of course, the bias that comes from delegation. Assumption A1 ensures that the informational benefits of delegation to the division manager always dominate. This leaves open the possibility, however, that it is optimal for the top manager to delegate directly to the worker. This cannot be optimal

since the division manager is less biased than the worker and, given that there are no preferences for power, the division manager will always delegate to the worker if the top manager would do so herself.

Finally, firm owners find it optimal to assign the initial decision right to the top manager, rather than to the division manager. Again, because there are no preferences for power, there is no conflict between firm owners and the top manager. The top manager always delegates if she is uninformed, but is valuable in the event that she is informed.

3.2 The value of middle managers

When managers are power-hungry, three-layered hierarchies are not necessarily optimal anymore. In what follows, we subsequently study the value of the middle layer (or middle manager) and the value of the top layer (or CEO). We conclude by discussing which managerial layer (top or middle) is more likely to be removed when both m_1 and m_0 are equally good ‘stand-alone’ decision-makers.

We first analyze when the middle manager m_1 is part of an optimal hierarchy h^* . In other words, we ask: “when does a middle manager add value?” Note that it does not matter whether the CEO or firm owners decide on the existence of a middle layer. Conditional on delegating authority, the CEO maximizes firm profits and her preferences are aligned with those of firm owner. Hence, $m_1 \in h^*$ if and only if the CEO prefers to delegate to the middle manager rather than the worker, and $h = \{m_0, m_1, m_2\}$ is preferred over $h = \{m_0, m_2\}$ if and only if $h = \{m_1, m_2\}$ is preferred over $\{m_2\}$.¹⁵

In our benchmark setting—with no preferences for power—the middle manager m_1 is always valuable, and the CEO never has an incentive to directly delegate to the worker. With preferences for power this need not be the case. The key trade-off in this setting is as follows. On the plus side, a middle manager internalizes the within-division externalities. On the minus side, however, the middle manager may hoard decision rights because of her preference for power (represented by r_1), and this creates an inefficiency.

Formally, efficiency requires that an uninformed middle manager m_1 delegates to the

¹⁵Note that this equivalence is sensitive to our assumption that the information of manager m_0 and m_1 is uncorrelated. As we will discuss in Section 5, in the presence of positive correlation, it may be that $\{m_1, m_2\} \succ \{m_2\}$ but $\{m_0, m_1, m_2\} \prec \{m_0, m_2\}$.

worker m_2 if and only if

$$\Pi^* - \sigma^2 - \mu \leq \Pi^* - 2\mu \iff 0 \leq \sigma^2 - \mu$$

which is always satisfied given Assumption A1. Given a private benefit of control r_1 , however, an uninformed m_1 delegates if and only if

$$\Pi_1^* - \sigma^2 + r_1 \leq \Pi_1^* - \mu \iff r_1 \leq \bar{r}_1 \equiv \sigma^2 - \mu$$

Thus, on the one hand, with probability $(1-p_1)(1-F(\bar{r}_1))$, the middle manager m_1 takes an uninformed decision, reducing payoffs by $\sigma^2 - \mu$ relative to a hierarchy $h = \{m_0, m_2\}$ where m_0 directly delegates to m_2 . On the other hand, with probability p_1 , the presence of a middle manager increases efficiency by μ , as she internalizes within-division externalities when informed. Finally, with probability $(1-p_1)F(\bar{r}_1)$ both hierarchies $\{m_0, m_2\}$ and $\{m_0, m_1, m_2\}$ yield the same outcome as the middle manager delegates efficiently. It follows that $m_1 \in h^*$ if and only if

$$p_1\mu > (1-p_1)(1-F(\bar{r}_1))(\sigma^2 - \mu) \tag{1}$$

This immediately leads to

Proposition 2. *A middle manager is valuable, that is $m_1 \in h^*$, if and only if*

$$\frac{p_1}{1 - (1-p_1)F(\bar{r}_1)}\sigma^2 \geq \bar{r}_1, \tag{2}$$

where $\bar{r}_1 \equiv \sigma^2 - \mu$. A more informed middle manager (increase in p_1) or a less power-hungry manager (downwards shift in $F(\cdot)$) can result in shift from $h^* = \{m_0, m_2\}$ to $h^* = \{m_0, m_1, m_2\}$ but never the other way around.

Given our discussion above about the pros and cons of having a middle manager in the hierarchy, the comparative statics above are intuitive. First, a middle manager is more likely to be valuable if she is more likely to be informed (i.e. p_1 is larger). Second, if decision-making rents are smaller (i.e. a downward shift in $F(\cdot)$) then a middle manager is less likely to hoard power, hence, is more valuable. Moreover, regardless of how likely she is to be informed (but with $p_1 > 0$), a middle manager is beneficial provided

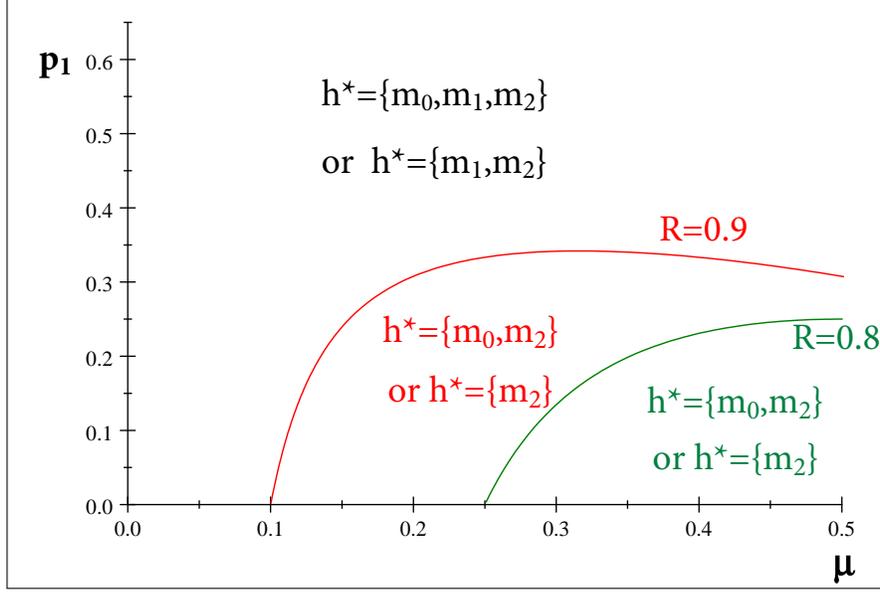


Figure 5 – Assume $r_i \sim U[0, R]$ and $\sigma^2 = 1$, then $m_1 \in h^* \Leftrightarrow p_1 > \bar{p}_1$ as given by (3). Figure 5 plots \bar{p}_1 as a function of the externality parameter μ and this for $R = 0.9$ (red curve) and $R = 0.8$ (green curve). $m_1 \in h^*$ above the curve, while $m_1 \notin h^*$ below.

preferences for power are sufficiently weak ($F(\sigma^2 - \mu) \sim 1$)

Perhaps surprisingly, our analysis shows that the value of a middle layer of management depends on the incentive conflict μ and the amount of uncertainty σ^2 , but in potentially non-monotonic ways. Inspecting (2), an increase in $\bar{r}_1 = \sigma^2 - \mu$ increases both the value of delegation to the worker m_2 and thus the RHS of (2), as well as the probability $F(\bar{r}_1)$ that the manager delegates to the worker when uninformed and thus the LHS of (2). Intuitively, when there is a large amount of uncertainty, delegation to the worker becomes more important in case the middle manager is uninformed, but she is then also more likely to delegate. Similarly, larger externalities make the middle manager more valuable when informed, but also push her to inefficiently hoard decision-rights when uninformed, leading to an ambiguous overall effect. As the next example and Figure 5 illustrate, an increase in externalities μ may therefore initially result in a removal of the middle layer.

Leading example (Uniformly distributed decision rents). To illustrate our main results, we will consider as a leading example the case where r_1 and r_0 are both i.i.d. uniformly on $[0, R]$ with $R < \sigma^2$. For simplicity, we normalize all parameters so that σ^2 equals 1.

If $R > \bar{r}_1 = 1 - \mu$, an uninformed middle manager delegates with probability $F(\bar{r}_1) = (1 - \mu)/R$ and it follows from Proposition 2 that

$$m_1 \in h^* \Leftrightarrow p_1 \geq \bar{p}_1 \equiv (1 - \mu) \frac{R - (1 - \mu)}{R - (1 - \mu)^2} \quad (3)$$

If $R < 1 - \mu$, an uninformed middle manager always delegates so that $m_1 \in h^*$ regardless of p_1 provided (A1) holds. It is now easy to verify that \bar{p}_1 is hump-shaped in μ : $\bar{p}_1 = 0$ for $\mu < 1 - R$, \bar{p}_1 is increasing in μ for $\mu \in [1 - R, \sqrt{1 - R}]$ and \bar{p}_1 is decreasing in μ for $\mu > \sqrt{1 - R}$. Hence, for μ and p_1 small, an increase the amount of externalities μ between activities results in the removal of the middle manager. Figure 5 plots \bar{p}_1 as a function of μ and this for $R = 0.8$ (green curve) and $R = 0.9$ (red curve). Larger decision rents (a larger R) require the middle manager to be more informed to be part of the hierarchy.

Incentive conflicts, uncertainty and worker authority. Keeping the hierarchy fixed, both m_0 and m_1 are less likely to delegate as externalities μ increase or uncertainty σ^2 decreases. As our leading example shows, however, an increase in μ (or decrease in σ^2) may also result in the removal of the middle layer, therefore making it more likely that decisions are fully decentralized to the worker. It follows that an increase in externalities between activities (and thus a larger incentive conflict for the worker) or a decrease in uncertainty σ^2 may result in an increase in the probability that the worker makes the final decision, which we report as:

Proposition 3. *An increase in μ or a decrease in σ^2 may result in de-layering and, hence, an increase the probability that the worker is delegated authority.*

The above result stands in contrast with the delegation model of Dessein (2002) which has the unambiguous prediction that decisions are less likely to be delegated to the agent when conflicts of interest are larger or uncertainty is smaller. Note that the above result would also hold if we kept $\mu_1 = \mu$ fixed, and only increase μ_2 (the externalities which only the worker does not internalize). As long as A1 is satisfied, the condition for $m_1 \in h^*$ only depends on μ_2 .

3.3 The value of a top manager (integration)

We now turn attention to the value of a top manager m_0 from the perspective of the owners/board of directors. In particular, we provide necessary and sufficient conditions under which an integrated hierarchy, where the initial decision-rights about all activities $x_s \in X$ are allocated to the top manager, is optimal.

Consider first the incentives of the top manager to delegate. On the one hand, if the middle manager m_1 is not valuable ($m_1 \notin h^*$), then m_0 can only delegate to m_2 and will do so if and only if

$$r_0 \leq \tilde{r}_0 = \sigma^2 - 2\mu,$$

where r_0 are the private benefits of control of the top manager. On the other hand, if the middle manager m_1 is valuable ($m_1 \in h^*$), then it must be that m_0 prefers to delegate to m_1 rather than m_2 and she will do so if and only if

$$r_0 \leq \hat{r}_0 \equiv p_1\sigma^2 - \mu + (1 - p_1)F(\bar{r}_1)(\sigma^2 - \mu)$$

where $\bar{r}_1 = \sigma^2 - \mu$. In words, an uninformed top manager will delegate to the middle manager if her private benefits of control are smaller than the sum of (1) the informational advantage of the middle manager $p_1\sigma^2$, (2) minus the loss μ due to the fact that m_1 does not internalize inter-divisional externalities, (3) plus a term which reflects the benefits of the middle manager delegating to the worker when uninformed. Note that even when $\sigma^2 < 2\mu$ and m_0 would never delegate herself to m_2 , she still benefits from an uninformed m_1 delegating to m_2 provided $\sigma^2 > \mu$. Indeed an uninformed m_1 deciding herself yields an expected payoff of $\Pi^* - \sigma^2 - \mu$, whereas an informed m_2 deciding yields a payoff of $\Pi^* - 2\mu$.

Consider now the value of a top manager from the perspective of firm owners. If firm owners delegate to the top manager, their payoffs equal

$$\Pi^* - \sigma^2 + p_0\sigma^2 + (1 - p_0)F(\bar{r}_0)\bar{r}_0$$

where $\bar{r}_0 = \max\{\tilde{r}_0, \hat{r}_0\}$ and $F(\bar{r}_0)$ is the probability that the top manager delegates when uninformed.

Instead, when firm owners directly delegate to the middle manager m_1 (if $m_1 \in h^*$) or the worker m_2 (if $m_1 \notin h^*$), their payoffs equal

$$\Pi^* - \sigma^2 + \bar{r}_0$$

It follows that delegation to the CEO, m_0 , is preferred if and only if

$$p_0\sigma^2 + (1 - p_0)F(\bar{r}_0)\bar{r}_0 \geq \bar{r}_0$$

We obtain the following result:

Proposition 4. *The top manager m_0 is valuable, that is $m_0 \in h^*$, if and only if*

$$\frac{p_0}{1 - (1 - p_0)F(\bar{r}_0)}\sigma^2 \geq \bar{r}_0. \quad (4)$$

where

$$\bar{r}_0 \equiv \max \left\{ \sigma^2 - 2\mu, \quad p_1\sigma^2 - \mu + (1 - p_1)F(\sigma^2 - \mu)(\sigma^2 - \mu) \right\},$$

As was the case for the middle manager, the top manager m_0 is more likely to be valuable if p_0 is higher—that is, if she is more likely to be informed. Recall that in the benchmark setting with no preferences for power, a top manager is always valuable since she internalizes externalities whenever she is informed, and delegates authority to the middle manager whenever she is uninformed. But once managers are power-hungry this need not be the case. If she is not sufficiently likely to be informed, it can be optimal to bypass her and give the initial decision rights to the middle manager or the worker.

Also similar to the case of middle managers, comparative statics other than p_0 are ambiguous. Figure 6 illustrates the non-monotonic comparative statics with respect to μ in our leading example where r_1 and r_0 are uniformly distributed (p_1 is such that $m_1 \in h^*$). The top-manager is least likely to be valuable for intermediate values of μ . In particular, for small values of μ and p_0 , an increase in externalities between activities then results in decentralization where the initial decision-rights are re-allocated from the top-manager m_0 to the middle manager m_1 . Note that this result stands in sharp contrast with standard comparative statics in the literature (see, for example, Alonso,

Dessein and Matouschek (2008)) where an increase in externalities can only result in a shift towards centralization, never towards decentralization.¹⁶

Leading example (Uniformly distributed decision rents). To illustrate Proposition 4, consider again the case where r_1 and r_2 are uniformly distributed on $[0, R]$ with $R < \sigma^2 = 1$. The top manager delegates when uninformed if and only if $r_0 \leq \bar{r}_0$ where

$$\begin{aligned} \bar{r}_0 &= 1 - 2\mu && \text{if } p_1 \leq \bar{p}_1 \text{ (and } m_1 \notin h^*) \\ \bar{r}_0 &= p_1 - \mu + (1 - p_1)(1 - \mu)^2/R && \text{if } p_1 \geq \bar{p}_1 > 0 \text{ (and } m_1 \in h^*) \\ \bar{r}_0 &= 1 - (2 - p_1)\mu && \text{if } R \leq 1 - \mu \text{ (and } \bar{p}_1 = 0) \end{aligned}$$

If $R < 1 - (2 - p_1)\mu$ both the top manager and the middle manager always delegate when uninformed, $F(\bar{r}_0) = F(\bar{r}_1) = 1$, so that $h^* = \{m_0, m_1, m_2\}$.

In contrast, if $R > 1 - (2 - p_1)\mu$, we have that $F(\bar{r}_0) < 1$ and

$$m_0 \in h^* \iff p_0 \geq \bar{p}_0 \equiv \bar{r}_0 \frac{R - \bar{r}_0}{R - \bar{r}_0^2} \quad (5)$$

Note that when $1 - (2 - p_1)\mu < R < 1 - \mu$, the middle manager always delegates when uninformed, $F(\bar{r}_1) = 1$, whereas the top manager hoards decision rights with positive probability, $F(\bar{r}_0) < 1$.

As discussed above, \bar{p}_0 is non-monotonic in the value of delegation, \bar{r}_0 and, hence, all the parameters that affect \bar{r}_0 such as μ and p_1 . In particular, \bar{p}_0 is continuously increasing the value of delegation \bar{r}_0 when $\bar{r}_0 < 1 - \sqrt{1 - R}$ and continuously decreasing in \bar{r}_0 when $\bar{r}_0 > 1 - \sqrt{1 - R}$ (until $\bar{r}_0 \geq R$ and $\bar{p}_0 = 0$).

The non-monotonic comparative statics are illustrated in Figure 6, which plots \bar{p}_0 as a function of μ and this for $R = 9/10$ (red), and $R = 3/4$ (green). It is assumed that $p_1 = 1/2$ so that $m_1 \in h^*$ for $\mu < 2/3$. We have that $h^* = \{m_0, m_1, m_2\}$ above the curve \bar{p}_0 , whereas $h^* = \{m_1, m_2\}$ below \bar{p}_0 . Note that a downward shift in the distribution of decision rents (a decrease from $R = 0.9$ to $R = 3/4$) makes the top-manager m_0 more valuable for μ small but not for μ large. Intuitively, when decision rents are smaller

¹⁶Beyond the impact of μ and σ^2 , also an increase in p_1 – the presence of a more informed middle manager – has an ambiguous impact on whether the top manager is valuable. A more informed middle manager increases both the the value \bar{r}_0 of delegating to the middle manager and the probability $F(\bar{r}_0)$ with which an uninformed top manager will do so herself.

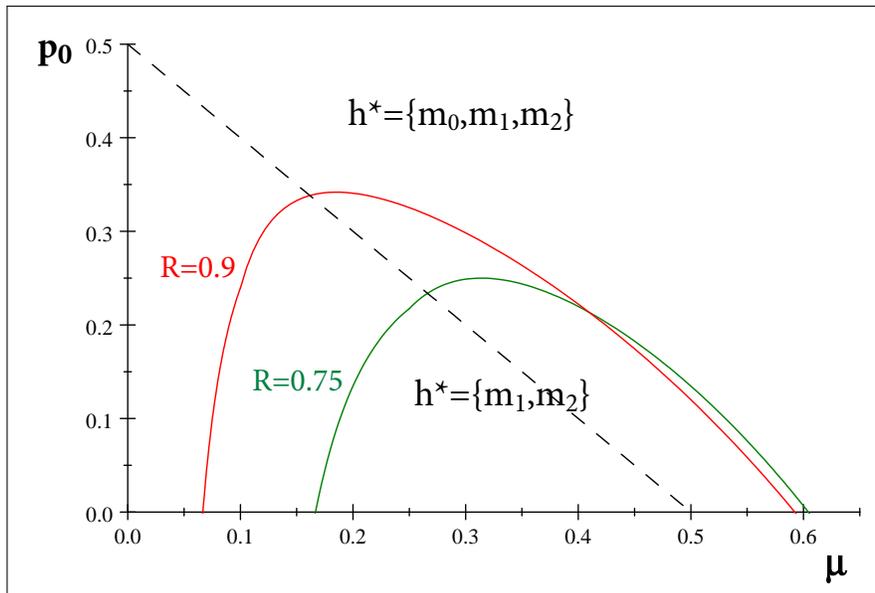


Figure 6 – Assume $r_i \sim U[0, R]$ and $\sigma^2 = 1$, then $m_0 \in h^* \Leftrightarrow p_0 > \bar{p}_0$ as given by (5). Figure 6 plots \bar{p}_0 as a function of μ when $p_1 = 1/2$, and this for $R = 0.9$ (red curve), and $R = 0.75$ (green curve). $h^* = \{m_0, m_1, m_2\}$ above the curve \bar{p}_0 , whereas $h^* = \{m_1, m_2\}$ below the curve. m_0 is a better stand-alone decision-maker than m_1 above the dashed black line, but there is still an area for which $m_0 \notin h^*$.

on average, this increases the probability with which m_0 delegates, but also makes the middle manager less power-hungry, increasing the value of directly delegating to m_1 .

Finally, when p_0 is above the dotted line in Figure 6, the top manager is a better stand-alone decision-maker than the middle manager ($p_0\sigma^2 > p_1\sigma^2 - \mu$). Despite this fact, there is an area above the dotted line where $h^* = \{m_1, m_2\}$ and $m_0 \notin h^*$, even though m_0 is a better stand-alone decision-maker than m_1 . We will discuss this finding in more detail in the following subsection.

3.4 De-layering versus de-integration

Our analysis of the value of top- and middle managers raises the question whether organizations are more likely to de-integrate (remove the CEO) or delayer (remove the middle manager) when managers are power-hungry? In the absence of power rents, both the CEO and the middle manager are always part of the optimal hierarchy (given A1). Which managerial layer is most likely to disappear as preferences for power become more pronounced?

In this section, we first show that the lack of delegation is more severe at the top than in the middle of the hierarchy. We subsequently show when m_0 and m_1 are equally good stand-alone decision-makers, then under reasonable conditions for $F(\cdot)$, the top layer is always removed first: as decision rents increase firms optimally de-integrate before they de-layer. We conclude by showing that even when m_0 is the best stand-alone decision-maker, one can always find distributions for $F(\cdot)$ such that $m_0 \notin h^*$ unless a lone m_0 is preferred over a perfect hierarchy of m_1 and m_2 where m_1 always delegates when uninformed. Our leading example is used to illustrate those results

Lack of delegation is more severe at the top We first note that the top manager m_0 is more likely to (inefficiently) hoard power than the middle manager m_1 .

Proposition 5. *Conditionally on having authority, a top manager is less likely to delegate when uninformed than a middle manager: $\bar{r}_1 > \bar{r}_0$ so that $F(\bar{r}_0) < F(\bar{r}_1)$.*

Indeed, conditionally on being uninformed, manager $m_i \in \{m_0, m_1\}$ delegates if and

only if $r_i \leq \bar{r}_i$ where

$$\begin{aligned}\bar{r}_1 &\equiv \sigma^2 - \mu \\ &> \bar{r}_0 = \max \{ \sigma^2 - 2\mu, \quad p_1\sigma^2 - \mu + (1 - p_1)F(\sigma^2 - \mu)(\sigma^2 - \mu) \},\end{aligned}\tag{6}$$

To see why the incentive not to delegate is particularly acute at the top of the hierarchy, consider a three-layer hierarchy $\{m_0, m_1, m_2\}$. From the perspective of the delegator (m_0 or m_1) the delegee (respectively, m_1 or m_2) is equally biased, but the delegee is more likely to become informed if she is further down the hierarchy. As a result, the value of delegation is $\bar{r}_1 = \sigma^2 - \mu$ to the middle manager, whereas the value of delegation to the top manager is at most $\bar{r}_0^{\max} \equiv p_1(\sigma^2 - \mu) + (1 - p_1)(\sigma^2 - 2\mu)$, where \bar{r}_0^{\max} is reached if the middle manager always delegates when uninformed. While our assumption that the worker (m_2) is perfectly informed is extreme, the result holds as long as $p_2 > p_1$. Note further that having the top manager, m_0 , delegate directly to the worker m_2 does not solve the problem, since the worker is (exactly) twice as biased as the division manager from the top manager's perspective.

Balanced expertise benchmark. As an interesting benchmark, consider now the case where m_0 and m_1 are equally good stand-alone decision-makers:

Condition C1 (Balanced Expertise) *Managers m_0 and m_1 have balanced expertise*

$$p_1\Pi(m_1) + (1 - p_1) [\Pi(m_1) - \sigma^2] = p_0\Pi(m_0) + (1 - p_0) [\Pi(m_0) - \sigma^2]\tag{C1}$$

Condition C1 levels the playing field between manager m_0 and manager m_1 : manager m_1 is more biased, as she does not internalize all externalities, but her superior expertise ($p_1 > p_0$) exactly compensates for this bias. Given Condition C1, firm owners are indifferent to whom to delegate decision-making authority in the absence of any hierarchy. Note that Condition C1 is equivalent to $p_0\sigma^2 = p_1\sigma^2 - \mu$. We further make the following mild restriction on the distribution of decision rents:

Condition C2: *Smaller decision rents are weakly more likely: $f'(r_i) \leq 0$ for $r_i \geq \sigma^2 - 2\mu$*

Condition C2 is satisfied for our leading example (uniform distributions) and other nat-

ural distributions with support on $[0, \infty)$ such as the exponential distribution. Condition C2 is a sufficient (but far from necessary) condition for the following result:

Proposition 6. *Assume Conditions C1 and C2 hold, then $m_0 \in h^* \implies m_1 \in h^*$. Removing the middle layer is only optimal if also the top layer is removed (no de-layering without de-integration).*

Proof See Appendix A2.

Proposition 6 formalizes the idea that when the managerial expertise and managerial bias in decision-making are in balance, de-integration is a better response to a lack of delegation in the hierarchy than de-layering. When preferences for power become more pronounced, we expect organizations to become smaller (more de-integrated) rather than flatter. Given balanced expertise, we do not expect to observe a hierarchy $h = \{m_0, m_2\}$. Intuitively, while both m_0 and m_1 are equally power-hungry on average, the lack of delegation is more severe at the top than in the middle, as the delegee is less informed while equally biased (from the perspective of the delegator). The top manager is also less willing than the middle manager to delegate directly to better informed bottom layer, as the bottom layer is much more biased from her perspective than from the middle manager's perspective.

Sufficient conditions for managers to be valuable. To conclude our analysis, we derive sufficient conditions for m_1 and m_2 to be part of an optimal hierarchy regardless of preferences for power $F()$. Consider first the following condition.

Condition C3: *A lone m_0 is dominated by a hierarchy $\{m_1, m_2\}$ without power preferences*

$$p_0\Pi(m_0) + (1 - p_0) [\Pi(m_0) - \sigma^2] \leq p_1\Pi(m_1) + (1 - p_1)\Pi(m_2) \quad (\text{C3})$$

Condition C3 states that the payoffs generated by a lone top manager m_0 who never delegates are lower than those generated by a hierarchy $\{m_1, m_2\}$ where m_1 always delegates when uninformed. Condition C3 is always satisfied whenever there is balanced expertise (Condition C2 implies C3). But Condition C3 may also be satisfied when the top-manager m_0 is the best stand-alone decision-maker.¹⁷ Indeed, a top manager m_0

¹⁷Condition C3 is equivalent to $p_0\sigma^2 < \sigma^2 - \mu + (1 - p_1)\mu$, whereas m_0 is the best stand alone decision-

who is a better decision-maker than both m_1 and m_2 but never delegates may be no match for a team of m_1 and m_2 who efficiently pool their knowledge.

We now compare necessary and sufficient conditions for m_1 and m_2 to be part of an optimal hierarchy for any distribution of decision rents $F(\cdot)$. The following results hold:

Proposition 7. *The middle manager is valuable, $m_1 \in h^*$ for any $F(\cdot)$ if and only if she is a better stand-alone decision-maker than the worker m_2 .*

The proof is instructive. Condition (2), which is necessary and sufficient for $m_1 \in h^*$, is satisfied regardless of $F(\cdot)$ whenever $p_1\sigma^2 > \sigma^2 - \mu$. The latter condition is equivalent with m_1 being, on average, a better stand-alone decision-maker than the worker m_2 . The latter condition is also tight in the sense that if it is not satisfied, one can always find a distribution $F(\cdot)$ such that $F(\bar{r}_1) \approx 1$ and (2) is violated ($m_1 \notin h^*$).

Interestingly, a similar condition is not sufficient when it concerns the CEO m_0 .

Proposition 8. *Given C3, there exist preferences for power $F(\cdot)$ – shared by m_0 and m_1 – such that a hierarchy $h = \{m_1, m_2\}$ is preferred over a hierarchy $h = \{m_0, m_1, m_2\}$. Given such preferences for power, $m_0 \notin h^*$ even when m_0 is a better decision-maker than both m_1 and m_2 .*

The proof and intuition for the above result relies on our result that the incentives to (inefficiently) hoard authority are particularly acute at the top of the hierarchy. The top manager delegates if and only if $r_0 < \bar{r}_0$, where $\bar{r}_0 < \bar{r}_0^{\max} \equiv \sigma^2 - \mu - (1 - p_1)\mu < \bar{r}_1 \equiv \sigma^2 - \mu$. Consider now preferences for power such that $F(\bar{r}_1) \approx 1$, and $F(\bar{r}_0^{\max}) \approx 0$. Then given such preference for power, we can conclude that an uninformed middle manager, m_1 , always delegates, but the top manager, m_0 , never delegates. Given this, and Condition C3, it is then optimal to allocate the initial decision right to m_1 rather than m_0 , even when m_0 is a better decision-maker than m_1 .

Note, finally, that if Condition C3 is violated, then it is direct that $m_0 \in h^*$. Even when m_0 never delegates and m_1 always delegates when uninformed, firm owners then prefer m_0 to have the initial decision right. In this sense, Condition C3 is tight.

maker whenever both $p_0\sigma^2 > p_1\sigma^2 - \mu$ and $p_0\sigma^2 > \sigma^2 - 2\mu$. Clearly, all three inequalities can be satisfied simultaneously.

Leading example (uniformly distributed decision-rents). We use our leading example, where r_1 and r_2 are uniformly distributed on $[0, R]$, to illustrate our results that the optimal hierarchy may be $h^* = \{m_1, m_2\}$, even when m_0 is a better decision-maker than m_1 , and to show how stronger preferences for power result in a shift from $\{m_0, m_1, m_2\}$ to $\{m_1, m_2\}$ when managers are equally good decision-makers (balanced expertise benchmark).

Figure 7 plots the optimal hierarchies as function of $R \in [2/3, 1]$ and $\mu \in [0, 1/2]$ when $p_0 \in \{1/4, 1/3\}$ and $p_1 = 1/2$.¹⁸ Given $p_1 = 1/2$, the middle manager is valuable whenever $\mu < 2/3$. Hence, all what matters is the choice between a three-layered hierarchy and two-layered, non-integrated hierarchy. In particular, in the plot, $h^* = \{m_0, m_1, m_2\}$ in the area below the curve, and $h^* = \{m_1, m_2\}$ in the area above the curve, where the relevant curve is drawn for $p_0 = 1/4$ (black curve) and $p_0 = 1/3$ (red curve). To the right of the dotted line, m_0 is a better stand-alone decision-maker than m_1 , but often $h^* = \{m_1, m_2\}$. Note, that an upwards shift in the preferences for power (an increase in R) always result in a shift from $\{m_0, m_1, m_2\}$ to $\{m_1, m_2\}$ (a decentralization of decision rights to the middle manager), but never the other way around.

Figure 8 plots the optimal hierarchy as a function of p_0 and p_1 (assuming $\mu = 0.25$ and $R = 0.9$). Consider first the combinations of (p_0, p_1) , represented by the dotted red line, where the top-manager and the CEO have *balanced expertise* (Condition C1 satisfied) and thus are equally good stand-alone decision-makers. For all points on the red line, the informational advantage of the middle manager exactly compensates for her bias.

Note first that as both managers become more informed (but keeping expertise balanced), we move from a situation in which we have stand-alone activities $\{m_2\}$, to some de-integrated hierarchies $\{m_1, m_2\}$, to full integration in a three-layered hierarchy $\{m_0, m_1, m_2\}$.¹⁹ This illustrates Proposition 6 which states that when the top manager and the middle manager are equally good decision-makers, the top manager is more at risk of being ‘cut’: de-integration is more common than de-layering. Second, note that in the triangle area between the red line and the two black lines, CEO m_0 is a better stand-alone decision-maker than the middle manager m_1 , yet $h^* = (m_1, m_2)$. This illustrates

¹⁸Note that (A1) is always satisfied for these parameter values.

¹⁹Note that for all expertise levels (p_0, p_1) on the red-line for which $p_0 < 0.5$, the worker is the best stand-alone decision-maker.

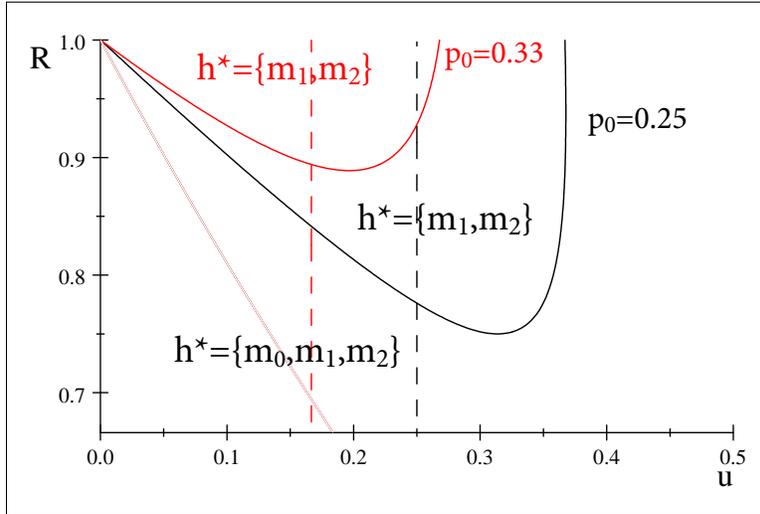


Figure 7 – Figure 7 plots the optimal hierachies as function of R and μ when $p_1 = 1/2$ and $p_0 = 1/4$ (black curve) or $p_0 = 1/3$ (red curve). $h^* = \{m_0, m_1, m_2\}$ in the area below the curve, and $h^* = \{m_1, m_2\}$ in the area above the curve. To the right of the dotted line, m_0 is a better stand-alone decision-maker than m_1 .

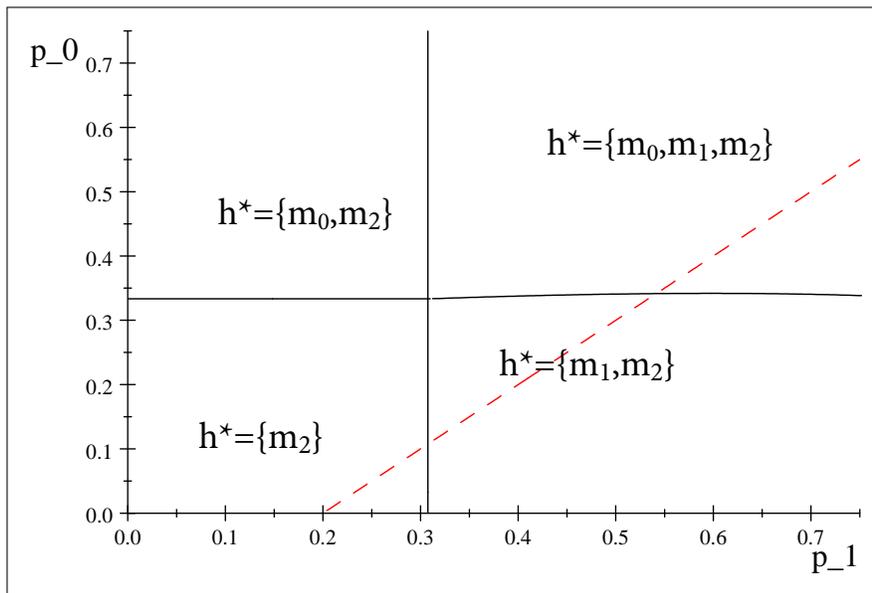


Figure 8 – Figure 8, plots the optimal hierarchy as a function of p_0 and p_1 ($\mu = 0.25$; $R = 0.9$). $m_0 \in h^*$ above the horizontal line, and $m_1 \in h^*$ to the right of the vertical line. $h^* = \{m_2\}$ in the bottom-left corner. The combinations of (p_0, p_1) represented by the dotted red line are those where m_1 and m_0 are equally good stand-alone decision-makers.

Proposition 8.

4 Deterministic decision rents

Having analyzed three-layered hierarchies for any distribution $F(\cdot)$, we now focus on the special (but very tractable) case where the private benefits of power are deterministic and identical for all managers. Thus, we assume that both $r_0 \approx r$ and $r_1 \approx r$. This limit case allows us to provide very precise comparative statics, as well as a generalization of some of our results to $L > 3$ layers.

As in our general analysis, an uninformed middle manager, m_1 , delegates to the worker, m_2 , if and only if

$$r_1 \approx r < \bar{r}_1 \equiv \sigma^2 - \mu.$$

If $r > \bar{r}_1$, both m_1 and the top manager, m_0 never delegate since one can verify that $\bar{r}_1 > \bar{r}_0$. If $r < \bar{r}_1$, m_1 always delegates when uninformed, and m_0 delegates to m_1 if and only if

$$r_0 \approx r < \bar{r}_0 \equiv p_1(\sigma^2 - \mu) + (1 - p_1)(\sigma^2 - 2\mu).$$

For $r < \bar{r}_0$, it never makes sense for m_0 to directly delegate to m_2 , as $\bar{r}_0 < \bar{r}_1$ and m_1 always delegates to m_2 when uninformed (she never hoards decision rights).

4.1 De-layering versus De-integration

The special case of deterministic decision rents is instructive in that it allows clear-cut comparative statics with respect to the magnitude of decision rents. When managers have no preferences for power, managerial layers always add value in our model. When there are decision rents, however, this is not necessarily the case. A natural question, then, is which managerial layer disappears first when manager increasingly value power: the top layer (CEO, de-integration) or the middle-layer (middle manager, de-layering).

Assume therefore again that Condition C1 holds: a lone m_0 who never delegates is dominated by a hierarchy $\{m_1, m_2\}$ where m_1 always delegates when uninformed.

The following proposition establishes the equivalent of Proposition 6 for the case of deterministic decision rents:

Proposition 9. *Assume $r_0 = r_1 \approx r$ and condition C1 holds:*

- *If $r < \bar{r}_0$, a three-layer hierarchy $h = \{m_0, m_1, m_2\}$ is optimal.*
- *If $r \in (\bar{r}_0, \bar{r}_1)$, a two-layer hierarchy $h = \{m_1, m_2\}$ is optimal..*
- *If $r > \bar{r}_1$, no manager ever delegates, and the initial authority is delegated to the best stand-alone manger.*

Proposition 9 is illustrated by Figure 9 which plots the optimal hierarchy as a function of decision rents r and the conflict/externality parameter μ , and this for the extreme case where the top and middle manager are equally likely to be informed: $p_0 = p_1 = 1/2$ and $\sigma^2 = 1$. Note that there is a region where $h^* = \{m_1, m_2\}$ and thus $m_0 \notin h^*$ even though m_0 is equally well-informed as m_1 and less biased. Despite this fact, firm owners prefer m_1 to be part of the hierarchy rather than m_0 in this region, as m_1 delegates to m_2 when uninformed whereas m_0 never delegates.

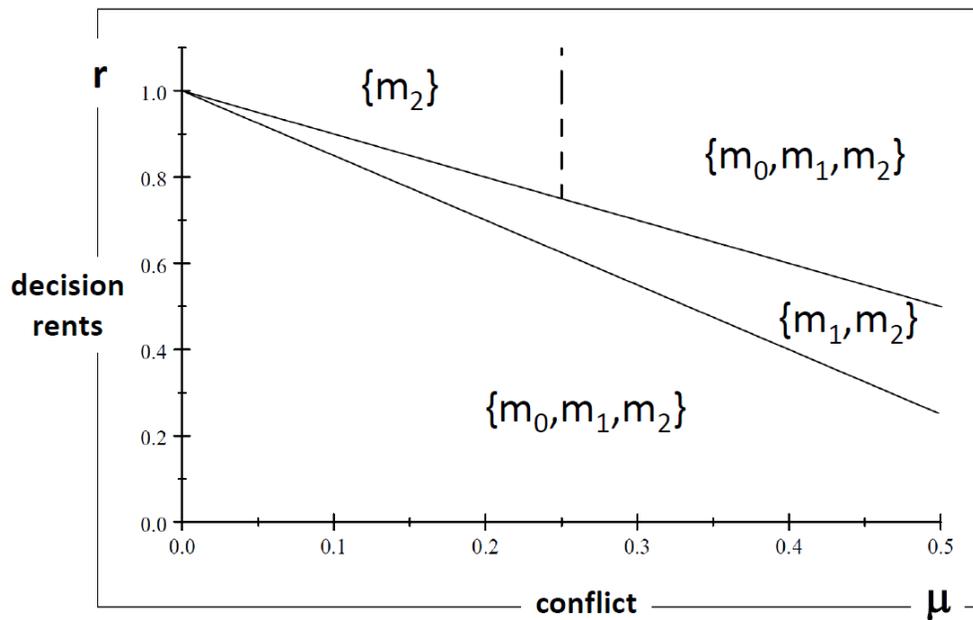
4.2 Preferences for power and worker authority

Consider next the Hayekian case where the worker m_2 is (weakly) the best stand-alone decision-maker, that is

$$\sigma^2 - 2\mu \geq \max \{p_0\sigma^2, p_1\sigma^2 - \mu\} \quad (\text{D1})$$

Note that D1 implies C1, but is more strict. The following result follows directly from Proposition 9:

Proposition 10. *Assume that $r_0 = r_1 \approx r$ and condition D1 holds (m_2 is the best stand-alone decision-maker), then managerial layers are decreasing in decision rents r . With a fixed hierarchical structure, stronger preferences for power reduce decision-making authority at the bottom of the hierarchy. When the hierarchical structure is endogenous, however, stronger preferences for power result in de-layering and de-integration, and therefore may increase decision-making authority at the bottom.*



Deterministic decision rents $r_0=r_1= r$, with $\sigma^2 = 1$ and $p_1 = p_0=1/2$

Figure 9 – Figure 9 plots the optimal hierarchy as a function of deterministic decision rents $r_i = r$ and the conflict/externality parameter μ , and this for $p_0 = p_1 = 1/2$ and $\sigma^2 = 1$.

Under the Hayekian assumption that decisions are best made by those with the best information (that is, the worker is the best stand-alone decision-maker), we thus obtain the interesting result that hierarchies become smaller and more de-integrated as decision rents play a larger role (i.e. managers are more power hungry). While for a given number of layers, an increase in preferences for power reduces worker authority, stronger preferences for power also result in de-layering and may therefore increase worker authority.

Intuitively, when $r < \bar{r}_0$ the top manager, m_0 , is not “too power-hungry” and is thus willing to delegate to the middle manager, m_1 . And since there is a chance that she becomes informed, the top manager, m_0 , adds value to the hierarchy, regardless of p_0 . When preferences for power are in an intermediate range, $r \in (\bar{r}_0, \bar{r}_1)$, and two-layer hierarchy with a middle manager and a worker is optimal since the middle manager, m_1 , is willing to delegate to the worker, m_2 , but the top manager will not delegate, and thus is optimally excluded from the hierarchy. Notice that $\{m_1, m_2\}$ is then the optimal hierarchy even when the top manager m_0 is more likely to be informed than m_1 , that is even if $p_0 > p_1$. Finally, when preferences for power are very large, $r > \bar{r}_1$, the middle manager, m_1 , will not delegate to the worker, m_2 , even if the middle manager is uninformed. In that case it is optimal to allocate the initial decision right to the worker, who is best stand-alone decision maker.

One implication of our result is that empirical studies which study how lower-level decision-making authority varies as a function of decision rents or preferences for power (which may vary, for example, depending on culture or industry), may find different results depending on whether they control for firm size and hierarchical layers or treat those as endogenous variables.

Following Hayek, we believe the assumption that the worker is the best stand-alone decision-maker is a natural one. If, instead, the middle manager m_1 is the best stand-alone decision-maker, then there exists a cut-off for r such that for small decision rents, $h^* = \{m_0, m_1, m_2\}$, whereas for large decision rents $h^* = \{m_1, m_2\}$. It is only when the CEO is the best stand-alone decision maker that $h = \{m_0, m_1, m_2\}$ is either always optimal, or that the value of m_0 is non-monotonic in r , with $h^* = \{m_1, m_2\}$ for ‘intermediate’ decision rents and $h^* = \{m_0, m_1, m_2\}$ otherwise. The latter case is illustrated in Figure 9

when μ is large.

4.3 Multi-layered hierarchies

The above insight, that hierarchies tend to become smaller and more de-integrated as preferences for power become more pronounced, can be generalized for multi-layered hierarchies where $N \geq 3$. Assume therefore that there are N potential managers $\{m_0, m_1, \dots, m_N\}$. To make the analysis tractable, we will again make the balanced expertise assumption, used in Proposition 6, which posits that the expertise of lower-level managers exactly offset their bias as follows:

Condition D2 (Balanced Expertise): *All managers m_i have balanced expertise*

$$p_{i+1}\sigma - p_i\sigma = \mu \quad (\text{D2})$$

For the sake of generality, we also relax the assumption that $p_N = 1$, and allow for $p_N \leq 1$. Note that Condition D2 implies both D1 and C1. In this setting we can generalize the result that stronger preferences for power lead to a smaller optimal hierarchy, and moreover it is the top layers that are removed first.

Let \bar{r}_l be the value to manager m_l of delegation to manager m_{l+1} , assuming that everyone below her in the hierarchy also delegates. We want to prove that

$$\bar{r}_l < \bar{r}_{l+1} \quad \text{for all } l \leq N - 2,$$

so that the value of delegation goes up as we move down the hierarchy. As decision rents r increase, it is then the managers at the top of the hierarchy who stop delegating first and who are first removed from the delegation hierarchy.

To see that this is indeed the case, note that manager m_{N-1} delegates to manager m_N if uninformed if and only if

$$r < \bar{r}_{N-1} = p_N\sigma^2 - \mu$$

The manager one level up in the hierarchy, m_{N-2} , delegates, again assuming everyone

below her delegates, if

$$r < \bar{r}_{N-2} = (p_N - x)\sigma^2 - \mu + (1 - p_N + x)(p_N\sigma^2 - \mu),$$

where $x \equiv p_{i+1} - p_i = \mu/\sigma$ given condition D2. Note that $\bar{r}_{N-2} < \bar{r}_{N-1}$.

The manager one level higher delegates if

$$r < \bar{r}_{N-3} = (p_N - 2x)\sigma^2 - \mu + (1 - p_N + 2x)(\bar{r}_{N-2})$$

where $\bar{r}_{N-3} < \bar{r}_{N-2}$ since $\bar{r}_{N-2} < \bar{r}_{N-1} = p_N\sigma^2 - \mu$.

More generally, we have that manager m_l with $l \leq N - 2$ delegates to manager m_{l+1} if and only if

$$r < \bar{r}_l = (p_N - (N - l)x)\sigma^2 - \mu + (1 - p_N + (N - l)x)(\bar{r}_{l+1}),$$

where

$$\bar{r}_l < \bar{r}_{l+1} \iff \bar{r}_{l+1} < \bar{r}_{l+2}$$

which is indeed the case since we have shown above that $\bar{r}_{N-2} < \bar{r}_{N-1}$.

It follows that the larger is r , the lower the manager who is optimally allocated the initial authority, which we denote by m_l^* . In particular, m_l^* should be the highest level manager who is still willing to delegate below her. We have thus established

Proposition 11. *Assume that $r_i \approx r$ and condition D2 holds (balanced expertise). Then there exists a sequence of cutoffs $(r_0, r_1, \dots, r_{N-1})$ with $0 < r_i < r_{i+1}$, such that*

1. *If $r \leq r_0$, an $N + 1$ layered hierarchy is optimal*
2. *If $r \in (r_{j-1}, r_j) : h^* = \{m_j, m_{j+1}, \dots, m_N\}$.*
3. *If $r > r_{N-1}$, stand-alone activities are optimal (no hierarchy)*

If decision rents are small (low r) then it is optimal to allocate the initial decision right to the top manager m_0 . As r increases, optimal decision-making authority is allocated to lower levels in the hierarchy. Intuitively, the further down the hierarchy the more

willing a manager is to delegate to the manager directly below her if she is uninformed, since the difference in bias is small, but the probability that the manager below her is informed is large. Higher up the hierarchy, a manager thinking about delegating to the manager immediately below her faces an incentive conflict of the same magnitude, but the manager to whom she might delegate is relatively unlikely to be informed. Thus, it is more likely that the decision is hoarded.

If the decision rents are very large (high r) then managers are so power hungry that they never delegate. Given our balanced expertise condition (D2), who makes the decision is then irrelevant and stand-alone activities are one of the optimal organizational designs.

4.4 Non-monotonic comparative statics.

The special case of deterministic decision rents, finally, is instructive in illustrating the ambiguous impact of changes in σ^2 , μ and p_1 on the number of managerial layers. To understand these non-monotonic comparative statics, let us return again to the case where $N = 2$. From Proposition 9, m_0 is always part of his part of the optimal hierarchy if she delegates when uninformed, that is $r < \bar{r}_1$. As she never hoards decision rights, this makes her always valuable regardless of her knowledge. This condition is more likely to be satisfied if σ^2 is large, p_1 is large and/or μ is small. On the other hand, from Proposition 9, m_0 is also always part of the optimal hierarchy if she is the best stand-alone decision, that is if $p_0\sigma^2 \geq \max\{\sigma^2 - 2\mu, p_1\sigma^2 - \mu\}$. The latter condition is more likely to be satisfied if σ^2 is small, p_1 is small and/or μ is large. In the latter case, conflicts are so large, the uncertainty is so small and/or the middle manager so uninformed that the CEO is the preferred decision-maker even when she never delegates. Thus, it is in the intermediate parameter range for σ^2 , μ and p_1 , where m_0 never delegates but a $\{m_1, m_2\}$ or $\{m_2\}$ hierarchy is still reasonably efficient, that a CEO destroys value.

Formally, we can prove the following two propositions:

Proposition 12. *Assume $r_0 = r_1 \approx r$. If $r < p_0\sigma^2$, then $m_0 \in h^*$ for any μ or p_1 . If $r > p_0\sigma^2$:*

- *there exist $\mu_H > \mu_L > 0$ such that $m_0 \in h^* \iff \mu \notin (\mu_L, \mu_H)$*

- there exist $p_H > p_L > 0$ such that $m_0 \in h^* \iff p_1 \notin (p_L, p_H)$.

Proposition 13. *Assume $r_0 = r_1 \approx r$. There exists a \bar{r} , such that*

- if $r < \bar{r}$, $m_0 \in h^*$ for any σ^2 .
- if $r > \bar{r}$, there exist $\sigma_H^2 > \sigma_L^2 > 0$ such that $m_0 \in h^* \iff \sigma^2 \notin (\sigma_L^2, \sigma_H^2)$.

5 Extensions

To be completed

6 Concluding remarks

We have analyzed a model of organizational hierarchies with the novel, but realistic, ingredient that managers have preferences for making decisions themselves regardless of the decision itself. That is, they are power-hungry.

Our analysis shows that this assumption can yield strikingly different implications than in the received literature. One example is that an increase in externalities between activities can, in fact, lead to fewer managerial layers and, hence, less centralization. We also showed that hoarding of decision rights tends to be particularly acute at the top of the hierarchy. A consequence of this is that a hierarchy led by a top manager who is the organization's best stand-alone decision-maker may be dominated by a team of lower-level managers because of the relative proclivity of the top manager to fail to delegate. As a result, our model predicts optimal hierarchies to be smaller and more de-integrated in environments where preferences of power are more pronounced.

It is natural to think that there is heterogeneity in how power-hungry managers are across different environments. Political organizations, for-profit firms, and not for-profit firms might plausibly differ in how power-hungry their agents are. Our comparative static results shed light on some of the forces shaping the structure of these organizations. We also suggested in the introduction that developing countries may have

different organizational forms, in part, due to differences in decision rents to those in developed countries.

Cultural differences, too, may be an important determinant of how much under-delegation there is in organizations. The world value service finds a large heterogeneity in attitudes towards authority. One major dimension of cross cultural variation in the world concerns traditional versus secular-rational values, where societies that embrace more secular values place much less emphasis on authority. Differences in religion provide a related proxy. Bloom, Van Reenen and Sadun (2008) suggest that the prevalence of hierarchical religions, such as Catholicism and Islam, may explain the lack of decentralization in certain countries compared to say Protestant countries as Sweden or the United States. Consistent with this premise, Bloom, Van Reenen and Sadun (2012) report startling differences in the cross-country decentralization of firms: those in the United States and Northern Europe appear to be the most decentralized and those in Southern Europe and Asia are the most centralized.

A further empirical implication of our model is that studies seeking to relate certain organizational activities to the internal structure of firms may be flawed if they fail to control for decision rents. For instance, an influential paper by Garicano and Hubbard (2007) provides empirical evidence on the relationship between knowledge utilization and the hierarchical structure of firms using data on law offices from the 1992 Census of Services. Since decision rents affect hierarchy size, in the context of our model, even a flawless identification strategy that ignored decision rents would be subject to omitted variable bias.

Our model also shows that larger decision rents/stronger preferences for power affect decentralization of decision-making both directly, for a given organizational structure, and indirectly, by making smaller and more de-integrated firms optimal. Papers which, following the seminal work by Bloom and Van Reenen (2007), study management practices and the extent of delegation must therefore be careful when they control for organizational size and managerial layers.

The power-hungry assumption may also have implications in settings that do not involve “organizations” in the sense considered in this paper, and, further, where the “Hayekian” local-knowledge assumption may be inverted. To take just one example,

the relationship between parent and child often involves a choice of how much authority is to be “delegated”, and where the parent may possess superior information about the correct choice. Our model may provide a framework for thinking about the demarcation between parent and child authority over different activities.

Finally, given the problems that hoarding decision rights can cause, it is natural to think that organizations would seek to develop ways of discouraging such behavior. The most obvious is a direct reward for delegation.²⁰ But, of course, there may be more complex and subtle ones. Understanding these mechanisms may help shed light on other features of organizational design and culture. Another fascinating venue for future research is the endogenous selection of managers into positions of power. When there is substantial (unobserved) heterogeneity among agents, one would expect the most power-hungry managers to devote most resources and effort to gain access to positions of power. Following this logic, it is likely the most power-hungry and, hence, least suitable agents who rise to the top of the hierarchy, exacerbating organizational inefficiencies.

²⁰Unless decision rents are deterministic, however, subsidizing delegation decisions provides only a partial solution and will unavoidably result in both over- and under-delegation in equilibrium.

7 Appendix

7.1 Appendix 1: Micro-foundation payoff structure

Model summary and payoff structure: In this paper, we have considered an organization who is engaged in a set of activities $x_s \in X$. Each activity x_s is associated with an action choice $a_s \in A$ and generates a payoff $\pi_s(\theta_s, \mathbf{a})$ where $\mathbf{a} = (a_s)$ is the organization's action profile and θ_s is an i.i.d. activity-specific shock with variance σ_θ^2 . Each activity x_s is assigned to a hierarchy of managers $h(x_s) = \{m_0(x_s), \dots, m_{N-1}(x_s)\}$.

In this Appendix, we provide micro-foundations for the expected organizational payoffs $\Pi(m_j)$ when an informed manager $m_j \in h(x_s)$ chooses a_s . In our model section, we posited that

$$\Pi(m_j) = \Pi^* - \sum_{0 \leq t \leq j} \mu_t^2,$$

where $\Pi^* = \Pi(m_0)$ are the first-best expected payoffs given some \mathbf{a}_{-s} and where $\boldsymbol{\mu} = [\mu_0, \mu_1, \dots, \mu_{N-1}]$ with $\mu_0 = 0$ characterizes the externalities between the activities. If an uninformed manager m_j chooses a_s , we posited that expected profits are given by $\Pi(m_j) - \sigma^2$, where σ^2 is linear in σ_θ^2 .

Simple case with four activities and three layers. Consider first the most simple case of our model, where there are four activities, $X = \{x_1, x_2, x_3, x_4\}$, one top manager, two middle managers and four workers. Activities 1 and 2 share the same middle manager $m_1(x_1) = m_1(x_2)$, and activities 3 and 4 share the same middle manager $m_2(x_3) = m_2(x_4)$. Each activity $x_s \in X$ is associated with a multi-dimensional action $a_s = [a_{s,0}, a_{s,1}, a_{s,2}]$ who must be responsive to the activity-specific shock θ_s , but also take into account externalities μ_2 on the activity belonging to the same division (with the same middle manager) and externalities μ_1 on the activities belonging to the other division (assigned to the other middle manager). Concretely, organizational payoffs are given by

$$\sum_{s=1,2,3,4} \left[\sum_{j=0,1,2} (\theta_s a_{s,j} - \frac{1}{2} a_{s,j}^2) - \mu_1(a_{s,j}) - \mu_2(a_{s,2}) \right].$$

so that first-best actions are given by

$$a_s^* \equiv (a_{s,0}^*, a_{s,1}^*, a_{s,2}^*) = (\theta_s, \theta_s - \mu_1, \theta_s - \mu_2)$$

The payoffs of each individual activity x_s , however, are such that the middle manager $m_1(x_s)$ chooses a_s as if $\mu_1 = 0$ whereas the worker $m_2(x_s)$ chooses a_s as if $\mu_1 = \mu_2 = 0$. In particular, let activities x_s and x_k belong to one division (have the same middle manager $m_1(x_s)$) and let activities x_t and x_v belong to the other division, then we posit that

$$\pi_s \equiv \pi(\theta_s, \mathbf{a}) = \sum_{j=0,1,2} (\theta_s a_{s,j} - \frac{1}{2} a_{s,j}^2) - \frac{1}{2} \mu_1 (a_{t,2} + a_{v,2}) - \mu_2 (a_{k,1})$$

and

$$\pi_k \equiv \pi(\theta_k, \mathbf{a}) = \sum_{j=0,1,2} (\theta_k a_{k,j} - \frac{1}{2} a_{k,j}^2) - \frac{1}{2} \mu_1 (a_{t,2} + a_{v,2}) - \mu_2 (a_{s,1})$$

so that an informed middle manager $m_1(x_s)$ would choose

$$(a_{s,0}, a_{s,1}, a_{s,2}) = (\theta_s, \theta_s, \theta_s - \mu_2) \neq a_s^*$$

whereas an informed worker $m_2(x_s)$ would choose

$$(a_{s,0}, a_{s,1}, a_{s,2}) = (\theta_s, \theta_s, \theta_s) \neq a_s^*$$

Since worker $m_2(x_s)$ maximizes π_s , she ignores both μ_1 and μ_2 when choosing a_s . Since middle manager $m_1(x_s)$ maximizes $\pi_s + \pi_k$, she ignores μ_1 when choosing a_1 and a_2 .

It is now straightforward to verify that if an informed middle manager $m_1(x_s)$ chooses $a_s = (a_{s,1}, a_{s,2}, a_{s,3})$, then this results in a payoff loss of μ_1^2 relative to first-best profits. Similarly, one can verify that delegating control over a_s to an informed worker $m_2(a_s)$ results in a payoff loss of $\mu_1^2 + \mu_2^2$ relative to first-best firm profits. Finally, from the perspective of an informed middle manager $m_1(x_s)$, who maximizes $\pi_s + \pi_k$, delegating a_s to an informed worker $m_2(a_s)$ reduces divisional profits $\pi_s + \pi_k$ by μ_2^2 .

Whenever an uninformed manager $m_j(x_s)$ chooses a_s rather than an informed manager $m_j(x_s)$, then given the quadratic payoff specification, expected (firm or divisional) payoffs are reduced by $\sigma^2 \equiv 3\sigma_\theta^2$, where σ_θ^2 is the variance of θ_s .

General case. The simple case above is readily extended to any number of organizational layers and managers. In an N -layer organization, each activity $x_s \in X$ is associated with a N -dimensional action $a_s = [a_{s,0}, \dots, a_{s,N-1}]$ and assigned (up) to $N - 1$ managers $\{m_j(x_s)\}$ with $j \in \{0, 1, \dots, N - 1\}$. We denote by $D_{s,j} \subset X$ the set of all activities x_k which share the same level- j manager as x_s and hence belong to the same level- j division. By assumption, $D_{s,0} = X$ as all activities share the same top manager m_0 and $D_{s,N-1} = \{x_s\}$ as the lowest level manager assigned only one activity.

Organizational profits are given by

$$\sum_{x_s \in X} \left\{ \theta_s \cdot I \cdot a_s^T - \frac{1}{2} a_s \cdot a_s^T - \boldsymbol{\mu} \cdot a_s^T \right\}, \quad (7)$$

where $I = [1, 1, \dots, 1]$ and $\boldsymbol{\mu} = [\mu_0, \mu_1, \dots, \mu_{N-1}]$ with $\mu_0 = 0$. It is easy to verify that the first-best action $a_s^* = [a_{s,0}^*, \dots, a_{s,N-1}^*]$ is characterized by $a_{s,j}^* = \theta_s - \mu_j$. The payoffs of each individual activity x_s , however, are such that manager $m_j(x_s)$ chooses a_s as if $\mu_t = 0$ for $j \leq t$. Concretely, the payoffs associated with each individual activity are given by

$$\pi_s(\theta_s, a) = \theta_s \cdot I \cdot a_s^T - \frac{1}{2} a_s \cdot a_s^T - \sum_{j=1}^{N-1} \left(\frac{1}{|D_{s,j-1}| - |D_{s,j}|} \sum_{x_k \in D_{s,j-1} \setminus D_{s,j}} \mu_j a_{k,j} \right). \quad (8)$$

In expressions (7) and (8), the term $\mu_j a_{s,j}$ is the aggregate externality imposed by x_s on all activities x_k that belong to the same layer- j division $D_{s,j}$ as x_s but not the same layer- $(j + 1)$ division $D_{s,j+1}$. It follows that total payoffs are still given by (7), but manager $m_j(x_s)$ chooses $a_{s,t} = \theta_s$ for $t \leq j$, and $a_{s,t} = \theta_s - \mu_j$ for $t > j$.

The above payoff structure results in a tractable loss of control which increases linearly as decision-making moves down the hierarchy. In particular, if a_s is delegated to an informed manager $m_j(x_s)$ whereas all other actions $a_k \neq a_s$ are set at their first-best level a_k^* , then expected profits equal

$$\Pi(m_j) = \Pi^* - \sum_{0 \leq t \leq j} \mu_t^2,$$

where Π^* are first-best profits. If an uninformed manager $m_j(x_s)$ chooses a_s then because of the quadratic payoff structure, this results in a expected payoff equal to $\Pi(m_j) - \sigma^2$,

where $\sigma^2 \equiv N\sigma_\theta^2$.

7.2 Appendix 2: Omitted proofs.

Proposition 6. *Assume Conditions C1 and C2 hold, then $m_0 \in h^* \implies m_1 \in h^*$.*

Proof: Without loss of generality, we normalize all parameters such that $\sigma^2 = 1$. If $m_0 \in h^*$, then from (4)

$$p_0 \geq \bar{r}_0 \frac{1 - F(\bar{r}_0)}{1 - F(\bar{r}_0)\bar{r}_0} = \bar{r}_1 \frac{1 - F(\bar{r}_0)}{1 - F(\bar{r}_0)\bar{r}_0} - (\bar{r}_1 - \bar{r}_0) \frac{1 - F(\bar{r}_0)}{1 - F(\bar{r}_0)\bar{r}_0}$$

From (6), $\bar{r}_1 - \bar{r}_0 \leq \mu$ and $\bar{r}_0 < 1$. Hence, it follows that

$$m_0 \in h^* \implies p_0 > \bar{r}_1 \frac{1 - F(\bar{r}_0)}{1 - F(\bar{r}_0)\bar{r}_0} - \mu$$

Finally, we have that

$$\frac{\partial}{\partial r} \left(\frac{1 - F(r)}{1 - F(r)r} \right) < 0 \iff F(r)(1 - F(r)) - f(r)(1 - r) < 0$$

We have that $F(r)(1 - F(r)) - f(r)(1 - r) = 0$ if $r = 1$. Moreover, for $r \in (\bar{r}_0, 1)$

$$\frac{\partial}{\partial r} (F(r)(1 - F(r)) - f(r)(1 - r)) = 2f(r)(1 - F(r)) - f'(r)(1 - r) > 0$$

given condition C2. Since $\bar{r}_0 < \bar{r}_1 < 1$, it follows that

$$\frac{1 - F(\bar{r}_0)}{1 - F(\bar{r}_0)\bar{r}_0} > \frac{1 - F(\bar{r}_1)}{1 - F(\bar{r}_1)\bar{r}_1}$$

and

$$m_0 \in h^* \implies p_0 > \bar{r}_1 \frac{1 - F(\bar{r}_1)}{1 - F(\bar{r}_1)\bar{r}_1} - \mu$$

So that if $f'(\cdot) \leq 0$, then whenever $p_1 - \mu \geq p_0$, we have that $m_0 \in h^* \implies m_1 \in h^*$. QED

References

- [1] Aghion, Philippe and Patrick Bolton (1992), "An Incomplete Contracts Approach to Financial Contracting," *Review of Economic Studies*, Vol. 59(3), 473-494.
- [2] Aghion, Philippe, Tirole Jean (1997). Formal and real authority in organizations. *Journal of Political Economy* (105) 1-29.
- [3] Aghion, Philippe, Holden, Richard (2011). Incomplete contracts and the theory of the firm: What have we learned over the past 25 years? *Journal of Economic Perspectives* (25) 181-197.
- [4] Alonso, Ricardo, Wouter Dessein; Niko Matouschek (2008). "When does coordination require centralization?" *American Economic Review* 98, 145-179.
- [5] Alonso, Ricardo, Wouter Dessein, Niko Matouschek (2015). "Organizing to Adapt and Compete," *American Economic Journal: Microeconomics*, 7(2): 158-87.
- [6] Baker, G., Gibbons, R., Murphy, K.J., 2002. Relational contracts and the theory of the firm. *Quarterly Journal of Economics* (117) 39-83.
- [7] Barltng, Bjorn, Ernst Fehr and Holger Herz (2014), "The Intrinsic Value of Decision Rights." *Econometrica*, Vol. 82, No. 6, 2005–2039.
- [8] Berle, Adolf, and Gardiner Means (1932), *The Modern Corporation and Private Property*. Mac Millan, New York, NY.
- [9] Bolton, Patrick and Mathias Dewatripont, 1994. "The firm as a communication network," *The Quarterly Journal of Economics*, Vol. 109, No. 4, 809-839
- [10] Bloom, Nicholas, Benn Eifert, Aprajit Mahajan, David McKenzie and John Roberts (2012), "Does Management Matters? Evidence from India." *The Quarterly Journal of Economics* 128 (1): 1-51.
- [11] Bloom, Nicholas, and John Van Reenen (2007). "Measuring and Explaining Management Practices Across Firms and Countries." *The Quarterly Journal of Economics* 122.4: 1351-1408.

- [12] Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2009). "The Organization of Firms Across Countries." NBER Working paper Series, July 2009.
- [13] Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (2012). "The Organization of Firms Across Countries." *The Quarterly Journal of Economics* 127.4 : 1663-1705.
- [14] Calvo, Guillermo A. and Stanislaw Wellisz (1979), "Hierarchy, Ability, and Income Distribution," *Journal of Political Economy*, 87, 991-1010.
- [15] Chandler, Alfred (1962), *Strategy and Structure* Garden City, N.Y.: Doubleday.
- [16] Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.
- [17] Dessein, W. 2002. Authority and Communication in Organizations. *The Review of Economic Studies* (69) 811-838
- [18] Dessein, W., Garicano, L., Gertner, R. 2010. Organizing for Synergies. *American Economic Journal: Microeconomics* (2) 77-114.
- [19] Dyck, Alexander and Luigi Zingales (2004) "Private Benefits of Control: An International Comparison," *The Journal of Finance*, 59(2), pp. 537-600.
- [20] Fehr, Ernst, Holger Herz, and Tom Wilkening (2013), "The Lure of Authority: Motivation and Incentive Effects of Power," *American Economic Review*, 103(4), 1325-59.
- [21] Friebel, G., Raith, M. 2010. Resource Allocation and Organizational Form. *American Economic Journal: Microeconomics* 2, 1-33.
- [22] Garicano, Luis (2000). "Hierarchies and the Organization of Knowledge in Production.," *Journal of Political Economy*, 108, 874-904.
- [23] Garicano, Luis and Tim Van Zandt (2013), Hierarchies and the Division of Labor, *Handbook of Organizational Economics*, Robert Gibbons and John Roberts, Editors, Princeton University Press.
- [24] Garicano, Luis and Thomas N. Hubbard (2007), "Managerial Leverage Is Limited by the Extent of the Market: Hierarchies, Specialization, and the Utilization of Lawyers' Human Capital" *Journal of Law and Economics*, 50(1), pp. 1-43.

- [25] Grossman, S., Hart, O., 1986. The costs and benefits of ownership: a theory of vertical and lateral integration. *Journal of Political Economy*, 94, 691-719.
- [26] Hamilton, Barton H. (200), "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment," *Journal of Political Economy*, 108(3), 604-631.
- [27] Hart, O., 1995. *Firms, contracts, and Financial Structure*. Oxford: Clarendon Press.
- [28] Hart, O., Holmstrom, B., 2010. A theory of firm scope. *Quarterly Journal of Economics* 125, 483-513.
- [29] Hart, O., Moore, J. 1990. Property Rights and the Nature of the Firm. *Journal of Political Economy* 98, 1119-1158.
- [30] Hart, O., Moore, J. 2005. On the design of hierarchies: Coordination versus Specialization. *Journal of Political Economy* 113, 675-702.
- [31] Hart, Oliver, and John Moore (1995) "Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management," *American Economic Review*, 85(3), 567-585.
- [32] Hayek, F. 1945. The use of knowledge in society. *American Economic Review* (35) 519-530.
- [33] Hsieh, Chang-Tai and Peter Klenow (2014), "The Life Cycle of Plants in India and Mexico." *The Quarterly Journal of Economics* 129(3) 1035-1084.
- [34] Marschak, Jacob, and Roy Radner (1972). *Economic Theory of Teams*. New Haven, Connecticut: Yale University Press.
- [35] McClelland, David (1961). *The Achieving Society*.
- [36] McClelland, David (1975). *Power: The Inner Experience*. Irvington, New York: Halsted Press.
- [37] Milton Harris and Artur Raviv (2002), Organization Design, *Management Science* Vol. 48, No. 7, pp. 852-865

- [38] Moskowitz, Tobias J., and Annette Vissing-Jørgensen (2002), "The Returns to Entrepreneurial Investment: A Private Equity Premium Puzzle?" *American Economic Review*, 92(4): 745-78.
- [39] Murray, Henry (1938) *Explorations in Personality*.
- [40] Owens, David, Zachary Grossman and Ryan Fackler. 2014. "The Control Premium: A Preference for Payoff Autonomy." *American Economic Journal: Microeconomics*, 6(4): 138-61.
- [41] Pugsley, Benjamin Wild and Eric Hurst (2011), "What Do Small Businesses Do?" *Brookings Papers on Economic Activity*, 43(2): 73-142.
- [42] Radner, Roy (1993), "The Organization of Decentralized Information Processing," *Econometrica*, 61, 1109-1146.
- [43] Rantakari, H. 2008. Governing Adaptation. *Review of Economic Studies* (75) 1257-1285.
- [44] Roberts, J., 2004. *The Modern Firm: Organizational Design for Performance and Growth*. Oxford: Oxford University Press.
- [45] Scharfstein D, Stein, J. 2000. The dark side of internal capital markets: divisional rent-seeking and inefficient investment. *Journal of Finance* 55, 2537-2564.
- [46] Sloof, Randolph and Ferdinand von Siemens (2016). "Illusion of Control and the Pursuit of Authority", *Journal of Experimental Economics*, Forthcoming.
- [47] Stein, J. 1997. Internal capital markets and the competition for corporate resources. *Journal of Finance*, 52, 111-133.
- [48] Stein, J., 2002. Information production and capital allocation: decentralized versus hierarchical firms. *Journal of Finance*, 57, 1891-1921.
- [49] Van den Steen, E. 2010. Interpersonal authority in a theory of the firm. *American Economic Review*, 100, 466-490.

- [50] Williamson, O., 1971. The vertical integration of production: market failure considerations. *American Economic Review* 61, 112-123.
- [51] Williamson, O., 1975. *Markets and hierarchies: Analysis and Antitrust Implications*. New York, NY: Free Press.
- [52] Williamson, O., 1985. *The Economic Institutions of Capitalism*. New York, NY: Free Press