Three Essays in Applied Microeconomics

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Abstract

When a contract is signed between two economic agents, it is likely to produce some effect on non-contracting, third parties and provide new information to the contracting parties. This thesis examines how such third party externality and newly generated information should affect the initial form of the contract.

In the first essay, a headquarters of a firm designs a mechanism with which it extracts the division managers' superior information about the external market opportunities. The information allows the headquarters to provide optimal investment incentive to the managers and make efficient trading decisions. The essay provides a justification for a real-world headquarters, who delegates all the operating decisions to the division managers but maintains the ultimate authority within the firm.

The second essay examines how a client would contract with her lawyer to provide best incentive to the lawyer and maximize her return from litigation. By providing different contingent shares based on settlement and judgment, she is able to provide better incentive without diluting her return from litigation. At the same time, when she has relatively poor bargaining leverage against the counter party, the essay shows that delegating the settlement authority to the lawyer and leaving him a large rent would be more beneficial for the client.

The third essay analyzes the salary contracting problem faced by the owner of a firm who is aware of a potential opportunity to sell her firm in the future. The essay demonstrates that when the owner grants a large severance payment to the employee, she would be able to defer the compensation burden to the potential buyer and increase her net return from the firm.

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Chapter 1

Introduction

In the canonical principal-agent problem, the principal offers a contract to her agent to induce the agent to undertake some desired but unobservable action. While attempting to solve this problem in different situations has produced vigorous research in economics, it would be surprising to see a real world contract that produces no effect on the economic actors immediately outside the two-party relationship. At a minimum, the bilateral contract possibly prevents a third party from entering into a contract, at least temporarily, with either of the contracting parties. Alternatively, the agent's action may not only affect the principal's bottom line but also that of a third party, so that attempting to encourage the agent to undertake some action through a contract may produce a collateral effect on a third party. In fact, such third-party effect may precisely be what the principal wants to induce from the agent in the first place. On a different angle, the contract could also change the principal's behavior by changing her expected return from the principal-agent relationship and thereby altering her behavior toward the third party.

In the presence of such third party effect, how does it redound back to the principal-agent duo? In their pioneering article, "Equilibrium Incentives in Oligopoly," Fershtman and Judd have shown how the principal offers different incentive schemes to the agent in accordance with the changing oligopolistic market settings in which the agent compete. While it may not be too surprising to know that the third party externality would have some effect on the contract, would the externality enable the principal to offer a better incentive scheme than in the purely bilateral case? If not, what additional benefit would it produce? As a starting point, Holmstrom's seminal article, "Moral Hazard and Observability," has demonstrated that an additional event that does not provide new information about the agent's actions is of no value to the principal in designing the incentive system. So, if an interaction with the third party is such an event, would it add any value for the principal? Perhaps at a more basic level, if the new information would be useful but the principal initially lacks access to them, how would the principal obtain such information in the first place? This thesis is an attempt to provide some answers to these questions by examining three different scenarios, where a principal designs a contract with the agent while expressly taking the third party effect into account.

The first essay, "The Role of Headquarters in Firm-Specific Investments and Intra-Firm
Trade,” examines how a headquarters can design a mechanism (contract) with selling (upstream) and buying (downstream) division managers to encourage both optimal investment and trading decisions. Because the divisions are potential trading partners, contracting with one division alone would produce an externality on the other division by altering the contracting division’s procurement, or sale, decisions. At the initial level, the essay asks why real-headquarters often stays aloof from operations but retains ultimate decision-making authority within the firm. In our investment-trading framework, the essay demonstrates that when trading parties need to make relationship-specific investments that directly affect the other’s profit from trade, if the parties were to achieve the efficient level of investments by themselves, both parties need to be residual claimants of the total profits. Thus, correction of the investment externalities problem requires the trading parties to be within a single hierarchical structure as divisions with a headquarters at the top.

On the other hand, because the headquarters stays aloof from the operations, it is at an informational disadvantage compared to the division managers. Especially when the external market conditions are unknown at the time of investment, divisional trading (internal trade) may not always optimal ex post: despite the initial investment, it may be more lucrative to either sell to or buy from the external market. To implement optimal type of trade, the headquarters, therefore, needs to extract the managers’ superior information about the external market. But, how does the real world headquarters extract such information? Motivated by the empirical studies conducted by sociologist Eccles, the essay presents a simple mechanism, consisting only of requests over either internal or external trade and trade-contingent (transfer) payments, that enables the headquarters to extract the managers’ information through deliberate creation of a potential disagreement over trade. Divisional haggling, thus, generates valuable information to the headquarters. Also, consistent with the real world, the headquarters relies on simple, communicable reports from the managers to create a contractible variable, which, in turn, is used to create an optimal decision making structure.

The other two essays take more partial equilibrium approach. The second essay, “Allocating Settlement Authority under Contingent Fee Arrangement,” for example, cloaks our principal as a litigant who needs to hire a lawyer to fight the counter party in court. Because the principal cannot observe the level of lawyer’s effort, she attempts to align the lawyer’s interest by giving some stake of the outcome to the lawyer: she uses a contingent fee arrangement. However, while bigger contingent share to the lawyer would provide better motivation to the lawyer and a possibly better settlement term, it is also costly to the principal. In order to provide the best possible incentive without diluting her return from litigation, she would bifurcate the settlement and trial shares for the lawyer. Settlement, thus, provides another contractible event while the lawyer’s effort imposes a direct externality on the counter party by altering the expected outcome from trial. Concurrently, the essay also examines the role of delegation. Specifically, when the principal has a weak bargaining power against the counter party, rather than trying to bargain herself, it would be better for her to leave the lawyer in charge. When she puts the lawyer in charge, even though she would leave the lawyer a substantial amount of rent, the lawyer will extract the highest possible settlement offer from the counter party. At optimum, in addition to using settlement as another contractible variable, the principal also delegates the decision-making authority to the agent to increase her return from litigation.
While the principal attempts to mitigate the under-effort problem in the second essay, the third essay, "A New Rationale for Golden Parachutes," presents a model where interaction with a third party does not allow the principal to better align the agent's interest per se. The model starts with an assumption that the agent's interest misalignment problem can be cured with a simple incentive contract. Instead, when the owner of a firm is aware of the possible emergence of a buyer in the near future, when designing a salary scheme for her manager-agent, she would have an incentive to shift the compensation burden to the yet unknown buyer through a large merger-related compensation to the agent (a golden parachute). When she grants the golden parachute, she can lower the compensation for the executive when the merger does not occur, and such reduction of non-merger compensation would increase her net value of the company so as to increase her reservation value against the future buyer. Thus, the article demonstrates that even though the principal's interaction with the third party buyer produces no information about the agent's actions nor allows her to provide better incentive system for her agent, the interaction still affects the form of the contract between the principal and the agent. In the current case, the contract itself produces an externality on the buyer by changing the principal's reservation value of the company.
Chapter 2

The Role of Headquarters in Firm-specific Investments and Intra-Firm Trade

2.1 Introduction

In most corporate organizations, there are divisions that make operating decisions and a headquarters who oversees the divisions' activities. Although the headquarters has the final decision-making authority within the firm, it usually remains aloof from the day-to-day operations of the firm. Instead, it hires division managers to gain first-hand knowledge of the respective divisional activities, and delegates to them the decision making authority over such activities. The headquarters relies on summarized reports from the managers and focuses on tasks that affect the entire organization, such as setting long-term strategic goals for the firm, providing managerial incentives, and allocating capital across divisions. The division managers are thus given responsibility over the performance of respective divisions while the headquarters functions as a supervisor.

Notwithstanding the widespread existence of such organizational structure, theoretical justification for the existence of a headquarters has not been fully satisfactory. The property rights theory, with its emphasis on non-verifiable, relationship-specific investments, has made path-breaking contributions to the issues of firm boundary and vertical integration. But it has left the puzzle over third party ownership of control rights unresolved. The theory pre-

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1 For synoptic descriptions of modern corporate organizations, see Chapter 2 of Milgrom and Roberts (1992) and Chapter 11 of Williamson (1988). For a more extensive, historical perspective over the emergence of such structure, see Chandler (1962). Lastly, see Freeland (1996) for a more critical perspective of the task specialization between the headquarters and divisions.


3 There are actually two (parallel) puzzles concerning third-party ownership: why would shareholders own the firm but leave control to the firm's managers, and why would headquarters have ultimate authority within the firm but leave investment choices to the divisions. In this paper, we focus on the latter, effectively assuming that there are no shareholders—the headquarters owns the firm. For similar concerns over property rights theory and the existence of headquarters, see Bolton and Scharfstein (1998) and Williamson (2000). Holmstrom (1999)
dicts that the control rights over property will reside with the party whose relationship-specific investments are most important. In the real world, however, such control rights belong to a third-party headquarters, even though the division managers make bulk of the investment decisions for the firm. If the managers are the ones who need to be encouraged to make firm-specific investments, why aren’t they granted final decision rights over corporate assets? Why do we even need a headquarters, who not only refrains from engaging in operations, but often is not even qualified to make investment decisions?

In this paper, we attempt to provide a justification as to why a headquarters figure may be essential and what it can do to promote efficiency when it is at an informational disadvantage compared to the division managers. We analyze the problem in the context of firm’s choice over internal versus external trade, and assume that the division managers need to make non-verifiable, firm-specific investments to increase the value of trade. When such investments directly benefit the other divisions, i.e., when the investments have “cooperative” components, leaving the managers alone will fail to achieve efficiency. To induce optimal level of investment, each manager needs to be compensated not only for the benefits of her investment on her own division but also for the benefits she generates on the other divisions. All division managers need to be residual claimants of the firm profit, and this is not feasible under budget balance. A headquarters, who does not make such investments, can function as the (margin) budget breaker to provide optimal investment incentives for the division managers.

Breaking the budget balance is only half the problem. Firm-specific investments notwithstanding, the firm would want to trade externally when lucrative opportunities are present in the outside market. The firm’s profit depends not only on the ex ante investments but also on the ex post choice over trade. To judiciously perform its budget-breaking function, therefore, the headquarters has to know what the ex post optimal trade is: i.e., needs to know when to break the budget balance. Unfortunately, while staying at a distance from the operations may have rendered the headquarters a good candidate for a budget breaker, such distance also keeps it away from the valuable information that are necessary to make optimal choice over trade. The division managers will have much better information, but delegating the authority to the managers would threaten to summon back the original hold-up problem. Hence, the headquarters needs to design a process that extracts the managers’ superior information without empowering them too much to dilute their investment incentives.

We are interested in a particular method of information extraction: information obtained through potential divisional disputes over trade. Based on an extensive field study of thirteen manufacturing firms, Eccles (1985) documents how a headquarters can use “conflict” between divisions to “generate information and facilitate control.”

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provides a broader perspective and criticism over the theory. For a different analytical approach to third party ownership of control rights, see Rajan and Zingales (1998).

4Che and Hausch (1999) distinguishes “cooperative” versus “selfish” components of investments based on whether one’s investment benefits the others or benefits oneself.

5Holmstrom (1982) analyzed the role of the principal as a budget breaker in a moral hazard in teams problem, but in this paper, the principal does not observe the realized state of the world without deciding on trade.

6Eccles (1985) at 213. This paper is also consistent with Dewatripont and Tirole (1999) in setting division managers as advocates of respective divisions and relying on their disputes to generate information.
when a division manager thinks internal trade is unprofitable for her division, she will provide the headquarters with the necessary information about the external market so as to convince the headquarters of her position. The headquarters can rely on the supplied information to get better informed about the external market and to institute better trade policy. While Eccles’ perception of conflict is quite general and the purported types of information supplied to the headquarters varied, we present a more stylized form of conflict by focusing on divisional disagreement over internal and external trade.

Suppose there are two divisions, upstream and downstream, and one external market for an intermediate good. When the market price of the intermediate good is high, the downstream division would prefer obtaining the good from the upstream division, but the upstream division would rather sell outside. The reverse happens when the market price is low: the downstream division prefers external procurement, while the upstream division prefers internal production.\(^7\) Foregoing detailed reports that it may not even understand, the headquarters can elicit simple trade requests (summarized reports) from the managers and make the manager who wants to trade externally live up to her words by adopting her request. Each manager would then request external trade only when it is in her interest to do so. By appropriate design of trade-contingent transfer payments, the headquarters can align her interest with that of the firm. At optimum, one division requests external trade when such is efficient for the firm, and the headquarters can rely on the external trade request to make optimal trading decision.

Finally, to make its reliance on the external trade request optimal, the request must be informative: the headquarters needs to prevent the other division manager from making its own external trade request when it is inefficient for the firm. In our example, if the upstream division requests external sale and the downstream division requests external purchase, then the headquarters will be at a loss as to what the optimal type of trade is. Since not both divisions can be right, the headquarters needs to prevent the lying division from sending the wrong request. Again, through appropriate transfer payments that punish inconsistent trade requests, the headquarters can prevent such information-destroying set of requests from being submitted. Thus, by discouraging some type of dispute while encouraging others, the headquarters confines the scope of the dispute. Divisional disputes are managed and tailored to transmit only the reliable information to the headquarters.

Two results from the model deserve a short mention. The first is that when investment affects the values of internal and external trade at the same or almost the same rate (i.e., when the market provides perfect or near-perfect monitoring), providing optimal investment incentive is not feasible. The reason directly stems from investment externalities. When one division’s investment increases the other division’s value of internal trade, the investing division is more likely to reap the benefit of its investment through more frequent internal trade. But when it increases the other’s value of external trade, the opposite occurs and the chances of lucrative internal trade for the investing division diminishes. When the two effects are equal at the margin, the investing division will not care about how its investment affects the other’s value of trade, even though this is suboptimal for the firm. Moreover, even if the effects are

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\(^7\)In Eccles’ terminology, “internal transactions are most attractive to one [division] when they are least attractive to the other.” *Id.* at 212. He calls this phenomenon, “an irony of [] integration.” *Id.*
almost equal, the headquarters has to provide such a strong incentive to the investing division to achieve optimality, that when the total value of trade is bounded, such incentive scheme will be impractical (i.e., it will violate participation constraints).

The second point relates to "dual transfer pricing," where the price a buying division pays for an internally produced intermediate good differs from that a selling division gets, as Eccles sometimes observed. Being a budget breaker implies that the net payments the headquarters makes to the divisions, or the headquarters' profit from trade, differ across states. When the headquarters implements a single transfer price, it receives no profit in case of internal trade. But if the optimal transfer payment schedule requires the headquarters' profit to be lower in case of external trade, it will be forced to suffer net outflows when it orders external trade. To restore the headquarters' ex post profitability, therefore, it needs to extract more profit from the division managers. In case of internal trade, it can lower the price the selling division gets, increase the price the buying division pays, and keep the difference. By doing so, it shifts the entire profit schedule and increases its profit under all trade regimes.

The paper is organized as follows. The next section presents a brief overview of the relevant literature. In section three, the basics of the model with a brief first best benchmark are presented. In section four, the main segment of the paper, we present our simple mechanism and the conditions that are necessary for the first best implementation under this mechanism. We also analyze and compare the implications of the perfect market monitoring and show when dual transfer prices may be necessary by examining the participation constraints. We take a step back in section five and demonstrate why the headquarters is necessary in the first place, i.e., whether the division managers themselves can implement the first best without a headquarters. In the penultimate section, we generalize the model by introducing more stochastic elements to the values of internal and external trade. Section seven concludes with discussions on the strengths and weaknesses of the model and possible extensions.

2.2 Literature Review

Although our topic relates to many different areas of research, we briefly review three interrelated strands of literature: property rights, incomplete contracts, and transfer pricing. First, Grossman and Hart (1986) and Hart and Moore (1990, 1999) provide an analytical framework in studying relationship-specific investments and property rights. When trading parties need to make non-verifiable, relationship-specific investment to increase the value of trade, property rights can play an important role. Granting one party with the control rights over a property, which is essential for trade, will increase the party's incentive to invest by protecting his investment from the trading partner's possible attempt of hold-up. However, if the trading partner also needs to make relationship-specific investments on the property, because his investments are now subject to the owner's opportunism, he will be much hesitant to make costly investment.

The central tenet of the authors' theory is that the control rights over a property must belong to the one whose investment is most important to the relationship. Extending this insight to the issue of the boundary of the firm, if one party's investment is most important
over several properties, he should be granted control rights over all of them. Such arrangement creates an owner-employee type of structure where a single party owns several properties while the others work under contractual relations with the owner. However, the theory also predicts that there is little reason for a party who does not make relationship-specific investment to have control rights over a property that is important for trade. Such prediction renders the theory at odds with the existing corporate structures, where a headquarters is given control over all corporate assets while division managers, who are much more influential in investments, act as mere agents of the headquarters.

On a different path, incomplete contracts literature has developed how the trading parties could contractually solve the hold-up problem without selectively assigning control rights over property. Aghion, Dewatripont and Rey (1994) and Noldeke and Schmidt (1995) propose mechanisms that involve a default (option) contract with explicit (implicit) allocation of bargaining power to one party. The party with all the bargaining power will fully internalize the benefit of his investment by extracting all the surplus from the other party, while the one with no bargaining power is given optimal investment incentive through change in the value of default contract. In a similar vein, Edlin and Reidelstein (1995) show how the two parties, without granting one party all the bargaining power, can achieve optimal investment incentive through default contract and ex post negotiated price.

Although such contractual scheme can solve what is essentially a moral hazard in teams problem that is endogenously created through hold-up, Che and Hausch (1999) demonstrate that when the investments exhibit direct externalities, i.e., when the externality condition is exogenous, such default contract scheme works poorly. They show that when the externality effects are sufficiently strong—when the "cooperative" components of investments are important, default contract scheme is worse than having no contract. This is because investment mostly strengthens the counter party's bargaining position by improving the counter party's value of default contract. So, the investing party will have even less of an incentive to undertake the costly investment, since it will only undermine his ex post return.

Pre-Holmstrom and Tirole (1991) literature on transfer pricing, notably Harris, Kriebel, and Raviv (1982), focused primarily on the information revelation aspect, where the headquarters attempts to induce truthful revelation of cost and value of the intermediate and final products. Parting with the tradition, Holmstrom and Tirole base their analysis on the incomplete contracts framework and examine the transfer pricing issue in light of organizational structure. In their model, division managers need to make firm-specific investments and the headquarters can choose among different organizational forms as a complementary incentive scheme to encourage such investments. The model demonstrates that while granting the division managers the freedom to trade with the market provides more monitoring on their investments, they may engage in too much market activities solely to increase their bargaining position vis-à-vis their trading partner. When firm-specific investments are sufficiently important and the market's monitoring of the investment (how the value of external trade changes compared to the value of internal trade) is not perfect, the headquarters can induce the managers to focus more on firm-specific investments by eliminating the external trade options.

In line with the market monitoring theme, Rotemberg (1991) employs Klein-Leffler approach to analyzing intra-firm trade. When the quality of traded good is not immediately observable
and the seller needs to make investment that improves the good's quality, granting the buyer the power to unilaterally severe the relationship with the seller may be necessary. When the trade occurs in the market, contractual freedom of the buyer to terminate the relationship provides implicit monitoring over the seller's investment over quality. On the other hand, when the buyer is forced to purchase from the seller, as under a mandate from the headquarters, such quality monitoring disappears in conjunction with the investment on quality. In contrast to the implicit assumption over mandatory internal trade, however, headquarters does often grant division managers the freedom to transact with external parties. So, the model leaves the question as to why the headquarters would always insist on internal trade unresolved.

Probably the most piercing criticism on borrowing the buyer-seller approach to internal transfer pricing policy comes from Holmstrom and Tirole. They note that such approach "overlooks the reasons why trade is internal in the first place. By considering transfer pricing as an isolated contracting problem, the analysis applies equally well to trade between two firms as to trade between two units of the same firm." Although adopting non-verifiable, relationship-specific investments into the analysis, as in Holmstrom and Tirole, may motivate the internal trade assumption better, mechanism design literature has already developed various contractual solutions to the hold-up problem that again destroy the internal versus external trade distinction. In the mean time, the issue over why a third party, such as the headquarters, would own control rights over all corporate assets still looms large. As an attempt to address these issues, we believe direct investment externalities across trading parties create an important role to be filled by the headquarters and also provide a good justification to the reason for internal trade.

Lastly, works by Eccles (1985) provide the most widely quoted examples. Based on interviews with thirteen manufacturing firms, he documents three broad types of transfer pricing policies: exchange autonomy, mandated market based, and mandated full cost. Some firms also use dual transfer pricing as a hybrid form. In an exchange autonomy, division managers are free to adopt any type of pricing policy and to trade with external parties, while in either mandated market based or full cost policies, they are to trade internally using the designated policy. When firms use dual transfer prices, although internal trade is usually required, what the buying division pays differs from what the selling division gets. Some of his notable findings are 1) the headquarters do sometimes allow division managers to trade with the market, 2) transfer pricing scheme, as part of a broader organizational policy, evolves over time, 3) divisional conflicts can be a useful tool for the headquarters because such conflicts produce information, and 4) managers are generally averse to internal trade.

This paper motivates mainly on the first three of his findings. First, by explicitly allowing the possibility that external trade is more profitable, the headquarters needs to, on occasion, allow the division managers to trade with the market. External trade does occur in equilibrium. Second, trade and transfer pricing policies must adapt to the changing external market conditions. When the market presents a superior alternative, the headquarters should not insist on internal trade but allow the division managers to take advantage of the opportunities. Lastly, by drawing potentially conflicting trade requests from the division managers, the

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headquarters gains better information about the market. Extracting their information without delegating too much authority enables the headquarters to provide optimal ex ante incentive for firm-specific investments without sacrificing ex post market opportunities.

2.3 The Environment

Figure 1 depicts the organizational structure of the firm. It consists of one headquarters and two divisions, upstream and downstream, all risk neutral. We assume that the headquarters owns all the physical assets of the firm and it assigns division managers to work with respective physical assets to produce an intermediate widget and a final good. The upstream division can manufacture one unit of intermediate widget, while the downstream division can produce one unit of final product with a unit of intermediate widget.

When producing the final product, the downstream division can either buy a unit of firm-specific widget from the upstream division or purchase a standard widget from an external market. Symmetrically, the upstream division can either produce one unit of widget specifically for the downstream division or produce and sell a unit of standard widget to the market. The market price of the standard widget is P and is not realized until the firm decides which type of intermediate widget to produce and use for the final product. P has a cumulative distribution function of F(P) and a differentiable density function of f(P) in the (normalized) range of (0, 1), such that f(P) > 0 ∀P ∈ (0, 1). Although the distribution of the market price is common knowledge, the realized P is observed only by the divisions and not by the headquarters.

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9 Both physical and human capital may be necessary for production, and we do not put any a priori restriction. The headquarters' owning of the physical assets is important because the division managers will have trouble committing to the budget breaking mechanism.

10 We refrain from modeling multiple unit production due to marginal cost concerns. Restricting our attention to one unit analysis enables us to focus better on the issues of organization and transfer pricing, without having to deal with non-constant marginal cost in case the divisions can produce more than one unit.
Furthermore, the nature of this default widget is not verifiable to the headquarters. These assumptions are motivated by the fact that the division managers are better aware of external market conditions than the headquarters.

If the downstream division buys a firm-specific widget from the upstream, the value of final product, net of assembly cost, is $V_I$, while if a unit of standard widget is purchased from the market, the value is $V_M$, where $V_I \geq V_M$. Similarly, if the upstream division produces a tailored widget for the downstream division, the production cost is $C_I$ while that for market sale is $C_M$, such that $C_I \leq C_M$. Producing a firm-specific widget is less costly and generates higher value for the final product. The production and sale decision, nevertheless, should depend on the (realized) market price of the standard widget. For example, when the market price is very low, the firm may want to buy and use the standard widget for the final good. If the price is favorably high, the firm would want to produce and sell a standard widget instead of a firm-specific widget.

If the firm produces a firm-specific widget and uses it for the final product, the profit ($\pi$) is $V_I - C_I$. If a unit of standard widget is purchased from the market to produce the final product, $\pi = V_M - P$. Lastly, if a standard widget is produced and sold to the market, $\pi = P - C_M$. Therefore, the firm would like to purchase the standard widget to produce the final product if $V_M - P > V_I - C_I$, produce and sell the standard widget if $P - C_M > V_I - C_I$, and produce the firm specific widget and trade internally if $V_I - C_I \geq \max\{V_M - P, P - C_M\}$. Denote the first case as external purchase (EP), second as external sale (ES), and the third as internal trade (IT). In terms of the market price, external purchase should occur when $P < V_M - (V_I - C_I) \equiv P$, while the firm should sell to the market when $P > C_M + (V_I - C_I) \equiv P$. These two “strike prices,” ($P, P$), guide the firm on ex post efficient trading decisions. Figure 2 shows the relationship between internal values and the market price, and three distinguishable trading regimes.\footnote{Even though $\{V, C\}$ are initially assumed to be deterministic with respect to initial period investment, the true value and cost of trade must take the opportunity cost (of trading with the market) into account. If we let $v \equiv V_I - \max\{V_M - P, 0\}$ and $c \equiv C_I + \max\{P - C_M, 0\}$, we have stochastic value and cost of internal trade, as in Hart and Moore (1988). Internal trade is optimal ($v > c$) when $P > P$, and $v < c$ whenever $P > P$ or $P < P$.}

Before the market price is realized, division managers can make investments that affect the value of final good (made with firm-specific or market widget) and the production cost of intermediate widget (firm-specific or market). Let $i_B$ and $i_S$ denote the levels of investments by the downstream and upstream divisions, respectively, such that $i_k \in \{0, \tilde{i}\} \forall k \in \{B, S\}$. Higher levels of investments will both increase the values of the final product and reduce the production costs, i.e., $\frac{\partial V_I}{\partial i_k} > 0$ and $\frac{\partial C_I}{\partial i_k} < 0$, where $j \in \{I, M\}$ and $k \in \{B, S\}$, but entail costs of $\phi(i_B)$ and $\phi(i_S)$. The cost of investment is increasing and strictly convex, i.e., $\frac{\partial^2 \phi}{\partial i_k^2} > 0$ and $\frac{\partial^2 \phi}{\partial i_k^2} > 0 \forall k$, although $\lim_{i \to 0} \frac{d \phi}{di_k} = 0$ and $\lim_{i \to \tilde{i}} \frac{d \phi}{di_k} = \infty$, so that optimal level of investment will always be positive and be within the interior of $[0, \tilde{i}]$. Note that the model explicitly accounts for direct externalities across divisions, and that we do not a priori assume that the value of
internal trade is more sensitive to investment at the margin. To make external trade possible, we assume \(0 < C_I \leq C_M \leq V_M \leq V_I < 1\ \forall i\), and \(\min\{1 - C_M(\bar{i}), V_M(\bar{i})\} > V_I(\bar{i}) - C_I(\bar{i})\). Even with the highest level of investments, external trade may still be more profitable for the firm.\(^{12}\)

Informationally, we assume that the investments \((i \equiv \{i_B, i_S\})\), the values of final product \((V \equiv \{V_I, V_M\})\), and the production costs \((C \equiv \{C_I, C_M\})\) are observed by both division managers but are neither observable nor verifiable to any third party, including the headquarters. The motivation for this assumption is that the headquarters may only have poor understanding of highly technical aspects of the investments and the exact characteristics of the intermediate and final goods. Although completely ignorant about the realized values of \(P, V,\) and \(C,\) and the levels of divisional investments, the headquarters is aware of the price distribution, \(f(P)\), how the investments affect the values and costs, \(V(i), C(i)\), and the costs of investments, \(\phi(i_k)\).

### 2.3.1 Trade-Contingent Transfer Payments

One important implication of the headquarters’ inability to observe or verify \(\{V, C, P, i\}\) is that it cannot engage in profit-sharing with the division managers, where the headquarters receives some portion of the profit, \(e.g., \alpha_k(V_I - C_I)\), while the division managers keep the rest, \((1 - \alpha_k)(V_I - C_I)\). So, we assume that the headquarters lets the division managers keep their respective divisional profits. The headquarters, instead, can observe and verify the type of trade the division managers engage in. It can thus order the managers to carry out a specific type of trade and make trade-contingent payments. In accordance, the headquarters sets up a mechanism where, after the managers have made their investments and the market price has

---

\(^{12}\)For notational simplicity, we assume that the investments are uni-dimensional, but this can be easily modified. For example, as in Che and Hausch (1999), we can let investment to consist of “selfish” and “cooperative” components, \(i_k = (s_k, c_k)\), such that \(V \in \{V_I(s_B, c_S), V_M(s_B, c_S)\}\) and \(C \in \{C_I(s_S, c_B), C_M(s_S, c_B)\}\). Selfish investment increases one’s own values, \(i.e., \frac{\partial V_I}{\partial s_B} > 0\) and \(\frac{\partial C_I}{\partial s_S} < 0\) while cooperative investments directly affects the partner’s values, \(i.e., \frac{\partial V_I}{\partial c_S} > 0\) and \(\frac{\partial C_I}{\partial c_B} < 0\). Then, internalizing the externalities is equivalent to encouraging the divisions to make cooperative investments. Also, we can decompose the investment costs (\(\phi\)) into monetary and non-monetary components, as in Holmstrom and Tirole (1991), where monetary costs could be reimbursed by the headquarters, while the managers bear their own non-monetary, private costs. Whether the investment is partitioned into selfish v. cooperative components or the cost into monetary v. non-monetary elements, the substantive results remain the same.
realized, 1) it receives (verifiable) reports from the division managers over trade, 2) decides which type of trade to mandate, and 3) makes trade-contingent payments to the managers.

Given three types of trade, \{IT, ES, EP\}, let trade-contingent payments from the headquarters to downstream and upstream divisions be \( (B_I, B_S, B_P) \) and \( (S_I, S_S, S_P) \), respectively. For example, when the headquarters orders external sale (ES), it pays the upstream division \( S_S \) and the downstream division \( B_S \). The upstream division’s profit \( (\pi_S) \), then, will be \( P - C_M + S_S \) and the downstream’s \( (\pi_B), B_S \). The headquarters’ net payment is \( B_S + S_S \) \( (= -\pi_{HQ}) \). Similarly, internal trade (IT) renders \( \pi_B = V_I + B_I, \pi_S = S_I - C_I \), and \( \pi_{HQ} = -(B_I + S_I) \), and in case of external purchase (EP), \( \pi_B = V_M - P + B_P, \pi_S = S_P, \) and \( \pi_{HQ} = -(B_P + S_P) \). In case of internal trade, \( \{B_I, S_I\} \) are transfer prices for the downstream and upstream divisions. If the headquarters sets \( B_I \neq -S_I \), single transfer price is used, while if \( B_I = -S_I \), dual transfer prices are used where the difference is kept (or subsidized) by the headquarters.

To summarize, first, the division managers make firm-specific and non-verifiable investments that affect the production cost of an intermediate widget and the value of a final good. Second, market price of default widget realizes. Last, upon verifiable reports from the division managers, the headquarters decides whether to impose internal trade (IT) or external trade (ES or EP) and make trade-contingent payments. Figure 3 delineates the time line.

### 2.3.2 The First Best

Suppose a fully informed headquarters is maximizing the firm’s ex post profit. Since it will sell to the market when \( P - C_M > V_I - C_I \) and buy from the market when \( V_M - P > V_I - C_I \), the expected expected profit, given the investment choices, is

\[
E(\pi(i_B, i_S)) = P\{\text{external purchase}\} \cdot E\{\pi|\text{external purchase}\} \\
+ P\{\text{internal trade}\} \cdot E\{\pi|\text{internal trade}\} + P\{\text{external sale}\} \cdot E\{\pi|\text{external sale}\} - \phi(i_B) - \phi(i_S)
\]

\[
= \int_0^{V_M - (V_I - C_I)} (V_M - P) f(P) dP + \int_{V_M - (V_I - C_I)}^{C_M + (V_I - C_I)} (V_I - C_I) f(P) dP \\
+ \int_{C_M + (V_I - C_I)}^{P - C_M} (P - C_M) f(P) dP - \phi(i_B) - \phi(i_S)
\]
First order conditions with respect to \((i_B, i_S)\) yield
\[
\frac{\partial V_M}{\partial i_B} F(V_M^* - (V_i^* - C_i^*)) - \frac{\partial C_M}{\partial i_B} \left\{ 1 - F(C_M^* + (V_i^* - C_i^*)) \right\} + \left( \frac{\partial V_i}{\partial i_B} - \frac{\partial C_i}{\partial i_B} \right) \left\{ F(C_M^* + (V_i^* - C_i^*)) - F(V_M^* - (V_i^* - C_i^*)) \right\} = \frac{d\phi}{di_B} \quad \text{(DF)}
\]
\[
\frac{\partial V_M}{\partial i_S} F(V_M^* - (V_i^* - C_i^*)) - \frac{\partial C_M}{\partial i_S} \left\{ 1 - F(C_M^* + (V_i^* - C_i^*)) \right\} + \left( \frac{\partial V_i}{\partial i_S} - \frac{\partial C_i}{\partial i_S} \right) \left\{ F(C_M^* + (V_i^* - C_i^*)) - F(V_M^* - (V_i^* - C_i^*)) \right\} = \frac{d\phi}{di_S} \quad \text{(UF)}
\]
Assuming that the solution exists and is unique, denote them as \(i^* = (i_B^*, i_S^*)\) and \((V_i^*, V_M^*, C_i^*, C_M^*)\). Then, \(F(V_M^* - (V_i^* - C_i^*))\), \(1 - F(C_M^* + (V_i^* - C_i^*))\), and \(F(C_M^* + (V_i^* - C_i^*)) - F(V_M^* - (V_i^* - C_i^*))\) denote optimal probabilities of external purchase, external sale, and internal trade, respectively. By assumption, all three probabilities are strictly positive.

2.4 Trade-contingent Mechanism with Uninformed Headquar ters

Coming back to our original assumption of uninformed headquarters, we now present a trade-contingent mechanism that the headquarters can use to achieve both ex ante investment and ex post trading efficiencies. We proceed backward from the trading stage to the investment stage to show 1) how the headquarters uses divisional "disputes" over trade to make optimal trading decision, and 2) how transfer payments can be structured to induce optimal investment.

2.4.1 Second Stage Trade Request Game

Suppose the headquarters lets division managers submit following trading requests: the downstream division can request between external purchase and internal trade, while the upstream division can request external sale or internal trade. Let the downstream division's request as \(\theta_B \in \{IT, EP\}\) and the upstream's as \(\theta_S \in \{IT, ES\}\). This creates four possible combinations of requests, and the headquarters sets a trading rule contingent on the messages: construct a decision map \(f : \theta_B \times \theta_S \rightarrow \{IT, EP, ES\}\). When both divisions agree on internal trade, internal trade is mandated: \(f(IT, IT) = IT\). Given that only the downstream (upstream) division can request to sell to (buy from) the market, the headquarters honors such requests when they are made: \(f(EP, IT) = EP\), and \(f(IT, ES) = ES\). Finally, when the headquarters receives both external purchase and external sale requests \((\theta = (EP, ES))\), it mandates internal trade and makes transfer payments of \(\{B_\theta, S_\theta\}\).\(^{13}\)

Based on the decision rule and the transfer payment schedule, the payoff matrix for the divisions simplifies to

\(^{13}\)Alternatively, the headquarters can order no trade and make zero transfer payments. We use internal trade instead, since this is more efficient from an uninformed headquarters' point of view.
<table>
<thead>
<tr>
<th>$(\theta_B, \theta_S)$</th>
<th>$ES$</th>
<th>$IT$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$EP$</td>
<td>$V_I + B_\theta - S_\theta - C_I$</td>
<td>$V_M - P + B_P, S_P$</td>
</tr>
<tr>
<td>$IT$</td>
<td>$B_S, P - C_M + S_S$</td>
<td>$B_I + V_I, S_I - C_I$</td>
</tr>
</tbody>
</table>

Table 1: 2x2 Trade Request Game

The downstream division’s strategies are in the first column and the upstream’s strategies in the first row. Let $\{B_\theta, S_\theta\}$ satisfy $V_I + B_\theta < B_S$ and $S_\theta - C_I < S_P$. This ensures the upstream (downstream) division to prefer requesting internal trade given that the downstream (upstream) division requests external purchase (sale). Also, let $0 < V_M + B_P - B_I - V_I < S_I - S_S + C_M - C_I < 1$, so that the market price is partitioned into three regions. Now, let’s analyze the equilibrium requests subject to the realized market price.

1. When $V_M + B_P - B_I - V_I < P < S_I - S_S + C_M - C_I$ (or $B_I + V_I > V_M - P + B_P$ and $S_I - C_I > P - C_M + S_S$), the unique Nash equilibrium is $(IT, IT)$, since both divisions have $IT$ as their strictly dominant strategies.

2. When $0 < P < V_M + B_P - B_I - V_I$, the upstream has the strictly dominant strategy of $\theta_S = IT$, since $P < V_M + B_P - B_I - V_I$ a fortiori implies $P < S_I - S_S + C_M - C_I$ (or $S_I - C_I > P - C_M + S_S$). Given $\theta_S = IT$, the downstream strictly prefers $\theta_B = EP$, since $P < V_M + B_P - B_I - V_I$ implies $V_M - P + B_P > V_I + B_I$. Therefore, the unique Nash equilibrium is $(EP, IT)$.

3. Analogously, when $S_I - S_S + C_M - C_I < P < 1$, the unique Nash equilibrium is $(IT, ES)$.

Thus, there are three possible equilibria, $(EP, IT)$, $(IT, IT)$, and $(IT, ES)$, contingent on realized market price, and when $V_I + B_\theta < B_S$, $S_\theta - C_I < S_P$, the headquarters will never receive $(EP, ES)$. The equilibria are summarized in Table 2.

<table>
<thead>
<tr>
<th>$P$</th>
<th>$\theta^NE$</th>
<th>Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 &lt; P &lt; V_M + B_P - B_I - V_I$</td>
<td>$(EP, IT)$</td>
<td>EP</td>
</tr>
<tr>
<td>$V_M + B_P - B_I - V_I &lt; P &lt; S_I - S_S + C_M - C_I$</td>
<td>$(IT, IT)$</td>
<td>IT</td>
</tr>
<tr>
<td>$S_I - S_S + C_M - C_I &lt; P &lt; 1$</td>
<td>$(IT, ES)$</td>
<td>ES</td>
</tr>
</tbody>
</table>

Table 2: Market Price Contingent Nash Equilibria

The headquarters elicits the upstream division to request external sale when the market price is sufficiently high and the downstream division to request external purchase when the price is sufficiently low. It intentionally creates divergent requests, $(EP, IT)$ and $(IT, ES)$, by selectively changing one division’s request incentives while keeping the other’s the same.\footnote{It is easy to show that given requests over trade, the headquarters cannot induce both divisions to always agree on optimal kind of trade. The reason is that the upstream (downstream) division’s profits are “fixed” under internal trade ($S_I - C_I$) and external purchase ($S_P$) (external sale). This renders the upstream (downstream) division’s preference between internal trade and external purchase (external sale) unchanged regardless of the market price.}
Such selective disagreements produce information to the uninformed headquarters about the external market conditions. For example, \((EP, IT)\) signals to the headquarters that the market price is substantially low, and \((IT, ES)\), that the market price is high. At the same time, a certain kind of divergent request, \(i.e., (EP, ES)\), is only harmful to the firm, since it leaves the headquarters uncertain over which type of trade is optimal. The headquarters, thus, encourages information-producing disputes and prevents information-destroying disagreement over trade.

### 2.4.2 First Stage Investments

In the first period, both divisions will take the above trading equilibria as given when making investment decisions. The first period, divisional expected profits are

\[
E(\pi_B) = P(EP) \cdot E(\pi_B|EP) + P(ES) \cdot E(\pi_B|ES) + P(IT) \cdot E(\pi_B|IT)
\]

\[
= \int_{V_M + B_P - B_I - V_I}^{V_M + B_P - B_I - V_I} (V_M - P + B_P)f(P)dP
\]

\[
+ \int_{S_I - S_S + C_M - C_I}^{1} B_S f(P)dP
\]

\[
+ \int_{V_M + B_P - B_I - V_I}^{S_I - S_S + C_M - C_I} (V_I + B_I)f(P)dP - \phi(i_B)
\]

and

\[
E(\pi_S) = P(EP) \cdot E(\pi_S|EP) + P(ES) \cdot E(\pi_S|ES) + P(IT) \cdot E(\pi_S|IT)
\]

\[
= \int_{0}^{V_M + B_P - B_I - V_I} S_P f(P)dP
\]

\[
+ \int_{S_I - S_S + C_M - C_I}^{1} (P - C_M + S_S)f(P)dP
\]

\[
+ \int_{V_M + B_P - B_I - V_I}^{S_I - S_S + C_M - C_I} (S_I - C_I)f(P)dP - \phi(i_S).
\]

Each division will choose an investment level to maximize respective expected profits:

\[
\frac{\partial V_I}{\partial i_B} \{ F(S_I - S_S + C_M - C_I) - F(V_M + B_P - B_I - V_I) \}
\]

\[
+ \frac{\partial V_M}{\partial i_B} \cdot F(V_M + B_P - B_I - V_I)
\]

\[
- \left( \frac{\partial C_M}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) \cdot f(S_I - S_S + C_M - C_I) \cdot (B_S - V_I - B_I) = \frac{d\phi}{di_B} \quad (D1)
\]
and
\[ -\frac{\partial C_l}{\partial i_S} \left( F(S_l - S_S + C_M - C_l) - F(V_M + B_P - B_I - V_I) \right) - \frac{\partial C_M}{\partial i_S} \left( 1 - F(S_l - S_S + C_M - C_l) \right) \\
+ \left( \frac{\partial V_M}{\partial i_S} - \frac{\partial V_I}{\partial i_S} \right) \cdot f(V_M + B_P - B_I - V_I) \cdot (S_P - S_I + C_I) = \frac{d\phi}{di_S} \]. \ (U1)

2.4.3 Optimal Transfer Payments and the Necessary Conditions

Since the firm is selling to the market when \( S_l - S_S + C_M - C_l < P \) and buying from the market when \( P < V_M + B_P - B_I - V_I \), trading efficiency requires the headquarters to set \( B_P - B_I = C_I \) and \( S_l - S_S = V_I \), where \( C_I \) and \( V_I \) are equal to the equilibrium values and costs. From the first order conditions (\( D1 \) and \( U1 \)), note that the investment incentives on externalities (\( \frac{\partial C_l}{\partial i_B} \) and \( \frac{\partial C_M}{\partial i_B} \) for the downstream division and \( \frac{\partial V_M}{\partial i_S} \) and \( \frac{\partial V_I}{\partial i_S} \) for the upstream division) are exactly opposite to each other.

Suppose \( \frac{\partial C_l}{\partial i_B} = \frac{\partial C_M}{\partial i_B} \) and \( \frac{\partial V_M}{\partial i_S} = \frac{\partial V_I}{\partial i_S} \). Then, with \( B_P - B_I = C_I \) and \( S_l - S_S = V_I \), the first order conditions (\( D1 \) and \( U1 \)) become

\[ \frac{\partial V_M}{\partial i_B} \cdot F(V_M - (V_I - C_I)) \\
+ \frac{\partial V_I}{\partial i_B} \cdot \left( F(C_M + (V_I - C_I)) - F(V_M - (V_I - C_I)) \right) = \frac{d\phi}{di_B} \]. \ (DP)

\[ -\frac{\partial C_M}{\partial i_S} \left( 1 - F(C_M + (V_I - C_I)) \right) \\
- \frac{\partial C_I}{\partial i_S} \left( F(C_M + (V_I - C_I)) - F(V_M - (V_I - C_I)) \right) = \frac{d\phi}{di_S}. \] \ (UP)

Comparing \( DP \) & \( UP \) with \( DF \) & \( UF \) shows that when \( \frac{\partial C_l}{\partial i_B} = \frac{\partial C_M}{\partial i_B} \) and \( \frac{\partial V_M}{\partial i_S} = \frac{\partial V_I}{\partial i_S} \), too little investments are made, because the externality effects do not enter into the managers' first order conditions. The equality condition (\( \frac{\partial C_l}{\partial i_k} = \frac{\partial C_M}{\partial i_k} \) or \( \frac{\partial V_M}{\partial i_k} = \frac{\partial V_I}{\partial i_k} \)) implies that a division's external option (\( V_M \) or \( C_M \)) is changing at the same rate as its internal value (\( V_I \) or \( C_I \)) with respect to investment. In other words, the value of market opportunities is perfectly correlated with the value of internal trade at the margin, and hence provides "perfect monitoring" for the value of internal trade. We formalize this concept in the following definition.

**Definition 1** Given investment \( i = (i_B, i_S) \), perfect market monitoring exists for \( V \), at the margin, when \( \frac{\partial V_M}{\partial i_k} \bigg|_i = \frac{\partial V_I}{\partial i_k} \bigg|_i \) \( \forall k \in \{B, S\} \). Analogously, the condition exists for \( C \) when \( \frac{\partial C_M}{\partial i_k} \bigg|_i = \frac{\partial C_I}{\partial i_k} \bigg|_i \).
To achieve investment efficiency, therefore, we must not have perfect market monitoring on either $V$ or $C$. The reason stems from two opposing effects of investment externalities. Consider how the downstream division’s investment ($i_B$) affects the upstream division’s value of trade ($C_I,C_M$). When it increases the upstream division’s internal value of trade ($\frac{dC_I}{di_B} < 0$), the downstream division gains the chance to earn $V_I + B_I$ at the cost of losing the chance to earn $B_S$. To the contrary, when it increases the upstream division’s value of external trade ($\frac{dC_M}{di_B} < 0$), the exact opposite happens: it is more likely to earn $B_S$ and less likely to earn $V_I + B_I$. When these two effects are equal, due to perfect market monitoring on $C$, no matter what the transfer payments to the downstream division ($B_I,B_S$) are, it does not take its investment’s effect on the upstream into account. In other words, the headquarters cannot make the downstream division internalize its externalities through adjusting transfer payments.

Assuming that the perfect market monitoring condition is absent on both $V$ and $C$, the optimal schedule is given by the following conditions.\(^{15}\)

**Optimal Transfer Payments**

\[
B_P - B_I = C_I^* \quad \text{(T1)}
\]

\[
S_I - S_S = V_I^* \quad \text{(T2)}
\]

\[
B_S - B_I = V_I^* - \xi_B \quad \text{(T3)}
\]

\[
S_P - S_I = \xi_S - C_I^* \quad \text{(T4)}
\]

where

\[
\xi_B \equiv \frac{\frac{\partial C_M}{\partial i_B} \{1 - F(C_M^* + (V_I^* - C_I^*))\} + \frac{\partial C_I}{\partial i_B} \{F(C_M^* + (V_I^* - C_I^*)) - F(V_M^* - (V_I^* - C_I^*))\}}{\left(\frac{\partial C_I}{\partial i_B} - \frac{\partial C_M}{\partial i_B}\right) \cdot f(C_M^* + (V_I^* - C_I^*))}
\]

\[
\xi_S \equiv \frac{\frac{\partial V_M}{\partial i_S} \{F(V_M^* - (V_I^* - C_I^*))\} + \frac{\partial V_I}{\partial i_S} \{F(C_M^* + (V_I^* - C_I^*)) - F(V_M^* - (V_I^* - C_I^*))\}}{\left(\frac{\partial V_M}{\partial i_S} - \frac{\partial V_I}{\partial i_S}\right) \cdot f(V_M^* - (V_I^* - C_I^*))}.
\]

Let us briefly examine the implications of the schedule. When we add the first and the last equations (T1 and T4), we get $S_P + B_P = B_I + S_I + \xi_S$. Similarly, when the second equation (T2) is subtracted from the third (T3), we have $S_S + B_S = B_I + S_I - \xi_B$. When there is no perfect market monitoring on both $V$ and $C$, i.e., $\frac{\partial V_M}{\partial i_S} \geq \frac{\partial V_I}{\partial i_S}$ and $\frac{\partial C_M}{\partial i_k} \geq \frac{\partial C_I}{\partial i_k}$, we get $\xi_S \geq 0$ and $\xi_B \leq 0$. This, in turn, implies that $S_P + B_P \geq B_I + S_I$ and $S_S + B_S \geq B_I + S_I$. Recall that $S_I + B_I$ denotes the net transfers the headquarters makes in trading regime $t \in \{IT,EP,ES\}$. Under the optimal schedule, therefore, the headquarters makes higher net transfer to the divisions under certain trading regime than the others: the headquarters breaks the budget balance between the divisions.

\(^{15}\)These transfer prices are similar to the option prices in Nöldeke and Schmidt (1995). In their mechanism, the option prices are set such that $p_1 - p_2 = c^*$, where $c^*$ is the first best cost of production. In our version, the headquarters provides two separate option-like prices to the divisions, $\{B_P - B_I = C_I^*, S_I - S_S = V_I^*\}$, and selectively grants one division the exercise right.\(^{21}\)
Since breaking the budget balance requires the headquarters to make net transfers that differ according to trade regime, if the division managers can communicate and make side payments before submitting their trade requests, they may have an incentive to request inefficient trade simply to capture higher transfers from the headquarters. This undermines budget breaking and the provision of efficient investment incentive. Therefore, in addition to absence of perfect market monitoring, divisional collusion must be prevented.\(^{16}\) The following proposition formally summarizes the necessary conditions.

**Proposition 1** Under the mechanism described in section 4.1, two necessary conditions for achieving both ex ante investment and ex post trading efficiencies are

1. absence of perfect market monitoring for both \(V\) and \(C\) at optimal level of investments \(i^*\), and
2. no collusion among division managers.

Before we proceed, a few remarks on perfect market monitoring are in order. In contrast to our result, in a simpler world where 1) internal trade is always optimal, 2) both sides always have viable outside options, and 3) there are no direct investment externalities, perfect market monitoring guarantees the first best.\(^{17}\) To see this, suppose the market price of the standard widget is fixed at \(C_M < P' < V_M\). Also suppose that there are no investment externalities and the division managers ex post negotiate the transfer price. Then, assuming they have equal bargaining power, divisions’ expected profits are

\[
E(\pi_B) = (V_M - P') + \frac{1}{2}((V_I - C_I) - (V_M - C_M)) - \phi(i_B)
= (V_I + V_M) + \frac{1}{2}(C_M - C_I) - P' - \phi(i_B)
\]

and

\[
E(\pi_S) = (P' - C_M) + \frac{1}{2}((V_I - C_I) - (V_M - C_M)) - \phi(i_S)
= \frac{1}{2}(V_I - V_M) - \frac{1}{2}(C_M + C_I) - P' - \phi(i_S).
\]

The first order conditions yield:

\[
\frac{\partial E(\pi_B)}{\partial i_B} = \frac{1}{2} \left( \frac{\partial V_I}{\partial i_B} + \frac{\partial V_M}{\partial i_B} \right) - \frac{d\phi(i_B)}{di_B} = 0
\]

\(^{16}\)The collusion problem is analogous to renegotiation problem between two independent firms. We would assume that when the firms are integrated under one headquarters, the headquarters will have requisite monitoring capacity to prevent collusion, whereas, if the headquarters is a disinterested third party and the firms are independent, such monitoring mechanism is poorer.

\(^{17}\)Holmstrom and Tirole (1991) call this condition “costless market monitoring.” In their model, the three conditions are satisfied, so that, when the market is a perfect monitor, the headquarters can achieve the first best simply by granting divisional autonomy over trade and transfer price.
and
\[
\frac{\partial E(\pi_S)}{\partial i_S} = -\frac{1}{2} \left( \frac{\partial C_I}{\partial i_S} + \frac{\partial C_M}{\partial i_S} \right) - \frac{d\phi(i_S)}{di_S} = 0.
\]

Recall that the first best solutions are given by \( \frac{\partial V_L}{\partial i_B} = \frac{d\phi(i_B)}{di_B} \) and \( -\frac{\partial C_L}{\partial i_S} = \frac{d\phi(i_S)}{di_S} \). When \( \frac{\partial V_L}{\partial i_B} = \frac{\partial V_M}{\partial i_B} \) and \( \frac{\partial C_L}{\partial i_S} = \frac{\partial C_M}{\partial i_S} \), therefore, ex post negotiated transfer price guarantees the first best. This is because each division's firm-specific investment is fully monitored and protected by the respective outside opportunity. Although the ex post negotiation endogenously created externality conditions through hold-up, perfect market monitoring functions as a quasi-budget breaker to solve the endogenous moral hazard in teams problem\(^{18}\). In contrast, when direct investment externalities exist, our model demonstrates that not only do we need a headquarters that actually breaks the real budget balance (by taking away and giving money to the managers), but also market's perfect monitoring of the internal value may be strictly detrimental to achieving investment efficiency.

### 2.4.4 Participation Constraints

To close the model, we need to satisfy the division managers and the headquarters' incentive to participate. Among different types of participation constraints, the appropriate set will depend on the necessity of division managers' firm-specific human capital. Since the headquarters owns all the physical assets, when the managers' human capital is unimportant, a division manager's quitting at the trading stage should have little effect, since the physical assets already reflect the ex ante investments and the division manager's departure does not render trade infeasible. Satisfying the manager's ex ante participation constraint may suffice. On the other hand, if the division manager's human capital affects the value of trade, he could threaten to withdraw his human capital at the trading stage if his outside option is not met. His ex post participation constraint needs to be satisfied.

Closely related to the ownership issue is limited liability. The division manager who does not engage in any trade ex post earns profit solely through the transfer payment from the headquarters, i.e., \( \{S_P, B_S\} \). If the managers are to receive non-negative compensation, \( S_P \) and \( B_S \) must be positive. Similarly, the transfer payments cannot be too costly for the headquarters, either. If the payments force the headquarters to make a negative return ex post, it may not want to execute optimal kind of trade. Since our model leaves the issue of managers' human capital and limited liability open, we will examine the toughest, ex post participation constraints. The following proposition gives us the necessary and sufficient condition.

**Proposition 2** All parties' ex post participation constraints are satisfied if and only if \( (V_I - C_I) \geq \max\{0, -\xi_S\} + \max\{0, -\xi_B\} - \min\{-\xi_B, -\xi_S\} \). A simplified sufficient condition is \( (V_I' - C_I') \geq |\xi_B| + |\xi_S| \).

\(^{18}\)The market's role as a margin-budget breaker is noted in Holmstrom (1999). Note that the market does not actually "break" the budget balance. It supplies the parties with the other half of the bargaining power. Also, although we have called the trading parties divisions, the analysis is equally applicable to two independent or vertically integrated firms.
From Proposition 1, a necessary condition to achieve efficiency, with the mechanism described in section 4.1, was that there should be no perfect market monitoring on \( V \) and \( C \). The above proposition shows that even if market monitoring is near perfect, efficiency cannot be achieved. From the optimal schedule \( (T1 - T4) \), the relative size of transfer payments depends on the "degree" of market monitoring. The more perfect the market monitoring, the larger the difference in transfer payments, i.e., \( \left| \frac{\partial C_1}{\partial t} - \frac{\partial C_M}{\partial t} \right| \) becomes smaller, \( |B_S - B_I| \) gets larger. The reason is that, when market monitoring becomes stronger, division managers will pay less attention to their externality contributions because the positive and negative components of externality are more likely to cancel each other out. Hence, to encourage them to pay more attention to the externality effects, incentive created through transfer payments needs to be stronger. But this entails the headquarters making unduly large transfer payments and suffering negative returns in some states. When market monitoring is even near perfect, there is too little rent from trade to satisfy all parties’ participation constraints.

### 2.4.5 Dual Transfer Prices

Under the assumption, the headquarters can make two, possibly different, transfer payments to the division managers in case of internal trade: \( \{B_1, S_I\} \). If the headquarters sets \( -B_I = S_I \), what the buying division pays to the headquarters is equal to what the selling division receives from the headquarters: single transfer price is used for internal trade. On the other hand, when the headquarters sets \( -B_I > S_I \), the price buying division pays is higher than the price the selling division gets, so that there are dual transfer prices for one intermediate good. While the initial assumptions of the model leave the option of using two transfer prices open, when does it become necessary, or when does using single transfer price become infeasible?

The answer relates crucially to the headquarters' budget breaking role. When a single transfer price is set up, the headquarters makes no profit from internal trade: its profit from internal trade is pegged at zero. Since the headquarters' profit will vary depending on the type of trade due to its budget breaking role, in order to satisfy its ex post participation constraints, its profits in both of the external trade cases (\( EP \) and \( ES \)), now, have to be positive. However, when market monitoring is "too strong," the headquarters will need to provide proportionately strong incentives to the managers and be forced to suffer negative profits in case of external trade. To restore its profitability, it needs to extract more rent from the managers in case of internal trade by setting up dual transfer prices. The following corollary shows when market monitoring can be "too strong."

**Corollary 1** As long as investment affects the value of internal trade more than the value of external trade at the margin, i.e., \( \frac{\partial V_M}{\partial h} < \frac{\partial V_I}{\partial h} \) and \( \left| \frac{\partial C_M}{\partial h} \right| < \left| \frac{\partial C_I}{\partial h} \right| \), single transfer price is feasible. In all other cases, dual transfer pricing is necessary.

What is central to the headquarters' budget breaking role is how the divisions' investment affects the values of internal and external trades at the margin. When the investment is more effective in increasing the value of internal trade than external trade, or the investment is firm-specific even at the margin, providing incentive for internal trade is more important, and
the headquarters’ internal trade profit will be the lowest when it is to provide the strongest incentive. The reverse happens when the value of external trade (either $EP$ or $ES$) is more responsive to investment: the headquarters needs to provide the strongest incentive in case of external trade, and its profit under external trade will be lower than that under internal trade. However, since single transfer price fixes the headquarters’ internal trade profit at zero, when the value of external trade is more sensitive, the headquarters will suffer a loss under the optimal transfer payment schedule. By adopting dual transfer prices, it can shift the entire transfer payment schedule and increase its external trade profit above zero.

2.5 Why is the Headquarters Necessary?

We have presented a simple and realistic mechanism that achieves the first best in a wide range of circumstances. We have also examined the implications of market monitoring on optimal transfer prices, including “dual transfer pricing.” Related to these results are observations made by Eccles as well. In this section, we take a step back and pose the question whether the parties themselves can implement the first best. In a generic buyer-seller model with no third parties, there could be two potential channels. The first is through a contract (formal mechanism) between two independent parties and the second is through integration of the kind envisioned in Grossman-Hart (1986) (where one party buys the other, with no headquarters involved). We will show that when direct investment externalities are present, neither of these methods will be able to achieve the first best.

A contractual approach usually employs a carrot and stick mechanism, where the parties receive a low, punishment outcome when non-desirable actions, such as inefficient level of investment or inconsistent message, are taken. When they are to implement such punishment ex post, however, they have a strong incentive not to do so. The stipulated punishment is not Pareto efficient because it entails throwing away some of the surplus from trade, so they would want to renegotiate the initial contract. The total budget will, then, balance between them. Furthermore, contractual possibilities are limited by the verifiability problem. In our model, the investment parameters, $\{V,C,P,i\}$, are assumed to be non-verifiable (by the headquarters or any other third party), so a contract can depend only on verifiable messages, e.g., requests over different types of trade. The following proposition demonstrates that given budget balance and verifiability, two independent parties cannot achieve the first best.

**Proposition 3** Under non-integration, any bilateral contract that depends on verifiable messages of trade requests cannot achieve the first best.

The central problem with any bilateral contract is that the contract’s attempt to accommodate one party’s investment incentives comes at the cost of reducing the other’s. Given budget balance, it cannot supply optimal incentives for both parties at the same time. Since the contractual form is sufficiently general, this will be true for simple contracts that stipulates default terms of trade. In other words, any mechanism that relies on a simple contract and ex-post renegotiation, as in Aghion, Dewatripont and Rey (1994) or Edlin and Reichelstein (1995), will not be able to achieve the first best, either.
Corollary 2 Any mechanism that relies on a default contract and allocation of bargaining powers between two parties cannot achieve the first best.

The budget balance and limited contractibility constraints still apply to vertically integrated firms. Renegotiation temptations again prevent breaking of the budget balance condition. On the contractibility side, even though the single owner of both divisions has perfect knowledge of the world, she cannot credibly order the employee to invest optimally. If he does not carry out the orders, the worst she can do is to fire him, in which case he simply receives his outside option. Punishment is constrained by limited liability. On the up side, even if he undertakes the optimal investment, she has an incentive, ex post, to reduce the implicitly promised compensation down to his outside option. He cannot contractually bind her for payment since the court will not be able tell whether he fulfilled his end of the deal. Compensation, therefore, can depend only on verifiable signals.

If the employee is allowed to keep his division’s profits, then, we are back to the previous, non-integration case. His compensation is determined by his division’s profit plus any wage, which are equivalent to profit minus transfer payments. The distinguishable case is, therefore, where the owner is the residual claimant of the firm’s entire profits and the employee only receives trade-contingent wages, \( \{w_T, w_{EP}, w_{ES}\} \). First, in order to motivate the employee, not all wages can be equal to one another. Under full insurance, \( w_T = w_{EP} = w_{ES} \), the employee does not have any incentive to exert effort.\(^{19}\) However, instituting a wage “slope” implies that the firm is making the employee a discrete-residual claimant of the firm’s profits. Since, given budget balance, not both of them can simultaneously be residual claimants, granting enough incentive to the employee will come at the cost of reducing the owner’s incentive, who needs to make firm-specific investments herself.

Proposition 4 Under vertical integration, where the owner retains all the profits of the firm, there does not exist a wage contract that depends on verifiable messages and implements the first best.

In both cases, non-integration and vertical integration, when there is no direct investment externalities, first best implementation is possible. As long as they can provide enough incentive through a default contract, either on transfer prices or wages, one party becomes the full beneficiary of his own investment. Since his investment does not affect the counter party’s bottom line, first best investment can be achieved. Direct investment externalities, to the contrary, requires both parties to be the residual claimants of the total profits. Not only does each party need to capture the benefit on his own division but must internalize the benefit he generated on the other division. Absent budget breaking, this is not possible. In our mechanism, the headquarters, who does not need to make any investment, becomes the budget breaker. Furthermore, it provides renegotiation-free transfer prices to both divisions, and institutes efficient trade through a simple, trade-contingent request mechanism.

\(^{19}\)As before, we assume that the cost of investment is born by the employee. Even though the owner observes the level of investment (effort) of the employee, because they cannot write a contract that directly depends on the cost, reimbursing for the cost will not be contractually feasible. For simplicity, we assume that the employee has to exert effort to increase his firm-specific human capital.

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2.6 Stochastic Internal Environment

In this section, we generalize our model by assuming stochastic values of trade. Under the initial assumptions, the values and costs of internal and external trades are deterministic with respect to investments. The transfer payments depended on the single, fixed values of \( \{V_I, C_I\} \). When the technology is not deterministic, such transfer prices may be inefficient. On the investment side, given the managers' risk neutrality, when the headquarters uses their ex ante, expected values, optimal investment incentives would remain unchanged. However, when making trading decision, since ex post efficiency necessitated the headquarters to set \( B_P - B_I = C_I^* \), \( S_I - S_S = V_I^* \), when \( \{V_I, C_I\} \) are stochastic, inducing optimal trading decision becomes problematic.

Somewhat surprisingly, uncertainty over \( V_M, C_M \) has no efficiency ramifications. At the trading stage, \( V_M \), for example, affects only the choice between external purchase and internal trade. This is because changes in \( V_M \) does not affect the values of external sale \( (P - C_M) \) and internal trade \( (V_I - C_I) \). Since the downstream division makes trading requests based on the realized value of \( V_M \), it will fully internalize the random effect of \( V_M \) when making its request. Identical argument can be made with respect to \( C_M \). Therefore, inducing both divisions to invest and trade optimally will not require additional control by the headquarters.

To the contrary, when the value of internal trade \( (V_I - C_I) \) becomes uncertain, it requires adjustments in all trading regimes. For instance, when the value of internal trade is larger than expected, the firm should reduce the incidences of both external purchase and sale. Suppose \( V_I \) is stochastic. The downstream division will take the realized value of \( V_I \) into account when making its external purchase request, but, because the upstream division's profits are determined by \( (S_I, S_P, S_S) \) which are independent of \( V_I \), upstream division's request strategies remain unchanged, making its requests inefficient in certain states. The headquarters now has to rely on both division managers to execute efficient trade, and this inhibits breaking of the budget balance, which was necessary to provide optimal incentive for the externalities. We will show that first best implementation through trade-contingent payments is possible if and only if there are no investment externalities.

2.6.1 When the External Option Values are Uncertain

Suppose \( \tilde{V}_M(i) \in \{V_M(i) + \delta, V_M(i) - \delta\} \) with equal probabilities, where \( \delta \) is small, such that \( V_M(i) + \delta \leq V_I(i) \) and \( V_M(i) - \delta \leq C_M(i) \ \forall i \). In making ex post trading decisions, this will change the partitions on possible market prices where the firm should either purchase from outside or trade internally. If \( \tilde{V}_M = V_M + \delta \), the firm should purchase from outside if \( P < V_M + \delta - (V_I - C_I) = P + \delta \) and trade internally if \( P \geq V_M + \delta - (V_I - C_I) = P + \delta \). Similarly, if \( \tilde{V}_M = V_M - \delta \), the widget should be bought from the market if \( P < V_M - \delta - (V_I - C_I) = P - \delta \) and should be produced and traded internally if \( P \geq V_M - \delta - (V_I - C_I) = P - \delta \).

<table>
<thead>
<tr>
<th>(( \theta_B, \theta_S ))</th>
<th>ES</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>( EP )</td>
<td>( V_I + B_\theta, S_\theta - C_I )</td>
<td>( (V_M \pm \delta) - P + B_P, S_P )</td>
</tr>
<tr>
<td>( IT )</td>
<td>( B_S, P - C_M + S_S )</td>
<td>( V_I + B_I, S_I - C_I )</td>
</tr>
</tbody>
</table>

Table 3: Trading Game when \( V_M \) is Uncertain
From table 3, uncertainty about \( V_M \) affects only the downstream division's strategies, and it will take full consideration of realized \( V_M \) in making its requests. Consider, for example, the case of \( \tilde{V}_M = V_M + \delta \). At the second stage, the buying division will request internal trade if \( V_I + B_I > V_M + \delta - P + B_P \) and external purchase when \( V_I + B_I < V_M + \delta - P + B_P \). These inequalities translate into \( P > V_M + \delta + B_P - V_I - B_I \) and \( P < V_M + \delta + B_P - V_I - B_I \). If \( B_P - B_I = C_I \), as before, they become \( P > V_M + \delta - (V_I - C_I) \) and \( P < V_M + \delta - (V_I - C_I) \) which are equivalent to efficient trading decisions. The situation is symmetric for uncertain \( C_M \): it only affects external sale v. internal trade choice and the upstream division takes full account of realized \( C_M \).

If the headquarters uses expected values of \( \{V_M, C_M\} \) in calculating the transfer schedule, the ex ante incentives should remain unchanged. This analysis can be easily extended to independent variations in both \( V_M \) and \( C_M \), and cases of less restrictive randomizations. The following proposition is a slight generalization of this idea.

**Proposition 5** Even when \( V_M \) and \( C_M \) are stochastic and transfer payments depend only on types of trade, first best can be achieved by the simple mechanism in section 4.1, as long as there are no perfect market monitoring in both \( V \) and \( C \), there is no divisional collusion, and participation constraints are satisfied, as in the deterministic case.

**2.6.2 When the Value of Internal Trade is Uncertain**

When the value of internal trade becomes uncertain, it should alter both divisions' request behaviors. For example, when \( C_I \) becomes stochastic, because it affects both divisions' internal options, it should change not only the internal trade versus external sale choice but also that between internal trade versus external purchase. The upstream division will take changes in \( C_I \) into account when making its request, but the downstream's strategies are unaffected by different realizations of \( C_I \), since its options are independent of \( C_I \). So, when trading requests are made non-cooperatively, the downstream division will make inefficient requests in certain states. The problem is symmetric when \( V_I \) is uncertain. While it does not distort downstream's trading requests, it renders the upstream division's requests inefficient in certain states.
Figure 2-5: Contingent Trading Ranges when $C_I$ is Stochastic

<table>
<thead>
<tr>
<th>$(\theta_B, \theta_S)$</th>
<th>ES</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$EP$</td>
<td>$V_I + B_S, S_0 - C_I$</td>
<td>$V_M - P + B_P, S_P$</td>
</tr>
<tr>
<td>$IT$</td>
<td>$B_S, P - C_M + S_S$</td>
<td>$V_I + B_I, S_I - (C_I \pm \eta)$</td>
</tr>
</tbody>
</table>

Table 4: Trading Game when $C_I$ is Uncertain

Suppose $\tilde{C}_I(e) \in \{C_I(e) + \eta, C_I(e) - \eta\}$ with equal probabilities, independent from $\tilde{P}$, where, again, $\eta$ is small so that $C_I(e) + \eta \leq C_M(e)$ and $C_I(e) - \eta \geq 0 \forall e$. Suppose $\tilde{C}_I(e) = C_I(e) + \eta$. Now, the firm should purchase from the market when $P < V_M - (V_I - (C_I + \eta)) = V_M + \eta - (V_I - C_I)$, and sell to the market when $P > C_M - \eta + (V_I - C_I)$. However, if $B_P - B_I = C_I$ as before, the downstream division will request external purchase whenever $P < V_M - (V_I - C_I)$. So, when $V_M - (V_I - C_I) < P < V_M + \eta - (V_I - C_I)$, internal trade occurs even though it is suboptimal. The problem is reversed when $C_I = C_I - \eta$. In this case, when $V_M - V_I + C_I - \eta < P < V_M - V_I + C_I$, the downstream division will request external purchase, even though internal trade is efficient. Too much market purchase occurs.

Thus, in order to achieve optimal trading decisions, the headquarters needs to rely on the divisions’ joint decision making. Now, the divisions will negotiate ex post in requesting which type of trading regime to institute and make appropriate divisional payments to reach Pareto efficiency. This, of course, is identical to the case of collusion in the deterministic case, which inhibited the headquarters’ ability to break the budget balance. Since budget breaking is necessary to compensate both divisions for their externality contributions, to achieve first best, therefore, no externality condition is necessary. In the following proposition, we show that absence of externality is also sufficient.

**Proposition 6** If transfer payments can depend only on types of trade and the value of internal trade $(V_I, C_I)$ is uncertain ex ante, the first best can be achieved if and only if there are no direct externalities.

Although our trade-contingent transfer scheme works poorly when $\{V_I, C_I\}$ are stochastic and investment externalities are present, if the headquarters can design a more elaborate
mechanism that solicits information on \( \{V_I, C_I\} \), first best implementation will be feasible. In such case, the headquarters still has the power to selectively alter the budget balance for the divisions, so that appropriate transfer prices that depend on \( \{V_I, C_I\} \) will provide correct investment incentives for both divisions while instituting the optimal trading regime.

2.7 Concluding Remarks

We have presented a mechanism that comprises only of trade requests and transfer payments but still achieves the first best. It is broadly consistent with the reality, in that, according to Eccles (1985), division managers often make competing requests between internal and external trades, and the headquarters acts as the arbiter either by granting the permission to trade with the outside or by mandating internal trade. Strengths notwithstanding, the model can be improved in many dimensions. First, the mechanism is too crude to implement the first best when the environment gets sufficiently complex, e.g., when the value of internal trade is stochastic. Under such situation, a more complex mechanism, that solicits reports on the value of internal trade, will be necessary. Also, the model retains only the minimal features of trade: the firm will never trade internally and externally at the same time. Real world corporations, as cited by Bradach and Eccles (1989), often do simultaneously engage in both activities. Incorporating such realism will provide a more complete picture in understanding the market versus hierarchy dichotomy.

In its reliance on trilateral transfers, the model does not seem to coincide too well with the transfer prices in practice. According to Eccles, actual transfer pricing policies fall into three categories of market-based, cost-plus, and dual pricing. Even under dual pricing, firms combine market-based and cost-plus policies rather than using two fixed prices, as in our model. If our headquarters can observe the market price or the marginal cost of production, transfer price can correlate with either one, in resemblance to the reality. Because the model starts from more parsimonious assumptions about the headquarters’ information, neither policy choices are readily available. If an uninformed headquarters relies on either market-based or cost-plus transfer pricing policy, it could potentially wreak havoc, as confirmed by the managers’ acute aversion to internal trade in Eccles. From a normative perspective, therefore, notwithstanding its departure from the real world practices, this model presents a more tractable approach to choosing the right policy for a headquarters that lacks relevant information.

On the organization side, the model demonstrates how an uninformed headquarters can play a crucial role for the division managers, who, by themselves, cannot execute efficient investment and trade. We believe the assumption of cooperative investment offers a strong theoretical justification for the existence of a headquarters. On the other hand, despite its role as a budget breaker, our headquarters does not maximize its own profit in any realistic sense. Given risk

\[ \text{For instance, suppose the division managers know the realized values of } (V_I, C_I) \text{ before they observe the market price. Before the managers are to make trade requests, the headquarters can order to submit a report on } C_I \text{ from the upstream division } (C_I^r) \text{ and } V_I \text{ from the downstream division } (V_I^d), \text{ and set } B_I - B_I = C_I^r \text{ and } S_I - S_I = V_I^d. \text{ Since } C_I^r \text{ affects (directly) only the downstream division’s profits and } V_I^d, \text{ upstream’s, truth-telling is a Nash equilibrium for both divisions. The first best is, then, implemented by subsequently receiving their requests over trade.} \]
neutrality of the managers, there are various ways the headquarters can extract all the profits of the firm, e.g., by requesting the managers to put up a bond ex ante, but such extraneous solutions do not seem to comport well with the reality. Furthermore, while the model examines the headquarters' role through the narrow lens of intra-firm trade, in reality, its role is much more encompassing. It develops corporate strategy, allocates capital and human resources, and devises managerial incentives systems, to name just a few. It functions as a visible hand within the "subeconomy" described by Holmstrom (1999). Examining the role of headquarters in vast other areas, in conjunction with its role in intra-firm trade, should provide a more comprehensive and realistic view of the firm.
Proofs

Proof of Proposition 1.

1. Suppose that perfect market monitoring exists at the optimum level of investments \( i^* \) and the firm can still achieve both investment and trading efficiencies. The firm is purchasing standard widget from the market when \( 0 < P < V_M + B_P - B_I - V_I \), selling the standard widget to the market when \( S_I - S_S + C_M - C_I < P < 1 \) and trading internally in between. Trading efficiency dictates the headquarters to set \( B_P - B_I = C_I \) and \( S_I - S_S = V_I \).

Perfect market monitoring implies that

\[
\left( \frac{\partial C_I(i^*)}{\partial B} - \frac{\partial C_M(i^*)}{\partial B} \right) \cdot f(C_M^* + (V_I^* - C_I^*)) \cdot (B_S - B_I - V_I^*) = 0
\]

\[
\left( \frac{\partial V_M(i^*)}{\partial S} - \frac{\partial V_I(i^*)}{\partial S} \right) \cdot f(V_M^* - (V_I^* - C_I^*)) \cdot (S_P - S_I + C_I^*) = 0
\]

\( \forall \{B_S - B_I, S_P - S_I\} \). At optimal investment level \( i^* \), therefore, divisional profit maximization conditions reduce to

\[
\frac{\partial V_M}{\partial B} \{F(V_M^* - (V_I^* - C_I^*))\} + \frac{\partial V_I}{\partial B} \{F(C_M^* + (V_I^* - C_I^*)) - F(V_M^* - (V_I^* - C_I^*))\} = \frac{d\phi}{di_B}
\]

\[
-\frac{\partial C_M}{\partial S} \{1 - F(C_M^* + (V_I^* - C_I^*))\} - \frac{\partial C_I}{\partial S} \{F(C_M^* + (V_I^* - C_I^*)) - F(V_M^* - (V_I^* - C_I^*))\} = \frac{d\phi}{di_S}
\]

Let the solution to the divisional profit maximization be \( i' \). By assumption that \( \frac{\partial C_i}{\partial i_k} < 0 \) and \( \frac{\partial V_i}{\partial i_k} > 0 \) \( \forall j \in \{I, M\} \) \( k \in \{B, S\} \) and \( i \in [0, 1] \), we have

\[
-\frac{\partial C_M}{\partial B} \{1 - F(C_M^* + (V_I^* - C_I^*))\} - \frac{\partial C_I}{\partial B} \{F(C_M^* + (V_I^* - C_I^*)) - F(V_M^* - (V_I^* - C_I^*))\} > 0
\]

\[
\frac{\partial V_M}{\partial S} \{F(V_M^* - (V_I^* - C_I^*))\} + \frac{\partial V_I}{\partial S} \{F(C_M^* + (V_I^* - C_I^*)) - F(V_M^* - (V_I^* - C_I^*))\} > 0.
\]

Therefore, at \( \{V^*, C^*\} \), marginal benefits of investments for both divisions will be strictly less than optimal marginal benefits. Given \( \phi' > 0 \), \( \phi'' > 0 \), and \( \lim_{i \to 0} \phi' = 0 \), divisions' profit maximizing investments will be strictly less than first best investments, \( i^* > i' \).

2. Now suppose that collusion (managers' ex post bargaining) is allowed but perfect market monitoring does not exist at optimum. In order to achieve ex post trading efficiency, the headquarters needs to set \( B_I + S_I = B_P + S_P = B_S + S_S \). Suppose not.

Without loss of generality, let \( B_I + S_I = B_P + S_P + \lambda \) such that \( \lambda > 0 \). When the divisions trade internally or purchase externally, their total profits are \( V_I - C_I + B_I + S_I \) and \( B_P + S_P + V_M - P \), respectively. Ex post efficiency dictates that the firm should purchase the standard widget from the market when \( V_M - P > V_I - C_I \) or \( P < V_M - (V_I - C_I) \).
Let $\Delta(P) \equiv (V_I - C_I + B_I + S_I) - (B_P + S_P + V_M - P)$. When the divisions do not collude, external purchase occurs, rendering $\pi_B = V_M - P + B_P$ and $\pi_S = S_P$. When $P - \lambda < P < P$, for any $\alpha \in (0,1)$, $V_M - P + B_P + \alpha \cdot \Delta(P) > V_M - P + B_P$ and $S_P + (1 - \alpha) \cdot \Delta(P) > S_P$. Therefore, for any arbitrary sharing rule $\alpha$, by jointly requesting internal trade, both divisions are strictly better off. Also, since $f(P) > 0 \forall P$, $P - \lambda < P < P$ is not a probability zero event.

However, given that the transfer schedules satisfy T1 through T4, absence of perfect market monitoring implies $\xi_S \geq 0$ and $\xi_B \leq 0$, which in turn implies $S_P + B_P \geq B_I + S_I$ and $S_S + B_S \geq B_I + S_I$. Therefore, ex post divisional collusion (renegotiation) strictly undermines first best implementation.

\textbf{Proof of Proposition 2.} We break this proof into two parts of satisfying the managers’ participation constraints and then that of the headquarters’.

1. Satisfying the upstream division manager’s participation constraint implies $S_I - C_I \geq 0$ and $S_P \geq 0$, since the manager will request external sale only when $P - C_M + S_S \geq S_I - C_I$. From $S_P - S_I = \xi_S - C_I$, $S_P \geq 0$ is equivalent to $S_I - C_I \geq -\xi_S$. Combining this with $S_I - C_I \geq 0$, therefore, we need $S_I - C_I \geq \max\{0, -\xi_S\}$. Similarly, for the downstream division, we have $V_I + B_I \geq \max\{0, -\xi_B\}$.

2. Now, to satisfy the headquarters’ ex post participation constraints, we need $B_I + S_I \leq 0$, $B_P + S_P \leq 0$, and $B_S + S_S \leq 0$.

First, consider $B_I + S_I \leq 0$. Adding $S_I - C_I \geq \max\{0, -\xi_S\}$ with $V_I + B_I \geq \max\{0, -\xi_B\}$, we have $(B_I + S_I) + (V_I - C_I) \geq \max\{0, -\xi_S\} + \max\{0, -\xi_B\}$. So, to satisfy $B_I + S_I \leq 0$, we need $(B_I + S_I) \geq -(V_I - C_I) + \max\{0, -\xi_S\} + \max\{0, -\xi_B\}$.

When $S_P - S_I = \xi_S - C_I$ and $B_S - B_I = V_I - \xi_B$ are combined with $B_P - B_I = C_I$ and $S_I - S_S = V_I$, $B_P + S_P \leq 0$ and $B_S + S_S \leq 0$ become $B_I + S_I \leq -\xi_S$ and $B_I + S_I \leq -\xi_B$, respectively. These two conditions, in turn, yield $B_I + S_I \leq \min\{-\xi_B, -\xi_S\}$.

Therefore, when we combine both $(B_I + S_I) \geq -(V_I - C_I) + \max\{0, -\xi_S\} + \max\{0, -\xi_B\}$ and $B_I + S_I \leq \min\{-\xi_B, -\xi_S\}$, we get

$$(V_I - C_I) \geq \max\{0, -\xi_S\} + \max\{0, -\xi_B\} - \min\{-\xi_B, -\xi_S\}$$

as the necessary condition. Sufficiency is shown by taking these steps backwards.

3. Suppose, without loss of generality, $-\xi_B > -\xi_S > 0$. Then, the condition becomes $(V_I - C_I) \geq -\xi_B = |\xi_B|$. 

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Next, if \(-\xi_B > 0 > -\xi_S\) (or \(\xi_B < 0 < \xi_S\)) the condition reduces to \((V_I - C_I) \geq -\xi_B - (\xi_S) = |\xi_B| + |\xi_S|\).

Finally, when \(0 > -\xi_B > -\xi_S\), it becomes \((V_I - C_I) \geq -(-\xi_S) = |\xi_S|\). Therefore, when \((V_I - C_I) \geq |\xi_B| + |\xi_S|\), all three conditions are satisfied.

Proof of Corollary 1. Suppose \(B_I + S_I = 0\) at optimum, so that there is single transfer price. Without loss of generality, let \(S_I = \lambda \cdot V_I + (1 - \lambda) \cdot C_I = -B_I\), where \(\lambda \in [0, 1]\). With \(B_P - B_I = C_I\) and \(S_I - S_S = V_I\) we get \(B_P = \lambda(C_I - V_I)\) and \(S_S = (1 - \lambda) \cdot (C_I - V_I)\).

Similarly, from \(B_P = \lambda(C_I - V_I)\) and \(S_S = (1 - \lambda) \cdot (C_I - V_I)\), with \(B_S - B_I = V_I - \xi_B\) and \(S_P - S_I = \xi_S - C_I\), we get \(B_S = (1 - \lambda) \cdot (V_I - C_I) - \xi_B\) and \(S_P = \lambda(V_I - C_I) + \xi_S\).

The condition \((V_I - C_I) \geq |\xi_B| + |\xi_S|\) guarantees that there exists a \(\lambda\) such that all participation constraints of division managers will be satisfied. However, the above schedule implies \(B_P + S_P = \xi_S\) and \(B_S + S_S = -\xi_B\). If \(\xi_S > 0\) \(\Rightarrow \left|\frac{\partial C_M}{\partial \xi_k}\right| > \left|\frac{\partial C_L}{\partial \xi_k}\right|\) and/or \(-\xi_B > 0\) \(\Rightarrow \left|\frac{\partial C_M}{\partial \xi_k}\right| > \left|\frac{\partial C_L}{\partial \xi_k}\right|\), the headquarters’ ex post participation constraint is violated.

If \(\xi_S < 0\) and \(-\xi_B < 0\), the headquarters’ ex post participation constraints are satisfied. For the division managers, we know that \(\pi_B(IT), \pi_S(IT), \pi_B(EP),\) and \(\pi_S(ES)\) are all (weakly) positive. For \(\pi_B(ES),\) and \(\pi_B(EP),\) from \((V_I - C_I) \geq |\xi_B| + |\xi_S|\), we know that there exists a \(\lambda\) such that \(B_S = (1 - \lambda) \cdot (V_I - C_I) - \xi_B \geq 0\) and \(S_P = \lambda(V_I - C_I) + \xi_S \geq 0\).

Proof of Proposition 3. Suppose there exists a contract (mechanism) that depends on verifiable messages of trade requests and achieve the first best.

Let such contract be \(f : (\theta_B \times \theta_S) \rightarrow \{IT, EP, ES\} \times \mathbb{R}\), where \(\theta, \epsilon \in \{IT, EP, ES\}\), so that based on trade requests, a certain type of trade is implemented with a transfer price \(t_0\) from the buyer to the seller. Underlying the assumption of a single transfer price is that they cannot commit not to renegotiate ex post. If the contract assigns two transfer prices, e.g., \(t_B \neq t_S\), the parties will have an incentive to renegotiate ex post so as to reap the differences, \(|t_B - t_S|\), since that yields Pareto improvement. Also, since only one type of trade is optimal ex post, any stochastic implementation (probability distribution over \{IT, EP, ES\}) cannot achieve ex post efficiency.

At the trading stage, in order to achieve ex post efficiency, we need \(\pi_B(\theta, \theta|\theta) \geq \pi_B(\theta', \theta|\theta)\) and \(\pi_S(\theta, \theta|\theta) \geq \pi_S(\theta', \theta|\theta)\) \(\forall \theta \in \{IT, EP, ES\}\), where the first two \(\theta\)'s denote the buyer and seller’s requests, respectively and the last \(\theta\) denotes optimal trade. For example, when internal trade is optimal, \(\theta = IT\), i.e., \(V_M - (V_I - C_I) < P < C_M + (V_I - C_I)\), the contract elicits truthful requests from both parties using the transfer price \(t_{IT}\), i.e., \(\pi_B(IT, IT|IT) \geq \pi_B(\theta', IT|IT)\) and \(\pi_S(IT, IT|IT) \geq \pi_S(IT, \theta'|IT), \theta' \in \{EP, ES\}\), where \(\pi_B(IT, IT|IT) = V_I - t_{IT}\) and \(\pi_S(IT, IT|IT) = t_{IT} - C_I\).
Although the punishment states ($\pi_B(\theta', \theta | \theta)$ and $\pi_S(\theta, \theta' | \theta)$) provide another scope for the possibility of renegotiation, the proof does not rely on renegotiation off the equilibrium. It shows that budget balance even on equilibrium undermines investment efficiency. At the investment stage, therefore, the expected profits of both parties are

$$E(\pi_B) = \int_0^{V_M-(V_I-C_I)} (V_M - P - t_{EP}) f(P) dP$$

$$+ \int_{V_M-(V_I-C_I)}^{C_M+(V_I-C_I)} (V_I - t_{IT}) f(P) dP$$

$$+ \int_{C_M+(V_I-C_I)}^{1} (-t_{ES}) f(P) dP - \phi(i_B)$$

and

$$E(\pi_S) = \int_0^{V_M-(V_I-C_I)} (t_{EP}) f(P) dP$$

$$+ \int_{V_M-(V_I-C_I)}^{C_M+(V_I-C_I)} (t_{IT} - C_I) f(P) dP$$

$$+ \int_{C_M+(V_I-C_I)}^{1} (P - C_M + t_{ES}) f(P) dP - \phi(i_S).$$

The first order conditions are

$$\left( \frac{\partial V_I}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) \left\{ F(\overline{P}) - F(P) - f(P) \cdot (t_{IT} - t_{EP} - C_I) + f(\overline{P}) \cdot (V_I - t_{IT} + t_{ES}) \right\}$$

$$+ \frac{\partial V_M}{\partial i_B} \left\{ F(P) + f(P) \cdot (t_{IT} - t_{EP} - C_I) \right\}$$

$$+ \frac{\partial C_M}{\partial i_B} \cdot f(P) \cdot (V_I - t_{IT} + t_{ES}) = \frac{d\phi}{di_B}$$

and

$$\left( \frac{\partial V_I}{\partial i_S} - \frac{\partial C_I}{\partial i_S} \right) \left\{ F(\overline{P}) - F(P) + f(P) \cdot (t_{IT} - t_{EP} - C_I) - f(\overline{P}) \cdot (V_I - t_{IT} + t_{ES}) \right\}$$

$$- \frac{\partial V_M}{\partial i_S} \cdot f(P) \cdot (t_{IT} - t_{EP} - C_I)$$

$$+ \frac{\partial C_M}{\partial i_S} \cdot \{ 1 - F(\overline{P}) - f(\overline{P}) \cdot (V_I - t_{IT} + t_{ES}) \} = \frac{d\phi}{di_S}$$

where $\overline{P} = C_M + (V_I - C_I)$ and $\underline{P} = V_M - (V_I - C_I).$
When equated with the first best conditions, investment efficiency implies that

\[
\begin{align*}
    f(\bar{P}) \cdot (V_I - t_{IT} + t_{ES}) \cdot \left\{ \left( \frac{\partial V_I}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) + \frac{\partial C_M}{\partial i_B} \right\} \\
    + f(\bar{P}) \cdot (t_{IT} - t_{EP} - C_I) \cdot \left\{ \frac{\partial V_M}{\partial i_B} - \left( \frac{\partial V_I}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) \right\} \\
    = -\frac{\partial C_M}{\partial i_B} \cdot (1 - F(\bar{P}))
\end{align*}
\]

and

\[
\begin{align*}
    -f(\bar{P}) \cdot (V_I - t_{IT} + t_{ES}) \cdot \left\{ \left( \frac{\partial V_I}{\partial i_S} - \frac{\partial C_I}{\partial i_S} \right) + \frac{\partial C_M}{\partial i_S} \right\} \\
    -f(\bar{P}) \cdot (t_{IT} - t_{EP} - C_I) \cdot \left\{ \frac{\partial V_M}{\partial i_S} - \left( \frac{\partial V_I}{\partial i_S} - \frac{\partial C_I}{\partial i_S} \right) \right\} \\
    = \frac{\partial V_M}{\partial i_S} \cdot F(\bar{P}).
\end{align*}
\]

Due to budget balance, the left hand sides of both equations are mirror images of each other. Since \(-\frac{\partial C_M}{\partial i_B} \cdot (1 - F(\bar{P})) > 0\) and \(\frac{\partial V_M}{\partial i_S} \cdot F(\bar{P}) > 0\), they cannot be satisfied simultaneously.

**Proof of Corollary 2.** Suppose they divide the bargaining power so that the seller (buyer) receives \(\alpha (1 - \alpha)\) fraction of any additional surplus from renegotiation, such that \(0 \leq \alpha \leq 1\). Default contract will stipulate the probabilities of respective trade and transfer price (from buyer to seller), \(\{(q_{IT}, t_{IT}), (q_{EP}, t_{EP}), (q_{ES}, t_{ES})\}\), such that \(q_{IT} + q_{EP} + q_{ES} \leq 1\) and \(0 \leq q_i \leq 1 \forall i\).

Let \(\Sigma \equiv \int_0^1 (V_I - C_I) (V_M - P) f(P) dP + \int_{C_M+(V_I-C_I)}^{C_M+(V_I-C_I)} (V_I - C_I) f(P) dP + \int_{C_M+(V_I-C_I)}^{C_M+(V_I-C_I)} (P - C_M) f(P) dP\), so that \(\Sigma\) denotes expected total profit \((E(\pi))\) from trade.

Given \(\alpha\), their ex ante expected profits are

\[
\begin{align*}
    E(\pi_S) &= \alpha \Sigma + (1 - \alpha) \left\{ q_{IT} (t_{IT} - C_I) + q_{EP} \cdot t_{EP} + q_{ES} (E(P) - C_M + t_{ES}) \right\} - \phi(i_S) \\
    E(\pi_B) &= (1 - \alpha) \Sigma + \alpha \left\{ q_{IT} (V_I - t_{IT}) + q_{EP} \cdot (V_M - E(P) - t_{EP}) - q_{ES} \cdot t_{ES} \right\} - \phi(i_B).
\end{align*}
\]

The first order conditions yield

\[
\begin{align*}
    \alpha \frac{\partial \Sigma}{\partial i_S} - (1 - \alpha) \left\{ q_{IT} \cdot \frac{\partial C_I}{\partial i_S} + q_{ES} \cdot \frac{\partial C_M}{\partial i_S} \right\} &= \frac{\partial \phi(i_S)}{\partial i_S} \\
    (1 - \alpha) \frac{\partial \Sigma}{\partial i_B} + \alpha \left\{ q_{IT} \cdot \frac{\partial V_I}{\partial i_B} + q_{EP} \cdot \frac{\partial V_M}{\partial i_B} \right\} &= \frac{\partial \phi(i_B)}{\partial i_B}
\end{align*}
\]
First best implementation requires

\[
q_{IT} \cdot \frac{\partial V_I}{\partial i_B} + q_{EP} \cdot \frac{\partial V_M}{\partial i_B} = - \left( q_{IT} \cdot \frac{\partial C_I}{\partial i_S} + q_{ES} \cdot \frac{\partial C_M}{\partial i_S} \right) = \\
\frac{\partial V_M}{\partial i} F(V^*_M - (V^*_I - C^*_I)) - \frac{\partial C_M}{\partial i} \{1 - F(C^*_M + (V^*_I - C^*_I)) \}
\]

\[
+ \left( \frac{\partial V_I}{\partial i} - \frac{\partial C_I}{\partial i} \right) \{ F(C^*_M + (V^*_I - C^*_I)) - F(V^*_M - (V^*_I - C^*_I)) \}
\]

which implies that

\[
q_{IT} \cdot \left( \frac{\partial V_I}{\partial i} - \frac{\partial C_I}{\partial i} \right) + q_{EP} \cdot \frac{\partial V_M}{\partial i} - q_{ES} \cdot \frac{\partial C_M}{\partial i} = 2 \left( \frac{\partial V_I}{\partial i} - \frac{\partial C_I}{\partial i} \right) q^*_{IT} + \frac{\partial V_M}{\partial i} \cdot q^*_{EP} - \frac{\partial C_M}{\partial i} \cdot q^*_{ES} \right) = 2 \frac{\partial \Sigma^*}{\partial i}.
\]

However, since \(\pi_B + \pi_S = \pi\), so that \(E(\pi_B) + E(\pi_S) = \Sigma, \frac{\partial E(\pi_B)}{\partial i} + \frac{\partial E(\pi_S)}{\partial i} < 2 \frac{\partial \Sigma^*}{\partial i} \). ■

**Proof of Proposition 4.** Without loss of generality, let the seller be the owner of the company and the buyer the employee. As in the proof for non-integration case, suppose there exists a wage contract that depends on verifiable messages.

Let such contract be \(f : (\theta_B \times \theta_S) \rightarrow \{IT, EP, ES\} \times \mathbb{R}\), where \(\theta_i \in \{IT, EP, ES\}\), so that based on trade requests, a certain type of trade is implemented with the wage \((w)\) from the seller-owner to the buyer-employee. At the trading stage, in order to achieve ex post efficiency, we need \(\pi(\theta, \theta'|\theta) - w(\theta, \theta'|\theta) \geq \pi(\theta, \theta'|\theta) - w(\theta, \theta'|\theta)\) and \(w(\theta, \theta'|\theta) \geq w(\theta, \theta'|\theta) \forall \theta \in \{IT, EP, ES\}\), where the first two \(\theta\)'s denote the buyer-employee and seller-owner's requests, respectively and the last \(\theta\) denotes optimal trade. Denote \(w(\theta, \theta'|\theta) = w_\theta\) and \(\pi(\theta, \theta'|\theta) = \pi_\theta\).

As before, the wage contract may need to specify a punishment schedule, \(\pi(\theta, \theta'|\theta) < \pi(\theta, \theta'|\theta)\) and/or \(\pi(\theta, \theta'|\theta) < \pi(\theta, \theta'|\theta)\), so as to create renegotiation incentive off the equilibrium, but we will show that budget balance even on equilibrium destroys efficiency.

Expected return for the buyer-employee is

\[
E(w) = \int_{V_M - (V_I - C_I)}^{V_M - (V_I - C_I)} w_{EP} \cdot f(P)dP + \int_{V_M - (V_I - C_I)}^{C_M + (V_I - C_I)} w_{IT} \cdot f(P)dP \\
+ \int_{C_M + (V_I - C_I)}^{1} w_{ES} \cdot f(P)dP - \phi(i_B).
\]

Under budget balance, the seller-owner retains all the profits minus the wage. The expected
return for the seller is
\begin{align*}
E(\pi_S) &= \int_0^{V_M-(V_t-C_t)} (\pi_{EP} - w_{EP}) f(P) dP \\
&\quad + \int_{V_M-(V_t-C_t)}^{\bar{C}_M+(V_t-C_t)} (\pi_{IT} - w_{IT}) f(P) dP \\
&\quad + \int_{\bar{C}_M+(V_t-C_t)}^1 (\pi_{ES} - w_{ES}) f(P) dP - \phi(i_S),
\end{align*}
which is equivalent to
\begin{align*}
E(\pi_S) &= E(\pi) - E(w) - \phi(i_S).
\end{align*}

Suppose the employee's incentives are perfectly aligned: \( \frac{\partial E(w)}{\partial \delta} = \frac{\partial E(\pi)}{\partial \delta} \). From the owner's first order condition, \( \frac{\partial E(\pi_S)}{\partial \delta S} = \frac{\partial E(\pi)}{\partial \delta S} - \frac{\partial E(w)}{\partial \delta S} - \frac{\partial \phi(i_S)}{\partial \delta S} \), since \( \frac{\partial E(\pi)}{\partial \delta S} = \frac{\partial E(\pi)}{\partial \delta S} \), given direct externalities, the condition reduces to \( \frac{\partial E(\pi_S)}{\partial \delta S} = -\frac{\partial \phi(i_S)}{\partial \delta S} \). Therefore, the owner has no incentive to undertake firm-specific investment. The result is symmetric when the buyer owns the seller.

**Proof of Proposition 5.** For the sake of simplicity, suppose that \( \tilde{V}_M(i) = V_M(i) + \delta \) and \( \tilde{C}_M(i) = C_M(i) + \eta \), where \( \delta \) has a continuous and differentiable distribution \( g(\delta) \) within the range of \( (\delta, \bar{\delta}) \) and \( \eta \) with \( h(\eta) \) in \( (\eta, \bar{\eta}) \), where \( \delta < 0 < \bar{\delta}, \eta < 0 < \bar{\eta} \) and that \( E(\delta) = E(\eta) = 0 \). When \( V_M \) and \( C_M \) are stochastic, we can let \( \tilde{V}_M = E(V_M) + \delta \), where \( \delta = V_M - E(V_M) \), so that the above notations can be thought of as decompositions. Also, assume that \( (P, \delta, \eta) \) are independent from one another.

The expected profit for the entire firm, now, is
\begin{align*}
E(\pi) &= \int_\eta^{\bar{\eta}} \int_\delta^{\bar{\delta}} \left\{ \int_0^{V_M+\delta-(V_t-C_t)} (V_M + \delta - P) f(P) dP + \int_{V_M+\delta-(V_t-C_t)}^{C_M+\eta+V_t-C_t} (V_t - C_t) f(P) dP \\
&\quad + \int_{C_M+\eta+V_t-C_t}^1 (P - C_M) f(P) dP \right\} g(\delta) d\delta \cdot h(\eta) d\eta - \phi(i_B) - \phi(i_S).
\end{align*}

Since \( (P, \delta, \eta) \) are independent, the first order conditions can be written as
\begin{align*}
\frac{\partial E(\pi)}{\partial i_k} &= \int_\eta^{\bar{\eta}} \int_\delta^{\bar{\delta}} \left\{ \left( \frac{\partial V_M}{\partial i_k} - \frac{\partial C_M}{\partial i_k} \right) F(C_M + \eta + V_t - C_t) - F(V_M + \delta - (V_t - C_t)) \right\} g(\delta) d\delta \cdot h(\eta) d\eta - \frac{\partial \phi}{\partial i_k},
\end{align*}
\begin{align*}
\frac{\partial V_M}{\partial i_k} F(V_M + \delta - (V_t - C_t)) - \frac{\partial C_M}{\partial i_k} [1 - F(C_M + \eta + V_t - C_t)] \right\} g(\delta) d\delta \cdot h(\eta) d\eta - \frac{\partial \phi}{\partial i_k}.
\end{align*}

Note that within the double integral, the program has remained the same except the additions of random variables, \( \delta \) and \( \eta \).
Given the transfer schedule of \( \{(B_I, B_P, B_S), (S_I, S_P, S_S)\} \), downstream will seek external purchase whenever \( P < V_M + \delta + B_P - V_I - B_I \), the upstream division will request external sale when \( P > S_I - C_I - S_S + C_M + \eta \), and both will request internal trade when \( V_M + \delta + B_P - V_I - B_I < P < S_I - C_I - S_S + C_M + \eta \). Therefore, the downstream division’s expected profit becomes

\[
E(\pi_B) = \int_0^{\eta} \int_0^\delta \left\{ \int_0^{V_M + \delta + B_P - V_I - B_I} (V_M + \delta - P + B_P) f(P) dP \\
+ (V_I + B_I) \left[ F(S_I - C_I - S_S + C_M + \eta) - F(V_M + \delta + B_P - V_I - B_I) \right] \\
+ B_S \left[ 1 - F(S_I - C_I - S_S + C_M + \eta) \right] \right\} g(\delta) d\delta \cdot h(\eta) d\eta - \phi(i_B).
\]

**Downstream division’s profit maximization yields**

\[
\frac{\partial E(\pi_B)}{\partial i_B} = \int_0^{\eta} \int_0^\delta \left\{ \frac{\partial V_I}{\partial i_B} \left[ F(S_I - C_I - S_S + C_M + \eta) - F(V_M + \delta + B_P - V_I - B_I) \right] \\
+ \frac{\partial V_M}{\partial i_B} F(V_M + \delta + B_P - V_I - B_I) \\
+ (V_I + B_I - B_S) \cdot f(S_I - C_I - S_S + C_M + \eta) \cdot \left( \frac{\partial C_M}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) \right\} g(\delta) d\delta \cdot h(\eta) d\eta - \frac{\partial \phi}{\partial i_B}.
\]

We can immediately see that as long as \( S_I - S_S = V_I \) and \( B_P - B_I = C_I \), trading efficiency will be satisfied.

To achieve investment efficiency, we need

\[
\int_0^{\eta} \int_0^\delta \left\{ - \frac{\partial C_I}{\partial i_B} \left[ F(C_M + \eta + V_I - C_I) - F(V_M + \delta - (V_I - C_I)) \right] \\
+ \frac{\partial C_M}{\partial i_B} [1 - F(C_M + \eta + V_I - C_I)] \right\} g(\delta) d\delta \cdot h(\eta) d\eta
\]

\[
= \int_0^{\eta} \int_0^\delta \left\{ (V_I + B_I - B_S) \cdot f(C_M + \eta + V_I - C_I) \cdot \left( \frac{\partial C_M}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) \right\} g(\delta) d\delta \cdot h(\eta) d\eta,
\]

which implies

\[
B_S - B_I = V_I^* - \frac{\int_0^{\eta} \int_0^\delta \left\{ \frac{\partial C_I}{\partial i_B} \left[ F(C_M + \eta + V_I - C_I) - F(V_M + \delta - (V_I - C_I)) \right] \\
+ \frac{\partial C_M}{\partial i_B} [1 - F(C_M + \eta + V_I - C_I)] \right\} g(\delta) d\delta \cdot h(\eta) d\eta}{\int_0^{\eta} \int_0^\delta f(C_M + \eta + V_I - C_I) \cdot \left( \frac{\partial C_M}{\partial i_B} - \frac{\partial C_I}{\partial i_B} \right) g(\delta) d\delta \cdot h(\eta) d\eta}.
\]

As in the deterministic case, first we need absence of perfect market monitoring in \( C \) at optimum, i.e., \( \frac{\partial C_M}{\partial i_B} \neq \frac{\partial C_I}{\partial i_B} \), and second, since \( B_S - B_I \neq V_I^* \), the headquarters needs to prevent divisional collusion. The conditions are analogous for the downstream division. ❄️

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**Proof of Proposition 6.** Suppose that $\delta$ and $\eta$ have respective continuous and differentiable density functions $g(\delta)$ and $h(\eta)$ within the respective ranges of $(\bar{\delta}, \delta)$ and $(\bar{\eta}, \eta)$, where $\delta < 0 < \bar{\delta}$, $\eta < 0 < \bar{\eta}$ and that $E(\delta) = E(\eta) = 0$. Let $\bar{V}_I(i) = V_I(i) + \delta$ and $\bar{C}_I(i) = C_I(i) + \eta$. Also, assume that $(P, \delta, \eta)$ are independent from one another.

1. Suppose direct externalities exist. We need to show that the first best implementation is not possible. Because the headquarters needs to break the budget balance, it cannot rely on joint decision (ex post collusion) by the division managers, since they will have an incentive to request inefficient trade solely to extract higher transfers from the headquarters in some states. Thus, it needs to extract information independently from both divisions. In addition, given that the headquarters can make transfer payments that depend only on types of trade executed, the schedule looks the same as before, i.e., $(B_I, B_S, B_P)$ and $(S_I, S_S, S_P)$.

In order to provide correct investment incentives, therefore, the headquarters still needs to set

- $B_P - B_I = C_I$
- $S_I - S_S = V_I$
- $B_S - B_I = V_I - \xi_B$
- $S_P - S_I = \xi_S - C_I$.

Suppose, without loss of generality, $\delta > \eta > 0$, and let $\bar{P} = C_M + (V_I - C_I)$ and $P = V_M - (V_I - C_I)$, so that $\bar{P}$ ($P$) denotes the expected price at which the firm should switch from internal trade to external sale (from external purchase to internal trade). We will show that the division managers’ preferences remain unchanged, for example, in the range of $P \in (\bar{P} + (\delta - \eta) - \epsilon, \bar{P} + (\delta - \eta) + \epsilon)$ where $\epsilon > 0$, so that even though the firm should trade internally when $P = \bar{P} + (\delta - \eta) - \epsilon$ and sell externally when $P = \bar{P} + (\delta - \eta) + \epsilon$, the headquarters will not be able to extract optimal requests, since preferences remain unchanged.

When $P - C_M + S_S > \max\{S_I - C_I - \eta, S_P\}$, the upstream division strictly prefers external sale. Given the high market price, the downstream division will not want to buy from outside. It will prefer either internal trade or external sale, depending on whether $(V_I + \delta + B_I) > B_S$ or $(V_I + \delta + B_I) < B_S$. Thus, as long as $V_M - P + B_P < 0$, which is easily satisfied when $P > \bar{P} - \eta$ and $\eta$ is not too large, the downstream division’s preferences remain unchanged. Suppose $S_I - C_I - \eta > S_P$. Then, since $S_I - S_S = V_I$, whenever $\bar{P} - \eta < P$, the upstream division prefers external sale. Thus, when $P \in [\bar{P} - \eta, 1]$, both divisions preferences on trade remain unchanged.

Suppose, instead, $S_I - C_I - \eta < S_P$. Then, the upstream division prefers external sale when $P \geq C_M + S_P - S_S > \bar{P} - \eta$, while the downstream division’s preferences remain the same as before. Unless $S_P - S_S = (V_I - C_I) + (\delta - \eta)$, which is a probability
zero event, the upstream division’s preferences are misaligned. Suppose \( S_P - S_S > (V_I - C_I) + (\delta - \eta) \), and let \( \varepsilon = (S_P - S_S) - ((V_I - C_I) + (\delta - \eta)) > 0 \). When \( P \in (\bar{P} + (\delta - \eta) - \varepsilon, C_M + S_P - S_S) \), neither divisions’ preferences over trades change, such that the headquarters will be unable to extract different equilibrium. The case of \( S_P - S_S < (V_I - C_I) + (\delta - \eta) \) is analogous.

The proof is identical to show that the division managers’ preferences over trade remain unchanged in the region of \( P \in (\bar{P} - (\delta - \eta) - \varepsilon, \bar{P} - (\delta - \eta) - \varepsilon) \). Also, other realizations of \( (\delta, \eta) \) produce analogous results.

2. Now suppose that there are no direct investment externalities. Since budget breaking is no longer necessary, the headquarters can rely on division managers’ renegotiation to produce ex post efficiency. When the headquarters institutes budget-constant transfer payment mechanism and relies on the division managers’ joint decision-making at the trading stage, it is in fact providing a default contract to achieve ex ante efficiency while relying on their trading negotiations for ex post efficiency. We will show that when the headquarters institutes such mechanism, the first order conditions remain unchanged with respect to the deterministic case.

First, as shown before, in the absence of direct externalities, the headquarters can set \( B_P + S_P = B_S + S_S = B_I + S_I \), where \( B_P - B_I = C_I \) and \( S_I - S_S = V_I \). At the trading stage, given some realization of \( (\delta, \eta) \), the firm should sell outside when \( P > \bar{P} + (\delta - \eta) \), buy from the outside when \( P < \bar{P} - (\delta - \eta) \), and trade internally in between. The transfer payments, however, designed the break points to be \( \bar{P} \) and \( \bar{P} \), so that whenever \( P < \bar{P} \), for example, the downstream division can force external purchase.

There are generally two cases. When \( \delta > \eta \), the firm should trade internally more often than expected ante, and when \( \delta < \eta \), less often than originally expected. Suppose \( \delta > \eta \).

When \( \bar{P} - (\delta - \eta) < P < \bar{P} \), the division managers will negotiate to trade internally. Assuming that they will evenly split the additional surplus, the upstream division’s profits will be \( S_P + \frac{1}{2} \{(V_I + \delta + B_I + S_I - C_I - \eta) - (V_M - P + B_P + S_P)\} \). Since \( B_P + S_P = B_S + S_S = B_I + S_I \), this reduces to \( S_P + \frac{1}{2} \{(V_I - C_I) - (V_M - P) + (\delta - \eta)\} \). Similarly, the downstream division will earn \( (V_M - P + B_P) + \frac{1}{2} \{(V_I - C_I) - (V_M - P) + (\delta - \eta)\} \). Symmetrically, when \( \bar{P} < P < \bar{P} + (\delta - \eta) \), we will have \( \pi_S = (P - C_M + S_S) + \frac{1}{2} \{(V_I - C_I) - (P - C_M) + (\delta - \eta)\} \) and \( \pi_B = B_S + \frac{1}{2} \{(V_I - C_I) - (P - C_M) + (\delta - \eta)\} \).

The results are exactly the opposite when \( \delta < \eta \). In general, therefore, both divisions are “guaranteed” of the profits implied by the transfer prices, while additional profits are derived from ex post negotiations.
For notational simplicity, let

\[ E(\pi_B|\delta = \eta = 0) \equiv \int_0^P (V_M - P + B_P) f(P)dP \]

\[ + \int_P^\bar{P} (V_I + B_I) f(P)dP + \int_{\bar{P}}^1 B_S f(P)dP. \]

Thus, \( E(\pi_B|\delta = \eta = 0) \) denotes expected profits from deterministic regime.

Also, let

\[ \sigma_B(\delta > \eta) \equiv \int_{P-(\delta-\eta)}^P \frac{1}{2} \{(V_I - C_I) - (V_M - P) + (\delta - \eta)\} f(P)dP \]

\[ + \int_{\bar{P}}^{\bar{P}+(\delta-\eta)} \frac{1}{2} \{(V_I - C_I) + (\delta - \eta) - (P - C_M)\} f(P)dP \]

and

\[ \sigma_B(\delta < \eta) \equiv \int_P^{P-(\delta-\eta)} \frac{1}{2} \{(V_M - P) - (V_I - C_I) - (\delta - \eta)\} f(P)dP \]

\[ + \int_{\bar{P}}^{\bar{P}+(\delta-\eta)} \frac{1}{2} \{(P - C_M) - (V_I - C_I) - (\delta - \eta)\} f(P)dP. \]

Thus, \( \sigma_B(\delta > \eta) \) and \( \sigma_B(\delta < \eta) \) denote additional expected return, conditional on the realizations of \( (\delta, \eta) \), from ex post negotiations for the downstream division.

As we can see, when \( \delta > \eta \), they will negotiate to trade internally in the regions of \( (P-(\delta-\eta), P) \) and \( (\bar{P}, \bar{P}+(\delta-\eta)) \), while when \( \delta < \eta \), negotiations will yield external purchase in the region of \( (P, P-(\delta-\eta)) \) and external sale within \( (\bar{P}+(\delta-\eta), \bar{P}) \). The ex ante expected profit for the downstream division, therefore, becomes

\[ E(\pi_B) = E(\pi_B|\delta = \eta = 0) \]

\[ + \int_0^\bar{P} \left\{ \int_\eta^{\bar{P}} \sigma_B(\delta > \eta) g(\delta) d\delta + \int_\eta^\eta \sigma_B(\delta < \eta) g(\delta) d\delta \right\} h(\eta) d\eta - \phi(i_B). \]

We can see that \( E(\pi_B) > E(\pi_B|\delta = \eta = 0) \).

However, as long as \( \frac{\partial E(\pi_B)}{\partial i_B} = \frac{\partial E(\pi_B|\delta = \eta = 0)}{\partial i_B} \), the investment incentives remain unchanged from the deterministic regime. In other words, we need to show that

\[ \frac{\partial}{\partial i_B} \left( \int_\eta^\bar{P} \left\{ \int_\eta^{\bar{P}} \sigma_B(\delta > \eta) g(\delta) d\delta + \int_\eta^\eta \sigma_B(\delta < \eta) g(\delta) d\delta \right\} h(\eta) d\eta \right) = 0. \]
Assuming that \( \frac{\partial}{\partial B} \left( \int_{\eta}^{\delta} \sigma_B(\cdot)d\delta h(\eta)d\eta \right) = \int_{\eta}^{\delta} \frac{\partial}{\partial B} \left( \sigma_B(\cdot) \right) g(\delta)d\delta h(\eta)d\eta \), such that both integrals are well defined and we can exchange the order of differentiation and integration. Given no direct externalities,

\[
\frac{\partial}{\partial i_B} \left( \int_{\eta}^{\delta} \left\{ \int_{\eta}^{\delta} \sigma_B(\delta > \eta)g(\delta)d\delta + \int_{\eta}^{\delta} \sigma_B(\delta < \eta)g(\delta)d\delta \right\} h(\eta)d\eta \right)
= \int_{\eta}^{\delta} \left\{ \int_{\eta}^{\delta} \frac{1}{2}(\delta - \eta) \left[ f(P) \cdot \left( \frac{\partial V_M}{\partial i_B} - \frac{\partial V_I}{\partial i_B} \right) \right] + f(P) \cdot \frac{\partial V_I}{\partial i_B} \right\} g(\delta)d\delta
+ \int_{\eta}^{\delta} \left[ f(P) \cdot \left( \frac{1}{2} \frac{\partial V_M}{\partial i_B} - \frac{\partial V_I}{\partial i_B} \right) f(P) \right] \cdot g(\delta)d\delta
+ \int_{\eta}^{\delta} \left[ f(P) \cdot \left( \frac{1}{2} \frac{\partial V_M}{\partial i_B} - \frac{\partial V_I}{\partial i_B} \right) f(P) \right] \cdot g(\delta)d\delta \right\} h(\eta)d\eta
\]

Since \( E(\delta) = E(\eta) = 0 \), \( \int_{\eta}^{\delta} \frac{1}{2}(\delta - \eta) \left[ f(P) \cdot \left( \frac{\partial V_M}{\partial i_B} - \frac{\partial V_I}{\partial i_B} \right) + f(P) \cdot \frac{\partial V_I}{\partial i_B} \right] g(\delta)d\delta = 0 \). So, within the \( \int_{\eta}^{\delta} \) bracket, only the last two terms remain.

After a slight rearrangement, we get

\[
\int_{\eta}^{\delta} \left\{ \frac{1}{2} \left( \frac{\partial V_I}{\partial i_B} - \frac{\partial V_M}{\partial i_B} \right) \left( \int_{\eta}^{\delta} \{ F(P) - F(P - (\delta - \eta)) \} g(\delta)d\delta \right) - \int_{\eta}^{\delta} \{ F(P - (\delta - \eta)) - F(P) \} g(\delta)d\delta \right\} h(\eta)d\eta.
\]

After pulling out the common factors, we get

\[
\frac{1}{2} \left( \frac{\partial V_I}{\partial i_B} - \frac{\partial V_M}{\partial i_B} \right) \left\{ F(P) - \int_{\eta}^{\delta} \int_{\delta}^{\eta} F(P - (\delta - \eta)) g(\delta)d\delta h(\eta)d\eta \right\}
+ \frac{1}{2} \frac{\partial V_I}{\partial i_B} \left\{ \int_{\eta}^{\delta} \int_{\delta}^{\eta} F(P + (\delta - \eta)) g(\delta)d\delta h(\eta)d\eta - F(P) \right\}
\]

When we apply the Taylor's approximation to let \( F(P - (\delta - \eta)) \approx F(P) - (\delta - \eta) \cdot f(P) \) and \( F(P + (\delta - \eta)) \approx F(P) + (\delta - \eta) \cdot f(P) \), since \( E(\delta) = E(\eta) = 0 \), the above expression reduce to zero.
Therefore,

\[ \frac{\partial}{\partial i_B} \left( \int_{\eta}^{\delta} \left\{ \int_{\eta}^{\delta} \sigma_B(\delta > \eta) g(\delta) d\delta + \int_{\delta}^{\eta} \sigma_B(\delta < \eta) g(\delta) d\delta \right\} h(\eta) d\eta \right) = 0. \]

and

\[ \frac{\partial}{\partial i_B} E(\pi_B) = \frac{\partial}{\partial i_B} E(\pi_B|\delta = \eta = 0). \]

The proof is analogous for the upstream division.
References


Chapter 3

Allocating Settlement Authority under Contingent Fee Arrangement

3.1 Introduction

Two of the most widespread negative perceptions about lawyers are that they get paid too much and they manipulate hapless clients for their own sake. These inter-related claims relate specifically to situations where lawyers represent unsophisticated individual clients. As the typical story goes, while large institutional clients, through well-staffed in-house legal departments, closely monitor their outside lawyers' activities and become actively involved in legal decision making, unsophisticated individual clients have no choice but to rely on their lawyers’ “recommendations” and to pay whatever legal fees their lawyers demand. Especially when the attention is focused on contingent-fee cases, the evils are amplified. Critics offer many real world examples where contingent-fee lawyers earn so much with doing so little, while their clients walk away from the system poorly compensated and, in many cases, feeling bitter.

The well-voiced criticisms notwithstanding, the fact that so many individual clients remain putatively “captured” by their lawyers remain a puzzling issue. Why don’t they spend more time and energy to be better informed of their predicaments? Why not try to control their

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lawyers by demanding more detailed explanations over fees and strategies?\textsuperscript{4} Even if information acquisition is costly to exercise effective control, why not try to better align their lawyers' interests through contracts? In fact, contingent fee contracts are supposed to enhance such alignment and reduce the lawyer's under-effort problem.\textsuperscript{5} It seems quite surprising that, in reality, contingent contracts are viewed as a paramount example of attorney's self-serving and greed.

As an attempt to solve these puzzles, this paper addresses the issues of attorney control and compensation under contingent fee contracts. Broadly, the paper examines the bargaining problem between a plaintiff and a defendant, and asks how a plaintiff can enhance her bargaining power through a contract with a third party, her lawyer.\textsuperscript{6} More specifically, the paper analyzes whether it is always in the client's interest to take the helm of the litigation and whether the client would always want to reduce the legal fee as much as possible, i.e., eliminate the lawyer's rent. The main result of the paper is that the client may be able to improve her bargaining position and her settlement return by leaving the lawyer in charge of litigation. Sure enough, leaving him in charge will entail giving him a high compensation, possibly a lot higher than what his outside option dictates, but if the client is faced with a tough bargainer, \textit{e.g.}, an institutional defendant with many well-paid lawyers, ceding control to the lawyer may not be bad after all.

Our model starts with the premise that a plaintiff and her lawyer are in a principal-agent relationship, and the lawyer's level of effort is not observable to the plaintiff. Given the client's poor monitoring ability, when the lawyer has no stake in the client's claim, he will have little incentive to exert costly effort to advance the client's claim. If he is compensated based on the number of hours worked and reported, he will always engage in cost-padding.\textsuperscript{7} So, rather than paying by the hour, if the plaintiff assigns some share of the claim to the lawyer through a contingent fee contract, she can alleviate this moral hazard problem. Assuming that the lawyer's effort influences their probability of prevailing at trial, he will work harder, since more effort will bring him a higher return.

In addition to reducing the under-effort problem, the contingent fee contract adds another dimension to the plaintiff's problem. The contract can also be used as a bargaining tool

\textsuperscript{4} See Kritzer, supra note 2, at 60-67 (citing how a majority of individual clients do not even discuss about allocation of responsibility and leave their lawyers in charge over almost every major decision).

\textsuperscript{5} See Kritzer, supra note 2, at 88, 116 (reporting strong positive relationship between stake and hours worked). For theoretical discussions, see J. Dana and K. Spier, Expertise and Contingent Fees: The Role of Asymmetric Information in Attorney Compensation, 9 J.L. ECON. & Org. 349 (1993); Bruce Hay, Effort, Information, Settlement, Trial, 24 J. LEGAL STUD. 29 (1995); Bruce Hay, Contingent Fees and Agency Costs, 25 J. LEGAL STUD. 503 (1996); and Schneyer, supra note 2, at 377. Reducing the under-effort problem is not the only rationale in favor of contingent fees. The most frequently proffered justification is access to the legal system for the financially constrained. See generally Brickman, supra note 3.

\textsuperscript{6} See J. Green, The Strategic Use of Contracts with Third Parties, in STRATEGY AND CHOICE (R. Zeckhauser ed. 1991) for a theoretical analysis on third party contracts.

\textsuperscript{7} See, \textit{e.g.}, Lisa Lerman, Lying to Clients, 138 U. PA. L. REV. 659, 705-20 (1990) (enumerating numerous tactics used by law firms to overcharge their clients); Lisa Lerman, Scenes from a Law Firm, 50 RUTGERS L. REV. 2153 (1998) (recounting an experience of an associate at a law firm being pressured to overcharge his clients); Stephen Budiansky, supra note 1, at 55 (citing that more than 60 percent of lawyers have personal knowledge of bill padding).
against the defendant during settlement negotiations. As the lawyer is expected to put more effort into the case when the case proceeds to trial, the defendant’s expected loss from trial is larger. Rather than taking chances with a hard-working plaintiff’s lawyer, the defendant would be willing to make a higher settlement offer than before. Furthermore, if the plaintiff can selectively reduce the lawyer’s share of settlement, she can make her settlement return higher than her expected return from trial. By giving the lawyer a high percentage of trial return, she keeps her agent’s interests aligned and extracts a high settlement offer, and by reducing the lawyer’s settlement share, she grabs a bigger portion of it.

But, how much should the client reduce the lawyer’s settlement share? Should she always eliminate the lawyer’s rent? The answer depends on whether the client violates the lawyer in charge of settlement decisions or negotiates the settlement terms herself. If she remains in charge, because the lawyer’s help is not (directly) needed in reaching an agreement, she does not need to pay the lawyer much more than what his outside option dictates. She can always minimize her legal bills. On the other hand, the settlement amount is affected by her reservation value. When she reduces the lawyer’s settlement fee, her gain from settlement increases dollar for dollar. So, even if the settlement offer decreases by a little, she would still be willing to accept the offer, since she already has made a substantial cost saving from her lawyer. Paying her lawyer less in settlement thus weakens her position against the defendant. Especially when the defendant is a tough bargainer, most of her fee saving will accrue to the defendant through a lower settlement offer, leaving her only marginally better off through settlement than proceeding to trial.

When she leaves the lawyer in charge of settlement negotiations, the story is reversed. Foremost, she has to pay the lawyer more, at least as much as he expects to get from trial. Otherwise, he will recommend they proceed to trial, and the settlement opportunity will be lost to the client. However, the lawyer will extract a better settlement offer from the defendant. The settlement amount now depends on the lawyer’s reservation value, and when she reduces his settlement share, the offer needs to be larger to make him accept the offer, since he is getting a small fraction of settlement while his expected return from trial remains unchanged. His reservation value increases as his share of settlement decreases, and she can decrease his settlement share until his reservation value equals the maximum amount the defendant is willing to pay. At optimum, the lawyer will always extract the highest settlement offer possible from the defendant, and the plaintiff takes maximal advantage of the settlement opportunity. The lawyer will also walk away with a sizable rent from settlement. Thus, delegating settlement authority to the lawyer and granting him some, possibly large, rent may be in the client’s interest.

In the following section, we present a simple, numerical example that captures the main ideas with minimal quantitative analysis. In section 3, we briefly review the existing regulations over

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4In this case, the lawyer has no authority to enter into a settlement agreement on behalf of the plaintiff and merely reports back and forth whatever offers and counter-offers the defendant and the plaintiff make to each other.

5Now, the lawyer is authorized by the plaintiff not only to negotiate but also to enter into a legally binding settlement agreement with the defendant. On the issues of whether and how a client can delegate the settlement authority to a lawyer, see infra section 3.2.
contingent fees and the delegation of settlement authority, particularly with respect to multi-tier contingent fees and express delegation of settlement authority. Then, we reflect our results from the numerical example onto a recent proposal, known as the “early offer” proposal, that is specifically geared toward reducing lawyers’ contingent fees in settlements. We highlight both the similarities and differences, and explore possible avenues of improvement on the proposal. In sections 4 through 6, the core of the paper, we present a full mathematical model and subject our ideas to a more rigorous analysis. Section 7 concludes with some ideas for future improvement.

### 3.2 Numerical Example

Suppose a plaintiff retains a lawyer, with a secure outside option of $100 (\(\bar{U}\)), to litigate against a single defendant. The expected size of the judgment from trial, if the plaintiff wins, is $1,000 (\(W\)), which is known by both sides. For the sake of simplicity, assume that all participants are risk neutral. The probability of prevailing at trial depends on the plaintiff’s lawyer’s expended amount of effort in trial. As the lawyer receives a bigger fraction of trial outcome, his effort and the probability of winning increase. Suppose that when he is guaranteed 30% (\(\alpha\)) of damages award from trial, the probability of winning at trial is 0.5 (\(F\)). Contingent fee of 40% increases the probability to 0.7, and 50% increases the probability to 0.8.\(^{10}\) Respective effort costs (\(\phi\)), in monetary terms, are $50, $100, and $150. These parameters are summarized in table 1. The last two columns represents the lawyer’s and the client’s expected return from trial, respectively.

<table>
<thead>
<tr>
<th>(\alpha)</th>
<th>(P)</th>
<th>(PW)</th>
<th>(\phi)</th>
<th>(\alpha PW - \phi)</th>
<th>((1 - \alpha) PW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>0.5</td>
<td>$500</td>
<td>$50</td>
<td>$100</td>
<td>$350</td>
</tr>
<tr>
<td>40%</td>
<td>0.7</td>
<td>$700</td>
<td>$100</td>
<td>$180</td>
<td>$420</td>
</tr>
<tr>
<td>50%</td>
<td>0.8</td>
<td>$800</td>
<td>$150</td>
<td>$250</td>
<td>$400</td>
</tr>
</tbody>
</table>

Table 1: Numerical Example

When there is no opportunity to settle the case, the client would set \(\alpha = 40\%), and receive an expected return of $420 from trial. The lawyer, on the other hand, will get an expected return of $180, $80 higher than his outside option of $100. Even if the client can settle the case, when she is constrained to use a single contingent fee, the settlement amount will be equal to the expected return from trial. The defendant expects to lose \(PW\) while the plaintiff-lawyer expect to gain \(PW\), so that there is no room for negotiation. The case will settle at \(PW\), netting the client \((1 - \alpha) PW\) and the lawyer \(\alpha PW\).\(^{11}\) As before, client will set \(\alpha = 40\%). Thus, although setting a higher contingent fee increases the plaintiff’s bargaining power against the defendant,

\(^{10}\) See Krizter, supra note 2, at 150 (reporting median probability of win of 0.56 in state tort, contingent fee cases).

\(^{11}\) When the case settles, because the lawyer has not exerted any effort, his compensation is higher by the amount of effort cost: \(\phi\). Thus, under a single contingent fee, while the client is indifferent between settlement and trial, the lawyer strictly prefers to settle. We will see shortly that these preferences will be reversed when the client delegates the settlement authority to the lawyer and uses optimal two-tier contingent fees. See infra note 14.
when she is constrained to use a single fee, the settlement opportunity provides no additional value to her.

Now, suppose the client can selectively adjust the lawyer's settlement share ($\beta$). First, suppose the client negotiates the settlement herself. Depending on $\alpha$, her expected return from trial is equal to $(1 - \alpha)PW$. If we let $S$ denote the final settlement amount, in order for her to accept a settlement offer, her return from settlement needs to be higher than what she expects from trial: $(1 - \beta)S \geq (1 - \alpha)PW$, or $S \geq \frac{(1 - \alpha)}{(1 - \beta)}PW$. From the defendant's point of view, he must pay less than what he expects to lose from trial: $S \leq PW$. The final settlement will be somewhere in between the plaintiff's and the defendant's reservation values, $\frac{(1 - \alpha)}{(1 - \beta)}PW$ and $PW$, and will depend on respective bargaining powers.

Suppose, for simplicity, that the defendant is a much tougher bargainer, so that the settlement amount will be close to the plaintiff's reservation value of $\frac{(1 - \alpha)}{(1 - \beta)}PW$. Since the plaintiff receives $(1 - \beta)$ fraction of settlement, her return from settlement is approximately equal to $(1 - \alpha)PW$, her expected return from trial. To maximize her return, she needs to set $\alpha = 40\%$. To minimize her legal fees in settlement, she sets $\beta = \frac{5}{8}$.

Then, the client gets $420, the lawyer gets $100, and the defendant pays $520 through settlement. Even though she pays her lawyer no more than his outside option, the settlement opportunity does not provide any additional benefit for the client. The defendant, on the other hand, leaves the negotiating table, well satisfied. Had the litigation proceeded to trial, he would have lost, on average, $700. Through settlement, he is $180 better off.

Now, let the lawyer negotiate with the defendant and make de facto settlement decisions. Similar to the last case, the settlement needs to leave the lawyer better off than going to trial: $\beta S \geq \alpha PW - \phi$ or $S \geq \frac{\alpha PW - \phi}{\beta}$. Suppose the plaintiff sets $\alpha = 50\%$. Then, the plaintiff-lawyer pair's expected return from trial is $800$, of which the lawyer expects to net $250$. Therefore, the lawyer's settlement compensation must be at least as high as $250$. Suppose the plaintiff sets $\beta = \frac{5}{16}$. Then, the lawyer's reservation value ($\frac{\alpha PW - \phi}{\beta}$) is equal to the expected return from trial ($PW$) of $800$, so they will settle at $800$. Of that, the client gets $\frac{11}{18}$ fraction, netting her $550. The lawyer receives $250, leaving him $150 of surplus over his outside option of $100. Compared to the previous case, not only has the client vastly improved her return but the lawyer also leaves the negotiating table well compensated. In fact, the lawyer is better off in the current case than when the client was constrained to use single contingent fee! On

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12 Even though the client's return seems independent of $\beta$ in the current example, this is peculiar only to the case when the defendant has all the bargaining power. We will prove in the central section that even as the defendant's bargaining power approaches one, the plaintiff will always minimize the lawyer's fee.

13 For the feasibility and method of formal delegation of settlement authority, see infra section 3.2. Even if the client does not formally (expressly or implicitly) grant settlement authority to the lawyer, the lawyer obtains de facto authority when he has better information about the case than the client. See infra note 67 for a discussion on information asymmetry and real authority delegation. See also P. Aghion and J. Tirole, Formal and Real Authority in Organizations, 105 J. Pol. Econ. 1 (1997) (distinguishing between formal and real authority based on information); J. Dana and K. Spier, Expertise and Contingent Fees: The Role of Asymmetric Information in Attorney Compensation, 9 J. L. Econ. & Org. 349 (1993) (analyzing how lawyer's superior information dictates decision to proceed to trial or drop the claim).
the other hand, the defendant walks away with no rent from settlement.\textsuperscript{14} The results are summarized in table 2.

<table>
<thead>
<tr>
<th>{\alpha, \beta}</th>
<th>Plaintiff in Charge</th>
<th>Lawyer in Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plaintiff</td>
<td>$420</td>
<td>$550</td>
</tr>
<tr>
<td>Lawyer</td>
<td>$100</td>
<td>$250</td>
</tr>
<tr>
<td>Settlement Amount</td>
<td>$520</td>
<td>$800</td>
</tr>
</tbody>
</table>

Table 2: Summary of Two Examples

The reason for this disparity can be best understood by examining the effect of changing the lawyer’s settlement share on the plaintiff-lawyer pair’s reservation price. When the client negotiates the settlement, reducing the lawyer’s settlement share weakens her bargaining power. Because a decrease in legal fees translates into cost saving for the client dollar-for-dollar, even if the settlement offer becomes a little lower, she would still be willing to accept the offer. Reduction in the lawyer’s settlement share decreases the bargainer’s, the client’s, reservation price. To the contrary, when she leaves the lawyer in charge, the opposite happens. When the lawyer receives a smaller fraction of settlement, to leave him as satisfied as before, the settlement offer needs to be larger.\textsuperscript{15} By reducing the lawyer’s settlement fee, the client has increased the reservation price of the bargainer, the lawyer, and elicits a higher offer from the defendant.

3.3 Legal Constraints on Contingent Fees and Settlement Authority

The attorney-client relationship is governed not only under numerous bodies of law but also by different regulatory entities.\textsuperscript{16} First, an agreement entered into between a client and a lawyer has to conform to the mild strictures of the contract law. Second, the agency law treats the lawyer as an agent of the client and imposes fiduciary obligations on the lawyer to the client. Third, the lawyer, as an officer of the court, owes duties to the court with regard to the legal process and is subject to the supervision of the court. Fourth, the bar association, as a quasi-regulatory body, can impose restrictions on lawyer conduct through self-imposed rules and perform quasi-judicial function through disciplinary hearings. Finally, state and federal legislatures can promulgate statutes and regulations that directly delineate the scope

\textsuperscript{14}Note that under delegation, in contrast to the single-fee case, because potential legal fees are too high had they proceeded to trial, the client strictly prefers to settle the case. On the other hand, the lawyer is indifferent between settling the case and proceeding to trial. In a sense, the client wants to settle to save on her legal fees, but this is endogenously created rather than assumed by setting up exogenous fee structure.

\textsuperscript{15}These two points can be most visible when stated mathematically. When the client retains the authority, \( \frac{\partial}{\partial \beta} R = \frac{\partial}{\partial \beta} (1 - \beta) PW < 0 \), but when she delegates the authority, \( \frac{\partial}{\partial \beta} R = \frac{\partial}{\partial \beta} (\alpha PW - \beta) > 0 \), where \( R \) denotes the plaintiff-lawyer pair’s reservation value.

of the attorney-client relationship. Such diverse sources of authority create a complex web of regulations over the attorney-client relationship, rendering some of the issues difficult to analyze and, in some cases, not subject to clear legal resolution.

Although the literature examining the different aspects of the attorney-client relationship is large and growing, we are concerned primarily with two facets of the relationship: contingent fee and the delegation of settlement authority. Due partly to widespread public concern over contingent fees, both the judiciary and the state legislatures have been active in controlling the use and size of contingent fees. Various state legislatures have promulgated explicit rules and statutes that impose limits on contingent fees, and the courts have also narrowed their use with the aid of the Model Rules promulgated by the American Bar Association. On the issue of delegation of settlement authority, while the state legislatures have been virtually silent, the courts have applied the doctrine of actual and apparent authority in determining whether a lawyer had actual or apparent authority to settle a client's matter. We first briefly review the two governing bodies, particularly with respect to two-tier contingent fees and express delegation of settlement authority, and then discuss the "early-offer" proposal that puts further restraints on contingent fees.

3.3.1 Regulation of Contingent Fees and the Use of Multi-tier Fees

Contingent fees were initially banned in the United States as a form of champerty under the English common law, but by 1965, with the state of Maine lifting its prohibition, they were universally accepted. The somewhat grudging acceptance, however, was accompanied by many restrictions. On legal fees generally, the Model Rules of Professional Conduct require that the lawyer's fees must be "reasonable," and lists eight factors in determining the reasonableness. Based partly on such reasonableness standard, various courts, through case law, have adopted an implicit cap of fifty percent on all contingent fees, and prohibited the use of contingent fees in certain areas, such as in criminal and divorce cases. State and federal legislatures have also adopted rules that impose, fixed or sliding-scale, caps on contingent fees on either specific types of cases or more broadly.

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17 See, e.g., Brickman, supra note 3, at 55-57 (noting ambiguity over whether arm's length or fiduciary standards should govern fee contracts).
18 See GEOFFREY HAZARD, JR. ET AL., THE LAW AND ETHICS OF LAWYERING 510-11 (3d ed. 1999) (some countries still banning the use of contingent fees, while Great Britain recently allowing their usage only in personal injury cases); Brickman, supra note 3, at 35-37. See generally Peter Karsten, Enabling the Poor to Have Their Day in Court: the Sanctioning of Contingency Fee Contracts, a History to 1940, 47 DEPAUL L. REV. 231 (1998).
19 MODEL RULES OF PROFESSIONAL CONDUCT Rules 1.5(a), (d). See also, MODEL CODE OF PROFESSIONAL RESPONSIBILITY DR 2-106 (barring "clearly excessive" fees).
20 See Brickman, supra note 3, at 30 n.1, 114 n.348 (citing both cases that deem 50 percent or more unlawful and a few cases that do allow fees in excess of 50 percent). See infra note 68 (cases that either allow or disallow contingent fee over 50 percent).
21 See HAZARD, supra note 18, at 518-21; Angela Wennihan, Let's Put the Contingency Back in the Contingency Fee, 49 SMU L. REV. 1639, 1846-48 (1996). See also, Brickman, supra note 3, at 40.
22 See, e.g., STEPHEN GILLES AND ROY SIMON, REGULATION OF LAWYERS, STATUTES AND STANDARDS 53-60 (1999) (restrictions on contingent fees imposed by state legislatures); 28 U.S.C. § 2678 (Federal Tort Claims Act) (restrictions on contingent fees for cases brought against the federal government under the Act); 31 U.S.C. § 3730(d)(1) (False Claims Act) (restricted to 15% to 25% range).
Two most direct regulations on contingent fees and allowance of multi-tier fees are given
by the American Bar Association and the state and federal legislatures. First, the Model
Rules of Professional Conduct specifically authorize the use of contingent fees, but it requires
that the contingent fee agreement be in writing. According to Rule 1.5(c), such written
agreement must include "the method by which the fee is to be determined, including the
percentage or percentages that shall accrue to the lawyer in the event of settlement, trial
or appeal, litigation" (emphasis added). The Rule also requires the lawyer to provide a
written statement, upon completion of the matter, concerning the outcome and how the lawyer
calculated the contingent fee. Thus, while Rule 1.5(c) puts procedural restrictions on the use
and collection of contingent fees, it explicitly contemplates multi-tier fee structure.

Some states have also implicitly recognized multi-tier fee structure within the legislative
regulations of contingent fees. The state of Florida, for example, puts sliding-scale caps on
maximum contingent fees that depends not only the amount of recovery but also on the stage
where the matter has concluded. For example, contingent fee on recovery of one million dollars
or less made before a defendant files an answer is capped at 33 and 1/3 percent while the cap
increases to 40 percent if the recovery is made after a defendant files an answer. If the matter
concludes after an appeal, the cap increases further by 5 percent. In the case of New Jersey,
when the client is a "minor or incompetent," contingent fee on settlement cannot exceed 25
percent regardless of the amount recovered, while the cap increases to 33 and 1/3 percent on
the first five hundred thousand dollars if the recovery is made other than through settlement.
On the federal side, the Federal Tort Claims Act allows contingent fees not greater than 25
percent of any recovery if the case has been filed and 20 percent of recovery before filing.

In practice, contingent fees are almost exclusively used by individual tort plaintiffs, and
the use of multi-tier fee structure is supposedly common. Professor Crystal claims that "a
common contingent fee in a personal injury action is 25 percent if the matter is settled before
trial, 33 percent if the matter is settled after a jury is selected, and 50 percent if the matter is
concluded after appeal." Notwithstanding such general statement, the most direct evidence
comes from a survey conducted by Professor Kritzer. In 1995, he collected survey data on

23 MODEL RULES OF PROFESSIONAL CONDUCT Rule 1.5(a)(8) (fee can be either "fixed or contingent").
24 Id. Rule 1.5(c).
25 Id.
26 Id.
27 F.L.A. BAR REG. R. 4-1.5(f)(4)(B)(a-d) (2000). A fee arrangement that exceeds such caps is presumed to
be "clearly excessive." Id.
30 See KRITZER, supra note 2, at 145-50. In fact, in Wanschel Law Firm, P.C. v. Clabaugh, the Iowa Supreme
Court held that a contingent fee charged to a defendant was illegal, as it was against public policy. 291 N.W.2d
331 (Iowa 1980). In contrast, the ABA Committee on Ethics and Professional Responsibility, in Formal Opinion
93-737, ruled that defense contingent fee contracts are not per se unethical.
31 NATHAN CRYSTAL, PROFESSIONAL RESPONSIBILITY 224 (2d ed. 2000). See also Lester Brickman, ABA
that contingent fee of 33% if case settles without suit, 40% if suit is filed, and 50% if case goes to trial was
"standard."); Wennihan, supra note 21, at 1643 (reporting 28% if the matter settles, 33 or 30% if tried, and 40
to 50% if goes to appeal).
over nine hundred contingent fee cases in Wisconsin and categorized them according to their fee types.\textsuperscript{32} He reports that in about 58 percent of the cases, single-contingent fee rate, mostly one-third, was used. In about 39 percent of the cases, variable contingent fee agreements were signed, and the majority of them consisted of multi-tier contingent fees that depended on the stage of litigation. The range of fees was quite wide: in case the matter ended without trial, the fee was between 20 and 43 percent, and if the matter proceeded to trial, the rate increased to between 25 and 50 percents.\textsuperscript{33}

Although the use of contingent fees is confined primarily to individual plaintiffs,\textsuperscript{34} multi-tier fee arrangements are not uncommon among supposedly unsophisticated individual plaintiffs, and the flexibility of fee arrangement seems to indicate some degree of attorney-client negotiation on fee structure.\textsuperscript{35} In light of such evidence, this article endorses a wider adoption of two-tier contingent fees and more flexible exercise of such arrangement. As demonstrated in the numerical example, lower settlement percentage not only reduces the moral hazard (under-effort) problem of the lawyer, but also increases the plaintiff's bargaining power. Especially given the fact that most of the litigants using contingent fees are individual plaintiffs litigating against institutional defendants, who face less serious monitoring problem and with relatively stronger bargaining position,\textsuperscript{36} the advantages of two-tier fees can be much more dramatic.

3.3.2 Constraints on Delegation of Settlement Authority

Under the agency law, once a client retains a lawyer, the lawyer becomes an agent of the client and owes the client fiduciary obligations.\textsuperscript{37} At the same time, the lawyer can also act on behalf of the client toward third parties, including the counter party in litigation. For example, the lawyer can enter into various agreements with third parties and contractually bind the client, as long as the lawyer has the proper authority to do so. According to the Restatement (Second) of Agency, such authority can be either actual or apparent.\textsuperscript{38} Actual authority is based either on express grant from the client or reasonable inference from the actions of the client to the lawyer. On the other hand, apparent authority can be based, not on how the client acts towards her lawyer, but on how she acts toward a third party with regard to the lawyer's authority.

With respect to settlement authority, although the Model Rules do not provide a clear

\textsuperscript{33}Id. at 286-87.
\textsuperscript{34}See Hazard, supra note 18, at 510 (while contingent fee is used in "most personal injury cases," it is also used in tax refund, condemnation proceeding, will, and debt collection cases).
\textsuperscript{35}Kritzer, supra note 32, at 268 (stating that "some lawyers were very open to negotiating individualized retainers agreements").
\textsuperscript{36}See Robert Mnookin, \textit{Commentary: Negotiation, Settlement and the Contingent Fee}, 47 \textit{DePaul L. Rev.} 363, 364-65 (noting that most defendants are repeat institutional players while plaintiffs are single-shot individuals).
\textsuperscript{37}See Restatement (Second) of Agency § 1 (1958); Restatement (Third) of The Law Governing Lawyers § 73 (1998) (stating duty of care to the client).
\textsuperscript{38}Restatement (Second) of Agency § 26 (1958). According to the Restatement (Third) of Law Governing Lawyers, lawyer's actual authority can be derived from either express or implied authorization, lawyer's inherent powers, or from the client's ex post ratification. § 38 (1998).
most authorities are consistent in allowing a client to delegate authority to a lawyer to settle a civil claim. At the same time, the scope of delegation is not unrestricted. Foremost, according to the Restatement (Third) of the Law Governing Lawyers, the decision “whether and on what terms to settle a [civil] claim” is reserved to the client unless it is “validly authorized to the lawyer,” and regardless of any agreement with the lawyer, such authorization must be revocable. Comment c goes on to state that such authorization must be “expressed by the client or fairly implied from the dealings of lawyer and client.” Thus, the Restatement imposes that while a client can delegate settlement authority, such delegation must be actual (express or implied) and revocable.

Similarly, courts generally hold that some type of proper authorization from the client must be made for an attorney to enter into a binding settlement agreement. While a minority of jurisdictions presume a lawyer’s authority to settle either from the agency relationship or from the power to negotiate on behalf of the client, the majority of the courts maintain that retention itself does not grant the lawyer the authority to settle. In addition to retention, either actual or apparent authorization must be given, but so long as such authorization is validly made or reasonably inferred, the courts will uphold a settlement. However, while the case law seems to unequivocally permit express delegation of settlement authority, some pockets of discord remain.

Foremost, courts disagree over how specific an authorization must be. While one federal appeals court held it permissible for a client to delegate her lawyer “general authority to settle cases,” another appeals court held that express authority “must be the result of explicit instructions regarding settlement.” In a similar spirit, while some courts allow general

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39 Model Rule only states that the “lawyer shall abide by a client’s decision whether to accept an offer of settlement of a matter.” 1.2(a). On the other hand, according to the Model Code of Professional Responsibility, the authority to decide whether to settle or not is “exclusively that of the client.” EC 7-7.

40 Such delegation is not allowed in criminal cases over a plea bargain offer, however. See HAZARD, supra note 18, at 484.

41 Restatement (Third) of The Law Governing Lawyers § 33.1 (1998). The Restatement also delineates the authority that is inherently reserved to the lawyer. Id. § 34 (1998).

42 Id. § 33.3.

43 Id. § 33 cmt. c.

44 See Koval v. Simon Telelect, Inc., 693 N.E.2d 1299, 1306 (Ind. 1998) (attorney’s inherent agency power to settle “results from the agency relation itself”); Brewer v. National R.R. Passenger Corp., 649 N.E.2d 1331, 1334 (Ill. 1995) (stating that while “an attorney’s authority to settle must be expressly conferred, the existence of the attorney of record’s authority to settle in open court is presumed unless rebutted by affirmative evidence that authority is lacking”); St. Amand v. Marriott Hotel, Inc., 430 F.Supp. 488, 490 (E.D.La 1977) (lawyer’s authority to settle presumed from authority to negotiate); Surety Insurance Co. of California v. Williams, 729 F.2d 581 (8th Cir. 1984) (strong presumption of valid authority).

45 See, e.g., Malave v. Carney Hospital, 170 F.3d 217, 221 (1st Cir. 1999) (stating that under “federal common law, a general retainer, standing alone, does not permit an unauthorized attorney to settle claims on his client’s behalf”).


47 Smedley v. Temple Drilling Co., 782 F.2d 1357, 1360 (5th Cir. 1986).

48 Tiernan v. Devoe, 923 F.2d 1024, 1033 (3d Cir. 1991) (applying Pennsylvania agency law). Such disagree-
authority delegation in a retainer agreement, others deem it void. For example, the Georgia Supreme Court invalidated a retainer agreement that delegated "full" settlement authority to the lawyer.\textsuperscript{49} Citing a state statute that prohibits lawyers from discharging a client's claim without "special authority,"\textsuperscript{50} the Court held that a client cannot "relinquish the right to decide whether to accept a settlement offer" to her attorney.\textsuperscript{51} On the other hand, the Alabama Supreme Court held such full delegation of settlement authority through retainer agreement valid, stating that "a client can give express authority to his or her attorney to act, by signing an employment contract that gives this authority."\textsuperscript{52}

The legal uncertainty over the permissible scope of delegation notwithstanding, courts will unlikely challenge an express delegation of settlement authority that accompanies more specific instructions, such as the minimum or maximum amount of acceptable settlement offer. Furthermore, under the doctrine of apparent authority, when a plaintiff causes a defendant to reasonably believe that the plaintiff's lawyer has the authority to settle, the courts will bind a settlement agreement entered into by the lawyer even if the court deems the lawyer's authority improper.\textsuperscript{53} Thus, when a client both expressly delegates authority to the lawyer with some limitations and communicates to the counter party that she has done so, the court will unlikely deem a settlement agreement entered into by the lawyer null and void. For our mechanism to work properly, such communication between the plaintiff and both her lawyer and the defendant will suffice, making full or general delegation of authority unnecessary.

\subsection*{3.3.3 The Early Offer Proposal}

Contingent fee practice has received close attention from the legal community, and partly in response to occasional public outcry over the abuse of contingent fees, there have been numer-

\begin{itemize}
\item \textsuperscript{49}In re Lewis, 463 S.E.2d 862, 863 (Ga. 1995).
\item \textsuperscript{50}G.A. Code Ann. § 15-19-6 (2000).
\item \textsuperscript{51}In re Lewis, 463 S.E.2d 862, 862 (Ga. 1995). By using "relinquish," the court seems to be most concerned about the irrevocability of delegation. \textit{See also} Newton v. Super Markets Gen. Corp., No. CIV.A. 88-4165, 1989 WL 144104 at *4 (E.D. Pa. Nov. 29, 1989) (stating that although general authorization is allowed, "blanket authorization without appropriate follow-up" may be inconsistent with Rule 1.4 of the Model Rules).
\item \textsuperscript{52}Beverly v. Chandler, 564 So. 2d 922, 924 (Ala. 1990). \textit{See also} First Federal Savings & Loan Association of Walla Walla v. C.P.R. Construction Inc., 70 Ore. App. 296 (1984) (upholding similar retainer agreement); Hayes v. National Service Industries, 196 F.3d 1252, 1254 (11th Cir. 1999) (stating "attorney's authority is determined by the representation agreement between the client and the attorney [ ] and that authority may be considered plenary unless it is limited by the client and that limitation is communicated to opposing parties").
\item \textsuperscript{53}Parness and Bartlett, supra note 46, at 132-56. Such binding doctrine is based also on the notions of equity. As an example, the Kentucky Supreme Court stated that if "third parties [] dealing with [ ] attorneys would be substantially and adversely affected by unauthorized [ ] settlements, then the client employing the attorney should be bound." Clark v. Burden, 917 S.W.2d 574, 576 (Ky. 1996). \textit{See also} Capital Dredge and Dock Corp. v. Detroit, 800 F.2d 525, 530 (6th Cir. 1986) (client's remedy is to sue the attorney for malpractice); Restatement (Third) of Law Governing Lawyers § 39 (1998) (describing lawyer's presumed apparent authority before a tribunal).
\end{itemize}
ous proposals to limit and control their usage. A proposal that has received a heightened attention and is directly relevant to our framework is known as the “early-offer proposal.” The main objective of the proposal is to induce an early settlement offer from the defendant and to minimize the lawyer’s contingent fee in case the early offer is accepted by the plaintiff. Specifically, there is a sixty-day window after a claim has been made by the plaintiff, during which the defendant can make an offer to settle. If the offer is accepted by the plaintiff, the plaintiff lawyer’s contingent fee is limited to hourly rate charges and is capped at 10% of the first $100,000 and 5% of any higher amounts. If the offer is rejected, contingent fee can be charged only against the net in excess of the offer, while if no offer is made within the window, the proposal has no effect on contingent fees.

As the architects of the proposal emphasize, the primary objective of the proposal is to limit the plaintiff’s lawyer’s compensation in case the defendant’s liability is not seriously contested and the suit settles early. By reducing the lawyer’s fee when the lawyer does not bear any risk of non-payment and does not expend effort, they attempt to restore the quid pro quo nature of contingent fees and minimize the lawyer’s unjustified rent. They claim that because most clients are unaware of the exact strength of their claims, they depend heavily on their lawyers’ judgments and become easy targets of the agents’ rent-seeking. Imposing fee caps on early settlements, they argue, will minimize the amount of rent captured by the lawyers. Furthermore, presenting the sixty-day window will facilitate early settlements, by encouraging the defendants to avoid needlessly dragging their cases.

Notable similarities between our model and their framework exist. First, in our model,

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57 See Monograph, supra note 55, at 26-27. See also, Horowitz, supra note 55, at 176. They also argue that the lawyer should not collect any fees on a settlement offer made before retainment. Id. Although our model does not explicitly address this issue, since no effort is necessary and the parties are not bargaining in the “shadow” of contingent trial in case of a settlement before retainment, there will be no reason to compensate the lawyer.

58 See Monograph, supra note 55, at 23; Lester Brickman, ABA Regulation of Contingency Fees: Money Talks, Ethics Walks, 65 Fordham L. Rev. 247, 284 (1996); Herbert Kritzer, Contingent-Fee Lawyers and Their Clients: Settlement Expectations, Settlement Realities, and Issues of Control in the Lawyer-Client Relationship, 23 Law & Soc. Inquiry 795, 800 (1998) (arguing that important service provided by lawyer is valuing the claim). However, if the client is poorly informed of the strength of her case, it seems doubtful that she will be able to judiciously exercise her option to accept an early settlement offer without conferring with her lawyer. When the client needs to rely on lawyer’s information over her decision, notwithstanding the settlement fee cap, the lawyer will be able to extract rent from the client by giving advice that benefits the lawyer, not the client. In fact, Professor Brickman does acknowledge that it is the lawyer, not the client, who controls the settlement process. Brickman, supra note 31, at 284.

59 See Monograph, supra note 55, at 29-30. In our model, we do not address the issue of timing of a settlement. When there is no information asymmetry between a plaintiff and a defendant, there is little reason to settle later than earlier. Thus, timing issue must incorporate some type of information asymmetry problem its resolution over time. For a work that considers this issue, see K. Spier, The Dynamics of Pretrial Negotiation, 59 Rev. of Econ. Stud. 93 (1992).
as presented in the previous section, there is not much information asymmetry between the defendant and the plaintiff. Both agree on the expected strength of the case (W) and the probability of plaintiff’s winning (P), determined by how hard the plaintiff’s lawyer will work in case the suit goes to trial. Absence of information asymmetry facilitates settlement, and in our model, both parties will always settle, unless the plaintiff irrationally pays her lawyer too little.\textsuperscript{60} Second, in case of an early settlement, lawyer does not expend any effort. Although this is a simplification, our model assumes that the lawyer exerts less effort when the case settles, and such low level of effort creates a scope for fee reduction.

More importantly, both our model and the proposal advocate the use of two-tier contingent fees. In our model, if the client negotiates a settlement herself, the absence of lawyer effort in settlement provides a good opportunity for her to reduce his fees, and she will always take advantage of the opportunity. When she leaves the lawyer in charge, settlement fee reduction provides a double-bang-for-the-buck result for the client: Not only does it save the client’s legal cost, it also increases her and her lawyer’s bargaining power against the defendant. To the contrary, when the client cannot selectively adjust the settlement fee, as we saw in the numerical example, the lawyer will collect a “windfall,” and the settlement opportunity provides no additional value to the client.

Settlement fee reduction cannot be the sole motivation, however. When the lawyer is in control of settlement, however little effort he expends in case of an early settlement, the client may still want to leave him with a sizable rent. Given the lawyer’s expected return from trial, if his compensation in settlement is too low, he would proceed to trial even if trial makes little sense for the client. Especially if we assume that the client lacks information that the lawyer has, as assumed by the authors of the proposal, the client will be prone to adopt the lawyer’s recommendations, ceding effective control to the lawyer.\textsuperscript{61} Since the lawyer’s “recommendation” to the client as to whether she should accept the (early) settlement offer or not will be determinative, unless he is better compensated through settlement than through trial, he would be quite hesitant to tell the client to take the defendant’s offer.

Let us illustrate this based on the previous example. In the case of delegation, the settlement contingent fee was set at 5/16 (about 32%), substantially higher than 10% advocated by the proposal, and the lawyer walked away with $250 of settlement fee, two and a half times his outside option of $100. If the client is constrained to cap the settlement fee at 10%, even if she grants 30% of trial return to her lawyer, the lawyer’s reservation value is $1,000, still $500 higher than what the defendant is willing to pay.\textsuperscript{62} Thus, there is no room for settlement, and the lawyer will recommend they proceed to trial. To avoid this, the lawyer’s trial share has to be even lower, yielding the final settlement amount substantially lower than $500. Even though the client receives 90% of the settlement, since the absolute amount is a lot smaller, the

\textsuperscript{60}Absence of information asymmetry also precludes the possibility of frivolous suits. See, e.g., Lucian Bebchuk, Litigation and Settlement under Imperfect Information, 15 RAND J. ECON 404 (1984); and Lucian Bebchuk, Suing Solely to Extract a Settlement Offer, 17 J. LEGAL STUD. 437 (1988).

\textsuperscript{61}See infra note 67 for how our model can be adjusted to reflect this information asymmetry problem.

\textsuperscript{62}Recall that the lawyer’s reservation value was equal to \(\alpha PW - \phi\). From the numerical example, when \(\alpha = 30\%\), \(PW = $500\) and \(\alpha PW - \phi = $100\), rendering the reservation value of $1000.
client is worse off than in the case without the settlement fee cap. In fact, she may be worse off than being constrained to use single contingent fee.\textsuperscript{63} Of course, if the plaintiff was most likely to prevail in trial without the lawyer's help, encouraging the lawyer to exert more effort through contingent fee would be unnecessary.\textsuperscript{64} The client would not want to set the lawyer's trial share very high and would cap his settlement share below 10%.\textsuperscript{65} However, if the lawyer's effort does matter in trial, as is implicitly assumed in our example, contingent fee contracts play an important role in providing more incentive for the lawyer. The client may want to grant a high share of damages award from trial and higher than 10% of settlement to the lawyer. The proposal could backfire in such situations, and the plaintiff may be worse off than committing a single high share to the lawyer. Because the proposal fails to consider the impact of contingent fees on the bargaining power for the plaintiff, even though it may succeed in reducing the lawyer's rent, it may handicap the plaintiff's ability to use the contingent fee as a bargaining tool against the defendant.

For a more complete approach to tackle the lawyer's excessive fees without diluting the plaintiff's bargaining power, there needs to be some proportionality between $\alpha$ and $\beta$. The basic guideline is that the lawyer's compensation in case of (early) settlement cannot be lower than what he expects to receive had they proceeded to trial, especially when we assume that the lawyer, not the client, is in control of litigation. Case-by-case determination of appropriate shares will produce the best result for the plaintiff. Based on an estimate of lawyer's net return in trial, $\beta$ can be appropriately lowered to match his expected return. If we were forced to set limits on $\alpha$ and $\beta$, some type of proportionate limits, based possibly on empirical approximations, will be more appropriate. For example, we could set the limit to be such that $\beta$ cannot be more than one-third or one-fourth of $\alpha$. The bottom line is that setting limits on $\beta$ without regard to how $\alpha$ is set could produce unexpected distortions and potentially cause more harm to the plaintiff than good.

\textsuperscript{63}When the settlement is less than $500, the client receives, at most, $450. In the case where there was no fee cap and the client was constrained to use single contingent fee, she set $\alpha = 40\%$ and earned, on average, $420 from trial.

\textsuperscript{64}More broadly, the non-necessity of encouraging effort will be true when the return from trial is insensitive to effort. From our example, this can be represented as having one flat probability of success, e.g., 50%, irrespective of the level of contingent fee. However, note that this argument depends on the marginal change of return not on the absolute level. Whether a case is exceptionally strong or weak does not matter, although if the probability of winning is close to 100%, encouraging the lawyer's effort would be unnecessary.

\textsuperscript{65}This is so when the probability of winning $W$ from trial is close to one without the lawyer. Suppose it is one. Then, she can set $\alpha \approx 10\%$ and $\beta < 10\%$, as long as the lawyer's outside option is met.
3.4 The Model

A plaintiff, the principal, and her lawyer, the agent, are engaged in a litigation. There are three periods, \( t \in \{0, 1, 2\} \), where the first period (\( t = 1 \)) presents a settlement opportunity, while the trial occurs in the second period (\( t = 2 \)), contingent on there being no settlement in the first period. The size of the expected damages award from trial, if they win, is \( W \), while the probability of winning is \( p(e) \), where \( e \in [0, \infty) \) denotes the level of lawyer's trial effort, such that \( p'(e) > 0 \), and \( p''(e) < 0 \). For the sake of an interior solution, assume that \( p'(0) > 0 \) and \( \lim_{e \to \infty} p(e) = 1 \). Lawyer's trial effort is not observable to the client and its cost to the lawyer is \( \phi(e) \), where \( \phi'(e) > 0 \), \( \lim_{e \to 0} \phi'(e) = 0 \) and \( \phi''(e) > 0 \).

Before the litigation starts, at \( t = 0 \), the principal decides whether to delegate the settlement authority to the lawyer, i.e., whether she will actively participate in the settlement or leave the lawyer in charge. In conjunction, she offers a contract \( \{\alpha, \beta\} \in [0, 1] \times [0, 1] \), where \( \alpha \) denotes the fraction of the damages award from trial given to the lawyer, while \( \beta \) represents the fraction of the settlement to the lawyer. Thus, the (implicit) contract consists of a triple, \( \{I, \alpha, \beta\} \), where \( I \in \{P, A\} \) indicates the person with the de facto authority over settlement. We assume that \( W, p(\cdot), \phi(\cdot), \) and \( \{I, \alpha, \beta\} \) are all common knowledge, so that the only unobservable variable to both the plaintiff and the defendant is the level of effort of the lawyer.

In the second period, given that they are in trial, lawyer will choose \( e \) to maximize \( \alpha p(e) W - \phi(e) \), which yields the subgame perfect equilibrium level of \( \alpha p'(e^*) W = \phi'(e^*) \). This implicitly defines the effort function \( e(\alpha) \), such that \( e'(\alpha) > 0 \) and \( e''(\alpha) < 0 \), since \( p''(e) < 0 \) and \( \phi''(e) > 0 \). In the first period, they engage in settlement negotiations, and for convenience, assume that the negotiations will not require any effort and that the defending party does not face any agency.

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\(^{66}W \) denotes the expected return from trial conditional on winning: \( W = E(w|\text{plaintiff wins}) \), where \( w \) represents realized verdict. Thus, we assume that the expected return from trial is multiplicatively separable: \( \text{probability of winning} \cdot E(w|\text{plaintiff wins}) \). Since the court first determines liability and then calculates the damages award, this simplification makes the subsequent analysis much more tractable without too much loss of realism.

\(^{67}\)If she is at an informational disadvantage compared to her lawyer regarding the strengths and the merits of the case, she will accept the lawyer's recommendations. See e.g., J. Dana and K. Spier, Expertise and Contingent Fees: The Role of Asymmetric Information in Attorney Compensation, 9 J.L. Econ & Org. 349 (1993). More specifically, suppose she is not entirely certain over the strength of her case, \( W \), and have only an idea of \( E(W) \) (This is an expectation of an expectation). The lawyer, on the other hand, knows the true value of \( W \) after some preliminary investigation. Then, the lawyer would be de facto in charge of the settlement negotiations, and the client will always accept the lawyer's recommendations. The contracting problem depends on whether they sign the contract before or after the lawyer finds out the strength of the case. If before, the client can still only offer a single set of \( \{\alpha, \beta\} \) that is independent of \( W \). After finding out the true value of \( W \), the lawyer can make three distinct recommendations: 1) drop the case 2) settle, or 3) proceed to trial. The client will accept the lawyer's recommendation given her lack of information, but the optimal contract will depend on the client's prior belief about the distribution of the strength of the case. If the contract is signed after preliminary investigation, the client could offer a menu of contracts \( \{\alpha(W), \beta(W)\} \), so as to make the lawyer reveal the true value of \( W \) by inducing him to choose the optimal contract.

\(^{68}\)Although setting \( \alpha \) or \( \beta \) above 50% is most likely not allowed in the common law, for the modeling purposes, we will discard this restriction for the moment. See e.g., Gruskay v. Simenauskas, 107 Conn. 350, 140 A. 724 (1928); In re Disarmament of Ostensoe, 196 Minn. 102, 264 N.W. 569 (1936). But see Sayble v. Feinman, 76 Cal. App. 3d 509, 142 Cal. Rptr. 895 (1978). All results can be easily reinterpreted with the fee cap.
problem.\textsuperscript{69} Given the expected trial outcome based on $\alpha$, the defendant’s expected loss is $p(e(\alpha))W$.

Let $S$ be the settlement amount. If the principal is in control of the negotiations, the lowest settlement amount she will accept is determined by $(1 - \beta)S \geq (1 - \alpha)p(e(\alpha))W$. On the other hand, if she leaves the lawyer in charge, he will recommend they settle the case only when $\beta S \geq \alpha p(e(\alpha))W - \phi(e(\alpha))$. Hence, the reservation settlement amount under the principal’s settlement authority is $\frac{\alpha p(e(\alpha))W - \phi(e(\alpha))}{1 - \beta} (\equiv R_P)$, while that under the agent’s authority is $\frac{\alpha p(e(\alpha))W - \phi(e(\alpha))}{\beta} (\equiv R_A)$. Meanwhile, the defendant’s reservation value is equal to what he expects to lose from trial: $R_D = p(e(\alpha))W$.

We assume that the litigants play Rubinstein type of bargaining game, and they alternate in making offers.\textsuperscript{70} The final settlement amount is determined by the respective levels of patience and reservation prices. When the proactive client is in charge,

$$S_P \equiv \gamma \cdot R_P + (1 - \gamma) \cdot R_D = \gamma \cdot \frac{(1 - \alpha)p(e(\alpha))W}{1 - \beta} + (1 - \gamma) \cdot p(e(\alpha))W$$

where $S_P$ denotes the final settlement amount, and $\gamma \in (0, 1)$ reflects her relative level of patience compared to the defendant’s.\textsuperscript{71} $\gamma$ close to zero means that she is very patient compared to the defendant, and as $\gamma$ gets larger, she becomes more impatient. Of the settlement amount, she gets $(1 - \beta)$ fraction. Similarly, if she leaves the lawyer in charge of settlement negotiations,

$$S_A \equiv \delta \cdot R_A + (1 - \delta) \cdot R_D = \delta \cdot \frac{\alpha p(e(\alpha))W - \phi(e(\alpha))}{\beta} + (1 - \delta) \cdot p(e(\alpha))W$$

where $\delta \in (0, 1)$ reflects the lawyer’s level of patience vis-à-vis the defendant’s. Again, the client receives $(1 - \beta)$ fraction of the settlement. Given no information asymmetry between the litigants, they will always settle in this model, as long as their settlement returns are, at least weakly, larger than their expected return from trial. We also implicitly assume that the parties prefer to settle whenever the settlement amount is equal to the expected trial outcome.

\textsuperscript{69} The assumption that the settlement does not require any effort from the lawyer is a simplification. If it did, the client simply needs to take his settlement effort cost into account when designing the contract. Furthermore, in similarity to the early offer proposal, if a settlement offer is made within sixty days of the initiation of the suit, then the assumption bears some realism. On the defendant’s side, we have in mind a large institutional defendant with a good ability to monitor its lawyer. A corporate defendant with an in-house counsel would approximate this assumption. Nevertheless, the assumption enables us to concentrate on the plaintiff’s issue better, so that, even if we incorporate the defendant’s agency problem, not much would be lost in analyzing the plaintiff’s contract.

\textsuperscript{70} See Ariel Rubinstein, Perfect Equilibrium in a Bargaining Model, 50 ECONOMETRICA 99 (1982).

\textsuperscript{71} More concretely, $\gamma$ depends on the periodic opportunity cost the plaintiff incurs as the litigation proceeds. As the litigation takes more attention and time away from the plaintiff, she loses her chance to engage in other productive activities. As this lost chance becomes more costly, she will be less willing to hold out longer and her bargaining position becomes weaker. Similar argument holds for $\delta$. The lawyer loses the opportunity to work on other cases as the litigation drags on.
3.4.1 Contracting Problem when Principal Retains the Authority

In the contracting period, the principal's problem is to choose \( \{\alpha, \beta\} \) with the appropriate allocation of settlement authority to maximize her payoff. If she retains the settlement authority, her problem is

\[
\text{Maximize}_{\{\alpha, \beta\}} \quad (1 - \beta)S_P = (\gamma \cdot (1 - \alpha) + (1 - \gamma) \cdot (1 - \beta)) p(e(\alpha))W
\]

subject to

\[(P1) \quad (1 - \beta) \cdot S_P \geq (1 - \alpha)p(e(\alpha))W \]

\[(P2) \quad \beta \cdot S_P \geq \bar{U}, \text{ and} \]

\[(P3) \quad \alpha p(e(\alpha))W - \phi(e(\alpha)) \geq \bar{U}. \]

The first constraint \((P1)\) states that in order for a settlement to occur, the client's return from settlement must be higher than what she expects to receive from trial: It denotes the client's settlement participation constraint. When we simplify the constraint, it becomes \( \alpha \geq \beta \), or \( S_P \leq p(e(\alpha))W \). So, the constraint implies that the settlement must be in the defendant's interest as well. The reason the constraint stands for both parties' settlement incentives is that the only occasion they will fail to settle is when the reservation value of the plaintiff is too high \((R_P > R_D)\). As long as \( \alpha \geq \beta \), or \( R_P \leq R_D \), there is a room for welfare improving negotiations, so that both parties will have an incentive to settle. On the other hand, \( \alpha > \beta \) also implies that the settlement amount is less than the expected return from trial. The defendant pays less than what he expects to lose from trial, and thus walks away with a positive rent that could have been captured by the plaintiff.

The second constraint \((P2)\) represents the lawyer's settlement participation constraint with the secure outside option of \( \bar{U} \). Substituting the full expression for \( S_P \), we get

\[
\beta \left( \gamma \frac{(1 - \alpha)}{(1 - \beta)} + (1 - \gamma) \right) p(e(\alpha))W \geq \bar{U},
\]

When the lawyer's return from settlement, the left hand side, is differentiated with respect to \( \beta \),

\[
\frac{\partial}{\partial \beta} \left\{ \beta \left( \gamma \frac{(1 - \alpha)}{(1 - \beta)} + (1 - \gamma) \right) p(e(\alpha))W \right\} = \left( \gamma \frac{(1 - \alpha)}{(1 - \beta)^2} + (1 - \gamma) \right) p(e(\alpha))W > 0.
\]

In addition, when we differentiate the client's return with respect to \( \beta \),

\[
\frac{\partial}{\partial \beta} \left( \gamma \cdot (1 - \alpha) + (1 - \gamma) \cdot (1 - \beta) \right) p(e(\alpha))W = -(1 - \gamma)p' e(\alpha)W < 0.
\]

In other words, increasing the share of settlement return to the lawyer \( (\beta) \) improves the lawyer's bottom line at the cost of reducing the client's return. The client, therefore, has an incentive to reduce \( \beta \) as much as possible. However, this also implies that the client cannot extract all the surplus from the defendant, since this is done only when \( \alpha = \beta \). By reducing \( \beta \), she creates
a gap between $\alpha$ and $\beta$ and leaves some rent for the defendant. Reduction in $\beta$ forces the client to make a trade-off between extracting more surplus from the defendant and reducing the lawyer’s fee.

The third constraint ($P3$) can be termed as the trial credibility constraint, or the lawyer’s trial participation constraint. If the client sets $\alpha$ so low that, even though the lawyer’s settlement participation constraint ($P2$) is satisfied but the lawyer’s trial participation constraint is not, the client’s “threat” against the defendant becomes non-credible. The lawyer will quit at the trial stage, and the defendant, foreseeing this, will not make any settlement offer. Hence, to make her trial threat credible against the defendant, the client needs to match the lawyer’s reservation utility on his expected trial outcome.

### 3.4.2 Contracting Problem under Delegation

Similarly, if the principal chooses to delegate the settlement authority to her lawyer, the problem becomes

$$\text{Maximize}_{(\alpha, \beta)} \ (1 - \beta)S_A = (1 - \beta) \left( \delta \cdot \left( \frac{\alpha p(e(\alpha))W - \phi(e(\alpha))}{\beta} \right) + (1 - \delta) \cdot p(e(\alpha))W \right)$$

subject to

(A1) $\beta S_A \geq \alpha p(e(\alpha))W - \phi(e(\alpha))$, and

(A2) $\alpha p(e(\alpha))W - \phi(e(\alpha)) \geq \bar{U}$.

The first constraint (A1) implies that the lawyer must have an incentive to settle. Similar to ($P1$), the constraint also satisfies the defendant’s incentive to settle: It is equivalent to $S_A \leq p(e(\alpha))W$. As in ($P1$), the only reason the litigants would not settle is when $R_A > p(e(\alpha))W = R_D$, and as long as $R_A \leq p(e(\alpha))W$, settlement opportunity exists. Analogous to ($P3$), the second constraint (A2) denotes the credibility of trial threat.

One notable difference from the previous case is that, the client does not need to worry about matching the lawyer’s outside option in case of settlement. Because the lawyer is in de facto control, the fact that he is willing to settle implies that he is better off settling the case than going to trial. By satisfying the lawyer’s trial participation constraint (A2), the lawyer’s settlement participation constraint is automatically satisfied. However, this also implies that the lawyer’s settlement return will be higher than his outside option. In the previous case, because the client was calling all the shots, she could arbitrarily reduce the lawyer’s settlement fees down to his outside option, irrespective of what the lawyer expects to earn through trial. In the current case, to encourage the lawyer to settle the case, his share of settlement has to be higher than his expected trial return. The client can no longer force the lawyer’s settlement wage down to his outside option.

On the other hand, suppose the client sets $\{\alpha, \beta\}$ to just satisfy the first constraint: $\beta p(e(\alpha))W = \alpha p(e(\alpha))W - \phi(e(\alpha))$, or $\beta = \alpha - \frac{\phi(e(\alpha))}{p(e(\alpha))W}$. This implies $S_A = p(e(\alpha))W$. Therefore, even though $\beta < \alpha$, the client is able to extract all the surplus from the defendant. In the previous case, the client could not extract all the surplus from the defendant unless
\( \beta = \alpha \). Hence, although delegation leaves more rent for the lawyer, extracting higher settlement offer has gotten easier. Conversely, retaining the settlement authority makes extracting the lawyer's surplus easier but at the cost of making it more difficult to extract the defendant's surplus. In section 5, we will examine these differences more formally.

### 3.5 Single Fee Benchmark

Before presenting the full solution to the problem, let us examine a simpler case of unitary contingency fee. Suppose the client is constrained to set \( \alpha = \beta \). Then,

\[
R_P = p(e(\alpha))W \\
R_A = p(e(\alpha))W - \frac{\phi(e(\alpha))}{\alpha}
\]

so that the respective settlement amounts are

\[
S_P = p(e(\alpha))W \\
S_A = p(e(\alpha))W - \frac{\delta}{\alpha}\phi(e(\alpha))
\]

First, when the client negotiates the settlement terms herself, her settlement return is identical to her expected return from trial. Given the contingency fee structure, the client does not directly bear any litigation cost when the case proceeds to trial. Hence, she will be indifferent between settling and going to trial.\(^{72}\) This also implies, however, that the settlement opportunity provides no additional benefit to the client.

Second, the settlement return under the lawyer's authority is lower than that under the client's authority: \( S_A < S_P \forall \alpha \). This is because the lawyer's reservation value needs to reflect his contingent effort cost, whereas the client's does not. Thus, when a single rate is used, it will be better for the client to retain the authority, but she will not be able to reap more than what she expects to receive from trial. We start with a simplifying assumption, then proceed to the proof.

**Assumption** If \( \alpha^* \in (0, 1) \) maximizes \((1 - \alpha)p(e(\alpha))W\), then \( W \) is large enough so that

\[
\alpha^*p(e(\alpha^*))W - \phi(e(\alpha^*)) \geq U
\]

This assumption ensures that the size of claim is big enough so that the client can maximize her return without having to worry about matching the lawyer's outside option. This will make the subsequent analysis much easier, since as long as \( \alpha \geq \alpha^* \), we do not need to worry

\(^{72}\)This point is noted by Bebchuk and Guzman, where they argue that the client's bargaining power in settlement is higher when she uses contingency fee than hourly fee. *See Bebchuk and Guzman, How Would You Like to Pay for That? The Strategic Effects of the Fee Arrangements on Settlement Terms, 1 Harv. Negotiations Law Rev. 53 (1996).*
about the lawyer's trial participation constraints (P3 & A2). Note that $\alpha^*$ will always be less than 1 but greater than 0.

**Proposition 7** When a single rate is used, the principal is better off negotiating the settlement terms herself, unless the lawyer has the maximum bargaining power ($\delta = 0$). However, she is indifferent about having a settlement opportunity.

The respective returns for the lawyer are

$$\alpha^* p(e(\alpha^*))W - \delta \phi(e(\alpha^*))$$

Because the client's maximization problem leaves uncertain whether $\tilde{\alpha} \leq \alpha^*$ or $\tilde{\alpha} > \alpha^*$, we need to consider two potential cases. If $\tilde{\alpha} \leq \alpha^*$, since the lawyer's return is increasing with respect to $\alpha$ and $\alpha p(e(\alpha))W > \alpha^* p(e(\alpha^*))W - \delta \phi(e(\alpha))$, the lawyer is definitely worse off under delegation. On the other hand, if $\tilde{\alpha} > \alpha^*$, although he bears some effort cost ($\delta \phi(e(\tilde{\alpha}))$), because he is getting a larger share of settlement ($\tilde{\alpha} p(e(\tilde{\alpha}))W > \alpha^* p(e(\alpha^*))W$), it leaves ambiguous, on its face, whether the lawyer would be better off under delegation.

However, under delegation, the aggregate settlement amount for the client-lawyer pair is lower and the client is worse off. At $\alpha^*$, a substantial gap between her returns exists:

$$(1 - \alpha^*) p(e(\alpha^*))W > (1 - \alpha^*) p(e(\alpha^*))W - \delta \frac{(1 - \alpha^*)}{\alpha^*} \phi(e(\alpha^*))$$

So, the only reason she would grant a higher share to the lawyer with delegation would be to close this gap. This is done by reducing the lawyer's return from settlement even further. Therefore, even if $\tilde{\alpha} > \alpha^*$, the lawyer will be worse off with the authority to settle the case.

**Corollary 3** Unless the lawyer has maximum bargaining power ($\delta = 0$), the lawyer is better off when the client negotiates the settlement terms herself.

One notable feature about the single contingent fee case is that even though the lawyer exerts no effort in the settlement process, he is equally costly to the client whether they settle the case or proceed to trial. Since this is true for all settlement amount, the client will always be indifferent between settlement and trial. The settlement opportunity for a risk neutral client is of no value. For the agent, however, settling the case is definitely better since he does not need to exert any effort. Furthermore, because the client has a superior bargaining power, she will draw a higher settlement terms for him. The lawyer only provides a credible threat service for the client but offers no actual service in equilibrium.
3.6 Optimal Two-tier Contingent Fees

Coming back to the general case, when the client can selectively adjust the lawyer’s settlement compensation, she would generally be better off. In the single contingent fee case, the reason she was getting no additional benefit from settling the case was that the settlement fee for the lawyer was too high. The lawyer walked away with much surplus even though he did not exert any effort in settlement. If she can reduce his settlement fee, without destroying his incentive to exert effort in case they go to trial, she can strictly increase her settlement return. Not surprisingly, this result is independent of who is in control of settlement negotiations. We consider these two cases in turn.

3.6.1 When Principal Retains the Settlement Authority

As informally examined in section 3, the gist of the client’s contracting problem lies in making a trade-off between extracting the defendant’s surplus and reducing the lawyer’s fees. The trade-off notwithstanding, when the client negotiates the settlement terms herself, she will always minimize the lawyer’s fees first. The reason is simple. When she pays the lawyer less in settlement, her return increases exactly as much as the amount of fee reduction. On the other hand, extracting more surplus from the defendant can be done only through raising her reservation price. Since she receives only a fraction of the total surplus from settlement \((R_D - R_P)\), even when she raises her reservation price by one, the settlement amount will rise by less than one. Reducing the lawyer’s surplus is cheaper and more efficient for the client. At optimum, therefore, the client will always pay the lawyer no more than his outside option, but the defendant will walk away with some rent from settlement.

**Proposition 8** When the client retains the settlement authority,

1. the lawyer receives no more than his outside option through settlement (P2 binds), but
2. the defendant pays less than what he expects to lose from trial (P1 does not bind).

With the lawyer’s settlement compensation reduced down to his outside option, the client’s return becomes

\[ (1 - \beta)S_P = S_P - \overline{U} \]

Now, the client turns her eyes to minimizing the defendant’s surplus. The amount of rent the defendant gets depends, foremost, on her bargaining power. There are two channels of influence. The first is by slicing different shares of the surplus \((\gamma)\) and the second by affecting the total return \((S_P)\) through changing her reservation value \((R_P)\). If she is infinitely patient \((\gamma \approx 0)\), she will captures all the surplus of settlement, \(S_P \approx P(e(\alpha))W\). She also needs not worry about decreasing her reservation value by committing a higher fraction of trial return to the lawyer. By increasing \(\alpha\), she minimizes the lawyer’s under-effort problem and increases the size of her trial return. So, not only does the defendant gets almost no rent, he faces a worse trial prospect.
If the client is very impatient ($\gamma \approx 1$), on the other hand, she cannot expect to recover more than what her reservation value dictates, $S_P \approx R_P$, so the bulk of the settlement surplus goes to the defendant. Worse still, she needs to be much more concerned about decreasing her reservation value, since it directly affects her return from settlement. She will be quite hesitant to increase $\alpha$ so high. Hence, not only would her settlement amount approximate her expected recovery through trial, but the expected recovery would also be lower than when she is more patient. The defendant faces a better trial outcome and grabs a bigger share of the surplus.

**Corollary 4** The client is at least as better off as in the case of single contingent fee, and when the client is more patient, $\alpha$ will be higher and $\beta$ lower, but as she gets more impatient, $\alpha$ decreases while $\beta$ increases: as $\gamma \to 0$, $\alpha \to 1$ and $\beta \downarrow$, but when $\gamma \to 1$, $\alpha \to \alpha^*$ and $\beta \uparrow$.

Before concluding this sub-section, let us briefly examine the case of infinitely impatient client. When $\gamma \approx 1$, her maximization program seems almost identical to the case of unitary contingent fee. Her settlement return is “independent” of $\beta$ since her return is equal to $(1-\alpha)p(e(\alpha))W$. Simplicity stops there, however. First, we know that the lawyer's settlement compensation is equal to his outside option for all $\gamma$: $\beta_P \cdot S_P = U$. In case of unitary contingent fee, however, the lawyer received more than his outside option: $\alpha^*p(e(\alpha^*))W > \alpha^*p(e(\alpha^*))W - \phi(e(\alpha^*)) \geq U$. The lawyer is strictly worse off under bifurcated fees, independent of the client's level of patience.

The defendant also pays less. This is because while the client's return is the same, the lawyer is getting less, enabling the defendant to pay less. When $\gamma = 1$, $S_P = \frac{1-\alpha^*}{1-\beta}p(e(\alpha^*))W$. Since $\alpha^* > \beta$, $\frac{1-\alpha^*}{1-\beta}p(e(\alpha^*))W < p(e(\alpha^*))W$. Thus, even though the client's return is “independent” of $\beta$, the two-tier fees are still useful for the plaintiff, because reducing the lawyer's fee in case of settlement is more beneficial for the client than increasing the settlement offer.73

The crucial parameter under the client's authority is, thus, her degree of patience. As she becomes more patient, she commits a higher fraction of trial return but a lower fraction of settlement return to the lawyer. The exact opposite happens as she becomes less patient. Infinitely patient client will sell the entire claim to the lawyer, eliminate the under-effort problem, and take full advantage of the settlement opportunity. For an infinitely impatient client, to the contrary, the settlement opportunity provides little additional benefit, although bifurcated fees lets her minimize the cost of litigation.

### 3.6.2 When Principal Delegates the Settlement Authority

When the client retains the settlement authority, she can pay the lawyer less through settlement than what he expects to receive from trial ($\beta S < \alpha pW - \phi$). Since she decides whether to settle

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73Hay claims that the advantage of bifurcated fee is not the “greatest” when the client has a weak bargaining power. Bruce Hay, *Optimal Contingent Fees in a World of Settlement*, 26 J. L. LEGAL STUD. 259, 270 (1997). We show that this is not true. When she retains the authority, she would always want to minimize the lawyer's settlement compensation using bifurcated contingent fees.
the case or not, as long as the lawyer's outside option is met, relative levels of compensation do not matter. When she delegates the decision authority, however, the relative levels become important. Unless the lawyer is paid more from settlement than from trial, he will recommend they proceed to trial. Therefore, even though the client would like to reduce his settlement fee as much as possible, his settlement compensation needs to at least match his trial compensation ($\beta S \geq \alpha pW - \phi$). The lawyer, at optimum, will receive some rent through settlement.

On the other hand, reducing the defendant's surplus becomes much easier under delegation. The main difference lies in how the lawyer's settlement share affects the client-lawyer pair's reservation price. Under delegation, when the client decreases the lawyer's share ($\beta$), the settlement offer needs to be higher to induce the lawyer to accept the offer. A decrease in $\beta$ increases the reservation price under delegation. When the client retains the authority, however, reduction in settlement fee directly translates into cost saving for the client. So, the defendant can now make a lower offer to keep her as satisfied as before. A decrease in $\beta$ decreases the reservation price under retainment. Hence, under delegation, reduction of the lawyer's settlement share not only improves their bargaining position, but also gives the client a bigger share of settlement. When she negotiates the settlement terms, the cost reduction is compromised by their reduced bargaining position.

**Proposition 9** When the client delegates the settlement authority to the lawyer,

1. the defendant pays his expected trial loss through settlement ($A_1$ binds), but
2. the lawyer receives more than his outside option.

The fact that the defendant receives no rent through settlement implies that there is no room for negotiation, i.e., $R_A = R_D = p(e(\alpha))W$. Therefore, the lawyer's relative degree of patience is irrelevant. The client can always leverage the bargaining power to extract all the surplus from the defendant. The client's return can be rewritten as

$$p(e(\alpha))W - \{\alpha p(e(\alpha))W - \phi(e(\alpha))\}$$

Recall that under the case of single contingent fee, the client could only maximize her trial return, so her return from settlement was

$$p(e(\alpha))W - \alpha p(e(\alpha))W$$

With two-tier contingent fee and delegation, the client pays the lawyer less at any given trial share to the lawyer ($\alpha$). She can also increase the total size of the pie by further increasing $\alpha$. Not only does she pays the lawyer less, she also provides more incentive for the lawyer.

**Corollary 5** When the client delegates the authority, she is strictly better off than in the case of single contingent fee, and gives the lawyer a higher share of trial return: $\alpha^* < \alpha_A$. 

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Although the client's welfare unilaterally increases from the single contingent fee case, change in the lawyer's return is ambiguous. This is because while the settlement fee is downward adjusted to subtract his effort cost, his expected return from trial is higher, leaving the change in his settlement return uncertain. However, on the issue of delegation, when bifurcated fee is used, the lawyer would rather negotiate the settlement terms himself than leave it to the client. Recall that in the case of single contingent fee, the lawyer always preferred the client to be in charge of negotiations. The primary reason was that the lawyer always had a weaker bargaining power than the client. Although this is still nominally true under bifurcated contingent fee, the reduction of his surplus dominates the weakened bargaining position. Because, under delegation, the client can leverage the lawyer's reservation price to be equal to the defendant's, the bargaining position weakening effect disappears. Delegation, therefore, provides downward protection to the lawyer's compensation without diluting his bargaining position.

3.6.3 When Should Principal Delegate?

When the client is very patient, she can elicit a high settlement offer from the plaintiff by negotiating the settlement terms herself. She also minimizes the lawyer's fee in settlement. Although delegation brings forth maximum extraction from the defendant, since she could do this herself, she would rather save on the lawyer's fee. The story is reversed for an impatient client. Minimizing the lawyer's fee still applies, but because she faces a relatively tough opponent, she cannot expect to recover more than what her expected trial results dictate. In such case, even if delegating the authority to the lawyer is costly, the benefit is much larger. She should treat her lawyer more generously in hopes of getting an even bigger return from settlement. The following proposition more rigorously confirms this intuition.

**Proposition 10** There exists $\gamma^* \in (0, 1)$ such that $\forall \gamma < \gamma^*$, the client is better off negotiating the settlement terms herself, and $\forall \gamma > \gamma^*$, delegation dominates.

One obvious addendum to the proposition is that as the lawyer becomes more expensive to retain due to a higher outside option, more clients should delegate the authority. As the lawyer's outside option grows, the fee-reducing benefit through authority retention becomes less pronounced, while the benefit of delegation remains unchanged. Informally, $\gamma^*$ is given by

$$S_P(\gamma^*) - \bar{U} = p(e(\alpha_A))W - [\alpha_A p(e(\alpha_A))W - \phi(e(\alpha_A))]$$

When $\bar{U}$ becomes higher, the left hand side becomes smaller. So, to restore the equality, $\gamma^*$ needs to be bigger. In the extreme, when $\bar{U} = \alpha_A p(e(\alpha_A))W - \phi(e(\alpha_A))$, the amount of fee saving is zero under retention. If $\alpha_A \geq 1$, the client will always delegate the authority, while if $\alpha_A < 1$, the client needs to be very patient for retaining the authority to make sense. In the other direction, as $\bar{U} \to 0$ or as the lawyer becomes relatively cheap to retain, the client needs to become more proactive in settlement negotiations. Thus, more expensive lawyers will act with relative freedom while inexpensive lawyers will be given small degree of latitude. However, retention never entirely dominates delegation. This is because when the client is infinitely impatient, her recovery from settlement is equal to $(1 - \alpha^*)p(e(\alpha^*))W$, even though
she doesn't pay anything to the lawyer \((\beta_p = 0)\). For a very impatient client, delegation is always better, irrespective of the amount of fee she has to pay the lawyer.

### 3.7 Conclusion

The model has demonstrated that there may be an inherent trade-off between eliciting a high settlement offer from the defendant and minimizing the lawyer's rent, and such trade-off dynamic depends crucially on whether the client or the lawyer controls the litigation. When the client is actively involved, she will watch her legal bills closely and minimize her agent's rent. By saving her legal fees, however, she undermines her position against the defendant at the bargaining table, and fails to extract a high settlement offer from the defendant unless she is a tough bargainer to begin with. In contrast, when the plaintiff leaves the lawyer in charge of negotiation, even though the lawyer may grab a substantial amount of rent from the client, he will make the client better off. For an impatient client, therefore, rather than trying to control her litigation and minimize her legal fees, she would be better off ceding control to the lawyer and letting him grab a bigger chunk of total surplus. By expressly delegating her authority, she commits not to extract the lawyer's rent too much and increases her return from settlement.

Although we have exclusively focused on the delegation issue on the plaintiff's side, the model can easily be extended to a two party delegation problem. When both the plaintiff and the defendant have an incentive to delegate the authority, matching both lawyers' outside options will become more difficult, since there may be too little total surplus to satisfy both agents' participation constraints. Optimal contingent fees may change as well, since the probability of prevailing at litigation will depend on both lawyers' amounts of effort. However, observing that, especially in tort litigations, defendants are usually corporations with superior monitoring mechanisms, we would presume that they have a less serious moral hazard problem. When they can effectively monitor the lawyer's effort and grasp good knowledge of the issues, neither the contingent fee nor delegation would be necessary. They will put the outside lawyers on a tight leash, making decisions every step of the litigation and authorizing only the works that they deem necessary. Delegation and contingent fee issues, therefore, seem much more relevant for individual plaintiffs.

Inclusion of risk aversion will introduce another dimension to the bargaining problem, since when both parties face different degrees of risk aversion (through different concavities of utility functions), it creates a bigger region of possible settlement possibilities. Although the optimal contingent fees, having to perform the dual roles of risk allocation and incentive provision, will become less clear cut, the inclusion will bring us a better understanding of optimal contracts. One interesting point about litigation is that, in contrast to the proverbial risk-neutral principal and risk-averse agent, when a contingent fee lawyer has a portfolio of cases while individual clients initiate at most one suit at a time, we are faced with a potential backward risk sharing possibilities. Although the legal literature has endorsed contingent fees based on lawyers' assumption of risk, from an efficiency perspective, lawyers are better suited to diversify and their bearing more risk is only natural. On the other hand, one agent with multiple principals creates a common agency problem. Analyzing the interplay between common agency and backward risk sharing will be quite fruitful.
Perhaps the biggest drawback of the model is that it does not explicitly consider the issue of information and delegation. In reality, the reason individual plaintiffs cannot exercise effective control over their lawyers is that they lack relevant information and good understanding of the legal issues. In our model, we have instead stressed the fact that the client has an incentive to delegate the authority even if she may have a good idea about her case. When the client lacks information, by exploring different contracting possibilities and degrees of delegation, she may be able to better align the agent's incentives. From the contracting perspective, information asymmetry creates the possibility of using a menu of contracts for the lawyer to self select and relying on renegotiation over fee contract after the lawyer has gathered information about the strength of the case. Since most individual plaintiffs neither present a menu of contracts to their lawyers nor renegotiate their contingent fee contracts before they proceed to trial, bridging the gap between the theoretical possibilities and the reality remain an important issue. Better reflecting the real world example through the information and delegation problem remains the next step of our work.
Proofs

Proof of Proposition 7. When the client retains the authority, she sets $\alpha$ to maximize $(1 - \alpha)p(e(\alpha))W$ subject to $\alpha p(e(\alpha))W - \phi(e(\alpha)) \geq U$ (P3). The first constraint (P1) is satisfied through $S_P = p(e(\alpha))W$ while the second constraint (P2) is automatically satisfied because $\alpha p(e(\alpha))W \geq \alpha p(e(\alpha))W - \phi(e(\alpha))$. The maximization problem is, thus, identical to the case when the client has no chance of settling the case. This proves the second part of the proposition.

The optimal $\alpha$ is given by

$$(1 - \alpha)p'(e(\alpha))e'(\alpha) = p(e(\alpha))W$$

Let the unique solution be $\alpha^\ast$, so that $(1 - \alpha^\ast)WP(e(\alpha^\ast)) > (1 - \alpha)WP(e(\alpha)) \forall \alpha \neq \alpha^\ast$.

If the client delegates the authority, she sets $\alpha$ to maximize $(1 - \alpha)p(e(\alpha))W - \delta \frac{1 - \alpha}{\alpha} \phi(e(\alpha))$ subject to $\alpha p(e(\alpha))W - \phi(e(\alpha)) \geq \bar{U}$ (A2). Again, since $\alpha p(e(\alpha))W \geq \alpha p(e(\alpha))W - \phi(e(\alpha))$, the first constraint (A1) is trivially satisfied. The optimal solution is given by

$$(1 - \alpha)p'(e(\alpha))e'(\alpha) = p(e(\alpha))W + \frac{\delta}{\alpha} \left[ (1 - \alpha)\phi'(e(\alpha))e'(\alpha) - \frac{1}{\alpha} \phi(e(\alpha)) \right]$$

Denote the solution as $\tilde{\alpha}$. Since $(1 - \alpha)\phi'(e(\alpha))e'(\alpha) - \frac{1}{\alpha} \phi(e(\alpha))$ may be either positive or negative, $\tilde{\alpha}$ is either bigger or smaller than $\alpha^\ast$. Nevertheless, we must have $\tilde{\alpha} < 1$, because otherwise, we get $0 = p(e(1))W - \delta \phi(e(1))$. The right hand side is strictly positive, since $p(e(1))W - \phi(e(1)) > 0$ by assumption.

Since $(1 - \alpha)p(e(\alpha))W - \delta \frac{1 - \alpha}{\alpha} \phi(e(\alpha)) < (1 - \alpha)p(e(\alpha))W$, as long as $\alpha < 1$ and $\delta > 0$,

$$(1 - \tilde{\alpha})p(e(\tilde{\alpha}))W - \delta \frac{1 - \tilde{\alpha}}{\tilde{\alpha}} \phi(e(\tilde{\alpha})) < (1 - \tilde{\alpha})p(e(\tilde{\alpha}))W \leq (1 - \alpha^\ast)p(e(\alpha^\ast))W$$

Therefore, the principal is strictly better off by retaining the settlement authority, unless the lawyer has the maximum bargaining power. \[\Box\]

Proof of Corollary 3. Respective returns for the lawyer are $\alpha S_P = \alpha p(e(\alpha))W$ when the client retains the authority and $\alpha S_A = \alpha p(e(\alpha))W - \delta \phi(e(\alpha))$ when she delegates.

We know that $\frac{d}{d\alpha} \alpha S_A = \frac{d}{d\alpha} \alpha p(e(\alpha))W - \delta \phi(e(\alpha)) = p(e(\alpha))W + (1 - \delta)\phi'(e) e'(\alpha) > 0$.

First, suppose $\tilde{\alpha} \leq \alpha^\ast$. Since $\alpha^\ast p(e(\alpha^\ast))W > \alpha^\ast p(e(\alpha^\ast))W - \delta \phi(e(\alpha^\ast))$ when $\delta > 0$, $\alpha^\ast p(e(\alpha^\ast))W > \tilde{\alpha} p(e(\tilde{\alpha}))W - \delta \phi(e(\tilde{\alpha}))$. Therefore, if $\tilde{\alpha} \leq \alpha^\ast$, lawyer is strictly better when the client has the authority.

Now, suppose $\tilde{\alpha} > \alpha^\ast$. From the principal’s maximization we have

$$(1 - \alpha)p'(e(\alpha))e'(\alpha) = p(e(\alpha))W + \frac{\delta}{\alpha} \left[ (1 - \alpha)\phi'(e(\alpha))e'(\alpha) - \frac{1}{\alpha} \phi(e(\alpha)) \right].$$
In order to have $\alpha > \alpha^*$, we need $(1 - \tilde{\alpha})\phi'(e)\phi''(\tilde{\alpha}) < \frac{1}{2} \phi(e(\tilde{\alpha}))$. The first order condition also implicitly defines $\alpha(\delta)$. Since $\phi''(e) > 0$, as $\delta \to 0^+$, $\tilde{\alpha} \to \alpha^*$. In other words, $\alpha(\delta) < 0$ given that $\tilde{\alpha} > \alpha^*$.

When we differentiate $\hat{\alpha}p(e(\tilde{\alpha}))W - \delta \phi(e(\tilde{\alpha}))$ with respect to $\delta$, we get

$$\frac{d}{d\delta} \hat{\alpha}p(e(\tilde{\alpha}))W - \delta \phi(e(\tilde{\alpha}))|_{\hat{\alpha} > \alpha^*} = \frac{d\hat{\alpha}}{d\delta} p(e)W - \phi(e) + (1 - \delta)\phi'(e)\phi''(\alpha)\hat{\alpha}'(\delta)|_{\hat{\alpha} > \alpha^*} < 0$$

Therefore, the lawyer's return is strictly decreasing as $\delta$ gets higher, or as $\tilde{\alpha}$ gets higher. Thus, $\alpha^* p(e(\alpha^*))W > \hat{\alpha}p(e(\tilde{\alpha}))W - \delta \phi(e(\tilde{\alpha}))$ even if $\tilde{\alpha} > \alpha^*$.

**Proof of Proposition 8.** When the client has the settlement authority, the Lagrangian is

$$L(\alpha, \beta, \lambda, \mu, \nu) = (\gamma \cdot (1 - \alpha) + (1 - \gamma) \cdot (1 - \beta))p(e(\alpha))W - \lambda \{\alpha - \beta\}$$

$$- \mu \left\{ \beta \left( \frac{1 - \alpha}{1 - \beta} + (1 - \gamma) \right) p(e(\alpha))W - \bar{U} \right\}$$

$$- \nu \left\{ \alpha p(e(\alpha))W - \phi(e(\alpha)) - \bar{U} \right\} \quad \text{(LP)}$$

The first order conditions are

$$\frac{\partial L}{\partial \alpha} = -\gamma \cdot p(e(\alpha))W + (\gamma \cdot (1 - \alpha) + (1 - \gamma) \cdot (1 - \beta))p'(e(\alpha))e'(\alpha)W - \lambda$$

$$- \mu \left\{ - \frac{\beta \gamma}{1 - \beta} p(e(\alpha))W + \beta \left( \frac{1 - \alpha}{1 - \beta} + (1 - \gamma) \right) p'(e(\alpha))e'(\alpha)W \right\}$$

$$- \nu \left\{ p(e(\alpha))W + \alpha p'(e(\alpha))e'(\alpha) - \phi'(e(\alpha))e'(\alpha) \right\} = 0 \quad \text{(FOC P1)}$$

$$\frac{\partial L}{\partial \beta} = -(1 - \gamma)p(e(\alpha))W + \lambda - \mu \left\{ \left( \frac{1 - \alpha}{1 - \beta} + (1 - \gamma) \right) + \frac{\beta \gamma (1 - \alpha)}{(1 - \beta)^2} \right\} \cdot p(e(\alpha))W = 0$$

$$\text{(FOC P2)}$$

After applying the agent's first order condition for effort to the first equation and some simplification, the solution is characterized by

$$p'(e(\alpha))e'(\alpha)W \left\{ \gamma (1 - \alpha) + (1 - \gamma)(1 - \beta) - \mu \beta \left( \frac{1 - \alpha}{1 - \beta} + (1 - \gamma) \right) \right\}$$

$$= p(e(\alpha))W \left\{ \gamma - \frac{\beta \mu \gamma}{1 - \beta} + \nu \right\} + \lambda$$

$$\lambda = \left\{ (1 - \gamma)(1 + \mu) + \mu \gamma \frac{1 - \alpha}{(1 - \beta)^2} \right\} p(e(\alpha))W$$

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The complementary slackness conditions are

\[ \lambda (\alpha - \beta) = 0 \]  
(\text{CS P1})

\[ \mu \left\{ \beta \left( \frac{1 - \alpha}{1 - \beta} + (1 - \gamma) \right) p(e(\alpha)) W - \overline{U} \right\} = 0 \]  
(\text{CS P2})

\[ \nu (\alpha p(e(\alpha)) W - \phi(e(\alpha)) - \overline{U}) = 0 \]  
(\text{CS P3})

with the multiplier restrictions of \( \lambda, \mu, \nu \leq 0 \).

Suppose (P2) does not bind at optimum. Then, \( \mu = 0 \) and

\[ \beta \left( \frac{\gamma (1 - \alpha)}{1 - \beta} + (1 - \gamma) \right) p(e(\alpha)) W > \overline{U}. \]

However, given optimal \( \alpha \), the objective function is strictly decreasing with respect to \( \beta \), i.e.,

\[ \frac{\partial}{\partial \beta} \left( \gamma \cdot (1 - \alpha) + (1 - \gamma) \cdot (1 - \beta) \right) < 0 \]

while the agent's return is strictly increasing with respect to \( \beta \), i.e.,

\[ \frac{\partial}{\partial \beta} \beta \left( \frac{\gamma (1 - \alpha)}{1 - \beta} + (1 - \gamma) \right) > 0. \]

By unilaterally decreasing \( \beta \), the principal is better off while the other constraints remain satisfied. Therefore, at optimum, \( \mu < 0 \) and

\[ \beta \left( \frac{\gamma (1 - \alpha)}{1 - \beta} + (1 - \gamma) \right) p(e(\alpha)) W = \overline{U}. \]

Now, suppose (P1) binds, so that we have \( \lambda < 0 \) and \( \alpha = \beta \). From the lawyer's settlement return, when we apply \( \alpha = \beta \), we get

\[ \beta \left( \frac{\gamma (1 - \alpha)}{1 - \beta} + (1 - \gamma) \right) p(e(\alpha)) W = \alpha (\gamma + (1 - \gamma)) p(e(\alpha)) W = \alpha p(e(\alpha)) W = \overline{U}. \]

But, since \( \alpha p(e(\alpha)) W - \phi(e(\alpha)) < \alpha p(e(\alpha)) W = \overline{U} \), the trial threat credibility constraint is violated. Therefore, we must have \( \alpha > \beta \) and \( \lambda = 0 \). In other words, the defendant always pays less than his expected loss from trial through settlement. \( \blacksquare \)

**Proof of Corollary 4.** Ignoring the trial-threat credibility condition (P3) for the moment, when we rearrange FOC P1, we get

\[ \left( 1 - \frac{\mu \beta}{1 - \beta} \right) \left\{ (\gamma \cdot (1 - \alpha) + (1 - \gamma) \cdot (1 - \beta)) p'(e(\alpha)) e'(\alpha) W - \gamma \cdot p(e(\alpha)) W \right\} = 0 \]

Let the solution be \( \alpha_P(\gamma) \), which is implicitly defined.
Since $\mu < 0$, to satisfy the equality, we need

$$(\gamma \cdot (1 - \alpha_P) + (1 - \gamma) \cdot (1 - \beta)) p'(e(\alpha_P)) e'(\alpha_P) W - \gamma \cdot p(e(\alpha_P)) W = 0$$

which is equivalent to

$$p(e(\alpha_P)) W = \left(1 - \alpha_P + \frac{(1 - \gamma)(1 - \beta)}{\gamma}\right) p'(e(\alpha_P)) e'(\alpha_P) W \quad (P^*)$$

Since $(1 - \alpha_P) + \frac{(1 - \gamma)(1 - \beta)}{\gamma} \geq (1 - \alpha_P) \forall \gamma \in (0, 1)$, $p'' < 0$, and $e'' < 0$, we must have $\alpha_P \geq \alpha^*$. By assumption, this implies that $\alpha_P \cdot p(e(\alpha_P)) W - \phi(e(\alpha_P)) > \alpha^* p(e(\alpha^*)) W - \phi(e(\alpha^*)) \geq U$, so the trial-threat credibility condition is satisfied with slack.

As $\gamma \to 1$, the right hand side of $P^*$ converges to $(1 - \alpha_P) p'(e(\alpha_P)) e'(\alpha_P) W$, rendering

$$p(e(\alpha_P)) W = (1 - \alpha_P) p'(e(\alpha_P)) e'(\alpha_P) W$$

This is identical to the client’s maximization problem without the settlement opportunity or with single contingent fee. Therefore, as $\gamma \to 1$, $\alpha \to \alpha^*$. Convergence is monotonic since $p'' < 0$ and $e'' < 0$. From

$$\beta \left(\gamma \frac{1 - \alpha}{1 - \beta} + (1 - \gamma)\right) p(e(\alpha)) W = U$$

as $\gamma$ increases, the left hand side becomes smaller. So, to satisfy the equality, $\beta$ has to become bigger. In the limit, $\alpha_P = \alpha^*$, and

$$(1 - \beta) \left(\gamma \frac{1 - \alpha}{1 - \beta} + (1 - \gamma)\right) p(e(\alpha)) W = (1 - \alpha^*) p(e(\alpha^*)) W$$

If $\gamma \to 0$, the right hand side of $P^*$ goes to infinity, implying that

$$p(e(\alpha)) W < \left(1 - \alpha + \frac{(1 - \gamma)(1 - \beta)}{\gamma}\right) p'(e(\alpha)) e'(\alpha) W \forall \alpha$$

or

$$\frac{\partial L_P}{\partial \alpha} > 0 \forall \alpha$$

The client wants to increase $\alpha$ as much as possible. Since $\alpha$ is bounded above by 1, as $\gamma \to 0$, $\alpha \to 1$. Similarly, as $\alpha \to 1$, $\beta$ becomes smaller. In the limit, the client gets

$$p(e(\alpha)) W - U > (1 - \alpha^*) p(e(\alpha^*)) W$$
Proof of Proposition 9. The Lagrangian is

\[ L(\alpha, \beta, \lambda, \mu) = (1 - \beta) \left( \delta \cdot \left( \frac{\alpha p(e(\alpha))W - \phi(e(\alpha))}{\beta} \right) + (1 - \delta) \cdot p(e(\alpha))W \right) - \lambda \{(\alpha - \beta)p(e(\alpha))W - \phi(e(\alpha))\} - \mu \{\alpha p(e(\alpha))W - \phi(e(\alpha)) - U\}. \] (LA)

The first order conditions with respect to \( \alpha \) and \( \beta \), after applying the agent’s effort maximization condition \((\alpha p'(e(\alpha))W - \phi'(e(\alpha)) = 0)\), are

\[
p'(e)e'(\alpha)W \{(1 - \beta)(1 - \delta) - \lambda \beta\} = p(e(\alpha))W \left\{ \mu - \delta \frac{1 - \beta}{\beta} - \lambda \right\} \quad \text{(FOC A1)}
\]

\[-\frac{\delta}{\beta^2} \{\alpha p(e(\alpha))W - \phi(e(\alpha))\} - (1 - \delta)p(e(\alpha))W = \lambda p(e(\alpha))W \quad \text{(FOC A2)}
\]

Complementary slackness conditions are

\[
\lambda \{(\alpha - \beta)p(e(\alpha))W - \phi(e(\alpha))\} = 0 \quad \text{(CS A1)}
\]

\[
\mu \{\alpha p(e(\alpha))W - \phi(e(\alpha)) - U\} = 0 \quad \text{(CS A2)}
\]

with the multiplier restrictions of \( \lambda \geq 0 \) and \( \mu \leq 0 \).

From FOC A2, the left hand side is strictly negative. Since \( p(e(\alpha))W > 0 \), we must have \( \lambda < 0 \). From the first complementary slackness condition (CS A1), therefore,

\[
\alpha p(e(\alpha))W - \phi(e(\alpha)) = \beta p(e(\alpha))W.
\]

From the settlement amount

\[
S_A = \left( \delta \cdot \left( \frac{\alpha p(e(\alpha))W - \phi(e(\alpha))}{\beta} \right) + (1 - \delta) \cdot p(e(\alpha))W \right),
\]

when we apply \( \beta p(e(\alpha))W = \alpha p(e(\alpha))W - \phi(e(\alpha)) \), we get

\[
S_A = p(e(\alpha))W
\]

The defendant pays his expected loss from trial through settlement and receives no rent.

When we rearrange FOC A2, we get

\[
\left( \lambda + (1 - \delta) + \frac{\delta}{\beta} \right) p(e(\alpha))W = 0
\]

This implies that \( \lambda = -(1 - \delta) - \frac{\delta}{\beta} \). When this is substituted into FOC A1, after rearrangement,
we get
\[ p'(e)e'(\alpha)W = p(e(\alpha))W (\mu + 1) \]

Since \( \mu \leq 0 \), at optimum, \( \alpha > \alpha^* \). By assumption, \( \alpha^* p(e(\alpha^*))W - \phi(e(\alpha^*)) \geq \bar{U} \). Therefore, at optimum,
\[ p'(e)e'(\alpha)W = p(e(\alpha))W \quad \text{(A*)} \]
and
\[ \beta p(e(\alpha))W > \bar{U} \]

\[ \square \]

**Proof of Corollary 5.** \( \mu = 0 \) implies that, at optimum,
\[ p'(e)e'(\alpha_A)W = p(e(\alpha_A))W \]

Under unitary fee
\[ (1 - \alpha^*)p'(e)e'(\alpha^*)W = p(e(\alpha^*))W \]

Since \( p''(e) < 0 \) and \( \alpha^* > 0 \), \( \alpha_A > \alpha^* \).

Also, at \( \alpha^* \),
\[ p'(e)e'(\alpha^*)W > p(e(\alpha^*))W \]
or, the objective function is strictly increasing. Since \( p(e(\alpha))W - \{\alpha p(e(\alpha))W - \phi(e(\alpha))\} > (1 - \alpha)p(e(\alpha))W \) \( \forall \alpha \),
\[ p(e(\alpha_A))W - \{\alpha_A p(e(\alpha_A))W - \phi(e(\alpha_A))\} > (1 - \alpha^*)p(e(\alpha^*))W \]

\[ \square \]

**Proof of Proposition 10.** When the client retains the authority, her return is \( S_P - \bar{U} \) where \( S_P = \left(\gamma \frac{1}{1-\beta} + (1 - \gamma)\right) p(e(\alpha))W \). Given \( \gamma \), the solution is uniquely defined, so that we can write her return as \( S_P(\gamma) - \bar{U} \). When \( \gamma = 1 \), we know that \( \alpha_P = \alpha^* \), so that \( S_P - \bar{U} = (1 - \alpha^*)p(e(\alpha^*))W \). When \( \gamma = 0 \), we know that \( \alpha_P = 1 \) and \( \beta = \frac{\bar{U}}{p(e(1))W} \), so that \( S_P - \bar{U} = p(e(1))W - \bar{U} \).

Given those two end points, we first show that \( \frac{d}{d\gamma} S_P(\gamma) < 0 \). When \( S_P(\gamma) \) is differentiated with respect to \( \gamma \) and \( P^* \) is used to simplify, we get
\[
\frac{d}{d\gamma} S_P(\gamma) = \frac{p(\gamma)W}{(1 - \beta)^2} \left( (1 - \beta)\gamma' - (1 - \beta)(\alpha - \beta) \right)
\]

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From $\beta S_P(\gamma) = \bar{U}$, we obtain $\beta'(\gamma)$ and when substituted into the above,

$$
\frac{d}{d\gamma} S_P(\gamma) = -\frac{(1 - \beta) S_P \cdot p(\cdot) W(\alpha - \beta)}{(1 - \beta)^2 S_P + p(\cdot) W \gamma(1 - \alpha)\beta}
$$

When we eliminate $S_P$,

$$
\frac{d}{d\gamma} S_P(\gamma) = - (\alpha - \beta) p(\cdot) W \frac{\gamma(1 - \alpha) + (1 - \gamma)(1 - \beta)}{\gamma(1 - \alpha) + (1 - \gamma)(1 - \beta)^2} < 0
$$

Therefore, when the client retains the authority, more patient client always does better than less patient client.

Under delegation, the client’s return is fixed at $p(\alpha_A) W - [\alpha_A \cdot p(e(\alpha_A)) W - \phi(e(\alpha_A))]$. We know that

$$
p(\alpha_A) W - [\alpha_A \cdot p(\alpha_A) W - \phi(\alpha_A)] > (1 - \alpha^* \cdot p(\alpha^*) W) = S_P(\gamma = 1) - \bar{U}.
$$

So, the client who delegates the authority always does better than an infinitely impatient client who retains the authority.

Now, let us compare the returns for the client who delegates and an infinitely patient client who retains the authority. Since we do not know whether $\alpha_A \leq 1$, we need to consider two sub-cases. First, suppose $\alpha_A = 1$. The client, who delegates, receives $p(e(1)) W - [p(e(1)) W - \phi(e(1))]$. When an infinitely patient client retains the authority, she gets $S_P(\gamma = 0) - \bar{U} = p(e(1)) W - \bar{U}$. Since $p(e(1)) W - \phi(e(1)) > \bar{U},$

$$
p(e(1)) W - \bar{U} > p(e(1)) W - [p(e(1)) W - \phi(e(1))]
$$

Now, suppose $\alpha_A < 1$. Since $p(e(\alpha_A)) W < p(e(1)) W$ and $p(e(\alpha_A)) W - \phi(e(\alpha_A)) > \bar{U},$

$$
p(e(1)) W - \bar{U} > p(e(\alpha_A)) W - [p(e(\alpha_A)) W - \phi(e(\alpha_A))]
$$

Therefore, irrespective of the optimal level of $\alpha_A$, the client who delegates the authority is always worse off than an infinitely patient client who retains the authority.

With the monotonicity of $S_P$ with respect to $\gamma$ and

$$(1 - \alpha^*) p(e(\alpha^*)) W < p(e(\alpha_A)) W - [p(e(\alpha_A)) W - \phi(e(\alpha_A))] < p(e(1)) W - \bar{U},$$

the existence is satisfied. ■
Chapter 4

A New Rationale for Golden Parachutes

4.1 Introduction

Large severance payments made usually to the top executive officers of companies in case they are merged or taken over, pejoratively known as golden parachutes, have generated contentious debate among scholars and practitioners. On the opponent side, they have been attacked as a paramount example of executive greed condoned by docile boards of directors.\(^1\) According to this capture theory, board directors are controlled and manipulated by powerful executives, and golden parachutes are but one method in extracting rent from the corporation. Others argue that golden parachutes cause a serious disincentive problem. When managers are guaranteed of a big severance package when the company performs poorly and is subsequently taken over, they would be unwilling to work hard to improve corporate performance and lift its stock price.\(^2\)

On the proponent side, some justify golden parachutes as a mechanism used to encourage executives to build firm-specific capital. They argue that executive managers need to accumulate human capital that is worth a lot more inside the firm than the outside. If the company is taken over and they are laid off after they have made the costly investment, they will be unable to realize the fruits of their labor, and thus be unwilling to make the investment ex ante. Golden parachutes are needed to guarantee due compensation for their investment in case of a takeover.\(^3\) Further, from a moral hazard perspective, others argue that golden parachutes

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\(^1\)For a general exposition of shareholder-manager conflict in case of a takeover, see Coffee (1986). The author provides a few real-world examples where golden parachute payments were deemed excessive. For example, in 1985, Beatris Cos. granted $23.5 million golden parachutes to six officers, even though one of the officers had been with the company for only thirteen months and the chief executive officer had come back from retirement only seven months before. Id. at 77. See also Carney (2000) at 123-24 for other examples of “excessively large” golden parachutes. Such visible examples of excessive compensation may have been one of the motives for Congress to adopt punitive tax measures. Id.

\(^2\)See generally Narayanan and Sundram (1998) for the presentation and empirical testing of this argument. They find, however, that such perverse incentive is not shown in statistics. Under our model, when an incentive pay system is simultaneously instituted with a golden parachute, incentive to drive down the stock price can be easily eliminated. See also Carney (2000) at 121 for a brief discussion of this perverse incentive problem.

\(^3\)Williamson states that “[g]olden parachutes ought to vary directly with the extent of the firm-specific in-
function as a bribe to managers not to block efficiency-enhancing takeovers. When the managers can inhibit value increasing takeovers for the sake of their own job security and private benefits, shareholders can use golden parachutes as a grease payment to the executives, so that efficient takeovers can occur with minimum managerial resistance.4

The arguments are not free from problems. On the rent extraction hypothesis, large compensation that depends only on a takeover seems quite an inefficient method of extracting rent, especially when there are other means by which the managers can exercise control and enjoy the benefits immediately. On the investment story, if golden parachutes are effective in encouraging firm-specific human capital investment, why would a buyer discharge the managers with supposedly valuable firm-specific skills once the firm is taken over? Furthermore, why should such payments be contingent on change of control, as opposed to layoff or retirement? In fact, many executive managers stay in the merged firms, even after they receive golden parachute payments.5 Lastly, if golden parachutes are used as a bribe to managers not to block value-enhancing takeovers, they seem to create a wrong kind of incentive for the managers to seek potentially value-reducing takeovers simply to trigger golden parachutes. Especially if the target shareholders can distinguish between good and bad takeovers, a potential buyer can use other mechanisms, such as public tender offers, that do not deal directly with the hostile management.

Recent evidence on golden parachutes is illuminating.6 First, golden parachutes are being offered to a bigger pool of executives and lower level managers. While they had been used almost exclusively for the top executives in the past, granting golden parachutes to other, lower-ranking executives (known as silver parachutes), and even lower level employees (known as tin parachutes)7 has become quite common. Second, golden parachutes are being granted often at the signing of the managers' employment contracts and, thus, well before the possibility of a takeover or a merger. If golden parachutes are being used to bribe the managers not to block value-enhancing takeovers, selective adoption of golden parachutes in the presence of a takeover attempt, as opposed to such blind adoption, seems to fit the story much better. Third, they are often accompanied by other incentive schemes, such as performance bonuses and stock

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4 See Choper, et.al. (2000) at 148-149. See also Easterbrook and Fischel (1981) at 1175.

5 See infra note 6.

6 See Lefanowicz, et. al. (2000) for the most recent survey over golden parachutes. Another important observation is that in more than 30% of acquisition cases with golden parachutes, executive managers stay with the merged companies after they receive golden parachute payments. Id. at 222. This seems to, at least partially, undermine the firm-specific investment rationale. But it is consistent with our story, where the target shareholders would be indifferent between the managers' staying at or leaving the merged firm.

7 For an extensive discussion over tin parachutes, see Ryan (1989). Herman Miller, an office furniture manufacturing company, for example, guarantees lump sum payment within ten days of termination to all employees with at least two years of service. Id. at 18. Similarly, Mobil Corporation doubles the severance payments for all of its employees in case of a hostile acquisition. Id.
options. If golden parachutes encourage executives to put less effort into improving corporate performance, provision of a separate incentive scheme seems contradictory.

This paper attempts to explain these empirical observations and to provide a rationale on why shareholders would willingly adopt golden parachutes, especially in conjunction with other incentive schemes. It argues that golden parachutes can be used simply to increase the shareholders’ reservation value of the company and to extract a higher takeover bid.\(^8\) Shareholders adopt golden parachutes to shift the burden of managerial compensation to the buyer. Once adopted, the shareholders can reduce the managers’ compensation in non.Takeover state, and this will increase their net value of the company.\(^9\) While reducing the managers’ no.Takeover state compensation benefits the shareholders dollar-for-dollar, increasing the size of the golden parachute is partly born by the buyer through a higher bid price. In short, even without any concern over firm-specific human capital or managerial resistance to value-enhancing merger, golden parachutes have a “neutral” objective of increasing the (potential) target shareholders’ bargaining power. And lastly, because the target shareholders enjoy the immediate benefit of golden parachute through lower managerial compensation, they would not care whether the managers would be retained or laid off after the takeover.

The paper is organized as follows. In the next section, a simple, numerical example is presented to present the main idea in the simplest terms. In the following section, the legal status of the golden parachutes is discussed with an eye toward providing a better policy analysis toward golden parachutes. In section four, an analytical model is developed to more rigorously support the initial findings. The last section concludes with some ideas for future research.

### 4.2 A Simple Example

Suppose a firm consists of one shareholder and one manager. There are two earnings (valuation) scenarios for the firm. When the firm does well, its earnings equals $500 million (\(x_h\)), but when it performs poorly, it only generates $100 million (\(x_l\)). Depending on the earnings, the firm’s stock price will be determined, and when the firm’s stock price is low, it would be cheaper for a potential bidder to acquire the firm. For the sake of simplicity, let’s assume that in the low earnings state, there is 10% (\(q\)) chance of a takeover attempt, while when the firm does well, the chance of takeover is zero. So, the low earnings state is divided further into takeover and no.Takeover sub-scenarios. This implies that the potential bidder’s valuation (\(v\)) of the company falls somewhere in between the firm’s high and low values (\(x_h > v > x_l\)). In the full model, we will relax this assumption and allow the possibility of a takeover in both states of the world.

---

\(^8\)The only model that proposes the golden parachute’s role in increasing bargaining power is that by Harris (1990). However, he proposes that anti.Takeover measures increase the managers’ bargaining power, while golden parachutes work as an adjustor. Thus, the use of golden parachute seems ancillary, if not unnecessary, for enhancing the bargaining power.

\(^9\)See Lambert and Larcker (1985) at 192. They report that there is a 1%, statistically significant, positive stock price response to the announcement of golden parachutes. Although their empirical finding must be filtered through the possibility of takeover signalling through the adoption of golden parachute, it is still consistent with our model.
The manager’s secure outside option is $1 million (= w),¹⁰ and suppose, for simplicity, that she must be guaranteed of $1 million compensation, in expectation, when the firm is in the low earnings state. However, since there is a possibility of a takeover, she can be compensated differently, i.e., the shareholder can grant her a golden parachute in case of a takeover. Suppose that when there is no takeover, she is paid $s_l$, while if there is a takeover, golden parachute is triggered and her compensation is $s_t$. To satisfy her outside option ($w$) in expectation, therefore, her compensation has to satisfy

$$q \cdot s_t + (1 - q) \cdot s_l \geq w,$$

or, $(0.1) \cdot s_t + (0.9) \cdot s_l \geq $1 million. Because the shareholder does not want to pay her a dollar more than necessary, the compensation condition will be satisfied with equality: $q \cdot s_t + (1 - q) \cdot s_l = w$.

Now, let us analyze the optimal compensation contract in the low earnings state, $\{s_l, s_t\}$. Let $x_t$ be the bid to buy the company from the emerged buyer, which the shareholder can either accept or reject the bid. If the shareholder accepts the bid, his gain is equal to $x_t - s_t$, while if he rejects, his net gain is $x_l - s_l$. In other words, in order for him to accept the bid, his gain under takeover must be higher than that under no takeover:

$$x_t - s_t \geq x_l - s_l.$$  

This can be rewritten as $x_t \geq x_l - s_l + s_t$. We can already see that the larger the golden parachute, the higher the takeover bid has to be for the target shareholder to accept the bid. Also, the more the shareholder pays the executive in case of no takeover, the lower the takeover bid. In short, the shareholder has an incentive to increase the golden parachute ($s_t$) and decrease the manager’s pay in case of no takeover ($s_l$) as much as possible.

From the compensation condition, $q \cdot s_t + (1 - q) \cdot s_l = w$, we again see that the size of golden parachute is inversely related to the size of compensation in case of no takeover. The more the shareholder pays the executive in case of takeover, the less he can pay when takeover does not occur. The relation can be rewritten as

$$s_t = \frac{1}{q} w - \frac{1 - q}{q} s_l.$$

Suppose the shareholder sets $s_l = $0. Then, the size of golden parachute is given by $s_t = \frac{1}{q} w$, or $s_t = $10 million. Now, the bid has to satisfy $x_t \geq $110 million (from $x_t \geq x_l + s_t$), since otherwise, the shareholder will not accept the bid. For comparison, suppose the shareholder does not grant any golden parachute and sets $s_t = s_l = $1 million. Then, from $x_t - s_t \geq x_l - s_l$, the takeover bid merely has to satisfy $x_t \geq $100 million. By granting $10 million golden parachute, therefore, the shareholder just increased the minimum takeover bid by $10 million.

From the shareholder’s net return perspective, golden parachute has a definite advantage.

¹⁰Among the firms that are taken over, the average size of golden parachutes, just for the top executives, is about 2% of the pre-takeover market value of the company, while the highest is more than 20%. See Lefanowicz, et. al. (2000) at 228.
Under no golden parachute \( (s_t = s_T = $1 million) \), because the bid only needs to be more than \$100 million, the shareholder’s (minimum) net return from takeover is \$99 million \( (= $100 \text{ million} - $1 \text{ million}) \). However, under \$10 million golden parachute, the bid has to be higher than \$110 million for the shareholder to accept the bid, and his net return is at least \$100 million \( (= $100 \text{ million} - $0) \). In short, by granting a golden parachute, the shareholder can lower the manager's compensation in case of no takeover and increase his reservation value of the company: he shifts the burden of managerial compensation to the bidder by increasing the bid and reducing the bidder's net gain from the acquisition. Meanwhile, since the takeover is not a certain event, the size of golden parachute will be determined by the probability of a takeover. As the takeover becomes more unlikely, the relative size of the golden parachute will be bigger. For example, if the probability of a takeover is 20%, the shareholder would grant \$5 million golden parachute, instead. As the takeover becomes less likely, the relative size of the golden parachute increases.

There are a few straightforward implications from this example. First, as the company's valuation gets lower, the golden parachute becomes more powerful. If the earnings are \$50 million, instead of \$100 million, the golden parachute still increases the shareholder’s absolute return by \$1 million, a higher return in percentage terms. As observed in the empirical literature, therefore, companies with a higher risk (more likelihood of facing a worse earnings outcome) should be more willing to adopt golden parachutes.\(^{11}\) The same effect appears as the executive’s outside option increases. When her outside option is \$2 million, the shareholder’s return from takeover becomes \$101 million. A simple extension of this is that the real world shareholders have an incentive to grant golden parachutes not just to the chief executive officer, but also to other top level officers (and possibly the lower level employees) so as to increase the leverage power.\(^{12}\)

Third, in our example, the golden parachute is ten times the “normal” salary for the executive, and as the probability of a takeover decreases, the relative size of the golden parachute becomes larger. The example is roughly consistent with real world golden parachutes that are several times larger than the executives’ annual compensation. At the same time, however, the executive, in expectation, is not earning a penny more than her outside option. Granting a large golden parachute does not necessarily imply that an executive is making a windfall, and to properly value the compensation, we must take into account of her non-takeover compensation, as well. Lastly, the example mentions nothing about whether the agent will be laid off after the merger, and in fact, the shareholder cares less about the status of the agent’s post-merger employment. The golden-parachute triggering event is the change-of-control of the company instead of the executive’s lay-off, and granting golden parachute to an executive who would stay on the merged company is not necessarily inconsistent with the target shareholder’s value maximization.\(^{13}\)

\(^{11}\)See Lefanowicz, et. al. (2000) at 238, Table 5. Firms with golden parachutes have a statistically significant, higher variation in market values than those without.

\(^{12}\)By the early 1990s, about 88% of the firms that are taken over granted golden parachutes to both the chief executive officer and at least four other executive officers. Id. at 221.

\(^{13}\)See supra note 6.
4.3 Legal Analysis of Golden Parachutes

Golden parachutes, when considered as part of an executive compensation policy, falls within the purview of duty of loyalty doctrine, and may invoke the protection of business judgment rule from the court.\textsuperscript{14} In general, the business judgment rule states that the court would defer to the good faith business judgment of the board of directors, unless there is evidence of fraud, bad faith, or abuse of discretion by the board. For a plaintiff to successfully challenge the protection of the rule, she must either convince the court that there was no rational basis for the board’s decision or produce a sufficient evidence of self-dealing in the transaction. Once she is successful in her claim, the burden of proof shifts to the defendant, who now has to show that the transaction was “fair and reasonable to the corporation.”\textsuperscript{15}

Under the current legal standard, therefore, it would seem hard to challenge a golden parachute, when it is set by a board consisting of disinterested outside directors, after a reasonable investigation, and based on the board’s good faith judgment.\textsuperscript{16} On the other hand, business judgment rule, however generous its protections are, is not a rubber stamp provision. Even after the presumption in favor of the transaction is established, if the court finds the transaction a “corporate waste” without “adequate consideration,”\textsuperscript{17} the court may still invalidate the transaction as a breach of fiduciary duty. In the case of golden parachutes, adequate consideration would require that the size of a golden parachute must bear some relation to the value of service performed by its beneficiary.

As our example demonstrates, however, the size of a golden parachutes may have little bearing on the amount of service performed by the manager. When it is used as a bargaining device by the target shareholders, its size is determined by two factors: the size of the manager’s “normal” salary (w) and the probability of a takeover (q). The first element bears some relation to the adequate consideration requirement, in that, when the manager faces a reduced salary due to a golden parachute, the parachute is, in some sense, being paid in return for the service performed.\textsuperscript{18} On the other hand, because the size of the golden parachute is also influenced by the probability of a takeover, it may bear no relation to the service performed by the manager. Our model implies that the shareholders would mitigate the manager’s under-effort problem through other incentive devices, so that the takeover occurs because of earnings risk beyond the manager’s control. When a golden parachute is thus adopted as a bargaining chip by the shareholders, the court’s striking it down as a corporate waste could potentially cause more harm to the shareholders.

\textsuperscript{14}See Coffee, et. al. (2000) at 148-49, Bress (1987), Johnsen (1985), and Ryan (1989) for legal analyses on golden parachutes. See Coffee, et. al. (2000) at 318-19 and Carney (2000) at 66-73 for a background analysis on business judgment rule. Some also argue that golden parachutes must also be examined as the target firm’s defensive strategy against a hostile raider. In Delaware, for example, such defensive tactic must pass the mid-level scrutiny adopted in \textit{Unocal v. Mesa Petroleum}, where the tactic must also be proportional to the takeover threat posed. Coffee, et. al. (2000) at 149.


\textsuperscript{16}Ryan (1989) at 29-30.


\textsuperscript{18}Note that the parachute’s size is independent of the amount of effort exerted by the manager, which is a better gauge of the amount of service performed than the manager’s outside option.
The judicial review notwithstanding, the most effective regulation of golden parachutes is implemented by the federal legislature through the tax code. In 1984, Congress adopted punitive tax provisions against golden parachutes, partly in response to a public outcry over large severance payments. In the newly adopted section 280G of the Internal Revenue Code, an “excess parachute payment” is defined as that in excess of three year’s compensation for an executive. If a parachute falls within the excess category or is more than $1 million in absolute size, the code presumptively denies the employer the tax deduction for the payment, and to successfully challenge the loss of tax deduction, the employer must show that the payment was reasonable. Furthermore, an excess parachute payment is subject to 20% excise income tax when received by the beneficiary.

Although the possible benefits of a bright-line rule provided by the tax code may be difficult to argue, our example demonstrates that the size of a golden parachute, determined by the probability of a takeover, may be much larger than three times the manager’s salary. Also, when the shareholders implement a golden parachute to defer manager’s compensation, she receives no more rent than in the case without a golden parachute. Punitive taxation over large golden parachutes, therefore, may reduce the target shareholders’ welfare without limiting the size of the manager’s rent, when the primary purpose of a golden parachute is to increase the shareholders’ bargaining position. From an empirical point of view, since the shareholders would reduce the manager’s compensation ($s_t$) in case of no takeover, the relative size of a golden parachute ($s_t/s_t$) would seem even larger, putting further restraint on the shareholders’ ability to control the manager’s compensation.

Given the danger of inefficient preemption, how would one distinguish a shareholder-oriented golden parachute from that used to further managerial rent extraction? Our example indicates that the former bears some distinctive characteristics. First, the parachute is adopted at the signing of a compensation contract and in conjunction with other incentive schemes. The presence of other schemes is an indication that a perverse incentive is being prevented, and the simultaneous adoption implies that the parachute is not being offered for non-bargaining or non-deferral purposes. Second, the parachute is voluntarily adopted by the shareholders. More generally, there should be no indication that the manager is controlling the compensation scheme. Third, perhaps the most important, the manager with a golden parachute has a steeper, and lower in average, incentive compensation than the one without. This results directly from deferring of the compensation and is most indicative of minimizing the executive’s rent from the company.

From the regulatory perspective, when a golden parachute is adopted as a part of an overall compensation scheme, more subtle judicial review and less punitive taxation may be justified.

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21 According to Coffee, such provisions provide a “bright-line standard that few boards will be willing to cross.” Coffee (1986) at 78. However, according to Carney, the tax provision produced only a “limited effect” on the size of golden parachutes. He cites a few post-statute cases, including the case of RJR Nabisco, where the chief executive officer, the vice chairman, and the vice president of the company received over $53 million, $45 million, and $18 million, respectively, following a leveraged buyout. Carney (2000) at 123. He further notes that many companies are required to increase the size of golden parachutes so as to cover the executives’ tax burden. Id. at 124.
Once the above distinguishing characteristics are identified, the administrative body or the
court may make a determination to waive the punitive measures against the golden parachute.
Such flexible approach to golden parachutes can increase the shareholders' welfare by allowing
more freedom in designing compensation contracts and improving their bargaining positions,
while minimizing excessive managerial rent seeking.

4.4 The Model

Our firm consists of one risk-neutral principal (target shareholder) and one risk-averse agent
(manager). There are two (verifiable) cash flow states of the world for the firm \( x \in \{x_h, x_l\} \)
where \( x_h > x_l \). Probability of attaining the high state of the world is determined by the
(unobserved) effort level of the manager. The manager can choose from either low or high
level of effort \( (e \in \{e_h, e_l\}) \) and while the high level of effort is more costly for the manager
\( (e_h > e_l > 0) \), it makes the high cash flow state more likely. In notation, let \( p_i \equiv \text{prob}(x = x_i|e_i) \)
where \( i \in \{h, l\} \), such that \( 0 < p_l < p_h < 1 \). Conditional on the effort level, the total expected
return of the firm is given by \( E(x|e_i) = p_i \cdot x_h + (1 - p_i) \cdot x_l \) where \( i \in \{h, l\} \). Since \( p_h > p_l \),
\( E(x|e_h) > E(x|e_l) \). Assume that \( E(x|e_h) - e_h > E(x|e_l) - e_l \), so that it is efficient for
the principal-agent duo that the agent puts in the high level of effort.

The manager’s expected utility is determined by the level of effort chosen by the manager
and the expected compensation:

\[
U_A(e, s) = p_i \cdot u(s_h) + (1 - p_i) \cdot u(s_l) - e_i.
\]

\( s_j \), where \( j \in \{h, l\} \), denotes managerial compensation given the realized cash flow state of the
world. While the manager prefers to receive more than less, she is also risk averse: utility function is increasing
and concave with respect to compensation, i.e., \( u' > 0 \) and \( u'' < 0 \). We will impose limited liability condition on the manager, or \( s_j \geq 0 \ \forall j \), so the principal cannot
take away money from the manager. The manager also has a secure outside option of \( \bar{U} \), so
the manager’s compensation, in expectation, must at least match the outside option.

On the other hand, risk-neutral principal maximizes the expected profit minus the compensa-
tion:

\[
U_P(x, s) = p_i \cdot (x_h - s_h) + (1 - p_i) \cdot (x_l - s_l).
\]

In this simplified world, the only input into the firm’s production is the manager’s effort and
because the compensation comes from the company’s realized revenue, the principal wants
to minimize the managerial compensation. In sum, after the compensation contract \( (s = \{s_h, s_l\}) \) is signed, the manager puts in unobservable level of effort, the principal and the agent
become aware of which state of the world they are in, and finally, cash flow comes in and the
compensation is made.

To incorporate the takeover possibility,\(^{22}\) suppose that after the cash flow state is known but

\(^{22}\) Throughout the paper, we will refer all types of sale of the company as a takeover. Takeover, thus, includes
both hostile and friendly acquisitions.
before the compensation is paid out, a buyer appears with a positive probability.\textsuperscript{23} Conditional on the cash flow state of the firm, let the probability of buyer's emergence be $0 < q_i < 1$ where $i \in \{h, l\}$. We will not assume that the buyer is more likely to appear in either of the state $(q_h \geq q_l)$.\textsuperscript{24} but assume that the buyer's valuation ($v$) is sufficiently high ($v \gg x_h$) so that once the buyer appears, the buyer will take over the firm after a negotiation with the target shareholder. In such light, we can interpret $q_i$ to be the probability of the emergence of a buyer who the target shareholder (and the board) would approve and $v$ to be that buyer's expected valuation for the firm. We also assume that the buyer is aware of the compensation contract and the cash flow state of the company,\textsuperscript{25} i.e., the buyer has the same information as the target shareholder.

Given the possibility of a takeover, the shareholder can further tailor the compensation for the manager; the takeover provides another contractible event. Let $\{x_i^t, x_h^t\}$ be the respective takeover price and $\{s_i^t, s_h^t\}$ be respective takeover-related compensation for the manager. For example, in the high cash flow state, if the company is sold to the buyer, the buyer pays $x_h^t$ to the shareholder while the shareholder pays $s_h^t$ to the manager. The shareholder's net return in that case is $x_h^t - s_h^t$. If the takeover does not occur, the shareholder simply receives the high cash flow of $x_h$, out of which $s_h$ is paid to the manager. The manager's and the shareholder's respective expected utilities, therefore, become

$$U_A(e, s) = p_i\{(1 - q_h)u(s_h) + q_hu(s_h^t)\} + (1 - p_i)\{(1 - q_l)u(s_l) + q_lu(s_l^t)\} - c_i,$$

and

$$U_P(x, s) = p_i\{(1 - q_h)(x_h - s_h) + q_h(x_h^t - s_h^t)\} + (1 - p_i)\{(1 - q_l)(x_l - s_l) + q_l(x_l^t - s_l^t)\}.$$ 

Note that if we preclude the possibility of a takeover, or set $q_h = q_l = 0$, we simply come back to the original problem.

The takeover prices, $\{x_i^t, x_h^t\}$, are determined through Nash bargaining, so that if $R_i$ is the target shareholder's reservation price in the $i$ cash flow state, $x_i^t = \delta \cdot v + (1 - \delta) \cdot R_i$ where $0 < \delta < 1$. To determine the target shareholder's reservation price, we must consider the compensation for the manager. Suppose the firm is in the low cash flow state. If the shareholder rejects the takeover bid, he expects to receive $x_l - s_l$ whereas if he accepts the bid, he receives $x_l^t - s_l^t$. In order for the shareholder to agree to the acquisition, we need

\textsuperscript{23}The assumption that the buyer emerges after the parties become aware of the cash flow state but before the cash flows are realized would seem restrictive. If we instead set $q_h = q_l$ and make the takeover price ($x^t$) and compensation ($s^t$) independent of the cash flow state, we can reflect the possibility that the buyer appears before they become aware of the cash flow state. This would simply impose additional restrictions without changing the main result.

\textsuperscript{24}On the one hand, since no fundamental nature of the firm has changed, when the stock price is lower, it should be easier to find a buyer, i.e., $q_i > q_0$. On the other hand, the fact that the firm is in the higher cash flow state may imply that the firm is deemed more valuable from the potential buyer's perspective, $q_i < q_0$. It is uncertain, a priori, which case would hold, and we entertain both possibilities.

\textsuperscript{25}Since this is not a story of managerial shirking, the motive of takeover can be best thought of as to take advantage of some other, e.g., synergistic or monopolistic, gains.
\[ x^*_t - s^*_t \geq x_t - s_t \text{ or } x^*_t \geq x_t - s_t + s^*_t, \] which implies that \( R_t = x_t - s_t + s^*_t. \) Similarly, we get \( R_h = x_h - s_h + s^*_h. \) We can already see that the target shareholder has an incentive to lower the non-takeover compensation, \( \{s_t, s_h\}, \) and increase the takeover compensation, \( \{s^*_t, s^*_h\}, \) to boost his reservation price and increase the takeover premium. Since the reservation price is determined by the shareholder’s net return, lowering the non-takeover compensation decreases the wage bill and increases the shareholder’s net value of the company. Similarly, increasing the takeover compensation would impose a cost on the target shareholder in case of a takeover, so that the premium needs to be larger to cover such cost.

In summary, the timing of the model is that at \( t = 1, \) compensation contract is signed, at \( t = 2, \) manager exerts unobservable effort, at \( t = 3, \) the cash flow state of the world realizes, at \( t = 4, \) buyer appears with some positive probability, and at \( t = 5, \) takeover occurs if the shareholders accept the bid and cash out. The compensation can depend on both the cash flow state of the firm and whether or not the firm is sold to the buyer.

### 4.4.1 When Takeover is Impossible: Benchmark

Suppose there is no takeover possibility, or \( q_h = q_t = 0. \) At the contracting period, assuming that the principal wants the manager to exert high level of effort, principal maximizes

\[
U_P(x, s) = p_h \cdot (x_h - s_h) + (1 - p_h) \cdot (x_t - s_t)
\]

subject to

\[
p_h \cdot u(s_h) + (1 - p_h) \cdot u(s_t) - e_h \geq \bar{U} \quad (IR^o)
\]

and

\[
p_h \cdot u(s_h) + (1 - p_h) \cdot u(s_t) - e_h \geq p_t \cdot u(s_h) + (1 - p_t) \cdot u(s_t) - e_t. \quad (IC^o)
\]

The first constraint tells us that the manager’s compensation, in expectation, must be higher than her outside option for her to sign the contract, and the second condition provides the incentive for the manager so that she would rather exert high than low level of effort. At optimum, since the principal is unwilling to pay a dollar more than necessary and unwilling to impose unnecessary risk on the manager, both constraints will bind. If we let \( \{s^*_h, s^*_t\} \) be the optimal compensation contract, then the contract satisfies the following two conditions:

\[
u(s^*_h) - u(s^*_t) = \frac{e_h - e_t}{p_h - p_t}
u(s^*_t) = \bar{U} + e_h - p_h \cdot \frac{e_h - e_t}{p_h - p_t}.
\]

Suppose it is in the principal’s interest to induce high level of effort from the manager, i.e.,

\[
p_h \cdot (x_h - s_h) + (1 - p_h) \cdot (x_t - s_t) > p_t \cdot x_h + (1 - p_t) \cdot x_t - \bar{U}.
\]

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A slight rearrangement of the equality conditions render

\[ u(s^0_l) = (\bar{U} + e_h) - p_h \cdot \frac{e_h - e_l}{p_h - p_l}, \]
\[ u(s^0_h) = (\bar{U} + e_h) + (1 - p_h) \cdot \frac{e_h - e_l}{p_h - p_l}. \]

Since \( u' > 0, s^0_h > s^0_l \) so that the agent bears some risk associated with the performance of the firm.\(^{26}\) For the sake of simplicity, we will assume that \( \bar{U} \) is sufficiently high so that \( s^0_l \) is sufficiently greater than zero. The following lemma formally proves the optimal compensation schedule.

**Lemma 1** In the absence of a takeover possibility, at optimum, both IR and IC constraints will bind.

### 4.4.2 When Takeover is Possible

Coming back to the general case, when takeover is allowed, the shareholder maximizes

\[ U_P(x, s) = p_h \{(1 - q_h)(x_h - s_h) + q_h(x_h - s_h^l)\} + (1 - p_h)\{(1 - q_l)(x_l - s_l) + q_l(x_l^l - s_l^l)\} \]

subject to

\[ p_h \{(1 - q_h) \cdot u(s_h) + q_h \cdot u(s_h^l)\} + (1 - p_h)\{(1 - q_l) \cdot u(s_l) + q_l \cdot u(s_l^l)\} - e_h \geq \bar{U} \quad (IR') \]

\[ p_h \{(1 - q_h) \cdot u(s_h) + q_h \cdot u(s_h^l)\} + (1 - p_h)\{(1 - q_l) \cdot u(s_l) + q_l \cdot u(s_l^l)\} \geq p_l\{(1 - q_h) \cdot u(s_h) + q_h \cdot u(s_h^l)\} + (1 - p_l)\{(1 - q_l) \cdot u(s_l) + q_l \cdot u(s_l^l)\} - e_l. \quad (IC') \]

Since the shareholder can always set \( s_h = s_h^l \) and \( s_l = s_l^l \), he still has an incentive to encourage the manager to exert high level of effort. Further, because leaving extra rent and imposing unnecessary risk on the agent is costly to the principal, both constraints would bind again. If we let \( \{s_h, s_l^l, s_h^l, s_l^l\} \) be the optimal compensation contract, we must have

\[ (1 - q_l) \cdot u(s_l^l) + q_l \cdot u(s_l^l) = (\bar{U} + e_h) - p_h \cdot \frac{e_h - e_l}{p_h - p_l}, \]
\[ (1 - q_h) \cdot u(s_h^l) + q_h \cdot u(s_h^l) = (\bar{U} + e_h) + (1 - p_h) \cdot \frac{e_h - e_l}{p_h - p_l}. \]

Irrespective of the takeover possibility, the manager receives, on average, no more than her outside option.

Furthermore, because the manager’s expected compensation (the right hand side) is “fixed,” takeover and non-takeover compensation would be inversely related. When the shareholder in-

\(^{26}\)As is well known, the agent’s bearing of some risk implies inefficiency, since at optimum, all risk should be born by the risk-neutral principal.
creases the takeover compensation, the non-takeover compensation should decrease accordingly, and vice versa. The question of whether the takeover compensation would indeed be higher than the non-takeover compensation can be resolved by looking at the takeover premium. As we saw before, when the shareholder decreases non-takeover compensation, the shareholder’s net return on the company in the absence of a takeover \((x_l - s_l)\) increases. Since the shareholder expects to receive a larger net return from the company without the takeover, in order for the buyer to successfully convince the shareholder to sell the company, the takeover premium needs to be larger. Thus, the shareholder has an incentive to decrease the non-takeover compensation, which in turn, implies giving more to the manager in case of a takeover, or granting a golden parachute. The following proposition proves this point more formally.

**Proposition 11** At optimum, \(s_h^* > s_h > s_h^\prime\) and \(s_l^* > s_l > s_l^\prime\). The target shareholder always grants larger takeover compensation, a golden parachute, to the manager.

One interesting note about the result is that the shareholder has an incentive to grant golden parachute, even though such compensation comes fully from his pocket. If the shareholder is reducing the non-takeover compensation for a higher takeover compensation, isn’t he simply switching from one kind of compensation to another? The answer again lies in how the compensation affects the takeover premium. For example, when the firm is in high cash flow state, when we rearrange the expression \(x_l' = \delta v + (1 - \delta) R_h\), we get \(x_l' = \delta v + (1 - \delta)(x_h - s_h) + (1 - \delta)s_h^\prime\). Thus, while the takeover compensation is fully funded by the target shareholder, its cost is partially \(((1 - \delta)\) fraction) born by the buyer through a higher takeover premium. At the same time, increasing the non-takeover compensation has become more costly for the shareholder, because higher non-takeover compensation will reduce the takeover premium and the shareholder’s net return in case of a takeover. In short, the possibility of a takeover has made non-takeover compensation more costly and takeover compensation relatively less costly. Naturally, the shareholder would more heavily utilize the cheaper method of compensation.

**Corollary 6** At optimum, \(s_h^* > s_l^*\) but \(s_h^\prime \leq s_l^\prime\). While the size of the golden parachute will be sensitive to the performance of the company, the relative size of the non-takeover compensation will depend on the relative probabilities of a takeover.

When the chances of a takeover is high, the target shareholder will decrease the non-takeover compensation more since increasing the takeover premium becomes more important. This implies that even if the expected compensation for the manager is higher when the company performs well, when the chances of a takeover is sufficiently high, the non-takeover compensation could be so low that it may actually be below the non-takeover compensation when the company performs poorly, i.e., \(s_l^\prime < s_l^\prime\). In short, when the target shareholder grants a golden parachute, the non-takeover compensation can be less sensitive, or even inversely related, to the performance of the company.

This result poses a couple of suggestions to the conventional understanding of executive compensation. Foremost, when golden parachute is analyzed independent of the performance-related incentive system, the fact that the non-takeover compensation is insensitive, or inverse,
to the performance of the company and the manager is receiving a large golden parachute strongly implies managerial capture, or a serious agency problem. But in fact, most of the true variation in the compensation is stemming from the golden parachute, and the "degree" of incentive alignment is as strong as ever. Furthermore, if we are trying to measure the sensitivity of the compensation to the firm's performance, or the strength of the incentive system, we should take the takeover-related compensation into account. Observation of an insensitive compensation plan does not necessarily imply lack of incentives.

4.4.3 Some Comparative Statics Results

The relative size of the golden parachute should depend on the relative bargaining strength (δ) of the target shareholder. From the takeover price equation in the high cash flow state, \( x_h^t = \delta v + (1 - \delta) (x_h - s_h + s_h^t) \), when δ is close to 1, or when the target shareholder grabs most of the surplus from the takeover, the takeover premium is determined largely by the buyer's value (v) of the company. The takeover premium depends much less on the size of the takeover compensation, and hence the shareholder would have less of an incentive to grant a golden parachute and shift the compensation burden to the buyer. On the other hand, when the shareholder has relatively weak bargaining power, or δ is close to 0, the takeover premium is more sensitive to the size of the golden parachute. The shareholder would be more willing to shift the compensation burden to the buyer through a golden parachute.

Proposition 12 As δ increases, \( \{s_h^t, s_i^t\} \) increase while \( \{s_h^t, s_i^t\} \) decrease. As the target shareholder's bargaining power increases, the size of the golden parachute decreases while the level of non-takeover compensation increases.

Similar results obtain as the probability of a takeover changes. At optimum, we know that the manager's expected returns in either high or low cash flow states are fixed. When the takeover is very likely, because the bulk of the manager's compensation comes from the golden parachute, the shareholder can reduce the manager's non-takeover compensation further so as not to over-compensate the manager. Conversely, when the takeover is very unlikely, takeover compensation means little to the manager, so the target shareholder must compensate the manager more generously in the no takeover stage. Empirically, therefore, the level of managerial compensation of a firm that is a likely takeover target should be lower than that of a firm which is unlikely to be a takeover target.

Proposition 13 As \( q_t \) increases, \( s_t \) decreases \( \forall i \). As takeover becomes more likely, the manager's non-takeover compensation decreases.

4.5 Concluding Remarks

We presented a simple model of golden parachutes that does not depend on the traditional rationales of either firm-specific human capital investment or bribery payment but provides empirically consistent implications. The gist of the model is that when shareholders grant
golden parachutes to their managers, they can lower the managers' compensation in case there is no takeover and thus increase their residual gain from the company. Golden parachutes immediately shift the burden of executive compensation to an unidentified buyer. When the buyer appears, the parachutes function as a tax mechanism and create a wedge between the buyer's and the shareholders' valuations of the company. The bid price has to increase to cover not only the higher reservation value of the target shareholders but also the managers' severance payments. Thus, while golden parachutes may be ineffective in preventing takeovers, they function as a bargaining chip, at the margin, for the target shareholders.

The model predicts that because the takeover is an uncertain event at the point of adoption of the parachutes, their size need to be larger than the managers' average compensation to provide enough compensation (in expectation) to the managers. Further, not only would target shareholders adopt golden parachutes well in advance of the emergence of a buyer, they would have an incentive to expand the scope of parachute coverage, possibly even to the employees who need no protection of firm-specific human capital and play no role in the merger process. Although the observed size of executive compensation compared to the market value of a company may be small, to the extent that managerial compensation is a burden to the shareholders, golden parachutes can be used to shift that burden to the buyer. In such sense, golden parachutes are a deferred payment scheme for the managers, except that the managers are being compensated not for their lost earnings after the takeover but for the lower earnings they make before the buyer appears.

Furthermore, because the golden parachute trades off with the pre-takeover compensation, shareholders would care less about whether the managers would be retained or laid off through the merger. Given that a sizable portion of executives stay within the merged company, our model predicts that granting a large golden parachute to such executives can still be consistent. Lastly, when a golden parachute is adopted, the sensitivity of the manager's compensation to the firm's performance can be lower than the case when there is no golden parachute. Therefore, observing only the non-takeover related compensation may be misleading, since the bulk of the incentive can be provided through takeover related compensation, possibly leaving the non-takeover related compensation quite insensitive to the firm's performance. In fact, granting a large golden parachute (that positively varies with the takeover price) in conjunction with a non-takeover compensation scheme that is relatively immune from the change in the firm's performance measures can still be consistent with shareholder wealth maximization.

Lastly, because the golden parachute is used to increase the shareholder's net value of the company, as soon as it is adopted, the stock price of the company would jump to reflect the higher net value. Given the potential buyer's value of the company, this implies that at the time of the takeover, the size of the premium would be smaller. Thus, if we simply look at the size of the golden parachute and the size of the takeover premium, we could interpret the golden parachute to have "caused" the lower takeover premium for the company, due, for example, to the manager's being too eager to sell the company to receive the large payment. However, the causation is flowing from the target shareholders' attempt to defer managerial compensation and increase the reservation value of the company. Because the shareholders immediately benefit from the contract through a higher net value, the correct measure of the takeover premium must include the post-contract increase in stock price as well.
Proofs

**Proof of Lemma 1.** The Lagrangian of the maximization problem is

\[
L = p_h(x_h - s_h) + (1 - p_h)(x_l - s_l) + \lambda \left[ p_h u(s_h) + (1 - p_h)u(s_l) - e_h - \overline{U} \right] \\
\quad + \mu \left[ (p_h - p_l) \{ u(s_h) - u(s_l) \} - (e_h - e_l) \right]
\]

with the multiplier restrictions of \( \lambda, \mu \geq 0 \).

The first order conditions are

\[
\frac{\partial L}{\partial s_h} = -p_h + \frac{du}{ds_h} (\lambda p_h + \mu (p_h - p_l)) = 0 \\
\frac{\partial L}{\partial s_l} = -(1 - p_h) + \frac{du}{ds_l} (\lambda (1 - p_h) - \mu (p_h - p_l)) = 0,
\]

which imply

\[
u' (s_h) = \frac{p_h}{\lambda p_h + \mu (p_h - p_l)} \\
u' (s_l) = \frac{(1 - p_h)}{\lambda (1 - p_h) - \mu (p_h - p_l)}.
\]

To verify that the both constraints bind, when the two conditions are rearranged,

\[
\lambda p_h + \mu (p_h - p_l) = \frac{p_h}{u'(s_h)} \\
\lambda (1 - p_h) - \mu (p_h - p_l) = \frac{(1 - p_h)}{u'(s_l)},
\]

so that

\[
\lambda = \frac{p_h}{u'(s_h)} + \frac{(1 - p_h)}{u'(s_l)} \\
\mu = \frac{p_h (1 - p_h)}{p_h - p_l} \left( \frac{1}{u'(s_h)} - \frac{1}{u'(s_l)} \right).
\]

By definition, \( \lambda > 0 \). Now, suppose \( \mu = 0 \). Then, we must have \( u'(s_h) = u'(s_l) \), or \( s_h = s_l \).

When plugged into the IC constraint, we get \( u(s_h) - e_h \geq u(s_h) - e_l \), which is a contradiction. Therefore, \( \mu > 0 \). □

**Proof of Proposition 11.** The Lagrangian of the maximization problem is

\[
L = p_h \{ (1 - q_h)(x_h - s_h) + q_h (x_h^t - s_h^t) \} + (1 - p_h) \{ (1 - q_l)(x_l - s_l) + q_l (x_l^t - s_l^t) \} \\
\quad + \lambda \left[ p_h \{ (1 - q_h) \cdot u(s_h) + q_h \cdot u(s_h) \} + (1 - p_h) \{ (1 - q_l) \cdot u(s_l) + q_l \cdot u(s_l) \} - e_h - \overline{U} \right] \\
\quad + \mu \left[ (p_h - p_l) \{ (1 - q_h) \cdot u(s_h) + q_h \cdot u(s_h) \} - (p_h - p_l) \{ (1 - q_l) \cdot u(s_l) + q_l \cdot u(s_l) \} - (e_h - e_l) \right]
\]

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with the multiplier restrictions of $\lambda, \mu \geq 0$.

The first order conditions with respect to $\{s_h, s_h^t, s_t, s_t^t\}$ are

\[
\begin{align*}
\frac{\partial L}{\partial s_h} & : -p_h(1 - q_h\delta) + (1 - q_h) \frac{du}{ds_h} (\lambda p_h + \mu(p_h - p_l)) = 0 \\
\frac{\partial L}{\partial s_h^t} & : -p_h q_h \delta + q_h \frac{du}{ds_h^t} (\lambda p_h + \mu(p_h - p_l)) = 0 \\
\frac{\partial L}{\partial s_t} & : -(1 - p_h)(1 - q_l\delta) + (1 - q_l) \frac{du}{ds_t} (\lambda p_h - \mu(p_h - p_l)) = 0 \\
\frac{\partial L}{\partial s_t^t} & : -(1 - p_h) q_l \delta + (1 - q_l) \frac{du}{ds_t^t} (\lambda p_h - \mu(p_h - p_l)) = 0
\end{align*}
\]

When simplified, we get

\[
\begin{align*}
u'(s_h) & = \frac{p_h(1 - q_h\delta)}{(1 - q_h)(\lambda p_h + \mu(p_h - p_l))} \\
u'(s_h^t) & = \frac{p_h \delta}{(\lambda p_h + \mu(p_h - p_l))} \\
u'(s_t) & = \frac{(1 - p_h)(1 - q_l\delta)}{(1 - q_l)(\lambda p_h - \mu(p_h - p_l))} \\
u'(s_t^t) & = \frac{(1 - p_h)}{(\lambda p_h - \mu(p_h - p_l)).}
\end{align*}
\]

Let's compare $s_h$ and $s_h^t$. From the first two equations, we see that

\[
u'(s_h) = \frac{(1 - q_h\delta)}{(1 - q_h)\delta} \nu'(s_h^t).
\]

Since $1 - q_h\delta > (1 - q_h)\delta$, we must have $u'(s_h) > u'(s_h^t)$. In addition, $u'' < 0$ implies $s_h < s_h^t$. Lastly, $(1 - q_l) \cdot u(s_t^t) + q_l \cdot u(s_t^t) = u(s_h^t)$ implies that $s_h^t > s_h^t > s_h^t$. The proof for $s_t$ and $s_t^t$ is almost identical. 

Proof of Corollary 6. From the first order conditions, we get

\[
\begin{align*}
\frac{u'(s_h^t)}{u'(s_h^t)} & = \frac{p_h \delta (\lambda p_h - \mu(p_h - p_l))}{(1 - p_h) (\lambda p_h + \mu(p_h - p_l))} \\
& = \frac{\lambda p_h (1 - p_h) - \mu p_h (p_h - p_l)}{\lambda p_h (1 - p_h) - \mu p_h (p_h - p_l) + \mu (p_h - p_l)}.
\end{align*}
\]

Since $\lambda, \mu > 0$, $u'(s_h^t) < 1$ or $u'(s_h^t) < u'(s_t^t)$. $u'' < 0$ implies that $s_h > s_t$. 

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We also have

\[
\frac{u'(s_h)}{u'(s_l)} = \frac{(1 - q_l)(1 - q_l \delta)}{(1 - q_l)(1 - q_l \delta)} \cdot \frac{[\lambda p_h (1 - p_h) - \mu p_h (p_h - p_l)]}{[\lambda p_h (1 - p_h) + \mu (1 - p_h)(p_h - p_l)]}
\]

where

\[
\frac{[\lambda p_h (1 - p_h) - \mu p_h (p_h - p_l)]}{[\lambda p_h (1 - p_h) + \mu (1 - p_h)(p_h - p_l)]} < 1.
\]

If we let \(q_h \equiv q_l + \Delta q\),

\[
\frac{(1 - q_l)(1 - q_l \delta)}{(1 - q_l)(1 - q_l \delta)} \cdot \frac{(1 - q_l)(1 - q_l \delta) + \Delta q \delta q_l - \Delta q \delta}{(1 - q_l)(1 - q_l \delta) + \Delta q \delta q_l - \Delta q}.
\]

Therefore, if \(\Delta q > 0\), \(\frac{(1 - q_l)(1 - q_l \delta)}{(1 - q_l)(1 - q_l \delta)} > 1\) and if \(\Delta q < 0\), \(\frac{(1 - q_l)(1 - q_l \delta)}{(1 - q_l)(1 - q_l \delta)} < 1\). Whenever \(q_h \leq q_l\), we have \(u'(s_h) < u'(s_l)\) or \(s_h > s_l\), but when \(q_h > q_l\), \(s_h \leq s_l\).}

**Proof of Proposition 12.** Consider the high cash flow state. At optimum, we must have

\[
(1 - q_h) \cdot u(s_h) + q_h \cdot u(s_h^t) = (\bar{U} + e_h) + (1 - p_h) \cdot \frac{e_h - e_l}{p_h - p_l}
\]

\[
(1 - q_h) \cdot u'(s_h) = \frac{(1 - q_h \delta)}{(1 - q_h \delta)}
\]

\[
(1 - q_h) \cdot u'(s_h^t) = \frac{(1 - q_h \delta)}{(1 - q_h \delta)}
\]

When the first equation is totally differentiated with respect to \(\delta\), we get

\[
(1 - q_h) \cdot u'(s_h) \frac{ds_h}{d\delta} + q_h \cdot u'(s_h^t) \frac{ds_h^t}{d\delta} = 0.
\]

With the substitution of equation (2), the above simplifies to

\[
\frac{1 - q_h \delta}{\delta} \frac{ds_h}{d\delta} + q_h \cdot \frac{ds_h^t}{d\delta} = 0,
\]

which implies that \(\text{sign}(\frac{ds_h}{d\delta}) \neq \text{sign}(\frac{ds_h^t}{d\delta})\).

When we differentiate the right hand side of equation (2),

\[
\frac{d}{d\delta} u'(s_h) = \frac{-1}{(1 - q_h \delta)^2} < 0
\]

Suppose \(\frac{ds_h}{d\delta} > 0\) and \(\frac{ds_h^t}{d\delta} < 0\). Then, when \(\delta\) increases, \(u'(s_h)\) decreases while \(u'(s_h^t)\) increases. So, this implies that \(\frac{d}{d\delta} \frac{u'(s_h)}{u'(s_h^t)} < 0\). On the other hand, suppose \(\frac{ds_h}{d\delta} < 0\) and \(\frac{ds_h^t}{d\delta} > 0\).
Then, increase in $\delta$ implies that $\frac{d}{d\delta} \frac{u'(s_h)}{u'(s^t_h)} > 0$, which is a contradiction. Therefore, $\frac{ds_h}{d\delta} > 0$ and $\frac{ds^t_h}{d\delta} < 0$. ■

**Proof of Proposition 13.** Consider again the high cash flow state. The proof for the low cash flow state is analogous. We again have

$$
(1 - q_h) \cdot u(s_h) + q_h \cdot u(s^t_h) = (U + e_h) + (1 - p_h) \cdot \frac{e_h - e_t}{p_h - p_t} \tag{1}
$$

$$
\frac{u'(s_h)}{u'(s^t_h)} = \frac{(1 - q_h\delta)}{(1 - q_h)^\delta} \tag{2}
$$

When we differentiate (1) and (2) with respect to $q_h$, we get

$$
[u(s^t_h) - u(s_h)] + (1 - q_h)u'(s_h) \frac{ds_h}{dq_h} + q_h u'(s^t_h) \frac{ds^t_h}{dq_h} = 0
$$

$$
u''(s_h) \frac{ds_h}{dq_h} - \frac{1 - q_h\delta}{(1 - q_h)^\delta} u''(s^t_h) \frac{ds^t_h}{dq_h} = u'(s^t_h) \frac{1 - \delta}{(1 - q_h)^2\delta}.
$$

When we substitute the first into the second, and after some algebra, we get

$$
\frac{ds_h}{dq_h} \left( u''(s_h) + \frac{(1 - q_h\delta)^2}{(1 - q_h)^\delta} u''(s^t_h) \right)
$$

$$= u'(s^t_h) \frac{1 - \delta}{(1 - q_h)^2\delta} - u''(s^t_h) \frac{1 - q_h\delta}{(1 - q_h)^\delta} \left( \frac{u(s^t_h) - u(s_h)}{q_h u'(s^t_h)} \right).
$$

The right hand side is positive since $u' > 0$, $u'' < 0$, and $s^t_h > s_h$. The expression in the parenthesis on the left hand side is negative, since $u'' < 0$. Therefore, we must have $\frac{ds_h}{dq_h} < 0$. ■

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References


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