

# A Financial-Agency Study in Private Delivery of Infrastructure

by

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
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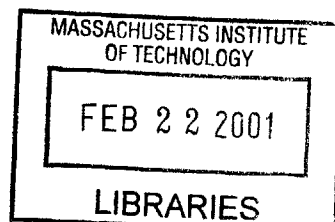
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## **Abstract**

This thesis combines the topics of private delivery of public infrastructure, (financial)-agency theory, and executive compensation to analyze the financial contracting process among the executive management team of private franchise and government and franchise stockholders.

The private delivery of an infrastructure creates a unique set of circumstances that affect (among others) the CEO and call for dynamic adjustment of the incentive scheme offered, to achieve his cooperation. In the context of the four-period model suggested by this study, the problem that became the focal point of this research (and was termed the "CEO Problem") is: "Who should the CEO be, and how should he be compensated during the period immediately after the delivery?"

While our analysis did not specifically answer those questions, it did illuminate the relevancy of this question-particularly at the time of an infrastructure's delivery when the development of a relationship between the franchise and the private-sector capital markets begins. Specifically, there are five areas in the literature identified as producing financial-agency conflict and costs that are likely to need special attention during infrastructure's private delivery. If the CEO encourages (1) no excess perquisite consumption, (2) no risk-shifting, (3) no over/under-investing, (4) an optimal debt-to-assets ratio, and (5) no unnecessary information asymmetry with the capital markets, he will be taking critical measures to minimize the franchise's costs of capital and maximize

shareholders' wealth. The incentives that are incorporated into the financial contract should (implicitly) motivate the CEO to give these areas of agency the attention needed.

By using a combination of fixed and variable remuneration, the shareholders can require the CEO to share some risk. The variable remuneration discourages static performance and should motivate the CEO to pursue measurable milestones as he redirects the franchise toward its new objective. The use of accounting- versus market-based remuneration can serve to set specific, measurable targets that coincide with the franchise's objective.

From the practitioner's perspective, the complementary phase of this research is to explore ways to integrate the insights from this work into the day-to-day, real-life private delivery activity occurring right now all over the globe. To increase the value of this research, a tangible methodology for guiding the financial-contracting process in a direction that explicitly integrates the insights gleaned from viewing private delivery from a financial-agency paradigm needs to be developed.

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## **Chapter 1 Introduction**

This thesis uses a framework based on financial-agency theory to analyze an economic topic of global importance: private delivery of public infrastructure. After decades of nationalization and state intervention in many economies around the world, the past decade has been a substantial change in many countries' delivery strategy of public infrastructure.

While arguments justify both nationalization and private delivery of public infrastructure are found in literature, more recent research motivated by the surge in private delivery of public infrastructure tries to answer whether the process of private delivering a traditionally state build/run infrastructure produces greater efficiency. The assessment of case-by-case changes in efficiency directly attributable to private delivery of public infrastructure is very difficult because, frequently, some degree of economic liberalization occurs either as a precursor or in parallel to the private delivery of public infrastructure process. Liberalization refers to government action directed at (1) the removal of price and wage controls; (2) deregulation; and (3) encouraging (or at least permitting) international involvement and competition.

The success or failure of private delivery of public infrastructure around the world will have a significant effect on the strength of the global economy in the future. The broad research agendas, to which this thesis tries to contribute, is to apply the basis of financial economic theory and analysis that provides a framework for increasing future gains (or minimizing losses) from private delivery of public infrastructure around the world.

### **1.1 Research Objective**

The objective of this thesis is to uniquely combine the topics of private delivery of public infrastructure, (financial)-agency theory, and executive compensation (see figure 1.1) to analyze the incentive designing and financial contracting process among the chief executive officer of private franchise and government and stockholders. Megginson, Nash, and Randenborgh (1992, p.2) observe that private delivery of public infrastructure

programs of the 1980s were "adopted largely on faith." Furthermore, they state:

*The academic literature available at the time these decisions [to deliver privately] were made offered precious little guidance as to the best method of divesting public assets, and only limited theoretical analysis of the predictable costs and benefits of private delivery of public infrastructure.*

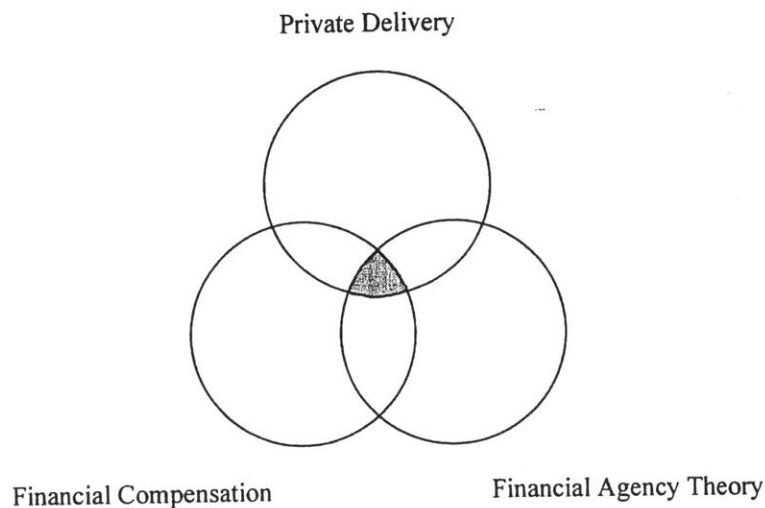


Figure 1.1 Interplay of Topics Used in the Analysis

The motivation to analyze the financial-contracting process between the franchise CEO and government of a privately delivered public infrastructure is to provide insight that is useful for constructing an efficient contract. While there are many important issues to consider in order to determine "the best method of divesting public infrastructure assets," the contribution made in this thesis is to codify and relate critical financial-contracting issues to the unique circumstances created by the private delivery of public infrastructure.

## **1.2 Research Framework and Methodology**

The research methodology that used to identify and codify the important facets to the financial-contracting process between the franchise CEO and government of a private

delivery of public infrastructure is to analyze the relationship between the franchise CEO and the party regulating the infrastructure (the government before and after an infrastructure private delivery) in a financial-agency framework. The appropriateness and benefit of analyzing this relationship in an agency context becomes evident as the relationship is superimposed into the agency paradigm.

Agency theory focuses on contractual relationships between two parties--one party (termed the agent) agrees to fulfill its responsibilities to satisfy a second party (termed the principal), who compensates the agent commensurately. One of the goals motivating research based on agency theory is to increase the efficiency of principal-agent contracts. Specifically, researchers examine methods of contracting that will lead to Pareto improvements between principals and agents.

Any deliver approach (including Design-Build, Build-Operate-Transfer, etc.) has relationships between parties that can be analyzed using an agency framework. For example, one ubiquitous principal-agent relationship existing within most infrastructures is that between a manager and subordinate. In this particular relationship, a manager agrees to compensate a subordinate in exchange for his performing useful work. In this thesis, the principal-agent relationship considered is not the relationship between a manager and his subordinate but, rather, the relationship between either the state sector or shareholders and a franchise CEO. Gayle and Goodrich (1990, pp. 4-5) observe that:

*The principal-agent problem persists in both the private and the public sectors: management does not necessarily act in the best interests of either widely diffused shareholders or taxpayers, so that effective performance monitoring remains problematic.*

As government constructs a financial contract between the franchise CEO and themselves, there are two agency problems that must be resolved: "adverse selection" and "moral hazard." Generally, adverse selection and moral hazard refer to hidden information and hidden action, respectively. In the context of private delivery of public infrastructure each term has a specific connotation. Adverse selection refers to the government's (the principal's) problem of selecting and contracting with a franchise CEO

(the agent) who holds hidden information that, if known by the principal, could influence the final selection and contract.

The second problem (i.e., the problem of moral hazard) also has an effect on the financial contract between the franchise CEO and government of a private delivery of public infrastructure. Milgrom and Roberts (1992, p.170) relate the problem of moral hazard to (among other relationships) a franchise CEO who "is the agent of the government" and state:

*[The problem arises] when agent and principal have differing individual objectives and the principal cannot easily determine whether the agent's reports and actions are being taken in pursuit of the principal's goals or are self-interested behavior.*

After a public infrastructure is decided to be privately delivered, government must decide who the franchise CEO should and what financial contract to offer. During the selection and the subsequent relationship with a franchise CEO, government will have incomplete information as to his credentials for the position and (post selection) performance.

In the first paragraph of this section it was stated that a financial-agency framework is used in this thesis. Financial agency refers (specifically) to the relationship between an infrastructure's executives and the holders of contingent claims (e.g., government and debtholders). If an infrastructure first plans (prior to its private delivery of public infrastructure) with no property rights held by the private sector, then at the time when the infrastructure is decided to be privately delivered a unique transformation of the relationship between the franchise CEO and principal begins. When control of an infrastructure shifts to the private sector, the franchise CEO is not only directly responsible to the state but becomes an agent of the government (and the private sector).

The "health" of the relationship that forms between a franchise CEO and the government is an important determinant of the infrastructure's overall (post-private delivery of public infrastructure) efficiency. There is managerial behavior that is described in the literature by Barnea, Haugen, and Senbet (1981, 1985) as potential

sources of "financial agency conflict." This behavior can exist in an infrastructure before or after it is privately delivered; likewise, it can exist before or after the financial contract between the franchise CEO and government is negotiated.

In chapter 2 the specific actions that can produce conflict are related to the private delivery of public infrastructure scenario. Financial-agency conflict produce associated costs that are embedded in an infrastructure's costs of capital. It is the ongoing concern (evident in the literature) for achieving greater efficiency through private delivery of public infrastructure that motivates the connection this thesis made between financial contracting with the franchise CEO and the mitigation of financial-agency conflict. While Milgrom and Roberts (1992, p.207) describe an efficient contract in terms of risk bearing, efficiency can be described in terms of financial-agency costs. An efficient contract is one that balances the marginal benefit and cost of reducing financial-agency conflict within the infrastructure delivery. By optimally restructuring an infrastructure's financial contracts (with the proper incentives) during its private delivery, equilibrium outcomes should be superior (in terms of overall efficiency) to those that would result if the agency issues were handled more casually.

The organization of the rest of thesis monograph is classified as follows. Chapter 2 discusses agency theory and relates it to the study of private delivery of infrastructure. Chapter 3 develops the framework and model for analyzing the critical financial-contracting issues relevant to the private delivery of public infrastructure. Chapter 4 builds on the model from chapter 3 and constructs several normative arguments related to financial contracting.

In chapter 5 an empirical methodology for analyzing case of private delivery is presented and case studies will be presented as an empirical illustration of several financial-contracting issues. The chosen case is selected on the basis specified in methodology and is relatively easy to financial data from them. Finally, chapter 6 contains a summary and suggestions for future research. Implicit to this thesis is that infrastructure is, and will be after its private delivery, operating in a well-developed market economy.





## Chapter 2 Agency Theory and the Contract Problem

### 2.1 The Streams of Agency Theory

Eisenhardt's (1989, p.58) review of agency theory helps us to put the origins of this theory in its proper perspective relative to other economics literature. She explains that:

*During the 1960s and early 1970s, economists explored risk sharing among individuals or groups (such as Arrow, 1971; Wilson, 1968). This literature described the risk-sharing problem as one that arises when cooperating parties have different attitudes toward risk. Agency theory broadened this risk-sharing to include the so-called agency problem that occurs when cooperating parties have different goals and division of labor (Jensen and Meckling, 1976; Ross, 1973). Specifically, agency theory is described at the ubiquitous agency relationship, in which one party (the principal) delegates work to another (the agent), who perform the work. Agency theory attempts to describe this relationship using the metaphor of a contract (Jensen and Meckling, 1976).*

*Agency theory is concerned with resolving two problems that can occur in agency relationships. The first is the agency problem that arises when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing. The problem here is that the principal cannot verify that the agent has behaved appropriately. The second is the problem of risk sharing that arises when the principal and agent have different attitudes toward risk. The problem here is that the principal and agent may prefer different actions because of the different risk preferences.*

Research based on agency theory can be organized into two streams: one is labeled as "positive-agency theory," and the other "principal-agent-agency theory." Both streams are similar in that both identify a principal and an agent and focus on the contract

between the two. At the same time, the two streams are dissimilar by virtue that application of principal-agent agency theory tends to be more mathematical than positive-agency theory; and each theory has a different style. The research of positive agency theory leads to information- and/or incentive based resolutions to conflicts between management and shareholders. The principal-agency theory leads to specific contract specifications that are most efficient under a particular scenario-not just between management and shareholders, but any general principal-agent contract.

Agency theorists from both streams can contribute to the study of delivery of infrastructure. For instance, many infrastructures are monopolies. A decision that needs to be made if a monopolistic infrastructure is privately delivered is whether and how the operation should be regulated. The principal-agent stream of research has analyzed and constructed a framework for resolving regulations (such as discussion in Baron and Myerson, 1982). This framework can be applied to the private delivery of infrastructure. Analytical research focusing on financial-agency issues will likely use a positive-agency approach. Like Eisenhardt (1989, p.59) states, "Positivist researchers have focused almost exclusively on the special case of the principal-agent relationship between owners and managers of large, public corporations (Berle and Means, 1932)."

This study is then going to deal with the efficiency issues pertaining to the set of agency relationships involving the infrastructure's property rights. This particular set of agency relationships is a subset of the larger set of relationships that is affected by the private delivery process. The major groups that find themselves in either a principal or agent role that can be affected by private deliver of infrastructure are political decision makers, consumers, employees (including managers), shareholders, taxpayers, financial institutions responsible for handling the financing, consultants, lawyers, etc. The magnitude and significance of private delivery become apparent when we consider that contracts between these parties all need to be renegotiated or affirmed to complete the delivery process.

## **2.2 Using Agency Theory for Infrastructure Delivery**

Research applying agency theory in the analysis of the economics of infrastructure

delivery (mostly in defense facilities) is fairly recent. There have been several noteworthy contributions to the literature that hint to the potential for better understanding infrastructure delivery through agency-based analysis and research.

As reviewed in the literature, one application of principal-agent research that developed during the 1980s was the area of monopoly regulation. Research into the regulation of franchise is relevant to private delivery since, often, an infrastructure being considered for private delivery is a monopoly in its industry/market. Since the gain in efficiency is the primary economic justification for private delivery, there is an interest in how allocative efficiency will change as a result of private delivery. Research centers on the question of whether private delivery of an infrastructure will produce greater allocative efficiency as an infrastructure building and operating as a regulated or unregulated monopoly.

Another topic is the risk sharing and incentive contracting. The incentive contracts implemented in practice are normally with the following approach:

$$\pi = \pi^* - s * (C - C^*) \tag{2.1}$$

where  $\pi$  is the profits earned by the contractor  
 $\pi^*$  is the expected profit  
 $s$  is a sharing rate (where  $s \in (0,1)$ )  
 $C$  is the actual cost  
 $C^*$  is the expected cost

Formula (2.1) contains three design parameter,  $\pi$ ,  $\pi^*$ ,  $s$ , which are subject to negotiations or competitive bidding. The restriction  $s \in (0,1)$  makes sense that if it values outside  $(0,1)$  would stimulate additional strategic considerations with respect to cost reporting. The bigger  $s$  the more sensitive is profit as a function of actual cost. Contracts with  $s \in (0,1)$  would constitute a compromise between two extreme contracting approaches, namely,

1. The cost-plus-fixed-fee contract ( $s = 0$ ) according to which any cost overrun ( $C - C^* > 0$ ) or cost underrun ( $C - C^* < 0$ ) is irrelevant for the contractor
2. The firm-fixed-price contract ( $s = 1$ ) according to which the contractor has to bear any cost overrun to the full extent. On the other hand, he also enjoys benefits from

any cost overrun to the full extent.

One obstacle to a widespread use of contracts (2.1) is the difficulty to assess the design parameters  $\pi$ ,  $\pi^*$ ,  $s$  appropriately. Several approaches have been discussed in the literature: bilateral bargaining, links between design parameters, and competitive bidding with respect to one or several design parameters.

### **2.3 The Outgrowth of Financial-Agency Theory**

Jensen and Meckling (1976) combine the theories of (1) property rights, (2) agency, and (3) finance to "develop a theory of ownership structure." Their work explores the conflicts of interest between (1) managers and shareholders, (2) managers and bondholders, and (3) shareholders and bondholders. Early success at applying agency theory to gain insight into finance related problems was achieved when agency theory was coupled with theories of finance and property rights to extend the literature dealing with optimal capital structure. This application of agency theory to capital structure determination was inspired by seminal work conducted by Modiglian and Miller (1985). Modiglian and Miller analyzed the importance of an infrastructure franchise's capital structure on shareholders' wealth. In their analysis of capital structure, they argued that the overall cost of capital would be constant regardless of the firm's capital structure. Thus, in their model, there is no optimal capital structure. Although this concept was arguable, agency theory provided the basis for pointing to an optimal capital structure. By applying agency theory it is possible to show that, depending on the agency costs of debt and equity, the franchise would have an optimal debt-to-equity ration. (Refer pp. 41-60 in Barnea, Haugen, and Senbet, 1985.)

Barnea, Haugen, and Senbet (1985) drawn on Barnea, Haugen, and Senbet (1981) and Jensen and Meckling (1976), divide the financial-agency problem into five distinct areas of financial-agency conflict (and cost) an infrastructure franchise can incur. The five areas are: (1) excessive perquisite consumption; (2) the incentive of stockholders to bear unwarranted risk; (3) the incentive of stockholders to forego profitable investments; (4) bankruptcy problems; and (5) the agency problem of information asymmetry. As stated in the first chapter, the prefix financial in the phrase financial-agency theory

emphasizes the focus on the agency relationships between an infrastructure franchise's management and security holders, e.g., stockholders and bondholders. The structure of these financial-agency relationships has bearing on the efficiency of an infrastructure franchise's interactions with the capital markets.

The study of an organization in the context of financial-agency theory brings financial markets into explicit consideration and transforms the analysis of an infrastructure franchise from one period to multi-period issues. At the same time, studying the private delivery of an infrastructure franchise leads to explicitly considering the role that financial markets will play in the franchise's future. The financial function within an infrastructure franchise is forced to radically develop during the infrastructure's private delivery. An infrastructure franchise's proficiency at financing its operations through the capital markets (after its sale) might determine its future success or failure.

In the context of the private delivery of an infrastructure franchise, a hypothesis that can be analyzed is:

$H_0$ : Management's behavior associated with financial-agency conflict does not change as a result of private delivery of infrastructure n.

This very general hypothesis can be divided into a set of five specific hypotheses that coincide with five distinct sources of five financial-agency conflicts modified from Barnea, Haugen, and Senbet's:

$H_{0,1}$ : Management's effort and requisite consumption do not change as result of private delivery of infrastructure.

$H_{0,2}$ : Management does not shift or change the risk borne by stakeholders as a result of private delivery of infrastructure.

$H_{0,3}$ : Management does not over/under-invest as result of private delivery of infrastructure.

$H_{0,4}$ : Management does not take actions that will change the infrastructure franchise's expected loss from bankruptcy as a result of private delivery of infrastructure.

$H_{0,5}$ : Management does not change their informational disclosure policy as a result of private delivery of infrastructure.

The notation  $H_{0,1}$  signifies secondary null hypothesis number one (of five). The symbol  $H_0$  (without a second subscript) denotes the primary hypothesis. These five

hypotheses are the building blocks of a financial-agency-theory-based framework that can be used to investigate for evidence that is consistent with the acceptance or rejection of the primary hypothesis. Conclusive evidence pertaining to the primary hypothesis would suggest whether private delivery of infrastructure leads to an overall change in behavior associated with financial-agency costs. In the following subsections, each area of financial agency and costs, associated with the five hypotheses will be briefly discussed.

### **2.3.1 The Agency Problem of Perquisite Consumption**

The next five sections will describe a logical segmentation of the potential financial-agency conflict and costs involving in infrastructure delivery. To the extent that a private franchise is concerned with its overall profitability from delivering infrastructure, it will need to be concerned with its overall financial costs that are contained in its costs of capital. Examples of events that can affect infrastructure franchise's agency conditions are acquisition, merge, and private delivery—taking delivery franchise of infrastructure. Analogous to an infrastructure franchise's focus on its overall profitability that motivates a division-by-division analysis of profit, a focus on a franchise's overall financial-agency conflict motivates a segmented analysis of financial-agency conflict.

The first area of potential financial-agency conflict that we could adopt from Barnea, Haugen, and Senbet (1985, p.31) is reflected in any discount that a private franchise incurs when it floats new equity needed for infrastructure delivery. The discount may partly reflect a reaction by capital markets to anticipated behavior by franchise management that is expected to ensure as a result of a dilution of management's ownership in the infrastructure, after new shares are asked and issued. Theory suggests that as management's ownership is diluted through the flotation of new shares their perquisite consumption, which is subsidized by outside shareholders, will increase relative to the perquisites consumed before the new issuance. An assumption behind this premise is that (over time) capital-market participants (1) will form unbiased forecasts of excess perquisite consumption precipitated by a dispersion of property rights and (2) will discount the share price commensurately.

In the case of infrastructure delivery where franchise management does not hold ownership rights prior to the delivery, perquisite consumption by franchise management does not lead to a corresponding reduction in their wealth. If the value of an infrastructure after private delivery decreases (due to perquisite consumption, or any other reason), the loss is spread across the owners of the state—i.e., the citizens. When infrastructure is privately delivered, changes in infrastructure management's perquisite consumption will likely be sensitive to the intensity of shareholder's or government's monitoring rather than wealth effects.

Also coupled with concern regarding franchise management's change in perquisite consumption is a concern regarding changes in their effort. Just as there might be a tendency for franchise management to change their perquisite consumption, there is also (possibly) an incentive for them to change their level of effort. Changes in effort are explainable by the fact that franchise management receives a varying portion of the benefits accruing from their effort, based on the amount of ownership they hold.

The theory suggesting that franchise management's effort or perquisite consumption will change, due to an allocation of property rights, leads to the first hypothesis ( $H_{0,1}$ ). If evidence leads to the acceptance of this hypothesis, this would suggest that there is no discernible increase or decrease in effort or perquisite consumption by franchise management as a result of private delivery.

### **2.3.2 The Agency Problem of Risk Shifting**

A second area of potential financial-agency conflict Barnea, Haugen, and Senbet (1985, p. 33) discuss is the shareholders' incentive to bear unwarranted risk. Owning equity can be viewed as holding to bear unwarranted risk. (See Smith, 1979, pp. 88-90.) Option-pricing theory suggests that, *ceteris paribus*, the value of an option increases as the variance (i.e., the level of risk) in the value of the underlying asset increase. The bondholders can be thought of as "writing" an option for the shareholders when they lend capital to an infrastructure franchise.

If shareholders default on a franchise's debt obligation (and new terms are not negotiated), then ownership shifts to the bondholders. Bondholders, who have an

investment-time horizon and tolerance for risk commensurate with fixed-income investments, want a franchise to meet its debt obligation (rather than to take ownership of the franchise). Consistent with their time horizon and tolerance for risk, bondholders want a franchise to invest in projects with minimum risk that still meet its overall cost of capital. Barnea, Haugen, and Senbet suggest that bondholders will discount the price they pay for a franchise's debt to offset the expected expropriation that will accrue as a result of shareholders' incentive to ratchet-up the variance in the franchise's value. Over time, bondholders will form unbiased forecasts of the actual level of risk associated with projects they are capitalizing.

What investment policy will ensure as a result of private delivery? Franchise shareholders and state government might view the perspective franchise management's past behavior/policy as too conservative and try to create incentives for greater risk taking by management. If franchise management is very risk averse there could be latent conflict between shareholders/governors and franchise management that could emerge after an infrastructure's control shifts/transfers to shareholders/governors.

In the context of financial-agency theory, the shareholders'/governors' incentive to bear unwarranted risk or, more generally, to change the risk borne by stakeholders, leads to the second hypothesis ( $H_{0,2}$ ). If evidence leads to the acceptance of this hypothesis, this would suggest that there is no discernible increase or decrease in the risk borne by stakeholders as a result of private delivery.

### **2.3.3 The Agency Problem of Over/Under-Investment**

A third area of potential financial-agency conflict Barnea, Haugen, and Senbet (1985, p. 35) discuss is based on the premise that a leveraged infrastructure franchise will make fewer optimal investment decisions compared to an all-equity franchise. The theory predicts that an all-equity infrastructure franchise will always invest in a project with positive net present value. However, a franchise carrying unusually high debt might be tempted to invest only if a project's value exceeds its debt. In the parlance of option theory, if a project's expected cash flows do not offset the investment and the franchise's debt, shareholders should not exercise their option to buy back the franchise from the



bondholders and should default on the debt. This incentive to pursue a less-than-optimal investment policy suggests a third agency cost that is incurred by shareholders.

It can be argued that this scenario of investing only if the cash flows exceed the franchise's debt is unlikely, and that only those franchises whose bankruptcy is highly probable would pursue such an extreme policy. There are, however, other more common scenarios where a franchise will over/under-invest. For example, a CEO might be cautious about investing in sub-infrastructure projects that could eventually reflect poorly on his judgement—even when the projects initially appear to meet the infrastructure franchise's hurdle rate. If an executive begins making investment decisions based on his expected gains and losses to his own human capital rather than the infrastructure's overall value, this behavior could lead to under-investment.

On the other hand, an infrastructure franchise's executives might have incentives to follow a policy of over-investment. These incentives could be explained by a situation where executive compensation (and, therefore, wealth) is heavily proportioned in option-based remuneration. Under this scenario the management will be encouraged to increase the variance in the value of the infrastructure, perhaps beyond the optimal level. Theory predicts that this incentive leads to risk shifting, which, in turn, leads creditors to discount debt issued by an infrastructure franchise commensurately (which raises the cost of debt financing). Both the over/under-investment problems derive from differences between the executives' and the owners' tolerances of risk. The incentive to over/under-invest leads to the third hypothesis ( $H_{0,3}$ ). If evidence leads to the acceptance of this hypothesis, this suggests that there is no discernible over/under-investment by franchise management as a result of private delivery.

#### **2.3.4 The Agency Problem of the Bankruptcy Threat**

A fourth area of financial-agency conflict discussed by Barena, Haugen, and Senbet (1985, p. 37) derives from the expected cost of bankruptcy. Both short- and long-term bankruptcy proceedings are costly. Examples of immediate costs that are incurred include lawyers' fees and lost credit. Over the long run, damaged relationships with customers and suppliers will be costly. Shareholders bear the expected cost of bankruptcy as

bondholders will form unbiased expectations of bankruptcy costs and will discount the franchise's debt commensurately. Specifically, in pricing an infrastructure franchise's debt, the capital markets (i.e., the bondholders) will (1) assess the likelihood of the franchise's bankruptcy and (2) estimate the cost of bankruptcy proceedings. The estimated likelihood and cost of bankruptcy translate into an expected bankruptcy cost as shown by equation 2.2:

$$E [\text{bankruptcy cost}] = \text{prob.}(\text{event} = \text{bankruptcy}) * \text{cost of bankruptcy} \quad (2.2)$$

*where E [bankruptcy cost] is an infrastructure franchise's expected cost of bankruptcy, and the probability of the franchise's bankruptcy is denoted as prob.(event = bankruptcy).*

As an infrastructure franchise increases its level of debt (as a percentage of assets) and becomes more highly levered (thus increasing the probability of bankruptcy, ceteris paribus), bondholders impose higher and higher financing costs until there is no cost advantage to using debt financing. If either the likelihood or the cost of an infrastructure franchise's bankruptcy proceedings changes, this subsequently changes the expected loss from bankruptcy and, correspondingly, the agency cost of debt financing. As argued by Modigliani and Miller (1963), the shareholders have an incentive to leverage the franchise. However, given the agency cost of debt, an infrastructure franchise has to balance the cost advantage and disadvantage of using debt in its capital structure. The bankruptcy threat leads to the fourth hypothesis ( $H_{0,4}$ ). If evidence leads to the acceptance of this hypothesis, this would suggest that there is no discernible increase or decrease in the bankruptcy threat as a result of private delivery.

### **2.3.5 The Agency Problem of Information Asymmetry**

The fifth area of financial-agency conflict discussed by Barena, Haugen, and Senbet (1985, p. 37) derives from information asymmetry. If management identifies a positive net present value project and plans to raise capital, a potential information asymmetry arises. To maximize the valuation of new shares issued to the equity-capital markets, an

infrastructure franchise should make an optimal disclosure of its plans for the funds. The optimal disclosure will often be less than full disclosure. Full disclosure will enable the capital markets to assimilate expectations that are essentially the same as management's as to the outcome of an investment project. If the market's and management's expectations are in agreement, then the market should price the equity at full value.

However, disclosures from an infrastructure franchise are probably and frequently less than complete, as some information is considered proprietary. Unless an infrastructure franchise is a monopoly, or there are high barriers to entry, the most that an infrastructure franchise can expect, frequently, is a lag in the responses from its competitors. This lag is important, since it represents how long the franchise has to capture excess profits generated from a new project. The time it takes for competition to react will partly depend on the extent of disclosure. This forces an infrastructure franchise to balance how much information it disseminates to the capital markets in order to strengthen its share valuation against the expected loss resulting from competitors' responses.

Thus, the optimal disclosure is the amount of information that maximizes the franchise's stock issue by providing sufficient detail to fairly value the securities, without damaging the franchise's proprietary position vis-à-vis the competition. The difference between the market valuation of an infrastructure franchise's equity (given optimal disclosure) and the actual valuation (given actual disclosure) is an agency cost.

Information asymmetry is a capital-market imperfection that affects debt as well as equity. A comparable argument made for the dependence of equity pricing on information asymmetry can also be made for the market's valuation of an infrastructure franchise's debt. As a consequence of sub-optimal disclosure of information about a project, the market will underevalue an infrastructure franchise's debt, which again translates into an agency cost to the franchise. The agency cost of underevaluated debt and equity is borne by the franchise's existing securities holders. The information asymmetry leads to the fifth hypothesis ( $H_{0,5}$ ). If evidence leads to the acceptance of this hypothesis, this would suggest that there is no discernible increase or decrease in the extent that information is disseminated to the capital markets as a result of private delivery.

## 2.4 Two Opposing Financial-Agency Scenarios

In this section, discussions of two scenarios that describe extreme financial-agency conflict scenarios in private delivery of infrastructure are addressed. All five areas of financial agency discussed in section 2.3 are relevant to the infrastructure as it is privately delivered.

During the private delivery process the franchise has the potential to influence its overall financial agency costs and, thus, its cost structure. At the threshold of being privately delivered, an infrastructure is in a unique situation with its nexus of interlocking agency relationships that, to some extent, must be structured during pre-delivery (such as request for proposal, bidding, negotiating, etc.) process. To understand an infrastructure's potential for determining its financial-agency costs after its privately delivered, consider two scenarios that characterized "best" and "worst" cases. After its being going to privately deliver, a franchised infrastructure will be positioned somewhere between these two extreme cases.

In the study of economics, to gain an understanding of market structure, the first step is to analyze the simple models of perfect competition and monopoly. These models establish a useful foundation for subsequent study of more complicated models, such as oligopoly and monopolistic competition. Analogously, two unrealistic (yet useful) scenarios can be described in terms of financial agency costs. One scenario (depicting the best case) is of an infrastructure franchise with no financial agency costs. The contrasting, or worse case scenario, is of an infrastructure franchise with financial agency costs so great that they are crippling the franchise's ability to raise capital at a reasonable cost—pushing it to eventual insolvency.

First, consider the best scenario of an infrastructure franchise whose management's behavior produces no financial-agency conflict (and, therefore, no financial-agency costs). The franchise can be characterized in terms of five areas of financial agency. The first area of financial agency is perquisite consumption. Under this scenario the franchise CEO, although he owns less than 100 percent of the franchise, consumes no unnecessary perquisites. Financial-agency theory suggests (Jensen and Meckling, 1976, p. 317) that as the owner-manager sells a portion of franchise perquisite consumption will rise. Under

the best case scenario the CEO only consumes a level of perquisites justified by increased profitability.

Without loss of completeness, the second and third areas of financial agency can be treated together. Under the best case scenario the franchise CEO will neither over nor under invest. Likewise, he will not seize any opportunity to shift to riskier projects and, thus, will not expropriate bondholders' wealth. Consequently, in terms of expenditures and risk level of investments, the franchise will executive a strategy that maximizes shareholders' expected wealth, with no expectation from any of the claimants.

The fourth area of financial-agency costs derives from the bankruptcy threat. Under the best case scenario, the franchise carries a debt burden that leads to a marginal expected cost of bankruptcy that just equals the marginal benefit of using the debt. A second consideration relevant to the bankruptcy threat is the cost of bankruptcy proceedings (recall equation 2.2). Even when the probability of bankruptcy is small, if the cost of bankruptcy is very high, the expected bankruptcy cost can be high, and the agency cost significant. In other words, this agency cost depends on the chance of bankruptcy plus the cost of bankruptcy proceedings. Under this scenario the assumption is that the franchise's cost of bankruptcy is exogenously determined, but that the franchise can influence its likelihood of bankruptcy.

Finally, to complete the characterization of the best scenario consider the financial-agency cost resulting from information asymmetry. The information asymmetry that exists is optimal to the extent that marginal cost incurred in the capital markets due to incomplete information just equals the marginal benefit to maintaining a certain level of proprietary information. As information is disseminated to the capital markets, the franchise benefits to the extent that the evaluations of its securities approach fair value. However, as a franchise releases more and more information, its competitors can be expected to use information to compete and realize a portion of the industry profits.

The second scenario that serves to define the continuum of financial-agency scenarios is a worst case scenario that is characterized by crippling financial-agency costs. Assume that the worse case is of an infrastructure privately delivered having financial-agency costs sufficiently high to make its medium- to long-run survival improbable (but do not preclude its existence in the short run).

In terms of perquisite consumption, under this scenario the CEO continually consumes perquisites well beyond a reasonable level. As was described earlier, some level of perquisite consumption is reasonable. Beyond this level, perquisite consumption becomes excessive when the expense is not offset by current or future (expected) profitability.

Unlike the treatment used for the first scenario, the franchise's over/under-investment and risk-shifting problems will be treated separately. In terms of over/under-investment, this scenario is characterized by management who perpetually invests either too much or too little, resulting in the infrastructure franchise operating with a non-optimal capital-to-labor ratio. Rather than pursuing an investment strategy that equates the ratios of marginal productivity to price all factors of production used by the franchise, the franchise management's investment policy leads to inequality between the ratios. As for risk shifting, the franchise described under the worse case scenario selects projects with greater volatilities, even in those instances when the more volatile project has a lower expected value than a mutually exclusive alternative projects.

Under the worst case scenario, the franchise continually increases its level of debt financing, exceeding its optimal debt-to-equity ratio. A high level of agency cost associated with the threat of bankruptcy results from an increasing probability of bankruptcy.

Finally, this scenario is described as having maximum information asymmetry in the capital markets. When a franchise raises new capital to finance its infrastructure operations, there is minimal disclosure as to the franchise's intention for the funds. Franchises offering securities usually issue a prospectus containing material information relevant to the sale. The worse case scenario is characterized by a franchise that releases vague details in its prospectus that are just sufficient (in information content) to avoid misrepresentation.

As the private delivery of infrastructure is analyzed to assess its changes in financial-agency costs, it is informative to consider what the franchise's positioning might be relative to the two extreme scenarios just described. These two extreme scenarios are depicted in Figure 2.1.

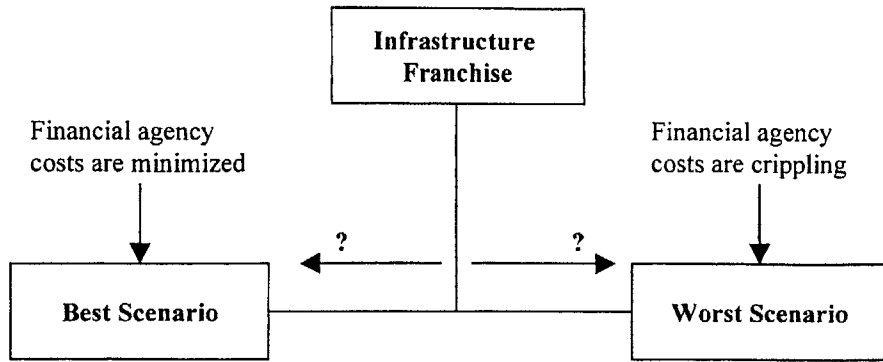


Figure 2.1 Where Will the Infrastructure Be Positioned After Its Being Private Delivery?

Recalling that a fundamental economic question is whether an infrastructure becomes more efficient as a result of its private delivery, an important and related question is how the managerial behavior associated with the determination of financial-agency conflict will translate into realized financial-agency costs, upon introduction of securities into the capital markets. One facet of strategy designed to lead the franchise to increased efficiency should concentrate on minimizing financial-agency conflict and costs. This special study calls attention to the importance that should be placed on this issue when adjustments in executive incentives and compensation are made during private delivery. By taking measures to ensure that an infrastructure evolves toward the best case scenario after its private delivery (through effective incentives), the holders of property rights are taking necessary action to increase (or maintain) an infrastructure franchise's overall efficiency.





## **Chapter 3      Critical Elements of Financial Contracting with Infrastructure CEO**

### **3.1 The Problems and Its Importance**

In chapter 1 the question analyzed for this study was presented. This section would construct a framework for answering the question. The question focuses on the private delivery process when control of the property rights to an infrastructure shifts to the private sector. One question is, "how should a CEO be compensated during the transitioned period immediately after the property rights are shifted?" The question could be twofold: "who should the CEO be, and how should he be compensated during the period immediately after the property rights are shifted?"

One critical element of the private delivery process is to decide what changes need to be made, not just with the CEO, but with the whole executive management team. In management operation, when an enterprise either merges or acquires another enterprise, it is common for the target enterprise's executive management team's responsibilities to shift to the controlling enterprise and, subsequently, several of the target enterprise's managers to be terminated. The fate of management positions within the target enterprise often depends on whether the takeover is hostile. When enterprises merge it is likely that there are a number of redundancies in executive management positions that eventually will precipitate the elimination of jobs (if not people).

In contrast, when the private franchise delivers an infrastructure and there is a shift in control (especially, through BOT and DBFO approaches), there is nothing inherent to this event that leads to a reduction in the executive ranks. However, in either event the ownership rights are reallocated with the private sector. In the case of public delivery of infrastructure, property rights are controlled by the government; but, in a democratic society, the government is controlled by the private sector through the election of public officials. Technically, infrastructure is owned by the public. With private delivery, the property rights continued to be owned by the public. However, they are more concentrated. In the case of an enterprise targeted for acquisition, property rights are owned by the equity holders of the target enterprise prior to acquisition. Then, after acquisition, property rights are owned by the equity holders of acquiring enterprise. As

with private delivery of infrastructure, the private sector holds the property rights.

While a parallel can be drawn between private delivery of infrastructure and acquisition in the context of how property rights are reallocated within the private sector, the private delivery scenario is quite different in some important aspects. As the infrastructure's ownership rights are allocated to private franchise during the delivery, there is no intrinsic duplication of staff as with acquisition. In the acquisition scenario, it is consistent with the objective of maximizing wealth that shareholders will support the elimination of redundant positions and efficient integration of the two enterprises' management hierarchies. In contrast, shareholders of private franchise of infrastructure will be more concerned about future managerial performance and, thus, that proper incentive is built into executive compensation packages. The principal-agent relationship between the CEO and owners will have a different structure via private delivery; correspondingly, this will require a different contract. Recognizing the need to negotiate efficient contracts at all levels of the infrastructure during its delivery and to provide insights into the CEO problems, the remainder of this section will try to model a framework that generates several important implications for the financial-contracting process between the CEO and the shareholders during private delivery.

### **3.2 Using a Framework Based on Agency Theory to Analyze CEO Problem**

There are two important strategic changes that can occur to an infrastructure, as it is privately delivered: (1) a change in the infrastructure's delivery objectives and (2) different financing constraints.

If an infrastructure is used to be entirely financed by the government, then private delivery an infrastructure necessitates building and maintaining different bonding and monitoring mechanisms with the private-sector capital markets. Establishing these mechanisms will be one of the primary responsibilities of the franchise CEO (and the board of directors). Effective managerial compensation will then need to be offered to create sufficient motivation for the CEO to collaborate with the capital markets effectively and efficiently. The remuneration alternatives that can be used for designing financial contracts differ once the franchise is going to take the responsibility of delivery.

To design an optimal compensation package for the CEO, a thorough understanding of what motivates him is required, along with an understanding of what the shareholders and bondholders expect as stakeholders in the infrastructure franchise.

The opportunity for gains from well-designed financial contract during the disequilibrium period through private delivery depends on the length of this period. If an infrastructure is privately delivered and the franchise obtains equilibrium very quickly, there is less impetus for delineating between the contract that emerges sometime later. How quickly the franchise reaches equilibrium is partly endogenous. For example, it will depend on how quickly the franchise can internally adjust to objectives set forth by the shareholders. The time taken to attain equilibrium will also depend on exogenous factor external to the franchise. For example, if competition among infrastructures is allowed, this can lead to a protracted disequilibrium period following the initial delivery. A protracted disequilibrium period expands the opportunity for gains from prompt resolution of the contract between the CEO and franchise owner.

As a framework is going to be modeled analyze the CEO problems, relevant questions could include:

1. How should the CEO's and the property rights owners' objective function be modeled?
2. How should the models reflect the principals' and agent's risk tolerance?
3. How should the CEO's performance be measured during the disequilibrium period?
4. What remuneration and financial-contracting alternatives should be considered? Is there an optimal financial contract for private delivery of infrastructure?
5. What is a realistic partition of the government of nature for an infrastructure being privately delivery, and how should exogenous economic factors be treated in the model?
6. What are the moral hazard and adverse selection problems embedded in the CEO problem, and how can they be solved jointly?
7. What association exists between a CEO's effort and the performance of an infrastructure franchise, especially in the disequilibrium period?
8. How critical is resolution of financial-agency conflict during private delivery, and how can the urgency be assessed?

9. How should the financial contract be designed to address each area of conflict identified in Chapter 2?

### 3.3 Chronological Overview of the Private Delivery Process

In this section the time dimensions of the model will be structured to provide a temporal frame of reference useful for this study. However, each private deliver approach is unique; that is, one model will not match all cases. In fact, the model assembled in this work may not fit to any case of private delivery. Nevertheless, a model is an invaluable tool for organizing the key issues of financial contracting with private delivery. In figure 3.1 periods related to private delivery are presented. Subsequent analysis will reference these periods that constitute the private delivery process. While a private delivery can take on many variations, the process generally occurs in each period with unique political and economic attributes. The following is a brief description of the periods and interim events that help to distinguish each period.

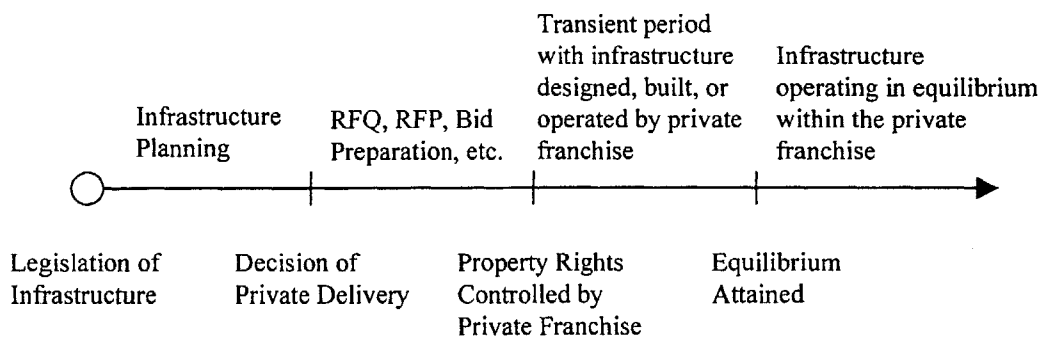


Figure 3.1 Periods of Private Delivery of Infrastructure

The inception of infrastructure legislation demarcates the beginning of period one. Period one is defined as the period in which the infrastructure is planned. Whether to adopt private delivery may be debated during period one; however, no specific private delivery measures are taken during this period. The beginning of period two is demonstrated in the model by a decision being made and announced to go through private delivery. During period two plans for private delivery are consummated and executed,

leading to the actual private delivery. Uncertainty regarding the construction/operations and future of the infrastructure increases during period two.

Next, the beginning of period three is demarcated by the award of private delivery franchise. Regardless of the private delivery approaches used, the control of infrastructure shifts to the private franchise. Both ownership and a different characterize period three or narrower defined set of objectives, such as wealth maximization. Periods two and three are the dynamic periods of the private delivery process since it is during these two periods that the franchise and government undergo the changes initiated by the private delivery proclamation. Finally, the beginning of period four is not as clearly defined as the beginning of the prior three periods. Conceptually, the fourth period begins when the franchise's operations obtain equilibrium. As conclusion quoted from Caves (1990), equilibrium is obtained at that time when private performance reveals itself.

In terms of the agency-theoretic framework used in this study, equilibrium is not obtained until the contracts between all the franchise's principals and agents have been negotiated or confirmed. The six hypotheses presented in section 2 pertain to periods two and three. These two periods are uniquely associated with the private delivery process. Therefore, actions taken or not taken during these two periods can potentially be explained by the private delivery process.

An important premise in this study is that the eventual gains in efficiency achieved by the infrastructure franchise depend heavily on the adjustments in the principal-agent relationships. This premise is not complete uniformly used in economics. Jensen (1983, p. 325) states:

*In most economic analysis, the firm is modeled as an entrepreneur who maximizes profits in an environment in which all contracts are perfectly and costlessly enforced. In this firm there are no "people" problems or information problems, and as a result the research based on this model has no implications for how organizations are structured or how they function internally.*

On the basis of the agency tenet that there are bonding and monitoring costs involved in the relationships between managers and owners, it would be a mistake to

characterize the principal-agent contract between the CEO and shareholders for an infrastructure going through private delivery as one that can be perfectly and costlessly enforced.

In the four period model outlined above, it is assumed that the people and information problems come to the fore during periods two and three. The announcement of an infrastructure's going to be privately delivered and the realization by delivery award that they will receive their directive from franchise introduces uncertainty and triggers speculation as to what the future will bring for both labor and management. The CEO, in terms of both people and information, finds himself in a precarious position. Ironically, while his situation is very uncertain with the infrastructure, part of his role during period two will be to maintain decorum and a sense of opportunity within the competition for bid. To do otherwise could lead, possibly, to chaos and make the private delivery more difficult.

Jensen (1983, p. 325) developed a classification system, used for economic analysis of an organization, that is quite relevant to the private delivery. In his development of a classification, Jensen differentiates between theory used for the analysis of the organization and "theory of the firm," which is market theory, not firm theory. The distinction is useful in the analysis of private delivery and franchise organization. That is because the infrastructure market in which franchise operates might be changing substantially at the same time that infrastructure business is changing, as a result of government's implementation of liberalization. To make economic gains through the resolution of agency problems, an examination inside the franchise is crucial. Jensen's three-part scheme is (1) the performance measurement and evaluation system, (2) the reward and punishment system, and (3) system for partitioning and assigning decision rights among participants in the organization.

As the principal-agent relationships are structured during periods two and three of the private delivery process, all three of these systems (identified by Jensen) need review and possible modification. The first and second systems are connected through financial contract. To devise a remuneration scheme that produces incentives for resolving financial-agency conflict, this objective will need to be integrated throughout the remuneration, performance measurement, and evaluation schemes.

In table 3.1 major issues cited by Vuylsteke (1988, p. 74) that could be addressed during the private delivery process are listed (with modification from his argument). The CEO problem is intertwined with most of the major issue Vuylsteke identifies with the process. In the second column of table 3.1 there is opinion as to the relative importance that the financial contract between the CEO and owners has to reach each time. Arguably, resolution of the CEO’s financial contract is the most urgent issue to resolve under two major issues that titled “planning and management” and “employment issues.”

Table 3.1 The Importance of the CEO Contract to the Major Private Delivery Issues

<u>Major Issues</u>	<u>Importance to CEO Contract</u>
Planning and Management	Very Important
Reading infrastructure competition	Somewhat Important
Valuation and Infrastructure Pricing	Less Important
Determining Future Ownership	Somewhat Important
Employment Issues	Very Important
Transaction Cost of Private Delivery	Less Important
Resource Mobilization and Financing	Less Important

It is likely that resolution of the CEO-Owner contract will either be delayed or spill over into period three. The events that occur during private delivery that grossly induce the principal-agent relationship are: (1) control shifts to the private sector, and therefore the agent (the CEO) is choosing to work for the bidding franchise, (2) the bidding principal’s objectives will be different and/or narrower defined than public sector delivery, and (3) beginning in period three the franchise’s financing requirement must be met, to the extent that the franchise is not self-financing, by the private sector capital markets. These interruptions in the CEO’s contract prompt the question as to what financial contract between the CEO and owners is optimal in terms of mitigating financial-agency conflict and minimizing financial-agency costs during period three of the private delivery process.

### **3.4 The Franchise CEO Problem in Terms of Adverse Selection and Moral Hazard**

The problem of financial contracting between the CEO of an infrastructure franchise and the government involves what is termed in the literature as “moral hazard” and

“adverse selection” problems. Darrough and Stoughton (1986, p.501) observe that:

*Moral hazard and adverse selection comprise two forms in which agency problems may take shape. Arrow (1984) equates these two terms with hidden action and hidden information, respectively.*

Moral hazard is associated with hidden action—that is, action taken by an agent that principal cannot directly observe. In the case of private delivery of infrastructure, the hidden action may be simply the inaction taken by the CEO of infrastructure franchise to reduce financial-agency conflict at the critical stages of private delivery process. It is impossible for the private sector to fully assess what measures have been taken or how much effort has been made by a CEO to resolve financial-agency conflict.

If the actions of an infrastructure franchise’s CEO are perfectly observable by shareholders (i.e., there is no potential for hidden action), then the contract between the CEO and shareholders can be designed to compensate the CEO for specific behavior consistent with shareholder’s goals. Realistically the CEO’s behavior is not entirely observable. This creates the potential for opportunistic behavior—the wasteful consumption of perquisites.

Adverse selection occurs when there is hidden information—that is, information known by the agent that is not known by the principal. The adverse selection problem arises in the private franchise’s decision whether to recruit the provisional CEO who was familiar with the project or search for and install a new professional successor. Infrastructure franchise will have limited information about the provisional CEO and his likelihood for success in managing the infrastructure under a private sector control structure (thus the adverse selection problem). Their evaluation of the CEO will have to be based largely on the provisional office’s predicted performance prior to decide to take the bid/delivery. However, this leads to the question, “How good of a predictor is to future performance (under private sector ownership)?” A related question is, “How does an provisional CEO’s past performance compare to the objectives it pursued under private ownership?” This question is rhetorical to the extent that the objectives of the infrastructure provisional office are usually not well defined nor fully understood, even



by the bureaucracy overseeing the provisional office.

A provisional office CEO is better informed than new franchise shareholders to forecast his future success after infrastructure's private delivery. Interestingly, the government, who monitors the provisional office's performance before private delivery, has a more complete information set regarding the CEO's performance than, ironically, the public (the actual owner of the infrastructure). The adverse selection problem confronting shareholders includes their evaluation of replacement candidates as well as the provisional. In general, shareholders have complete information on all candidates' knowledge, abilities, and likely actions (with respect to risk-taking). If shareholders did have perfect information on all candidates for CEO (including the provisional), they would be able to select the candidate most closely matching the attributes they believe are necessary to produce goal congruence. The adverse selection problem implies that because shareholders' information is incomplete, their selection of a CEO could be sub-optimal.

The problems of adverse selection and moral hazard simultaneously have an effect on financial contracting with the CEO during private delivery. Given the new franchise's uncertainty about the provisional CEO's future performance, the decision whether the provisional CEO should be retained, or a new CEO installed, is the adverse selection problem. The disadvantage of replacing the CEO is the forfeiture of his human capital. The significance of this potential loss is difficult to evaluate. If the franchise (1) perceives the infrastructure to be operating fairly efficiently and (2) plan to remain on a similar strategic course after private delivery, then the franchise might perceive the CEO's human capital to be quite valuable. In contrast, an advantage of CEO replacement is the opportunity to install an individual with an attitude toward risk more closely aligned with infrastructure franchise, i.e., less risk averse. The difficulty in ex ante measurement or assessment of an individual's risk aversion extends the adverse selection problem.

A second advantage of CEO replacement is the opportunity to recruit an individual who has unique human capital that might increase the likelihood that the infrastructure achieves success after private delivery. Holmström (1982) uses a principal-agent framework to model an enterprise's manager. In his model, output is the dependent variable, while the individual's talent is specified as a predicting variable. This

specification suggests that a manager's talent helps explain the output achieved by the enterprise.

If the provisional CEO is replaced, the significance of the lost human capital depends on (1) how long the CEO was in his position before private delivery (this should correlate to the amount of valuable knowledge and expertise he acquires until the time that replacement/private delivery occurs) and (2) how relevant the CEO's human capital is to the objectives of the infrastructure after its private delivery. It can be argued that the two decisions, (1) whether to recruit the CEO and (2) what contract to use, need to be made simultaneously, since the degree of the CEO's risk aversion will have an effect on his preference between fixed and variable compensation. If a (more risk-averse) CEO is recruit/retained, then risk-sharing aspect of the financial contract between the principal and agent is more critical.

In the context of investment policy and the potential agency conflict between shareholders, bondholders, and the franchise's management, the providers of capital will prefer a CEO who has similar attitudes toward risk; or, at least, one who will behave as though he does. A misalignment in risk attitudes between the CEO and managers can be solved in two ways. First, an attempt can be made to select and install a CEO who has a similar attitude toward risk as do shareholders. A second method for dealing divergent risk tolerances between the CEO and franchise owners is to offer a financial contract that will produce incentives to motivate the CEO to take actions compatible with the franchise owner's interests. If the CEO's behavior and actions concerning investment policy and overall business strategy are consistent with the franchise owners' attitudes toward risk-taking, then a divergence in risk tolerance in and of itself is not as much of a problem.

After replacement/recruit decision is made, the next decision is one of contract. What sorts of contracts should be considered, and how effective are the different alternatives at aligning CEO behavior with franchise owners' interests? Private delivery creates alternatives for remuneration schemes not available while the infrastructure is delivered by the state. Via state delivery property rights are technically held by the public, but are not marketable. Private delivery creates both primary and secondary markets for buying and selling the infrastructure franchise's property rights. Rational goals for the contract between the CEO and franchises are: (1) to be efficient in terms of risk sharing;

(2) to align CEO behavior with the franchise' objective; and (3) to minimize the contracting costs to the franchise.

### **3.5 Causality between CEO Remuneration and Franchise Performance**

When infrastructure is privately delivered, the government has a number of issues to resolve as it prepares the infrastructure to be delivered by private franchise. How should the infrastructure be bided? Given the complexity of the private delivery process, the government will have to establish priorities for period two (the period when infrastructure is prepared for its delivery). Included in the list of priorities will be the resolution of managerial incentives and compensation. One question that this work points to is whether resolution of incentives should be immediate priority or something that can be dealt with later in the process—perhaps after the infrastructure is delivered.

In the context of private delivery, the urgency of resolving incentive issues and deciding about changes in compensation can be debated. For any particular country that is implementing a private delivery program, in ten to twenty years there may be a larger sample of franchises that have operated successfully (or, perhaps not so successfully) for a number of years since being privately delivered. At that point in the future there will be an opportunity to conduct empirical research to investigate for evidence of a link between an infrastructure private delivery success and managerial compensation. Until such an analysis can be conducted, the question whether managerial compensation affects private delivery success remains unanswered.

According to Murphy (1985, p. 42), the ambiguous results of the research prior to his paper that had looked for a connection between performance and remuneration was based on faulty analysis. "Previous cross-sectional estimates of the compensation-performance relationship are biased and misleading." Murphy (1985, p.13) argues that his analysis of 72 United States enterprises (including 461 executives and 4,500 executive years) supports the connection between managerial compensation and enterprise performance. He found a strong statistical link between managerial compensation and enterprise performance and states:

*The primary conclusion of this paper is succinct and incontrovertible—corporate performance, as measured by the rate of return realized by shareholders, is strongly and positively related to managerial remuneration*

However, the question of causation remains unanswered—does greater remuneration lead to improvements in enterprise performance or vice versa?

If Murphy's findings are extrapolated to the privatized enterprise and the causation assumed is that remuneration leads to performance, then it can be argued that resolution of managerial compensation early in the private delivery process will accelerate the gains precipitated from privately delivering an infrastructure. Two questions that arise, if Murphy's results are extrapolated to the private delivery of infrastructures, are: (1) does enterprise performance in other countries correlate to managerial compensation as found with enterprises in the United States; and (2) how sensitive and quickly will the performance of infrastructure franchise respond to managerial compensation? The first question has likely been researched by economists in other countries. However, as already discussed, research designed to answer questions related to private delivery performance will be delayed until sufficient data can be generated to enable the analysis to be econometrically rigorous.

The importance of creating incentives for the CEO and the potential gain to an enterprise depend on the level of competition in the product market and the concentration of the ownership. If an enterprise operates in a very competitive environment, poor CEO performance and inefficiency will lead to a less-competitive enterprise, which is more likely to fail. In fairly competitive industries, the more efficient enterprises will be the ones most likely to survive over time, while poorly managed enterprise will be the ones most likely to fail. Thus under a competitive-industry scenario, market forces provide the necessary incentives for efficient operation. In contrast, under a monopoly or oligopoly scenario, an enterprise's survival is less dependent on its efficiency. Inefficient CEO behavior will lead to greater costs that can more easily be passed on to the consumer. Since most infrastructures provide services as either a monopoly or oligopoly, they will not be subject to as intense market forces as enterprise operating in more competitive industries. Therefore, creating incentives internally will be more important.

In terms of ownership concentration, when ownership is diffuse there are many individuals who hold relatively insignificant portions of the enterprise's property rights. Under diffuse ownership, each individual stockholder is less concerned about the profitability of the enterprise than someone would be who controlled a major block of the enterprise's securities. Furthermore, these individuals holding diffuse ownership rights might collectively be less aggressive in the monitoring of the enterprise than an individual who holds the aggregate block of rights. As with oligopolistic or monopolistic product market, under a diffuse ownership scenario, incentives are very important. It would be ideal if a contract could be structured so that the CEO puts in the same level of effort that he would if he were being more closely monitored.

If we accept the premise that a franchise performance is depend on the amount and how managerial remuneration is set, we can return to the question as to what financial contract is optimal. This revolves back to understanding the CEO's and the capital providers' (i.e., shareholders' and bondholders') incentives and how they might be aligned through financial contracting. Although Gaver (1992) does not specifically examine private delivery franchise, she raises important issues pertaining to compensation contracts that can be related to private delivery. In her work, she delineates two enterprise attributes. First, an enterprise either has a "stagnant investment opportunities set" or does not, and (2) the enterprise is either undergoing "strategic change" or is not. If strategic changes, such as mergers, acquisitions, and divestitures, were ranked (in ordinal terms) by the degree of uncertainty created by the event—for the enterprise's agency relationships—private delivery would rank very high. The private delivery of an infrastructure introduces the potential for a massive strategic change in terms of ownership and enterprise objectives. Furthermore, depending on how restrictive the government's oversight is on the infrastructure's investment policy (during periods 1 and 2), the investment opportunity set is likely not to be stagnant (as it enters period 3).

Gaver's paper motivates the consideration of two fundamental issues that are relevant to the financial-contracting process during a private delivery. The first issue is whether an infrastructure franchise has a stagnant investment opportunity set. If it does not, this implies that the franchise will attempt to raise capital in the private sector capital markets to finance value increasing investment opportunities, which were identified prior

to, or soon after, the decision of involving in private delivery.

The second issue motivated by Gaver's paper is whether an infrastructure franchise is undergoing significant strategic change because of private delivery. A strategic change could result from either a shift in or a greater emphasis on profit maximization. Usually, strategic change is initiated by a new mission statement. For the model going to be developed in this study the assumption is that an infrastructure being privately delivered divests those services that are incompatible with profit maximization. However, its mission does not change.

These two issues are significant in the context of managerial remuneration. If profitable investment opportunities exist (as the delivery enters period 3), it is the shareholders' best interest that the CEO promptly pursues these. Therefore, incentives need to be in place to encourage pursuit of these opportunities. However, aggressive pursuit of new investment opportunities could introduce risk for the CEO and the franchise. Since the CEO is exposed to much higher risk during period 3, the contract between the owners and him should be negotiated with this in consideration.

Past research supports the premise that there is a connection between enterprise performance and managerial compensation. Particularly relevant to the privately delivered infrastructure is that strategic changes with the delivery, e.g., change in enterprise objectives and property rights, will make traditional compensation obsolete. Thus, it can be argued that the resolution of incentive and compensation issues should be a high priority after the decision to involve in private delivery has been made.

### **3.6 What Should the CEO's Priorities Be during Private Delivery**

At the time that the infrastructure is decided to be privately delivered, a new set of owners becomes the new principal in terms of control. It follows that a different principal will lead to different principal-agent relationship; and, subsequently, a different relationship will yield potentially different agency conflicts and call for different managerial incentives while comparing to public delivery.

The phrase "managerial incentives" encompasses a broad scope of managerial behavior. Before assessing or designing incentives, the first question to ask is, "What

behavior are the incentives trying to encourage?” Agrawal and Mandelker (1987) specifically looked at managerial incentives related to (1) engaging in risky investments and (2) changing the enterprise’s financial leverage. The behavior associated with five areas of financial-agency conflict (discussed in chapter 2) can be related to managerial incentives. In terms of CEO behavior, the five are can be phrased as:

- (1) the CEO’s incentive to shirk and to consume perquisites;
- (2) the CEO’s incentive to shift risk;
- (3) the CEO’s incentive to either under/over-investment;
- (4) the CEO’s incentive to make financing adjustments that can affect the enterprise’s expected cost of bankruptcy;
- (5) the CEO’s incentive to disclose information and to reduce information asymmetries in the capital markets.

Because of the important role that capital markets will have in infrastructure’s future success after it is privately delivered, it is argued that the CEO’s financial contract must contain incentives that address these five areas of agency behavior.

A useful step in designing a financial contract that results in the reduction of financial agency conflict is to inspect the franchise and to characterize it in terms of its principal-agent relationships, and to focus on those relationships that will have an effect on any of the five areas of financial agency. Figure 3.2 is a schematic of a public delivery infrastructure’s major constitutes. The principal-agent relationships are numbered from one to eleven. A relationship is observed when two distinct parties are identified, one party compensating the other for doing something on its behalf. (The two directional symbol “ $\leftrightarrow$ ” symbolizes a contract between two parties, one the principal, the other the agent.)

It can be argued that all contracts depicted in figure 3.2 can influence an infrastructure franchise’s financial-agency costs. For example, even contract no. 10 between the employees and consumers (which might though seem far removed from the operations of the capital markets) can have an effect on contracts no. 5 and no. 6., i.e., the contract between CEO and claimants. If, for instance, employees shirk on customer commitments, customer loyalty on infrastructure services can be damaged. This could lead to a decrease in the prices for the infrastructure’s services and ultimately, to a

decrease in profits and earnings. Hypothetically, the result might be a lower stock price in response to reduced earnings. An important aftermath of this example is that raising new capital would be more expensive, due to greater financial-agency costs and a rise in the franchise's overall cost of capital.

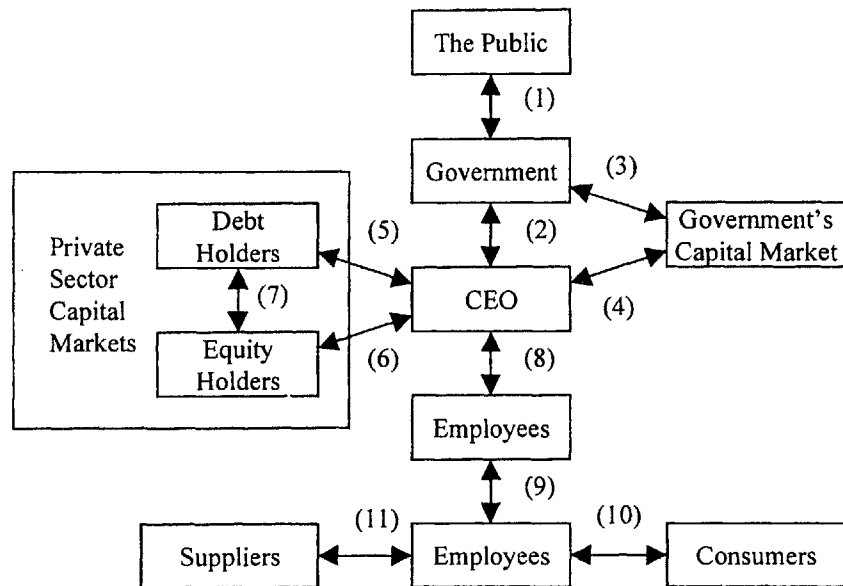


Figure 3.2 Principal-Agent Relationships under Public Delivery

To extend the agency framework, figure 3.3 depicts the major principal-agent relationships with private delivery. The figure is constructed assuming all property rights are managed and operated by the private franchise, and that future financing will come entirely from the private capital markets. For completeness, it should be emphasized that not all private deliveries lead to an elimination of state ownership. In several instances such as BOT or DBO, the state contains regulatory control of the services and assets after private delivery.

While all financial-agency relationship have a bearing on the franchise's financial-agency costs, this work focuses on the termination of the contract between the CEO and the government (contracts no. 2 in figure 3.2) and the newly formed contracts between the CEO and the providers of capital (contracts no. 2, 3, and 4 in figure 3.3). The principal-agent relationship of primary interest is between the CEO and equity holders.



The interest is in the equity holders because control of the franchise shifts from the government to them during private delivery. The principal-agent relationship between the bondholders and the CEO can be viewed as a constraint. The equity holders must, to retain control, satisfy all indenture agreements in pursuit of their objectives.

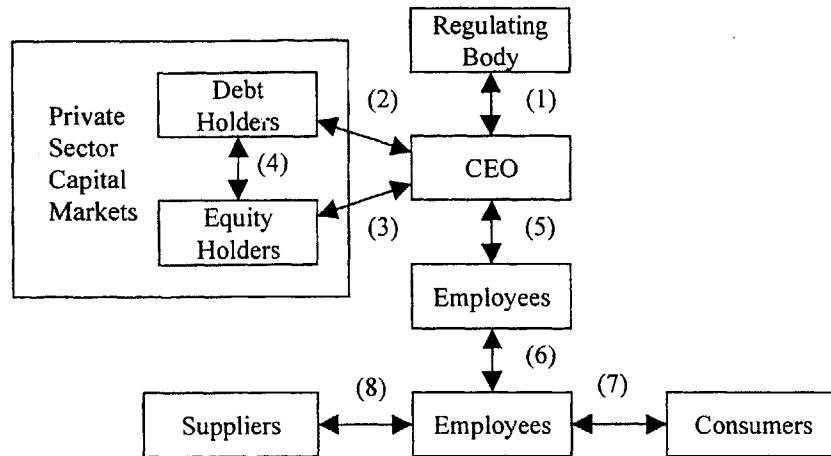


Figure 3.3 Principal-Agent Relationships under Private Delivery

While figures 3.2 and 3.3 depict two general sets of contracts for the infrastructure via public and private delivery, there are different versions of the above models that make for interesting variations on the principal-agent problem. For example, the model considered in this study assumes that the public delivered infrastructure is controlled by a government that holds 100 percent of the infrastructure entity's property rights. This implies that no financing is obtained from the private sector capital markets (through an exchange of property rights) to finance the infrastructure's operations (and that contracts no. 5, 6, and 7 in figure 3.2 are not existed). Furthermore, under this scenarios, all required financing would come either directly from the government, in the form of transfers, or from government subsidized institutes (such as contract no. 3 in figure 3.2). In reality, there are public delivered infrastructures that are partially financed by the private sector. For example, many infrastructures in Asia have sold minority shares to the private sector.

To structure a financial contract with proper incentives, the agent's role must be defined by the principal—that being either the government (under public delivery) or the

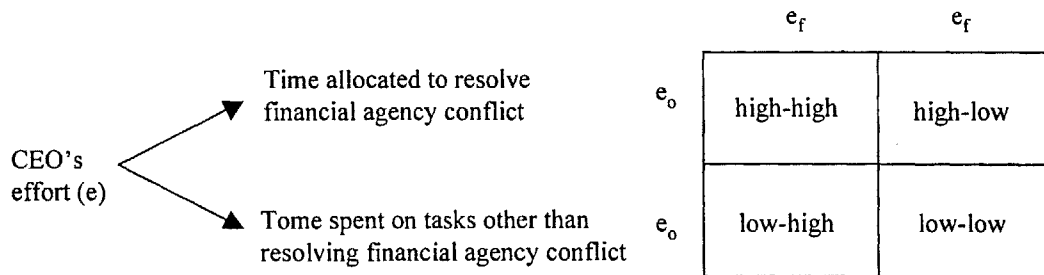
owners of the franchise property rights (under private delivery). Hypothetically, assumes that the shareholders want the CEO's time allocated between two activities—one being the resolution of financial-agency conflict and another being the involving in all responsibilities other than those activities directly associated with resolving financial-agency conflict. It is probable that little effort is allocated to the financial-agency conflict resolution while the infrastructure in under public delivery, since private capital markets are not active participants in the oversight of the infrastructure due to the fact that financing required by the infrastructure services comes from the government. If little time is spent by the CEO of a public delivered infrastructure encouraging behavior that reduces financial-agency conflict, then the potential for reducing conflict might be significant due to neglect.

The magnitude of savings that is realized by a franchise resolving its financial agency conflict depends on the volume of financing it obtains via private delivery. For instance, if a franchise raises small amounts of capital after being involved in private delivery, then gains from reduced financial-agency conflict will correspondingly be small. However, if the franchise raises large amounts of capital, then significant cost savings will be realized, due to fairer (i.e., higher) pricing of its securities. Fairer pricing of the franchise's securities will result to the extent that reductions in financial-agency conflict are accurately reflected in the pricing of the franchise's securities.

A second set of activities that the CEO involved is that includes all responsibilities other than those activities directly associated with resolving financial-agency conflict. The division between activities that have a direct effect on financial-agency conflict and those that do not is nebulous. It can be argued that every task performed within the franchise, even something as menial as ordering paper clips, is behavior that can have some influence on the level of financial-agency conflict. Yet, some activities carried out by a CEO are more secondary than others to resolve conflict. For, example, effort made in day to day oversight of the franchise's service operations might be less visible to the capital markets than time spent on pursuing new investment opportunities.

Assume that a CEO's time can be divided between strategic and operational activities. Furthermore, assume that strategic activities directly influence the level of perceived financial-agency conflict, while operational activities have a secondary effect.

This could lead to figure 3.4, which is a two by two matrix that represents four possible scenarios that can exist at the time infrastructure is under private delivery. The top-left-hand corner of the matrix is marked high-high to represent a scenario where there is a need for significant effort to resolve both financial-agency conflict ( $e_f$ ) and to carry forth other activities (i.e., nonfinancial-agency) activities ( $e_o$ ). The box in the bottom-right-hand corner marked low-low represents the opposite scenario. If the franchise falls in this category, then neither time spent on resolving financial-agency conflict nor on other tasks will produce large gains to the franchise in the short run. It is improbable that a franchise would be identified by this scenario under private delivery. If it is, then the franchise is operating very efficiency and enjoys a competitive cost of capital; and the CEO's primary responsibility should be maintenance of the status quo, which means a public delivery could be successful and there is no need of private delivery.



Note: high means that is a high priority requiring immediate and significant effort  
low means that is a low priority requiring neither immediate nor significant effort

Figure 3.4 CEO Effort Matrix

Almost all infrastructures in Asia (except Japan) are most accurately characterized by the upper-left-hand box of the matrix. After private delivery, infrastructure in Asia require immediate and significant effort (on behalf of the CEO, management, and labor) to resolve both financial and nonfinancial-agency conflicts. Part of the need to resolve the financial agency conflict is exogenous to the infrastructure franchise and can be attributed to the lack of development of the non-Japan-Asian capital markets. Development of these markets requires a concerted effort be made by the infrastructure franchise, government, the banking industry, and domestic and foreign investors. Internally, the CEO of franchise

have critical responsibilities to assist in the structuring of the franchise and to update the technologies. To the extent that an infrastructure franchise in Asia comes out of period one positioned outside the top-left-hand box (indicating that its operations and financial conditions are sound), this might be attributable to the initiatives taken by the government during period one (the preparation stage) of the private delivery process.

To the extent that an infrastructure franchise might be positioned in the bottom-left-hand box (the low-high), this category suggests that the franchise's CEO should take immediate action after private delivery to resolve financial-agency conflict. Likewise, this category suggests that less aggressive action is needed for the non-financial agency tasks. Since infrastructures in well developed economies are structured more efficiently than infrastructures in either LDCs or developing economies, the primary change for an infrastructure franchise in an developed economy is the new and vital role that the private sector capital markets have in its future growth.

Considering where an infrastructure franchise is positioned in the above matrix is an important step in forming an optimal financial contract for a franchise's CEO. By positioning a franchise in the matrix, this suggests what action needs to be encouraged through incentives and financial contracting. The matrix was modeled with period three in mind. Since incentives can be used to encouraged more of a certain behavior and a change in behavior, it is important to be familiar with what behavior was encouraged prior to period three. To the extent that a public delivered infrastructure CEO has to lobby the government's bureaucracy to obtain funding for its operation, a parallel can be drawn to the period three activity of raising funds in the private sector capital markets. However, it is unlikely that the time dedicated to (1) raising capital and (2) bonding and monitoring with the providers of capital (during periods one and two) is significant—unless, perhaps, period two becomes quite protracted and the CEO identifies important short term investment opportunities that need to be pursued before earning the bid. Therefore, the emphasis during period three placed on bonding with capital markets is expected to be much greater than placed on similar activities involving the government (prior to period three).

Both public- and private-delivered infrastructure entities conduct capital budgeting. This activity involves some method of evaluating investment opportunities identified by

the management. A private sector franchise might simply choose those projects that meet the franchise's cost of capital. In the public sector the budgeting process is likely to be similar, except that each project might be required to return (at minimum) the social cost of capital, which is more difficult to quantify. While it is likely that there is a fairly strong parallel between internal capital budgeting in the public and private sectors (i.e., the use of some sort of hurdle rate), emphasis was made above on the difference between the CEO's responsibilities public versus private delivery with respect to raising funds. Assume that private franchise's overall cost of capital ( $k$ ) can be modeled as:

$$k = f(e_1, e_2, e_3, e_4, e_5; \text{other exogenous factors})$$

where  $e_i$  ( $i = 1, 2, 3, 4, \text{ or } 5$ ) is defined as the CEO's effort devoted to resolving area  $i$  of financial-agency conflict. (Each area of conflict was discussed in chapter 2 and is briefly discussed below.) The set of other exogenous factors would include important determinants of interest rates, such as the real rate of interest required and an inflation premium. Recall that in the CEO effort matrix that the CEO's total effort ( $e$ ) is allocated between time spent resolving financial-agency conflict ( $e_f$ ) and time spent on all other responsibilities ( $e_o$ ). By definition,  $e \equiv e_f + e_o$  and  $\sum_{i=1-5} e_i = e_f$ . The following is a brief description of behavior the CEO might pursue in order to reduce each of the five areas of financial-agency conflicts.

- (1) The first variable ( $e_1$ ) is the effort made by the CEO to reduce perquisite consumption within the enterprise.
- (2) The second variable ( $e_2$ ) is the effort made by the CEO to implement an ongoing investment policy that does not bring about any risk shifting between stakeholders.
- (3) The third variable ( $e_3$ ) is the effort made by the CEO to ensure that the enterprise pursues an optimal investment expenditure plan in terms of not over/underinvesting.
- (4) The fourth variable ( $e_4$ ) is the effort made by the CEO to see that the enterprise pursues a prudent capital structure and long-term solvency.
- (5) The fifth variable ( $e_5$ ) is the effort made by the CEO to reduce information asymmetry between the franchise and the capital markets with respect to internal information about investment opportunities.

If shareholders elect to recruit the provisional CEO, one of his most important responsibilities and changes in his job description will be to collaborate effectively with the capital markets to raise funds at the lowest possible cost. Regardless of who is installed as CEO, by his working to minimize the franchise's cost of capital, he will contribute to the objective of wealth maximization through cost minimization. To minimize the franchise's cost of capital, the CEO will need to efficiently allocate his effort among the five areas of agency (*e*). If any of the five areas is ignored, this could result in greater costs being incurred when raising capital.

Exogenous factors, such as market interest rates and inflation expectations, will largely determine an franchise's costs of capital. However, unresolved financial-agency conflict will translate into commensurate discounting of the franchise's debt and equity and increase the overall cost of capital. When the franchise pursues needed funds to finance its period-three investments, the financial-agency-conflict-induced discounts will lead to under-evaluation of newly issued debt and equity and will result in greater amounts of property rights being forfeited to raise each additional dollar of capital.

### **3.7 The Relevance of Risk to Financial Contracting**

One very important facet of the structuring and the building of incentives in the principal-agent relationship (between the owners and the CEO during private delivery) is risk-sharing. There are two facets of risk that are germane to the private delivery process. The first is the absolute risk associated with the infrastructure's private delivery, and second is that of risk sharing. The private delivery of infrastructure creates risk—risk for the CEO and the providers of capital, among others. Although under public delivery while the government is the custodian of the infrastructure's operation, a typical citizen would not view himself as part owner of an infrastructure. Nor would an individual citizen consider his share of an infrastructure in an estimation of his net worth. The individual's ownership rights in a public delivered infrastructure are both negligible and nonmarketable. However, after private delivery, the property rights held by an individual are marketable and may be significant relative to his personal wealth. The riskiness or volatility in the value of the franchise's assets determines the individual investor's risk.

As with any investment, the franchise's providers of capital can diversify their portfolios and eliminate the nonsystematic portion of this latent risk.

What risk does private delivery create comparing with a public delivered infrastructure's CEO and the government? The risk to a government under a public delivery depends on how significant an infrastructure is in terms of the government's overall fiscal responsibilities. When a public delivered infrastructure has a profitable year and requires government financing, the infrastructure is a fiscal drag on the government. For this work it is assumed that a government's sheer size, in terms of its inflows and outflows, is much greater than those flows of any of its infrastructures and, therefore, that it is risk neutral with respect to the public delivered infrastructure yields reason to go to private delivery. By deciding to privately deliver infrastructure, a principal emerges who is more interested in the infrastructure franchise's profitable performance.

After private delivery, the risk tolerance of the principal (the providers of capital) and the agent might remain depending on the assumptions made. The assumption made regarding the principal's and agent's tolerance toward risk and the possibility that the infrastructure franchise identifies a number of profitable opportunities around the time of involvement in private delivery parallels work by Smith and Watts (1992, p. 275). They state:

*When we apply this principal-agent analysis to large firms, shareholders are considered risk-neutral because they can diversify firm-specific risk. If manager cannot effectively diversify the risk of their compensation payments, they are risk-averse in their actions. We suggest that managers' actions are less readily observable if the firm has more investment opportunities. It is difficult for shareholders or outside board members who do not have the manager's specific knowledge to observe all the investments from which the manager chooses. In general, the larger the proportion of firm value represented by growth options, the more likely that the firm ties compensation to the effect of the manager's actions on firm value.*

The study of private delivery of infrastructure is more complex due to the structure

shifts in risk occurring during private delivery process. The transition (periods 2 and 3) in particular are characterized by greater levels of risk and uncertainty. As the infrastructure is prepared for private delivery (during period two), measures are being taken to enhance the infrastructure's feasibility/profitability, such as elimination of unprofitable segments of the operation/business. The execution of these measures introduces uncertainty to the future operations of the infrastructure (such as real estate development in some projects with locational edge). Moreover, concurrent liberalizing activity by the government to introduce or increase competition in the marketplace also adds to the uncertainty.

If remuneration is dependent on franchise's performance, then uncertainty in franchise's performance translates into uncertainty in remuneration. In figure 3.5, the relationship between wealth ( $W$ ) and utility of wealth ( $U(W)$ ) is depicted for a risk averse CEO. For simplicity, two equally probable outcomes for CEO wealth are depicted,  $W_1$  and  $W_2$  (the subscripts 1 and 2 correspond to low and high values for  $W$ , respectively,  $W_2 > W_1$ ). The relative positions of  $U(E[W])$  and  $E[U(W)]$  are shown on the y-axis. The level of utility given by  $U(E[W])$  is the utility associated with an expected level of wealth equal to  $E[W]$ . In contrast,  $E[U(W)]$  is the expected utility from a 50/50 chance of realizing  $W_1$  versus  $W_2$ . (The level of wealth depicted by  $E[W]$  is the value of wealth centered between  $W_1$  and  $W_2$ , based on the 50/50 chance of  $W_1$  versus  $W_2$ .)

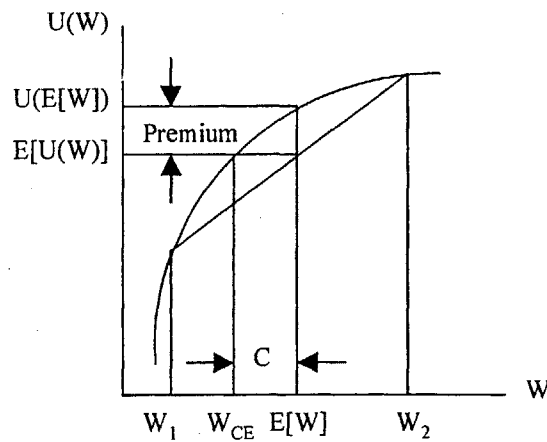


Figure 3.5 CEO Utility as a Function of Wealth

Since  $U(E[W]) > E[U(W)]$ , the function drawn in  $U(W) - W$  space depicted a risk-



averse individual (See Markowitz, 1959). The level of wealth identified as  $W_{CE}$  represents the certainty equivalent (CE) level of wealth that translates into a level of utility equal to  $E[U(W)]$ . In terms of the nomenclature used for figure 3.5,  $U(W_{CE}) = E[U(W)]$ , again assuming a 50/50 probability of  $W_1$  and  $W_2$ . The interval level labeled  $C$  in the figure contains values of  $W$  where  $U(E[W]) \geq U(W) \geq E[U(W)]$ . If a franchise is risk neutral and the CEO risk averse, a Pareto improving-compensation scheme would guarantee the CEO a certain level of compensation that translates to a value for wealth that falls in the range  $W_{CE} < W \leq E[W]$ . This range in compensation (i.e., the width of interval  $C$ ) will depend on (1) the values for  $W_1$  and  $W_2$  and (2) the convexity of the CEO's utility function. As the distance between the end-points  $W_1$  and  $W_2$  decreases or the curve becomes less convex (i.e., more straight), the interval  $C$  becomes smaller. As the interval defined by  $W \in (W_{CE}, E[W])$  decreases, the range of certainty equivalents that can be exploited in constructing a Pareto-improving financial-incentive contract between the owners of the franchise and the CEO is reduced.

Figure 3.5 can be used further to clarify the implications of a structural shift in risk that is likely to occur during the private delivery process. Greater uncertainty precipitated by the private delivery process can be reflected in the width of the interval  $[W_1, W_2]$ . The correlation between uncertainty in the infrastructure's future performance and uncertainty in the CEO's wealth depends on the context that the CEO's compensation is contingent on the franchise's performance. From the perspective of the owners, setting remuneration for the risk-averse CEO contingent on outcome can provide powerful incentives that serve to align his interests with those of the owners. Shavell (1979, p.59) writes as "Proposition 2" in his paper:

*Suppose that the agent is risk averse. Then under a Pareto optimal-fee schedule the agent (a) is paid an amount which must depend on some extent of the outcome, but (b) he never bears all the risk.*

A last point that can be made on risk relates to the adverse selection problem. A position in the public sector might be perceived (especially by a provisional office CEO) to be more secure than a comparable job in the private sector, because of the greater

emphasis that the private sector places on performance and the covering of cost. If this perception accurately portrays the beliefs of the managerial labor market, then individuals who are relatively more risk-averse will pursue those jobs in the public sector, trading-off higher expected remuneration for greater job security and lower variability in remuneration. In contrast, less risk-averse individuals will favor private sector jobs, as they are willing to sacrifice a bit of job security for greater remuneration. This tendency is important to the CEO problem since the franchise owners might seriously consider recruiting new CEO during the financial-contracting process. The obvious advantage to recruiting different risk inclined CEO is that the owners can install an individual having a more compatible risk tolerance with their own. The most compelling disadvantage is the loss of the human capital that the provisional office CEO has accrued while the infrastructure was under his supervision and stewardship for the pre-private-delivery planning and study activities. Referring to figure 3.5, the ultimate decision as to who the CEO is will determine the range of certainty equivalents.

### 3.8 Modeling the Behavior and Incentives of the Principal and Agent

Returning to the four period model for private delivery, recall that during period one the entity operates as a provisional office, i.e., it is owned and operated by the government. Beginning with period one, and over the course of the private delivery process, the expected objective for the infrastructure is assumed to be the pursuit of some combination of consumer surplus and profit. Throughout the private delivery process, the expected utility functions for the shareholders and the CEO can initially be specified as:

$$U = f(CS, \pi, \lambda)$$

$$V = f(W, e)$$

where  $U$  is the shareholders' utility derived from its design, build, finance, and operation of the infrastructure,  $CS$  is the consumer surplus,  $\pi$  is the profit,  $\lambda$  is the weighting between consumer surplus and profit (a parameter of the model),  $V$  is the CEO's utility,  $W$  is the CEO's wealth (including his salary), and  $e$  is the CEO's effort put into the business.

The definition used for the CEO's wealth in above equation is the same used by

Agrawal and Mandelker (1987):

$$W = W_s + W_h + W_o$$

where  $W_s$  is the CEO's common stock and option holdings in the franchise,  $W_h$  is the CEO's human capital "which equals the present value of the stream of future earnings from employment and  $W_o$  is the CEO's holdings of other assets, other than those related to the franchise. Depending on the magnitude and components of  $W_s$ ,  $W_h$  and  $W_o$ , behavior that maximizes the CEO's salary (captured in the term  $W_h$ ) will not necessarily maximize his wealth.

As an infrastructure is private delivered and eventually obtains equilibrium, it passes through periods two and three (refer to figure 3.1) and, eventually enters period four. The time required to traverse periods two and three of the private delivery process and to obtain equilibrium (the beginning of period four) is uncertain. The time it takes to span periods two and three is usually several years—perhaps as one to three year for period two and ten to twenty years for period three. As a response to the private delivery announcement (at  $T_{1,2}$ ), the provisional office CEO will anticipate a disruption in his (principal-agent) relationship with the government. The disruption of the relationship includes: (1) the replacement of the principal, (2) the potential replacement of the agent; and (3) a change or reaffirmation of the principal's objectives. As an infrastructure is private delivered, this necessarily leads to a change in the principal (i.e., there will be franchise owners). This change occurs at  $T_{2,3}$ . Likewise, the agent (i.e., the provisional office CEO) might be replaced with another individual—most likely just before or just after the private delivery is started. Although not a prerequisite for the successful execution of a private delivery, the principal's objective is very likely to change.

The four-period model builds off the premise that a new contract between the CEO and the owners is negotiated each period. At the time that the CEO negotiates his contracts for period three, it is uncertain (ex ante) what his wealth will be at the end of the period—particularly if  $W_h$  and  $W_h$  are both set contingent on franchise performance. Assuming that a CEO negotiates a contract and decides how hard to work based on his expectations, the CEO's utility is more realistically modeled as:

$$E[V_{CEO}] = f(E[W], E[\sigma_w^2], e; \gamma_{CEO})$$

where  $E[W]$  is the CEO's expected wealth,  $E[\sigma_w^2]$  is the CEO's expected variance

in wealth, and  $e$  is defined as before. The parameter  $\gamma_{CEO}$  is the CEO's risk tolerance. (The risk tolerance is denoted explicitly in the model to emphasize its importance to the CEO problem.) This specification suggests that the CEO will make a decision about how hard to work ( $e$ ) based on his expected wealth and expected variance in wealth, given his level of risk-aversion.

If the franchise owners decide to recruit new CEO rather than negotiate a financial contract with provisional office CEO, two important changes occur: (1) the franchise CEO's risk tolerance, and (2) franchise CEO's human capital to the franchise. Compounding the problem of drafting a financial contract compatible with the risk-tolerance of the CEO is the increasing risk that the CEO is exposed to during period three.

In section 3.7, the certainty-equivalent concept was presented to illustrate how expected payoffs, with different dispersions, can be compared in a utility framework. Milgrom and Roberts (1992, pp. 210-211) state that, "One of the central results of decision theory is that the certainty equivalent can be estimated by a simple formula." The formula they give is:

$$CE = I - 1/2 * \gamma_{CEO} * Var(I)$$

where  $I$  is income (say, for this application, period three remuneration),  $\gamma_{CEO}$  is the CEO's level of risk-aversion as defined earlier ( $1/\gamma_{CEO}$  = risk-tolerance), and  $Var(I)$  is the variability in income (or period three remuneration). Using equation above as a frame of reference, there is a twofold effect on the CEO's certainty equivalent that emerges as the private delivery transcends period two and begins period three.

First, if a new CEO is installed with a greater risk-tolerance, then the certainty equivalent increases. Second, period three is characterized as a "noisy" period, which can lead to increases in  $Var(I)$ . The use of a proxy for the franchise's performance as a proxy for the CEO's performance will be more prone to inaccurate assessment during period three. To the extent that the CEO's remuneration depends on this proxy, noise in measuring the franchise's performance by means of this proxy will translate into noise in remuneration. Furthermore, the investment policy implemented after an infrastructure's private delivery can affect the CEO's certainty equivalent to the extent that the pursuit of new projects/services introduces uncertainty in the franchise's performance.

The possible shift in investment strategy that might occur in period three, as a franchise defines new objectives, is one of the primary sources of noise. Agrawal and Mandelker (1987, p. 284) observe that:

*It has been argued that the manager has an incentive to select investment projects that reduce the variability of the firm's earnings stream, ceteris paribus, due to the over-investment of his or her human capital in a single firm and the consequent under-diversification of his or her personal wealth portfolio. Amihud and Lev (1981) argue that, to the extent that the manager's employment income is tied to changes in firm value, an increase in the variance of returns on the firm's total assets,  $\sigma^2_v$ , increases the variance and reduces the certainty equivalent of the stream of his or her employment income. The manager obviously dislikes such decreases in his or her human capital,  $Wh$ , and therefore has an incentive to reduce  $\sigma^2_v$ .*

As with the agent's utility function, the principal's utility function can also be specified in terms of expectations as:

$$E[U] = f(E[CS(E[R])], E[\pi(E[R])]; \lambda)$$

where  $E[CS(\cdot)]$  and  $E[\pi(\cdot)]$  are expected consumer surplus and profit, respectively,  $E[R]$  is the expected remuneration paid to the CEO, and  $\lambda$  is the weighting between consumer surplus and profit. Similar to the CEO's decision as to how hard to work ( $e$ ) based on his expected remuneration and wealth, the shareholders should choose a remuneration scheme for the CEO based on expected consumer surplus and profit. The above equation explicitly shows  $R$  in the specification to represent the principal's ex ante decision as to what remuneration scheme to offer. The expected consumer surplus and profit for the franchise will depend on expected remuneration.

### 3.9 Alternative Components of Remuneration

One possible remuneration strategy for the private delivery process is to use the same

financial contract for the CEO for all four periods. However, that would ignore the changing risks and incentives inherent to the private delivery process and leave new alternatives for compensation unexploited. While researchers have been interested in investigating efficiency gains due to private delivery, a question that has received less attention in the literature is, “What incentives and remuneration structure should be used to effect maximum efficiency gain?” Because of the fluidity of the CEO’s responsibilities and the noise that accompanies the private delivery process (during periods two and three), it would be inappropriate to model the CEO’s remuneration after that used by a typical private sector franchise operation. There are risks and uncertainties inherent to the private delivery process that should be considered in the design of the remuneration scheme. During the execution of private delivery, the greater risk and uncertainty should be acknowledged and the CEO’s compensation adjusted to maintain the correct incentives.

In terms of fixed and variable compensation, three basic schemes can be considered, each one of the general form  $R = \alpha + \beta(M)$ , where  $R$  is defined as total remuneration,  $\alpha$  is defined as fixed remuneration,  $\beta(M)$  is defined as variable remuneration that is a function of  $M$ , and  $M$  is defined as a performance measurement that serves as a proxy for CEO’s effort. One scheme that can be used is a 100 percent fixed remuneration scheme having the form  $R_F = \alpha_F + \beta_F(M)$ , where  $\alpha_F > 0$  and  $\beta_F = 0$ . A second scheme that can be considered is a combination of fixed and variable remuneration and has the form  $R_{FV} = \alpha_{FV} + \beta_{FV}(M)$ , where  $\alpha_{FV} > 0$  and  $E[\beta_{FV}] > 0$ . A third scheme that can be considered is a 100 percent variable remuneration scheme that has the form  $R_V = \alpha_V + \beta_V(M)$ , where  $\alpha_V = 0$  and  $E[\beta_V] > 0$ .

The reason that the expectations operator is used rather than writing  $\beta(M)$  is that the scheme might specify a zero payoff for some states of nature (for the variable component). When there is a variable component in the CEO’s total remuneration that depends on performance, selecting a proxy for measuring performance is an important decision the franchise owners and CEO need to agree upon. Because of the nature of the CEO’s responsibilities and the measurement problem during period three, choosing a fair measure of his performance is a vital part of financial contracting.

Consider the four scenarios depicted in figure 3.6 for period three of the private delivery process. The two by two matrix reflects combinations between remuneration (either 100 percent fixed or 100 percent variable) and the CEO's outside wealth (either very high or very low). While these four scenarios do not encompass all possible remuneration scenarios for the CEO, they serve to illustrate the role that the remuneration scheme has in determining the CEO's expected utility. First, consider the scheme using all fixed remuneration ( $\alpha > 0$  and  $\beta = 0$ ), where the CEO is paid a fixed amount independent of franchise performance. Under this scheme the CEO's remuneration will be insensitive to how well the infrastructure franchise performs during period three. The opposite scheme is an entirely variable remuneration ( $\alpha = 0$  and  $E[\beta] > 0$ ), where the CEO is paid variable remuneration that depends on the performance of the franchise. If the CEO is compensated using a variable scheme, then the variability in the CEO's remuneration will be correlated to the franchise's period-three performance.

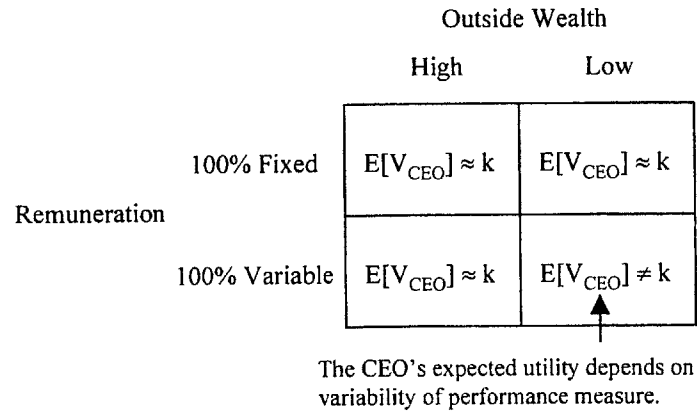


Figure 3.6 Remuneration Matrix

Applying the definition for the CEO's wealth ( $W = W_s + W_h + W_o$ ), consider how these alternative compensation schemes can influence the CEO's utility under the two scenarios:  $W_s + W_h \gg W_o$  and  $W_s + W_h \ll W_o$ . Under the first scenario the CEO's outside wealth is much less than his wealth in the franchise's securities and his own human capital, and  $W \approx W_s + W_h$ . If remuneration takes the form of straight salary under this scenario, then is no securities-based component in remuneration ( $W_s = 0$ ) and  $W \approx W_h$ . This scenario is depicted by the upper-right-hand cell in figure 3.6 as being a situation

where  $E[V_{CEO}] \approx k$ , or where the CEO's utility is going to be essentially insensitive to CEO effort and franchise performance. For comparison, if we continue with the scenario where  $W_s + W_h \gg W_o$ , but now consider a 100 percent variable-remuneration scheme (depicted in the lower-right-hand cell of figure 3.6), then variability in franchise performance (or inaccuracies in the measurement of performance) will affect the CEO's remuneration and utility.

If, however,  $W_s + W_h \ll W_o$ , then wealth no longer depends so substantially on  $W_s$  or  $W_h$ . Under this scenario the variability in wealth and, subsequently, utility is much less sensitive to the remuneration scheme used, whether fixed or variable. (These two scenarios are depicted by the top-left- and bottom-left-hand cells of figure 3.6, respectively.) Under either of these two scenarios the franchise's performance will have much less influence on the CEO's wealth and utility. The bottom-right-hand cell in figure 3.6 depicted the preferred scenario, if the principal wants the CEO's utility to be sensitive to the franchise's performance. When the CEO's outside wealth does not dominate his overall wealth, the CEO will realize greater marginal utility from financial rewards received from the franchise.

We have discussed two broad categories of remuneration—fixed and variable. There are two general categories of variable remuneration: (1) accounting-based and (2) market-based. The distinction between these two is important for the design of incentive during private delivery. First, consider accounting-based remuneration. Accounting-based remuneration is contingent on accounting measurements, such as return on equity or net income. By having remuneration dependent on one or a set of accounting measures, this creates an incentive for the CEO to pursue accounting goals that might be consistent with the shareholder objective of wealth maximization. However, it is conceivable that increasing return on equity is not consistent with increasing shareholders' wealth if the increase is due to increasing leverage to a point where the expected cost of bankruptcy offsets the improvements in return or equity.

In contrast, market-based remuneration is contingent on market valuation, such as the price of the franchise's share of common stock. By setting remuneration depend on the valuation of the franchise's securities, this builds an incentive for the CEO to take measures that will increase the prices of those securities. Setting the CEO's remuneration



contingent to market valuations directly associates his wealth to shareholders' wealth. This is an effective method of mitigating agency conflict between management and the shareholders.

The difficulty in implementing this scheme emerges if there are different classes of claimants who have conflicting attitudes toward risk and franchise behavior. For instance, bondholders and shareholders can have diverging attitudes toward the franchise's investment strategy. Given the likely discrepancy between the objectives of the different classes of claimants and a remuneration scheme contingent on stock valuation, these create an incentive to expropriate wealth from bondholders. However, ultimately, any history of expropriation of wealth from any of the classes of claimants that becomes embedded in investors' expectations will eventually increase the franchise's costs of capital and reduce shareholders' wealth.

While variable compensation can be contingent on either accounting measurements or market valuations, another important distinction can be drawn between short- and long-term remuneration. In the context of the private delivery model, short-term remuneration can be viewed as the CEO's reward for successfully obtaining goals set for period three. Similarly, long-term remuneration can be viewed as the CEO's reward for subsequent success in period four. Tirole (1992, p. 238) observes that, "Managers who face primarily short-term incentives are prone to focus on current profits to the detriment of future profits." The temptation to pursue short-term goals could be significant for a CEO of an infrastructure franchise just after the delivery.

As an infrastructure begins period three of its private delivery, its operations can be evaluated and goals set using one of two perspectives. The simplest would be to evaluate performance after private delivery and to set goals based on rational performance. A more difficult and less tangible strategy for CEO to pursue would be to evaluate and form goals associated with long-term success. If shareholders want CEO to apportion his effort between attempting to improve performance and implementing a visionary plan for the future, they will need to structure his financial contract with short- and long-term incentives to encourage this behavior.

In summary, there are fixed versus variable, account- versus market-based, and short- versus long-term remuneration alternatives available for constructing a

remuneration scheme for the CEO of a private delivered infrastructure. By private delivery it creates the opportunity to offer market-based remuneration, which complements the more limited alternatives that are available under public delivery. Because of the greater range of alternatives that private delivery introduces to the financial-contracting process, the potential exists to create a more efficient financial contract with private delivery.

### **3.10 Summary of Chapter**

In this chapter critical elements of financial contracting with the CEO of an infrastructure private delivery were discussed. The objective was to structure a model that provides worthwhile insights into the CEO problem. The CEO problem was presented as a twofold question or decision. The first decision is to select an individual who is highly capable of guiding the enterprise through a period of change as it pursues a set of either new and/or affirmed objectives, which are designed to maximize shareholders' wealth. In addition to selecting the CEO, the second decision is what financial contract to use in order to produce sufficient incentives for motivating the CEO to perform in accordance with shareholders' expectations.

To identify the appropriate priorities for the CEO in the short run with private delivery, a financial-agency paradigm was applied. The premise applied to the analysis of priorities was that bonding and monitoring activities between the franchise and the owners could be one of the most important activities for the CEO to devote himself to. This premise originates from two observations. The two observations are (1) that the effort spent on bonding and monitoring, specifically the five areas of financial agency, can result in lowering the overall cost of capital, and (2) the infrastructure franchise might accelerate its capital expenditure program (during period three) and would need to tap the private sector capital markets in the short run.

Financial contracting for period three should be adjusted and designed with three underlying facets to the CEO problem accounted for. The first is the sharing of risk. The private delivery of an infrastructure introduces risk throughout the infrastructure services and operation (which can also affect the customers and suppliers). Because the CEO is

assumed to be risk-averse, the balance of risk sharing between him and the owners is an important issue. A second facet that should be carefully considered during contracting is the potential combination of fixed versus variable, accounting- versus market-based, and short- and long-term remuneration. Furthermore, to the extent that the franchise's objectives are more clearly and narrowly defined (e.g., wealth maximization), performance proxies can be identified and targets set. The fundamental objective behind the balance between remuneration components is to align the CEO's incentives with the owners' objectives for the franchise. And third, the contract needs to specify what measurements will be made to assess the CEO's compliance with the contract. Since the shareholders cannot directly observe the CEO's actions (the problem of moral hazard), they need to make their assessment indirectly. There are exogenous factors that can lead to substantial noise in the measurement of franchise performance. As assumption made is that when the franchise enters period three of the private delivery process this typically leads to greater noise in performance measurements, due to disequilibrium conditions that prevail in the short run.



## **Chapter 4 Further Analysis of Financial Contract**

The objective of this chapter is to further analyze the financial-contracting process between a CEO and the shareholders, occurring in the infrastructure private delivery process. Because there is an infinite number of combinations of constraints, incentives, and punishments that can be included in a financial contract (to achieve goal congruence between the CEO and the shareholders), the goal for this thesis is not to pinpoint the specific attributes that a contract should include, such as the optimal mix between the various components of remuneration (i.e., fixed versus variable, accounting- versus market-based, and short- versus long-term remuneration). Rather, the goal is to contribute to the codification of the important dimensions of the contracting process.

### **4.1 A Summary of the Assumptions Used for the Model**

In chapter 3 many assumptions were presented and discussed as the CEO Problem was examined. In this section a list of assumptions is presented to formalize the structure of a private delivery model that is consistent with our analysis. This thesis believes that the model is unique and relevant to case-by-case private delivery programs that are occurring in developed economies. (The attributes of a model applicable to infrastructure private delivery, e.g., the United States' private delivery program, would be entirely different to developing countries.) Those assumptions are:

A1) All provisional office and prospective CEOs, from either the private or public sector, are risk-averse (i.e.,  $r_{CEO} > 0$ ). The assumption of risk-aversion does not preclude risk-taking behavior by the CEO. The assumption implies that the CEO must be compensated for taking risks. If the CEO were risk-neutral or risk-loving, the implications would change considerably. For example, if the CEO were risk-loving, then the added risk exposure during private delivery would increase his satisfaction (*ceteris paribus*). Rather than needing to compensate the CEO to share greater risk, he (the CEO) would be willing to give up (some) remuneration for greater risk exposure.

A2) A typical CEO recruited from the private sector is less risk-averse (with respect to his wealth) than provisional office CEO.

A3) The CEO's risk-aversion ( $r_{CEO}$ ) is constant. (A common assumption made in the literature and used in this thesis is that the coefficient of absolute risk-aversion is not a function of income.)

A4) The probability that the CEO of a franchise is fired increases monotonically across periods one, two, and three but then decreases in period four. Thus, if  $p_t^j$  is the per annum probability of the CEO being fired in period  $t$ , then  $p_1^j < p_2^j < p_3^j$ , and  $p_4^j < p_3^j$ .

A5) The variability in the returns from the franchise's securities (stocks, bonds, and options) are greater during period three than period four. In terms of standard deviations, this variability can be expressed as:  $E[\sigma^2(R_{s,3})] > E[\sigma^2(R_{s,4})]$ , where  $R_{s,t}$  is the return on security  $s$  in period  $t$ .

A6) The principal (i.e., the government in periods one and two, or the body of shareholders in periods three and four) is risk-neutral with regards to the franchise's performance. An infrastructure provisional office represents a very small portion of a government's fiscal responsibility.

A7) During periods one and two the infrastructure is entirely under state planning, and none of the infrastructure's financing comes from the private sector. Prior to its private delivery (at  $t_3$ ), the infrastructure has no ownership rights held by the private sector (i.e., no shares are outstanding). (Therefore, the CEO's common stock and option holdings in the infrastructure during these periods are equal to zero, i.e.,  $W_s = 0$ .) After the private delivery of an infrastructure, all its financing comes from the private sector capital markets.

A8) Consistent with the ownership structure described in assumption A7, the franchise's principal-agent representations before and after infrastructure private delivery are depicted in figures 4.1 and 4.3, respectively. Figure 4.1 (public delivery) is identical to Figure 3.2 (presented in chapter 3), with one important change. The private-sector capital markets are deleted based on the assumption that no property rights are held by the private sector.

A9) The CEO's wealth across the four periods of private delivery is defined as  $W_t = W_{s,t} + W_{h,t} + W_{o,t}$ , where  $t = 1, 2, 3, \text{ or } 4$  for the four periods, and  $W_s$ ,  $W_h$ , and  $W_o$  are defined as before. The CEO's level of outside wealth ( $W_{o,t}$ ) is independent of the amount of effort ( $e$ ) he puts into the franchise.

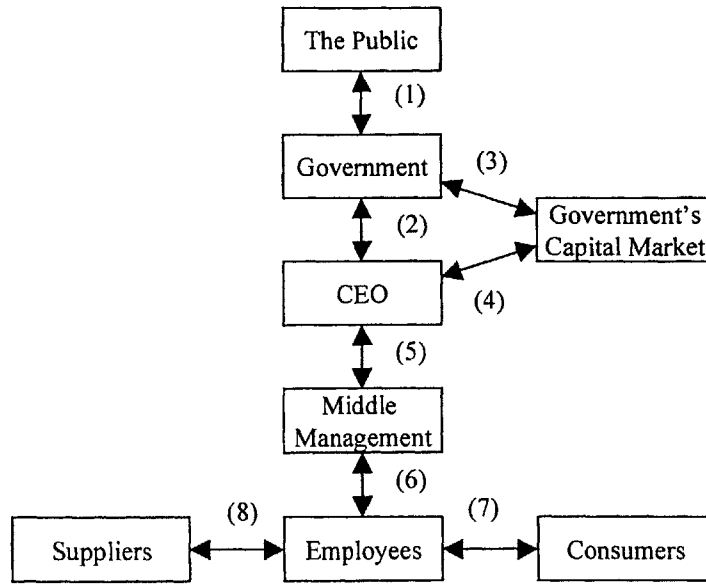


Figure 4.1 Principal-Agent Relationships under Public Delivery

A10) The expected utility functions for the principal and agent before and after the private delivery are:

$$E[U] = f(E[CS(E[R])], E[\pi(E[R])]; \lambda_i) \quad (4.1)$$

$$\text{and } E[V] = f(E[W], E[\sigma_w^2], e; r_{CEO,i})$$

respectively, where the terms  $E[CS(\cdot)]$  (expected consumer surplus),  $E[\pi(\cdot)]$  (expected profit),  $E[R]$  (expected remuneration),  $E[W]$  (expected wealth), and  $E[\sigma_w^2]$  (expected variance in wealth) are all functions of the CEO's effort ( $e$ ).

A11) The weighting between consumer surplus ( $\lambda_i$ ) and profit ( $1 - \lambda_i$ ) satisfies the following:  $\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \lambda_4 \geq 0$ , where the subscripts reference the weights for the four periods. By definition, as the principal increases his emphasis on profit maximization, this is reflected by decreases in  $\lambda_i$ . Likewise, the CEO's risk-aversion ( $r_{CEO,i}$ ) satisfies the following:  $r_{CEO,1} = r_{CEO,2} \geq r_{CEO,3}$ . (No assumption is made for the CEO's risk-aversion in period four ( $r_{CEO,4}$ ).

A12) The two weak inequalities ( $\geq$ ) specified in A11 (between  $\lambda_1$  and  $\lambda_2$ , and  $\lambda_3$  and  $\lambda_4$ ) suggest that the principal's objective functions for periods one and two and for

periods three and four could be identical. In other words, the objective function does not necessarily change across periods one and two or periods three and four.

A13) The principal's objective function does change across periods two and three, with a greater (if not a complete) emphasis on profit maximization.

A14) The partial derivatives of the utility functions (denoted with subscripts) satisfy the following inequalities:  $U_{cs}$  and  $U_{\pi} > 0$ ;  $U_{cs, cs}$  and  $U_{\pi, \pi} < 0$ ;  $V_w > 0$ ,  $V_{\sigma} < 0$ ;  $V_e < 0$ ;  $V_w, V_{\sigma, \sigma}$ , and  $V_{e, e} < 0$ .

A15) The decision to recruit the CEO occurs at  ${}_2t_3 + \Delta t$ , where  $\Delta t$  represents a very brief time (for example, less than three months) after the control of the infrastructure transfers to the private sector. The recruit decision will be made by the new shareholders. (There is no golden parachute agreement made between the CEO and government in period two that affects the financial contracting between the CEO and the shareholders in period three.)

A16) An infrastructure being privately delivered divests or liquidates (over time) those businesses that are incompatible with profit maximization. However, its mission (i.e., the franchise's business) does not change.

A17) An infrastructure undergoes strategic change during private delivery. The strategic change results from either a shift or a greater emphasis on profit maximization.

A18) Because of the changes induced by an infrastructure's private delivery, there is increased uncertainty in the provisional office's performance during period two relative to period one and, similarly, during period three relative to period two. The monotonic increase in the uncertainty in performance reverses at  ${}_3t_4$  (when the franchise begins period four and obtains equilibrium).

A19) Concurrent to increased uncertainty in franchise performance, there is increased noise in the measurement of the CEO's performance during period two relative to period one and, similarly, during period three relative to period two. The monotonic increase in noise also reverses at  ${}_3t_4$ .

A20) One of the CEO's most important responsibilities (in terms of increasing shareholders' wealth) during period three of the private delivery process might be to mitigate financial-agency conflict. Time spent on issues related to ongoing operations might have less of an effect on shareholders' wealth.



A21) The franchise, if regulated, will pursue an objective function as specified by equation 4.1 (see assumption A10). Regulation will not lead to a profit constraint.

#### 4.2 Further Elucidation of the Adverse Selection Problem

The model for the CEO's utility ( $V$ ) can be specified as:

$$V = f(W, e) \tag{4.3}$$

to focus on the effect that wealth has on the CEO's utility. If the CEO's utility monotonically increases at a decreasing rate with wealth (and, thus, is concave), then the graphical representation (see figure 4.2) reveals higher marginal utilities from an extra dollar of wealth at lower levels of wealth, and lower marginal utilities at higher levels of wealth. If a principal seeks greater effort from a CEO, he will find that (*ceteris paribus*) a CEO who derives a high marginal utility from an extra dollar of wealth is more responsive (in terms of changes in effort) to remuneration than one with a lower marginal utility. To maximize his utility, the CEO will increase his effort until his (expected) marginal utility from an extra dollar of wealth and the marginal disutility from the additional effort (required to earn the subsequent increment in expected wealth) are equal.

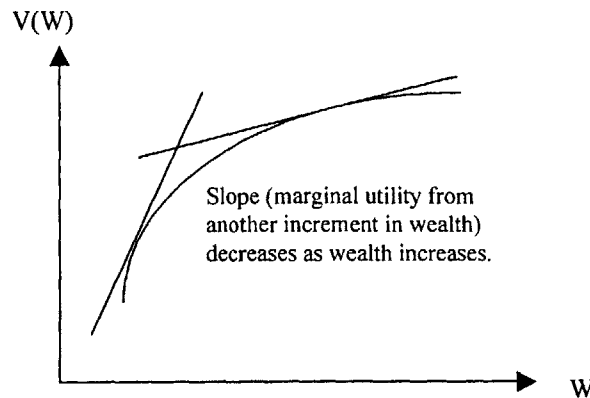


Figure 4.2 The CEO's Utility as a Function of Wealth

Figure 4.3 depicts the level of effort where the marginal utility and disutility are equal. If a principal expects greater effort from a CEO who has a relatively high marginal utility from an extra dollar of wealth, should he search for a CEO having little wealth

(where marginal utility is high)? This rhetorical question helps elucidate the adverse-selection problem confronting the new principal at the beginning of period three. If a manager enters the CEO market announcing that his wealth is low (which implies that his marginal utility is high), that perhaps sends a negative signal about his competency. The adverse-selection problem exists due to the asymmetry of information between the principal and agent: (1) a CEO has far more knowledge concerning his own competency (i.e., the intrinsic value of his human capital) than the principal does, and (2) a manager's total wealth and the composition of that wealth will, most likely, not be known by the principal.

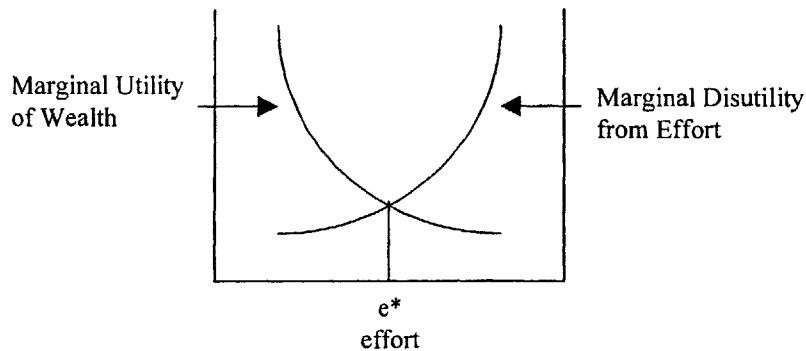


Figure 4.3 Marginal Analysis to Determine CEO Effort

The extent that a CEO's proficiency at managing an infrastructure corresponds to his proficiency at managing a privatized franchise is empirically untested. His success via infrastructure private delivery will depend on several factors. Two important ones are: (1) the extent that his role changes as a result of the profit seeking/maximizing objectives and (2) how remuneration is adjusted to obtain goal-congruence. There are at least three alternative solutions to the adverse-selection problem. First, the principal can attempt to retain the CEO of the provisional office. Although information about his last performance and ability will be incomplete, information obtained on the infrastructure's performance provides inferential background on the CEO's past performance. A second alternative is to hire a CEO with well-known credentials from a franchise owned and controlled by the private sector. While the shareholders again will have incomplete information, this alternative might offer the most information for predicting the individual's likelihood for

future success in the private sector. A third alternative is to hire someone who is unemployed, but has verifiable and sufficient credentials to legitimately position him in the executive labor market. Regardless of whether the provisional CEO is retained or replaced, after the CEO selection is made, the owners will need to negotiate a contract to mitigate the moral-hazard problem. Resolution of the moral-hazard problem is further developed in sections 4.4 and 4.5.

Continuing with the analysis of the adverse-selection problem, should a CEO's level of wealth necessarily be associated with his level of competence or talent? Holmström (1982) models the franchise's output ( $y_t$ ) at time  $t$  as a function of  $\eta$  and  $a_t$ , the manager's talent and effort, respectively (the equation also includes a stochastic noise term,  $\varepsilon_t$ ):

$$y_t = \eta + a_t + \varepsilon_t \quad t=1, 2, \dots \quad (4.4)$$

Since Holmström's decision to model output as a linear function of talent and effort is irrelevant to the work herein, consider the implicit form of equation 4.4 for simplicity:

$$y_t = f(\eta, a_t) \quad t=1, 2, \dots \quad (4.5)$$

where it is understood that output is (based on the model specification) monotonically increasing as a function of talent and effort, respectively. Holmström refers to his model as a production function with talent and action (or effort) as the inputs, and  $y_t$  as representing output. (Notice that  $\eta$  remains constant across time, while  $a_t$  is an independent variable that can change each period.)

Relating this model to the CEO Problem, the value for  $\eta$  is determined when the owners decide upon a CEO. The CEO, whether he comes from an infrastructure or is hired from the private sector, brings a certain level of talent to the job. Holmström's model suggests that a person's unique talent, which is a very abstract attribute, helps explain output. A literal interpretation of equation 4.4 is that a manager who has  $\eta$  units of talent will produce  $\eta$  units of output every period (in addition to his discretionary and random productivity,  $a_t$  and  $\varepsilon_t$ , respectively). According to Holmström's specification, each manager brings a certain level of talent and, thus, productivity to a position, independent of incentives or wealth.

In contrast, action taken by the CEO ( $a_t$ ) is discretionary; he decides what level of effort to put in for period  $t$ . What effort is made, and the CEO's augmentation to productivity for any one period, will depend on incentives. This interpretation of

Holmström's model helps delineate the adverse-selection problem (i.e., the problem of finding a talented CEO whose discretionary effort is sensitive to incentives) from the moral-hazard problem (i.e., the problem of designing a contract that will entice him to work hard).

### 4.3 The Implications of Increasing Risk Across Periods

Consider a scenario where the shareholders' decision with respect to the adverse-selection problem is to retain the CEO from the infrastructure (at least) for period three. (There are likely to be private delivery where the principal places a very high value on the provisional office CEO's experience and knowledge and does not want to lose this human capital.) The following discussion analyzes the progression from period one to two, and then from period two to three, from the perspective of the CEO's wealth and the uncertainty in his wealth. Although the analysis is based on several simplifying assumptions, it suggests that to maintain the current level of satisfaction (which might be a necessary condition for retaining the CEO), the CEO's expected remuneration needs to be increased in periods two and three.

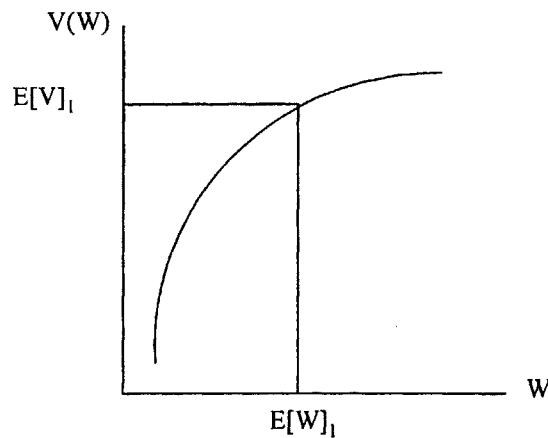


Figure 4.4 CEO's Utility Versus Wealth in Period 1

In section 3.7 the CEO's utility was graphed to depict a concave dependence on wealth. In figure 4.4 a similar graph is presented. If we assume (for period one) that (1) the typical CEO in the public sector/provisional office is risk-averse (see assumption A1);

(2) the CEO expects to serve out his career working for the government and has 100 percent confidence in the real value of his future earnings stream; (3) the CEO is aware of (and puts in) the minimum level of effort ( $e_{min}$ ) required to retain his job; and (4) the CEO expects his portfolio of outside investments ( $W_o$ ) to grow at a predictable rate, then the CEO's expected wealth and utility for the end of period one are given as  $E[W]_1$  and  $E[V]_1$ , as depicted in figure 4.4. To focus on the CEO's risk and return exposure, we further assume (for all periods) that the amount of remuneration remains constant (even though the CEO's expectations change), and that the CEO puts in  $e_{min}$  each period (regardless of his expectations regarding the volatility in his wealth).

The assumptions just described are used to construct a scenario where the CEO expects, with probability equal to one, that  $E[W]_1$  will be the future value of his wealth at the end of period one. Because the CEO sees only one possible state of nature, this model describing the CEO's expected wealth for period one depicts complete certainty (with respect to his wealth). The CEO's expected utility is initially  $E[V]_1$  and can mathematically be expressed as  $f(E[W]_1, 0, e_{min}; r_{CEO}, \nu)$ , where the subscript one designates period one, and the expected variance in wealth is zero.

This utility-versus-wealth analysis can be extended to periods two and three of the private delivery process to better understand the intertemporal effect that private delivery can have on the agent's (i.e., the CEO's) utility. Assume that shortly after the time of the announced private delivery (recall that the announcement occurs at  $t_2$ ), the CEO's expectations can be described as follows (see figure 4.5). The CEO will expect that there is a 50 percent chance he will be retained by the franchise (at the start of period three) and, thus, will make a successful transition to the private-sector's managerial-labor market. In this state of the world ( $S_2^g$ ) the CEO expects his wealth will be  $W_2^g$  (the subscript 2 signifies the CEO's wealth at the end of period two and the superscript g signifies "good state of the world"). The CEO also believes there is a 50 percent chance of being terminated by the franchise at the end of period two. If this state ( $S_2^b$ ) occurs (the superscript b signifies "bad state of the world"), the CEO believes his market wage will decrease, due to the negative signal his firing would send to the labor market. Moreover, the CEO expects his wealth would be  $W_2^b$ .

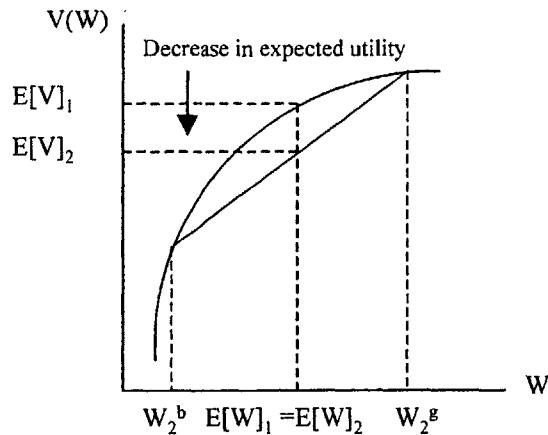


Figure 4.5 CEO Expected Utility Versus Wealth in Periods 1 and 2

Although the events that transpire at the beginning of period two introduce uncertainty in the CEO's wealth, the expected wealth for the end of period two is the same as the expected wealth for the end of period one (i.e.,  $E[W]_1 = E[W]_2$ ). Since the CEO's expected wealth remains constant, but uncertainty in wealth increases, the CEO's utility is reduced (continuing with the important assumption that the CEO continues to put in  $e_{min}$ ). The loss in utility between periods one and two is depicted in figure 4.5 as the difference between  $E[V]_1$  and  $E[V]_2$ .

If the government were to increase the CEO's remuneration in period two, this would raise  $E[W]_2$  above  $E[W]_1$  for two reasons. First, if the CEO's remuneration were increased, then  $W_2^g$  would rise since the CEO would anticipate a continuation of the greater remuneration into period three (if the good state of the world  $S_2^g$  were realized). Second, the increase in remuneration would signal the CEO that the government considered him to be valuable to the infrastructure and he would raise his probability forecast for the occurrence of the "good" state of nature  $S_2^g$ . However, an increase in the CEO's forecast for the probability of  $S_2^g$  would be tempered by the fact that any decision to increase the CEO's remuneration during period two would be made by the government, and, ultimately, the decision whether to retain the CEO for period three is made by the new shareholders.

Next consider the expected utility-versus-wealth scenario for the CEO at the

beginning of period three (see figure 4.6). The assumptions are (1) the government does not increase the CEO's remuneration during period two; (2)  $E[V]_2$  exceeds the CEO's reservation utility (therefore, the CEO does not quit during period two); and (3) state  $S_2^g$  is realized, i.e., the new owners decide to retain the provisional office CEO for (at least) period three. In figure 4.6 the two new states of nature for the end of period three are depicted as  $a'$  and  $b'$ , along with the prior periods' states of nature ( $a$  and  $b$  for the end of period two and  $z$  for the end of period one). The chord ( $a'b'$ ) "connecting the two states of nature for the end of period three is longer than the chord ( $ab$ ) connecting the two states of nature for the end of period two. The implication of the longer chord is that the CEO's uncertainty in wealth increases again as period three of the private delivery begins.

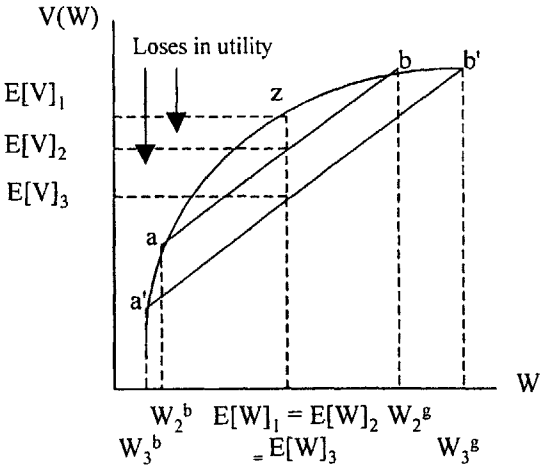


Figure 4.6 CEO Expected Utility Versus Wealth in Periods 1 and 2

The new chord ( $a'b'$ ) depicts a unique situation where the values of wealth in the good and bad states are greater and less than the values for period two, respectively, but  $E[W]_3 = E[W]_2$ . A possible scenario that matches this graphical representation can be described as follows. The value for  $W_3^b$  is less than  $W_2^b$  due to the increased threat of firing during period three (see assumption A4 in section 4.1). If the CEO is fired, that signals the labor market that the CEO has been unsuccessful after making a transition to the private-sector's managerial-labor market; being fired would call into question his competency. Consequently, his subsequent prospects of finding a job in the private sector would be reduced. If the CEO was fired during period three, it would be probable that he

would return to the public-sector labor market (rather than remain in the private-sector labor market), where the value of his human capital would be contingent on the valuation determined in that market.

An assumption made is that the CEO's valuation of his human capital would decrease due to his temporary absence from the public sector (i.e., his time spent working for the private sector during period three). The bureaucrats who might be expected to assist in the relocation of high-level managers in the public sector would likely work less aggressively to find a new job assignment for the CEO at the end of period three than they would have in the prior period. This could be explained by a weakening in the relationship between the CEO and government officials that would understandably occur during the CEO's absence.

In terms of  $W_3^g$  being greater than  $W_2^g$ , one explanation for a higher level of wealth at the end of period three versus period two (in the good state of nature) is the expected increase in the valuation of the CEO's human capital that would reflect his accomplishments while working in the private sector. At the beginning of period three, the CEO is essentially selling his services to a monopsony, i.e., the (newly) private franchise. The success achieved by the franchise during period three would elevate the valuation of the CEO's human capital and, correspondingly, his wealth to  $W_3^g$ . This increased valuation would reflect the private sector's adjustment to the news of the CEO's success.

The analysis shows that as the private delivery process traverses period one to two, and then from period two to three, the CEO's expected utility is reduced due to increased volatility in wealth. Two underlying assumptions are (1) the principal does not change the CEO's remuneration across periods, and (2) the CEO does not change his level of effort. The magnitudes of the monotonic decreases in utility depicted in figures 4.5 and 4.6 are attributable to the degree of convexity in the function  $V(W)$ ; the greater the curvature, the larger are the incremental decreases in utility. Graphically, greater curvature in the  $V(W)$  function depicts greater risk-aversion on behalf of the agent. If the CEO were risk-neutral, a sketch of the  $V(W)$  function would be linear and the expected utility would have been constant across all three periods (for the states of nature and probabilities described).

The implication of this analysis for financial contracting is that the CEO's expected



remuneration will (perhaps) need to be increased to keep the CEO above (or equal to) his reservation utility (assuming the principal wants to retain the CEO). If we relax the assumption that effort is fixed, it leads to the question as to how the CEO might adjust his level of effort across periods. In periods two and three, expectations (as to remuneration) would depend on planned effort. For example, the CEO's period-three expectations for the dependencies between (1) wealth and effort and (2) variance in wealth and effort would depend on the financial contract with the new shareholders. One exception would be if the principal continued to offer the CEO guaranteed remuneration over his entire career. Under a guaranteed contract there would continue to be no relationship between effort and wealth (and the CEO would likely continue to put in  $e_{\min}$ ). Given the expected commitment to wealth maximization by the principal in period three, it is highly unlikely that the remuneration strategy employed under state-ownership would be sustained.

#### **4.4 The Importance of the Financial Contract to Forming Expectations**

In the real world, future outcomes are always uncertain. The range of outcomes for an event can either be discrete, such as whether a light switch is in the "on" or "off" position, or continuous, such as the amount of rain that accumulates during a 24-hour period. When the range of outcomes is continuous, the number of possible outcomes is infinite; each having zero probability of occurrence. When forming expectations, an individual will assign probabilities to discrete states, even if the range of outcomes is continuous. For example, the decision to carry an umbrella will be made based on the chance of rain (versus the chance of no rain). The probability assessment will be determined by partitioning the continuum of outcomes into two states--"rain" and "no rain"--and assigning cumulative probabilities to both states.

In the last section, the analysis and interpretation were based on the assumption that the CEO's behavior corresponded to his assuming two states of nature, with equal probabilities of occurrence. This assumption is simplistic, yet intuitive. Consider how the assumed partitioning of the states of nature and the assignment of probabilities can affect the CEO Problem. Rather than assuming just two states of nature, a more realistic assumption is that there is an infinite number of states of nature. Each successive

outcome or state is characterized by the franchise's value at the end of period three. The cumulative probabilities depend on, among other variables, the CEO's effort. To partition the continuum of states of nature, it is assumed in the upcoming discussion that there are three states for the infrastructure after its private delivery (at the end of period three).

For illustrative purposes and as stated above, the assumption used here will be to consider three possible states: (1) the best state is described by a *greater* market valuation of the franchise ( $V_g$ ) at the end of period three (relative to the beginning); (2) the second state is described by an *unchanged* valuation of the franchise ( $V_u$ ); and (3) the third state is described by a *reduced* valuation of the franchise ( $V_r$ )----but not failure. (The model focuses on period three and, therefore, only the short-run valuation is considered.) The model does not preclude eventual failure of the franchise; just that failure will not occur during period three. In figure 4.7 the three possible states of nature are depicted for an infrastructure.

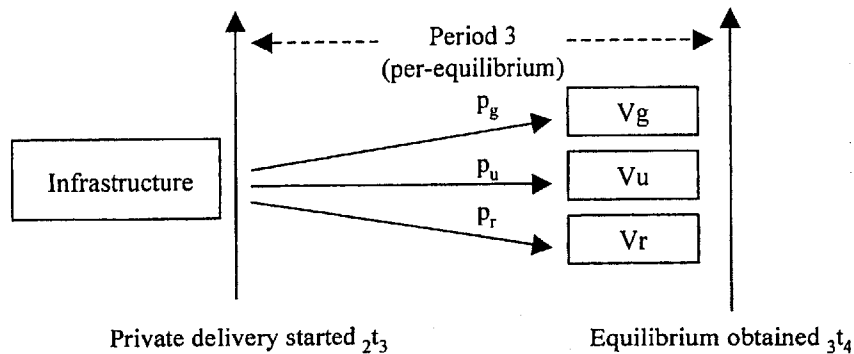


Figure 4.7 Three Possible States of Nature for an Infrastructure after Being Private Delivered

Since one of the three states of nature will (with probability = 1) occur,  $p_g + p_u + p_r = 1$ , where  $p_g$  is the probability of a greater valuation being realized,  $p_u$  is the probability of an unchanged valuation being realized, and  $p_r$  is the probability of a reduced valuation being realized. The three valuations  $V_i$ , where  $V_i \in \{V_r, V_u, V_g\}$ , satisfy the relationship  $V_r < V_u < V_g$ , and the three performance probabilities correspond to the franchise value; having the same subscripts. For example,  $p_g$  is the probability of a greater franchise value ( $V_g$ ). Finally, the dependence between the probabilities of each state and the CEO's effort can be represented using mathematical notation as:  $p_g = g(e)$ ,  $p_u = u(e)$ , and  $p_r = r(e)$ .

While the explicit functions for the three probabilities are unspecified, hypothetical probability profiles are depicted in figure 4.8 for illustrative purposes. Assumptions pertaining to the probability profiles are:

(1) The probability of achieving a greater valuation ( $V_g$ ) by the end of period three is increasing and strictly concave in  $e$ , with  $0 \leq p_g \leq 1$  for all  $e \in \mathfrak{R}^+$ .

(2) The probability of achieving reduced valuation ( $V_r$ ) by the end of period three is decreasing and strictly convex in  $e$ , with  $0 \leq p_r \leq 1$  for all  $e \in \mathfrak{R}^+$ .

(3) The probability of the valuation remaining stagnant ( $V_u$ ) from the time the infrastructure is private delivered ( $t_2$ ) until the end of period three ( $t_4$ ) is first increasing and then decreasing in  $e$ , with  $0 \leq p_u \leq 1$  for all  $e \in \mathfrak{R}^+$ . Furthermore,  $p_u = u(e) = 1 - p_g - p_r = 1 - g(e) - r(e)$ .

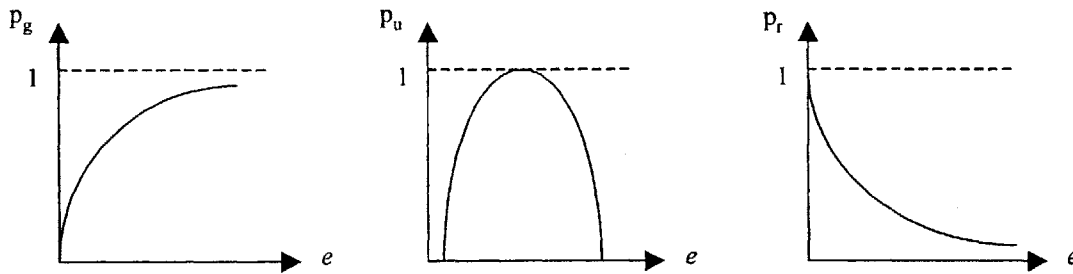


Figure 4.8 Probability of Outcomes as a Function of CEO Effort

If shareholders homogeneously believe there are three possible states of nature, then they can set a remuneration scheme that has a variable component of compensation contingent on the state that occurs. Specifically, if the new owners believe that the value of the franchise ( $V_i$ ) will accurately reflect the CEO's performance during period three and want to set the CEO's remuneration contingent on franchise performance, then they can set period three's remuneration ( $R$ ) equal to  $\alpha + \beta_i$ , where  $\alpha$  is a constant and  $\beta_i$  equals  $\beta_r$  if  $V_i = V_r$ ,  $\beta_u$  if  $V_i = V_u$ , or  $\beta_g$  if  $V_i = V_g$ . The effect of using this particular remuneration scheme on the CEO's utility can be analyzed using the model specified as the CEO's utility function:

$$E[V_{CEO}] = F(E[W], E[\sigma_w^2], e; r_{CEO}) \quad (4.2)$$

Recall that neither the owners nor the board of directors can directly observe the

CEO's effort ( $e$ ) during period three. They can, however, observe ( $V_t$ ) at the end of the period ( $t_4$ ). The "+" and "-" symbols above the terms in equation 4.2 indicate that (1) an increase in expected wealth will increase the CEO's expected utility; (2) an increase in the expected variance of wealth will decrease the CEO's expected utility; and (3) an increase in effort will decrease the CEO's utility (see assumption A14 in section 4.1). Applying marginal analysis, we expect the CEO to put in a level of effort that leads to his marginal utility from (expected) wealth just equaling the marginal disutility derived from the combination of greater (expected) variance in wealth and greater effort.

To gain further appreciation for the importance that the assumption concerning the possible states of nature has in financial contracting, consider a simplified version of the model given by equation 4.2:

$$V_{CEO} = f(E[R], e) \quad (4.6)$$

where  $E[R]$  is the CEO's (expected) period-three remuneration and  $e$ , as before, is effort (the variance term has temporarily been removed). By assuming that the three states of nature (and their probabilities) are the identical expectations held by the CEO and shareholders, and using the above remuneration scheme, an explicit utility function can be posited:

$$E[V_{CEO}] = \alpha + p_r(e) \cdot \beta_r + p_u(e) \cdot \beta_u + p_g(e) \cdot \beta_g - e^\gamma \quad (4.7)$$

where the first four terms equal the CEO's  $E[R]$ , the fifth term is the disutility from working, and  $\gamma > 1$  to reflect increasing marginal disutility from expending effort (see assumption A14 in section 4.1). Recognizing that the selection of three states of nature is arbitrary, and that expectations and financial contracting might be based on any number of states, equation 4.7 can be expressed (more generally) as:

$$E[V_{CEO}] = \alpha + \mathbf{p}' \cdot \boldsymbol{\beta} - e^\gamma \quad (4.8)$$

where  $\mathbf{p}'$  is the transpose of the  $3 \times 1$  probability vector and  $\boldsymbol{\beta}$  is an  $n \times 1$  vector containing the variable remuneration associated with the chosen number of states of nature (in this example, three). On the basis of this utility equation, it can be argued that the CEO will expend an amount of effort that solves the following differential equation (found by differentiating equation 4.7 with respect to effort):

$$p_r' \cdot \beta_r + p_u' \cdot \beta_u + p_g' \cdot \beta_g - \gamma e^{\gamma-1} = 0 \quad (4.9)$$

The solution to equation 4.9 is the optimal level of effort (denoted as  $e^*$ ) from the perspective of the CEO. If the CEO decides to put in  $e^*$  during period three, he maximizes his expected utility.

The discussion thus far provides a foundation for understanding the significant role that expectations have in the CEO Problem and, specifically, the remuneration conundrum. Equation 4.9 suggests that  $e^*$  depends on the CEO's expectations for changes in  $p_r$ ,  $p_o$ , and  $p_g$ , as a function of his effort. While it is abstract to contemplate that a CEO can map a probability vector ( $\mathbf{p}$ ) to effort, a mapping of the derivative of the probability vector to effort is even more abstract (and unlikely). Furthermore, the complexity of expectations becomes even more evident as the analysis transcends the simpler model (equation 4.6) and the full specification (equation 4.2) is considered.

Nevertheless, the analysis is made more robust by defining expected wealth and expected risk and then considering equation 4.2. First, the CEO's expected wealth could be denoted by applying the expectation operator to equation 3.4:

$$E[W] = E[W_s] + E[W_h] + E[W_o] \quad (4.10)$$

Equation 4.10 suggests that the CEO's expected wealth is equal to the summation of his expected wealth in the franchise's securities, in human capital, and in outside investments. If remuneration is made contingent on franchise performance (which, in turn, depends on the CEO's effort), then expected wealth can be expressed in terms of effort as:

$$E[W(e)] = E[W_s(e)] + E[W_h(e)] + E[W_o] \quad (4.11)$$

The "0" above the third term, ( $E[W_o]$ ), indicates that the CEO's outside wealth is invariant to  $e$  (see assumption A9 in section 4. 1); the variance in  $W_o$  will depend on exogenous factors that affect the overall economy.

The second term in the fully specified model for the CEO's utility (equation 4.2) is the CEO's expected variance in his wealth. Again, applying the framework presented by Agrawal and Mandelker (1987, p. 836), the expected variance can be expressed as:

$$\begin{aligned} E[\text{Var}(W(e))] = & X_s^2 \cdot E[\text{Var}(W_s(e))] + X_h^2 \cdot E[\text{Var}(W_h(e))] + X_o^2 \cdot E[\text{Var}(W_o)] \\ & + 2 \cdot X_s \cdot X_h \cdot E[\text{Cov}(W_s(e), W_h(e))] + 2 \cdot X_s \cdot X_o \cdot E[\text{Cov}(W_s(e), W_o)] \\ & + 2 \cdot X_h \cdot X_o \cdot E[\text{Cov}(W_h(e), W_o)] \end{aligned} \quad (4.12)$$

where  $X_s$  is defined as the fraction of wealth in the franchise's securities ( $X_s = W_s/W$ ),  $X_h$  is the fraction of wealth in human capital ( $X_h = W_h/W$ ), and  $X_o$  is the fraction

of wealth in outside securities ( $X_o = W_o/W$ ). (Note that the notation  $\text{Var}(W)$  replaces  $\sigma_w^2$ )

Equations 4.11 and 4.12 illuminate three fundamental aspects of the CEO Problem. First is the role that financial contracting has in determining the variance in the CEO's wealth. The financial contract negotiated between the CEO and shareholders at the beginning of period three will determine the initial values of  $W_s$ ,  $W_h$ ,  $W$ ,  $X_s$ ,  $X_h$ , and  $X_o$ . Likewise, the contract will affect the CEO's expectations for his wealth and variance in wealth through the following terms:  $E[W_s(e)]$ ,  $E[W_h(e)]$ ,  $E[\text{Var}(W_s(e))]$ ,  $E[\text{Var}(W_h(e))]$ ,  $E[\text{Cov}(W_s(e), W_h(e))]$ ,  $E[\text{Cov}(W_s(e), W_o)]$ , and  $E[\text{Cov}(W_h(e), W_o)]$ .

The second aspect of the CEO Problem illuminated by equations 4.11 and 4.12 is the role of effort. These two equations show the factors influenced by  $e$ . Effort, depending on the terms of the principal-agent contract, can have an important effect on  $E[W(e)]$  and  $E[\text{Var}(W(e))]$ , even before an infrastructure's private delivery (if remuneration depends on performance in some way). An important point to make at this juncture is that the association between effort and eventual remuneration does not necessarily emerge solely because of an infrastructure's private delivery. However, it is likely that a franchise's private delivery will increase the principal's interest in the agent's effort (due to the private sector's increased concern over the franchise's performance). Thus, in turn, might accentuate the effect that effort has on remuneration depending on the terms of the contract. For example, if securities contingent on the value of the franchise's property rights are incorporated in the remuneration scheme after private delivery, this immediately creates a stronger (and more complex) dependency between the CEO's effort and remuneration through the terms containing  $W_s$ .

Third, returning to the complex issue of expectations, the two equations reveal that the expectations for wealth and variance in wealth (which build the CEO's utility expectations) depend on multiple expectations. A CEO transferring from the public to the private sector will have no experience negotiating a financial contract with components of remuneration based on a franchise's property rights. The lack of experience makes it uncertain as to how closely the principal's intentions (reflected in the remuneration scheme) will coincide with the agent's perceptions. A mismatch between the principal's intended incentives and the agent's perceived opportunity (to affect wealth through his effort) results in an unpredictable response by the agent.

## 4.5 How Much Effort Will the CEO Expend?

Next this thesis further examine the CEO's decision concerning how much effort to put into the franchise during period three. For this has gained knowledge and experience regarding remuneration contingent on property rights during a prior assignment in the private sector. For this section an assumption made is that the CEO has sufficient knowledge of the roles that each term specified in the models for  $E[W]$  and  $E[\text{Var}(W)]$  has, and that he understands the terms of his contract well enough to make reasonable estimates for those terms. Consequently, the CEO is able to postulate in his mind values for  $E[W(e)]$  and  $E[\text{Var}(W(e))]$  to make a decision about how hard to work based on those expectations. If the CEO accepts the financial contract offered by the new owners, he then will choose  $e$  to maximize his expected utility:

$$\text{Maximize } E[V(e)] = f(E[W(e)], E[\sigma_w^2(e)], e; r_{\text{CEO}}) \quad (4.13)$$

The analytical procedure for determining the optimal level of effort for the CEO is to differentiate equation 4.13 with respect to  $e$ , and to solve the differential equation (after setting it equal to zero):

$$\begin{aligned} (\partial E[V]/\partial e) = & (\partial E[V]/\partial E[W]) \cdot (\partial E[W]/\partial e) + \partial E[V]/\partial E[\text{Var}(W)] \cdot (\partial E[\text{Var}(W)]/\partial e) \\ & + \partial E[V]/\partial e \end{aligned} \quad (4.14)$$

Recall that  $r_{\text{CEO}}$  is not a function of  $e$  (or income). Without an explicit specification for  $E[V(e)]$ , as we had with equation 4.7, it is not possible to determine  $e^*$  analytically. Again, though, the goal is to anticipate the CEO's effort. We expect the CEO to take actions that increase his utility. In the discussion that follows, the influence that each term in equation 4. 14 has on utility is considered. The sensitivity between utility and effort is determined by (1) the CEO's individual sensitivities to wealth, risk, and effort; (2) the terms of the financial contract; and (3) exogenous factors (such as the strength of the economy).

### 4.5.1 The Effect of Wealth on Utility

Equation 4.14 suggests that the change in the CEO's utility, based on an

infinitesimally small change in his effort, depends on three terms comprised of five factors. The first factor contained in the first term ( $\partial E[V] / \partial E[W]$ ) is the change in expected utility resulting from an incremental change in expected wealth. The sign of this factor is positive, on the basis of monotonic preferences; i.e., more is preferred to less (see Jarrow, 1988, P. 40). Financial contracting indirectly affects the magnitude of this term through the principal's decision as to whom to appoint CEO (adverse selection). In section 4.2, figure 4.2 was presented to illustrate that the level of the CEO's absolute wealth determines his marginal utility of wealth. Assuming that the function for  $V(W)$  is strictly convex, then, as wealth increases, marginal utility from incremental increases in wealth monotonically decreases. The principal (shareholders) will have incomplete information as to a candidate's marginal utility of wealth, which, as was discussed in section 4.1, is a facet of the adverse-selection problem embedded in the CEO Problem. The agent's marginal utility of wealth is nontrivial to the CEO Problem since it affects the CEO's responsiveness to wealth- adjusting incentives.

#### 4.5.2 The Effect of Effort on Wealth

The second factor contained in the first term of equation 4.14 ( $\partial E[W] / \partial e$ ) is the change in expected wealth resulting from an incremental change in effort. The sign of this second factor is also positive, with two important determinants affecting the magnitude of this term. One determinant is specific to the selection of the CEO, and the other is specific to the financial contract. To the extent that the CEO's wealth is contingent on the franchise's value at the end of period three, the relationships between effort and each of the probabilities,  $p_r(e)$ ,  $p_u(e)$ , and  $p_g(e)$ , are important. Among other (some exogenous) factors, the probabilities of the different states of nature depend on how much effort the CEO makes and on his competency. If the CEO is highly incompetent, then  $p_g(e)$ , the chance for a high future valuation for the franchise, will be less sensitive to the CEO's effort.

If the CEO is incompetent and/or the remuneration is not strongly dependent on outcome, then the sensitivity between  $E[W]$  and  $e$  will be less than the reverse scenario. For example, if the CEO is highly competent and the financial contract contains



significant contingent-based rewards, then  $\partial E[W]/\partial e$  will likely be much greater in magnitude. A more competent CEO is expected to produce superior results that will translate into greater remuneration, to the extent that the financial contract effectively recognizes excellent performance with greater remuneration, and superior results can be measured. Thus, the two determinants of the magnitude of  $\partial E[W]/\partial e$  are (1) how competent the CEO is (adverse selection) and (2) the level-of-performance contingency incorporated into the financial contract.

The basis for affixing a positive sign to the term  $\partial E[W]/\partial e$  can be seen from equation 4.11 given earlier:

$$E[W(e)] = E[W_s(e)] + E[W_h(e)] + E[W_o] \quad (4.11)$$

The "+" symbol suggests that incremental increases in effort lead to greater values in the first two terms (while  $E[W_o]$  is invariant to effort). Unless a lifetime, guaranteed remuneration contract (as mentioned in section 4.4) is offered, the CEO's expected wealth will depend on his effort, even if he is somewhat incompetent. Even if remuneration was fixed for period three of the private delivery process (which would weaken the relationship between  $e$  and  $E[W(e)]$ ), the CEO's decision as to  $e$  still would alter his expected wealth somewhat. A closer inspection of the terms,  $E[W_s(e)]$  and  $E[W_h(e)]$  helps explain this dependency.

Both terms,  $E[W_s(e)]$  and  $E[W_h(e)]$ , are contingent on expected cash flows that occur over the CEO's lifetime. Specifically, the value for  $E[W_s(e)]$  equals the net present value of expected wealth accruing to the CEO (during periods three and four) from contingent claims against the franchise. On the basis of the model specification, no more wealth from claims against the franchise can accrue after period four since the end of period four is demarcated by the demise of the franchise. Similarly, the value for  $E[W_h(e)]$  captures the net present value of expected cash flows accruing in the form of fixed and nonsecurities-based variable remuneration (e.g., salary plus cash bonuses) spanning the CEO's entire working career. Even if greater effort does not affect period-three remuneration (i.e., remuneration is fixed), the value for  $E[W_h(e)]$  will still be somewhat sensitive to third-period effort since it reflects the future changes in remuneration that are expected to occur. By making a greater effort during period three, a CEO increases the

likelihood for a higher franchise value by the end of the period, which will likely influence the level of remuneration offered by the principal for period four (and beyond).

If the principal constructs a financial contract primarily around variable, market-based remuneration, then the private delivery scenario creates an unfamiliar environment for the formation of the CEO's expectations. Forming expectations for  $W_s$  will be entirely new for the CEO. Furthermore, while forming expectations for  $W_h$  will be less difficult than for  $W_s$ , it will be more difficult than it was during period two. This is because the CEO will be less experienced with valuation of human capital by the private-sector labor market. Recall, though, that an assumption made for this section is that the CEO has the ability to form the expectations needed to choose  $e^*$ .

#### **4.5.3 The Effect of the Variance in Wealth on Utility**

The third factor contained in the second term of equation 4.14  $\partial E[V]/\partial E[\text{Var}(W)]$  is the change in expected utility resulting from an incremental change in the expected variance (or volatility) in the CEO's wealth. The sign of this factor is negative due to the assumption that the agent (CEO) is risk-averse. If the agent is risk-loving, the sign of this factor would be positive. The magnitude of this factor, or the agent's sensitivity to risk, will depend on his level of risk-aversion. Another facet to the adverse-selection problem is the principal's incomplete information regarding each candidate's level of risk-aversion. It was suggested earlier that a typical manager in the public sector is more risk-averse than his counterpart in the private sector. If this conjecture is correct, then the typical public-sector executive's utility will be more sensitive to changes in expected volatility in wealth.

As with the first factor  $\partial E[V]/\partial E[W]$  the sensitivity to risk is a personal attribute. After the shareholders select a CEO for period three, the financial contract will not affect the CEO's relationship between marginal disutility and risk. However, the contract will have significant implications for the level of risk exposure and, thus, the level of disutility derived (from a certain level of effort).

#### 4.5.4 The Effect of Effort on Utility

The fifth factor, which is the third term of equation 4.14 ( $\partial E[V]/\partial e$ ), is the change in expected utility from an incremental change in effort. Incremental changes in  $e$  indirectly affect utility through the first and second terms of equation 4.14; the third term of the model suggests a direct effect from effort. The agent (it is assumed) will not perform uncompensated work (he derives no utility from volunteering). Or, stated differently, doing work leads to disutility.

The marginal disutility derived from work is again independent of the financial contract, but is dependent on the individual chosen to be the CEO. Therefore, the adverse-selection problem again becomes evident since the principal is limited in what he knows about any one candidate. Specifically, the principal knows that any (prospective) agent does not want to work; however, he does not know how much the agent dislikes work and, correspondingly, how much remuneration is necessary to entice the agent to expend the effort needed to maximize the principal's wealth. *Ceteris paribus*, the principal will want to install the CEO who dislikes work the least, since the less that the agent dislikes work, the smaller will the increments of remuneration be that are necessary to motivate him to work. Selecting a CEO who requires smaller increments of remuneration per unit of effort (*ceteris paribus*) will minimize the cost of the remuneration package.

#### 4.5.5 The Effect of Effort on the Variance in Wealth

The fourth factor contained in the second term of equation 4.14 ( $\partial E[\text{Var}(W)]/\partial e$ ) is the change in expected variance in the CEO's wealth resulting from an incremental change in effort. This factor, as with the second factor discussed above ( $\partial E[W]/\partial e$ ), can be greatly influenced by the financial contract offered by the principal. The sign of the fourth factor is (expected to be) positive; however, the question mark above the term denotes some uncertainty as to sign. Portfolio theory suggests that greater expected returns coincide with greater levels of expected risk. If that theory is applicable to equation 4.14, then the sign of other words, when greater effort leads to greater expected remuneration, this, in turn, should lead to greater variability in remuneration.

However, the relationship between expected return and expected variance common to portfolio analysis may or may not be observed in CEO remuneration. The relationship between expected franchise value and the expected variance in franchise value will determine the relationship between the CEO's expected remuneration and expected variance in remuneration (if remuneration is, at least partly, determined by franchise value). After its private delivery, if the franchise begins investing in projects (say, with positive net present values), the franchise's expected value should increase. How the variance in expected value changes is less certain. The extent that new projects increase or decrease the variance in the franchise's value will depend on the risk contribution of each new project. If the addition of new projects serves to diversify the franchise's investment portfolio, the franchise's expected value could increase while the expected variance (in value) is reduced. In contrast, if the CEO aggressively pursues projects with high expected values and variances during period three of a private delivery, this could increase the expected variance in franchise value. An aggressive short-term investment policy might be motivated by shareholders' emphasis on redefining the franchise's objective to wealth maximization, after control shifts to the private sector.

In the context of the term  $\partial E[\text{Var}(W)]/\partial e$ , greater effort by a CEO after a franchise's private delivery will correspond to an franchise's continued investment in value-increasing projects (assuming the CEO is competent). The uncertainty in how that greater effort (and investment) will translate into  $E[\text{Var}(W)]$  will depend on (1) the increase or decrease in the variance of the franchise's value and (2) the extent that the CEO's expected remuneration depends on franchise value.

Due to the environment of added risk and uncertainty brought on by the private delivery announcement and the sell-off (see section 4.3), the principal might find it optimal to adjust the CEO's financial contract to offset the (unusual and temporary) high level of risk. If the contract reinforces a scenario where greater CEO effort contributes to the uncertainty in wealth--compounding the added uncertainty assumed to ensue as the franchise begins period three--this might be counterproductive to the objective of motivating the CEO to work harder. In section 4.3 the analysis suggested that remuneration might need to be increased across periods two and three, just to maintain the CEO's initial level of utility. (The analysis assumed that the CEO's effort was constant

across periods.) Since increased variability in remuneration might parallel greater expected remuneration, it might be prudent to design a financial contract which offers an improved risk-return trade-off than otherwise would be offered (under more usual circumstances). See section 4.6 for further discussion of this point.

The principal and agent's understanding of the determinants of the fourth factor  $\partial E[\text{Var}(W)]/\partial e$  is vital to their negotiating an efficient financial contract for period three. The scope of the problem of assessing how the CEO's effort can affect the variance in his wealth can be seen by carefully examining the factors in equation 4.12 (the equation describing the expected variance in wealth) to understand the effect that the CEO's effort can have on each term. Since the following discussion refers extensively to equation 4.12, this equation is given again:

$$\begin{aligned}
 E[\text{Var}(W(e))] &= X_s^2 \cdot E[\text{Var}(W_s(e))] + X_h^2 \cdot E[\text{Var}(W_h(e))] + X_o^2 \cdot E[\text{Var}(W_o)] \\
 &\quad + 2 \cdot X_s \cdot X_h \cdot E[\text{Cov}(W_s(e), W_h(e))] + 2 \cdot X_s \cdot X_o \cdot E[\text{Cov}(W_s(e), W_o)] \\
 &\quad + 2 \cdot X_h \cdot X_o \cdot E[\text{Cov}(W_h(e), W_o)] \tag{4.12}
 \end{aligned}$$

Recall that at the beginning of period three, when the CEO and shareholders negotiate a financial contract, the terms of the contract will help establish the value of the CEO's wealth in the three categories:  $W_s$ ,  $W_h$ , and  $W_o$ . If the CEO's wealth is viewed as a three-asset portfolio, then the variance in the CEO's portfolio of wealth will depend on (1) the fractions of wealth in each of the three categories; (2) the variances in the values of the three categories; and (3) the covariances between categories.

Similar to the financial contract's bearing on the relationship between  $E[W]$  and  $e$ , the contract also has bearing on the relationship between  $E[\text{Var}(W)]$  and  $e$ . Consider several hypothetical remuneration schemes to illustrate this point. One extreme example of a remuneration scheme (used several times in this work) is a lifetime, guaranteed contract that places no performance-contingent conditions on future remuneration. If an agent believes the franchise will meet all of its contracted responsibilities over his lifetime, then the expected variance in his human capital and wealth will be invariant to effort (this assumes  $W_s = 0$ ). The opposite extreme is a contract that pays strictly for effort-baby-sitting is a good example. For each hour of baby-sitting, a sitter receives an hour's wage. As a baby-sitter increases the number of hours he plans to work, his expected remuneration increases linearly, based on an average wage. Also, as expected

remuneration rises, expected variance in remuneration rises due to different amounts being paid for baby-sitting (frequently the buyer of baby-sitting services sets the wage, so multiple jobs could lead to multiple wage rates).

In the case of a CEO who has been delegated control of the franchise at the beginning of period three, the relationship between  $\text{Var}(W)$  and  $e$  can, potentially, be very complex. If the CEO is offered fixed remuneration, this will create a situation where his wealth is mostly invariant to effort. However, if the CEO is paid using variable remuneration, this will have various (potential) effects on the variance in his wealth. Consider three components of compensation that can be used (see section 3.9) in a remuneration package: (1) fixed, (2) variable-contingent on accounting measures, and (3) variable-contingent on market valuations. As effort increases, what changes in the values of the components are expected?

By definition, the fixed component's expected value is invariant to effort, whether increasing or decreasing, as just discussed. The fixed portion of a CEO's remuneration will dampen the overall variance in remuneration. As the portion of fixed remuneration increases, the dampening effect will increase. In contrast, the expected values of the accounting- and market-contingent components of remuneration will increase with effort. This expectation is based on the premise that greater CEO effort will translate into "better" values for accounting measures and increases in market valuations of contingent claims against the franchise. If effort is increased, the expected effect on the variance of wealth might be harder to predict.

Return to the baby-sitting example. If the market wage for baby-sitting is homogeneous, then a decision to increase effort (measured as hours worked) will increase expected remuneration, but not the expected variance in remuneration. For example, if the sitter plans to baby-sit for two hours at \$2 per hour, he can expect to receive \$4 with zero deviation; likewise, if the sitter plans to baby-sit for four hours (at the same hourly wage), he can expect to receive \$8 (again, with zero deviation). Thus, an increase in effort and expected remuneration is not a sufficient condition for an increase in the expected variance in remuneration.

The expected variance of a CEO's remuneration will be much greater than that of a typical laborer, or even a lower-level manager, if the CEO's contract includes a wide

range in the potential maximum and minimum values in pay. Milgrom and Roberts (1992, P. 209) point out (in the context of incentives contracting) that, "Increasing the probability of very high and very low values tends to increase the variance." This statistical property; of random numbers has important implications for remuneration schemes that include the possibility of extreme payoffs. The potential for large probabilities of very high and very low values for remuneration (in the short term) would derive from the variable components of remuneration and the threat of being fired.

If a CEO decides to increase his effort in order to increase his expected remuneration, his expected variance in remuneration, might also increase. Normally, a CEO's effort will not translate into franchise performance in a highly predictable pattern (as in the baby-sitting example). The discussion of financial agency illuminates the CEO's decision as to how to allocate his time between discretionary tasks, each having short- and long-term implications for the franchise. This work has contended that a financial-agency paradigm is useful for delineating the CEO's important tasks immediately after a franchise's private delivery. Even with guidelines for how a CEO should allocate his effort, the reality is that there is an infinite number of allocations he can ultimately choose from. And in addition to the multitude of options a CEO has for allocating his time, there is also an infinite number of possibilities for how the CEO 's effort will translate into measurable results.

In section 3.10 the potential problem of additional noise during period three was discussed. The suggested premise was that added "noise leads to (potentially) a weaker correlation between CEO effort and measured performance in the shod run. The worse-case scenario would be one where there is no detectable relationship between the CEO 's effort and the chosen measure(s) of performance. Therefore, a key objective for the financial contracting between the shareholders and CEO should be to find an optimal balance (given the potential noise problem) between variable and fixed components of remuneration. Once the details of the contract are known by the agent, he will make his decision as to how hard to work during period three. To make an informed decision, the CEO needs an assessment for the expected payoffs, variances, and covariances for the different components of remuneration.

Although it seems plausible that a prospective CEO from the public sector will base

his expected utility on expected wealth, expected variance in wealth, and effort, the presentation of equation 4.12 can be misinterpreted as an attempt to model a CEO's innate ability to form expectations for uncertainty in wealth. Instead, applying this equation to the analysis of the CEO Problem is an application of positive economics. Mathematically, equation 4.12 gives the variance of a portfolio containing three assets; in this application the three assets are the three areas of CEO wealth as defined earlier. If the incumbent CEO is retained and he, subsequently, engages in contract negotiations, his understanding of remuneration contingent on market valuation of the franchise's property rights (i.e., stock and stock options) might, possibly, be limited. Furthermore, the CEO might be unfamiliar with remuneration that is contingent on accounting measurements associated with profit maximization, such as return on equity. A conclusion that is suggested from this model is that the CEO's task of forming expectations for his wealth portfolio (potentially) becomes more complicated across periods one, two, and three.

A CEO and a portfolio manager make comparable decisions involving expected risk and return. However, there is an important distinction that can be made between a CEO's decision as to how hard to work (*e*) and a portfolio manager's decision as to asset allocation. The investment manager makes his asset-allocation decisions based on projected trade-offs between expected risk and return; expectations for returns, risks (measured by securities' standard deviations or variances), and covariances are largely formulated using readily available historic performance data. Second, the asset-allocation decision (in terms of dollar amounts) is made largely by institutional investors who have extensive training and expertise in the principles of portfolio management. In contrast, a CEO transferring from the public to the private sector will not be an expert at negotiating remuneration contracts with owners of private infrastructure. Nor will he possess (past) performance data for formulating his expectations for how market-based remuneration will likely affect his future wealth. This void in the CEO's experience and information as he enters into financial- contracting negotiations might be an impetus for the principal (shareholders) to educate him on the terms and implications of various financial- contracting alternatives. However, this contemporaneous need to negotiate a contract and educate the CFO creates a conflict of interest for the principal. Therefore, a third party (or agent) should perhaps be employed to assist the CEO in his negotiations.



Returning to equation 4.14, can any further insights be made into the moral-hazard problem and the CEO's decision as to how hard to work? To consider what influence a change in effort can have on the uncertainty in the CEO's wealth, an expression for  $\partial E[\text{Var}(W)]/\partial e$  is found by differentiating equation 4.12 with respect to effort:

$$\begin{aligned}
\partial E[\text{Var}(W)]/\partial e &= X_s^2 \cdot \partial E[\text{Var}(W_s(e))]/\partial e + X_h^2 \cdot \partial E[\text{Var}(W_h(e))]/\partial e \\
&+ X_o^2 \cdot \partial E[\text{Var}(W_o)]/\partial e \\
&+ 2 \cdot X_s \cdot X_h \cdot \partial E[\text{Cov}(W_s(e), W_h(e))]/\partial e \\
&+ 2 \cdot X_s \cdot X_o \cdot \partial E[\text{Cov}(W_s(e), W_o)]/\partial e \\
&+ 2 \cdot X_h \cdot X_o \cdot \partial E[\text{Cov}(W_h(e), W_o)]/\partial e
\end{aligned} \tag{4.15}$$

Since the  $X_i$  factors are determined ex ante, they are treated as constants, with respect to changes in effort. In contrast, the variances and covariances are expected values that are subject to reevaluation (just as expected wealth is reevaluated), given changes in effort. By recognizing (1) that the CEO's effort only affects the components of wealth tied to the performance of the franchise, i.e.,  $W_s$  and  $W_h$ , and (2) that the "variance in the outside wealth will be dependent on factors external to the franchise), equation 4.15 can be simplified to:

$$\begin{aligned}
\partial E[\text{Var}(W)]/\partial e &= X_s^2 \cdot \partial E[\text{Var}(W_s(e))]/\partial e + X_h^2 \cdot \partial E[\text{Var}(W_h(e))]/\partial e \\
&+ 2 [ X_s \cdot X_h \cdot \partial E[\text{Cov}(W_s(e), W_h(e))]/\partial e \\
&+ X_s \cdot X_o \cdot \partial E[\text{Cov}(W_s(e), W_o)]/\partial e \\
&+ X_h \cdot X_o \cdot \partial E[\text{Cov}(W_h(e), W_o)]/\partial e
\end{aligned} \tag{4.16}$$

As argued earlier, it is generally acknowledged that many of the investment practitioners optimize their portfolios and select an asset allocation using a mean-variance approach; but, it is unlike that a CEO transferring from the public to the private sector will behave (independent of recommendations from an agent) in a manner identifiable with equation 4.16. Nevertheless, the potential benefit of modeling the variance in the CEO's wealth using such a sophisticated expression is that it extends the framework in a useful direction for formulating a financial contract during private delivery. During period one, when a franchise's private delivery is being debated (presumably without the CEO's knowledge) by government policy-makers, the CEO possesses no securities in the franchise. Thus, all factors in equation 4.16 dependent on  $W_s$  are zero (during period one), and the equation reduces to:

$$\partial E[\text{Var}(W)]/\partial e = X_h^2 \cdot \partial E[\text{Var}(W_h(e))]/\partial e + 2X_h \cdot X_o \cdot \partial E[\text{Cov}(W_h(e), W_o)]/\partial e \quad (4.17)$$

Furthermore, if the CEO perceives his future with the organization to be essentially guaranteed, he will likely view his future earnings (captured in  $W_h$ ) to be essentially invariant to changes in effort. Under this hypothetical scenario,  $\partial E[\text{Var}(W)]/\partial e \approx 0$ . Although it is unrealistic to suggest that a CEO evaluates his remuneration using a calculus paradigm, it is plausible that he can be indoctrinated to the potential he has for affecting his expected wealth, during financial-contract negotiations.

#### 4.6 Comments on the Design of a Financial Contract

The analysis of the financial-contracting process between the CEO of a private delivery and the shareholders presented in chapters 3 and 4 leads to the following suggestion. Due to the environment created by the private delivery process, the financial contract between the CEO and shareholders should be designed to limit the risk exposure to the CEO, without eliminating the components of remuneration that contribute to risk. Any component of the CEO's remuneration that is contingent on an uncertain outcome exposes him to risk. (Only a 100 percent fixed-remuneration scheme would be risk-free.) Because of greater uncertainty during the transition periods of private delivery, variable (contingent-based) compensation might contribute to abnormally high (potential) volatility in total remuneration. On the other hand, to exclude variable components of compensation during any period of the private delivery process would forego the incentives derived from contingent-based remuneration.

Before clarifying and expanding this normative economic discussion, an important assumption is that the infrastructure's (provisional office) CEO is retained. This assumption circumvents the adverse-selection problem that is part of the original CEO Problem and enables us to analyze the moral-hazard problem in greater detail.

The retention of an incumbent CEO is more likely in those cases of private delivery where the infrastructure is performing profitably before its private delivery. In cases of successful infrastructure, the signal transmitted to outsiders (e.g., potential buyers of infrastructure) is that the CEO is competent and, therefore, his human capital is an important path of the private sector's acquisition of the infrastructure. (The selection of

infrastructure for private delivery is an attribute of recent private delivery programs in Taiwan.)

As the franchise begins period three, the shareholders must negotiate a contract with a CEO whose risk-aversion is greater than a typical CEO in the private sector (see assumptions A1 and A2 in section 4.1). Furthermore, the disequilibrium conditions, described earlier in this work, increase the probability that the CEO's effort will not be accurately evaluated by the new property-rights holders (during period three). These two conditions could be used to justify a remuneration scheme where the principal assumes 100 percent of the risk. This could be accomplished by offering the CEO a fixed-remuneration scheme during period three--until equilibrium is obtained (at the beginning of period four). This solution is appealing because of its simplicity and effectiveness (i.e., it would remove risk from the CEO); however, the potential gains from using contingent remuneration are sacrificed if a fixed scheme is selected. Since there are nontrivial objectives that the CEO needs to pursue in period three, limiting the set of remuneration schemes solely to reduce risk would seem to be inefficient.

In section 4.5.5, equation 4.16 modeled the effect that an infinitesimal change in effort is expected to have on a CEO's variance in wealth. The model suggests that the change in the variance in wealth is determined by the amounts of wealth in each category, the variances in  $W_s$  and  $W_h$ , and the covariance between  $W_s$ ,  $W_h$ , and  $W_o$ . To mitigate (but not eliminate) risk to the CEO, the shareholders can manipulate the terms in this expression through the financial contract. An example of manipulation of executive remuneration is the resetting of a stock option's exercise price. Rather than have an executive's "out-of-the-money" options expire with zero value, some franchises have lowered exercise prices on certain options (prior to their expiration dates) in order to shift the options back "into-the-money." Another example of an artificial adjustment to the volatility in executive wealth that can be implemented through the financial contract is the suspension of the threat of firing (for a specified period). For example, if shareholders want to encourage the CEO to pursue an aggressive investment strategy that will maximize shareholders' wealth in the long run (without a counterbalancing concern for short-term results), they could offer him guaranteed employment over a finite period. Guaranteeing his employment would not preclude using contingent remuneration it

would simply reduce the potential downside (that could be incurred by the executive) in short-term remuneration. This, in turn, would reduce the potential variance in remuneration, since the probabilities of very poor (short-term) payoffs are eliminated.

This thesis has primarily viewed the CEO Problem in the context of the CEO's desire to maximize his utility, while the shareholders maximize their wealth. In the pursuit of maximum wealth, the shareholders will need to decide how much CEO effort is optimal. Recall that Holmström (1982) treated the CEO's effort as an input to a production function. If effort is treated as an input, then the "optimal" number of units of effort would be the amount where the marginal product from another unit of CEO effort per cost of that extra unit equals the marginal product to cost ratios of all other inputs. In theory, this type of analysis would lead to an optimal figure for the amount of CEO effort that shareholders should employ.

Realistically, although this theory-based procedure has merit when determining how many units of capital should be combined with an hour of labor, it is too abstract to apply to a manager's time. There is great uncertainty in measuring the tangible benefit from one hour of a manager's time; whereas measuring the productivity of using another ton of steel or another hour of a laborer's time in the factory is quite feasible. When assessing a CEO's effort, the bigger concern might be how he spends his time—not how hard or how much effort he makes. Milgrom and Roberts (1992, p. 181) state:

*The problem typically is not that the executives are lazy and do not work hard enough. Corporate executives put in remarkably long hours of very intense effort. Rather, the complaint is that they pursue goals other than maximizing the long-run value of the firm.*

While Milgrom and Roberts' comment reinforces our point, care has to be taken when extrapolating findings from the United States' (private sector) corporate environment to a foreign country's public sector. Just as it was assumed that public sector executives are more risk-averse than their private sector counterparts, it is possible that the public sector executives are more work-averse and need to be noticed to work hard.

Rather than attempting to create incentives to work hard (i.e., assume that public

sector managers are not any more work averse than private sector managers), a conceivably more worthwhile strategy might be to create specific incentives that will condition the CEO to be more aware of the private sector wealth motive. Setting remuneration contingent on accounting- and market-based performance targets can have an important role in sensitizing the CEO to shareholder objectives. However, during period three, when there is highly risk averse individual operating in risk prone environment, wealth maximizing behavior (by the shareholders) might necessitate manipulating the risk return characteristics of the CEO-shareholder financial contract to provide a more favorable trade-off for the CEO.

Equation 4.16 points to the role that the covariances between the categories of CEO wealth have. Examples were given above of methods to manipulate the expected returns and variances on stock options (e.g., adjusting the exercise price) and the CEO's current period's remuneration (e.g., reduce or suspend the short-term threat of firing). These measures would have an effect on  $E[W_s]$ ,  $E[W_h]$ ,  $E[\text{Var}(W_s)]$ , and  $E[\text{Var}(W_h)]$ . Specifically, the two expected wealth categories would increase, while the two expected variances would decrease. These tactics would also affect the values of  $E[\text{Cov}(W_s, W_h)]$ ,  $E[\text{Cov}(W_s, W_o)]$ , and  $E[\text{Cov}(W_h, W_o)]$ .

By assembling a diversified portfolio, a portfolio manager can reduce risk without sacrificing return. The opportunity to diversify and to reduce risk is due to the fact that most assets' returns are not perfectly correlated. The portfolio manager is powerless in determining what correlation will exist between assets—correlation coefficients are determined by the market. In financial contracting the shareholders can manipulate the correlation between the assets offered the CEO. For example, if shareholders give the CEO stock and stock options for period three, a drop in share price would normally reduce the values of both stock and options. But, to reduce the negative effect on the CEO and to provide a hedge against too much additional risk (that can be a result of greater effort), shareholders could reduce the options' exercise price and lengthen the expiration date. This could increase the value of the options, depending on the new exercise price and expiration date, enough to offset the loss on the stock. By taking measures to selectively manipulate the expected returns, expected variances, and the expected covariances between the components of the CEO's (period three) remuneration,

the shareholders could construct a financial contract that creates significant incentives for the CEO to pursue a wealth maximizing strategy with minimal financial-agency conflict.

## Chapter 5 Case Study of Private Delivery

The following quote is taken from one in a series of articles written by the Wall Street Journal and dedicated to the topic of "Executive Pay":

*You are going to see more CEO compensation based on risk and based on ownership in the organization. ... Chief executives should be in the same canoe as investors.*

As observed in chapters 3 and 4, caution is needed when extrapolating the United States' experiences to other countries. Nevertheless, incentives in capitalistic economies are universally important. The above quote is noteworthy in the context of private delivery, since establishing proper incentives and financial contracting are vital parts of an infrastructure's transformation to private sector. As the infrastructure is transformed, norms will be dictated by the private-sector, with private-sector franchises as the model.

This quote points out that strategies used for compensation within the representative model are still evolving. Neither the public nor the private sector has reached a consensus on how to construct the optimal financial contract containing the necessary incentives to achieve goal-congruence between executives and shareholders.

This thesis research has drawn a connection between financial contracting with the CEO and the objective of creating the proper incentives for encouraging resolution of financial-agency conflict (to reduce agency costs). Measuring agency costs is an imprecise task that is receiving attention in the literature. For example, Mello and Parsons (1992, p. 1903) "adapt a contingent claims model of the franchise to reflect the incentive effects of the capital structure and thereby to measure the agency costs of debt."

Their analysis leads to present value calculations that they report as a percentage of franchise value to put the relative significance into perspective. In addition to attempting to quantify agency costs, a second avenue that empirical agency theory research has taken is to search for evidence that supports or refutes hypotheses motivated by agency theory. For example, Agrawal and Mandelker (1987, p.823) search for evidence which supports or refutes the hypothesis that "executive security holdings have a role in reducing agency

problems."

Both objectives pursued by the two research methodologies just discussed, i.e., quantifying and inspecting for changes in agency costs, are relevant applications. However, in the case of a private delivery of new infrastructure, conducting an absolute measure of financial-agency costs is less informative than a relative measure across periods. If the fundamental economic objective for private delivery is to increase an infrastructure's efficiency, then, to be consistent with this objective, the franchise should be taking steps to mitigate financial-agency costs.

Earlier in this work it was suggested that if all infrastructure floats neither debt nor equity to the private sector then, technically, the franchise incur no (explicit) financial-agency costs. By definition, a financial-agency cost is realized when a private financial market discounts a franchise's security in response to unresolved financial-agency conflict. If neither debt nor equity securities are floated by an infrastructure to the private sector, then the capital markets do not participate in the pricing of the infrastructure's property rights.

One of the assumptions of the model discussed in chapters 3 and 4 is that the government does not let private sector delivery any fraction of infrastructure until the time of the infrastructure delivery (at  $t_3$ ). Under this scenario, a private delivered infrastructure's financial-agency costs are concealed before the franchise's assets are delivered, and thus, attempting to measure them is pointless. In contrast, it is appropriate to track an infrastructure's progression through private delivery to obtain evidence supporting or refuting the hypothesis that behavior associated with financial-agency conflict has been curtailed.

It was discussed earlier that one of the CEO's most important activities immediately after the delivery of an infrastructure's assets (the beginning of period three of the private delivery process) is likely to be the cultivation of viable bonding and monitoring mechanisms between the franchise and the private-sector capital markets. These mechanisms are nonexistent (and unnecessary) when an infrastructure is under government control, assuming that no capital is obtained from the private-sector capital markets (during periods one and two). Time spent on bonding might be the most efficient way for a CEO to allocate his time in the short run, particularly if there are a number of



promising investment opportunities for the franchise that require raising capital during period three.

The financial contract between a CEO and a franchise's new owners needs to provide the necessary incentives for the CEO to perform those activities consistent with shareholders' interests. If time spent resolving financial-agency conflict will result in reduced costs of capital, and the franchise needs to raise substantial amounts of capital soon after its delivery, then encouraging resolution of financial-agency conflict is consistent with maximizing shareholders wealth.

Given the premise that financial contracting during period three will (at least implicitly) address the resolution of financial-agency conflict, a thorough analysis of financial contracting should include a search for evidence that agency conflict has been resolved. If the CEO's role in resolving agency problems is important to shareholders, then we expect to see detectable changes in both remuneration and behavior associated with agency conflict, during period three.

To reveal the specific effects from selling the franchise's property rights during private delivery, an empirical analysis must focus on the franchise during periods two and three of the process. Changes that occur during period one are not associated with the transfer of property rights, since the private delivery announcement is not made until the end of period one. Likewise, the events occurring during period four are not associated with the delivery. Measures taken to resolve financial-agency conflicts that are attributable to the franchise's private delivery will occur during periods two and three. Any action taken to resolve financial-agency conflict during period two will be initiated by either the government (the principal) or the CEO (the agent). After the delivery, action taken to resolve financial-agency conflict will be initiated by either the new owner (the new principal) or the CEO.

## **5.1 Proxies Relevant to Perquisite Consumption**

In each of the following four sections a general discussion is presented on ideas for what an appropriate proxy should reflect as to each particular area of agency, followed with ideas for actual proxies. The ideas for proxies are influenced by availability of

information and financial data contained in annual reports received from private franchise.

Hypothesis one ( $H_{0,1}$ ) is concerned with both the CEO's effort and his perquisite consumption. The public is supplied with much financial data that can be used to infer how much effort the CEO is devoting to the organization, all revolving around portability. For example, from the income statement figures for "profit for the year after extraordinary items" are reported. Furthermore, return on equity, which can be calculated from information contained in an annual report, and the franchise's share price (after delivery) are available. Given our interest in whether the CEO changes his behavior in period three (e.g., does he work harder during the first year after delivery), it is uncertain how quickly the CEO's actions (in period three) would translate into results reflected in measures of a franchise's profitability.

In contrast, changes in perquisite-consuming behavior should be reflected immediately in accounting measures. While strategies adopted to increase a franchise's profitability can take years to be reflected in franchise performance, changes in expenditures on perquisites should immediately affect the franchise's cash flows, and, thus, should be detectable in the short run. From Route 91's "Group Profit and Loss Statement," a potential proxy is the "administrative expenses" category. Obviously, there is no place in the franchise's financial statements where "perquisite expenditures" are going to be reported. Rather, these expenses will be embedded in other expense categories.

In identifying an expense category from the financial statements that might be a suitable proxy for perquisite expenses, there needs to be a balance struck between being too broad and not being broad enough. The expense category used for a proxy should be sufficiently broad to capture all perquisite expenditures, yet not so broad that changes in perquisite expenditures are masked by other variables affecting the magnitude of the proxy. Another consideration in choosing a proxy is that as toll increase or decrease variable expenses will spontaneously increase or decrease in synchronization. Therefore, to separate the spontaneous and discretionary changes in administrative expenses, a ratio of expenses-to-revenues is used.

In addition to viewing administrative expenses as an expense category that

(potentially) reflects changes in perquisite expenditures, the expense category labeled by CR-91 as "selling costs" (and included in its analysis of operating expenditures) is also a candidate for a proxy that might capture (at least some fraction of the) perquisite expenditures. The selling costs and administrative expense categories convey inclusion of a much broader, less-well-defined set of expenses.

In summary, both administrative expenses and selling costs, as a percentage of toll revenues, are used as proxies for perquisite consumption. Because of the potential lag between effort and profitability, no proxy for CEO effort is investigated.

## **5.2 Proxies Relevant to Risk-Shifting and Over/Under-Investment**

Both hypotheses two ( $H_{0,2}$ ) and three ( $H_{0,3}$ ) address the CEO's investment behavior. Suitable proxies need to provide evidence that the CEO is changing the franchise's strategy to either (1) increase or decrease the risk of its investments or (2) increase or decrease the rate of its investing. To evaluate the risk inherent in the CEO's investment strategy, first we need to decide what risks are important. Four risks that can be considered are business, financial, diversifiable, and nondiversifiable (or market) risk.

Since the analysis contained in this chapter is limited to franchises in the United States (where capital markets are sufficiently mature to offer satisfactory opportunities to diversify away nondiversifiable risk), the attention on risk should not be on the franchise's total risk, but, rather, on its nondiversifiable risk. A franchise's financial risk is particularly relevant to the fourth hypothesis ( $H_{0,4}$ ), which considers the bankruptcy threat. The risk relevant to both  $H_{0,2}$  and  $H_{0,3}$  is market risk. Market risk is often referred to as beta risk in the context of the capital asset pricing model.

A possible candidate for a proxy that captures risk ramifications of the CEO's investment behavior is beta. Although all franchise's beta cannot be estimated using market data before the infrastructure's delivery, in theory this does not preclude using beta as a proxy. Before its delivery an infrastructure is in a similar situation as a privately held company preparing to go public. Both cases involve an initial public offering where market participants need to make ex ante judgements as to the latent risk to investing in the franchise.

The two methods for making ex ante estimates of beta are (1) the "pure-play" technique and (2) calculation of an accounting beta. To estimate an infrastructure's beta using the pure-play methodology, a close match is needed between an infrastructure and another franchise that closely resembles the infrastructure (e.g., a competitor). To estimate an accounting beta, specific accounting and financial data are needed. The estimate for an accounting beta is limited by the accuracy of the infrastructure franchise's financial statements.

After an infrastructure is delivered and its equity is trading in the capital markets, the opportunity exists to estimate its beta using the market model. To detect changes in risk during period three, an empirical analysis would need to use data spanning the entire period. For example, if an assumption was made that period three spans just one year, and then beta would need to be estimated using return data for one year. Research has shown that beta calculations are sensitive to the length of the period over which estimates are based. Therefore, using beta as a proxy for risk is plagued with potential inaccuracies, both before and after an infrastructure's delivery.

While it can be argued that the beta proxy can provide evidence relevant to the CEO's investment behavior vis-a-vis risk-taking, it is not a suitable proxy for revealing over/under-investment. To assess a franchise's over/under-investment, a benchmark for the "nominal" investment rate is needed. If the franchise is part of an industry, an average rate of investment (for the industry) could be obtained and used as a benchmark. Then an individual franchise's rate of investment could be compared to the industry average. Many infrastructures are either monopolies or represent a large fraction of the industry, so statistics on their own investment policy could skew any calculations made for the industry. This could lead to a biased benchmark that would lead to dubious conclusions.

Another approach for assessing over/under-investment would be to examine an infrastructure franchise's investment policy over time to see if there is all acceleration or deceleration in the rate of investment that occurs around the time of the infrastructure's delivery. Again, though, this analysis would be hampered by lack of a benchmark. For example, if an infrastructure franchise's rate of investment accelerated, this could be interpreted as the franchise shifting from a state of under-investment to a normal rate of investment or from a normal rate of investment to over-investment.

One proxy for the rate of investment is an inflation-adjusted measure of capital expenditure. Interpretation of the proxy requires making an assumption about the normal rate of investment. For example, CR-91's capital expenditures for 1996 and 1997 were \$21.8 million and \$24.1 million, respectively. Given the 1997 rate of inflation of 4.2 percent, the 10.6 percent nominal growth in capital expenditures yields a real investment growth rate of 6.4 percent. To assess whether 6.4 percent is acceleration in the rate of investment, a benchmark is needed for CR-91 normal rate of investment increases. If 6.4 percent exceeds that benchmark, and then that would be evidence that the CEO supported a strategy to increase the rate of investment after CR-91's delivery. Yet, to make a judgement as to whether the CEO is behaving in a manner consistent with over/under-investment, the franchise's investment activity would need to be compared to an industry benchmark.

### **5.3 Proxies Relevant to the Bankruptcy Threat**

A proxy for hypothesis four ( $H_{0,4}$ ) must reflect action taken by the franchise, presumably instigated by the CEO, to adjust the expected cost of bankruptcy. Recall from equation 2.2 that the expected bankruptcy cost for a franchise is equal to the product of the probability of bankruptcy and the cost of bankruptcy. The CEO can affect the expected cost of bankruptcy in two ways. First, he can take measures that will increase or decrease the chance of bankruptcy-such as the amount of leverage used. Second, the CEO can make known what his policy would be in terms of his choice of attorneys and the delivery of assets should bankruptcy be declared. Since it is uncertain how to project what policy a CEO would employ during bankruptcy, we only consider proxies that might reveal the probability of bankruptcy.

There are at least two measurable determinants of the probability of bankruptcy. First is the amount of debt that has to be serviced by the franchise. As a franchise increases its capitalization, if the capital raised is skewed toward debt financing relative to the franchise's core debt-to-assets ratio, and then the risk associated with financial leverage rises. Increases in financial leverage are associated with greater vulnerability to downturns in the business and a greater chance of insolvency.

The second determinant is the franchise's ability to service its debt. If the franchise generates earnings before interest and taxes (EBIT) that well exceed its interest expense, then the market will perceive the franchise to be quite solvent. The margin between EBIT and interest expense is sensitive to business conditions, such as consumer demand (which affects delivery) and interest rates (which affects floating-interest-rate obligations).

The two proxies that are used to obtain evidence related to the fourth hypothesis are (1) the franchise's debt-to-assets ratio and (2) its times-interest-earned ratio. Both of these proxies will reflect short-run action taken to reduce the franchise's probability of insolvency. This area of agency is likely to be an immediate concern to the initial investors in the franchise, since the government's policy of not allowing an infrastructure to fall into bankruptcy will likely end after its delivery. As the franchise begins period three, both prospective stockholders and bondholders will (*ceteris paribus*) favor a more solvent franchise.

On the basis of the premise that these two proxies are associated with the probability of bankruptcy, the most pertinent action that can be taken to reduce the likelihood for bankruptcy is to restructure the franchise's balance sheet in order to reduce the franchise's debt-to-equity ratio and increase the times-interest-earned ratio. If evidence shows that these two proxies both change in favorable directions, this would be evidence consistent with the rejection of the hypothesis that the CEO does not take actions that will change the franchise's expected loss from bankruptcy as a result of private delivery. In fact, in many countries' private delivery of infrastructure, some government contracted/subsidized loans were not transferred as debt to franchise [in order] to maintain an acceptable debt-to-equity ratio. This is direct evidence of a government's attempt to resolve the financial-agency conflict associated with the threat of bankruptcy.

#### **5.4 Proxies Relevant to Information Asymmetry**

The final area of financial agency and hypothesis five ( $H_{0,5}$ ) are related to the degree of information asymmetry between the franchise and capital markets. An appropriate proxy needs to reflect changes in the quality and quantity of information disseminated to the markets concerning its operations. By default, independent of the CEO's actions,

private delivery will bring changes to the information the franchise provides the private sector. First, after an infrastructure's delivery, the government is no longer in a role of stewardship, which requires it to provide (to the public) certain amounts of information concerning the infrastructure. Second, again after delivery, the franchise will have to satisfy capital-market requirements for disclosure--if it issues securities. In the United States, franchises offering securities for delivery must adhere to the Securities Act of 1933 by registering with the Securities and Exchange Commission. The registration "is intended to provide adequate and accurate disclosure of material facts concerning the company and the securities it proposes to sell."

To evaluate whether an franchise's communications exceed its required release of information to the public before and after its delivery, actual communiqués need to be analyzed and assessed in terms of what information is discretionary and what is compulsory. After discretionary information is identified, the information needs to be further analyzed for content to assess whether an infrastructure franchise is providing a level of information (in terms of quality and quantity) that changes the degree of information asymmetry. Sources of information that can potentially provide investors with more complete information on an franchise include press releases and articles in the popular press, e.g., the Financial Times, and communiqués delivered directly from the franchise's communications director to market analysts.

If evidence is consistent with the conclusion that a change in information occurred, there still remains an unanswered question. That question is, "How does the amount of information released compare with the optimal level of disclosure (as discussed in section 2.3.5)." If the CEO is attempting to reduce financial-agency conflict associated with information asymmetry, he should strive to have the franchise release the amount of information that maximizes the pricing of its securities (*ceteris paribus*). The optimal amount of information for an infrastructure franchise could be changing during period three if the level of competition is changing. Unlike several of the specific proxies discussed for the other four hypotheses, there is no single proxy that can be extracted directly from a franchise's financial statements that relates to  $H_{0.5}$ . Furthermore, the evaluation of information made public and the judgment as to its content requires a more subjective analysis than simple comparison of ratios.

## 5.5 Case Study of California State Route 91 Express Lanes

In this chapter case of highway private delivery is analyzed with the goal of applying the empirical methodology presented in former sections to answer the two general empirical questions posed in sections 5.4 and 5.5 regarding remuneration and financial-agency conflict. The empirical analysis of agency conflict specifically considers the perquisite consumption ( $H_{0,l}$ ) and the bankruptcy threat ( $H_{0,s}$ ) hypotheses.

The case selected is the California State Route 91 Express Lanes (CA SR-91) operated by California Private Transportation Co. (CPTC), a partnership of United Infrastructure and Cofiroute, a French company. There are two lanes in each direction, with flexible barriers separating them from public lanes. Opened for service Dec. 27, 1995. Financing was handled privately by the partners; cost was listed as \$126 million. The company's profits may not exceed 17 percent of what is invested, and in the event of a financial failure, the tollway reverts to the state. The company is authorized to collect tolls for 35 years, when the state takes ownership. Law enforcement and road maintenance is provided by state agencies but paid for by the company. Tolls are collected using a small transponder that drivers receive when they open a prepaid account with the company. The gadget emits a radio signal that opens a gate to let each vehicle enter the lanes and then records the time. The toll is charged to each user's account. Tolls vary from 25 cents to \$2.50 per one-way trip depending on time of day and traffic flow.

The case analyzed illustrates ideas for a methodology for examining an infrastructure's private delivery in the context of the financial-contracting issues raised earlier. The case also provides further illustration of the empirical methodology, plus it is an example how the methodology can be adapted to other cases of private delivery. In the context of the four-period model, the inception of CA SR-91 coincided with  $t_2$  (i.e., the time of the private delivery announcement). CA SR-91 never operated in equilibrium as a state-owned highway agency. Given the broader private delivery of the highway services that was opening in 1989 and the rapidity of CA SR-91's private delivery, it appears that the California government had every intention to deliver CA SR-91 HOV lanes right after Assembly Bill 680's enactment.



The passing of the Assembly Bill 680 was the precursor to the formation of private delivery of highway services. Although the chronology of the CA SR-91 case deviates somewhat from the four-period model presented in chapter 3, there are some interesting findings from the materials sent by CA SR-91 franchise that are relevant and help illustrate the issues of CEO remuneration and financial-agency conflict. The analysis that follows in this section uses the annual financial statements sent by CA SR-91 franchise and the Caltran.

In 1995 CPTC states that it is "one of the state's leading independent highway services companies and the 91 Express Lanes project is an internationally acclaimed transportation facility." A sense of CA SR-91's size, profitability, and growth can be gained from tables 5.1-5.4. Table 5.1 lists (in nominal US dollar) the franchise's toll revenue, profit on ordinary activities before taxation, and total assets less current liabilities for 1996-99. Table 5.2 summarizes CA SR-91's annual revenue in constant 1996 dollar for 1996-98, including the annual percentage changes in revenue.

The (net) growth rate in toll revenues (again in constant dollar) for the year of operation just prior to its first full year of operation under private sector control was 76 percent. Because of the difficulty in establishing which assets were generating which revenues during the divestiture of CA SR-91 (in 1996), a comparison between 1995 and 1996 revenues is meaningless. During the three years after its delivery, CA SR-91's average (net) change in revenues was -13 percent. Similarly, tables 5.3 and 5.4 summarize (also in constant 1996 dollar) CA SR-91's annual profit and total assets, the percentage changes, and the net changes, respectively. There are several observations that can be made from the inflation adjusted figures.

Table 5.1 Summary Statistics for Operation (at \$000)

Year	Nominal Revenues	Nominal Profit	Nominal Assets	United States Price Index
1996	14255	8321	34812	100.0
1997	26674	13853	45422	105.0
1998	26632	11115	61983	111.3
1999	27881	5106	78444	115.1

Sources: Orange County Annual Statistics, 1996; CA SR-91's Annual Report and Accounts 1996, 1997, 1998, and 1999 (numbers have been modified for analysis, here and after); the International Monetary Fund's 1999 International Statistics Yearbook, vol. XLV.

Before making our observations it should be mentioned that the private delivery of CA SR-91 high speed lanes occurred in late 1995, while its 1995 fiscal year ended on December 31, 1995. Nevertheless, our analysis treats 1995 and 1996 as the crossover years. Although control shifted in the late of fiscal 1995, it is reasonable to presume that results for 1996 were primarily affected by decisions made by the public-sector control structure, prior to CA SR-91's delivery.

Table 5.2 (Real) Growth in Toll Revenues (at \$000)

Year	Real Revenues	Percentage Change	Net Percentage Change in Revenues
1996	14255		
1997	25401	78	76
1998	23942	-6	-10
1999	24224	1	-3

Note: The difference between the percentage change in revenues minus the percentage change in GDP.

Table 5.3 (Real) Growth in Profit (at \$000)

Year	Real Profits	Percentage Change	Net Percentage Change in Profits
1996	8321		
1997	13192	58	56
1998	9983	-24	-28
1999	4434	-56	-60

Table 5.4 (Real) Growth in Assets (at \$000)

Year	Real Assets	Percentage Change	Net Percentage Change in Profits
1996	34812		
1997	43262	24	22
1998	55683	29	25
1999	68141	22	18

The data (in tables 5.2-5.4) illustrate that the net growths in revenues, profit, and assets were all positive for 1996, the year after private delivery of high speed lanes. As argued regarding the growth in revenues between years 1996 and 1997, all accounting figures for 1996 would have been sensitive to the accounting methodology decisions

made with respect to the divestiture of pre-delivery assets (which became CA SR-91). In addition to negative growth in revenues for the three years after CA SR-91's delivery, the growth in profit averaged -19 percent. In contrast to the reductions in revenues and profitability, the net growth in real assets (for the three years after delivery) averaged 12 percent--this represents a deceleration in investment.

The CA SR-91 case, albeit an anomaly, is an example of the different roles that the public and private sectors can have vis-a-vis the CEO's financial contract. By selecting a CEO and entering into an agreement with him just before CA SR-91's delivery, the government (and not the shareholders) addressed the CEO Problem (i.e., who should be CEO and how to compensate him?) in period two.

In the 1995 Business Plan, a profile of each director and senior manager is presented. The selected CEO began his career in 1959, includes associations with more than half a dozen private-sector corporations. Therefore, for the CA SR-91 case, the CEO should not be viewed as depicted in our model, i.e., highly risk-averse-willing to trade remuneration for job security.

Also in the business plan there is a brief section titled, "Directors' Service Agreements." In this section the names of five individuals are listed, including the chairman and the CEO. Both the chairman and the CEO entered into service agreements with CA SR-91 for three and five years, respectively. In section 4.3, analysis of our model suggested that risk to the CEO increase between periods two and three. The agreement between CA SR-91 and its CEO reduces this risk (for this particular case).

Although the term is stated as five years, the reduction in risk actually spans (only) three years given the statement (p.13) that:

*The agreements will continue unless and until terminated by notice from either party to the other of not less than three years in the case of the Chief Executive, one year in the case of the Chairman and two years in the case of the other Executive Directors.*

A reduced threat of firing and/or increased (expected) remuneration both serve to offset disutility originating from greater risk. The last bit of noteworthy evidence from

the business plan pertaining to the financial-contracting process is contained in sections titled, "Directors' and Other Interests" and "Employee Share Scheme and Senior Executive Option Scheme." In these sections it is emphasized (p.48) that, prior to the offer for private delivery, none of the directors "has any interest in any share capital of franchise." Since the assets held by CA SR-91 for the bidding were entirely for pre-delivery at the time of the offer, this statement is consistent. The business plan goes on to discuss the directors' intentions to hold a special meeting before the end of 1994, when shareholders would vote on the adoption of an employee profit-sharing scheme. During the meeting one specific item that was to be reviewed was the granting of "options to selected senior executives."

Interestingly, the final sentence in the section titled "Employee Share Scheme and Senior Executives Option Scheme" states:

*Any executive to whom options are granted would, as a condition of such grant, withdraw from participation in the profit sharing scheme or, if already a participant, from further participation.*

In the context of incentives, this statement suggests a conflict of interest between profit sharing and options. Since profit sharing is associated more with short-term performance, while options are associated more with long-term performance, it would seem that using both in an executive's financial contract would encourage a balance between short- and long-term performance.

Table 5.5 lists the emoluments received by CA SR-91's chairman and highest-paid director for 1996-99. Although the CEO is not listed, his "current salary" of \$90,000 given in the business plan matches fairly closely with the \$98,000 listed for the highest-paid director's salary in 1996. On August 5, 1998 the chairman stepped down and another became the chairman and CEO. The new CEO's aggregate emolument for 1999 was \$368,000.

Table 5.6 lists the emoluments received by CA SR-91's chairman and highest-paid director for 1996-99 in constant 1996 dollar. The percentage changes are consistent with the theory discussed in chapters 3 and 4 regarding the CEO's risk exposure: Although CA

SR-91's revenues and profitability were decreasing in the early years after its operation, both the chairman and the CEO received significant increases in remuneration in 1996 (i.e., 53 and 21 percent, respectively). Both received smaller increases in 1998 and 1999, which can be explained by (1) a lag in the growth in revenues and profitability versus remuneration increases and (2) the franchise's transition into period four. As an infrastructure franchise begins period four (and the CEO has survived the added uncertainty inherent to period three), it can be argued that the executive managers are exposed to less risk and, therefore, should require less compensation to remain satisfied.

Table 5.5 1996-99 Emolument Data (at \$000)

Year	Chairman's Emolument	Highest-Paid Director's Emolument	Price Index
1996	41	76	100.0
1997	66	98	105.0
1998	78	118	111.3
1999	83	135	115.1

Sources: The Annual Report and Accounts 1996, 1997, 1998, and 1999

Table 5.6 1996-99 Emolument Data—Constant Dollar (at \$000)

Year	Chairman's Emolument	Percentage Change	Highest-Paid Director's Emolument	Percentage Change
1996	41		76	
1997	62	53	93	21
1998	70	14	106	16
1999	74	3	121	10

Sources: The Annual Report and Accounts 1996, 1997, 1998, and 1999

Next, consider the issues of financial-agency conflict and costs in the context of the CA SR-91 case. Given the set of data provided and its prompt delivery after its formation, the logical analysis is to compare the post-delivery values for the proxies (related to  $H_{0,1}$  and  $H_{0,4}$ ) to values just before CA SR-91's delivery (i.e., values for 1996). CA SR-91 reports "administrative and selling expenses" as one aggregate figure. The format used by CA SR-91 for its annual report does not appear to offer any other proxy for perquisite consumption expenses than the lone category of "administrative and selling expenses."

The ratio of expenses to revenues for 1996 was 1.1 percent, while for 1997 it was 2.5 percent. Thus, for the crossover period, the change in the ratio is consistent with the conclusion that perquisite consumption increased.

In table 5.7 the time-series data for administrative and selling expenses are presented for 1997-99. The scant evidence on  $H_{0,1}$  is consistent with the conclusion that perquisite consumption increased over the four-year period. Albeit a discontinuity in the time-series, the trend appears to have flattened out.

What do the proxies suggest about the SR-91 franchise's level of debt and ability to service its debt just prior to and immediately after delivery? The debt-to-assets ratio increased from 65 percent to 66 percent for the years 1997 and 1998, respectively (see table 5.8). An increase in debt could signal that SR-91 franchise's solvency decreased across  $t_3$ ; however, the change observed is viewed as insignificant. Realistically, though, the increase in the level of debt is so slight and the times-interest-earned ratio large that it seems highly unlikely that creditors would have viewed expected costs of bankruptcy to have changed.

Table 5.7 Administrative and Selling Expenses and Revenues for 1997-99

Year	Administration and Selling Expenses	Revenues	Expenses as a Percent of Revenues
1997	293	26674	1.1
1998	665	26632	2.5
1999	1055	27881	3.8

Sources: The Annual Report and Accounts 1997, 1998, and 1999 (at \$000)

The debt-to-assets and the times-interest-earned ratios for 1997-99 presented in table 5.8 suggest a slight rise in debt as a percentage of assets. More noteworthy is CA SR-91's use of credit "falling due after more than one year" in 1997. While short-term credit actually decreased from \$10.38 million to \$9.94 million between years 1997 and 1998, long-term credit jumped to \$11.44 million.

The second proxy, i.e., the times-interest-earned ratio, changes in a reinforcing direction to the increase in the debt-to-assets ratio. The times-interest-earned ratio decreases substantially across years 1997-99. Although the trends in the debt-to-assets and the times-interest-earned ratios (theoretically) are consistent with a greater expected

cost of bankruptcy (since greater debt-to-assets ratios and lower times-interest-earned ratios signal reduced solvency), the values for the two ratios are reasonable.

Table 5.8 Debt-to-Assets and Times-Interest-Earned Ratios for 1997-99

Year	Total Debt	Total Assets	D/A Ratio	EBIT	Interest Payable	Interest
1997	29354	45422	65	12957	8	1069
1998	40785	61983	66	9654	52	1062
1999	53955	78444	69	4798	542	987

Sources: The Annual Report and Accounts 1997, 1998, and 1999 (at \$000)

The data are consistent with the conclusion that perquisite consumption increases and franchise solvency decreases with the private delivery of CA SR-91. In the context of the two hypotheses,  $H_{0,1}$  and  $H_{0,4}$ , the evidence does not lead to the rejection of the hypotheses, but is consistent with rejection. If statistical evidence showed that perquisite consumption increased, then this would support the conclusion that agency conflict (related to CEO perquisite consumption) became more severe (and potentially more costly to the infrastructure franchise). Likewise, if statistical evidence showed that solvency decreased, then this would support the conclusion that agency conflict (related to the threat of bankruptcy) became less severe (and potentially less costly to the franchise).

The evidence related to the two hypotheses overall is consistent (albeit tenuous) with the rejection of  $H_0$ , i.e., the conclusion that CEO behavior associated with financial-agency conflict did change with private delivery. Since the combined evidence is consistent with not only a change in behavior, but an increase in conflict in both areas of financial agency, the evidence is consistent with an overall increase in agency conflict and costs for CA SR-91 after its private delivery.

## 5.6 Comment on the Findings

The analysis of CA SR-91 helps illustrate a methodology for assessing the changes in executive remuneration and financial-agency conflict during a private delivery. Because of the limited empirical results reported in this paper, it would be erroneous to

generalize the findings. A broader sample would have to be examined before drawing a conclusion.

If statistical methods are used in later work to extend this research, there are two areas where (successful) statistical validation could provide major contributions. First, the question whether the design of executive remuneration (during private delivery) can influence the performance achieved by an infrastructure franchise remains unanswered. Attempting to generate econometric results that support or refute the hypothesis that executive incentives do explain infrastructure franchise performance will be plagued by the same problem discussed earlier when Murphy's work (1985) was cited, i.e., the difficulty in proving causality.

The second area that econometric validation could contribute is in the selection of proxies that are correlated to agency costs. The first step would be to statistically test whether a particular proxy explains some percentage of an infrastructure franchise's costs of equity and debt financing. If a statistical association is found, it could be argued that the association is between the proxy and the agency-cost component. Because research has not shown a reliable methodology for measuring the agency cost of debt and equity, it is infeasible to test directly for a correlation between a proxy and agency costs.

The absence of statistical validation that a proxy's changes are correlated to actual changes in agency costs leads to the drawing of any conclusions as being speculative. For example, if administration and selling costs as a percentage of revenues increases, all that can be stated is that the increase is consistent with what would be expected from greater perquisite consumption. There has not been any statistical evidence presented in this study that links perquisite expenses to the selling-expense ratio. Therefore, inferences suggesting a link cannot be made. Because we have not conducted an analysis where other variables have been considered, it is conceivable that the selling-expense ratio could decrease when perquisite expenses rise, if some other expense component (embedded in selling costs) happens to be decreasing (in absolute terms) by more than the increase in perquisite expenses.



## **Chapter 6 Summary of Work and Ideas for Future Research**

The objective of section 6.1 is to summarize chapters 1-5, with special attention on what we believe are contributions to infrastructure private delivery research. As this study was conducted, several areas needing further research (to make this analysis more robust) became apparent. In section 6.2, ideas for future research are discussed.

### **6.1 Summary of Work and Contribution**

In chapter 1 the research objective presented was to uniquely combine the topics of private delivery, financial-agency theory, and executive compensation to analyze the financial-contracting process between the chief executive officer and shareholders, who are taking control of an infrastructure as it is privately delivered. In earlier research by others looking at public- versus private-delivered infrastructure, a dichotomy emerged between whether private delivery or liberalization leads to improved efficiency. One group argues that shifting new infrastructure control to the private sector (through private delivery) is the catalyst needed to transform an infrastructure into an efficient operation.

Others argue that promoting competition, both from domestic and international concerns, and exposing the franchise to market forces will encourage greater efficiency. The bridge that links both schools is incentivization, which means to create incentives within an organization to operate more efficiently. In our analysis of the financial-contracting process involving the CEO and shareholders of a private-delivered infrastructure, issues on negotiating an efficient contract were critically examined.

A premise used in this study is that one of the franchise's most important tasks at the time of infrastructure delivery is likely to be the development of a viable relationship with the private-sector capital markets. An infrastructure needs to obtain its future financing (after its private delivery) to survive (and grow) from the private-sector capital markets, through the competitive selling of contingent claims and property rights. To establish this (principal-agent) relationship between the franchise's executives and shareholders, the CEO has to devote himself (at least in the short term) to the bonding activities associated with the solidification of this relationship.

The core contribution made in this study is contained in chapters 3 and 4. Recognizing the lack of homogeneity between cases of private delivery (even within the same country), we identified and codified the important facets to the financial-contracting process between the executives (specifically, the CEO) and shareholders of a private delivery. The private delivery of an infrastructure creates a unique set of circumstances that affect (among others) the CEO and call for dynamic adjustment of the incentive scheme offered, to achieve his cooperation.

The private delivery process can be modeled in four periods. Period one is the period when an infrastructure operates by a state-planned provisional office prior to the private delivery announcement. Period two begins when the private delivery announcement is made. During period two the franchise is being prepared for the transformation of its property rights to the private sector. Next, period three begins immediately after the delivery (and transfer) of the franchise's property rights. During period three the franchise operates under the control of the private sector. The beginning of period four is described as the point in the franchise's operation when the effects of private delivery are operated at its maximum efficiency. While periods two and three are demarcated by clearly recognizable events (i.e., the announced and actual delivery, the end of period three and the start of period four are not as visible).

In the context of the four-period model, the problem that became the focal point of this research (and was termed the "CEO Problem") is: "Who should the CEO be, and how should he be compensated during the period immediately after the delivery?" Asking this question in reference to "the period immediately after the delivery" suggested that only the new shareholders are confronted with this question. As the analysis was developed, it became evident that period two (the time from the announced to the actual delivery) can become protracted (e.g., in the case of SR-91).

The CEO Problem was dissected into two problems--one of adverse selection and one of moral hazard. The problem of adverse selection is: "Who should the CEO be, given that a candidate for CEO holds private information about himself that (if shareholders had this information) could have an effect on their selection?" The CEO from the infrastructure provisional office has human capital that might be quite valuable. Because of his experience with the infrastructure it is likely that the provisional has ideas

for profitable investment opportunities that will expand the infrastructure and/or will make it more efficient after its delivery. The problem of adverse selection exists because the shareholders do not have complete information on the provisional nor on outside candidates for CEO. This information asymmetry could, for example, lead shareholders to overestimate the provisional CEO's value to the franchise relative to other candidates, resulting in their selection of him over (perhaps) more-qualified managers. Other facets of the adverse-selection problem that exist under the private delivery scenario were discussed in this study.

The second problem, which is one of moral hazard, is: "What financial contract should be offered to the CEO to provide the incentives necessary for him to perform most effectively?" In moral-hazard models a manager's effort or action is explicitly specified as a determinant of output. Unlike individuals who are assigned specific tasks, a manager's "output" might not correlate at all closely to his effort. How the CEO allocates his time during a private delivery might (arguably) be more important than the amount of time he devotes (overall). How should the CEO allocate his time with a private delivery?

While our analysis did not specifically answer this question, it did illuminate the relevancy of this question-particularly at the time of an infrastructure's delivery when the development of a relationship between the franchise and the private-sector capital markets begins. This research views the development of this relationship through a financial-agency paradigm. Specifically, there are five areas in the literature identified as producing financial-agency conflict and costs that are likely to need special attention during infrastructure's private delivery. If the CEO encourages (1) no excess perquisite consumption, (2) no risk-shifting, (3) no over/under-investing, (4) an optimal debt-to-assets ratio, and (5) no unnecessary information asymmetry with the capital markets, he will be taking critical measures to minimize the franchise's costs of capital and maximize shareholders' wealth. The incentives that are incorporated into the financial contract should (implicitly) motivate the CEO to give these areas of agency the attention needed.

How risk is shared between the CEO and shareholders is an important facet of the CEO Problem. Three circumstances that can exist during a private delivery that prompt careful examination of risk-sharing are: (1) the possible transition of a relatively risk-averse CEO from the public to the private sector (if the provisional office CEO is

retained); (2) the increased "noise" and uncertainty in accurately measuring the CEO's performance during the disequilibrium period just after the delivery; and (3) the new (risk-latent) methods of remuneration being available after the infrastructure's delivery.

"The model specified for the CEO's utility assumes that he will make his decision as to how hard to work based on expected wealth and expected variance in wealth. The use of expected variance in the utility specification for a CEO involved in a private delivery is a contribution to the private delivery literature. The important implication is that a CEO's utility will be reduced (the reduction will depend on how the CEO adjusts his expectations for variance in wealth) during private delivery, if the CEO is exposed to greater uncertainty.

By using a combination of fixed and variable remuneration, the shareholders can require the CEO to share some risk. The variable remuneration discourages static performance and should motivate the CEO to pursue measurable milestones as he redirects the franchise toward its new objective. The use of accounting- versus market-based remuneration can serve to set specific, measurable targets that coincide with the franchise's objective. For example, if the shareholders of a newly private delivered infrastructure want the franchise to increase its efficiency, they might set goals for the CEO in terms of expense ratios, such as cost of goods sold as a percentage of services delivered. While accounting-based remuneration could have been used (by the government) before private delivery, market-based remuneration was not an option. However, upon the transformation of the infrastructure's property rights during its private delivery, setting goals (and incentives) relative to market valuation of those rights is a powerful alternative that becomes available.

After two chapters (chapters 3 and 4) of careful analysis of the facets of financial contracting, in chapter 5 ideas were presented to illustrate how an empirical analysis of all franchise might be conducted to uncover evidence that conveys information as to what changes were actually made to executive remuneration during private delivery. The illustration, which includes the examination of case of private delivery from the California State Route 91, also presents common-sense ideas for proxies that can be compiled from a franchise's financial statements that provide evidence that is either consistent or inconsistent with acceptance of the hypothesis that behavior associated with

financial-agency conflict has not changed during a private delivery. In parallel to the theoretical presentation in chapter 2, the empirical methodology identifies proxies corresponding to each of the five areas of financial-agency conflict. In addition to presenting proxies for the five areas of agency, two of the five areas (i.e., perquisite consumption and the bankruptcy threat) are analyzed using data contained in the franchise's annual reports .

For CA SR-91 there were noticeable increases in executive remuneration just after its delivery. The chairman and CEO received (nominal) increases of 61 percent and 29 percent, respectively, after CA SR-91's delivery. Consistent with the normative conclusion that risk exposure (to the CEO) increases during private delivery (see section 4.3), CA SR-91 extended service agreements to five of its top executives during the infrastructure's private delivery. The temporary removal of the threat (and risk) of firing is one method for maintaining an executive's level of utility during a private delivery. It also encourages an executive to take a longer-term perspective in his decision-making.

Limited by the format used by CA SR-91 for its annual report, only one proxy was identified for detecting changes in perquisite expenses. With only one proxy, conflicting results are impossible. In the CA SR-91 case, the evidence was consistent (but tenuous) with the conclusion that perquisite consumption and the threat of bankruptcy both increased after its delivery.

The financial-agency hypotheses have not been econometrically tested for acceptance/rejection. The proxies used have not been statistically linked to the areas of conflict; e.g., the proxies used for perquisite consumption have not been shown to have a statistical link with actual perquisite consumption. Nor have the two proxies chosen for the bankruptcy threat been shown to have a statistical link to an infrastructure's chance of bankruptcy after its delivery. Therefore, the proxies have only been analyzed qualitatively to see if they appear to be consistent with a particular conclusion.

## **6.2 Ideas for Future Research**

### **I. How Long Is Period Three?**

By focusing on events occurring in period three of the private delivery process, this

work implies that the duration of period three is significant. If, rather, period three is a short interval (for example, less than one year), then it weakens the argument that adjusting the CEO's period-three financial contract in response to disequilibrium conditions should be an important priority. On the other hand, the longer that period three is, the more important proper incentives should be to the implementation of a policy aimed to produce efficiency gains and greater profitability for the owners in the short run. This prompts the question, "How long is period three?"

Before methods for measuring the length of period three can be suggested, a proper definition of period three is required. In section 3.3 a four-period model for the chronology of a private delivery was constructed. Period three in our model corresponds to the period described by Caves (1990, p. 145) as a temporary period after an infrastructure's delivery when state control/subsidy is still reflected in the franchise's operations.

Our work extends Caves' description by further suggesting that period three includes changes in the principal's objective for the franchise and renewal of principal-agent relationships associated with the franchise. The changes that occur during period three are assumed to produce added "noise" (see section 3.10).

Noise was discussed in the context of measuring the CEO's performance in an atmosphere of a changing objective, a possible change in investment policy, and the renewal of the franchise's principal-agent relationships. In theory, all this symptomatic commotion could make it more difficult than usual to assess the CEO's performance. The same argument can be applied to the capital markets' appraisal of the franchise's securities. Therefore, one method for assessing the length of an infrastructure's period three would be to analyze the pricing of a state-backed franchise's common stock immediately after its initial flotation (at the time of the infrastructure's delivery).

Tracking stock volatility and examining whether there is a temporary period of unusual volatility for the stock of an (newly delivered) infrastructure might provide insight into the duration of period three. It is likely that an infrastructure franchise's initial public offering would exhibit relatively high volatility as it begins trading in the secondary market, due to uncertainty about the infrastructure franchise's future performance. Schmidt and Schnitzer (1992) discuss the existence of noise during an

infrastructure's transition to the private sector. Excessive volatility in an infrastructure franchise's stock price would be evidence of this noisy period.

How could security prices be analyzed to provide useful information? Case-by-case analysis of new issues from private delivery could provide useful information regarding the time-path that the volatilities of the new issues' prices take.

One hypothesis that could be tested could be based on whether the volatilities of franchises' securities' prices tend to approach asymptotic values after delivery. The average time that it takes for the volatilities to level off might be an estimate of the average length of period three.

## **II. How Changes in Risk-Preference Assumptions**

Change the results it is not certain that shareholders of newly private-delivered infrastructure are less risk-averse than the executives managing those franchises. A logical extension of the analysis presented in this research would be to consider and contrast how the financial-contracting process would be affected by changing the risk-preference assumptions applied to the principal and agent.

## **III. The Effect of Regulation on Financial Contracting**

Often infrastructures are regulated even it is being delivered by the private sector. There are at least two regulation schemes that could be enacted. One would limit how much profit the franchise can generate from its operations. A second scheme would be for the regulating body to set prices and then permit the franchise to generate as much profit as it can (under the price constraint). The assumption used herein is that regulation does not affect the financial-contracting process between the franchise's executives and shareholders. The premise behind our assumption is that regulation can affect the franchise's objective function, without altering the shareholders' underlying objective of wealth maximization and (implicit to that objective) their desire to have the executives perform as effectively as possible. Therefore, we are assuming (indirectly) the later form of regulation just described.

Very likely, though, regulation will affect financial contracting due to the constraints that the government imposes. Changes in the infrastructure franchise's objective (vis-a-vis

government regulation) might, correspondingly, necessitate changes in the measures of CEO performance. To the extent that a CEO's remuneration is based on a set of performance standards that are consistent with imposed regulations, the CEO's incentives will partly align with the regulatory body's objective for the franchise. This is one reason why prospective investors try to anticipate what role the government will take after an infrastructure is delivered. In the event of regulation, the delivery of an infrastructure will not yield a complete shift in control to the private sector. Further research could investigate the ramifications of regulation with respect to the financial-contracting process.

#### **IV. Comparison of Public- versus Private-Sector CEO Performance**

During a private delivery--at the time of delivery and shift of control--shareholders can replace the provisional office CEO. How, generally, do the performances of CEOs that transfer from the public-planned provisional office to the private sector (by way of private delivery) compare to CEOs from the private sector? It was argued that a provisional office CEO (potentially) has human capital that might be quite valuable to private franchise, in their pursuit of wealth maximization after taking control of all infrastructures. Yet, an executive from the public-planned provisional office might be relatively more risk-averse than his counterpart directly from the private sector. Is a typical CEO from the private sector any more or less responsive to accounting- and market-based incentives than a typical CEO from the public sector?'

To begin researching these issues, two sets of private delivery cases could be compiled--one set of private deliveries identified as cases where the provisional office CEO was retained with private delivery and a second set of cases where the CEO was replaced (with an individual from the private sector). Performance for the two sets could then be compared using accounting- and market-based measures of performance, such as return on equity and stock price performance.

In addition to researching whether infrastructures franchise that retain provisional office CEOs tend to out-perform or under-perform infrastructures that replace with private sector CEOs, it would be relevant to search for evidence that supports or refutes the hypothesis that public-sector managers are more risk-averse than their private-sector



counterparts. If public-sector managers are more risk-averse, then financial contracting with an executive from the public sector requires greater sensitivity to the risk-sharing characteristics of the remuneration alternatives offered.

## **V. A Search for Further Evidence Related to Agency Conflict and Costs**

Only two of the five hypotheses posed for analyzing for changes in financial-agency conflict were used in the analyses of CA SR-91. To gain a more complete appraisal of financial-agency-related behaviors during a private delivery, successful methods for analyzing these other areas should be researched.

The empirical analysis contained in chapter 5 needs to be made more robust. For example, consider the analysis of the hypothesis regarding the expected cost of bankruptcy ( $H_{0,4}$ ). We know that as franchises are perceived as less credit-worthy by bond rating agencies, e.g., Standard & Poors and Moody's, that franchises will receive lower credit ratings as a result. Research has shown that the market learns of and adjusts to an infrastructure franchise's changes in credit-worthiness even before its rating changes (see Wakeman, 1981). The market's adjustment to credit-worthiness will be seen in the yield debtholders require when they buy bonds from the franchise. As credit-worthiness decreases, the cost of debt financing increases.

To begin quantifying the costs that ensue due to the financial-agency conflict associated with the bankruptcy threat, we need to investigate the determinants of credit worthiness. Then a set of privately delivered infrastructure could be examined to see whether the pronounced determinants of credit worthiness coincided with their actual costs of debt financing. An analysis following this methodology would begin to quantify the cost of behavior associated with financial agency. In general, the costs of all the areas of agency conflict need to be quantified. This would enable an estimate to be made as to the significance of financial-agency costs relative to an infrastructure franchise's overall cost of capital.

## **VI. Application of this Research to Actual Private delivery**

From the practitioner's perspective, the complementary phase of this research is to explore ways to integrate the insights from this work into the day-to-day, real-life private

delivery activity occurring right now all over the globe. The research herein has implied that, through this financial-agency paradigm (that has been used to analyze the issues relevant to financial contracting), a financial contract can be struck between the CEO and shareholders that will entice the CEO to behave "optimally." The implied optimal behavior for the CEO is for him (1) to consume an "optimal" amount of perquisites and to put in an "optimal" amount of effort; (2) to pursue an "optimal" level of risk in the infrastructure franchise's investments; (3) to pursue an "optimal" amount of investments; (4) to pursue an "optimal" debt-to-assets ratio with an "optimal" level of coverage for fixed obligations; and (5) to disseminate an "optimal" amount of information to the capital markets. Attempting to assess what these "optimal" levels are will be a continuing objective for research using (among other theories) agency theory.

Because of the elusiveness of the set of optima suggested from the financial-agency theory, translating the insights into incentives and performance objectives is nebulous. For example, the shareholders cannot reward the CEO for achieving an optimal capital structure if they themselves do not know what the optimal structure is. Similarly, how is the CEO to know what the optimal amount of information to release to the capital markets is--i.e., that amount of information that will balance the gains in the values of the infrastructure franchise's securities with the losses that will result because of actions taken by rivals (as a response to the released information)?

Therefore, to increase the value of this research (to the practitioner), a tangible methodology for guiding the financial-contracting process in a direction that explicitly integrates the insights gleaned from viewing private delivery from a financial-agency paradigm needs to be developed.

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