A Theoretical Assessment of Private versus Public Provision of Airport Security

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The attacks of September 11 have sparked a number of important policy debates focusing on civil liberties and law enforcement, national security, energy policy, and homeland defense. Because the attacks were carried out with domestic aircraft, the debate over the future of airport security has been particularly heated. Indeed, the Airport Security Federalization Act was proposed ten days after September 11 and was passed into law less than two months later. This act calls for the federalization of all airport security personnel in the United States and places them under the supervision of the newly created Transportation Security Administration within the Department of Transportation.

The arguments for federalization of airport security were primarily based on the assertion that private firms hired to provide security have the wrong incentives and consequently perform poorly. Private firms, it was argued, are too concerned with the bottom line, leading them to cut costs even when this significantly decreases the quality of security. Most famous among the cost cutting measures adopted by the private security firms were the low wages paid to screeners. A study by the United States General Accounting Office found that starting salaries for screeners at 14 of the nation’s 19 largest airports were $6 per hour or less, and starting salaries were $5.15 per hour at the remaining five airports (USGEO 2000). Further, according to the FAA, from May 1998 through April 1999 there was anywhere from 100 to more than 400 percent turnover among screeners at the 19 largest airports (USGEO 2000). The workers’ union also argued that because airport security personnel are not provided with “the paid sick leave or health coverage that most other workers receive, they are on the job even when not feeling well enough to focus properly,” (SEIU 2001)

The logic underlying the decision to federalize was that airport security is a costly public good that is difficult to monitor because most breaches do not result in actual catastrophes. Consequently private companies who run security at airports have an incentive to overly emphasize cost-cutting measures. The security costs of these measures are borne (in expectation) by the entire populace. But the benefits of cost savings are enjoyed only by the security firms themselves. The government, on the other hand, as the representative of society at large, internalizes more of the costs associated with a decrease in the public
good of airport security, and so will not cut costs as heavily when such cuts adversely affect security.

The debate over federal versus private management of airport security is not a moot point following the passage of the Airport Security Federalization Act (ASFA). Indeed, one might argue that the issue is more salient than ever. The ASFA mandates the federalization of airport security personnel in the short-term. The Department of Transportation is called on to hire and train 28,000 federal employees in one year. Importantly, however, the bill also grants the President the discretion to allow airports to sub-contract back to private firms in three years. Consequently, the relative efficacy of federalized and privatized airport security remains important.

The existing economic literature on private versus public provision of public goods can shed considerable light on this important public policy debate. In particular, economic analysis indicates that the trade-offs to be considered may be more nuanced than those that came out in the most recent debate. At the same time, the issues raised by the question of whether airport security should be publicly or privately provided suggest new extensions to extant theoretical work. Indeed, while this paper is partly motivated by the particular case of airport security, I will argue that my model fits many cases better than earlier models of public versus private provision of public goods. (Examples). In this sense, the theoretical scope of this work is not meant to be limited to the particular issue of airport security.

In an important recent paper, Hart, Shleifer, and Vishny (1997) (from now on, HSV) explore the effects of public versus private management of prisons from an incomplete contracts perspective. They are concerned with managers’ incentives to cut costs and to invest in innovative new technologies under private and public management regimes, when these decisions cannot be contracted on. Broadly speaking, they find that government administration leads to less cost cutting but also less technical innovation. The overall effects on quality and social welfare are indeterminate in their model, depending on the relationship between several parameter values. In particular, HSV’s work suggests that in order to evaluate the merits of federalization and privatization one needs to evaluate the relative import of the detrimental effects of cost cutting and the positive effects of innovation.

I believe that this same trade-off exists in airport security and, as such, I adopt HSV’s basic approach. However, I extend the model in several ways. First, unlike in the case of prisons, it may be relatively easy for the government to do some “undercover” monitoring of the quality of airport security. For instance, the government secretly sends inspectors through security checkpoints at American airports carrying materials that should not be allowed through, in order to evaluate the level of security. Consequently, in my model, the government can engage in costly monitoring, which will probabilistically allow the government to produce concrete evidence of “shirking” and fine the private security provider.

When one views the debate over airport security in terms of the trade-off between cost cutting and technical innovation, another interesting dynamic
emerges having to do with the United States’ ability to arbitrage technical innovations from other countries. Historically, European countries (especially Britain and France) and Israel have been more focused on terror prevention than the United States. As a result, there is a significant amount of latent technical security innovation that the United States can adopt without a large investment in research and development. Economically speaking, the marginal costs of technical innovation are currently quite low. To explore the dynamics of this issue, unlike the HSV model, my model does not include a specific functional form for the costs of developing technical innovation or cost cutting techniques. Rather, I include general convex costs and explore the effect of a change in marginal costs. This leads to the conclusion that when marginal costs of technical innovations are low, government ownership is relatively more attractive because the difference in the level of technical innovation between the federalized and privatized regimes is small. Therefore in the short-term federal control over airport security may be good policy, but as the latent technology is fully adopted and the marginal costs of technical innovation rise, the government may want to phase back in privatization, as provided for by the Airport Security Federalization Act.

Including more general cost functions and the possibility of government monitoring discussed above also allows me to explore how the government can best prevent private firms from cutting costs too much, once re-privitization occurs. I investigate two potential government strategies, one involving monitoring with inspectors and the other involving raising the marginal costs of developing cost-cutting techniques by imposing high minimum wages and mandatory training (which are the obvious, and therefore “inexpensive” ways of cutting costs). I am able to identify the trade-offs between these two techniques and suggest conditions under which each is optimal.

The paper proceeds as follows. In the next section I develop a model of airport security, building on the base provided by HSV’s model of prison privatization, but extending it in the ways discussed above. I then analyze the model, demonstrating several key results. I interpret the results and discuss their implications for government policy regarding airport security federalization. Finally, I explore other cases of public goods provision (including ...) where this model may offer a better theoretical fit than earlier models.

1 A Model of Airport Security

I present a model of airport security that is an extension of the HSV model. I lay out the model in much the same manner as HSV, highlighting the differences between my model and their’s. Some of the results of my model follow directly from their intuitions, which I note throughout the text, while pointing out results that are new. Whenever possible I use HSV’s notation.

There are two unitary actors, the Government (denoted $G$) and a manager or bureaucrat (denoted $M$). The manager may be the director of a private security firm or a government employee. The government wants high quality,
affordable, airport security, while the manager is motivated by profits or salary. The government has two choices, it can either contract out airport security to private firms or it can utilize federal employees and run security as a federal program. The key difference between these two schemes is who controls important security decisions. If the government contracts out to a private firm, then the manager of the firm has control over the facilities and staff, and consequently can make crucial decisions regarding how to run security. If, however, the government runs airport security, then the manager is a government bureaucrat taking orders from above.

I assume that airport security has a "price" denoted by $P_0$. That is, the government agrees to pay $P_0$ either as a fee to an independent corporation or as a wage to the bureaucratic manager in exchange for providing security. The quality of airport security can be changed by two types of innovation: cost reducing measures or technical advances. I assume that ex-ante there are too many possible innovations for the government and the manager to write a complete contingent contract over. To do so would either be impossible or too expensive to be worthwhile. Another possible interpretation, in the case of airport security, is that because the consequences of lax security are rare it is difficult for a third-party to verify the actual quality of security being provided. Ex-post the government can observe the amount of effort that has been invested in cost cutting and in technical improvements, and renegotiation can occur based on these observations, even though they cannot be verified by a court. But ex-ante contracts that specify a level of service are not realistic. Thus, the manager and the government renegotiate the price to be paid once the actual contingencies have been realized.

Cost-cutting innovations lower the cost of providing airport security, but also decrease the quality. Obvious examples of such cost cutting innovations in airport security include decreasing the level of training for security personnel or hiring unskilled screeners who are willing to work for low salaries. The manager can also implement quality innovations which improve the quality of airport security but increase the costs. Better scanners, random searches, and explosive-sniffing dogs might constitute such innovations.

Let $B$ denote the total level of security provided and $C$ the total cost of providing it. Denote the effort invested in developing cost innovations by $e$ and the effort invested in developing quality innovations by $i$. The effect of cost innovations on $B$ is given by $b(e)$ and the effect of cost innovations on $C$ is denoted by $c(e)$. Similarly the effect of a quality innovation on $B$ is denoted by $\beta(i)$. As in HSV I do not model the effect of a quality innovation on costs explicitly. The implicit assumption is that quality innovations are beneficial on net. And I do not need to keep track of the separate cost and quality components of quality innovations for my results, so including a cost component would needlessly clutter the analysis. The same is not true of the two components of cost innovations, which will play a key role in some of the results. Thus, the
total level and cost of security are given by:

\begin{align*}
    B &= B_0 - b(e) + \beta(i) \\
    C &= C_0 - c(e)
\end{align*}

where \( B_0 \) and \( C_0 \) are constants. Note that cost innovations lower costs and lower quality, while quality innovations raise costs and raise quality (though they raise quality more than they raise costs, and the costs are not included explicitly). Following HSV I make a series of standard assumptions regarding these functions. In particular, I assume that \( b(0) = 0 \) and \( b(\cdot) \) is convex, \( c(0) = 0 \) and \( c(\cdot) \) is concave, \( \beta(0) = 0 \) and \( \beta(\cdot) \) is concave.

I also assume that it is personally costly for the manager to invest in developing innovations of either kind. In particular, the manger bears cost \( \varphi(e) \) for developing a cost innovation and cost \( \gamma(i) \) for developing a quality innovation, where \( \varphi(0) = 0, \gamma(0) = 0 \), and \( \varphi(\cdot) \) and \( \gamma(\cdot) \) are both taken to be convex. This is a change from the HSV model, where costs are taken to be linear in effort. This alteration will allow me to examine some additional policy implications that are particularly relevant to the current debate over airport security. I also assume that, ex-post, all of the parameters of the model are observable to both the government and the manager though they are not generally verifiable to outsiders (such as a court) so that contracts must remain incomplete, but renegotiation is possible.\(^1\)

I extend the HSV model in another, more fundamental, way. Though in general the level of effort invested in cost-savings is not verifiable, I allow for some possibility that if the manager shirks his duties by cutting costs too much the government will be able to find evidence of this shirking and punish the manager with a fine. In particular, I assume that the probability of the manager being caught shirking is given by the cumulative density function \( F(e) \). \( F(\cdot) \) is assumed to be continuous and strictly increasing. Further, I assume that \( F(e^*) = 0 \), where \( e^* \) is the socially optimal amount of cost cutting, so that if the manager chooses the socially optimal level of cost savings (or less) there is no chance that he is found guilty of shirking his duties, while the more cost cutting he does beyond the social optimum, the more likely he is to be caught shirking. If the manager is caught shirking the government levies a fine \( K \) against the manager. For technical reasons, I assume that \( F''(e) > \frac{[\varphi''(e) - \varphi''(e^*)]}{2} \).

The substantive interpretation of this is that the probability of being caught shirking cannot be too concave relative to the concavity of the benefits of cutting costs. The government bears cost \( d \) for monitoring.

The game proceeds as follows. At time 0 the government and the manager write a contract and specify who will control decisions over airport security. At time 1 the manager chooses how much effort to invest in cost and quality innovations. At time 2 the government and the manager renegotiate the terms of the contract, whomever controls the airport security decides whether or not to implement the innovations, and if the manager is caught shirking the fine

\(^1\)For a discussion of verifiability versus observability see Hart (1995).
is levied. Following HSV I assume that the gains from the renegotiation are divided through Nash bargaining, so that each side receives half of the surplus relative to their default options. Players are taken to be risk-neutral. The solution concept is sub-game perfection.

As mentioned above, it is assumed that the player who controls security has the right to decide whether or not any innovations will be implemented. Thus, if the players fail to reach an agreement at time 2, the player in charge can choose not to implement innovations. In the case of federalization, the government can implement innovations without the consent of the manager, though, as will be discussed below, the government bears a cost for doing so. With private subcontractors the government cannot implement innovations (either cost cutting or quality improvements) without the manager, because security is controlled by the private firm. The private manager, of course, will always implement cost-cutting measures, since he internalizes the cost savings but not the public bad of decreased security. However, a private manager has no incentive to implement quality innovations if the government has not agreed to pay for them.

Also following HSV I assume that not all of the possible innovations associated with $M$’s investments are in the form of personal human capital. That is, in the case of a federalized security system, if $M$ is fired by the government and replaced with a new bureaucrat (which would happen if agreement were not reached), some of the benefits of $M$’s research and development are left behind and can be used without his input. The percentage of all innovations that $M$ takes with him when he is fired is given by the parameter $\lambda \in [0,1]$. The intuition is that innovations may be more effective when the manager who developed them is present or that some of the innovations may be his personal human-capital. But a manager’s research and development is not totally lost if the manager leaves.

2 Analysis

2.1 Social Optimum

If a fully contingent contract could be written on $e$ and $i$ the level of investment would reflect the social optimum. In particular, the social surplus would be maximized. This first-best solution will be a useful point of comparison. At the social optimum the following maximization problem would be solved:

$$\max_{e,i} \{B_0 - b(e) + \beta (i) - C_0 + c(e) - \varphi (e) - \gamma (i)\}$$

The following Lemma insures that the first order conditions will give the maximum:

Lemma 1 The function $\{B_0 - b(e) + \beta (i) - C_0 + c(e) - \varphi (e) - \gamma (i)\}$ is concave in both $e$ and $i$. 
Proof. The function is clearly continuous. Further the second derivative with respect to $e$ is $c''(e) - b''(e) - \varphi''(e)$. Since $c(\cdot)$ is concave $c''(e) < 0$, while because $b(\cdot)$ and $\varphi(\cdot)$ are convex $b''(e) > 0$ and $\varphi''(e) > 0$ so that $c''(e) - b''(e) - \varphi''(e) < 0$. Similarly for $i$ the second derivative with respect to $i$ is $\beta''(i) - \gamma''(i) < 0$ by the concavity of $\beta(\cdot)$ and convexity of $\gamma(\cdot)$. $\blacksquare$

Lemma (1) implies that this maximization problem has a unique solution given by the first-order conditions:

\[ c'(e^*) - \beta'(e^*) = \varphi'(e^*) \quad (1) \]
\[ \beta'(i^*) = \gamma'(i^*) \quad (2) \]

The marginal benefits (taking into account the effects on cost and quality) equal the marginal costs at the social optimum $(e^*, i^*)$.

### 2.2 Sub-contracting to a Private Firm

Suppose the government hires a private firm to provide airport security. I use backward induction to calculate the level of effort expended by the manager in developing both cost-cutting techniques and quality innovations. At time 2, after the efforts have been sunk but before the manager has actually implemented the innovations, there is a chance for renegotiation. If agreement is not reached the manager will not implement the quality innovations, though he will implement his personally optimal level of cost innovations, because he reaps the gains of decreased costs without suffering the public bad of decreased airport security. There is, however, a chance that the firm will be caught shirking. This probability is given by $F(e)$. The government bears cost $d$ for monitoring. It is assumed that even without quality innovations the firm is not in breach of its contract and so some security is provided and the fee ($P_0$) is paid. Consequently, the manager’s default value of not reaching agreement, when the government has sub-contracted, is given by

\[ R^{SUB}_M = P_0 - C_0 + c(e) - \varphi(e) - \gamma(i) - F(e) K \]

The government’s default value of not reaching agreement is given by the level of quality of security, minus the fee paid:

\[ R^{SUB}_G = B_0 - b(e) - P_0. \]

If the government and the manager reach a negotiated settlement, the extra benefit generated is $\beta(i)$ which the two sides Nash bargain over, and so, split evenly. In equilibrium, renegotiated settlement will always be reached, consequently the expected utility of the two players are:

\[ U^{SUB}_G = B_0 - b(e) - P_0 + \frac{\beta(i)}{2} - d \]
\[ U^{SUB}_M = P_0 - C_0 + c(e) - \varphi(e) - \gamma(i) - F(e - e^*) K + \frac{\beta(i)}{2} \]

The manager, at time 1, chooses his levels of effort to maximize $U^{SUB}_M$. The following Lemma shows that first-order conditions characterize the maximum.
Lemma 2 \( U^\text{SUB}_M = P_0 - C_0 + c(e) - \varphi(e) - \gamma(i) - F(e - e^*) K + \frac{\beta^i}{2} i \) is concave.

Proof. The function is clearly continuous. Further, the second derivative with respect to \( e \) is \( \varphi''(e) - F''(e - e^*) K < 0 \) given that \( c(\cdot) \) is concave, \( \varphi(\cdot) \) is convex, and the assumptions on \( F(\cdot) \) made above. The second derivative with respect to \( i \) is \( \frac{\beta^i}{2} - \gamma''(i) < 0 \) given that \( c(\cdot) \) is concave and \( \gamma(\cdot) \) is convex.

The first order conditions, thus yield the unique solution to this problem, denoted by \((e_{\text{SUB}}, i_{\text{SUB}})\):

\[
\begin{align*}
    c'(e_{\text{SUB}}) - F'(e_{\text{SUB}} - e^*) K &= \varphi'(e_{\text{SUB}}) \\
    \frac{\beta^i(i_{\text{SUB}})}{2} &= \gamma'(i_{\text{SUB}})
\end{align*}
\]

(3)

(4)

There are a few points to notice here. First, consider a world in which there was no chance of being caught shirking, so that the \( F \) term dropped out of equation (3). This would make the analysis very similar to the HSV model (except that they also do not consider the cost function \( \varphi(\cdot) \)). In the non-monitoring case there is clearly over-investment in cost cutting. That is, \( e_{\text{SUB}} > e^* \). I will denote the level of cost-cutting investment where there is no government monitoring by \( e_{\text{SUB}} \), rather than simply \( e_{\text{SUB}} \) which will be used to denote the level of cost-cutting investment when there is government monitoring. Private firms cut costs too much in the absence of government enforcement because they do not internalize the public bad of the decrease in the quality of security.

Comparing equation (4) to the social optimum reveals that the level of investment in quality improvements is also too low under private ownership. The intuition is that private managers know that they will not be able to capture all of the surplus generated by their efforts. This diminishes their incentive to invest. These results are fully consistent with the findings of HSV.

An interesting question arises from the addition of monitoring in my model. Can the government provide incentives for private firms not to cut costs too much? The answer turns out to be yes. If the government sets the fine at the proper level, the firm will cut costs at the socially optimal level. This result is captured in the following proposition.

Proposition 1 \( \) Under private \( e \text{rm sub-contracting, the manager will invest the socially optimal amount} (e^*) \text{ in cost cutting if the government sets the one for} \) shirking at \( K = \frac{\varphi'(e^*)}{F'(0)} \).

Proof. The firm’s first order conditions, given in equation (3) show that the firm will choose \( e_{\text{SUB}} = e^* \) if and only if \( c'(e_{\text{SUB}}) - F'(e_{\text{SUB}} - e^*) K = \varphi'(e_{\text{SUB}}) \) when \( e_{\text{SUB}} = e^* \). If the manager chooses \( e_{\text{SUB}} = e^* \), then the first order conditions are \( c'(e^*) - F(0) K = \varphi'(e^*) \). When \( K = \frac{\varphi'(e^*)}{F'(0)} \), the first order conditions can be rewritten as \( c'(e^*) - \varphi'(e^*) = \varphi(e^*) \), which is known to be true from the first order conditions for the social optimum given in equation (1).
2.3 Federalized security

If the government chooses to run security on its own, then the manager becomes the government’s employee. The effect of this is that the government can choose to implement the quality and cost-cutting innovations associated with the manager’s research and development without the manager’s consent. One way the government might do this is by firing the manager and replacing him with a new bureaucrat if the manager refuses to cooperate. However, some of the gains associated with innovations come directly from the manager, either because the manager has invested in human capital development or because of his knowledge of what programs are to be implemented. The percentage of the benefits that are directly associated with the manager is given by $\lambda$. Consequently, if in time 2, the manager and government fail to reach a renegotiated settlement and the manager is fired, the government’s default payoff is given by:

$$R_{G}^{FED} = B_0 - P_0 - C_0 + (1 - \lambda) [\beta (i) + c(e) - b(e)]$$

If the manager is fired, I assume he receives his salary in severance and so his default payoff is

$$R_{M}^{FED} = P_0 - \varphi(e) - \gamma(i)$$

The surplus generated by reaching a renegotiated agreement is $\lambda [\beta (i) + c(e) - b(e)]$ which the two players split evenly after Nash bargaining. Because it turns out that the manager will always cut costs at a level below the social optimum under federalization, there is no chance of being caught shirking and so this can be omitted from the analysis. Consequently, this part of the model is virtually identical to HSV, other than the fact that I consider convex costs.

The expected utility of each of the players in this case are given by:

$$U_{G}^{FED} = B_0 - P_0 - C_0 + \left(1 - \frac{\lambda}{2}\right) [\beta (i) + c(e) - b(e)]$$

$$U_{M}^{FED} = P_0 - \varphi(e) - \gamma(i) + \frac{\lambda}{2} [\beta (i) + c(e) - b(e)]$$

At time 1 the manager chooses his levels of investment in order to solve the following maximization problem:

$$\max_{e, i} \left\{ P_0 - \varphi(e) - \gamma(i) + \frac{\lambda}{2} [\beta (i) + c(e) - b(e)] \right\}$$

Because this objective function is clearly concave in both $e$ and $i$ the unique maximum, denoted $(e_{FED}, i_{FED})$ is given by the following first order conditions:

$$\frac{\lambda}{2} [e' (e_{FED}) - b' (e_{FED})] = \varphi' (e_{FED})$$  \hspace{1cm} (5)

$$\frac{\lambda}{2} \beta' (i_{FED}) = \gamma' (i_{FED})$$  \hspace{1cm} (6)

It is clear that $e_{FED} < e^*$ and $i_{FED} < i^*$. The public bureaucrat’s incentives to invest in either type of innovation are attenuated by the fact that the government
has to approve decisions, which means that the manager does not gain the full share of benefits from the improvements he implements. Further because the government can replace the manager and still use some of the manager’s research and development, his incentives to invest are even weaker.

3 Comparing Sub-contracting and Federalization

In this section I present a series of results that will motivate the discussion of current airport security policy. First, it is important to assess the amount of investment under each regime.

Proposition 2 The level of cost cutting is ordered as follows $\hat{e}_{SUB} > e^* = e_{SUB} > e_{FED}$

Proof. The results follow directly from the first-order conditions. █

Private firms cut costs more than federalized security services. If the government can monitor them, however, then private security firms will cut costs at the socially optimal level, while if they are un-monitored they cut costs at a level higher than the social optimum. Federalized management of airport security leads to the least cost cutting. It is important to note here that, while monitored private firms cut costs at the socially optimal level, this does not mean that they cut costs at the level that maximizes airport security. Rather, they cut costs at the level that maximizes social surplus, which takes into account the quality of airport security, the costs of providing that security, and the individual costs borne by the manager for developing cost-cutting mechanisms. However, less cost cutting is always better from the standpoint of airport security.

Investment in quality improving technologies can be compared across regimes as well.

Proposition 3 The level of investment in quality improving innovations is ordered as follows $i^* > i_{FED} > i_{SUB}$

Proof. The result follows directly from the first-order conditions. █

Neither private nor federal managers capture all of the gains from quality innovation, so they both invest in such innovations at sub-optimal levels. However, private managers capture more of the gains and so invest in quality innovation at a higher level.

These results now allow for a comparison between the level of airport security under each of these regimes.

Proposition 4 Security is strictly better under a monitored private orm than an un-monitored private orm. However, it is ambiguous as to whether security is better under a monitored sub-contracting arrangement or a federalized arrangement.
Proof. The level of security is given by \( B_0 - b(e) + \beta(i) \). Proposition (2) shows that \( b(e_{SUB}) > b(e_{SUB}) \) and the \( \hat{v} \)'s are unchanged regardless of monitoring. This establishes the first claim of the proposition. Proposition (2) also implies that \( b(e_{FED}) < b(e_{SUB}) \) but Proposition (3) shows that \( \beta(i_{FED}) < \beta(i_{SUB}) \). Thus, depending on which effect is bigger, security may be better under either regime. \[\]

There is a trade-off in terms of the quality of security. On the one hand, private firms invest more in quality innovations, improving security. On the other hand, private firms engage in more cost-cutting than does the federal government, leading to a reduction in quality. Which system will yield better security depends on numerous factors. HSV focus on questions of the functional forms of \( b(\cdot) \) and \( \beta(\cdot) \) arguing that when cost cutting has a relatively small effect on quality (small \( \theta \), as when there are many inefficiencies that could be done away with) then federalization will lead to better quality, while when policy innovations have a relatively large effect then privatization will lead to higher quality. I believe that for the case of airport security policy, the more interesting questions have to do with the marginal cost of the innovations themselves (the functions \( \varphi(\cdot) \) and \( \gamma(\cdot) \)). This is why I included these cost functions in my model, while HSV did not. The following proposition characterizes the impact of these costs.

**Conjecture 1** When the marginal cost of developing a quality innovation \( (\gamma'(\cdot)) \) is low then federalization is relatively more attractive. When the marginal cost of developing a technique for cost cutting \( (\varphi'(\cdot)) \) is low then sub-contracting is relatively more attractive.

The intuition: The lower \( \gamma'(\cdot) \) the higher \( i \) under both regimes. Since \( \beta(\cdot) \) is concave, there are decreasing marginal security returns to investments in quality innovations. Consequently, as \( i \) becomes very large \( \beta(i_{FED}) \) gets increasingly close to \( \beta(i_{SUB}) \), though always smaller than it. But as they get closer, the advantages associated with greater investment from sub-contracting become smaller and so it become increasingly likely that the security benefits associated with less cost cutting under federalization will dominate the security benefits from increased quality innovation from sub-contracting, making federalization relatively more attractive. Similarly for the second claim. The lower \( \varphi'(\cdot) \) the higher \( e \) under both regimes. Since \( -b(\cdot) \) is concave, there are decreasing marginal security costs associated with cost cutting. Thus, as cost cutting becomes very high in both systems the difference between the two, on the cost cutting dimension, becomes inconsequential relative to the quality benefits associated with sub-contracting. This makes sub-contracting relatively more attractive.

Finally, before turning to the discussion of the implications of this model for airport security policy, it is useful to know under what conditions each regime maximizes total social welfare, that is, a welfare calculus that takes into account total expenditures as well as the level of security. The social welfare from each option can be found easily. For the case of sub-contracting without monitoring
the social welfare is given by:

$$S_S = B_0 - b(\hat{e}_{SUB}) + \beta (i_{SUB}) - C_0 + c (\hat{e}_{SUB}) - \varphi (\hat{e}_{SUB}) - \gamma (i_{SUB})$$

When the government sub-contracts and monitors the social welfare is:

$$S_S = B_0 - b (e^*) + \beta (i_{SUB}) - C_0 + c (e^*) - \varphi (e^*) - \gamma (i_{SUB}) - d$$

Finally, in the case of federalization, social welfare is:

$$S_F = B_0 - b (e_{FED}) + \beta (i_{FED}) - C_0 + c (e_{FED}) - \varphi (e_{FED}) - \gamma (i_{FED})$$

It is clear from looking at these social welfare calculations that privatization with monitoring will be better than privatization without monitoring unless the cost of monitoring outweighs the benefits of lowering cost cutting. Further, since under privatization with monitoring the level of cost cutting is socially optimal and the level of quality investment is closer to socially optimal than under federalization, privatization with monitoring will also be better than federalization unless the cost of monitoring is sufficiently high. Finally, HSV show that privatization without monitoring will be unambiguously better than federalization if the loss of quality from cost cutting is low, while federalization will be better than privatization without monitoring when the loss of quality from cost cutting is large and outweighs the effects of quality improvement. It is important to note in all of these comparisons that social welfare is analytically distinct from the quality of airport security. Security is one element of social welfare, but welfare also includes the costs of providing security ($C_0 - c (e)$) and the costs that the manager bears in research and development ($\varphi (e)$ and $\gamma (i)$).

4 Implications for Airport Security

The model presented above offers insight into the current policy debate over how to structure airport security in the wake of September 11 and whether the President should re-privatize security in three years. The basic point is that the decision between federalization and privatization is not simply a decision between a publicly-minded government and cost-cutting private industry. There is another, more subtle trade-off. Government may cut fewer corners in providing security as shown in Proposition (2), but according to Proposition (3) government will not do as good a job developing new technologies that improve the efficacy of airport security. Consequently, in thinking about how to structure airport security it is important that specialists be called on to estimate the relative importance of the deleterious effects of cost cutting and the positive impact of technological advancement.

This trade-off raises the interesting possibility that the optimal short-run policy differs from the optimal long-run policy. Currently, quality innovations are relatively inexpensive to implement, because there is a significant amount of latent technology in airport security. This untapped knowledge is the product of research and development done by countries such as Britain and Israel, where
security against terror has been a high-salience matter for a significantly longer time than in the United States. These arbitrage opportunities make implementing quality innovations relatively inexpensive because these innovations require only capital investments, they do not require research and development. The speed with which American airports adopted practices such as random searches, stationing visible and uniformed military person in airports, reinforcing cockpit doors, ID checks, and tighter personnel inspections are evidence of the extent to which there exist latent opportunities for improving the quality of security without too much effort spent in development.

The low, short-term marginal cost of quality innovations suggests that federalization may be the optimal policy in the short-run, even if quality innovations are more important to airport security than preventing cost cutting. Recall from Proposition (1) that when the marginal cost of quality innovations is low then federalization is relatively more attractive. This is because with low marginal costs of quality innovations a lot of quality innovation gets done under both regimes, and there are diminishing marginal returns, so that federalization and privatization become similar in terms of quality innovation. Under these conditions, preventing cost cutting becomes more salient, which favors federalization.

The marginal costs of quality innovation are low because of latent technology that is being tapped. This will only be true, however, in the short run. There are, of course, still innovations to be arbitrated. The Israelis, for instance, have a highly developed training system for the security personnel, interview every passenger before every flight and apply a sophisticated set of screening criteria, have armed air marshals on many flights, scan checked luggage for explosives, and so on. Clearly, for a while America can continue to improve security without a significant investment in research and development. However, once the US has co-opted all of the cost effective innovations from other countries, the only way to improve security through quality innovation will be to invest in research. This will raise the marginal costs of quality improvements, increasing the gap in the level of security that can be expected from federalized and privatized security. This suggests that the best strategy for the US to adopt may be short-term federalization followed by re-privatization.

With respect to this trade-off, the Airport Security Federalization Act appears to be good legislation. In particular, it calls for federalization of airport security, but gives the President the discretion to sub-contract out to private firms after three years. Of course, certain problems may arise that should be addressed. In particular, there is reason to be concerned that, having created a 28,000 person federal airport security force, the government will meet political and labor resistance when it tries to re-privatize. This suggests that if the government is planning on sub-contracting after a few years, it should begin to lay the groundwork for a gradual transition early.

It seems probable that in the long-run the government will want to sub-contract airport security back out to private firms. Assuming that long-run technical innovation is very important, this is a good policy. However, even if the government does re-privatize, my model suggests that security could be improved by some form of monitoring. In particular, the government would like
to encourage the private security firms not to reduce cost cutting. There are two methods the government could use to try to ensure this outcome: monitoring and mandatory standards.

Proposition (4) demonstrates that when private security firms are monitored and face the threat of a fine for cutting costs too severely, the incentive to cut costs is counter-balanced, leading to better security. Thus, if the government invested in inspections, and had the power to fine those firms for violations, cost cutting could be reduced. Some of this already goes on. For instance, the security firm Argenbright was fined $1.2 million and given three years probation for employing convicted criminals at the Philadelphia airport. The government also deploys plain-clothes inspectors to try to sneak inappropriate materials through security.

Two potential problems arise from the strategy of monitoring and fining private security firms for shirking. First, the fine that must be levied in order to provide firms with the proper incentives not to cut costs too much may be very large. If it is too large then the firms may be unwilling to agree to the inspection regime or the courts may be unwilling to enforce the fine. The social-optimum restoring fine, recall, is given by \( K = \frac{\partial^2 c}{\partial c} \). This fine is large when the negative effect on security of a small increase in shirking is big or if the increase in the probability of being caught from shirking a little is small. This latter condition would presumably be the case when there are relatively few inspectors. Thus, in order to keep the fine down to a reasonable level, the government must employ a large number of inspectors. But this raises the costs of the inspection regime, which suggests a second potential problem with the inspection and fine solution to shirking. If the costs of this strategy are sufficiently high (which they might be in order to keep the fine relatively small) then the benefit in terms of better security may not be worth the costs. This is shown in the welfare analysis conducted at the end of the previous section. Hence, the inspecting and fining regime is only a good solution to the problem of private-firm cost cutting if it can be done with a low enough fine and at reasonable cost. The model, however, suggests another possible solution to cost cutting.

Suppose the government were to impose a high minimum wage and a serious level of mandatory training for security workers. This would, of course, improve security, functioning, in effect, as a quality innovation. However, it would also have a more subtle effect. Low worker salaries and poor training are two of the most obvious and effective strategies that private firms can implement to cut costs. If the government rules these out by imposing high minimum standards, then the marginal costs to the private firm of developing cost-cutting techniques increases. Proposition (1) demonstrates that when a significant amount of effort has to be invested in order to devise cost-cutting techniques, cost cutting will decrease and privatization will be relatively more attractive. This is because, when cost cutting is difficult the salience of cost-cutting (where federalization has an advantage) is reduced and the salience of quality innovations (where private industry has the advantage) is heightened. Consequently, by imposing a high minimum wage and a high level of mandatory training, the government
can both improve quality directly and decrease incentives for cost cutting by private firms.

It is not immediately clear whether inspections and fines or raising minimum requirements in order to raise the marginal cost of cost cutting is a superior strategy for reducing shirking by private airport security firms. Of course, the two techniques are not mutually exclusive and it seems likely that some combination of both of them will be optimal if privatization is phased back in. The extent to which each should be employed requires that experts study the costs of implementing an effective inspection regime and the effects on marginal costs of raising minimum standards. However, the model has highlighted the key points of comparison.

5 Applicability to other types of public goods

Examples where monitoring is important and marginal costs can be manipulated?

6 Conclusion

The costs and benefits of airport security federalization is a matter of vital interest. I have presented a model of the trade-offs between federalization and private sub-contracting that builds on HSV’s insight regarding the trade-off between cost cutting and quality innovation, but adds important new elements including the possibility of government inspection and more general cost functions. My model suggests several points of comparison and highlights some new issues that should be part of the policy debate. Among these are the short- and long-term marginal costs of quality innovation, the effectiveness of inspections, the size of fines that must be levied to decrease shirking, and the effects of minimum standards on the marginal cost of developing methods to cut costs.

This model also addresses the general theoretical debate regarding private versus public provision of public goods. There may be many areas of public goods provision where the government could implement an inspection regime of the type modeled in this paper or could change the marginal costs of innovations. (examples). As I demonstrated, these possibilities have significant implications for assessments of the merits of privatization of public goods provision. In this sense, my model contributes more generally to the theoretical investigation of private versus public provision of public goods.

References

