Contracting Out Public Service Provision to Not-for-Profit Firms*

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Abstract

In an incomplete contract setting, we analyze the contracting out of public service provision, comparing the performance of for-profit and not-for-profit private firms. Two institutional arrangements are considered, control rights lying either with the firm as under the UK's Private Finance Initiative (PFI) or the government (as under traditional procurement). We derive the conditions under which provision by not-for profit firms leads to greater investment and social benefit than provision by for profit firms. The role played by the non-distribution constraint in not-for profit firms and the nature of the investment are emphasized.

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1 Introduction

Recent years have witnessed a steady stream of innovations in the way public services are provided. In the UK, under the Private Finance Initiative (PFI), it has become common for the government to contract out the provision of public services to a consortium of private firms that designs, finances, builds and manages the facilities concerned (HM Treasury, 2003). In Canada, such public-private partnerships have been used for major infrastructure projects, such as the 407 Express Toll Route to the north of Toronto and the redevelopment of Pearson International Airport (Daniels and Trebilcock, 2000), while in the US, in much of the European Union, and in developing economies, there has been increasing use of similar schemes (Linder and Rosenau, 2000). This approach contrasts sharply with the way public services have traditionally been procured. Under traditional procurement, the government specifies the inputs and retains control rights over how the service is delivered. Instead, under PFI, the government specifies the output, that is, it specifies a basic service standard, but it is the firm that has control rights over how to deliver the service.

Not-for-profit firms (NPs) have long been established in public service provision, for example in health and education. However, there has recently been an extensively-debated expansion in the role of NPs (see Bennett *et al.,* 2003; IPPR 2003, and Weisbrod 1997). An important recent example in the UK is the responsibility for rail track facilities that the government has given to the NP, Network Rail. Among the other well-publicized cases are Glas Cymru, which was created on a private initiative in April 2000 as a holding company for the assets of Dwr Cymru, the Welsh water utility, and NAV Canada, which was established in 1996, and owns and operates Canada's civil air navigation service.

In this paper, we analyze the contracting out of service provision to private firms, and we compare the case in which the contractor is an NP to that in which it is a for-profit firm (FP). We consider these cases under two different institutional arrangements. The first is traditional

procurement, under which the government retains control rights over the project; the second is PFI, the firm having control rights. We take an incomplete-contract approach (see, e.g., Hart, 1995), building on the seminal work on public service provision by Hart, Shleifer and Vishny (1997). We assume that the firm may make an observable but unverifiable investment, researching innovative approaches to perform its task in excess of the basic standard specified in the initial contract. We assume that an innovation, if implemented, has an effect both on the social benefit that is generated by the production of the public service and on the firm's profit. Control rights (i.e., ownership of the project) give the power of veto over the implementation of any given innovation. For most of the paper we assume that investment is non-monetary, but we also consider the monetary case.

An NP and an FP are each assumed to have a utility function that is a linear combination of social benefit, profit, and the disutility of researching innovative approaches to provide the public service. However, the NP operates under a non-distribution constraint (NDC), which bans it from redistributing profit to its members. Hence, the value attached to profit is lower for the NP than for an FP: profits are valuable to the NP only insofar as they permit consumption of perquisites and the building up of precautionary financial reserves (see Glaeser and Shleifer (2001)). Additionally, we allow for the possibility that, because of the participation of users and stakeholders on its Board of Trustees, an NP cares more than an FP does about the social benefit generated by the provision of the public service.

We compare the investment incentives of an FP and an NP under different institutional arrangements, noting the implications for different types of public services. We consider three alternative scenarios. In the first, which we call the 'No Conflict' case, implementation of an investment increases both the contractor's profit and social benefit. For example, the investment may be in asset quality (e.g., of a hospital or a school building) that generates both lower maintenance costs for the contractor and greater social benefit from the use of

the asset for public service provision (e.g., fewer disruptions to teaching or a better healing environment). In contrast, the second and the third scenarios are characterized by a conflict between social benefit and profit. In the second, labelled 'Type-1 Conflict,' this occurs because implementation of an investment that increases social benefit is costly and, in the absence of a side-payment from the government, will cut the contractor's profit. For example, implementation of the investment might improve safety, but the original contract may not offer scope to raise revenue to cover the costs of implementation. In the third, labelled 'Type-2 Conflict,' implementation of an investment increases profit, but has an adverse impact on social benefit. For example, a cost-cutting innovation might compromise safety. We show that the appropriate institutional arrangement depends on which scenario obtains.

To simplify the exposition, we organize our analysis by focusing first on the role of the NDC, on the assumption that an NP and an FP care equally about social benefit. Then we disregard the NDC, instead considering the case in which an NP cares more about social benefit than an FP does. The combination of these two different perspectives is also briefly discussed.

When an NP and an FP care equally about social benefit, their utility functions differ purely because of the NDC for the NP. Our results in this case can be summarized as follows. Under traditional procurement, the government's approval is needed for implementation of an innovation, and this leads to bargaining between the firm and the government. By not caring about profit as much as an FP does, and thus not caring so much about the monetary transfer to or from the government following negotiations over implementation, an NP tends to fare worse than an FP does in bargaining with the government. As a result, compared to an FP, an NP internalizes less of the effect of its investment on both profit and social benefit. Under PFI, however, the firm has control rights. It will implement its innovation without consulting the government, and the weights attached to social benefit and profit in its utility function

will uniquely determine its incentives to invest. Consequently, an NP internalizes the effect of innovation on social benefit to the same extent as an FP does, although it internalizes less of the effect of its innovation on profit.

These considerations imply that how each institutional arrangement and type of firm performs depend crucially on which scenario is present. With No-Conflict, the for-profit motive works well, both in terms of promoting investment and in terms of maximizing social benefit. FP provision is thus desirable in this case. Our results then suggest that the FP should provide the service under PFI if the profit effect is sufficiently greater than the benefit effect, but otherwise traditional procurement should be used.

When instead there is a conflict between profit and social benefit, NP provision is more likely to be desirable, although the presence of conflict does not exclude FP provision. Indeed, with Type-1 Conflict, both the negotiating stance of an FP in bargaining with the government, and the lesser concern for profit of an NP work in favour of greater investment and social benefit. Furthermore, with both an FP and an NP investment and social benefits are greater under traditional procurement than under PFI. If, alternatively, there is Type-2 Conflict, NP provision under traditional procurement unambiguously leads to the highest social benefit, while FP provision under PFI leads to the greatest investment and lowest social benefit.

We go on to discuss how the above results change when an NP cares more about social benefit than an FP does. In this case NP provision may also be desirable in the No-Conflict scenario and in any case it will be more desirable for investment that increases social benefit. Also, we relax the assumption that investment in researching innovative approaches is non-monetary. When an investment is monetary, whether an FP invests more than an NP depends mainly on whether innovation increases or decreases social benefit. This is because the NDC no longer weakens the bargaining stance of the NP or its incentives to invest. Now an NP invests more than an FP whenever its investment has a positive impact on social benefit.

When investment decreases social benefit, an FP generally invests more than an NP. However, social benefit is always greater with an NP under traditional procurement. FP with PFI leads to the lowest social benefit.

The theoretical literature on the provision of public services is expanding rapidly. Hart, Shleifer and Vishny (1997), Schmitz (2000), and King and Pitchford (2001) compare public provision with contracting out to an FP. The optimally of bundling building and managing operations in PFI projects with FPs is discussed by Bennett and Iossa (2004) and Hart (2002) under incomplete contracts, and by Bentz, Grout and Halonen (2001) under complete contracts. Bundling in an incomplete-contract model is also analyzed by Bös and De Fraja (2002), who examine the case of health care for which quality is unverifiable. However, none of these papers considers public service provision by NPs.

There is also an extensive literature on NPs, though, for many years, its main focus was on the relationship between the firm and its donors (see Rose-Ackerman, 1996, and Weisbrod, 1998). However, a related branch of the literature considers NPs that do not rely on donations (see Hansmann, 1986, 1996). A recent formulation by Glaeser and Shleifer (2001) examines why an entrepreneur setting up a firm might prefer to make it an NP. In their model, as in ours, an NP generates perquisites for an entrepreneur that are not as valuable as income, so that, relative to a FP, the NP has weaker profit incentives. Closer to our work is that of Besley and Ghatak (2001). In their model, as in ours, a critical role is played by the service provider's valuation of social benefit. They show that control rights should be left with the party that values services more highly, thus indicating a role for 'benevolent' NPs. However, contrary to us, they do not consider the effect of the NDC; nor do they discuss the role played by the correlation between the effects of investment on social benefit and profit.

The paper is organized as follows. Section 2 outlines the model, while in Section 3, on the assumption that the only difference between an FP an NP is the NDC of the latter, we

examine and compare investment incentives under traditional procurement and PFI. Section 4 extends our results to the case which an NP cares more than an FP does about social benefit. Section 5 discusses briefly the case where investment in researching innovative approaches is monetary. Section 6 concludes.

2 The Model

We consider a setting where, initially, the government and the firm agree a contract that specifies observable and verifiable basic standards for the provision of a public service. However, before operations begin, the firm may make an observable but unverifiable investment, researching innovative approaches to performing its task in excess of the basic standard. We denote by $x \geq 0$ the level of the investment. This is also the unverifiable cost of the investment, which we assume, until Section 5, is measured in terms of the disutility of effort. Investment cannot be contracted upon *ex ante*, for it is not possible to specify in advance the delivery of a specific innovation. We assume that an innovation, if implemented, affects both the profit and the social benefit generated by the provision of the public service. In our solutions, innovation x is implemented, and so we economize on notation by writing social benefit and profit as functions of x.

The social benefit generated by the provision of the public service is

$$B(x) = B_0 + \beta b\,(x)\,, \tag{1}$$

where B_0 is a positive constant denoting verifiable basic standards, $b_x > 0$ and β is a shift parameter whose value is either 1 or -1. If $\beta = 1$, x increases social benefit, and we assume that $b_{xx} \leq 0$; $b(0) = 0; b_x(0) = \infty$; and $b_x(\infty) = 0$. If $\beta = -1$, x decreases social benefit, and we assume $b_{xx} \geq 0$; $b(0) = \infty$; $b_x(0) = 0$; and $b_x(\infty) = 0$.

We define $\Pi(x)$ to be the sum of net receipts for the contractor from two sources. One, which we denote by $\pi_0 (> 0)$ is the profit that would be made by providing the basic standard

of service. The other, which we denote by $\pi(x)$, is the change in profit from implementing innovation x, the source of which may be a change in the direct costs of service provision or a change in revenue received. Note that $\pi(x)$ excludes two factors: the cost x of investing in an innovation x, and any side-payment negotiated with the government for implementing the innovation. Thus,

$$\Pi(x) = \pi_0 + \gamma\pi(x). \tag{2}$$

where $\pi_x > 0$, and γ is a shift parameter whose value is either 1 or -1. If $\gamma = 1$, x increases profit and we assume that $\pi_x > 0$; $\pi_{xx} \leq 0$; $\pi(0) = 0; \pi_x(0) = \infty$; and $\pi_x(\infty) = 0$. If $\gamma = -1$, x decreases profit and we assume that $\pi_x < 0$; $\pi_{xx} \geq 0$; $\pi(0) = \infty; \pi_x(0) = 0$; and $\pi_x(\infty) = 0$. In practice, the sign of π_x might vary with the level of x, but the inclusion of this complication has limited impact on our qualitative results and so, for simplicity, we rule it out. We assume that $B(x)$, $\Pi(x)$ are observable but unverifiable.

We focus on the following three scenarios (examples of which are discussed in Section 3):

- *No Conflict*: implementation of innovation x raises both social benefit and the firm's profit ($\beta = \gamma = 1$).
- *Type-1 Conflict*: implementation of innovation x raises social benefit but cuts the firm's profit ($\beta = 1, \gamma = -1$).
- *Type-2 Conflict*: implementation of innovation x raises the firm's profit but cuts social benefit ($\beta = -1, \gamma = 1$).

We compare two institutional arrangements: traditional procurement (TP) and the private finance initiative (PFI). Under TP, the government has control rights over the project, and if there would be gains from implementing the innovation, bargaining between the firm and the government takes place. We assume that there is 50:50 Nash bargaining between the

firm and the government. Under PFI, the firm has control rights and it is free to implement the innovation without consulting the government.

In each of these two arrangements, the firm can be either a for-profit (FP) or a not-for profit (NP); we use subscript $j = F, N$ to denote the firm's type. We assume that both types of firm maximize a linear combination of social benefit, profit and the disutility of effort, and we consider both the case where the weight on social benefit is the same for each type of firm and the case where a higher weight is attached to social benefit by the NP than by the FP. Any firm (FP or NP) involved in public service provision may care about social benefit because of the impact on its reputation; an NP may also care about social benefit because of the presence of users on the Board of Trustees, as a result of which social benefit is a part of its mission. Furthermore, we assume that the NP is affected by a non-distribution constraint (NDC), which bans redistribution of profits to the firm's members. As emphasized, for example, by Glaeser and Shleifer (2001), this results in an NP valuing \$1 of profits less than a FP does.

Formally, the utility function of firm j is given by

$$\Omega^j = \alpha^j B(x) + \delta^j \left[\Pi(x) + s^j\right] - x; \quad j = F, N, \ 0 < \alpha^F \leq \alpha^N < 1, \ \delta^F = 1, \ \delta^N < 1 \qquad (3)$$

where s^j is the monetary transfer received from the government ($s^j \gtreqless 0$); α^j is the weight that j places on social benefit; and $\delta^N < \delta^F = 1$ captures the effect of the NDC. We refer to $1 - \delta^N$ as the 'power' of the NDC.

Finally, the government maximizes the social benefit from the service net of the payment to the firm, its objective function being given by

$$\Phi = B(x) - s^j; \quad j = F, N$$

In this setting, for each institutional arrangement, traditional procurement and PFI, and for each type of firm, FP or NP, we compare investment levels. We do not define a first best

level of investment x to use as benchmark since its definition would inevitably depend on which type of firm, FP or NP, provides the service. Thus, we prefer to focus our discussion on which institutional arrangement leads to the greatest incentives to investment and which, if they differ, leads to the greatest level of social benefit.

The timing of the game is as follows. In period 0 the government sets the basic standards of service provision. In period 1 the contractor (FP or NP) undertakes investment x researching improved methods for performing its task in excess of the basic standards. In period 2, if the government has control rights (traditional procurement), and if there would be gains from implementing the innovation, bargaining between the firm and the government takes place; if instead the firm has control rights (PFI), it is free to implement the innovation without consulting the government. In period 3 the service is provided.

3 Investments under alternative regimes: the role of the NDC

In this section we focus our attention on the role played by the NDC, and so we assume that each type of firm places the same weight on social benefit: $\alpha^F = \alpha^N \equiv \alpha$.

3.1 Traditional procurement

Consider the case of traditional procurement, the government having control rights. Then an innovation cannot be implemented without the government's approval. However, whenever there are positive gains from implementation, it is reasonable to expect bargaining between the firm and the government to occur. We assume throughout that the firm and the government engage in 50:50 Nash Bargaining. Then the monetary transfer from the government to firm j is

$$s^j \equiv \arg\max_{z_i} \left\{\alpha b(x) + \delta^j[\pi(x) + z_i]\right\}[b(x) - z_i],$$

yielding

$$s^j = \frac{1}{2}b(x) - \frac{1}{2}\left[\frac{\alpha}{\delta^j}b(x) + \pi(x)\right]. \tag{4}$$

Substituting for s^j in (3), the firm's *ex ante* utility becomes

$$\Omega^j = \frac{1}{2}\alpha b(x) + \frac{1}{2}\delta^j[b(x) + \pi(x)] - x.$$

Therefore, using (1) and (2), setting $d\Omega^j/dx = 0$ yields $x = x^j_{TP}$, where

$$\frac{1}{2}\beta\alpha b_x(x^j_{TP}) + \frac{1}{2}\delta^j\left[\beta b_x(x^j_{TP}) + \gamma\pi_x(x^j_{TP})\right] = 1, \qquad j = F, N. \tag{5}$$

We obtain our first lemma.

Lemma 1 *Under traditional procurement, (i) if there is No-Conflict or Type-2 Conflict, an FP invests more than an NP. (ii) If there is Type-1 Conflict, an FP invests more than an NP when α is low, but the opposite may occur when α is high.*

Lemma 1(i) follows from the fact that the NDC makes an NP softer in negotiation with the government (and the more so the higher the power of the NDC). From (4), multiplying through by δ^j, the 'value' to a firm, $\delta^j s^j$, of the monetary transfer s^j that the firm receives from the government is increasing in δ^j. In bargaining with government, the firm appropriates a $\frac{1}{2}\delta^j$ share of the benefits $\beta b(x)$ that its innovation brings to the government, and gives up $\frac{1}{2}$ a share of the benefits $\beta\alpha b(x)+\gamma\delta^j\pi(x)$ that the innovation brings to itself. Hence, compared to an FP, an NP internalizes less of the effect of its investment on both profit and social benefit. This implies that an FP invests more than an NP under No-Conflict, where investment increases both social benefit and profit. The same result holds when there is Type-2 Conflict. This explains point (i). Point (ii) then follows by noting that, with Type-1 Conflict, where investment increases social benefit but decreases profit, the lower concern for profit of an NP may increase its incentive to invest to an extent that is sufficient to compensate for the lower

concern for social benefit that comes from a worse bargaining outcome with the government. If this occurs, the incentive to invest is greater with an NP than with an FP.

An immediate consequence of Lemma 1 relates to the effect of the type of firm on social benefit.

Corollary 1 *Under traditional procurement, (i) if there is No conflict, or if α is low and there is Type-1 Conflict, social benefit is greater with an FP than with an NP. (ii) If there is Type-2 Conflict, or if α is high and there is Type-1 Conflict, social benefit is greater with an NP than with a FP.*

Corollary 1(i) indicates that, with traditional procurement, provided α is low, an FP yields the greatest level of social benefit whenever $\beta = 1$, that is whenever innovation has a positive impact on social benefit. This is due to the negative effect that the NDC plays on the ability of an NP to negotiate with the government and extract $b(x)$, which depresses the incentives of an NP to invest. However, when $\beta = -1$, the weaker incentive to invest of the NP, due to the NDC, works favourably in the sense that it helps to safeguard social benefit. This explains Corollary 1(ii).

3.2 PFI

Consider now the case of PFI, where the firm, rather than the government has control rights over the project. Given (1), $d\Omega^j/dx = 0$ yields $x = x^j_{PFI}$, where

$$\beta\alpha b_x(x^j_{PFI}) + \gamma\delta^j\pi_x(x^j_{PFI}) = 1, \quad j = N, F. \tag{6}$$

Differentiating (6) with respect to δ^j, the following lemma obtains.

Lemma 2 *Under PFI, if there is No Conflict or Type-2 Conflict an FP invests more than an NP If there is Type-1 Conflict an NP invests more than an FP.*

Lemma 2 indicates that, under PFI, if investment increases profits ($\gamma = 1$), an FP invests more than an NP, while the reverse holds if investment decreases profits ($\gamma = -1$). The intuition follows from the fact that, under PFI, since the firm has control rights, it is residual claimant for its investment and can implement its innovations without any government's approval. Thus, the weights attached to social benefit and profit in the firm's utility function uniquely determine its incentives to invest. Since, an NP cares less about profit than an FP (because of the NDC), it will invest more than an FP if the effect of its investment on profit is positive, and less if the effect is negative. Furthermore, the difference in incentives to invest increases with the power of the NDC.

The following corollary gives the implications of Lemma 2 for the effect of the type of firm on social benefit.

Corollary 2 *Under PFI, social benefit is greater with an FP than with an NP only if there is No Conflict. In the presence of Type-1 or Type-2 Conflict, social benefit is higher with an NP than with an FP.*

A comparison of Corollaries 1 and 2 indicates that, when there is conflict between social benefit and profit, the introduction of PFI has created additional scope for public-service provision by NPs as a means of enhancing social benefit. In particular, if there is Type 1-Conflict, an NP always yields the higher social benefit under PFI, whilst under TP social benefit is higher with an NP only if α is high. This is because, under TP, an NP is disadvantaged by its weaker ability to negotiate with the government (as a result of the NDC). Under PFI this effect is not present and the thus the NP invests more than an FP.

3.3 Comparisons

In this section we use the above results to compare investments under traditional procurement and PFI for the two types of firm. Our first proposition compares traditional procurement

and PFI for a given type of firm, while our second proposition brings the type of firm into the comparison. From (5) and (6), we obtain the following.

Proposition 1 *Firm j ($j = F, N$) invests more under PFI than under traditional procurement if*

$$\gamma\delta^j\pi(x^j_{TP}) - (\delta^j - \alpha)\beta b_x(x^j_{TP}) \gtreqless 0 \tag{7}$$

In particular, (i) with No Conflict an FP invests more under PFI than under traditional procurement if the effect of investment on profit is sufficiently high compared to the effect on social benefit. (ii) With Type 1-Conflict, an FP invests more under traditional procurement than under PFI. (iii) With Type-2 Conflict, an FP invests more under PFI than under traditional procurement. When $\delta^N > \alpha$, (i)-(iii) also hold for an NP.

Under PFI, the weights attached to profit and social benefit in a firm's utility function uniquely determine its incentives to invest. This is because, having control rights, the firm implements the innovation without negotiation with the government. Under traditional procurement, however, the government's approval is needed for implementation, which leads to bargaining between the firm and the government. As discussed in Section 3.1, in bargaining with the government, the firm gives up half of its total gain from implementation, $\beta\alpha b(x) + \gamma\delta^j\pi(x)$, but obtains a fraction $\frac{1}{2}\delta^j$ of the benefits $\beta b(x)$ that innovation brings to the government. Thus, the firm always internalizes more of the effect of its investment on profit under PFI than under traditional procurement. Moreover, it internalizes less of the social benefit effect whenever $\delta^j > \alpha$, which is always the case for an FP, but not necessarily for an NP. We conclude from this that whenever the profit effect is positive and significant, investment tends to be higher under PFI, which explains parts (i) and (iii) in Proposition. These considerations apply to both an FP and an NP. However, as shown by condition (7), compared to an FP, an NP is more likely to generate a greater investments under PFI whenever the social benefit effect is positive (as under No Conflict and Type 1

Conflict).

From Proposition 1 we gain some insight as to which institutional arrangement is more likely to maximize social benefit, given the firm's type.

Corollary 3 *(i) If the firm is an FP, social benefits are maximized under PFI if there is No Conflict and the profit effect is high; otherwise social benefit is maximized under traditional procurement. If the firm is an NP, the same is true if* $\delta^N > \alpha$.

Corollary 3 suggests that with an FP any conflict between social benefit and profit is better dealt with traditional procurement than under PFI. In the absence of conflict, PFI may in fact result in the greatest level of social benefit. The intuition for this corollary comes from the fact that PFI makes the firm internalizes more of the profit effect than traditional procurement. Thus, when the profit effect is positively correlated with the social benefit effect, social benefit is higher under PFI than under TP, but the opposite is true if the correlation is negative.

We are now in a position to compare all of the different arrangements. We denote the case of an FP under PFI by PFI-FP, an NP under traditional procurement by TP-NP, and so on.

Proposition 2 *(i) With No Conflict, investment is highest with an FP; and investment will be higher under PFI or under traditional procurement according to the condition in Proposition 1.*

(ii) With Type-1 Conflict, and $\delta^N > \alpha$, *the highest level of investment is obtained under traditional procurement and investment will be higher with FP if* α *is low but may become higher with an NP if* α *is high*

(iii) With Type-2 Conflict, investment is highest under PFI-FP.

Proposition 2 looks at investment levels across the different institutional arrangements. We can also consider the effect of each arrangement on social benefit. This is summarized in the corollary below; a discussion of Proposition 2 and Corollary 4 follows.

Corollary 4 *(i) With No Conflict, social benefit is greater with an FP than with an NP, and it will be greater under traditional procurement or PFI according to the condition in Proposition 1.*
(ii) With Type-1 Conflict and $\delta^N > \alpha$*, the highest level of social benefit is obtained under traditional procurement and investment will be higher with FP if* α *is low and with an NP if* α *is high.*
(iii) With Type-2 Conflict, social benefit is maximized under TP-NP.

Proposition 2 and Corollary 4 suggest that the for-profit motive works in favour of both incentives to invest and social benefit whenever there is no conflict between social benefit and profit maximization. This is also the scenario in which PFI works particularly well, and will work well if the profit effect is sufficiently higher than the benefit effect. FP provision can also be desirable - both in terms of investment and in terms of social benefit - when there is Type-1 conflict. Here, investment and social benefit are maximized with traditional procurement and we know from Proposition 1 that under traditional procurement the NDC of an NP weakens its incentives to invest, compared to an FP. However, when there is conflict between social benefit and profit maximization, NP provision is more likely be preferable, and it will surely be the best means to safeguard social benefit if there is Type-2 Conflict, where PFI does not work well for social benefit.

In the light of Propositions 1 and 2 and Corollary 4, we now discuss some examples, applying our results to highlight circumstances where one institutional arrangement is preferable to another.

Case 1 *No Conflict*

Investment in building quality can raise both social benefit and reduce maintenance costs. For example, better school buildings with less frequent need for repairs also lead to fewer disruptions and help to create a good learning environment; and higher-quality hospital buildings reduce disruptions and generate a better healing environment. Construction of roads is another example where investment can raise both profit and benefit. In all these cases, our results suggest that provision by an FP is desirable and, if the effect of investment on maintenance cost is sufficiently high, then investment and social benefit will be maximized with PFI. It the effect of investment on maintenance is lower, traditional procurement is preferable.

It is interesting to note that it is precisely for building schools, roads and hospitals that PFI with an FP is being used in the UK. By bundling the building and maintenance functions of infrastructure provision, PFI gives incentives to the contractor to internalize the effect of its investment on maintenance cost. As contracts tend to be long-lived (generally about 25 years), better design has the potential to translate into significantly greater profits, by reducing the future stream of maintenance cost. This in turn may also work well for social benefit.

The no conflict-scenario may also apply for free-standing projects, such as leisure centres and nursing homes, where users are charged a fee and where there is competition among providers, so that a higher quality of service may well raise total revenues and profits. Thus, also for these types of services, FP provision is desirable and if the profit effect is sufficiently high, PFI is preferable to traditional procurement.

Case 2 *Type-1 Conflict*

Investment in building quality that raises social benefit can also result in lower profit because a better design may be expensive to implement and maintain. Furthermore, many public services are characterized by an inelastic demand and are offered in conditions of

limited competition among the private providers. If also the government is the purchaser of the service or if user fees are specified in advance, increasing some unverifiable quality aspect of the service is likely to be unprofitable for the contractor.

In these circumstances our analysis indicates that investment and social benefit may be greatest if traditional procurement is used with an FP provider, although an NP provider may also do well. There are no circumstances in which PFI with an FP yields the highest investment and social benefit, and it is interesting to note that the NHS Confederation in the UK recently reported that PFI hospitals designed and built by FPs often failed to create a good healing environment with less noise and more daylight.[1]

Case 3 *Type-2 Conflict*

Investments that decrease costs may have the side-effect of reducing social benefit. This may be in the form of reduced safety, for example in railway maintenance or air traffic control, but may relate to any quality aspect of the service (e.g. quality of health care).

With Type-2 Conflict an FP always invests more than an NP, and the highest investment is achieved in the case of PFI using an FP. But is also in this case that social benefit is at its lowest. In terms of social benefit, public service provision by an NP under traditional procurement is the most desirable. In the UK, the healthcare system is changing fast and significant parts of healthcare provision are to be placed in private hands. Our analysis suggests that not-for-profit organizations should be given a central role in this sector for they may help to ensure that cost effectiveness does not go at the expense of quality of healthcare.

4 Difference in care for social benefit

Until now we have assumed that an FP and an NP value social benefit equally. However, an NP is characterized by the presence of users on the Board of Trustees and so it is reasonable to

[1]See *PublicPrivateFinance*, 85, July/August 2004.

think that they may show a greater concern than an FP does for the social benefit generated by the public service that is provided. Therefore, in this section we assume that $\alpha^N > \alpha^F$, and, in order to focus on the implications of this difference, we at first assume away the presence of an NDC in NPs; that is, we let $\delta^N = 1$. We then discuss briefly the implications of having $\delta^N < 1$.

Equations (6) and (8) become, respectively,

$$\frac{1}{2}\beta\alpha^j b_x(x^j_{TP}) + \frac{1}{2}\left[\beta b_x(x^j_{TP}) + \gamma\pi_x(x^j_{TP})\right] = 1, \tag{8}$$

$$\beta\alpha^j b_x(x^j_{PFI}) + \gamma\pi_x(x^j_{PFI}) = 1; \quad j = N, F. \tag{9}$$

Under PFI, whether an NP invests more than an FP depends now on the effect of the investment on social benefit. A greater effect of investment on social benefit raises the incentives of an NP to invest relative to that of an FP.

The next proposition classifies the ranges in which different institutional arrangements lead to the highest investment, and then gives the classification with respect to the highest social benefit.

Proposition 3 *Let $\alpha^N > \alpha^F$ and $\delta^N = 1$. Then the institutional arrangement that leads to the highest investment is*

$$\begin{array}{c} \textit{TP-NP if } b_x(x^N_{PFI}) \geq 1 \\ \textit{PFI-NP if } b_x(x^N_{PFI}) \in [0,1) \\ \textit{PFI-FP if } \beta = -1. \end{array}$$

The highest level of social benefit is always achieved with an NP, and in particular it is achieved under

$$\begin{array}{c} \textit{TP-NP if } b_x(x^N_{PFI}) \geq 1; \\ \textit{PFI-NP if } b_x(x^N_{PFI}) \in [0,1); \\ \textit{TP-NP if } \beta = -1. \end{array}$$

Not surprisingly, once we assume away the effect of the NDC on investment, provision by an NP always generates the greatest social benefit. It also yields the highest investment if investment has a positive effect on social benefit, that is, in the No-Conflict and Type-1 Conflict scenarios. However, when investment cuts social benefit, that is, with Type-2 Conflict, the greater concern for social benefit of an NP induces it to restrict investment relative to an FP. Since bargaining with the government under traditional procurement induces the firm to internalize further the negative effect of investment on social benefit, the institutional arrangement that maximizes investment is PFI with an FP.

When we let $\delta^N < 1$, as well as $\alpha^N > \alpha^F$, a full taxonomy of cases leads to less clear-cut results. However, Propositions 2 and 3 suggest that the relative effects of the different institutional arrangements on investment and on social benefit depend on the weight (α^F, α^N) attached by the firm to social benefit; on the power of the NDC $(1 - \delta^N)$; and on the relative effects of the investments on marginal social and private benefits ($b_x(x)$ versus $\pi_x(x)$).

In particular, we have seen from Proposition 2 that in the No-Conflict scenario, when $\delta^N < 1$ but $\alpha^F = \alpha^N$, investment and social benefit are higher with an FP than with an NP. However, from Proposition 3, where $\delta^N = 1$ but $\alpha^F < \alpha^N$, the highest levels of investment and social benefit occur with an NP. Combining these arguments suggests that when $\delta^N < 1$ and $\alpha^F < \alpha^N$, investment will be highest in the PFI-FP case only if the profit effect is sufficiently high. Instead, PFI-FP will lead to the lowest level of investment if the benefit effect is sufficiently high. This is because, when the benefit effect is high, the incentive to invest is relatively strong for TP-FP through bargaining with the government, whilst NP provision gives relatively strong investment incentives through the greater concern for social benefit of an NP compared to an FP. PFI-FP does neither.

Using Propositions 2 and 3, further insights can be gained for Type-1 Conflict and Type-2 Conflict. With Type-1 Conflict, taking into account (8) and (9), it can be seen that a greater

excess $\alpha^N - \alpha^F$ of an NP's care for social benefit over that of an FP will still raise investment and social benefit with NP provision relative to with FP provision. However, an FP under traditional procurement may nonetheless invest more than an NP (with either traditional procurement or PFI) because the firm's bargaining stance allows the FP under traditional procurement to appropriate a large proportion of the effect of the investment on social benefit. With Type-2 Conflict, results are clear-cut. From Propositions 2 and 3 we observe that an FP under PFI will lead to the highest investment, though to the lowest level of social benefit. Social benefit is best safeguarded by NP-provision with traditional procurement.

5 Monetary investment

Until now we have assumed that the investment in researching innovations is non-monetary; that is, that x can be regarded as a human-capital type of investment. As we briefly show in this section, results change substantially when we instead assume that x is a monetary investment and innovation is associated with physical capital investment. To emphasize the effect of the monetary nature of investment, we return to the assumption that an NP and an FP care equally about social benefit; that is $\alpha^N = \alpha^F \equiv \alpha$.

The utility function of the firm is now

$$\Omega^j = \beta\alpha B(x) + \delta^j \left[\gamma\Pi(x) + z - x\right], \quad 0 < \alpha < 1, \quad \delta^F = 1, \quad \delta^N < 1.$$

The cost x of innovation has a weight of δ^N in the NP's utility function. This is because, other things equal, incurring this cost reduces profit for an NP - just as for an FP - but, because of the NDC, a \$1 reduction in profits reduces the NP's utility by only $\$\delta^N$.

In this case the levels of investments under traditional procurement and PFI solve, respectively,

$$\beta\alpha b_x(x^j_{TP}) + \delta^j \left[\beta b_x(x^j_{TP}) + \gamma\pi_x(x^j_{TP}) - 2\right] = 0, \qquad j = N, F; \tag{10}$$

$$\beta\alpha b_x(x^j_{PFI}) + \delta^j \left[\gamma\pi_x(x^j_{PFI}) - 1\right] = 0, \quad j = N, F. \tag{11}$$

From these two expressions we obtain the following proposition.

Proposition 4 *When investment in researching innovations is monetary, under either traditional procurement or PFI, (i) investment is higher with an NP if there is No-Conflict or Type-1 Conflict, whilst investment is higher with an FP if there is Type-2 Conflict. (ii) If there is No-Conflict or Type-1 Conflict, investment is highest with TP-NP if* $b_x(x^j_{PFI}) > 1$, *and with PFI-NP if* $b_x(x^j_{PFI}) < 1$. *If there is Type-2 Conflict, investment is highest with PFI-FP.*

When the investment is monetary, whether an FP invests more than an NP depends mainly on whether innovation increases or decreases social benefit. In particular, part (i) of this proposition indicates that an NP invests more than an FP if the effect of investment on social benefit is positive, and vice versa. This is because when the cost of investment is monetary, the NDC no longer weakens the bargaining stance of the NP, and neither does it weaken its incentives to invest. The NP now places a smaller weight on this cost than an FP does. The NDC only affects the incentive of the NP to invest insofar as it results in a greater relative weight being attached to social benefit.

Part (ii) follows from the fact that under traditional procurement there is negotiation between the firm and the government that, as explained in Section 3.1, results in the firm internalizing part of the gain to the government (the increase in social benefit) from implementing the innovation. It follows that if $\beta = 1$ and the social benefit effect is sufficiently high (as under No-Conflict or Type-1 Conflict) the firm's incentives to invest are increased by the bargaining with the government, while the opposite obtains if $\beta = -1$ (as under Type-2 Conflict).

The implication of Proposition 4 for the level of social benefit is stated in the following corollary.

Corollary 5 *When investment in researching innovations is monetary, social benefit is greatest with TP-NP.*

Regardless of the scenario, NP provision under traditional procurement always generates the greatest social benefit. The intuition is related to that of Proposition 4(i), and stems from the fact that when investment is non-monetary, the presence of the NDC results in a greater relative weight being attached to social benefit by an NP than by an FP. When $\beta = 1$, TP-NP leads to the highest level of investment and so to the greatest social benefit. When $\beta = -1$, the ranking of arrangements with respect to investment level is reversed, so that TP-NP leads to the lowest level of investment; but it is this that generates the greatest social benefit.

6 Conclusions

In this paper we have analyzed contracting out to a not-for-profit firm and to a for-profit firm under two alternative procurement arrangements. The first is traditional procurement, whereby the government retains control rights over how to deliver the service; the second is PFI, whereby the firm is allocated these control rights.

The main insights of the paper can be summarized as follows. First, even when a not-for-profit firm cares more than a for-profit firm does about social benefit, it does not follow that provision by a not-for profit generates the greatest social benefit. This is because the non-distribution constraint of a not-for profit firm may work against its incentive to invest. Second, the new procurement strategy of PFI increases the scope for not-for profit provision, compared to traditional procurement; that is, in some scenarios, the optimal administrative arrangement is PFI with a not-for-profit firm, even though, if traditional procurement were used, it would be preferable to use a for-profit firm. Third, in determining the desirability of provision by a not-for profit firm, a crucial role is played by the 'correlation' between the effects of the

implementation of an investment on social benefit and on profit. Positive correlation tends to favour provision by a for-profit firm. Negative correlation can call for provision by a for-profit or by a non-profit firm. However, when implementation of an investment increases profits but reduces social benefit, provision by a not-for-profit firm always yields the greater social benefit. Fourth, the more investment into researching innovations is monetary rather than non-monetary, the greater is the scope for provision by a not-for profit as a means of boosting investment and social benefit.

7 Appendix

Proof of Lemma 1. Differentiating (5) with respect to δ^j, we obtain

$$sign\{\partial x^j_{TP}/\partial \delta^j\} = sign\{\beta b_x(x^j_{TP}) + \gamma \pi_x(x^j_{TP})\} \tag{A1}$$

which is always positive when $\beta = \gamma = 1$, implying $x^F_{TP} > x^N_{TP}$. Substituting from (5) into (A1), we obtain $sign\{\partial x^j_{TP}/\partial \delta^j\} = sign\{2 - \beta\alpha b_x(x^j_{TP})\}$, thus (A1) is positive also when $\beta = -1$ and $\gamma = 1$. Now consider the case where $\beta = 1$ and $\gamma = -1$. For $\alpha \to 0$, $sign\{2 - \beta\alpha b_x(x^j_{TP})\} > 0$ and therefore $sign\{\partial x^j_{TP}/\partial \delta^j\} > 0$. As α increases x^j_{TP} increases too, since differentiating (5) with respect to α yields $\partial x^j_{TP}/\partial \alpha > 0$ for $\beta = 1$. Thus, for α sufficiently high $b_x(x^j_{TP}) - \pi_x(x^j_{TP})$ can become negative, implying $sign\{\partial x^j_{TP}/\partial \delta^j\} < 0$. ■

Proof of Proposition 1. Let $A^j_{PFI}(x) \equiv \beta\alpha b_x(x) + \gamma\delta^j \pi_x(x) - 1$. Setting $x = x^j_{TP}$ and substituting from (5), we obtain $A^j_{PFI}(x^j_{TP}) = \frac{1}{2}(\gamma\delta^j \pi(x^j_{TP}) - (\delta^j - \alpha)\beta b_x(x^j_{TP}))$. Suppose $\beta = 1$. Then, since A^j_{PFI} is decreasing in x and $A^j_{PFI}(x^j_{PFI}) = 0$, it follows that $x^j_{PFI} \gtreqless x^j_{TP}$ as $A^j_{PFI}(x^j_{TP}) \gtreqless 0$. ■

Proof of Proposition 2. Parts (i) follows from Lemmas 1, 2 and Proposition 1. Part (ii) follows from Lemmas 1 and Proposition 1. Parts (iii) follows from Proposition 1 and Corollary 1. ■

Proof of Corollary 4. Parts (i) and (ii) follow immediately from Proposition 2. Part (iii), follows from Proposition 1(iii) and Lemma 1. ■

Proof of Proposition 3. (a) Comparison of PFI-FP with PFI-NP. Let $H^N_{PFI}(x) = \beta\alpha^N b_x(x) + \pi_x(x) - 1$. Setting $x = x^F_{PFI}$ and substituting from (9), $H^N_{PFI}\left(x^F_{PFI}\right) = \beta\left(\alpha^N - \alpha^F\right) b_x(x^F_{PFI})$. Since $H^N_{PFI}(x)$ is decreasing in x and $H^N_{PFI}(x^N_{PFI}) = 0$, $x^N_{PFI} > x^F_{PFI}$ for $\beta = 1$, and $x^N_{PFI} < x^F_{PFI}$ for $\beta = -1$.

(b) Comparison of TP-NP with TP-FP. Let $H^N_{TP}(x) = \left(\alpha^N + 1\right)\beta b_x(x) + \pi_x(x) - 2$. Setting $x = x^F_{TP}$ and substituting from (8), $H^N_{TP}\left(x^F_{TP}\right) = \frac{1}{2}\left(\alpha^N - \alpha^F\right)\beta b_x(x^F_{TP})$, Since

$H^N_{TP}(x)$ is decreasing in x and $H^N_{TP}(x^N_{TP}=0)$, $x^N_{TP} > x^F_{TP}$ for $\beta = 1$ and $x^N_{TP} < x^F_{TP}$ for $\beta = -1$.

(c) Suppose $\beta = 1$. Then, from (a) and (b), an NP invests more than an FP under both PFI and traditional procurement. Now compare PFI-NP and TP-NP. Consider $H^N_{TP}(x)$, as defined in part (b). Setting $x = x^N_{PFI}$ and substituting from (9), $H^N_{TP}(x^N_{PFI}) = \left(b_x(x^N_{PFI}) - 1\right)$, so that, since $H^N_{TP}(x)$ is decreasing in x and $H^N_{TP}(x^N_{TP}) = 0$, $x^N_{TP} \gtreqless x^N_{PFI}$ as $b_x(x^N_{PFI}) \gtreqless 1$.

(d) Suppose $\beta = -1$. Then, from (a) and (b), an FP invests more than an NP under both PFI and traditional procurement. Now compare PFI-FP with TP-FP. Let $H^F_{PFI}(x) = -\alpha^F b_x(x) + \pi_x(x) - 1$. Setting $x = x^F_{TP}$ and substituting from (8), $H^F_{PFI}\left(x^F_{TP}\right) = b_x(x^F_{TP}) + 1 > 0$. Hence, since $H^F_{PFI}(x)$ is decreasing in x and $H^F_{PFI}(x^F_{PFI}) = 0$, $x^F_{PFI} > x^F_{TP}$.

We now combine (a)-(d) to obtain the first part of the proposition. When $\beta = 1$, from (a), $x^N_{PFI} > x^F_{PFI}$, while from (b), $x^N_{TP} > x^F_{TP}$. If, also, $b_x(x^N_{PFI}) \geq 1$, then, from (c), $x^N_{TP} \geq x^N_{PFI}$, so that x^N_{TP} is the (weakly) highest of the four investment levels; but if, instead, $b_x(x^N_{PFI}) < 1$, then $x^N_{TP} < x^N_{PFI}$, so that x^N_{PFI} is the highest. Alternatively, when $\beta = -1$, from (a), $x^N_{PFI} < x^F_{PFI}$, while from (b), $x^N_{TP} < x^F_{TP}$. Using (d), x^F_{PFI} is therefore the highest of the investment levels.

For the second part of the proposition, note that if $\beta = 1$ then the arrangement that leads to the highest level of investment also yields the greatest social benefit. From the reasoning above, this is $x = x^N_{TP}$ if $b_x(x^N_{PFI}) \geq 1$, but $x = x^N_{PFI}$ if $b_x(x^N_{PFI}) \in [0, 1)$. Finally, if $\beta = -1$, the arrangement yielding the lowest investment gives the greatest social benefit. From (d) above, this is either TP-NP or PFI-NP. Writing again $H^N_{TP}(x) = -\left(\alpha^N + 1\right) b_x(x) + \pi_x(x) - 2$, set $x = x^N_{PFI}$. Substituting from (9), we obtain $H^N_{TP}(x^N_{PFI}) = -b_x(x^N_{PFI}) - 1 < 0$. Thus, since $H^N_{TP}(x)$ is decreasing in x, $x^N_{PFI} > x^N_{TP}$. It follows that, for NP, social benefit is greater under traditional procurement than PFI.

■

Proof of Proposition 4. (i) Let $F^N_{TP}(x) \equiv \beta\alpha b_x(x)+\delta^N\left[\beta b_x(x)+\gamma\pi_x(x)-2\right]$. Setting $x = x^F_{TP}$ and substituting from (10), we have $F^N_{TP}(x^F_{TP}) \equiv \beta\alpha b_x(x^F_{TP})(1-\delta^N)$. Since $F^N_{TP}(x)$ is decreasing in x and since $F^N_{TP}(x^N_{TP}) = 0$, it follows that $x^F_{TP} < x^N_{TP}$ when $\beta = 1$, and $x^F_{TP} > x^N_{TP}$ when $\beta = -1$. Similarly, let $F^N_{PFI}(x) \equiv \beta\alpha b_x(x) + \delta^N(\gamma\pi_x(x)-1)$. Setting $x = x^F_{PFI}$ and substituting from (11), we have $F^N_{PFI}(x^F_{PFI}) \equiv \beta\alpha b_x(x^F_{PFI})(1-\delta^N)$, implying that $x^F_{PFI} < x^N_{PFI}$ when $\beta = 1$ and $x^F_{PFI} > x^N_{PFI}$ when $\beta = -1$.

(ii) Let $F^j_{TP}(x) \equiv \beta\alpha b_x(x) + \delta^j\left[\beta b_x(x)+\gamma\pi_x(x)-2\right]$. Setting $x = x^j_{PFI}$ and substituting for $\delta^j(\gamma\pi_x(x)-1)$ from (11), we obtain $F^j_{TP}(x^j_{PFI}) \equiv \beta b_x(x^j_{PFI}) - 1$. Thus, when $\beta = 1$, $x^j_{PFI} > x^j_{TP}$ as $b_x(x^j_{PFI}) < 1$. When $\beta = -1$, $F^j_{TP}(x^j_{PFI}) < 0$ which implies $x^j_{PFI} > x^j_{TP}$ Combining this result with that of part (i), Proposition 4(ii) follows. ■

Proof of Corollary 4. From Proposition 4, if $\beta = 1$, TP-NP yields the highest level of investment, and therefore the greatest social benefit; and if $\beta = -1$, TP-NP yields the lowest level of investment, and therefore the greatest social benefit. ■

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