CEDI

Working Paper No. 07-08

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

John Bennett and Elisabetta Iossa

April 2007

CEDI DISCUSSION PAPER SERIES

Centre for Economic
Development & Institutions
Brunel University
West London
http://cedi.org.uk

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30 April 2007

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 firms (NPs). Two institutional arrangements are considered, with control rights lying either with the firm ('PPP') or the government ('traditional procurement'). The use of an NP with traditional procurement is found never to be the preferred option in terms of social welfare. But for a range of parameter values an NP in a PPP is the preferred option. The development of PPP provision has thus created opportunities for the advantageous use of NPs in public services.

JEL Classification: H41, L31, L33.

Keywords: contracting out, not-for-profit firms, private finance initiative, public-private partnership, incomplete contracts, public service provision.

1 Introduction

Recent years have witnessed a steady stream of innovations in the way public services are provided, particularly through the development of public-private partnerships (PPPs). 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, 2006). In Canada, similar PPPs 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 such schemes (Linder and Rosenau, 2000). Provision through PPPs 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-type PPPs, 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 Weisbrod 1997, Bennett *et al.,* 2003, and IPPR 2003). 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).[1] We consider these cases under two different institutional arrangements. The first is through a PPP, under which the private firm has control rights over the project; the second is traditional procurement, the government retaining 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. 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. With a PPP, the firm's control rights over the project give it the power to implement an innovation without consulting the government (provided basic standards are met), whereas with traditional procurement, the firm must get the government's agreement for implementation, and this involves bargaining.[2]

[1] This is a much revised version of Bennett and Iossa (2005).

[2] In the UK renegotiation does sometimes occur under PFI, for example when the contractors refinance a project. However, it is not in the spirit of PFI, which is specifically designed to stimulate innovation by allowing contractors to keep the resulting financial rewards (Audit Com-

Whereas an FP may be assumed to maximize profits, an NP operates under a non-distribution constraint, which bans it from redistributing profit to its members. Also, an NP may be founded with a specific mission in mind, its users and stakeholders may participate on its board of trustees, and there may be self-selection of managers and workers with concern for this mission (see, e.g., Bilodeau and Slivinski, 1996, and Besley and Ghatak, 2004). To capture these considerations as simply as possible, we assume that the NP's objective is to maximize benefits, though subject to a profit constraint. Such a constraint is particularly important for an NP because, given its non-distribution constraint, an NP does not have the option of raising funds on the stock market. Indeed, because of this, the NP is not subject to the market for corporate control, and this frees it to pursue its mission objective.[3]

We compare the investment incentives of an FP and an NP under different institutional arrangements, noting the implications for different types of public services. Three alternative scenarios are considered. In the first, implementation of an investment increases both the contractor's profit and social benefit (we refer to this as 'profitable quality improvement'). For example, the investment may be

mission, n.d.). According to the House of Commons (2003), 73% of UK construction projects using traditional procurement had a final price that exceeded that in the original contract, but the corresponding figure for PFI was 22%, and most of these were the result of changes led by the relevant government department, not by the contractor.

[3]In contrast, Glaeser and Shleifer (2001) assume that NP status is chosen by a self-interested entrepreneur as a commitment device, to reassure customers and other agents against ex post expropriation (e.g. on non-contractible output quality). In their model the NP entrepreneur pursues profit (as well as output quality - for reputational reasons or out of altruism) to an extent that is limited by the fact that, because of the non-distribution constraint, profits can only be used to buy perquisites. As a referee has pointed out, this ignores that NPs are generally exempt from corporate income tax in the US, so that, if we were to accept the view that the NP entrepreneur is self-interested, this could in principle imply that the NP would put a greater weight on profit than an FP does.

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 ('unprofitable quality improvement') 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 ('cost cutting at the expense of quality') implementation of an investment increases profit, but has an adverse impact on social benefit. For example, a cost-cutting innovation might compromise safety.

We organize our results around the distinction between the effect on benefits of implementing an innovation and the effect on profit of implementing the innovation. We say that the benefit effect dominates if, per unit of investment, implementation has a larger effect (of either sign) on benefit than the effect (of either sign) that it has on profit. We focus on the case where the benefit effect dominates, as this is the most relevant for public service provision.

Suppose that the budget constraint for the NP is such that an innovation can be implemented only if it is profitable. If the benefit effect dominates then we find that there is an optimal matching: FP provision with traditional procurement on the one hand, and NP provision with PPP on the other. Welfare maximization

requires that the effect of investment on benefit is taken into account. This can be achieved by either NP provision, because an NP cares about benefit directly, or by traditional procurement, because then control rights are held by the government which also cares about benefit. With NP provision under traditional procurement, too much weight, in welfare terms, would be put on benefits relative to profits; with FP provision under PPP too little relative weight would be put on benefits. If instead the profit effect dominates, FP provision is weakly preferred to NP provision because an FP maximizes profits and profits give a relatively big payoff in welfare terms. If an NP budget constraint is less tight, the matching may break down because the NP may overinvest. These general conclusions apply across all three investment scenarios.

The above results suggest the introduction of PPP has increased the scope for welfare-enhancing provision by an NP; but NP provision can only be preferable if the benefit effect dominates.

The theoretical literature on the provision of public services is expanding rapidly. Hart, Shleifer and Vishny (1997) and Schmitz (2000) compare public provision with contracting out to an FP. The optimality of bundling building and managing operations in PPP projects with FPs is discussed by Hart (2002) and Bennett and Iossa (2006) 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 e.g. Rose-Ackerman, 1996). However, a related branch of the literature considers NPs that do not rely on donations (see Hansmann, 1986, 1996). Glaeser and Shleifer (2001) model NP status as a device to maximize the returns of a self-interested entrepreneur producing a private good (see note 3 above), but 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 explicitly consider PPP - which is shown in our analysis to widen the potential role for NPs in effective public service provision, and they do not allow for the possibility that the NP has a budget constraint.

The paper is organized as follows. Section 2 outlines the model and compares the alternative institutional arrangements. Section 3 considers the effects of changing assumptions. Section 4 gives concluding comments, with illustrations of the relevance of our results to public service provision in practice.

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, which we denote by $x \geq 0$, researching innovative

approaches to performing its task in excess of the basic standard. The cost of this investment in monetary terms is $C(x)$, which, for simplicity, we shall assume to be quadratic: $C(x) = x^2/2$. The 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 always implemented.

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

$$B(x) = B_0 + \beta bx, \quad b > 0 \tag{1}$$

where B_0 is a positive constant denoting verifiable basic standards and β is a shift parameter whose value is either 1 or -1. If $\beta = 1$, x increases social benefit; if $\beta = -1$, x decreases social benefit.

Gross profit is defined to be

$$\Pi(x) = \Pi_0 + \gamma\pi x, \quad \pi > 0 \tag{2}$$

where Π_0 is the default profit that the firm by satisfying basic standards with $x = 0$. γ is a shift parameter whose value is either 1 or -1: if $\gamma = 1$, x increases profit;. if $\gamma = -1$, x decreases profit. We assume that $B(x)$ and $\Pi(x)$ are observable but unverifiable.

Net profit $\hat{\Pi}(x)$ is defined also to include the investment cost $C(x)$ and the monetary transfer z that is received from the government should bargaining occur in order to get the firm to institute the innovation x. Thus,

$$\hat{\Pi}(x) = \Pi_0 + \gamma\pi x - C(x) + z.$$

An FP chooses x to maximize net profit $\hat{\Pi}(x)$. An NP chooses x so as to maximize benefits, subject to a net profit constraint; that is, its objective function is

$$\max_x B(x) \text{ subject to } \Pi_0 + \gamma\pi x - C(x) + z \geq \bar{\Pi}. \tag{3}$$

$\bar{\Pi}$ is a parameter which, for now, we assume equals Π_0, implying that, if we disregard the profit Π_0 that would be achieved by satisfying basic standards, any further profit $\gamma\pi x - C(x) + z$ (the profit related to innovation) must be non-negative.

The government is assumed to maximize $B(x) - z_0 - z$, where z_0 is the payment it makes for satisfying basic standards; that is, it maximizes benefits minus any payments to the firm.[4]

We focus on the following three scenarios (examples of which are discussed in Section 4):

(a) Profitable quality improvement: implementation of innovation x raises both social benefit and the firm's profit ($\beta = \gamma = 1$).

(b) Unprofitable quality improvement: implementation of innovation x raises social benefit but cuts the firm's profit ($\beta = 1, \gamma = -1$).

(c) Cost cutting at the expense of quality: implementation of innovation x raises the firm's profit but cuts social benefit ($\beta = -1, \gamma = 1$).

We compare two institutional arrangements: public-private partnership (PPP) and traditional procurement. We assume that under PPP the firm has control rights over the project, being free to implement the innovation without consult-

[4] We are assuming here that 'the government' is a government agency, such as a local government or ministry, with its own objectives, rather than an abstract welfare-maximizing government.

ing the government. Under traditional procurement, however, the government has control rights over the project, and if there are gains from implementing the innovation, bargaining between the firm and the government will take place. To simplify we assume that with probability 1/2 the government makes a take-it or leave-it offer, while with probability 1/2 the firm makes a take-it or leave-it offer.

As a benchmark, we specify the first-best solution. Welfare $W(x)$ is defined to be the sum of benefits, gross profits and (negatively) the investment cost; that is,

$$W(x) = B(x) + \Pi(x) - C(x). \tag{4}$$

The first-best investment x^* maximizes $W(x)$. We assume for now that $b > \pi$, that is, the dominant effect of an innovation is on benefits, rather than gross profits. (The reverse of this inequality is considered in the next section.) x^* is therefore given, for the respective cases, by

$$\begin{aligned} \text{(a) } x^* &= b + \pi; \\ \text{(b) } x^* &= b - \pi; \\ \text{(c) } x^* &= 0. \end{aligned} \tag{5}$$

In this setting, for each institutional arrangement, PPP and traditional procurement, and for each type of firm, FP or NP, we compare investment levels, and thus welfare levels. The timing of the game is as follows. In period 0 the government sets the basic standards for service provision and specifies the institutional arrangement and type of firm: PPP or traditional procurement, and FP or NP. Also, the chosen FP or NP agrees a contract with the government to provide at

least the basic standards B_0 for price z_0.[5] 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, the contractor implements the innovation - without consulting the government if the contractor has control rights (PPP), but after bargaining with the government if the government has control rights (traditional procurement). In period 3 the service is provided.

2.1 PPP

We assume in this section that the firm has control rights over the project. We consider what happens to investment first when the firm is FP and then when it is NP.

When the firm is an FP it chooses x to maximize $\hat{\Pi}(x)$, as given by (2). Thus, writing x_p^F for the level of x it chooses, we have

$$\begin{aligned} \text{(a) } x_p^F &= \pi; \\ \text{(b) } x_p^F &= 0; \\ \text{(c) } x_p^F &= \pi. \end{aligned} \tag{6}$$

In cases (a) and (c), with profit increasing in x, an interior solution obtains; and in case (b), with profits decreasing in x, the FP does not invest. In each case the solution is different to the first-best because the FP does not take into account the effect of x on benefits. In cases (a) and (b) $x_p^F < x^*$ since the FP does not take into account the positive effect of x on B; in case (c) $x_p^F > x^*$ since the FP does

[5] We do not consider how the contractor was chosen. On the difficulties of competitive bidding schemes when NPs are involved, see Steinberg (1997).

not take into account the negative effect of x on benefits.

Suppose now that the firm is an NP, maximizing $B(x)$ subject to its budget constraint. Denote its investment by $x = x_p^N$. In case (a) both benefits and gross profit are increasing in x, and so the NP invests up to the point at which the budget constraint is binding; that is, $\pi x_p^N - C(x_p^N) = 0$. Thus,

$$\text{(a) } x_p^N = 2\pi. \tag{7}$$

In case (b), although x increases benefits, it is unprofitable, while in case (c) x decreases benefits. Therefore the NP does not invest in either case:

$$\text{(b,c) } x_p^N = 0. \tag{8}$$

Compared to the first-best, it is seen that in case (a) there is underinvestment, given that $b > \pi$. Since B is increasing in x, the NP invests up to where the budget constraint binds. Since π is low compared to b, the budget constraint binds at a point from which welfare could have been raised by further increasing x, but the budget constraint prevents the NP from doing so. In case (b) the first-best involves positive investment since $b > \pi$; but the budget constraint prevents any investment, and so there is underinvestment compared to the first-best. In case (c) $x_p^N = x^*$ since both are zero.

These conclusions lead immediately to our first proposition.

Proposition 1 *For PPP with $b > \pi$ and $\bar{\Pi} = \Pi_0$, the NP weakly dominates the FP in welfare terms. In case (a) $x_p^F < x_p^N < x^*$; there is underinvestment under both arrangements, but investment and welfare is greater with an NP than with*

an FP. In case (b) $x_p^F = x_p^N < x^*$*; there is the same amount of underinvestment under each arrangement. In case (c)* $x_p^F > x_p^N = x^*$*; the provision by the NP yields the first-best level of investment, but there is overinvestment by an FP.*

With PPP the firm has control rights over service provision. If it is an FP, being only concerned with profit, the benefit effect is not taken into account. This suggests that, when the benefit effect is high relative to the profit effect, provision by an NP, which cares about benefit, is preferable to provision by an FP. We shall see however that this conclusion does not necessarily hold when the NP has a less tight budget constraint.

2.2 Traditional Procurement

We now turn to traditional procurement, the government having control rights. Then an innovation cannot be implemented without the government's approval. If there are positive gains from implementation, bargaining between the firm and the government occurs.[6] We assume that the outside option is zero for each player. Hence, if bargaining occurs the default payoff for each player is the payoff that would obtain if there were no implementation of x and only the basic standards were achieved. Thus, respective the default payoffs are $B_0 - z_0 \equiv V_0$ for the government, Π_0 for an FP and B_0 for an NP.

Suppose first that the firm is an FP. With bargaining, if the FP makes the offer, the best it can do is ask the government to pay the amount that makes the

[6] Thus, we follow Hart Shleifer and Vishny (1997) and assume that the control rights of the government work as a commitment device for renegotiation to take place over how to share the gains from implementation. Investment cost $C(x)$ is a bygone but implementation of the investment is not.

government indifferent between agreeing to the offer or not; that is, the offer the FP makes is $z = \beta bx$. If the government makes the offer, the best it can do is ask the FP to pay the amount for which the FP is indifferent between accepting or not; that is, the government makes the offer $z = -\gamma\pi x$.[7] Hence, given the simple formulation of alternating-offers bargaining, there is an equal chance that $\hat{\Pi}(x) = \Pi_0 + \gamma\pi x - C(x) + \beta bx$ or $\hat{\Pi}(x) = \Pi_0 + \gamma\pi x - C(x) - \gamma\pi x = \Pi_0 - C(x)$. Thus, $E[\hat{\Pi}(x)] = \Pi_0 + \frac{1}{2}(\gamma\pi x + \beta bx) - C(x)$. We therefore have that in cases (a) and (b) the FP will set $dE[\hat{\Pi}(x)]/dx = \frac{1}{2}[\gamma\pi + \beta b] - x = 0$. In case (c) $E[\hat{\Pi}(x)] = \Pi_0 + \frac{1}{2}(\pi - b)x - C(x)$, which, for $b > x$, is decreasing in x. Thus,

$$\begin{aligned} \text{(a) } x_t^F &= \frac{1}{2}(\pi + b); \\ \text{(b) } x_t^F &= \frac{1}{2}(b - \pi); \\ \text{(c) } x_t^F &= 0. \end{aligned} \tag{9}$$

Compared to the first-best, there is underinvestment in cases (a) and (b). If the FP makes the offer, it asks the government to pay the value of benefits from implementation, which, if this offer were going to be accepted, would cause the FP to internalize benefits fully and therefore the first-best would be achieved. However, if the government makes the offer it asks the FP to pay the amount of profits that result from implementation. If this offer is accepted, the FP will not earn these profits, and therefore it will internalize neither the profits nor the value of benefits. It is because there is a 50% chance that the government will make the offer that the FP's investment is below the first-best level. However, case (c)

[7] Recall that the cost $C(x)$ has already been incurred here, so the government does not have to take $C(x)$ into account in its offer.

coincides with the first-best solution.

Suppose, instead, that the firm is an NP. Then, as far as it can, it will exploit its budget constraint to extract money from the government, which can then be used to increase benefits. With $\beta = 1$, that is, in cases (a) and (b), the maximum it can extract is found by setting the government's default payoff $V_0 = B_0 - z_0$ equal to $B_0 + bx - z_0 - z$; that is, $z = bx$. Thus, if it chooses x such that the budget constraint binds at $z = bx$, the government will pay it this amount. It is not relevant here which player makes the offer, for there is only one value of z that is acceptable to both players. Substituting $z = bx$ into the NP's budget constraint, we have $bx + \gamma\pi x - x^2/2 = 0$. Given also that in case (c) the NP will choose not to invest, we have the following:

$$\begin{aligned} \text{(a) } x_t^N &= 2(\pi + b); \\ \text{(b) } x_t^N &= 2(b - \pi); \\ \text{(c) } x_t^N &= 0. \end{aligned} \tag{10}$$

In cases (a) and (b) there is overinvestment relative the first-best. The NP's budget constraint is satisfied where $W(x) - B_0 - \Pi_0 = 0$. Assuming that $W(x^*) > 0$, if we raise x above x^* by a small enough amount, $W(x)$ will still be positive, but will fall in value. The solution given for cases (a) and (b) in (10) involves the NP raising x so far above x^* that $W(x)$ falls to zero. Thus, $x > x^*$. In case (c), however, x_t^N equals the first-best level.

Our second proposition brings these results together and also specifies that in cases (a) and (b), for which we have found underinvestment by an FP but

overinvestment by an NP, welfare is higher with the FP.

Proposition 2 *For traditional procurement with $b > \pi$ and $\bar{\Pi} = \Pi_0$ the FP weakly dominates the NP in welfare terms. In cases (a) and (b) $x_t^N > x^* > x_t^F$, with welfare higher with an FP than with and NP. In case (c) $x_t^N = x^* = x_t^F$.*

Proof. The rankings of x_t^F, x_t^N and x^* follow from (9) and (10). Now consider only (a) and (b). From (1), (2) and (4), $W'(x) = \beta b + \gamma\pi - x$; and from (5), $W'(x^*) = \beta b + \gamma\pi - x^* = 0$. Since $W''(x) < 0$, it follows that for any value of x such that $W'(x) < 0$ we have that $x > x^*$, and for any value of x such that $W'(x) > 0$ we have that $x < x^*$. Using Taylor expansions, given that $W'''(x) = 0$, we have $W(x) = W(x^*) + W'(x^*)(x - x^*) + W''(x^*)(x - x^*)^2/2$. Since $W'(x^*) = 0$ and $W''(x) < 0$, it follows that for $x = x_1$ and $x = x_2$, $W(x_1) \gtreqless W(x_2)$ as $(x_1 - x^*)^2 \lesseqgtr (x_2 - x^*)^2$; that is, as $|x_1 - x^*| \lesseqgtr |x_2 - x^*|$. From (5), (9) and (10), in case (a) $\left|x_t^F - x^*\right| = |-(\pi + b)/2| = (\pi + b)/2$, while $\left|x_t^N - x^*\right| = \pi + b$. Hence, $\left|x_t^F - x^*\right| < \left|x_t^N - x^*\right|$, so that $W(x_t^F) > W(x_t^N)$. In case (b), $\left|x_t^F - x^*\right| = |-(b - \pi)/2| = (b - \pi)/2$, while $\left|x_t^N - x^*\right| = |b - \pi| = b - \pi$. Hence, $\left|x_t^F - x^*\right| < \left|x_t^N - x^*\right|$, so that $W(x_t^F) > W(x_t^N)$. ■

With traditional procurement, social benefits are internalized to some extent by the FP because it bargains with the government, although there is underprovision compared to the first-best. In contrast, an NP prioritizes benefits and, as a result, if it also bargains with the government, it overprovides relative to the first-best. We find that the NP overprovides to such an extent that welfare is lower than with an FP. We return to this result and its sensitivity to our assumptions in Section 3.

2.3 PPP versus Traditional Procurement

The above results can be used to give an overall comparison of the four arrangements - with PPP or traditional procurement, and FP or NP provision. First, however, it is informative to note briefly whether with provision by a given type of firm (FP or NP) PPP or traditional procurement is preferable.

Lemma 1 *Assume that* $b > \pi$ *and* $\bar{\Pi} = \Pi_0$. *(i) If provision is by an FP then traditional procurement is preferred to PPP in all cases. (ii) If provision is by an NP then PPP is weakly preferred; in cases (a) PPP is preferred, while in cases (b) and (c) PPP and traditional procurement produce the same results.*

Proof. These results follow immediately from the first-order conditions except for (ii) (a) and (b). Consider (ii)(a). Using the same approach as in the proof of Proposition 2, since $x_p^N = 2\pi$ and $x_t^N = 2(\pi+b)$, we have $\left|x_p^N - x^*\right| = |\pi - b| = b - \pi$ and $\left|x_t^N - x^*\right| = \pi + b$. Hence, $\left|x_p^N - x^*\right| < \left|x_t^N - x^*\right|$, so that $W(x_p^N) > W(x_t^N)$. In (ii)(b), $x_p^N = 0$ and $x_t^N = 2(b-\pi)$, and so $\left|x_p^N - x^*\right| = |-(b-\pi)| = b - \pi$ and $\left|x_t^N - x^*\right| = b - \pi$. Hence, $\left|x_p^N - x^*\right| = \left|x_t^N - x^*\right|$, so that $W(x_p^N) = W(x_t^N)$. ■

From Propositions 1 and 2 and Lemma 1, we obtain the following.

Corollary 1 *Assume that* $b > \pi$ *and* $\bar{\Pi} = \Pi_0$. *There is a (weakly) optimal match: FP provision with traditional procurement on the one hand, and NP provision with PPP on the other.*

A general conclusion to emerge from our analysis is that the introduction of PPP into public service provision has given scope for the advantageous employ-

ment of NPs. With traditional procurement NP provision is always weakly dominated by FP provision, whereas with PPP, NP provision is the (weakly) preferred arrangement. In our framework there are two ways to ensure that the effect of investment on benefits is taken into account. One is provision by an NP (because of its objective of benefit maximization) and the other is through traditional procurement (since control rights are then with the government, and it cares about benefits). However, when the benefit effect of investment dominates the profit effect, if we have *both* an NP and traditional procurement, then the effect on benefits may be taken into account excessively. Social welfare is higher if *either* an NP *or* traditional procurement is used (but not both).

Our third proposition specifies which of the two options, FP with traditional procurement or NP with PPP, yields the greater welfare.

Proposition 3 *Assume that* $b > \pi$ *and* $\bar{\Pi} = \Pi_0$*. In case (a) the preferred arrangement is an NP with PPP if* $b < 3\pi$*, but it is an FP with traditional procurement if* $b > 3\pi$*. In cases (b) and (c) the weakly preferred arrangement is an FP with traditional procurement.*

Proof. Case (a). From Propositions 1 and 2, either an NP with PPP, or an FP with traditional procurement, yields the highest welfare. Since $\left|x_p^N - x^*\right| = b - \pi$ and $\left|x_t^F - x^*\right| = (\pi + b)/2$, we have that $\left|x_p^N - x^*\right| \gtreqless \left|x_t^F - x^*\right|$ as $b \gtreqless 3\pi$. Thus, $W(x_t^N) \lesseqgtr W(x_p^F)$ as $b \gtreqless 3\pi$. Cases (b) and (c) follow from Propositions 1 and 2 and Lemma 1. ■

Consider case (a), where investment is in profitable quality improvement. With both an NP under PPP and an FP under traditional procurement there is underin-

vestment. However, for given b, a higher level of π increases the investment of the NP more than that of the FP. The reason is that the FP must share the additional profit with the government through the bargain, whilst the NP will use the entire additional profit to finance more investment.

In case (b), where investment is in unprofitable quality improvement, the NP does not have the funds to invest under PPP. With traditional procurement the government's control rights work as a commitment device to share the benefit effect with the FP, through bargaining, i.e. the government provides funding for unprofitable investment. Thus, there is some investment (though less than the first best) and welfare is higher than with an NP under PPP.[8]

In case (c), each arrangement yields zero investment, as in the first best.

3 Alternative Assumptions

In this section we examine the effects of dropping the assumptions that $b > \pi$ and $\bar{\Pi} = \Pi_0$.

3.1 $b \leq \pi$

Suppose that $b \leq \pi$; that is, assume that the dominant effect of an innovation is on gross profits, rather than benefits. (The assumption that $\bar{\Pi} = \Pi_0$ is retained.) Then a repeat of our earlier analysis gives the values of x in shown Table 1. Compared to our results for $b > \pi$, the values in the table only change for cases

[8] This conclusion would unaffected. If we were to relax the assumption that there is no bargaining under PPP. Bargaining with an NP under PPP would yield the same level of investment as bargaining with an NP under traditional procurement. But we have already seen that welfare is weakly higher with an FP under traditional procurement than with an NP.

(b) and (c). However, the implications of the values in the table affect the welfare comparisons in all three cases. In contrast to when $\pi > b$, the first-best solution in case (b) is now zero investment because each unit of investment would cut gross profit by more than it would raise benefit; but the first-best now involves a positive investment in case (c) because each unit of investment raises gross profit by more than it cuts benefit. In case (b) each of the four arrangements now leads to the first-best solution, so we focus on cases (a) and (c), highlighting the differences from our analysis for $b > \pi$.

	x^*	x_p^F	x_p^N	x_t^F	x_t^N
(a)	$b+\pi$	π	2π	$(b+\pi)/2$	$2(b+\pi)$
(b)	0	0	0	0	0
(c)	$\pi - b$	π	0	$(\pi - b)/2$	0

Table 1. Levels of x when $b \leq \pi$ and $\bar{\Pi} = \Pi_0$

Consider PPP first. In each case, the first-order conditions for both FP and NP provision are the same as when $b > \pi$. However, in case (a), with $b \leq \pi$ both FP and NP lead to overinvestment, and so, since $x_p^N > x_p^F$, welfare is higher with the FP.[9] In case (c), with $b \leq \pi$ it is found that $W(x_p^F) \gtreqless W(x_p^N)$ as $\pi \gtreqless 2b$.[10]

Turning to traditional procurement, since in case (a) π and b play symmetric roles in the the formulae for x, the analysis is identical to that in the previous section: $x_t^N > x^* > x_t^F$, with welfare higher with an FP than an NP. In case (c) there was no investment when $b > \pi$, but with $b \leq \pi$ there is a positive surplus

[9] $\left|x_p^F - x^*\right| = b$ and $\left|x_p^N - x^*\right| = (b+\pi)/2$. Since $b \leq \pi$, we have that $\left|x_p^F - x^*\right| \leq \left|x_p^N - x^*\right|$. Therefore $W(x_p^F) \geq W(x_p^N)$.

[10] $\left|x_p^F - x^*\right| = b$ and $\left|x_p^N - x^*\right| = \pi - b$. The welfare ranking in the text follows.

from the bargain between the FP and the government for implementation of the innovation. Because the FP must share the surplus with the government it invests less than the first-best amount; but this contrasts with the behaviour of an NP which, because benefits would fall, does not invest at all; that is for $x^* > x_t^F > x_t^N$, with welfare is higher with an FP than an NP.

If provision is by an FP, then in case (a), for both PPP and traditional procurement, there will be underprovision relative to the first-best, but we now find that PPP is preferred to traditional procurement. In case (c) it is found that $W(x_p^F) \gtreqless W(x_t^F)$ as $\pi \gtreqless 3b$;[11] that is, if the profit-effect of investment substantially outweighs the benefit-effect, PPP with an FP is preferred to traditional procurement with an FP. Alternatively, if provision is to be by an NP then, in case (a), there is overinvestment, more so under traditional procurement, so PPP is preferred. In case (c), however, neither PPP nor traditional procurement results in any investment.

The overall implications for the choice between the four arrangements are summarized in the next proposition.

Proposition 4 *For $b \leq \pi$ and $\bar{\Pi} = \Pi_0$ the FP weakly dominates the NP in welfare terms. In case (a) welfare is highest with an FP under PPP. In case (b) all arrangements yield the first-best. In case (c), if $\pi > 3b$ welfare is highest with an FP under PPP, while if $\pi < 3b$ welfare is highest with an FP under traditional procurement.*

[11] $\left|x_p^F - x^*\right| = b$ and $\left|x_t^F - x^*\right| = (\pi - b)/2$. Therefore $\left|x_p^F - x^*\right| - \left|x_t^F - x^*\right| = (3b - \pi)/2$, and the condition in the text follows.

A significant feature to emerge from Propositions 3 and 4 is that, while PPP has opened up new opportunities for welfare-enhancing public service provision NPs, NP provision can only be strictly preferred if $b > \pi$. A second general conclusion is that, across all our cases, for $b > \pi$ or $b \leq \pi$, traditional procurement with an NP is always at least weakly dominated by other arrangements.

3.2 $\bar{\Pi} \neq \Pi_0$

We have assumed until now that the research into innovation and the subsequent implementation cannot be a net cost to the NP; that is, the amount of profit from fulfilling the basic standards must be at least achieved by innovation and implementation. Suppose, however, that the NP may be willing to forgo all of Π_0 to increase benefits, where, by assumption, $\Pi_0 \geq 0$. Thus, we have $\bar{\Pi} = 0$ in (3).[12] For brevity, we refer to this case as entailing a 'less tight' budget constraint - compared to the case analyzed in Section 3.

Assume first that $b > \pi$ and consider PPP. In case (a) the NP now invests up to the point at which $\pi x_p^N - (x_p^N)^2/2 = -\Pi_0$. Thus, taking the real root of the quadratic,

$$\text{(a) } x_p^N = \pi + (\pi^2 + 2\Pi_0)^{1/2}. \tag{11}$$

Hence, under PPP, having the less tight budget constraint causes the NP to invest more. In case (b), x increases benefits, and although it is unprofitable, the availability of the amount Π_0 to spend enables the NP to invest. In this case

[12] Other levels of constraint might also occur. For example, the NP might have other urgent calls on its funds, so that, net, it must accumulate some profit. Alternatively, it may be willing to forgo some, but not all, of Π_0. We focus on the specific constraint in the text for simplicity, but the effects of other levels of the constraint may be inferred from our results.

$-\pi x_p^N - (x_p^N)^2/2 = -\Pi_0$. Again taking the real root,

$$\text{(b) } x_p^N = -\pi + (\pi^2 + 2\Pi_0)^{1/2}. \tag{12}$$

As in case (a), in case (b) the less tight budget constraint results in greater investment. In case (c), however, since investment reduces benefit, the NP sets $x_p^N = 0$.

With traditional procurement, in cases (a) and (b) the NP's budget constraint binds with $z = bx$; but now this entails $bx + \gamma\pi x - x^2/2 = -\Pi_0$. Thus we obtain

$$x = b + \gamma\pi + [(b + \gamma\pi)^2 + 2\Pi_0]^{1/2}.$$

We therefore have

$$\begin{aligned} \text{(a) } x_t^N &= b + \pi + [(b + \pi)^2 + 2\Pi_0]^{1/2} > 2(b + \pi); \\ \text{(b) } x_t^N &= b - \pi + [(b - \pi)^2 + 2\Pi_0]^{1/2} > 2(b - \pi). \end{aligned}$$

In case (c) the NP will choose not to invest.

These results give our next lemma.

Lemma 2 *Assume that $b > \pi$ and that the NP aims to break even overall (a 'less tight budget constraint'). (i) In cases (a) and (b) under both PPP and traditional procurement the NP will invest more with the less tight budget constraint. (ii) In case (a), for $b < 3\pi$, if Π_0 is not too large, then having a less tight budget constraint increases the extent to which the NP under PPP yields greater welfare than other arrangements do; but, for increases in Π_0 above $(b^2 - \pi^2)/2$, $dW(x_p^N)/d\Pi_0 < 0$, and if Π_0 becomes large enough, $W(x_t^F) > W(x_p^N)$. If $b > 3\pi$, $W(x_t^F) > W(x_p^N)$*

for all $\Pi_0 \geq 0$. *(iii) In cases (b) and (c), having a less tight budget constraint has no implications for which arrangement yields the highest welfare.*

Proof. (i) This follows from comparison of (11) with (7), and (12) with (8). (ii) $b < 3\pi$ is the condition for which x_p^N is the best arrangement in Proposition 3. From (5) and (11), $x_p^N = x^*$ if $\Pi_0 = (b^2 - \pi^2)/2$. A larger Π_0 than this raises x_p^N above x^*, and eventually $W(x_p^N)$ becomes smaller than $W(x_t^F)$. If $b > 3\pi$, we already have that $W(x_t^F) > W(x_p^N)$ for $\Pi_0 = 0$; a higher value of Π_0 strengthens this inequality. (iii) In case (b), if $\Pi_0 = 0$, $x_p^N > x^*$ and an NP under traditional procurement is not the preferred arrangement. Since $dx_p^N/d\Pi_0 > 0$, $dW(x_p^N)/d\Pi_0 < 0$, so that this arrangement is still not preferred. In case (c) since $x_p^N = 0$ for all $\Pi_0 \geq 0$, $dw(x_p^N)/d\Pi_0 = 0$. ■

With $b > \pi$, since $dx_p^N/d\Pi_0 > 0$, the existence of a less tight budget constraint can have a positive effect on welfare if $x_p^N < x^*$ when (as in Section 3) the budget constraint is tight. However, a sufficiently large value of Π_0 can have a negative effect on welfare by causing excessive investment by the NP under PPP.

If, instead, $b \leq \pi$, no changes are required to our conclusions in the previous sub-section about which form of provision yields the greatest welfare.

4 Concluding Comments

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 PPP, whereby the firm is allocated control rights over how to deliver the service; the second is traditional procurement, whereby the government retains control rights.

Our main conclusion is that the development of PPP provision for public services has increased the scope for welfare-enhancing not-for-profit provision; that is, for some ranges of parameter values, the preferred administrative arrangement is PPP with a not-for-profit firm, even though, if traditional procurement were used, it would be preferable to use a for-profit firm. In the light of our results, we end by discussing some examples, applying our results to highlight circumstances where one institutional arrangement is preferable to another.

Consider first case (a), where potential investments are in profitable quality improvement. In practice, 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. The profitable quality improvement 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. Construction of roads is another example where investment can raise both profit and benefit. In all these cases, our results suggest that the use of PPP is desirable. If the effect of investment on maintenance cost is relatively small ($b > \pi$), NP provision will be preferred provided the NP's budget is tight enough; but if the effect of investment on maintenance cost is relatively large ($b \leq \pi$), FP provision is preferable.

Case (b) relates to investment in unprofitable quality improvement. For ex-

ample, 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 the weakly welfare-maximizing arrangement is traditional procurement with an FP. In this context, it is interesting to note that the NHS Confederation in the UK recently reported that PPP hospitals designed and built by FPs often failed to create a good healing environment with less noise and more daylight.[13]

Finally, in case (c) investment is in cost cutting at the expense of quality. 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). In this case our analysis indicates that the preferred arrangement for provision is highly sensitive to parameter values. If, however, the first-best solution is to have no such investments, then provision by an NP, either through PPP or traditional procurement, is the weakly preferred arrangement.

In the UK the healthcare system is changing fast, and significant parts of provision are being put in private hands. If there is concern that provision by FPs will lead to lower welfare through cost cutting at the expense of quality, this concern may be alleviated by reliance on NPs. If we broaden our analysis to allow

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

for the possibility that firms may have more than one option as to which kind of investment they make, investment in quality improvement also being feasible, then the broad indication of our analysis is that, with provision by an NP, PPP may be preferable to traditional procurement.

Acknowledgments

For helpful comments or discussions we wish to thank Bertrand du Marais, Matthew Ellman, Paul Grout, Gabriella Legrenzi, Miltos Makris, Michael Monoyios, Zoe Moss and Stéphane Saussier, and Al Slivinski. We also wish to thank seminar participants at the Workshop on Public Private Partnerships, 2004 (Brunel University, London), at the International Workshop on Public Private Partnerships: Theoretical Issues and Empirical Evidence, 2004 (Paris), at the Conference on Public Services and Management, 2006 (Toulouse), at the ASSA Meetings, 2007 (Chicago). We are grateful to two referees for detailed comments on an earlier version of the paper. Financial support from the ESRC under grant R/000/22/3811 is gratefully acknowledged.

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