The Role of User Fees in the Cost-Benefit Analysis of Privatization with an Application to Inpatient Psychiatric Services in the US[*]

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Abstract

When there is no asset sale, and thus no lump sum revenues to accrue to the government, one of the major benefits of privatization is then absent. Because of this, the revenues that were previously obtained from private clients assume more importance. This paper incorporates these client revenues fully into a cost-benefit framework and applies the framework to an evaluation of the privatization of psychiatric wards in non-federal general hospitals in the US. We find that the privatization of psychiatric services in general hospitals would provide a social gain only if the change took place using for-profit rather than nonprofit hospitals, a finding that depends crucially on including the excess burden effects of public revenues.

Keywords: Cost-Benefit Analysis; Privatization; Psychiatric Hospitals.

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1. Introduction

There is a current worldwide movement towards privatization whereby private producers replace state producers. Replacement may be direct whereby the public sector relinquishes control completely, or indirect whereby the public sector retains discretion for setting targets, but contracts out to the private sector the fulfillment of the targets. Irrespective of the process, it is fair to say that the privatization movement has proceeded, on the whole, in advance of detailed economic evaluations of whether such organizational changes would be socially worthwhile.

Within the health care field, the area of mental health has gone through the most dramatic privatization changes. Presumably, this was because there was more scope for it, given that government involvement was so much larger in mental health than for other health services. An important difference between privatization of a state mental hospital in the US and other types of privatization is that it did not have the large sale of public assets that other types involve.[1] The revenues from selling off the publicly owned activity constitute one of the most important forces driving privatization throughout the world. In an era where public budgets are severely constrained for resources, the revenues from selling off public activities to the private sector are especially attractive.

[1] Dorwart and Schlesinger (1988)

However, in the US, instead of selling state hospitals to the private sector, newly formed private psychiatric hospitals and psychiatric wings in existing general hospitals were set up to provide the care. In the absence of the revenues from the sale of public hospitals, the client revenues that the public sector no longer earn play a more important role in affecting the public budget. Client revenues must be separately allowed for in the calculations of any cost-benefit analysis (CBA) of privatization. Analyzing client revenues is crucial for evaluating ownership changes in mental health because the public sector will continue to be a client even when it ceases to be a producer. It will have to give up (pay) revenues to the private sector when previously it was receiving revenues from private clients.

In the light of these considerations, it is important to have available a cost-benefit framework for evaluating privatization that includes revenue effects. An important ingredient in this framework is the concept of the marginal cost of public funds (MCF) for this recognizes that any payments by the government that come from tax revenues involve an excess burden in addition to the utility loss from the funds themselves. The excess burden arises from the distortions created by taxes that cannot be collected in a lump sum way. In this way the MCF can render government expenditures less worthwhile. However, in the context of privatization the role of the MCF can be reversed because any revenues from user prices accruing to the government has an added benefit in terms of avoiding the need for taxation.

The importance of the role of the MCF is beginning to be recognized in the mental health evaluation field. Brent (2003) has estimated the MCF for each of the 50 US states and

has shown how the privatization of state mental hospitals in Massachusetts, and the cost-shifting from the state to the federal governments that this involves, depends on the difference between the state and federal MCFs. The MCF was a key parameter in judging the desirability of transfer payments to families of mental hospital patients in California, see Brent (2004), and it can be used to convert a cost-effectiveness analysis of a mental health episode into cost-benefit analysis, see Brent (2002). However, the link between the MCF and user fess has not been analyzed in the health care field within a cost-benefit framework and remedying this deficiency is a main contribution of the paper.

In the next section we construct the cost-benefit framework. This framework is an extension of the class of cost-benefit models covered in Brent (1996). Then we present the data on costs, prices and quantities and apply them to the cost-benefit framework to obtain the estimates of the efficiency costs and benefits of general hospital psychiatric care. We close with the summary and conclusions where we draw out some implications of our analysis for more recent developments in the area of privatization in mental health.

2. The cost-benefit framework

Denote the public sector by the number 1 and the private sector by number 2. In our analysis the public and private sectors enter both as producers and consumers. So throughout we will use a pair wise numbering scheme *ij*, where the first number *i* identifies the producer, $i = (1,2)$ and the second number *j* indicates the consumer, $j = (1,2)$. This means that there will

always be four group effects to consider: 11, 12, 21 and 22, where, for example, 21 identifies a private hospital producing services and selling them to the government.

Define W_i as the welfare level that corresponds to a particular sector's production activity. The welfare level from public production is denoted by W_1 and that for private production will be W_2. Each producer sells to two different clients such that $W_1 = W_{11} + W_{12}$ and $W_2 = W_{21} + W_{22}$. The welfare effect of privatization is the difference in welfare levels between private and public production and given as:

$$\Delta W = W_2 - W_1 = (W_{21} - W_{11}) + (W_{22} - W_{12}) = \Delta_1 W + \Delta_2 W \qquad (1)$$

The final part of equation (1) uses a decomposition that involves partitioning the total welfare change ΔW into the change related to the two types of client. Thus, $\Delta_1 W$ stands for the change in welfare from privatizing the sales to the government and $\Delta_2 W$ from privatizing sales to private clients.

Welfare levels are mainly to be determined on the basis of social benefits B and social costs C. The benefits are reflected by the willingness to pay for the output by gainers and the costs are the minimum that the losers must receive in compensation for the output. However, because beneficiaries of psychiatric hospital services receive care only if someone pays for it, we need to consider firm receipts as a further ingredient determining social welfare. Denote by R the revenues that clients pay for the services. These revenues play the role of

redistributing the gains from the beneficiaries to those who incur the costs. Thus, the net gains become $B - R$ and the net costs fall to $C - R$.

The importance of R depends on who is paying for the services. Public revenues differ from private sources of funds because they basically depend on taxation, which involves a marginal excess burden (also called the "marginal welfare cost of taxation").[2] Let λ represent the marginal cost of public funds and value at unity a dollar of revenues that comes from private funds.[3] Then $\lambda - 1$ is the marginal excess burden to be attached to the public resources. What we now need to explain is how the ingredients B, C and R (together with λ) combine to form CBA criteria for the four welfare levels W_{11}, W_{12}, W_{21} and W_{22} and thereby provide the determinants of the two components of the social desirability of privatization $\Delta_1 W$ and $\Delta_2 W$.

2.1 The criterion for private producers and consumers: W_{22}

The simplest case to consider relates to W_{22}, where the private sector is both the producer and consumer. Here no government funding is affected and all net benefits and costs can be given equal weight. We will make these private effects the numeraire and hence assign a unit value to them. The welfare criterion for this case is:

$$W_{22} = (B_{22} - R_{22}) - (C_{22} - R_{22}) = B_{22} - C_{22} \qquad (2)$$

[2] On this concept see, for example, Browning (1987) and Brent (1996), chapter 9.
[3] In this way we are regarding private funds as the numeraire and valuing public funds relative to these private funds via λ.

Note that in equation (2), the revenues from private clients R_{22} cancel out as they are intrasectoral transfers that operate symmetrically on the net gains and losses. Equation (2) is the standard CBA criterion that appears, *inter alia*, in Mishan (1976).

2.2 The criterion for public producers and consumers: W_{11}

We next consider the public sector counterpart to the situation just analyzed. Here the government is both the producer and client. Revenues from the government attract the marginal cost of public funds weight λ. This makes the net gains going to the government $B_{11} - \lambda R_{11}$. Any part of the net losses affecting the government, whether they be the costs C_{11} that they incur as producers, or the revenues R_{11} that they pay as clients to the public producers, directly impact on the government budget and therefore require the λ weight. The welfare criterion then is:

$$W_{11} = (B_{11} - \lambda R_{11}) - \lambda (C_{11} - R_{11}) = B_{11} - \lambda C_{11} \qquad (3)$$

Again the revenues cancel out because of the intrasectoral nature of the transfer. Though, in this case, it is the social significance of the revenues λR_{11} that affects symmetrically the net gains and losses. Equation (3) is equivalent to the welfare maximization condition for pure public goods as derived by Atkinson and Stern (1984).

2.3 The criterion for private producers and public consumers: W_{21}

There are two mixed cases where the private and public sectors interact which cause revenues to operate asymmetrically on the net gains and losses. In the first, the private sector produces the services and the government buys them. The funds that the government passes over for the services have the penalty weight λ and this reduces the net gains going to the government to $B_{21} - \lambda R_{21}$. Because it is the private sector that incurs the net losses, government revenues do not get special treatment in this context. That is, government revenues reduce private losses on a par with private revenues and the welfare criterion is:

$$W_{21} = (B_{21} - \lambda R_{21}) - (C_{21} - R_{21}) = B_{21} - C_{21} - R_{21}(\lambda - 1) \quad (4)$$

Equation (4) expresses the welfare level W_{21} in terms of the components of the standard CBA criterion (2), except for the reduction in welfare due to the excess burden associated with the government having to pay taxes to provide the funds that go to the private sector.

2.4 The criterion for public producers and private consumers: W_{12}

In the second of the mixed cases, the public sector produces the services for use by private clients. The funds that the private sector pays for the services reduce the net gains going to the private sector, but do not have any additional significance for this sector. Net gains are thus simply $B_{12} - R_{12}$. However, from the point of view of the public sector producing the services, the revenues paid by private clients go directly to offset the government's deficit, which has the penalty λ, attached to it. The welfare level for the second mixed case is therefore:

$$W_{12} = (B_{12} - R_{12}) - \lambda (C_{12} - R_{12}) = B_{12} - \lambda C_{12} + R_{12} (\lambda - 1) \quad (5)$$

The main difference of this criterion from the first mixed case is that, this time, the public sector is receiving funds from the private sector and not the reverse as with the previous case, there is a social gain from *reducing* the excess burden.

Although the final version of equation (5) may look unfamiliar, we can use the first equality in it to reproduce criteria existing in the literature for judging the desirability of selling public enterprises. $B_{12} - R_{12}$ is the excess of what consumers are willing to pay over what they have to pay for services and is thus equal to consumer surplus S. $C_{12} - R_{12}$ is the financial loss from producing, which is $-\Pi$. The negative of this is $+\Pi$. So the first part of equation (5) can be written as $S + \lambda \Pi$, which is Jones, Tandon and Vogelsang's (1990) equation (5.4). It also contains the two key elements (profits and consumer benefits) that determine the welfare effects of the privatization decision in the analysis by Vickers and Yarrow (1991).

2.5 The CBA privatization criterion: ΔW

Equations (2) - (5) feed into equation (1) to produce the CBA privatization criterion. We consider the criterion in the decomposed form as this will ease the exposition in the applications section. Note that in our efficiency formulation we assume that what a private

client is willing to pay has the same social significance as that stemming from government demand.

The welfare effect of privatizing the sales to the government is obtained by gaining W_{21} at the expense of W_{11}. From equations (3) and (4), we obtain:

$$\Delta_1 W = (B_{21} - B_{11}) - (C_{21} - R_{21}) + \lambda (C_{11} - R_{21}) \quad (6)$$

The criterion depends on three components. The first is the change in consumer benefits (consumer surplus) that the privatization may bring about, initially ignoring what clients have to pay for them. Then there is the financial loss that the private firms may incur from the move. Finally, there is the marginal cost of public funds effect, whose magnitude depends on the extent to which the cost savings from the government no longer producing exceed the revenues that the government must give up by now having to purchase the services from the private sector.

For sales to private clients, the welfare effect of privatization is defined by $W_{22} - W_{12}$ and, from equations (2) and (5), we have:

$$\Delta_2 W = (B_{22} - B_{12}) - (C_{22} - R_{12}) + \lambda (C_{12} - R_{12}) \quad (7)$$

This criterion again has three components: from the change in benefits from private production one must subtract the financial difference for the private sector (between the costs

of producing for private clients and the revenues from sales to government clients) and add the social value of any avoided financial loss from the public sector selling to private clients.

3. The application related to the privatization of US psychiatric hospitals

Privatization of US state mental hospitals has taken place in two main ways.[4] Private psychiatric specialty hospitals sprang up. Also newly created psychiatric wings in non-federal general hospitals (NFGHs) were established. We will be applying our CBA framework only to the general hospitals because: (a) only general mental hospitals produce services by, and sell services to, both the private and public sectors, which allows us to focus fully on the role of client fees, and (b) there is likely to be more comparability in the data among types of general hospitals than among types of specialty psychiatric hospitals. The private hospitals sector comprised both for-profit and nonprofit organizations. So we cover separately privatization involving the two kinds of private ownership.

From the CBA framework we can see that there are four main ingredients in a CBA of the privatization of NFGHs when user fees are important, i.e., we need estimates of λ, R, C and B. We now give a brief summary how these four ingredients were estimated. Note that a number of strong assumptions had to be made to generate these estimates. So the results must be viewed as indicating only rough orders of magnitude.

For the marginal cost of public funds, λ, we will use a figure of 1.2455. This is an average of the four general equilibrium estimates provided by Ballard, Shoven and Whalley

(1985), which depended on the particular elasticities of supply of labor and savings that were chosen.

Data for *R* and *C* were collected by the Center for Mental Health Services (CMHS) for the year 1990. The unit of output that was published in this data source was an episode. However, CMHS provided the author with unpublished information on length of stay, severity of illness, and the number of full-time equivalent professional staff giving care. So an allowance for the quality of services provided was made in terms of these three factors. The resulting output unit was called a *severity-adjusted episode.* It is the revenues and costs for this adjusted output measure that is reported in table 1. It is important to be aware that because some of the data in table 1 come from unpublished records released to the author, there are no later figures available that anyone can use to make more up-to-date estimates. On the basis of CMHS's figures for total revenues and costs we derived the prices and costs that are displayed in the bottom part of table 1. The appendix explains the methods used to derive these estimates.

Estimates of the benefits *B* were derived from the areas under the severity-adjusted client demand curves, which were assumed to be linear between the price and quantity of sales to the private sector and the price and quantity sold to the public sector. The number of episodes was obtained by assuming that the quantities that the public sector sold to the private and public sectors before the privatization would be the quantities that were sold to the two types of clients after the privatization. It was just the source of the production (the ownership) and hence the prices, and costs, that would be different after privatization.

[4] See Dorwart and Schlesinger (1991).

Dividing the revenues by the quantities produced estimates of the prices and these are also shown in table 1. The benefits (not shown in the table) were derived from the prices and quantities shown using the standard formula for an area under a triangle. For reference, the cost per unit is also given in table 1. Note that the cost per unit did not vary with the client, but prices did. The price charged to the private sector was always greater than that for the public sector.

As we can see in table 1, the estimates resulted in prices and costs for public NFGHs being lower than for private for-profit hospitals; but these prices and costs are higher than those in the private nonprofit sector. The nonprofit and public hospitals charge the same price to clients irrespective of the sector purchasing the services. The for-profit hospitals charge a higher price to private clients than to the government.

Table 1*: The data on prices, revenues and costs for non-federal general hospitals (1990).*

	Public	Private For-Profit	Private Non-Profit
Totals (in thousands of dollars)			
Revenues from Government	599,444	204,061	1,535,130
Revenues from Private Clients	187,329	194,675	1,227,437
Total Expenditures (Total Costs)	771,356	362,231	2,540,850
Quantity sold to Government	70,549	23,563	193,016
Quantity sold to Private Clients	22,047	18,264	154,329
Averages (in dollars)			
Cost per unit	$ 8,497	$ 8,660	$ 7,953
Price to government	$ 8,497	$ 8,660	$ 7,953
Price to private clients	$ 8,497	$10,659	$ 7,953

We are now in a position to try to put dollar amounts on the costs and benefits. The outcomes depend crucially on what type of change one is envisaging. There are two dimensions that must be included. When there is a displacement of public production, we need to identify both the organizational type and the particular profit status of the private sector hospital taking up the slack. In addition, we need also to distinguish the effects on the two separate sets of buyers, the government and the private buyers. In all cases, we assume that what the public sector produces and sells now will be replaced by what the private sector produces and sells now. As we see in table 1, this means that privatization using for-profit hospitals means reducing the number of episodes produced and sold, while privatization using no-profits implies expanding the scale of operations. Privatization is viewed as an "all or nothing comparison"; either the public sector produces, or the private sector produces, but not both. The results across the two dimensions are displayed in table 2.

Table 2: *Net benefits of privatization on NFGHs in the US (in millions of US dollars).*

Privatization change		MCF = 1	MCF=1.245	MCF=1.111	MCF=1.351
Public to for-profit					
Sales to Public Sector	$\Delta_1 W$	– 8	+ 89	+ 36	+131
Sales to Private Sector	$\Delta_2 W$	– 7	– 7	– 7	– 7
Total		– 15	+ 82	+ 29	+124
Public to nonprofit					
Sales to Public Sector	$\Delta_1 W$	+ 71	– 158	– 32	– 257
Sales to Private Sector	$\Delta_2 W$	+ 48	+ 48	+ 48	+ 48
Total		+119	– 156	+ 16	– 209

The welfare effects of sales to the public sector use equation (6) and the welfare effects of sales to the private sector are based on equation (7). Column 3 (with MCF =

1.245) displays the main results. To highlight the role of the MCF, we show in column 2 what difference it makes to adopt a value of $\lambda = 1$ in both of these welfare equations. The last two columns show the results of undertaking a sensitivity analysis for the MCF. The lower and upper bounds are taken from the range of MCFs in Brent (2003), table 2. MCF = 1.111 corresponds to Nevada's state tax system and MCF = 1.351 relates to Alaska. We summarize the main findings in turn.

3.1 From public to for-profit status

We start by assuming that the public sector will cease producing and selling 70,549 adjusted episodes to government buyers and 22,047 to private buyers and that the private for-profit firms will step in and sell instead 23,563 to the government and 18,264 privately (see table 1). We find that privatizing NFGH sales to the government has a positive net effect of $89 million, as the weighted revenue gain to the government more than exceeds the loss of benefits from the private sector producing a lower quantity. Note that the net effect would have been negative (approximately $8 million) if the excess burden consideration was ignored and the marginal cost of public funds were set equal to unity. On the other hand, the result for privatizing private sales clearly would be negative (− $7 million) as it is unaffected by the size of the marginal cost of public funds.[5] The standard cost-benefit criterion would be sufficient to rule out this ownership change.

[5] This is because of the assumption that the public sector charges a price that breaks even and so there are zero profits to weight by the MCF.

On the basis of the results for both sets of sales, to the public and private sectors, we obtain the conclusion that the aggregate effect of privatizing NFGHs by replacing them with for-profit firms would be positive at $82 million, being the difference between a gain of $89 million from private sales ($\Delta_1 W$) and a loss of $7 million from sales to the government ($\Delta_2 W$). If the standard cost-benefit criterion were employed, that ignores revenue effects and sets $\lambda = 1$, then the overall result would be reversed, and privatizing for-profit private sector output would decrease social welfare by $15 million.

3.2 From public to nonprofit status

Privatizing NFGHs via transferring production to the nonprofit sector involves moving from a situation where the public sector produces and sells 22,047 adjusted episodes to private buyers and 70,549 to government buyers to one where the private nonprofit firms sell 193,016 to the government and 154,329 privately (again see table 1). As sales by private nonprofit hospitals to the government are greater than for publicly owned hospitals, the change in benefits from privatization is positive. The revenue effect turns out to be negative. The net effect of privatizing sales to the public sector is negative by $158 million as the revenue loss dominates the gain of benefits from greater output by private firms. Interestingly, the result would again be reversed if λ were set equal to 1, and a positive outcome would be forthcoming (around $71 million).

Privatizing sales to private clients involves a larger output produced by the private sector. There is a gain in benefits and a negative financial difference. The net effect of

privatizing private sales leads to a net gain of $48 million. The existence of a gain does not depend on the value for λ. On balance, we see that the result of privatizing NFGHs using the nonprofit sector would be negative to the extent of $110 million (the gain of $48 million from private clients being swamped by the loss of $158 million from government sales). This adverse judgment depends crucially on the revenue effects of privatization. There would be a welfare gain of close to $120 million if λ were equal to unity, as both components $\Delta_1 W$ and $\Delta_2 W$ would be positive in this scenario.

The sensitivity analysis reveals that our main results using a MCF = 1.245 would not be qualitatively altered by applying either extreme for the MCF when considering the switch from public to for-profit general hospitals. In all cases the net-benefits are positive. However, the results are changed for the case when a MCF = 1.111 is used for the move from public to nonprofits. A $32 million loss would turn into a $16 million gain. This differential finding can be explained by the fact that the scale of operations are so much larger for nonprofits, so even a small fractional change can lead to large changes in absolute numbers.

4. Summary and conclusions

This paper used CMHS data to calculate point estimates of prices, quantities and costs, and then used these estimates in a cost-benefit framework to provide an economic evaluation of the privatization of psychiatric wards in non-federal general hospitals in the US. Distributional considerations would need to be added to convert this evaluation into a social appraisal. We covered sales to government and private clients by public organizations and

both private for-profit and private nonprofit hospitals. Thus our evaluation included private and public buyers as well as private and public producers. Our data and methods enabled us to estimate the necessary ingredients for three sets of producer (public, private for-profit and private nonprofit) each serving two kinds of consumer (government and private clients).

To help us interpret our data estimates as equilibrium outcomes, we adopted various assumptions governing hospital behavior. For public hospitals we assumed welfare maximization. For private non-profit hospitals we postulated the objective of breaking-even. A multi-market monopoly model was used for private for-profit hospitals. These assumptions simplified matters enormously because for public and private nonprofit firms serving both types of client, and private for-profit firms selling to the government, we could assume marginal cost pricing. From our constant costs assumption, which enabled us to estimate per unit costs, five of our six unknown prices could be determined (all but p_{22} for for-profit producers). The multi-market monopoly model allowed us to estimate the remaining price.

The criteria we developed to make our evaluations included revenue effects together with benefit and cost categories based on economic efficiency. It is well known in CBA that public sources of funds entail more of a cost than private sources because they require taxation and taxes involve an excess burden. However, one of the important insights stemming from our evaluation is that when there are public and private buyers as well as producers, private revenues interact with public revenues and can also have an impact on excess burden directions. Hence our criteria of privatization recognized that public revenues would still be required to pay for government clients even if privatization did take place. So

no differential excess burden was involved for these clients. On the other hand, private revenues going to public producers lessen the need for taxation if privatization does not take place and thereby lead to excess burden reductions.

Our main finding was that privatization was economically worthwhile only for certain kinds of client and particular forms of organization. Privatization via for-profit NFGHs was worthwhile, but would have been adverse if the excess burden of revenue effects were ignored. The result for nonprofits was exactly the opposite, with a negative overall outcome being reversed without including the excess burden in the calculations. Privatization is a multi-dimensional option. On the basis of our findings we can suggest that, in assessing the desirability of further privatization of psychiatric hospitals in the US, it needs to be specified whether the new private producer is to be for- or nonprofit, and whether it is to be selling to private and/or government clients.

However, it is important to emphasize that the main contribution of the paper is in developing and refining a cost-benefit framework that includes user fees. The application of the framework to psychiatric hospitals was based on data that required a series of very strong assumptions. Hence, the application is not intended at this stage to show the full effects of privatization in mental health, as more appropriate data would be required in order to generate a firm evidence-base conclusion.

In their review of the new generation of privatization decisions of mental health in the US, Donohue and Frank (2002) point out that privatization can involve three main functions:

there is privatization of production, financing and management. Privatization of production, which is the main topic of this paper, continues to expand in the form analyzed here. In 1969, NFGHs had roughly the same 37 percent share of 24-hour hospital and residential admissions as State and County Mental Hospitals. By 1994, NFGH's 47.1 percent share was over four times that of SMCH's 10.5 percent share.

Privatization of financing, whereby private funds can substitute for public funds, has not taken place. Although the average annual growth rate of payments from private sources rose by 6 percent between 1986 and 1996, the increase from public sources rose even greater at 8.3 percent. Thus the mechanism highlighted in our analysis of privatization in which the public sector has to give up revenues to the private sector to continue care still takes place. This is clearly illustrated in the data presented by Nierman and Lyons (2001) in their evaluation of the effects of closing down the Illinois State psychiatric hospital in Chicago. In 1997 when the state ran the hospital, public expenditures were $12 million. When the services were carried out in the community in 1999, state expenditures fell to $1.5 million (and Medicaid paid a further $0.78 million). However, nonhospital resources shifted to the community rose from zero to $10.6 million. So there were no net public sector revenue savings. With no privatization of financing, the *MCF* will continue to play the important role emphasized in our CBA framework.

The third and final function that can be privatized is the management of services. Medicaid finances much of the deinstitutionalization of clients from the state hospitals out into the community. Recently Medicaid programs have used managed care providers. The process, called "carve out", involves states separating mental health or substance abuse

services from other health benefits and contracting for these benefits to be managed by a specified organization. Sixteen states have carved out part or all of the Medicaid behavior health benefit for Medicaid recipients. Donohue and Frank conclude that ownership status was not a good guide to the success of the managed care organization. What is particularly interesting about the experience of the sixteen carve out states is that of the ten who did not contract only with public entities, some held contracts with either for-profit or nonprofit corporations exclusively. It would seem that, consistent with our CBA results, that the desirability of privatization does depend very much on the particular private sector type with whom the state is contracting.

Appendix: The methods used to derive the data used in the CBA calculations

The way that the prices, costs and quantities were derived from the CMHS revenues and expenditures is as follows. The crucial assumption is that of constant costs. From this assumption, for all sectors, we not only deduce average costs, but also marginal costs. From marginal costs (for the public sector) and average costs (for the nonprofit sector) we determine prices. The key estimation equation therefore is that we find the cost per unit by dividing total costs by quantity, where total costs are measured by total expenditures:

$$c_i = C_i / q_i \qquad \text{(A.1)}$$

For the private for-profit hospitals we build our estimates around the profit maximizing, multi-product, monopoly model presented below. We also assume price equals marginal cost, but only for the public clients, i.e., $p_{21} = c_2$ [this is equation (A.5) below]. For the price and the quantity sold to the private sector, i.e., p_{22} and q_{22}, we use two interrelated steps. From (A.8) we have $p_{22} = (\Pi_2 / q_{22}) - c_2$. We already know c_2, and can find Π_2 from subtracting revenues from costs, but q_{22} has to be determined. We solve this by first finding q_{21} from R_{21} / p_{21} ($= R_{21} / c_2$) $= q_{21}$ and then using $q_{22} = q_2 - q_{21}$. Note

that, just for the private for-profit sector, we are estimating the episodes sold in each market because the CMHS data only gives us the total q_2 sold in both markets. It is because CMHS gives us data on revenues that go to each client (R_{21} and R_{22}) that we can deduce the quantities in each sub-market and hence the prices.

All that remains is to explain the multi-product profit maximization model that was used to determine the private for-profit sector price p_{22} and quantity q_{22}. We assume that for-profit firms operate as multi-product monopolies where each hospital produces in a single production unit, but trades in two separate markets, selling to the government and selling to the private sector. The special case of this model that we will be considering is one where the hospital sells to the government at a fixed price p_{21} (equal to the constant marginal cost c_{22}), but sells to the private sector at a price that the market will bear, given by the inverse demand curve $p_{22}(q_{22})$. Sales revenues to the two sets of clients would then be:

$$R_{21} = p_{21} . q_{21}; \qquad R_{22} = p_{22}(q_{22}). q_{22} \tag{A.2}$$

Output will be produced at a constant cost per unit that is the same irrespective of the sector doing the buying. Total costs C_2 depend on the cost per unit c_2 and the total output produced:

$$C_2 = c_2 (q_{21} + q_{22}) \tag{A.3}$$

Utilizing equations (A.2) and (A.3), we can write the profit equation as:

$$\Pi_2 = \Pi_{21} + \Pi_{21} = p_{21} . q_{21} + p_{22}(q_{22}). q_{22} - c_2 (q_{21} + q_{22}) \tag{A.4}$$

The profit-maximizing conditions for private and public clients are:

$$p_{21} = c_2 \tag{A.5}$$

and

$$MR_{22} = c_2 \qquad \text{(A.6)}$$

where MR stands for marginal revenue. Equation (A.6) confirms that pricing at marginal cost (equals average cost) is optimal also for for-profit firms selling to the government. If we now substitute equation (A.5) into equation (A.4), we can see that any profit or loss is generated exclusively by sales to the private sector:

$$\Pi_2 = (p_{22} - c_2)\, q_{22} = \Pi_{22} \qquad \text{(A.7)}$$

Rearranging equation (A.7) produces:

$$p_{22} = (\Pi_2 / q_{22}) + c_2 \qquad \text{(A.8)}$$

That is, we can estimate the price charged by the for-profit hospitals to private clients by adding the profit per unit sold to private clients to the average cost per unit.

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