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INCENTIVES, OPTIMALITY, AND PUBLICLY PROVIDED GOODS: THE CASE OF MENTAL HEALTH SERVICES

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ABSTRACT

In this paper we investigate the incentives present in intergovernmental transfers for public mental health care. This represents an important issue due to the large portion of mental health care that is provided by local governments, the central role of states in financing care via intergovernmental transfers, and recent innovations adopted by some states altering the traditional terms of these transfers. Using a relatively simple model we show that when a state government provides both financing and a free input into local government production there will be excessive use of that input. If the preferences of society and those of the local provider of service are identical, this problem can be remedied by simply charging the provider a price equal to marginal cost for use of the input. If, however, the provider and society differ in their preferences, setting the price of the input at marginal cost will not induce optimal behavior, nor will the imposition of capacity constraints. Setting the correct Pigovian subsidies and taxes may induce social optimality. However it is unlikely that optimality will be achieved if the budget for the public good is fixed. The optimal prices are proportional to the sum of the elasticities of the provider's supply of services with respect to the subsidy (tax). These results are directly analogous to those for optimal commodity taxation.

Examination of the transfer contracts for Wisconsin, Ohio and for Texas reveals that these contracts may not be optimal. These departures from optimal decisions may be partially due to the practical issues related to implementation of optimal transfer arrangements, e.g., setting subsidy or tax levels or imposing budget reductions.

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I. INTRODUCTION

A. Background

The provision of governmental services has long been a decentralized activity. State and local governments are the dominant units of production for non-defense publicly provided goods and services in the United States. The financing of government goods and services, in contrast, has increasingly been centralized at higher levels of government (Inman, 1987a). States have become more dependent on federal revenues, and likewise local government on state transfers. As the size of intergovernmental transfers grows, the terms of exchange governing the transfers are of increasing importance as instruments of public policy. Since the exchanges represented by transfers are made outside markets, one can view the terms of such transfers in a manner akin to incentive contracts. That is, the rules under which intergovernmental transfers are made can be structured to influence the behavior of the decentralized producers of public services.[1] The research presented here considers public policy towards intergovernmental transfers and how it can be used to alter the utilization patterns for publicly provided services. The specific case we study is state government financing of local government provision of mental health services.

Using a relatively simple model, we show that when a state government provides both financing and a free input into local government production there will be excessive use of that input. If the preferences of society and the local government provider are identical, this problem can be remedied by charging a user fee to local governments equal to the marginal cost of the

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[1]See Inman (1987b) for an excellent review of the literature on fiscal federalism and intergovernmental grant mechanisms.

input. If the preferences of society and the provider differ, we show that this strategy will not result in a first-best solution. A set of optimal prices are found which are proportional to provider supply elasticities.

We analyze the incentives present in the transfer systems of the states of Wisconsin, Texas, and Ohio and discuss some empirical evidence on their impacts.

B. Mental Health Care

Approximately 18% of the population at any one time is affected by mental disorders (Locke and Regier, 1985). Expenditures for treatment of these illnesses were estimated to be $32.5 billion in 1985, or 1.2% of national income. Approximately 40% of that total is accounted for by various levels of government (Goldman and Frank, 1985). State government plays a major role in the public financing of mental health care. State mental health agencies spent roughly $8.3 billion in 1985 on direct service provision[2]. This constituted roughly 2.2% of total state expenditures and 3.5% of non personal income transfer expenditures (U.S. Bureau of the Census 1986).

The past 30 years have witnessed dramatic shifts in the locus of treatment for mental disorders, which have had important implications for the public provision and financing of mental health care in the United States. In 1955, care to the severely mentally ill was provided via 559,000 beds in State mental hospitals. This was the basic source of care for 80% of the chronically mentally ill persons in the United States in 1955 (Burt and Pittman, 1985). By 1985, however, there were only about 130,000 beds serving

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[2] This does not include what has been estimated to be spent on mental illness via the Medicaid program.

the chronically mentally ill in state mental hospitals (Manderscheid and Barrett, 1987). Most of the accompanying reduction in care offered in state hospitals occurred from 1965 to 1980. During that time, the number of resident patients in state mental hospitals fell at a rate of 6% per year (Gronfein, 1985).

In spite of these important shifts in the locus of care for publicly supported mental patients and the growth in state mental health budgets over the same period, the budget share of state mental hospitals has remained remarkably stable, at about 66%, since the 1970s (Glover et al., 1985; Mazade et al, 1987).[3] This composition of expenditures has been viewed by numerous students of the mental health system to represent an imbalance (Mechanic, 1987). It is also viewed as an impediment to expanding funding of community mental health programs in states under tight budgets. One possible reason for this discrepancy between patient and expenditure shares is that county providers of mental health care may view the public mental hospital as a "free good" to which they may send the most difficult to treat patients and thereby avoid the need to take responsibility for their care.[4]

State mental health policy makers have two main policy instruments at their disposal for changing the balance between state mental hospital and community based program funding. These are: 1) the use of capacity constraints on the availability of state mental hospital beds, and 2) the use of incentive payments incorporated in intergovernmental transfers. The use of

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[3] Useful summaries of some of the major transformations in the mental health care system can be found in recent work by Mechanic (1987), Grob (1983, 1987) and Brown (1985).

[4] Of course there are other possible reasons: e.g., diseconomies realized due to smaller scale, unionization, or rising input prices.

capacity constraints appears to be a simple means of achieving the desired level of public mental hospital use. However, the politics of state mental hospital systems often make extensive reliance on this instrument complex and costly. Public employee unions, the affected communities, and some patient groups have mounted strong opposition to the closing of public mental hospitals and to shrinking state hospital systems (Frank and Welch, 1982). This opposition has resulted in long delays in hospital closures, restrictive legislation, and costly labor negotiations. States may view reliance on incentive mechanisms as more attractive than capacity constraints because they reduce opposition to decreased hospital budgets from both communities and patient groups. Incentive mechanisms may also allow for more gradual and less politically visible shifts in resources.[5]

As states search for strategies to realign expenditures on mental health services they are experimenting with a broad set of alternatives.[6] The object of the remainder of this paper is to consider capacity constraints and a number of incentive schemes for making intergovernmental transfers in terms of their economic welfare properties. The paper is organized into six sections. The second section presents the basic model. The social optimum and results on optimal incentives are described in Section III. Examples of existing incentive transfer mechanisms are portrayed in Section IV. Conclusions are drawn in the final section of the paper.

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[5]See Cordes and Weisbrod (1983) for a review of such mechanisms.

[6] A number of states have adopted various incentive schemes to at least partially form the basis of intergovernmental transfers to specific localities. We believe that the case of public mental health services provides some useful lessons that can be applied to a variety of other local public goods that depend heavily on intergovernmental transfers for financing.

II. THE MODEL

A number of state governments have introduced incentive contracts for local governments which lead to sharing of fiscal and administrative authority for the provision of care for the mentally ill. Although these contracts are relatively new in the public sector, the economic theory of incentive contracts is well developed.[7] The model draws on that theory to describe the behavior of a local government bureau charged with providing mental health services (referred to as a local mental health authority or LMHA) financed, at least in part, by state government.

The LMHA is a quasi-independent bureau of local (usually county) government charged with providing mental health services which are financed in part by transfers from the state. The LMHA is assumed to determine the quantities and types of treatments received by patients. Treatment options consist of care in the community or care in the state mental hospital system. The LMHA receives utility from the mental health of residents in the locality but incurs disutility from the number of "difficult" patients treated (U.S. General Accounting Office, 1977).[8]

We identify two main types of patients that receive mental health services, indexed by i=1,2. "Less desirable" patients are referred to as type 1's, and type 2's are called "more desirable" patients. For example, type 1's may be non-compliant and difficult to treat individuals with severe mental

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[7] See the excellent survey by Holmstrom and Tirole (1989).

[8] This is a representation which is intended to convey the disutility associated with treating type 1's. Other representations may include treating the percentage of the case load as determining the level of disutility. There is extensive clinical evidence indicating that there is a segment of the mentally ill population which is substantially more difficult to treat, namely the severely mentally ill (Bachrach 1982).

illnesses whereas type 2's may be cooperative and less severely ill. Type 1's have poor prognoses, are less pleasant, and may be more costly to treat.

The LMHA maximizes a preference function which depends positively on the mental health of a representative mentally ill community resident of each patient type, H_i, and negatively on the number of treatments to a representative type 1. This may be expressed as

$$U = u(H_1, H_2, Q_1) , \qquad (1)$$

where u is monotonically increasing in H_1 and H_2, monotonically decreasing in Q_1, and is strictly quasi-concave.[9]

The mental health of each representative mentally ill resident of type i is produced with community treatments received by them, Q_i, and treatments in the state mental hospital received by them, A_i, according to a monotonically increasing and quasi-concave health production function

$$H_i = h_i(Q_i, A_i), \qquad i=1,2. \qquad (2)$$

Assume that state hospital and community treatments are produced subject to constant returns to scale, so that

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[9] Any other arguments in the utility function, such as a composite public commodity (e.g., expenditures on all other county goods or services) have been omitted. This is because we wish to focus on the choice of treatment in the community or in the state mental hospital, not on the tradeoff between public provision of mental health services and other goods. This amounts to the assumption that utility is strongly separable in mental health services and other goods.

$$C(Q_1, Q_2, A_1, A_2) = C_1Q_1 + C_2Q_2 + C_3A_1 + C_4A_2, \qquad (3)$$

where C_1, C_2, C_3, and C_4 are positive constants. The LMHA is constrained to incur costs (C) equal to its budget (B), $B = C$.[10]

III. INTERGOVERNMENTAL TRANSFERS AND EFFICIENCY

In this section we consider the social welfare implications of state provision of both financing and a free input to local government production. We label the situation where the LMHA receives a fixed budget as total revenue and bears no financial responsibility for use of the state mental hospital as the baseline case. That corresponds to what has been historically prevalent until recently. This transfer system is shown to be non-optimal. Providing state hospital treatments as a free good to LMHAs leads to their overuse. The method used to achieve optimality depends on the structure of social preferences. Two alternative sets of assumptions about the congruence of LMHA and local preferences are considered.[11] In the first case, social preferences are identical with those of the LMHA. In this case it suffices to price state mental hospital services to the locality at marginal cost. Social preferences and LMHA preferences are assumed to diverge in the second case. The solution

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[10] We assume that the total budget (state plus local) for mental health has been set optimally, e.g., as in two-stage budgeting.

[11] We assume that public aspects of mental health care are local in nature. For example, if the public aspect of mental health care is that those with poor mental health impose negative externalities on others (e.g., antisocial behavior, crime) these external effects are largely confined to the local community. If individuals derive positive externalities from the receipt by others of mental health care, these effects are also strongest at the local level. Thus, spillovers across communities are not a major concern.

for that situation is more complex than under congruent preferences.

Optimal use of community and state hospital treatments is defined by the maximum of utility subject to the breakeven constraint (B=C), where costs include the cost of state hospital use.[12]

In the baseline case the LMHA's budget constraint is

$$B = C_1Q_1 - C_2Q_2. \qquad (3')$$

In considering the baseline case we add a second constraint that defines the capacity of state hospital systems: $A_1 + A_2 \leq A_{max}$ where A is defined as state hospital use.[13,14]

The LMHA's problem is to choose the mix of community and hospital treatment for both patient types subject to the budget and capacity constraints.

A. Congruent Preferences

Consider first the question of social optimality under congruent preferences. Social and LMHA preferences are assumed to be identical in order to focus on the pure effect of the incentives of intergovernmental transfers. The social preference function is given by equation (1) above. Q_1 enters the social utility function to indicate the greater negative externalities that

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[12] We ignore issues associated with the financing of such expenditures.

[13] Since the state hospital is a free good, some limit on use is required to close the system. In reality, states which provide state hospital use free of charge do impose some limits on utilization.

[14] This remains the case in many states, e.g., Indiana, Maryland, Massachusetts, New York, and North Carolina.

the presence of type 1 patients impose on community residents. This is consistent with some observations that community residents often prefer to have the severely mentally ill (type 1's) removed from the community (e.g., Segal et al., 1980). The social costs of community and state hospital treatments reflect the fact that society must bear the full pecuniary costs of all treatments.

The first-order conditions are (where L is the LaGrangian objective function and λ is the LaGrange multiplier associated with the net revenue constraint)

$$\frac{\partial L}{\partial Q_1} = \frac{\partial u}{\partial H_1} \cdot \frac{\partial h_1}{\partial Q_1} + \frac{\partial u}{\partial Q_1} - \lambda C_1 = 0, \tag{4}$$

$$\frac{\partial L}{\partial Q_2} = \frac{\partial u}{\partial H_2} \cdot \frac{\partial h_2}{\partial Q_2} - \lambda C_2 = 0 \tag{5}$$

$$\frac{\partial L}{\partial A_i} = \frac{\partial u}{\partial H_i} \frac{\partial h_i}{\partial A_i} - \lambda C_{2+i} = 0, \qquad i=1,2 \tag{6}$$

and

$$\frac{\partial L}{\partial \lambda} = B - C_1Q_1 - C_2Q_2 - C_3A_1 - C_4A_2 = 0. \tag{7}$$

The socially optimal levels of community and state hospital treatments are implicitly defined by equations (4) - (7).

The baseline system does not lead to optimal levels of state hospital treatments even if the preferences of the LMHA and society are identical.

This is because social optimality requires that the LMHA take the marginal cost of state hospital use into account when making treatment decisions. The LMHA's choice of community treatment for type 1 patients meets the marginal condition for efficiency since it faces the marginal cost of its use of community based care.

Socially optimal levels of A can be achieved by setting a capacity constraint. The problem with using capacity constraints is that too many community treatments will be provided due to the effect of free hospital care on the LMHA budget.[15] Alternatively, an optimal mix of services can be achieved by making the LMHA fiscally responsible for use of the public mental hospital system.

This result is illustrated in Figure 1. BB represents the LMHA's budget line in the baseline case where state hospital services are a free good. DD represents the true costs of community and state hospital treatments. This is the social budget constraint. Let there be a capacity constraint for state hospital use denoted by A_{1max}. The social optimum is at the tangency between the indifference curve U_oU_o and DD. The LMHA chooses point L_o under the baseline system. It is easy to see that, for the case where LMHA and social preferences are identical, achieving social optimality is simply a question of charging the LMHA for the cost of state hospital use. Note, that in the case illustrated charging LMHAs for state hospital costs implies reduced use of state hospital care and increased community treatment for type 1 patients.

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[15] This is analogous to an income effect. Reducing the LMHA's budget, in combination with the capacity constraint, can bring the LMHA to the socially optimal output levels. Reducing the budget will not be optimal, however, since the original level of the budget represents the socially optimal level of expenditure on mental health care.

B. Divergent LMHA and Social Preferences

Although it is illustrative to focus on the case where social and LMHA preferences coincide in order to facilitate analysis of contracting incentives, in reality the preferences of society and those of the LMHA may differ.[16] We now consider such a case.

We assume that the health of both types of patients are the only arguments in the social utility function. Assume further that LMHA preferences are additively separable in the health variables and Q_1, and let LMHA and social preferences over health have the same functional form and be monotonically increasing and strictly concave in H_1 and H_2.[17] The social utility function is

$$W = u(H_1, H_2), \tag{8}$$

and the LMHA preference function is

$$U = u(H_1, H_2) + v(Q_1). \tag{9}$$

The LMHA experiences disutility from treating type 1 patients, but society does not. For example, it appears that clinical staff find treating nonresponsive and noncompliant patients difficult and distasteful. This

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[16] This divergence of the LMHA's preferences from those of society at large may be due to the bureaucratic nature of LMHA's. As described by Niskanen (1971), bureaucracies are more likely to pursue their own separate objectives when it is difficult for the polity to observe the output of the bureau and when there is uncertainty about the technology of production. Both of these conditions are satisfied by mental health services.

[17] The assumption of additive separability is for clarity in exposition. All that is necessary is that Q_1 be an argument which is present in the LMHA's preference function but not in that of the larger society.

representation will be referred to as the case of divergent preferences.[18]

If social and LMHA preferences are not identical, the optimality conditions differ from the case of identical preferences in an important way. Leaving the break-even constraint the same, the relevant first-order conditions for the social optimum are[19]

$$\frac{\partial u}{\partial H_1}\frac{\partial h_1}{\partial Q_1} - \lambda C_1 = 0, \tag{10}$$

$$\frac{\partial u}{\partial H_2}\frac{\partial h_2}{\partial Q_2} - \lambda C_2 = 0, \tag{11}$$

$$\frac{\partial u}{\partial A_i}\frac{\partial h_i}{\partial A_i} - \lambda C_{i+2} = 0, \; i = 1,2 \tag{12}$$

Comparing the first order conditions for community treatments for the LMHA and for society, the difference is equal to the LMHA's marginal disutility of treating type 1's, $\frac{\partial v}{\partial Q_1}$. The expression for Q_1 is clearly negative, indicating that LMHA's provide too few community treatments to type 1 patients. Hence, if providers experience disutility associated with treating type 1 patients, they will undertreat these individuals relative to the socially preferred level.

Comparing the first order conditions for state hospital treatments for

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[18] We do not consider the process by which individual preferences are aggregated to social preferences, since we focus on the behavior of the LMHA in response to transfer policies. We intend to examine issues of political economy in an extension and public choice becomes salient there.

[19] Omitting the first order condition for the revenue constraint.

the LMHA with the first-order conditions for society results in the same expression for their difference as in the congruent preferences case. While an optimal value of state hospital use can be achieved by making the LMHA responsible for those costs, making the LMHA responsible for state hospital costs alone will not achieve the social optimum. This is because the levels of community treatments are not optimally chosen. An additional requirement is a set of subsidies to the LMHA to overcome the disutility associated with treating type 1 patients. This means that the social optimum can be reached by paying a per-unit subsidy equal to the marginal disutility of community treatments of type 1 patients.[20]

I. Optimal Incentives

Since simply charging the LMHA for state hospital (marginal) costs alone will not restore optimality, optimal incentive contracts involve subsides or taxes related to all of the LMHA's choice variables. Analysis of this problem is analogous to that of a von Stackelberg game in which society (i.e., state government) is the leader and the LMHA the follower. In this case, the relevant constraints are LMHA behavior and a balanced budget.

State government moves first in setting "prices", (i.e., per unit subsidies or taxes for each of the services chosen by the LMHA) given the LMHA's reaction functions, and then the LMHA chooses the levels of treatments, given prices. The optimal "prices" are the prices for community and state

[20] An example of this type of mechanism is currently being used in Ohio. Intergovernmental transfers to community mental health boards in Ohio depend, in part, on the number of individuals who meet clinical criteria that define them as severely mentally disabled. The definition of the severely mentally disabled is closely related to our characterization of type 1 patients.

hospital treatments which maximize social welfare, constrained by the combination of treatments that the LMHA will choose under a balanced budget.

First consider the behavior of the LMHA. The LMHA maximizes its preference function (1) as before, subject to its budget constraint. The budget constraint is now

$$NR = B-(C_1+S_1)Q_1-(C_2+S_2)Q_2-(C_3+S_3)A_1-(C_4+S_4)A_2 = 0, \qquad (13)$$

where the S's are per-unit subsidies or taxes. This is directly analogous to the analysis of subsidies and taxes in the theory of the consumer. Increases in the subsidy of a treatment will increase the amount chosen, and vice versa. Cross-price effects depend on substitution or complementarity in consumption. The LMHA's optimizing choices of the Q_i's and A_i's are implicitly defined by the first order conditions to the LMHA's utility maximization problem as functions of per-unit costs, subsidies, and the budget,[21]

$$Q_i = q_i\ (B,\ C_1,\ C_2,\ C_3,\ C_4,\ S_1,\ S_2,\ S_3,\ S_4),\ i = 1,2 \qquad (14)$$

and

$$A_i = a_i\ (B,\ C_1,\ C_2,\ C_3,\ C_4,\ S_1,\ S_2,\ S_3,\ S_4),\ i = 1,2. \qquad (15)$$

These act as constraints on society's choices of subsidies/taxes.

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[21] The FOC are relegated to an Appendix for the purpose of brevity.

Society's problem is to choose S_1, S_2, S_3, S_4 to maximize social utility (equation 8), subject to the reaction functions (14) and (15) of the LMHA (these are usually referred to as incentive-compatibility constraints in principal-agent problems), and subject to the budget-balancing constraint. The results can be stated in terms of a proposition.

Proposition

The vector of optimal taxes and subsidies will involve setting those prices proportional to subsidy/tax supply elasticities. These prices will not be equal to marginal costs.

Proof

See the Appendix.

The solution for the vector of optimal subsidies specified in the Appendix reveals that each subsidy is a function of its own and cross subsidy elasticities of demand (see equations A10 - A13 in the Appendix)[22]. This means that optimality requires that the entire vector of subsidies be chosen simultaneously. Otherwise, a subsidy on only one input in the mental health production function will cause an inefficient distortion in the use of the other non-subsidized inputs.

Figure 2 illustrates this situation for type 1 patients. The social optimum is at point S_o, where the social indifference curve W_oW_o is tangent to the "true" budget line DD. The LMHA chooses point L_o in the baseline case.

[22] This is directly analogous to results from the literature on optimal taxation. See Starrett (1988) for a summary.

The levels of state hospital treatments are lower and community treatments are higher at the social optimum than those chosen by the LMHA in the baseline case L_o[23]. U_2U_2 represents an indifference curve for the LMHA, where the LMHA values community treatments less highly relative to state hospital treatments than does society. In the case where the LMHA bears the full costs of state hospital care the equilibrium is at point L_1. State hospital use actually increases, in the example, relative to the baseline case and community treatments are reduced.

The socially optimal point can be achieved by setting the LMHA's budget so that it faces budget line GG. It will then choose point S_o. This can be achieved by setting a per-unit subsidy as described above. This will alter relative "prices" in the manner illustrated by GG. This will not necessarily be budget neutral, however.

The implication of this result is that the overall social optimum, or the first-best, is not necessarily achieved. In order to achieve the social optimum with respect to the various types of treatments it may be necessary to increase expenditures on mental health. Assuming that the previous allocation of resources in society was otherwise optimal, however, reallocating resources to mental health would reduce overall social welfare.

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[23] Note that the excessive use of community treatments for type 1's is an artifact of the two-dimensional representation of choice in the graph. In reality, the budget savings due to free use of the state hospital will be spent on more preferred factors: treatments of type 2 patients (or emoluments, although they are not included in our model).

IV. Observations on the Use of Incentives and Capacity Constraints

The majority of state mental health policies regarding local use of public mental hospitals can be classified into three broad categories. They are: 1) utilization control (primarily by placing tight constraints on the availability of public mental hospital beds),[24] 2) using persuasion and administrative procedures to control use (this corresponds most closely to the base case)[25], and 3) the use of incentives in making intergovernmental transfers to local mental health programs[26].

The approach to using incentives has differed markedly across states adopting such an approach. We briefly describe three sets of state policies that represent the diversity of strategies.

A. Wisconsin

Wisconsin was the first state to adopt performance contracting with local providers, starting in 1973. The LMHA has complete authority for all fiscal, administrative and clinical decisions. The LMHA receives a fixed part of its budget as a transfer from the state based on the LMHA's request and on historical levels of expenditure, inflation and population growth. The locality must provide 9% in matching funds and can collect and retain patient fees for care provided. The LMHA also receives a block grant transfer based on

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[24] States such as California, Colorado, Arkansas, Hawaii, Nevada and Utah have taken this approach. Wisconsin now also has a relatively low number of beds per capita after a decade of relying on strong financial incentives.

[25] States in this category include Maryland, New York, Pennsylvania, North Carolina, New Jersey and Indiana.

[26] States in this group include Michigan, Ohio, Wisconsin, Rhode Island and Texas.

its historical use of the state mental hospital. The LMHA is then responsible for all costs of patient care, regardless of whether it occurs in the community or in the public mental hospital (Stein and Ganser 1983). Hospital charges are calculated according to average costs.[27]

The Wisconsin case will unambiguously reduce use of state hospital care relative to the baseline case. This reduction occurs because state hospital use is no longer a free good to the LMHA. If LMHA and social preferences are identical, the Wisconsin system leads to optimality via correct pricing of state hospital services.

If the preferences of the LMHA and society differ, however, the first-best solution will not be achievable, as demonstrated in Section III.B. This will be true even if the charge for state hospital services equals marginal cost. In this case, the outcome under the Wisconsin approach will correspond to point L_1 in Figure 2. It is unclear whether state mental hospital use will be reduced relative to the baseline case. The LMHA will clearly not choose a socially efficient combination of state hospital and community treatments.

B. Ohio

The Ohio system is based in part on existing allocation mechanisms and partly on legislation that went into effect in July of 1989 (the Mental Health Act of 1989). Two key components are relevant: 1) an existing subsidy payment for treating severely mentally disabled patient, and 2) a method of making the LMHA responsible for state mental hospital costs. In July of 1989 the state of

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[27] Since there is considerable evidence that state hospitals produce according to constant returns this is likely to be a reasonable approximation to marginal cost (Frank and Welch, 1982).

Ohio began to phase in an approach to intergovernmental transfers that makes county mental health boards financially responsible for use of state mental hospitals[28]. For the fully phased-in program each county mental health board gets a yearly allocation based on its historical use of the state mental hospital system[29]. The state has also set up a risk fund, financed by the mental health boards. The boards bear all costs of state hospital use up to the amount of the payment they receive from the state. For costs incurred for 100% to 105% of the state payment there is 50% cost sharing between the risk pool and the board. In cases where incurred costs amount to between 106% and 110% of the state allocation the board pays 25% of the costs. Costs between 111% and 115% are fully covered by the risk pool and any expenses above 115% are borne fully by the local mental health board.

The second component of the Ohio approach has been in place for some time. The state bases a significant portion of the allocation of community treatment dollars on the number of severely mentally disabled individuals served by the local mental health board. There is a certification process defined by the state in which a set of criteria must be met in order to classify an individual as severely mentally disabled. County mental health boards therefore receive additional transfers from the state based on the number of severely mentally disabled individuals. These individuals correspond quite well to our characterization of type 1 patients.

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[28] Local public mental health care is the responsibility of county special districts. These quasi-public mental health boards have taxing authority. Property tax levies are set according by referenda.

[29] The program is phased in as follows: in year 1 each board gets a payment based on 10% of historical use, year 2-20%, year 3-40%, year 4-60%, and year 5- 100%.

In combination, the two elements of the Ohio approach to making intergovernmental transfers for publicly financed mental health services has desirable incentives for the case where LMHA and societal preferences are divergent. They include making the LMHA consider the economic consequences of using state mental hospital services and subsidization of type 1 patients. The key parameters for correctly specifying the incentive structure are the cost of state hospital services and the subsidy for treating severely mentally disabled patients. Ohio uses a measure of average cost to set the "price" of state hospital services. This is probably a reasonable approximation to marginal cost. Our model implies that the appropriate subsidy rate is the dollar value of the disutility of treating type 1 patients. In practice, the allocation for the care of these individuals appears to be based on aggregate mental health budget appropriations from the legislature, some assessments of additional treatment needs of this population, and some recognition of the difficulties associated with serving the severely mentally disabled. This latter consideration may be viewed as disutility compensation. Thus it is unlikely that the subsidy is correctly set.

It is important to note that the risk pool weakens the incentives for the board to choose the socially efficient levels of both community and state hospital care. This is a small part of the total transfer and its impact is likely to be modest.

C. Texas

The incentive contract in Texas is commonly referred to as "the thirty-five fifty program", since its salient feature is that LMHAs are paid $35.50 for each day of state hospital care that is averted below a certain target.

The target level is based on historical utilization of the state hospital for a geographic area served by an LMHA. A payment is then made for each day falling below the target level [30].

Since the Texas case is quite different in its specifics from the general cases we have discussed we present its features in Figure 3. Figure 3 illustrates the LMHA response to this system. BB is the budget line in the baseline case. L_o is the equilibrium point for the LMHA in the baseline case. DFB represents the LMHA budget under the bonus system with the per-unit bonus set at p. If the LMHA's preferences are as represented by U_oU_o, there will be no response to the bonus system and L_o will continue to be the point chosen. If, however, LMHA preferences look like $U_o'U_o'$, i.e., if the marginal rate of substitution of state hospital treatments for community treatments is less than society's, then the LMHA will respond to the bonus p and the equilibrium will be at L_o', where state hospital use is below the target.[31]

Budget EFP corresponds to a higher per unit bonus, p>p. At this bonus there is an equilibrium in which the LMHA responds to the bonus and chooses state hospital use below the target. This demonstrates that there exists some per-unit bonus at which the LMHA will choose to operate in the region $A<\bar{A}$, due to continuity and strict quasi-concavity of the utility function. This bonus will not necessarily be equal to per-unit cost. It will depend on the structure of preferences and the distance $A_{max}-\bar{A}$.

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[30] The average cost of a day of care in a state mental hospital in Texas appears to have been roughly $200 in 1985. Thus $35.50 has little relation to those expenditures.

[31] Note that, although Figure 3 shows no increase in utility under the bonus, it is possible that a tangency with DF could be achieved on a higher indifference curve.

Even if the LMHA responds to the bonus the point chosen will not be socially optimal. The reason is that the LMHA is not facing true social costs, since the bonus program only covers part of the range of choice possibilities. Referring to Figure 3, it can be seen that any point chosen by the LMHA lies outside BC. It is possible that the LMHA could choose a point which lies on the social indifference curve WoWo, e.g., if W_oW_o and U_oU_o cross at L_o. Even if that is so, achieving a point like L_o requires greater expenditure than achieving S_o. If the budget for mental health services is fixed, points on the line segment EF (or DF) are not achievable. If it is possible to increase the budget, that implies that consumption of some other commodity(s) must be reduced, therefore reducing overall welfare.[32]

The drawback of this system relative to those in Wisconsin and Ohio is that the first-best cannot be achieved, even if LMHA and social preferences are identical, whereas the Wisconsin system will achieve the first-best under these circumstances. This is simply due to the incompleteness of the contract described in (29). The remarks relative to the second-best made for the case of Wisconsin are also operative here.

D. Experiences to Date

There is a growing body of evidence related to the results of various strategies for controlling use of public mental hospitals. As might be expected, where tight constraints on bed capacity have been imposed, utilization of public mental hospitals is quite low. In states such as Colorado and California (where there are 29 and 22 beds per 100,000 population

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[32] This is true regardless of assumptions about separability of preferences across commodities.

compared to a national average of 52) the level of utilization is quite low: 111 admissions per 100,000 population in Colorado and 59 per 100,000 in California, versus 191 per 100,000 in the nation overall[33]. Most states, however, have not been able to impose strong constraints on state hospital capacity.

The experience of Wisconsin serves to illustrate some of the difficulties related to setting correct financial incentives. The state of Wisconsin in many ways represents a success story. The response to incentives in Wisconsin is startling. In 1972 Wisconsin had 230 state and county mental hospital beds per 100,00 population. By 1986 the number of state and county hospital beds had fallen to 36.4 beds per 100,000 population. There was no significant increase in other types of inpatient psychiatric beds.[34] As a result 47% of the state's mental health budget is devoted to public mental hospitals (Stein, 1989). This compares to 67% nationally. There is considerable variation in the percentage of LMHA budgets being devoted to hospital care in Wisconsin. It ranges from 13% to 73%. This may be indicative of heterogeneity in LMHA preferences regarding treatment of the less desirable patients. Also, over the years there has been a dramatic shift of patients from public mental hospitals to nursing homes. This is due to the fact that Medicaid programs will pay for care in nursing homes and the cost is divided between federal and state government (at between a 50% and 30% cost to states). The price of nursing home care to the LMHA is therefore zero. This

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[33] These data are for 1985 and are based on Statistical Note #189 from the Division of Biometry and Applied Sciences, National Institute of Mental Health.

[34] These data are from NIMH Statistical Note #155 and NIMH (1990).

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the strength of the incentives are growing.

The response to the subsidy associated with care of the severely mentally disabled (SMD) has also been quite strong. The average number of SMD patients treated per 100,000 population across Ohio counties prior to the implementation of the subsidy program was 229. In the post subsidy period that number grew to 307. This represents a 34% increase and was significant at the 1% level using a 1 tailed t test.

V. Summary and Conclusions

In this paper we have investigated the incentives present in intergovernmental transfers for publicly provided goods. Mental health care has been employed as an example due to the large portion of mental health care that is publicly provided by local government, the central role of the state in financing this care through intergovernmental transfers, and recent innovations adopted by states in altering the traditional terms of these transfers.

The approach to the analysis is very Pigovian in character and allows us to obtain a number of strong results using a relatively simple model. State governments have two general classes of policy instruments at their disposal: capacity constraints and the terms of intergovernmental transfers. We have shown that when the state provides both financing and an input to production as a free good, there will be excessive use of that input. If the preferences of society and those of the provider of the service are identical, this problem can be remedied by simply charging the LMHA a price equal to the marginal cost of the input.

If, however, the LMHA and society differ in their preferences, setting

the price of the input at marginal cost will not induce optimal behavior by the provider. It might seem that simply setting the right Pigovian subsidies and taxes would induce social optimality, but these taxes and subsidies will not necessarily be achieved if the budget for the public good is fixed. An optimal set of prices which balance the budget are found to be proportional to the sum of the elasticities of the provider's supplies with respect to the subsidy (tax). This is directly analogous to the result for optimal taxation in an economy.

We examined the intergovernmental transfer policies adopted by several states. A number of practical problems related to implementation of optimal transfer arrangements or capacity constraints arise. These relate to the setting of subsidy levels that compensate for the disutility of type 1 patients, and the imposition of budget reductions that must accompany adoption of capacity constraints on state mental hospital systems. Examination of the transfer contracts for Wisconsin, Ohio and for Texas reveals that these contracts may not be optimal. These departures from optimal decisions may be partially due to the practical problems mentioned. They are also likely to be due to political rigidities in state government and state and local government relations (Rochefort, 1987).

The approach we have taken represents an initial attempt at analyzing intergovernmental transfers when significant financing occurs at one level and production at another. This situation arises in other public services such as education, medical care, and recreation. We emphasize the importance of moving beyond simple welfare analyses of transfer programs because of the likely divergence in preferences between local providers and state government. Analysis of the second-best is probably necessary in most real world cases.

We have pursued a simple model of state government and local provider behavior in order to illustrate our points. Future work could fruitfully explore extensions of these models that allow for problems of observing provider behavior, global analysis of the second-best, and analysis of political economy/public choice issues associated with determination of the terms of intergovernmental transfers.

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APPENDIX

I. The First-Order Conditions for the LMHA In the Case of Divergent Preferences

The LMHA's preference function is

$$U = u(H_1, H_2) + v(Q_1). \tag{9}$$

The Budget constraint is

$$NR = B-(C_1+S_1)Q_1-(C_2+S_2)Q_2-(C_3+S_3)A_1-(C_4+S_4)A_2 = 0, \tag{13}$$

The FOC are

$$\frac{\partial u}{\partial H_1} \cdot \frac{\partial h_1}{\partial Q_1} + \frac{\partial v}{\partial Q_1} - \mu\,(C_1+S_1) = 0,$$

$$\frac{\partial u}{\partial H_2} \cdot \frac{\partial h_2}{\partial Q_2} - \mu\,(C_2+S_2) = 0,$$

$$\frac{\partial u}{\partial H_1} \cdot \frac{\partial h_1}{\partial A_1} - \mu\,(C_3+S_3) = 0,$$

$$\frac{\partial u}{\partial H_2} \cdot \frac{\partial h_2}{\partial A_2} - \mu\,(C_4+S_4) = 0,$$

$$B-(C_1+S_1)Q_1 - (C_2+S_2)Q_2 - (C_3+S_3)A_1 - C_4+S_4)A_2 = 0.$$

These jointly define the LMHA's optimal choices of community and state hospital treatments for both types as functions of per-unit costs, the subsides/taxes, and the LMHA's budget,

$$Q_i = q_i\,(B, C_1, C_2, C_3, C_4, S_1, S_2, S_3, S_4),\ i = 1,2 \tag{14}$$

and

$$A_i = a_i\,(B, C_1, C_2, C_3, C_4, S_1, S_2, S_3, S_4),\ i = 1,2. \tag{15}$$

II. Proof of Proposition

The proposition can be proved by considering the first-order conditions for society's problem and deriving from them expressions for the optimal prices. These are shown to be non-zero. This implies that the optimal prices do not equal marginal cost and that all of the treatments for both types must be subsidized or taxed.

The LaGrangian objective function is $G = u(H_1H_2) + \gamma_0 q_1(B, C_1, C_2, C_3, C_4, S_1, S_2, S_3, S_4) + \gamma_1 q_2 (B, C_1, .., C_4, S_1, ..., S_4) + \gamma_2 a_1 (B, C_1, .., C_4, S_1, ..., S_4) + \gamma_3 a_2 (B, C_1, .., C_4, S_1, ..., S_4) + \partial_4 [B-(C_1 + S_1) Q_1 - (C_2 + S_2) Q_2 - (C_3 + S_3) A_1 - (C_4 + S_4) A_2]$,

where the constraint multipliers are γ_0, γ_1, γ_2, γ_4. Assume that the constraints are strictly convex.[35] The first-order conditions are

$$\frac{\partial G}{\partial S_1} = - \gamma_0 \frac{\partial q_1}{\partial S_1} - \gamma_1 \frac{\partial q_2}{\partial S_1} - \gamma_2 \frac{\partial a_1}{\partial S_1} - \gamma_3 \frac{\partial a_2}{\partial S_1} - \gamma_4 Q_1 = 0 \qquad \text{(A1)}$$

$$\frac{\partial G}{\partial S_2} = - \gamma_0 \frac{\partial q_1}{\partial S_2} - \gamma_1 \frac{\partial q_2}{\partial S_2} - \gamma_2 \frac{\partial a_1}{\partial S_2} - \gamma_3 \frac{\partial a_2}{\partial S_2} - \gamma_4 Q_1 = 0 \qquad \text{(A2)}$$

$$\frac{\partial G}{\partial S_3} = - \gamma_0 \frac{\partial q_1}{\partial S_3} - \gamma_1 \frac{\partial q_2}{\partial S_3} - \gamma_2 \frac{\partial a_1}{\partial S_3} - \gamma_3 \frac{\partial a_2}{ZS_3} - \gamma_4 Q_1 = 0 \qquad \text{(A3)}$$

$$\frac{\partial G}{\partial S_4} = - \gamma_0 \frac{\partial q_1}{\partial S_4} - \gamma_1 \frac{\partial q_2}{\partial S_4} - \gamma_2 \frac{\partial a_1}{\partial S_4} - \gamma_3 \frac{\partial a_2}{ZS_4} - \gamma_4 Q_1 = 0 \qquad \text{(A4)}$$

$$\frac{\partial G}{\partial \gamma_0} = Q_1 - q_1 (.) = 0, \qquad \text{(A5)}$$

$$\frac{\partial G}{\partial \gamma_1} = Q_2 - q_2 (.) = 0, \qquad \text{(A6)}$$

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[35] Strictly speaking this does not have to be so. If the constraints do not form a continuous, convex surface however, then the so-called "first-order" approach is not applicable. We abstract from these technical problems here.

$$\frac{\partial G}{\partial \gamma_2} = A_1 - a_1(.) = 0, \tag{A7}$$

$$\frac{\partial G}{\partial \gamma_3} = A_2 - a_2(.) = 0, \tag{A8}$$

$$\frac{\partial G}{\partial \gamma_4} = B - (C_1+S_1)Q_1 - (C_2+S_2)Q_2 - (C_3+S_3)A_1 - C_4+S_4)A_2 = 0 . \tag{A9}$$

Note that $\gamma_0 = \frac{\partial u}{\partial H_1} \cdot \frac{\partial h_1}{\partial Q_1}$, $\gamma_1 = \frac{\partial u}{\partial H_2} \cdot \frac{\partial h_2}{\partial Q_2}$, and so on. The term $\gamma_4 = \frac{\partial u}{\partial B}$, or the marginal utility of money. Equations (A1)-(A4) can be rewritten in terms of own and cross elasticities with respect to the subsidies,

$$S_1 = -\frac{\gamma_0}{\gamma_4}\frac{\partial q_1}{\partial S_1}\cdot\frac{S_1}{Q_1} - \frac{\gamma_1}{\gamma_4}\frac{Q_2}{Q_1}\frac{\partial q_2}{\partial S_1}\cdot\frac{S_1}{Q_2} - \frac{\gamma_2}{\gamma_4}\frac{A_1}{Q_1}\frac{\partial a_1}{\partial S_1}\cdot\frac{S_1}{A_1}$$
$$- \frac{\gamma_3}{\gamma_4}\frac{A_2}{Q_1}\cdot\frac{\partial a_2}{\partial S_1}\cdot\frac{S_1}{A_2}, \tag{A10}$$

$$S_2 = -\frac{\gamma_0}{\gamma_4}\frac{Q_1}{Q_2}\frac{\partial a_1}{\partial S_2}\cdot\frac{S_2}{Q_1} - \frac{\gamma_1}{\gamma_4}\frac{\partial a_2}{\partial S_2}\cdot\frac{S_2}{Q_2}$$
$$- \frac{\gamma_2}{\gamma_4}\frac{A_1}{Q_2}\frac{\partial a_1}{\partial S_2}\cdot\frac{S_2}{A_1} - \frac{\gamma_3}{\gamma_4}\frac{A_2}{Q_2}\frac{\partial q_2}{\partial S_2}\cdot\frac{S_2}{A_2} \tag{A11}$$

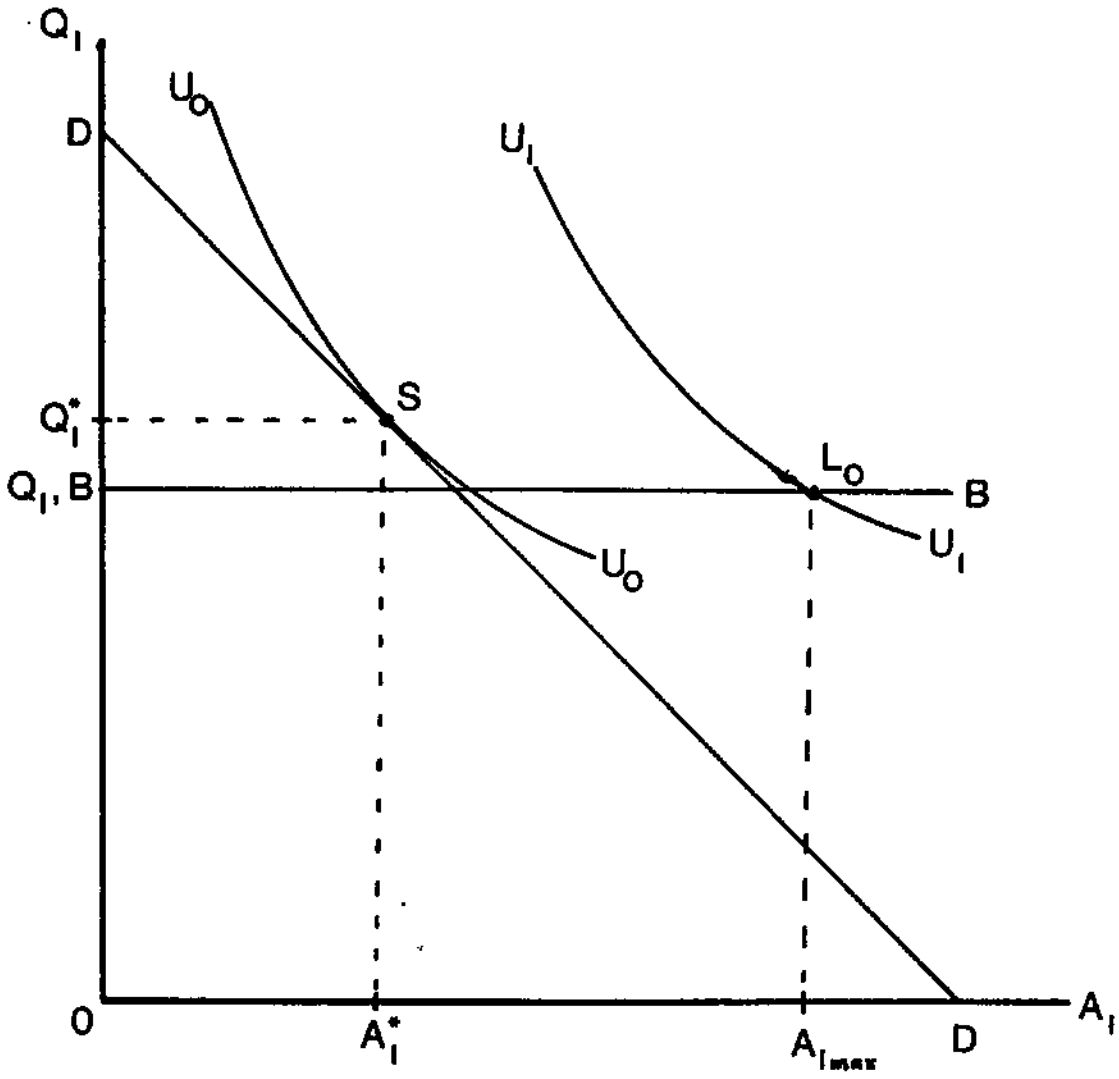
$$S_3 = -\frac{\gamma_0}{\gamma_4}\frac{Q_1}{A_1}\frac{\partial q_1}{\partial S_3}\cdot\frac{S_3}{Q_1} - \frac{\gamma_1}{\gamma_4}\cdot\frac{Q_2}{A_1}\frac{\partial q_2}{\partial S_3}\cdot\frac{S_3}{Q_2}$$
$$- \frac{\gamma_2}{\gamma_4}\frac{\partial a_1}{\partial S_3}\cdot\frac{S_3}{A_1} - \frac{\gamma_3}{\gamma_4}\frac{A_2}{A_1}\frac{\partial a_2}{\partial S_1}\cdot\frac{S_1}{A_2} \tag{A12}$$

and

$$S_4 = -\frac{\gamma_0}{\gamma_4}\cdot\frac{Q_1}{A_2}\frac{\partial q_1}{\partial S_4}\cdot\frac{S_4}{Q_1} - \frac{\gamma_1}{\gamma_4}\frac{Q_2}{A_2}\frac{\partial q_2}{\partial S_4}\cdot\frac{S_4}{Q_2}$$
$$- \frac{\gamma_2}{\gamma_4}\cdot\frac{A_1}{A_2}\frac{\partial a_1}{\partial S_4}\cdot\frac{S_4}{A_1} - \frac{\gamma_3}{\gamma_4}\frac{\partial a_2}{\partial S_4}\cdot\frac{S_4}{A_2}\cdot \tag{A13}$$

Consider equation (10) for the purposes of exposition. The ratios of γ_1 to γ_3 through γ_4 represent the marginal budget effect of another unit of that output. The cross elasticities are weighted by the ratio of that type of output to the output being subsidized, e.g. Q_2/Q_1. Since these are optimally chosen quantities, this ratio represents the ratio of these two commodities along the expansion path of the LMHA.

Note that all the subsidies/taxes S_i, i=1,...,4 $\neq 0$ unless all the supply responses, $\frac{\partial q_i}{\partial S_i}, \frac{\partial q_i}{\partial S_j}$, i=1, 2, j=1, 2 = 0. This proves that marginal cost pricing is not optimal. A treatment for a particular type will not be subsidized or taxed only if its own and all the cross elasticities equal zero. The cross elasticities will only equal zero if there are not substitution possibilities in production. This is explicitly not the case for our model. Thus, all treatments for both types are taxed or subsidized. ∎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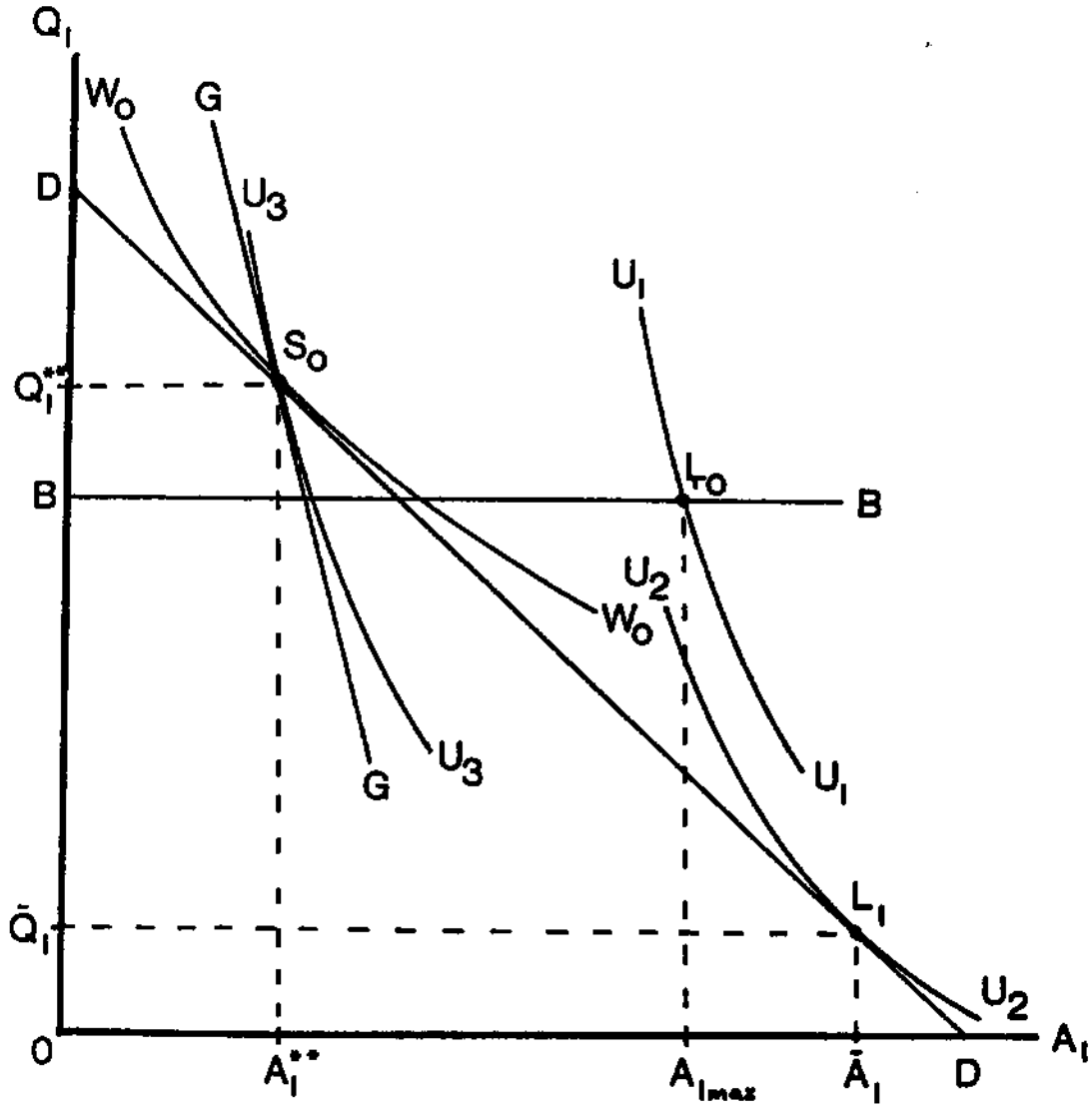
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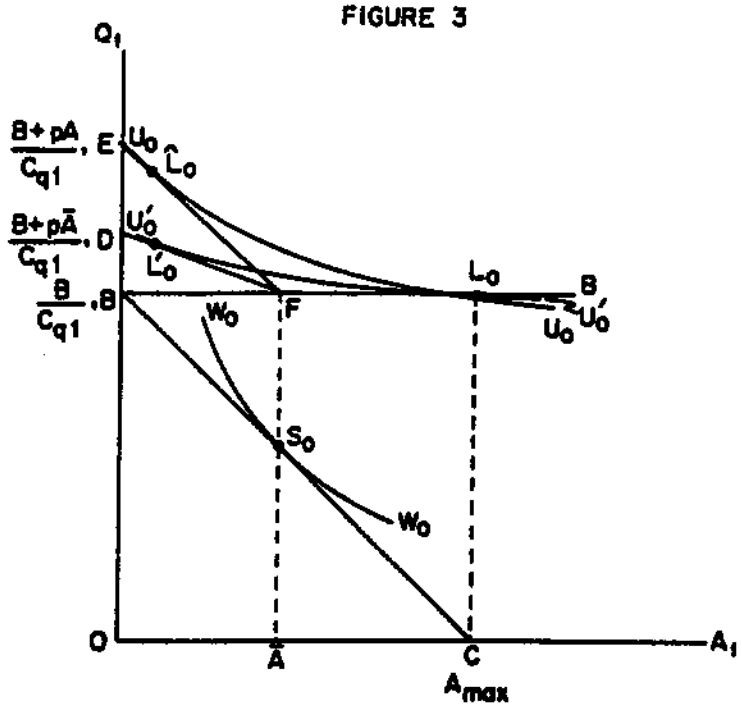
FIGURE 3



Texas' Incentive Contract