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Prices and Protocols in Public Health Care

Jeffrey S. Hammer

An attempt to derive price and rationing rules for public health facilities.

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Hammer tries to derive price and rationing rules for public health facilities. He highlights the effect on these rules of different assumptions about the objectives of government (health versus welfare), the limits of available policy instruments, and the market environment in which the public system operates.

One recurrent finding: Policy reform must be assessed in relation to the changes it induces relative to the status quo before reform. This point may seem obvious, but it represents a distinct gap in the literature on resource allocation in health.

To assess changes, the behavior of the private sector must be known in the type of care given in a system and on how this care will change in response to the policy. Substituting for a reasonably well-functioning private sector is not as valuable as providing services that the private sector cannot be expected to sustain.

Research is needed to characterize market equilibrium for medical care and its response to policy measures. Hammer could not examine many issues — most important, those related to uncertainty and insurance. But if the research he calls for in this paper is pursued, those issues must figure prominently as major determinants in the demand for care. This need was originally identified by Arrow, and there is still a long way to go.

Hammer's analysis is not done in terms of "preventive" or "curative" care, and he argues for assessing interventions on the basis of changes in the stated objectives of a public system. But there could well be a connection with the preventive-curative dichotomy if there were reason to believe that preventive care will systematically lose out to curative care in a market setting. On the basis of people's generally acknowledged undervaluation of preventive services, this may well be the case.

Other prevention activities also have many "public good" features, with few private alternatives, and will look good when improvements over status quo are examined for all interventions. But all activities must be evaluated in their improvement over market provision. It is not necessary to prejudge the case for certain types of intevention.

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by
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0. Introduction

Providers of health care in public clinics in the developing world work under circumstances in which the demands placed upon them are beyond the resources they have available to them. This requires that choices have to be made in order to get the most out of their limited budgets. One response to this inability to serve all clients for all conditions would be the adoption of protocols or rules which ration the range of services available in the public health service. The criteria for such a choice would, naturally, depend on how much health one could buy for a given budget. A second possible response is to try to recover costs in the form of user charges which could then be used to stretch the budget allocation with the supplementary funds. This comes, of course, at the risk of deterring people, particularly poor people, from the use of desired and effective services.

This paper attempts to formulate ways to analyze the impact on various objectives of pricing and rationing decisions within a public system. It attempts to show that decisions will in general depend on a wide range of factors both under the control of the health authorities and not. These factors are:

1) the nature of the objective of the government. Is the goal to improve health per se or to improve a more general notion of "welfare"?

2) the nature of demand for health services in the public sector and of both demand and supply (and market equilibrium) in the private sector (or other alternatives to the public system).

3) whose budget is being allocated. Are the resources of the Ministry of Health the only relevant ones? The government as a whole? The entire economy?

4) the range and flexibility of policy instruments the government has at its disposal. Constraints on the use of some policies, such as the inability to charge at different rates for individual treatments in the public sector or to charge at all need to be considered. Similarly, can the private sector be regulated or must its behavior be regarded as a given by the authorities?

One candidate for a criterion on which to base the rationing decision which appears in the literature has been the cost-effectiveness of interventions. This decision rule implies that the amount of some unit of output (lives saved or, as in a recent World Bank study, discounted healthy life years[1]) per dollar spent on the intervention is calculated and the activities with the highest ratios be undertaken. If correctly measured, this criteria is clearly the proper one by definition. However, the proper measure of this concept depends on the factors just listed and these are not usually included in its calculation. One aim of the paper is to show under what conditions these commonly calculated versions of cost-effectiveness of medical and public health procedures provides an adequate guide to decision-making. As will be demonstrated, the conditions are so restrictive as to be usable in only very special circumstances. A further goal of the paper is to identify the types of information which do need to be collected in order to make correct public health decisions.

The type of questions which are addressed in the first section of this paper are limited to the treatment of people who voluntarily show up at public health facilities, the prices charged them and the range of disease conditions the health authorities choose to treat. The objective is assumed to be the improvement in health status and the budget is that of the Ministry of Health. Various assumptions concerning the private sector are then made. Broader issues (and in the context of developing countries, very possibly the more important issues) such as the extent of the network of health facilities, the provision of public health measures such as safe water, sanitation or vector control, the regulation of private providers or public information campaigns designed either to change lifestyles and habits or to increase demand for services in public clinics are handled in section 2. In section three, the broader class of problems in which welfare rather than health status is the objective will be examined. This formulation overcomes many of the problems which arise in the first two sections. Since much of the basic analytics for this case are standard in the literature of project evaluation and generally transfer to

[1]Dean Jamison and Henry Mosley (eds.),(forthcoming), Disease Control Priorities in Developing Countries.

issues of health, the discussion will focus on a few areas in which the health sector requires special handling.

The method is to specify a particular form or family of forms of objectives the government is assumed to want to pursue, the constraints under which it must act (primarily a budget for the ministry of health) and varying forms of policy interventions available to it. For the purposes of this paper, the latter are limited to prices which may be charged for publicly provided services (whether specific to disease conditions or not) and a rule concerning which disease conditions may be treated in public facilities. Rules by which the appropriate pricing and treatment criteria may be selected are then derived: those rules which best further the social goals may then be characterized. The problem is set forth in its most general form to begin with and then subsequently made simpler to capture particular policy contexts.

Except for the initial description of the problem to be solved, the paper is written with little mathematics in the main text which summarizes the main results without the details of the formal argument. The appendices derive the results and discuss the nature of the solution in more detail.

1. Health as the Objective

The government wishes to run its public clinics in such a way as to get the greatest improvement in health status possible for a given amount of money to be devoted to it. For the time being, health improvement is the only goal, other components of the government's objective will be mentioned in the final section of the paper. The full range of interventions by disease to be considered is known: there are N possible disease conditions and interventions indexed by i. The health centers do no active case finding though they may do outreach in the form of follow up for certain disease conditions. The improvement in health outcome is dependent on the number of people who show up for a given disease condition and the effectiveness of treatment currently available. Each of the treatments entail a known cost and the total number of people treated is limited by a given budget. The health center can charge for services, thereby relaxing this constraint on the budget. Whether the fees can be levied at different levels for different disease conditions is a complication to be dealt with in the following section. The health center can also decide not to treat a particular condition (if, for example, it is too expensive and

will lead to too rapid a depletion of the budget available). The government is not the only provider of health services (though the case of a government monopoly is examined in the following section as well). The private sector, non-governmental (usually non-profit) organizations, traditional healers or self care by the afflicted person can all substitute for the provision of services in the public facilities.

A formulation of the problem which reflects the above considerations can be written:

$$\underset{P_i^B, I_i}{\text{maximize}} \quad L = \sum_i^N [L_i^B(D_i^B(P_i^B, P_i^V)) \cdot I_i + L_i^V(D_i^V(P_i^B, P_i^V, I_i))]$$

$$\text{subject to:} \quad \sum (C_i^B - P_i^B) \cdot D_i^B(P_i^B, P_i^V) \cdot I_i \leq R$$

Where: L_i^j = Health improvement in people visiting sector j (j= B (public) or V (private)) with condition i

D_i^j = Number of people visiting sector j with condition i

P_i^j = Price charged for treating condition i in sector j

I_i = A variable which indicates whether condition i is treated by the public clinic (1 if yes, 0 if no)

C_i^B = Unit cost of treatment for service i by the public clinic

R = Total public budget for health care

The first line sets out the main objective of the government, which in this case is to maximize health status, L, of the population through policies related to the public health care system. Whether health status is improved by public or private practitioners is not a concern in and of itself. Other possible objectives of the government such as improving the income distribution, or increasing welfare in dimensions other than improving health status are ruled out at this point but are picked up in the extensions to the model. Ignoring other objectives of government can be shown to have unacceptable

consequences but will be done in the first pass through the problem.

The second line is the budget constraint for the public health system. Total subsidies (the difference between costs of provision and the price charged for the service for each time the service is used summed across all services provided) cannot exceed the total resources, R, available to the public health service. This is not the budget constraint for the whole government nor for the society as a whole and its use can also lead to unacceptable results. However, this could well be the constraint that the Minister of Health finds the most relevant. The consequences of taking this narrow a view of the social welfare and social costs will be discussed below.

The demand for public services $D_i^B(\cdot)$ depends on prices in both the public and private sector. Demand is written as being for a particular disease condition, i, however, this needs to be interpreted with some care. The individual is not assumed to know the cause of her illness, and demand is really a function of symptoms rather than of disease. However, underlying the demand relation as expressed here is an unexpressed relation linking disease conditions to demand for services. This is captured in full generality by having demand functions which are specific to disease i and which can vary according to the usual severity of symptoms and the likelihood to seek help when they appear. The demand for services will bear a relationship to the incidence of the disease to the extent that specific symptoms are more or less likely to induce a search for care. Schistosomiasis may go undetected and so have a large gap between incidence and demand for treatment. Illnesses with more severe symptoms will have a closer connection between incidence and demand.

The degree of substitutability between the public and private sectors is captured by the responsiveness of demand to their respective prices. High own and cross price elasticities reflect a great degree of substitution. Other determinants of demand, particularly income, are held constant for this analysis. Explicit recognition of demand by different groups for either ethical valuation of outcomes or in describing the pattern of use of public and private sectors is left to the concluding comments.

The health improvement function $L_i^B(\cdot)$ in the public sector can be in terms of lives saved or healthy life years saved conditional on someone with condition i showing up for treatment. The same

sort of function $L_i^V(\cdot)$ applies in the private sector. This can be the same function or can reflect quality differences in the two sectors. In a country with a well functioning public sector with very little private modern care, the treatment outside public clinics could be mostly very poor care by traditional healers or self care. In other settings, a sophisticated private sector may exist (with the possibility that treatment is more effective in the private sector than in the public, $L_i^V(\cdot) > L_i^B(\cdot)$, for certain illnesses) or, for psychosomatic · culturally dete: .ined illnesses, even the traditional sector may exhibit this property. Health improvement due to treating a condition (i.e., the functions, $L_i^{B,V}(\cdot)$) will sometimes be considered simply proportional to the number of people being treated for the condition, i.e., the marginal benefits to treating any given condition once someone has already presented with symptoms may not vary with the number seeking treatment. This assumption could fail to be true if the more severely afflicted are more prone to seek treatment at any level of prices and health improvement from treatment varies with severity.

Costs of treatment in the public sector, C_i^B , will be assumed in the following to be constant for each treatment. Treatment costs should include the costs of all diagnostic tests needed to identify an eligible disease and its treatment. To some extent, then, costs could be attributable to diseases which are not covered by the health service if they take up diagnostic or other resources before the ineligibility is discovered. This effect is assumed to be small. Other issues raised by the form of the cost function are similarly assumed away. In particular, joint costs and scale economies or diseconomies are not considered. This is a potentially serious limitation in practical application since most policy decisions will involve packages of services whose complementarity may well determine the appropriate choices. Having a certain piece of equipment with multiple uses in place may make some treatments worthwhile which otherwise would not be justified and would not alone justify the purchase of the equipment.

The price in the public sector is determinied within the problem as a matter of policy. Different degrees of specificity of this price are assumed below. In the most general case, a separate charge may be given for each condition. However, this degree of flexibility in the pricing structure may be impossible and therefore, various constraints on the allowable price rules can be examined. The price in the private sector is not subject to direct control by the government. Two versions of private price determination are possible. In one the price in the private sector is given and unaffected by either the

price charged or the inclusion of the disease in the protocols of the public sector. The other possibility is that either of these two policies can have an effect on the price charged (and thus a secondary effect on total demand) in the private sector. A careful analysis of the connection of the private sector price and performance as influenced by policies within public clinics is beyond the scope of this paper, however, the basic point point that private sector behavior may be influenced by competition on price and rationing rules in the public sector is captured in a simple way in what follows.

The other policy parameter is the indicator I_i which takes on the value 1 if the service is given in the public clinic and 0 if it is not. For the simplest analysis in the paper, peoples' demand for services is independent of the range of services offered by the public sector. However, it is possible that if certain services are not provided, this lack of comprehensiveness may discourage people from using the public sector even when they have conditions which would be treated. People's demand is determined primarily by symptoms and not the actual disease condition and thus the possibility of being turned away from treatment will not be known to the person when treatment is originally sought.

Solution with Condition-Specific Charges. The maximization problem described above can be solved by examining the effect of changes in the prices charged for different services and the choice of services to provide on the overall objective. The health indicator is maximized when two sets of equations are satisfied: those corresponding to the prices, P_i^B's, and to the set of diseases to include in the public health service, I_i's. The derivation of these equations are described in appendix 1.

The main results are the following:

- Interventions should be chosen which lead to the greatest improvement in health relative to what is being done for the same disease condition outside the public sector.

- This relative improvement must be assessed in comparison with the budget impact of the intervention when the price for the service is set correctly not relative to the resource cost of the service.

- The net health impact depends on the manner in which private markets respond to policy

changes in the public sector: pricing and rationing rules depend on the degree of competition in the private sector.

- Prices should be set which balance two competing ends: limiting the adverse, net (of private sector response) health effect of a reduction in use of the particular service and increasing the revenue that allows more services to be provided.

The point is to stretch the public budget as far as it can go in achieving health gains. If a service of comparable quality is readily available and used in the private sector, either it should be left to private practitioners to handle. At least, should not absorb much public subsidy, i.e., its price in the public sector should be closer to costs. Conditions in which many people will be dissuaded from getting effective treatment, in either sector, when higher prices are charged in the public sector should, sensibly, have lower prices. On the revenue side, the more inelastic is demand, the higher the price which can be charged without affecting health status, saving money that can be used to extend services (or increase the subsidy) for other ailments.

A few comments in explanation and interpretation are in order. Some of these results are quite standard in optimal pricing theory and are discussed in greater detail in Besley (1988) and in Barnum and Kutzin (forthcoming). The innovation here is to link the problem with the rationing of services and specialize the problem to the decision of the Ministry of Health rather than addressing the broader question of improving overall societal well-being. This perspective runs into a few very serious problems as discussed below but mirrors the particular interest of health decisionmakers. The main contribution is to underscore the central role of demand and other aspects of market behavior in the setting of priorities and prices within the public sector.

As far as the choice of interventions to include in the public health service is concerned, the interaction with the optimal pricing problem complicates the interpretation of the result. In one sense, the flexibility afforded by this very general problem (as far as being able to charge separately for different services is concerned) makes the choice of which services to provide much less interesting. If, for example, the public sector does no better than the private for some particular condition and draws all its clients from the private sector, one could argue that the service should not be provided publicly.

However, if fees can recover the costs of provision, then there is no budgetary impact of providing the service (there is no net cost) and it does not really matter whether it is provided or not. In this case, it is possible that there will be no condition under which I_i is zero, i.e., all diseases are treated as long as the public sector can do as well as the private on technical grounds. Full cost could be charged for all services which would otherwise be proscribed. This would have no effect on the budget and therefore have no cost associated with it. Cases below in which there are added, more realistic, constraints on the pricing policies, will make the choice of service a more substantive problem.

There are two ways in which private response is captured in this formulation. The first, which can attribute mostly to the demand side, is the choice by consumers to switch between providers at given prices. This leads to the appropriate health improvement being measured by the difference between the medical outcomes in the public and private sector weighted by the change in use of each sector due to price changes or rationing rules. The second, which can be attributed more to the supply side (or to market equilibrium taking both supply and demand into account) is the possible endogenous change in the private sector price as a result of the pricing and rationing rules within the public sector. If the public sector decides to provide a service at subsidized prices, it becomes harder for private providers to charge much higher rates. If the sector were competitive, this would result in private doctors going out of business and is ambiguous in its social contribution. If, as is commonly acknowledged, the sector is anything but competitive and exhibits elements of monopoly or more complex equilibrium conditions, the reduced price (or even the full marginal cost) could lead to reductions in the private sector price (inclusive of market distortions) as well and may have a second round effect of increasing service use in both the public and private spheres.

Pricing needs to balance competing needs. On the one hand, higher prices discourage users of health facilities. They could lead to a substitution to an inadequate private sector (especially if dominated by self-care or ineffective traditional healers) and they may have an indirect effect of increasing prices and thus discouraging use in a modern private sector. On the other hand, the increase in revenue raised by increasing prices can help relieve the budget constraint facing the Ministry. While this obviously does not expand the treatment of the disease whose price is being raised, it can help in the expansion of services (or, more importantly in this most general case, the reduction of prices) for <u>other</u> disease conditions.

The pricing rules presented above allow for the possibility that certain services may actually make money for the ministry, that is, the appropriate fee could be greater than the cost of provision. This is most likely to happen under the following conditions: 1) demand for the service in the public sector is very inelastic since, in this case, increases in fees have little impact on health status and have maximal impact on revenue generation, 2) cross elasticities with the private sector are high and the private sector is at least as effective than the public. There are, of course, limits to how high the cross price elasticity can be with a low own-price elasticity.

Finally, the connection with often-suggested cost-effectiveness analysis can be drawn. In standard formulations, the effectiveness of the technique is compared to the resource cost and thos with high ratios, L_i/C_i, are to be offered. While sometimes suggested that this method be used in allocating resources in the public sector, it appears to bear little relation to the solution presented here. Unrelated to the choice of public or private provision or to price policy issues, the ratio L_i/C_i appears nowhere in the solution as such. The gain relevant in these calculations is the one net of private response ($L_i^P - L_i^V$) and the cost which is relevant is the change in net subsidy when prices are flexible and depends both on the per unit subsidy (C_i-P_i) and the change in use of public facilities (the number of units which must be subsidized). To the extent that cost-effectiveness is supposed to answer a broader question of social allocations (not confined to the public sector and not dependent on Minstry budgets) this comparison may not be completely relevant. Comparisons with different specifications of the problem are dealt with below.

2. Simplifications and Extensions

Free Public Provision. In this section, the first of two variants of the general model discussed above is presented. In this case, rather than being able to charge any price and distinguish such prices by type of service, the extreme opposite assumption is examined: that of not being able to charge any fees at all but rather having to fund the entire Ministry of Health expenditure out of a fixed budget. This version of the model puts the rationing rules into greater relief since any activity in the public sector is a drain on government funds and therefore on the total health package which can be offered to the public. This in contrast to the case above where even "frivolous" (yielding little change in health status) activities could be provided if they were charged at full cost.

In this case, equation 1 is changed to remove all terms P_i^B from the problem and the budget constraint becomes:

$$\sum C_i^B \cdot D_i^B(0,P_i^V) \cdot I_i \leq R$$

Since there are no public prices to solve for, the solution is in terms of the decision to include or not include a particular treatments of a disease condition in the set offered. The appropriate decision rule (derived in appendix 2) has the following characteristics:

- A treatment should be offered for free in the public sector if the ratio of the net gain in health status (net of substitution from the private sector) to costs exceed a certain cut-off level. The cutoff level depends on the overall size of the budget.

- The substitution from the private sector should take into account any price changes in that sector that the existence of free public care induces.

The decision rule is the same as ranking each of the treatments according to net improvement over status quo per dollar spent and exhausting the budget in that order. The relevant private demand to consider should include the induced effect on prices in the private sector. The inclusion of a treatment in the public domain can have two effects on private provision. First, it is likely to substitute for services since many people will find it more attractive to get free care than pay (to the extent that they can recognize an illness as being treatable in public clinics). On the other hand, the increased competitive pressure from the public sector may lead to a fall in the private prices and a net increase in service will result from the combination of free public care and a reduced price for private care.

A further simplification from this point is instructive. If in addition to the assumption that all care in the public sector is free, we assume that there is no private sector[2] and we assume that the technology is linear in that the health indicator is a constant times the number of people seeking treatment

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[2] or that treatment in the private sector is useless ($L_i^V(\cdot) = 0$ for all conditions) or that whether or not a service is offered in the public sector has no effect on private demand for that service.

(a fairly innocuous assumption in this particular context), then the decision rule is to calculate simple cost effectiveness ratios, rank interventions in that order and do them until the budget is exhausted. Note that it is only when all of these assumptions are met that this decision rule is appropriate and only in the case where the total society's health care (or useful health care if the private sector exists but is useless and only exists due to extreme ignorance of the population) is provided out of an arbitrary budget. Even with all these assumptions there is a serious problem in applying the cost-effectiveness ratios. Implicit in this problem is society's valuation of life (or health) which is the effectiveness per dollar of the least attractive procedure included. It is certainly possible that people's own evaluation of their own life could be quite different from this number. This would indicate (if people's valuation were higher than that implicit in the Ministry's budget) that while the ministry might be doing the best it can with the budget R, society could do much better in terms of health and welfare than the monopoly position of the government allows. People with higher valuation of their own health status would want to pay more for services which are not allowed by this allocation mechanism. Since there is no place in which personal preferences affect this allocation, serious inefficiency can result.

Uniform User Fees. In this case, the assumption that prices charged in the public sector can differ by disease is again abandoned but rather than having free care, there can be a common fee for all disease conditions (or certain classes of conditions). The common fee is then a matter of policy as well.[3] The solution to this problem is derived in appendix equation 2.4.

The results as presented in the appendix are a bit cumbersome but can be interpreted quite intuitively. Start from a situation in which the general problem is solved for a single service (the average of all services). That solution will, as in the general case, have a higher price for the service if the elasticity of demand is low taking private supply into account. Taking the fact that this demand is made up of many different services, the uniform price should depend on the type of illnesses whose treatments are most discouraged by a higher price. If the kinds of illnesses which fail to be treated (in either the public or the private sectors) due to an increase of the common price have effective treatments available leading to big improvements in health, this would argue for limiting those increases. If the ailments which are discouraged by a price increase happen to be those for which treatments are not very effective,

[3]A similar analysis with somewhat more aggregate disease groups is done by Musgrove (1986).

the price can be raised more in order to extend treatments where they are more effective. Similarly, if people happen to be dissuaded from using particularly expensive treatments (holding their effectiveness constant), this too argues for higher prices (since there will be greater savings which can be used to extend services). The relevant piece of information is the covariance between the elasticity of demand for public service and the marginal effectiveness (or cost) across treatments.

All of this is relative to the degree to which treatments are picked up by the private sector. The common price can be higher, the higher is the covariance between the cross price elasticiy of demand for private services and the effectiveness of those services. If a higher price disproportionately pushes people into the private sector for treatments which private providers are good at giving, that price should be higher than it would be if it pushes people with eminently treatable conditions (in the public sector) into the hands of unqualified private practitioners (traditional healers or self care). If patients happen to sort themselves out in ways helpful to the public service (i.e. they know when the public service is most useful or, by luck, they stop using expensive services), the price can be higher. For the most part, this is an entirely empirical question based on how informed the public is, or cultural patterns or luck. To some extent, though, one might expect the term corresponding to the cost to mitigate against higher prices since the gap between private and public prices is likely to be higher for the expensive treatments (private practitioners will be charging closer to costs) than for cheap and the demand change in the public sector is likely, therefore, to be greater for the cheaper services than for the expensive.[4]

The rationing rule which corresponds to the uniform price case is not different in form from the previous sections. With a single price, the rationing rule does have real consequences as in the free care case since prices cannot be raised on individual services to cover less effective or more expensive treatments. The higher the price charged, the more services can be provided. Improved sorting of

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[4]This emphasis on covariances between elasticities and costs or effects parallels results in the optimal tax literature. When taxes assessed on commodities are calculated taking the effects on different income groups into account, the tax rates on each commodity are modified according to the covariance of income shares of that commodity by different income groups and the marginal social valuation of income going to that group (presumably higher for the poor). This results in lower taxes on items disproportionately consumed by the poor (see Feldstein (1972)). The objective function examined here is not sensitive to distributional concerns (since it is hard, ethically, to distinguish between health outcomes per se by income group) and is best left to the section on welfare. If it were, however, this aspect of the standard results would apply: those treatments which disproportionately go to the poor would have lower prices. Or, in the case with uniform fees, the common price will be lower if diseases afflicting poor people are disproportionately included in the package of provided services.

people (i.e., lower covariances between service reduction and relative effectiveness in public facilities) can stretch the public health subsidy further.

The appropriate price, and simultaneously the appropriate choice of treatments to offer, depends on the behavior of people and will vary by area. Some studies have examined the pattern of service use before and after price increases. There appears to be a wide variety in this pattern with quite essential services being reduced in some areas (see Bennett (1989) for Lesotho) while more appropriate selectivity (i.e., less use of less effective services) occurs in others (see Gertler and Melnick (1993) on Indonesia). This indicates that the type of price increase and the types of services offered needs to take into consideration features of the demand (and supply) structure of the medical services market which are not routinely examined. These features are:

1) own and cross price elasticities of demand for public and private services.

2) the private sector response to public sector price and rationing policies.

3) covariances between elasticities of demand and the costs and effectiveness (again relative to the private sector) of treatments

Public Health Interventions. The above framework can be modified to handle public health initiatives which do not rely upon a clinic-based delivery system. Vector control (killing disease-bearing pests), information, education and communications (IEC) activities, provision of public goods such as safe water or sanitation services are examples of such initiatives. These can be incorporated into the analysis by modifying equation 1 in the following way:

$$\underset{P_i^B, I_i, F}{\text{maximize}} \quad L = \sum [L_i^B(D_i^B(P_i^B, P_i^V, F)) \cdot I_i + L_i^V(D_i^V(P_i^B, P_i^V, I_i, F), F) + L_i^*(F)]$$

$$\text{subject to: } \sum (C_i^B - P_i^B) \cdot D_i^B(P_i^B, P_i^V) \cdot I_i + C(F) \leq R$$

The direct investment, F, enters the equation in at least four possible places. First, there is the direct improvement on health from the intervention. Cases of malaria avoided by killing mosquitoes, for example, translates into a direct health benefit through the function $L^*(F)$. Second, the number of cases of a disease avoided will translate into the demand for health services in both the public and private sectors. This translation need not be one for one, that is, some people may suffer (and possibly die) from a disease without ever seeking help and so the number of cases avoided need not be the same as the reduction in the number of people seeking help. Certain kinds of interventions may have no direct effect on disease but operate by increasing the demand for services. For example, public information campaigns which make mothers more aware of symptoms of disease and more prone to seek help for them has no direct health impact but will increase the demand for services (public or private). Stimulating demand for preventive care such as immunization would be another example. Third, information campaigns directed toward private providers can improve treatment currently given in the private sector (for an example of this in the context of improving drug prescription accuracy, see Hammer (1992)). Finally, the intervention will entail a cost C(F). For many of the clinical interventions, the costs attached to the provision of service could be assumed constant without much problem. However, when direct, population based interventions are considered, the cost structure can be very important. Large fixed start up costs for pest control operations or information campaigns could generate decreasing costs. On the other hand, costs of successfully reaching harder and harder (or more and more remote and sparsely settled) groups within a population with health information or water networks could lead to increasing costs.

The basic results of including direct interventions are:

- Preventing health problems for which there is effective care is less valuable than preventing problems with no solution (net benefits of direct interventions need to subtract out the health benefits of effective clinical care whether in the public or the private sectors.). Conversely, the degree of subsidy and the decision to treat an illness can be influenced by the existence of effective primary prevention. The direction of this effect is not obvious, however. The use of funds for primary prevention will make the budget constraint bind more tightly and will knock some diseases off the treatable list. On the other hand, effective prevention may make treating any remaining cases less burdensome.

- Preventive activities are more valuable when care for the conditions they prevent is heavily subsidized.

-Public health investments can change the appropriate pricing and rationing rules for health care delivery. Improving the quality of private care may obviate the need to provide free public care for the same condition. Improvement in the sorting of patients by disease conditions (in the case of uniform user fees) may allow a higher fee and a greater range of services to be provided.

- Information campaigns which increase the demand for effective services in the private sector (relative to subsidized services in the public sector) are to be preferred to those which increase public demands.

The last proposition is particularly sensitive to the initial statement of the problem in which it is only overall health outcomes and the public budget which concerns the relevant policy maker (the minister of health). In the following section in which welfare is considered, other, less appealing aspects of the private market may modify this result.

3. Welfare as the Objective

The argument up to this point was based on the assumption that it is only health outcomes and only the budget of the Ministry of Health which matters in public decision making. This position is not tenable in a number of ways. Consider the following proposed investment: there is already a network of public health facilities (and no private sector). Everyone goes to a clinic when they are ill. However, some people who live far from the closest clinic have to expend much money and foregone earnings to get there. The ministry is considering adding one clinic in a particularly remote area which would decrease the travel time significantly for many people (travel time worth much more than the cost of the facility) but would not improve health at all (everyone already gets needed treatment). Should the facility be built? The decision rule implicit in the analysis above would answer unequivocally "no" since no extra health is obtained from the scarce public health budget. From society's point of view, however, the answer is certainly yes since, as assumed, the costs saved from reduced travel time and money is greater

than the cost of the facility. The problem is that the total costs to society are not captured in the Ministry's budget alone.

A second type of problem is with promoting private care. When health status is the only objective, a price or rationing change which pushed people into a private sector which was medically equivalent to the public was good since there would be no sacrifice of health status while saving on the government budget. If, however, the private sector was not characterized by normal competitive behavior but tended to give too much care (due, for example, to doctors' financial incentives in a fee-for-service system) this would entail too great a sacrifice, socially, for the amount of improvement in health the service brings. Again, the problem is that only some costs of the system are included in the problem. Related: even if care was equivalent in the two sectors, private providers (due to some monopoly power) may charge high prices and an undesireable transfer from poorer to richer people would result. The common feature is that there are aspects of the private sector, not related to health promotion per se, which may be undesireable from the perspective of welfare improvement.

A third type of problem, mentioned briefly in the preceding section, is that in the rationing rules described above, too much depends on the value of λ. This term is the implicit value of life based on the arbitrary degree of funding (R in equation 1) in the public sector. The problem rules out expenditures on health people may be willing to make for themselves when there own valuations of health differ from that implicit in λ.

The first two problems could be handled by changing the budget constraint in equation 1 to include all costs borne by everyone in the system before and after the intervention. This would still leave the problem of satisfying people's own valuations of health benefits unsettled. An alternative is to change the objective of the problem to include all benefits, monetary or health-based, and all costs borne by the society in the original problem. While this sounds like a much harder problem than that involving health alone, it is the basis of the project evaluation literature and does not need to be rederived here. There are a few issues involved in interpreting this literature for the health sector which are worth discussing.

The literature on the welfare economics of policy reform and project evaluation (see Boadway

(1975), Dreze and Stern (1989), Squire (1989) and Kanbur (1991)) identifies conditions in which welfare is improved either as a result of policy reform (changes in prices essentially, though other reforms can be interpreted in this way) or as a result of a direct investment. For use in the evaluation of investments, the method determines the appropriate prices (or the "shadow" prices) to be used to value the outputs and inputs of the investment. If the investment makes a profit at these prices, it will lead to an increase in social welfare and should be done. It is the calculation of these prices which allows for the difference between investments justified for social purposes rather than for private profit. If all of these prices were the same as those facing the private sector in a laissez faire world, there would be little justification for public investment. However, many characteristics of health sector lead to a divergence between public and private values. Applications in the health field need to keep the following features in mind.

First, while much of the literature on project evaluation was motivated by the need to correct for policy induced distortions, the distortions which justify an investment or policy reform in health are not primarily due to taxes. There are true market failures which require government intervention. For some health related items such as treatment of communicable disease, the social value of consuming the good will be greater than the private value since people cannot be expected to take the risk of infecting others into account when evaluating the need for treatment. Increases in the consumption of such goods, whether by policy changes (say, by subsidizing treatment) or by direct investment (providing subsidized treatment or, in some cases, vaccination) will be evaluated at a premium over the private price of the service. In the case of pure public goods, or those cases in which no private market can exist due to the inability to exclude any non-paying user (vector control, some water supply problems), the whole value of the investment is attributable to the public intervention. An argument could be made (see appendix 3) that direct investments by the government should be done only if the correction of market failures and other distortions is necessary for the project to turn a profit.

Other market failures commonly associated with the health sector revolve around the problem of imperfect information. Here some difficult conceptual issues could arise but the main problem is that the "true" value of the commodity may not be perceived by people due to general lack of knowledge of the effectiveness of treatment or the consequences of lack of treatment. People are frequently assumed to undervalue the benefits of preventive activities (immunizations, life-style changes including cessation of smoking). This would yield a social value greater than the perceived private value. How this value is

determined is a major question, both in principle and in actual measurement. As far as the principle goes, the value needs to capture the effect of providing the consumer with more complete information. The value would be the marginal benefit under this better set of information. Certain kinds of information are known to medical professionals such as the change in the probability of disease incidence with and without vaccination or the kinds and degrees of health improvements which may be expected from alternative treatments. Other kinds of information are known to the patient, such as tolerance for pain or uncertainty of outcome or burdens put on family members due to disability, death or financial cost. The appropriate information set to consider is the combination of personal situation and preferences on the one hand and professional knowledge on the other. Practically speaking, there could be two different ways of handling this problem. One would be to try to approximate the social value of a service under the augmented information set by 1) guessing (or doing research into) how many more people would use a given service if they were fully informed of the consequences of using it 2) determining the elasticity of demand for the service (either using demand studies for the service under the status quo or using studies from better informed (better educated?) populations or subpopulations within the same area and 3) inferring how much higher the price under the new demand curve would be at the old, status quo, level of demand. Alternatively, an explicit valuation of the service under the new information could be avoided by allowing there to be more than one dimension of valuation for the project giving the decision maker the freedom of using different weighting systems between them. Monetary changes (or things which may be easily converted into monetary values) could be added up in one dimension with various sorts of health outcomes left in a separate account.

Finally, social and private price may diverge indirectly due to the lack of information on the part of consumers as a result of having to rely on medical professionals to suggest treatment. This "principal-agent" problem revolves around the problem that medical professionals may have incentives to provide care which are different from those that would be chosen by a perfectly informed consumer. This problem, identified 30 years ago by Arrow (1963), is at the core of attempts to model behavior in markets for medical care. A number of researchers (Ellis and McGuire (1986, 1991), Selden (1990), Pauly (1988))have advanced models of this phenomenon though there is little consensus as to the most salient features to include or how these models might best be adapted to the conditions faced in developing countries. The often mentioned "supplier induced demand" problem may be thought of in these terms. This is the hypothesis that an increase in the supply of doctors may not reduce the price of

medical services as the providers induce more, and more expensive, procedures in order to maintain income (Evans (1974)). They can get away with this since consumers are not in a position to second guess the professional. Here, again, the "true" value of a service to the consumer differs from the supply price due to the decision making of an agent, probably with different values and motives than that of satisfying the consumer.

Second, health services are almost always non-traded goods, i.e., as services they are provided and used in the same place as opposed to ordinary commodities which can be sent. This distinction is important because the proper output to value is the net addition to consumption of an item, that is, net of adjustments of the market for the service that already exists. This is exactly the same as the result in the analysis of health outcomes discussed above. The only thing that should be valued are net additions above what the market will supply. An essential piece of empirical information then, in evaluating public investment in the health sector is the change in demand, supply and the market equilibrium that in the private sector that results from that investment. This would be true even if all medical markets were competitive simply due to the nature of non-traded goods. When combined with the argument of the preceding paragraph, that the markets have non-competitive characteristics (in ways which go beyond the standard non-competitive models of markets), the need for convincing models of behavior takes on central importance.

Third, the approach outlined in appendix three is quite flexible in the type of outcomes and policies which can be evaluated. On the outcome side, the welfare measure does not have to be a single, money valued number but can be defined as a list of different types of outcomes: money, lives saved (or other health measure) or any other kind of outcome which is not easily converted into a single standard. The income (or health effects, for that matter) of different income groups could be one such set of outcomes though there are a number of ways in which different weights could be placed on the separate incomes (at least) in order to obtain an aggregate measure of welfare (see Squire (1989) on distributional weights in project evaluation).

4. Conclusions

This paper attempted to derive price and rationing rules for public health facilities. The effect on these rules of different assumptions concerning the objectives of government (i.e., health versus welfare), the limitations on available policy instruments and the market environment in which the public system operates was highlighted.

One recurrent finding is that policy reform needs to be assessed in relation to the changes it induces relative to the status quo before reform. While an obvious point, it identifies a distinct gap in the literature on resource allocation in health. In order to assess changes, the behavior of the private sector needs to be known both in terms of the type of care which is given in a system and in terms of how this care will change as a response to the policy itself. Substituting for a reasonably well functioning private sector is not as valuable as providing services which a private sector cannot be expected to sustain. Research is needed into the characterization of market equilibrium for medical care and its response to policy measures. Many issues could not be examined here, the most important being those related to uncertainty and insurance. If the research called for in this paper is pursued, however, these issues will have to figure prominently as a major determinant for the demand for care. There is still a long way to go since this need was originally identified by Arrow.

The analysis here is not done in terms of "preventive" or "curative" care and argues for the assessment of interventions on the basis of changes in the stated objectives of a public system. However, there could well be a connection with the preventive/curative dichotomy if there were reason to believe that preventive care will systematically lose out to curative in a market setting. On the basis of people's generally acknowledged undervaluation of preventive services this may well be the case. Other prevention activities also have many "public good" features with few private alternatives and will look good when improvements over status quo are examined for all interventions. However, all activities need to be evaluated in terms of their improvement over market provision and it is not necessary to prejudge the case for certain types of intervention.

Appendix 1- Solution with Disease-Specific Charges

The maximization problem in equation 1 requires simultaneously solving two sets of first order conditions.

For prices:

$$\frac{\partial L}{\partial P_i^B} = L_i^{B\prime}\cdot\left(\frac{\partial D_i^B}{\partial P_i^B} + \frac{\partial D_i^B}{\partial P_i^V}\cdot\frac{\partial P_i^V}{\partial P_i^B}\right)\cdot I_i + L_i^{V\prime}\left(\frac{\partial D_i^V}{\partial P_I^B} + \frac{\partial D_i^V}{\partial P_i^V}\cdot\frac{\partial P_i^V}{\partial P_i^B}\right)$$

$$- \lambda\cdot((C_i^B - P_i^B)\left(\frac{\partial D_i^B}{\partial P^?} + \frac{\partial D_i^B}{\partial P_i^V}\cdot\frac{\partial P_i^V}{\partial P_i^B}\right) - D_i^B)\cdot I_i = 0$$

(A1.1)

where: $L_i^{j\prime}$ = marginal health improvement resulting from a visit to sector j (B= Public, V = Private) for condition i

λ = the Lagrange multiplier for the budget constraint of the Ministry

$\frac{\partial P_i^V}{\partial P_i^B}$ = change in the private sector price for condition i with respect to a change in the public sector price

For indicator variables we need to evaluate the change in the objective function with a (discrete) change in the inclusion of a treatment:

$$\frac{\Delta L}{\Delta I_i} = L_i^B(D_i^B(P_i^B, P_i^V|_{I_i=1})) + L_i^V(D_i^V(P_i^V|_{I_i=1}, P_i^B, 1))$$

$$- L_i^V(D_i^V(P_i^V|_{I_i=0}, 0, 0)) - \lambda\cdot((C_i^B - P_i^B)\cdot D_i^B(P_i^B, P_i^V|_{I_i=1}))$$

(A1.2)

where: $P_i^V|_{I_i=1,0}$ = the price charged by the private sector when a service is ($I_i=1$) or is not ($I_i=0$) offered by the public sector

In the optimal allocation, a treatment should be given if this expression is positive. The objective function (health status plus a term reflecting the budget constraint) will increase with a new treatment if the improvement in health resulting from extra demand for services in the public sector net of any reduction in the private sector L is greater than a term which reflects the extra cost to the system of providing the service. This extra cost will be higher, the "tighter" is the budget constraint faced by the public health service, reflected in higher values of the term λ.

Rearranging terms to solve for optimal prices:

$$P_i^B = \frac{1}{1 + e_i^B}\left(e_i^B C_i - \frac{1}{\lambda}(L_i^{B'} e_i^B + L_i^{V'} e_i^V \frac{D_i^V}{D_i^B})\right) \qquad \text{(A1.3)}$$

where e_i^B is the elasticity of demand for public service i with private prices changing as a result of the change in the public price, and e_i^V is the cross price elasticity of demand for private care again with price changing in the new equilibrium.

This price equation corresponds to a rationing rule of:

$$\frac{L_i^B(D_i^B(I_i=1)) + L_i^V(D_i^V(I_i=1)) - L_i^V(D_i^V(I_i=0))}{(C_i - P_i)\cdot D_i^B} \gtrless \lambda \qquad \text{(A1.4)}$$

where to simplify notation, demand is written as a function of the indicator variable, that is, with prices (not presented) allowed to reflect whether the service is provided in the public sector.

The expression for the optimal price (A1.3) indicates, first of all, that the price charged for a service will be such that demand for the service is elastic ($\epsilon_i^B < -1$) as is the case with all monopoly pricing models. Given this condition, prices will be higher:

1) the less elastic is the demand for the service. The higher the elasticity of demand for a service (ignoring for the moment its health effects), the more is the sacrifice in earnings (given that elasticities are all high) from further raising the price. Therefore, the services which are relatively more elastic will have lower prices (higher subsidies) at the optimum.

2) the smaller is the health consequence of raising the price in the public sector. The second term in equation A1.3 reflects the health impact (evaluated in money terms by the multiplier λ) of a price rise. The term involving superscripts B is the direct discouragement of treatment in the public sector, the term involving the V's reflects the offset to this effect due to increases in demand in the private sector. The extent of this offset is captured by the cross-price elasticity. The greater the net reduction in the health status of the population due to a price increase for a particular service, the lower the price for that service.

3) the more binding the budget constraint, that is, the higher is λ. As the term λ increases (which would happen if the budget R, were cut), the second term in A1.3 will decrease in absolute value. Since this term represents the amount by which prices will be discounted in pursuit of better health, a decrease raises the price.

For the rationing rule, the left hand side of A1.4 can be interpreted as the net improvement in health due to offering a service per unit of subsidy to the public sector. The numerator is the health impact due to the direct provision of services, the L_i^B's, net of the offset of (presumably) lower use of private services, (the difference in use, L_i^V, with and without competition from the public sector). The denominator is the net cost of providing the service at (simultaneously determined) prices P_i, or, the per unit costs (C_i - P_i) times the demand in the public sector. This ratio, which represents health improvement per unit subsidy, is to be compared to λ, the implicit value of health or, the amount of health status improvement which would result in a unit increase in the budget allocation, R. Only conditions having

ratios of benefit per unit subsidy higher than this should be treated.

For both the pricing and the rationing rule, there is a little sleight of hand going on here in the way in which the private sector prices are being handled. The elasticities in the price equation as well as the levels of demand in both sectors with and without public provision all depend on the prices determined by the private market equilibrium associated with the public price and rationing decisions. We don't know much about these markets and their response to public policy. This indicates an important set of questions for research. In the current context, lowering a price in the public sector could induce competitive price falls in the private sector (especially if the original private price was not determined by competitive cost considerations and, thus, included excess profits). The accompanying price fall may limit both the number of people who leave the private sector and (not surprisingly) come to the public sector. If the two sectors are equally competent technically, this means a lower cross price elasticity of demand for the private sector and would be reflected in both a lower optimal price and a higher likelihood of inclusion in the public sector.

Appendix 2- Simplifications and Extensions

Free Public Provision

If no prices can be charged in public facilities, then the pricing rule, obviously, is no longer relevant and the rationing rule is modified only slightly to become:

$$\frac{L_i^B(D_i^B(I_i=1)) + L_i^V(D_i^V(I_i=1)) - L_i^V(D_i^V(I_i=0))}{C_i \cdot D_i^B} \gtrless \lambda$$

(A2.1)

The differences in interpretation between the case with individual prices and this are:

- the rationing rule now compares net health benefits to actual resource costs, C_i, rather than to subsidy costs, $(C_i - P_i)$
- the rationing rule has real "bite" in the sense that some services will certainly not be provided since their prices cannot be arbitrarily raised to match small health benefits with small subsidy costs; subsidy costs are technologically determined (given zero price) rather than determined as part of the solution.

If, in addition to free care, the technology of curative care is linear in cases seen (or, $L_i(D_i) = L_i \cdot D_i$) the rationing rule becomes:

$$\frac{L_i^B + L_i^V \cdot \dfrac{D_i^V(I_i=1) - D_i^V(I_i=0)}{D_i^B(I_i=1)}}{C_i} \gtrless \lambda$$

(A2.2)

which ignores any effect of the relative size of the public and private sectors (probably not a bad assumption for people who have already shown up for treatment. There could be scale effects due to differential severity of health problems if for some conditions people are nearly indifferent between seeking or not seeking treatment and less severe cases are seen when prices are low. This effect would have less to do with the public/private split, though, than with the treatment/non-treatment split).

If, in addition to free care and linear technology, there is either 1) no private sector ($D_i^V = 0$ for all i) or 2) a useless private sector (i.e., one that can generate no improvement in health status: $L_i^V = 0$ for all i) or 3) there is no cross price elasticity of demand at all between public and private sectors (in the sense that private demand for services is completely unaffected by whether or not services are offered in the public sector: $D_i^V(I_i=1) = D_i^V(I_i=0)$, for all i), then the rationing rule for the public sector becomes:

$$\frac{L_i^B}{C_i} \gtrless \lambda^* \qquad \text{(A2.3)}$$

This is the rationing rule associated with standard cost effectiveness analysis of curative care options where the health improvement associated with a technology is divided by its resource cost (not the subsidy component only because of the assumption of free care) and this ratio is higher for any included procedure than for any excluded one.

Uniform User Fees

If equation 1 is solved with the restriction that all prices charged in the public clinic must be the same, the common price will be:

$$P_B = \frac{-\frac{1}{\lambda}\left(cov(L_i^B,\eta_i^B) + cov(L_i^V,\eta_i^V) + \overline{L_i^B}\,\overline{\eta_i^B} + \overline{L_i^V}\,\overline{\eta_i^V}\right) + cov(c_i^B,\eta_i^B) + \overline{c_i^B}\,\overline{\eta_i^B}}{\sum \varepsilon_i^B \theta_i - 1}$$

(A2.4)

where: $\theta_i = \frac{D_i^B \cdot I_i}{\sum D_i^B \cdot I_i}$ = the share of public visits accounted for by condition i

$\eta_i^B = \varepsilon_i^B \cdot \theta_i$ = the elasticity of demand for public visits for condition i weighted by the fraction of visits accounted for by this condition. The sum of these terms is the elasticity of demand for all public visits.

$\eta_i^V = \varepsilon_{P_B}^V \cdot \theta_i \frac{D_i^V}{D_i^B}$ = the cross price elasticity of demand for private care for condition i with respect to the price of care in the public sector weighted by the ratio of private sector visits for this condition to total public sector visits

$\overline{X}$ = the mean of X

Ignoring the covariance terms for a moment, this expression is very similar to the one in which each price may be chosen separately. Where individual elasticities and cross elasticities appear in equation A1.3, they are replaced by the equivalent weighted average of all elasticities in A2.4. The health care system is being treated as a whole in the derivation of the optimal common price. The basic

results are equivalent to the results in appendix 1, that the common price should be: higher the lower is the overall elasticity of demand for public service, higher the closer the private sector substitutes for the public both in quality of care (L_i^B versus L_i^V) and, behaviorally, in the cross price elasticity of demand.

The terms representing the covariances between elasticities and effectiveness or costs modify the basic results by reflecting the fact that price increases will have different effects on different categories of care. Higher (negative) covariances between demand for public visits and the effectiveness of care in the public sector means that the demands which would be most discouraged by higher prices are also those for which treatments are most effective. In that case, the optimal price would be lower than when the more price sensitive treatments are less effective in a technical sense.

Population based interventions

Equation 1 can be modified to take into account a policy which can directly influence health status and/or demand for health services through means other than price or rationing. This can be either because preventive activities reduce the demand for care or that health education and promotion can increase demand. The modification requires the addition of the intervention F both in the demand functions and in health status itself. The additional first order condition to determine the appropriate level of the public health intervention is:

$$C'(F) = \frac{1}{\lambda}\left(\sum\left(\frac{\partial L_i^B}{\partial D_i^B}\frac{\partial D_i^B}{\partial F} + \frac{\partial L_i^V}{\partial D_i^V}\frac{\partial D_i^V}{\partial F} + D_i^V\frac{\partial L_i^V}{\partial F}\right) + \frac{\partial L^*}{\partial F}\right) - \sum(C_i - P_i)\frac{\partial D_i^B}{\partial F} \qquad \text{(A2.5)}$$

This indicates that the marginal cost of provision should be set equal to the benefit due to health improvement (represented by the term multiplied by the conversion factor $1/\lambda$) and due to budget savings. The health benefits are composed of two types of effects. The expression $\frac{\partial L^*}{\partial F}$ captures any direct health benefit from the investment itself. An example of F in this case would be vector control or any primary

prevention activity done by the ministry. The expression $D_i^V \frac{\partial L_i^V}{\partial F}$ reflects any improvement in the effectiveness of the private sector as a result of the investment. An example would be IEC (information, education and communication) activities directed at private providers. Against these direct improvements in health status must be counted the health improvement for the cases which could have been handled by the curative care system had the people become ill and sought treatment. The terms involving $\frac{\partial L_i^B}{\partial D_i^B} \frac{\partial D_i^B}{\partial F}$ and their equivalent for the private sector are negative since the effect of prevention, say, on demand for services should be negative. Prevention of diseases in which effective curative care is being used is less important than prevention of diseases with no cure. However, the existence of curative care is irrelevant if people are not using it and therefore, the offset to the health effects of the prevention activity only comes from that part of the reduced incidence which is reflected in the reduction of demand for care. Those who never sought care to begin with still reap the benefits. The budgetary benefits for the Ministry are captured in the last term in expression A2.5. Prevention is beneficial to the extent that it saves the Ministry its subsidy to services.

The existence of public health interventions can change the optimal pattern of subsidies and services provided though there is no general rule concerning what these changes will be. Direct investments may lead to a disease condition either appearing or disappearing from the list of treated illnesses. For the cases where the rationing rule has real effects (free care or uniform fees) the inclusion of direct investments can drive some activities out of the list since the budget constraint will bind more tightly and the cutoff level of effect, λ, will rise. The same would happen, of course, if the investment led to the actual eradication of the disease. Alternatively, reducing the demand for a particular type of treatment to a low level may make it worthwhile to promise since the budgetary impact will be much less (the denominator in expression A2.1 or A2.4 will be lower). In the case of disease-specific charges, this would show up as a possibly higher subsidy rate on treating the residual cases of the disease. There could also be impact on the pattern of own and cross price elasticities if the people who are most affected by the control activities (say, remote rural dwellers) vary systematically from others in the sector in which they seek treatment or the way in which they respond to prices. For example, if demand for public services in the remote areas is more inelastic (since fees may be a smaller fraction of the total cost of

seeking treatment due to transport and time costs), market demand elasticity will rise. The control activities can change the market level elasticities of demand for treatment and therefore the appropriate price and rationing rule for those treatments.

Appendix 3- Welfare changes from policies and projects

The underlying problem discussed in section 2. in the text is described in Boadway (1975), Squire (1989) and Kanbur (1991) and sets out the problem of improving the level of welfare of a society either by policy reform or by direct investment in productive activities (a "project"). Here we use the notation in Kanbur and note that a change in welfare can be written:

$$dW = \left(-t \cdot \frac{\partial x}{\partial q} \cdot E^{-1} \cdot \frac{\partial y}{\partial p}\right) dt + \left(p + t \cdot \frac{\partial x}{\partial q} \cdot E^{-1}\right) dz \qquad \text{(A3.1)}$$

where: W = measure of welfare

q = a vector of consumer prices (marginal benefit) of a commodity

p = a vector of producer prices (marginal private cost) of a commodity

t = q-p or, the "distortion" of prices in the economy

x = a vector of levels of consumption of each commodity

y = a vector of production levels of each commodity

E = the matrix of elasticities of net demands

z = the vector of net inputs and outputs associated with a project

Note that both policy reform, dt, and direct project investment, dz, are justified on the part of the government by the existence of the distortions, t. This is obvious for the case of policy reform from the first term in the expression since there could be no improvement in welfare from any change in t if all distortions were originally zero. On the project evaluation side, it is less obvious since the term describing the welfare change due to projects (dz) is composed of two parts. The second term in the shadow price calculation is the "distortion correcting" component of the valuation. Investments receive a premium in the calculation if they lead to an expansion of consumption of goods with higher social valuation than private. The first term, p, is the actual private resource cost. If there are no distortions in the system, the value of a project would be: p'dz.

This argument seems to indicate that an increase in welfare would result from a public project if it would turn a profit at private prices and could therefore be justified. However, this raises some

questions as to the source of projects for evaluation. The usual, zero profit condition for competitive equilibrium would be (in the current notation): $p'dz=0$. This indicates that, in the absence of any distortions (policy induced or a result of private market failure), while the condition of turning a profit by government is sufficient to justify an investment, such an investment is not likely to be found. On the other hand, as Hammond (1990) says, "[those], with more open minds, will at least wish to consider the possibility of there being some desirable projects which private sector corporations and entrepreneurs have overlooked." However, it is not clear that, even if the government were to identify such a project, it will actually want to do things which are viable at private prices. An alternative would be simply to provide the information that profit making opportunities exist. If no one in the private sector takes advantage of the information, one might wonder if there are, in fact, distortions in the capital markets, say, which prevent the investment or, that it just isn't so certain that the calculation was correct. When there are distortions to be corrected, the role for public involvement is clear and the reason for the project not being undertaken is less mysterious.

In the usual description of this problem, the "distortions" associated with the problem are policy induced taxes (hence the mnemonic "t") which drive a wedge between producer and consumer prices. In the case of the health sector, however, these are as likely to be due to market imperfections in the private sector as policy induced. The specific forms of the distortions in the health sector are described in the text. For the cases in which the market failure is due to non-competitive elements of the market for medical care, both the wedge between social and private values, t, and the response of net consumption of all commodities to both policies and investments, E, a model of private market equilibrium is necessary.

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