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WELFARE IMPACTS OF HEALTH CARE USER FEES: A HEALTH-VALUATION APPROACH TO ANALYSIS WITH IMPERFECT MARKETS

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Abstract

Despite large investments in determining the demand effects of raising health care user fees in developing countries, there has been little *welfare* analysis of user fees. Conventional wisdom assumes that the more that user fees discourage demand, the worse is a user-fee policy. This paper shows that this conventional wisdom is contradicted by neoclassical analysis. It is then argued that empirically resolving these conflicting predictions using standard consumer surplus measurement is inadequate. This is because market imperfections make individual private revealed values potentially different from actual social benefits. An alternative "health-valuation" approach to social welfare measurement is proposed here instead. This involves a re-orientation of analyses towards direct measurement of health outcome effects, which is argued to be the preferred research strategy.

JEL Classification Code: I18
Key Words: User Fees, Bamako Initiative

SECTION 1: INTRODUCTION

Health care in developing countries has long been provided by governments, and typically at heavily subsidized prices. In the past decade this has begun to change, as budget tightening has led the World Bank (Akin et al., 1987) and others to call for raising user fees, both to recover costs and to reduce inefficiency. This policy was embraced in 1987 by a meeting of African health ministers who endorsed UNICEF's "Bamako Initiative" (Lancet, 1988), which specifically promoted user fees to raise funds for local health care improvements. User fee proposals have met resistance, however, from people concerned that cutting subsidies is inequitable (e.g., Waddington and Enyimayew, 1989; Creese, 1991).

This paper assesses past approaches to analyzing the equity and efficiency effects of user fee policies, and suggests improvements by explicitly incorporating information on health outcomes.

Section 2 reviews past analysis approaches, and presents differences in price elasticities of health care demand across socioeconomic groups in Cote d'Ivoire. Elasticities have been important in previous analyses, based on the conventional wisdom

that the more demand falls as fees rise, the worse is the policy (eg., Akin et al., 1985; Akin et al., 1987; Jimenez, 1990; Griffin, 1991; Creese, 1991; Litvack and Bodart, 1993).

However, this conventional wisdom is shown theoretically and empirically to be contradicted by neoclassical economics, which predicts that more elastic consumers lose less welfare when prices increase (Ramsey, 1927). This is because elastic consumers are better able to substitute to alternative care, instead of having to decrease non-health consumption to afford higher prices. The conflict between conventional wisdom and neoclassical analysis may be resolved by incorporating both the concept of health as a merit good, and also market imperfections. In particular, imperfect information about the effect of health care on health outcomes may be important.

If these neoclassical assumptions do not hold, however, then estimation of welfare effects is made more difficult: The usual welfare analysis based on individual revealed preference may not accurately represent the true social costs of higher user fees. For example, individuals may undervalue preventive measures such as prenatal care. Similarly, sick people may value high-tech curative procedures more highly than does society overall.

To remedy this empirical deficiency, Section 3 suggests re-orienting research towards a "health-valuation" approach to measuring welfare effects. Instead of inferring health care value solely from private consumer surplus, it is argued that a preferred strategy is to develop ways to measure and value changes

in health itself. The social cost of decreased health can then be compared to the revenue generated, while still taking into account changes in non-health consumption when fees rise. This approach has formidable information requirements, but progress is already being made in these areas.

One implication of this approach is that evaluations of actual user fee experiments should focus on measuring health outcome changes, instead of merely demand changes. This will not necessarily entail large new costs, since resources are already being spent to monitor user fee effects, as witnessed by the many case studies undertaken. Examples include Waddington and Enyimayew (1989) in Ghana, Yoder (1989) in Swaziland, de Bethune et al. (1989) in Zaire, Litvack and Bodart (1993) in Cameroon, Thomason et al. (1994) in Papua New Guinea, and Mwabu et al. (1995) in Kenya.

The potential benefits of incorporating health information are considerable. Determining differences between private and social benefits of both primary care and high-tech curative care would become more transparent. The challenge, however, will be in harnessing and advancing the literatures on measuring and valuing health, for use in these judgements of user fee effects.

SECTION 2: ELASTICITIES AND WELFARE

This section considers past approaches to analyzing the

welfare effects of user fees, which have relied on varying levels of economic theory. First, the simplistic "health is the only thing that matters" interpretation is given to the view that higher elasticities imply that fees are worse, and some general caveats are discussed. Second, it is shown that under neoclassical conditions, higher elasticities imply that fees are less bad. Third, possible ways to resolve this contradiction are discussed.

There have been several user fee analyses which are important, but not considered here because they are not directly relevant to the issues in this paper (some have been reviewed elsewhere, such as in Jimenez, 1995, and McPake, 1993). For example, Akin et al. (1987) and Jimenez (1987, 1990, 1995) have discussed many of the consequences of market imperfections for the welfare analysis of health care user fees. Musgrove (1986) has also analyzed optimal fee policy, but his analysis is only relevant for health planners once their budget has been allocated. In contrast, a key element of the present analysis is that it may be desirable to trade-off the health budget for other types of welfare-improving government programs.

2.1: The "Higher Elasticities Imply Higher Welfare Losses" View

Many discussions of user fees do not explicitly invoke welfare economics, but appear to assume that the higher are elasticities, the worse is a user fee policy. One interpretation of this view is that its adherents are only interested in health

outcomes, and not in individuals' overall well-being (more sophisticated interpretations are offered below). A consequence of this interpretation is that for those concerned with equity, it is important to see how elastic the poor are relative to the rich.

To illustrate this view, Table 1 presents health care demand levels and time-price elasticities for various socioeconomic groups in Cote d'Ivoire. The data is the 1985 Living Standards Survey as described in the Appendix, estimated for rural adults. Because monetary fees were zero, the "prices" analyzed are the community reported travel times to hospitals and clinics. The elasticities are simulated changes in demand probabilities, based on discrete choice nested logits of the choice between visiting hospitals, clinics, or neither; estimation does not condition on sickness status. The regressions underlying the reported elasticities are presented in Tables 4-6. For further discussion see the Appendix, and Dow (1995).

According to conventional wisdom, Table 1 would indicate that the poor and the elderly would be hurt most by user fees, while adults aged 15-55 would feel little impact. User fees would thus appear to be inequitable.

Even if health is the only thing one cares about, however, one must be careful in interpreting these elasticities. For example, Table 1 also highlights the importance of considering not just difference in elasticities, but also in demand *levels* across groups. A striking effect is apparent for the poor, who are only one-third as likely to use a hospital as the rich. Given that the

mean income of the poorest quartile is about one-fourth that of the rest of the population in Cote d'Ivoire, if the poor valued the health care at only 75% of what it is was worth to the rest, user fees would be a progressive policy.

Furthermore, the cross-elasticity of clinic demand by the poor with respect to the hospital travel time is -.35. When the elasticity is converted to the marginal change in demand probabilities for the poor, this implies that a marginal hospital travel time increase leads to a .02 decrease in the probability of hospital demand. That is completely offset, however, by a .02 increase in the probability of clinic usage when only the hospital fee increases. Thus not only do the poor pay a smaller share of the tax, they continue to receive modern health care. Clearly, analyzing the equity effects of user fees is more complex than comparing the own-price elasticities of health care demand of the rich versus those of the poor.

Despite the above general caveats, evidence in Gertler et al. (1987) does support the idea that user fees are inequitable. They use a discrete choice demand model to simulate the effects of user fees in Peru, and calculate consumer surplus losses of the rich and poor (but only among the sick population). Their results show that the poor's losses were higher as a percentage of their income, implying that the policy is regressive.

However, as discussed below, this finding is not driven by the fact that the poor in that sample are also more elastic. Because they assume individuals care about both health and non-

health consumption, and they assume neoclassical markets (as pointed out by Griffin, 1991), their finding is in *spite* of the fact that the poor are more elastic. They do not present information to determine which group has higher absolute consumer surplus losses, but the neoclassical prediction is that the rich do; it is only as a percentage of income that the poor are hurt more in their sample.

2.2 Neoclassical Welfare Predictions

The neoclassical intuition of user fees causing diminishing welfare losses with higher elasticities is simple; it is also unsurprising, given the similarity to Ramsey's (1927) well-known results. While inelastic consumers are caused to decrease consumption of other goods and pay the higher user fee, elastic consumers are able instead to substitute alternative inputs for the good being "taxed." The elastic consumers reveal these substitutes to be preferred to the old good, at the higher price. Furthermore, inverse demand curves can also be interpreted as willingness-to-pay curves, thus a related interpretation is that elastic consumers do not value the last unit consumed as much as do inelastic consumers. While the rich consider health care valuable, the poor may prefer to spend their money on other health inputs such as nutrition. For example, paying higher prices for health care may require selling the family goat which provides milk for the children (Mwabu, 1990). When instead the health care is foregone, this reveals that the care was not as worthwhile as

other expenditures. This can be seen in Figure 1, which shows that when price rises from p_0 to p_1 the elastic consumer loses a surplus amount represented by area A. This loss is less than that of the loss to the inelastic consumer, the difference being area B.

To make this point more concrete, assume a simple linear inverse demand function as in Figure 1: p=a-bq. Let S represent consumer surplus, which can be easily calculated from the geometrical area (A+B+C+D) under the willingness-to-pay curve and above the actual price p_0:

$$S=\frac{(a-p)^2}{2b} \tag{1}$$

The change in surplus as the price increases is the first derivative:

$$\frac{dS}{dp}=\frac{p-a}{b} \tag{2}$$

This will be negative (surplus is lost when price increases) as long as a>p, which is the region where demand is positive.

Furthermore, for a given observed price and quantity, the elasticity will be inversely related to b. Hence the second cross derivative of consumer surplus S with respect to b shows that higher elasticities (lower b) are associated with smaller welfare losses from the price increase:

$$\frac{d^2S}{dpdb}=\frac{a-p}{b^2}>0 \tag{3}$$

This is the result discussed above informally.

One implication of this is that when neoclassical welfare measurements such as consumer surplus are used empirically, more elastic individuals should be found to have lower private welfare losses than inelastic individuals. This is illustrated in Table 2 with the Cote d'Ivoire data, comparing consumer surplus changes across income quartiles when hospital travel time-prices increase by 15 minutes.[1] The losses were calculated as equivalent variations (EV), averaged over all individuals i in each quartile. The calculation was based on the Small and Rosen (1981) derivation of discrete choice welfare analysis:

$$EV_i = (1/\lambda_i)\,[W_{0i} - W_{1i}] \qquad (4)$$

where W_0 and W_1 are expected utilities evaluated at the original and new prices, respectively. The marginal utility of income, λ, was calculated for each individual as the derivative of welfare W, evaluated at the original prices. W is calculated as in Gertler et al. (1987):

$$W = \ln\left[\exp(V_0) + \left(\sum_{j=1}^{J} \exp(V_j)\right)^{\sigma}\right] \qquad (5)$$

where V_j is the utility index for each choice j=0...J, as specified in the Appendix.

As Gertler et al. (1987) found with Peruvian data, raising

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[1]To ensure that the results are not driven by the stratified estimation methodology used in Table 1, all of these calculations are derived from a single unconditional regression pooling all four income quartiles.

the hospital access price for this Cote d'Ivoire sample is regressive, although not nearly as much as was found in Peru. (The Peruvian experiment also simulated simultaneous hospital *and clinic* fee increases). As predicted, however, *absolute* welfare losses are higher for the (inelastic) rich. In columns 3 and 4 it is seen that this result is not affected if only the currently ill are considered (as in Gertler et al., 1987). Whether these private perceived losses are considered to be "inequitable" or not will depend on the definition of equity used, but it is remarkable that this policy costs the inelastic rich seven times more than the elastic poor.

2.3 Imperfect Information, and Health as a Merit Good

The previous two sub-sections presented contrasting implications of elasticity magnitudes for the welfare impact of user fees. This section presents ways to expand the neoclassical framework to make it consistent with more sophisticated versions of the "higher elasticities are bad" view.

First, the above neoclassical analysis can be made more flexible by relaxing the assumption that individuals correctly determine the health benefits of health care. Imperfect information is considered to be widespread in health (e.g., Arrow, 1963), in both developing and developed countries. If planners consider the direction of bias to be that people systematically undervalue health care, for example, then the above neoclassical results could be overturned, as shown below.

A second deviation from neoclassical analysis is to assume that planners consider health to be a "merit" good, meaning that society may place a higher value on healthiness than do individuals. Effectively, this implies that non-health aspects of individual well-being are de-emphasized relative to health. Such a perspective could result in discounting opportunities for an individual to become better off by substituting, for example, nutrition for curative health care.

Other ways in which the neoclassical assumptions could be relaxed might include taking into account disease-transmission externalities, which would again cause society to value health more highly than do individuals.

These external social benefits could be incorporated into the neoclassical model in various ways, and it turns out that the exact assumptions have an effect on whether or not higher elasticities imply higher welfare losses from user fees.

One set of assumptions is illustrated by Figure 2, where it is assumed that health planners have some ideal health status, and any deviations from that are bad. Each successive health care unit foregone has an increasingly larger value according to the planner than is revealed by the individual. The planner prefers high health care levels, with little regard for whatever this entails in terms of other alternatives foregone. It is readily apparent from the graph that higher elasticities lead to greater social welfare losses (area E+F is the additional lost welfare when consumers are elastic).

An alternative scenario is depicted in Figure 3, where individuals under-value health care by some constant amount Δa per unit. It happens that in this case, the welfare implications of elasticities depend on the relative sizes of Δa and the price increase Δp:

$$S(p) - S(p+\Delta p) = \Delta p\left[q + \frac{1}{b}\left(\Delta a - \frac{\Delta p}{2}\right)\right] \qquad (6)$$

Since smaller b implies higher elasticities:

if $\Delta a > (\Delta p/2)$ then more elastic ==> welfare loss larger

if $\Delta a < (\Delta p/2)$ then more elastic ==> welfare loss smaller

This indeterminacy of welfare predictions is revealing, because of the difficulty in measuring externality parameters such as Δa. One implication of this is that it is inadequate to simply rely on elasticity measures for determining the social welfare effects of raising user fees.

Furthermore, the social external benefits emphasized here have other implications beyond simply the relationship between welfare and elasticities. They also make it difficult to estimate the true social costs of user fees, for use in cost-benefit analysis. Imperfect information, disease-transmission externalities, and the merit value of health, all are inherently difficult to capture with direct measurement of consumer willingness-to-pay through neoclassical methods, since the individual only reveals private benefits. Difficulties with

private values also arise since those who are actually sick in the data may have higher ex-post (after becoming sick) values for high-tech life-saving care than does the social planner ex-ante (Weinstein et al., 1980). It is for these reasons that the next section investigates alternative approaches to measuring social welfare in the presence of externalities.

SECTION 3: A HEALTH-VALUATION APPROACH

This section presents a general framework for welfare evaluation of user fees[2], and shows exactly what information the neoclassical consumer surplus method misses when markets are imperfect. Alternative ways of measuring such information are then explored, including the direct measurement and valuation of changes in health itself, which is argued here to be the preferred strategy.

3.1 Modeling The Costs and Benefits of User Fees

Raising user fees has both costs and benefits. The benefits

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[2]Many discussions fail to isolate the evaluation of user fees from the evaluation of new investments in health care quality. Although the questions are related, and have been linked by the Bamako Initiative, they are analyzed separately here. Health care quality may not be the best use of additional public funds, and user fees may not be the best way to raise new funds.

are the easier of the two to assess. Additional public funds will be raised, and the value of those will be the value of their best available use. For simplicity, this assumes that the costs and benefits are determined before these funds are disbursed back to individuals. Given efficient allocations, the funds' value equals the amount of extra revenue raised ΔR times the marginal cost m of public funds (since that should equal the benefit of the next available project)[3]. Thus the user fee has

$$Benefit = m\Delta R \tag{7}$$

The cost of user fees is more difficult to measure, as it depends on how different individuals' health H and non-health consumption C are affected. Write utility as a function of these, which each depends on medical care M and user fees F:

$$U\,[H(M(F)),\ C(M(F))] \tag{8}$$

Then the social costs can be written as the sum over individuals i of changes in the social value V of their utility. V can further be broken into additively separable components for health and consumption: $V=V_H+V_C$. This social value is defined to reflect externalities and the merit value of health; equity considerations are captured by separate welfare weights w_i:

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[3]Jimenez (1995) points out that current resource allocations may often be far from efficient. In that case, simply substitute for m an estimate of the marginal benefit of the next best available project.

$$Cost = \sum_i w_i \left(\frac{dV_{H,i}}{dF} + \frac{dV_{C,i}}{dF} \right) \quad (9)$$

The most difficult part of this cost to measure is dV_H/dF (suppressing the individual subscript i). It is instructive to separate this into several components, following the hypothesized differences between private (superscripted by p) and social valuations, the difference between them being some social external effect (superscripted by ε). Thus

$$\frac{dV_H}{dF} = \frac{dV_H^p}{dF} + \frac{dV_H^\varepsilon}{dF} \quad (10)$$

Write the private portion of the derivative as depending on the private value of health, the individual's perception of the technological effect of medical care on health, and individual's demand for medical care:

$$\frac{dV_H^p}{dF} = \frac{dV^p}{dH} \frac{dH^p}{dM} \frac{dM^p}{dF} \quad (11)$$

The difference (dV_H^ε/dF) between the social and private valuations is modeled to depend on two effects. First, individuals may have imperfect information about health technology, and thus their actual ex-post health may systematically differ from expected health by some prediction error dH^ε/dM. Second, social planners may consider health to be a merit good, having a larger social benefit than myopic individuals may assign to it. This change in the difference between the social and private values which arises from merit value can be

written as dV^e/dH. This term might also represent changes in disease-transmission externalities.

The change in the social value of each individual's total health and non-health consumption basket can then be written as:

$$\frac{dV}{dF} = \frac{dV_H^p}{dF} + \frac{dV_H^p}{dH}\frac{dH^e}{dM} + \frac{dV^e}{dH} + \frac{dV_C}{dF} \qquad (12)$$

3.2 Estimating User Fee Costs

There are different potential ways for measuring the change in social (private plus external benefits) value dV/dF. The method chosen by Mwabu and Mwangi (1986) and Gertler et al. (1987) was to use consumer surplus analysis to measure each individual's private revealed change. The advantage of this approach is that it captures in a single measure the sum $dV_H^P/dF + dV_C/dF$, which is the expected private cost. If the social externality elements were insignificant, then each individual's consumer surplus change could be multiplied by welfare weights, and this total social cost could be compared to the benefits $m\Delta R$. Even when the differences between private and social values is not inconsequential, this method still is useful for at least estimating the private portion of the welfare cost. This may be sufficient for answering some policy questions, such as whether user fees are regressive. This is because external benefits may be considered to be higher for the poor who tend to be less educated about health care's benefits, so if in this case private values reveal regressivity, then social ones may be also.

However, given that previous literature has repeatedly emphasized non-private costs as also being significant, they need somehow to be estimated in order to measure overall social welfare effects, beyond equity issues.

An alternative approach, which captures these social external benefits, is to separately analyze the following three components of the fees' impact on welfare:

$$\frac{dV}{dF} = \frac{dV_H}{dH}\frac{dH}{dF} + \frac{dV_C}{dF} \qquad (13)$$

The last of these is the easiest to measure; it is simply the change in private health expenditure, which is obtainable from demand studies. The first two terms in dV/dF, however, are more difficult to measure.

The first term, dV_H/dH, represents the social value of changes in health. This is difficult to quantify, but there is a growing literature which attempts to measure the value of health (see for example the study by Manning et al., 1991). The second term, dH/dF, represents the effect of user fees on health. This is also difficult to measure, but again there are researchers already attempting to determine key health outcome indicators which could potentially be measured.

Two health measurement methods might be used: First, actual user fee experiments have been longitudinally studied in numerous countries. In the past, such studies have tended to focus only on utilization. In the future, these could also focus on identifying changes in health outcomes as a result of the fees. Second,

demand responses to fees, and the health effects of changed demand, could each be estimated separately. The demand estimates are becoming better understood, but again more research is necessary on the effects of utilization of various procedures on actual health outcomes.

In order to be operational, this approach may require detailed information on specific aspects of health. Thus, instead of asking the question of whether user fees for all procedures should be zero, it could be asked whether fees for renal dialysis should be closer to zero, or closer to their market price.

Related progress is also being made in translating the costs of different diseases into comparable units such as Quality-Adjusted Life-Years, Healthy-Year Equivalents, and Disability Adjusted Life-Years (eg., World Bank, 1993), although refinement is still needed. Thus far these have been used primarily to compare the benefits of different health interventions, and further work is needed to enable comparisons of health to non-health expenditures.

The information requirements of measuring health changes and their value are not trivial. This is inevitable, given the difficulty in measuring the difference between private and social costs of user fees. Diamond and Hausman (1994) have argued that it is possible for poorly obtained welfare estimates to impede social decisions. It is argued here, however, that the comprehensive investigation of user fee welfare effects through direct health measurement is likely to yield more transparent and

credible welfare estimates, that can improve these decisions.

SECTION 4: CONCLUSION

There is disagreement over both the welfare effects of health care user fees in developing countries, and how those welfare effects should be measured. Much resources have been spent on analyzing how fees affect demand, but it has been shown here that the relationship between demand and welfare is theoretically ambiguous. Furthermore, widespread market imperfections question the accuracy of empirical social welfare valuation approaches based on individual's private consumer surplus.

In analyzing equity, neoclassical methods were shown to predict that higher price-elasticities of demand by the poor implied that user fees were more equitable. This difference from conventional wisdom is likely due to both imperfect information about health care's benefits, and social views of health as a merit good. However, the magnitude of the difference between private and social benefits remains unknown.

This paper has proposed that user fee research be re-oriented towards a different type of analysis which circumvents many of these problems. This health-valuation approach is an application of cost-benefit techniques, and requires new research on both measuring health outcomes as well as estimating the social value of health changes. Furthermore, it calls for new directions in

survey analyses of actual user fee experiments, to focus not only on utilization changes, but also on the resulting health outcome changes. This is a long-term research agenda, but it offers the promise of more transparent and comprehensive analyses of the full array of social costs and benefits of user fee changes.

Appendix: Data and Econometric Specification

The data used in Section 2 are the 1985 Cote d'Ivoire Living Standards Survey, collected jointly by the World Bank and the Ivorian government. This was a random household survey of over 13,000 individuals from 1600 households, which included both extensive household level and community level questionnaires. Table 3 presents means and definitions of variables used in this study; Ainsworth and Munoz (1986) describe the data in more detail, and Dow (1995) describes the exact sample used here. These data are well-suited for this application, as their basic features have already been explored in several health care demand studies (Dor et al., 1987; Dor and van der Gaag, 1993; Gertler and van der Gaag, 1990).

Dow (1995) explains the behavioral model (14) underlying the present analysis, where utility is a polynomial in lagged, current, and future health H and consumption C terms. That paper also derives the actual econometric specification used (15) of the indirect utility function V, which is a function of socioeconomic characteristics X, price P, income Y, travel times T, and wages w.

$$U_j = \alpha_1 C_{j,t} + \alpha_2 C_{j,t}^2 + \alpha_3 E[C_{j,t+1}] + \alpha_4 E[H_{j,t}] + \alpha_5 E[H_{j,t+1} - H_{j,t}] + \alpha_6 C_{j,t} E[H_{j,t}^c - H_{t-1}] + \alpha_7 C_{j,t}^2 E[H_{j,t}^c - H_{t-1}] + \varepsilon_j \quad (14)$$

$$V_j = \beta_{0j} + \beta_{1j}X + \beta_{2j}P_j + \beta_{3j}(P_j)^2 + \beta_{4j}(P_j*Y) + \beta_{5j}Y + \beta_{6j}P_k + \beta_{7j}T_j + \beta_{8j}w + \epsilon_j \quad (15)$$

Furthermore, Dow (1995) argues that it is permissible to stratify estimation on the exogenous variables analyzed here such as age and gender. This is reasonable because of the many possible interactions between health and consumption in the utility function, and the possibly non-linear way in which socioeconomic shifters may enter the health production function. Thus such stratified analyses do not violate rational choice axioms, and can simply be viewed as searches for appropriate interactions in the data, with more flexible specifications than represented by (14) and (15).

In Cote d'Ivoire, individuals are assumed to choose between three health care options: public hospitals, public clinics, or neither. Although user fees in 1985 for these services were zero, the past studies on this sample have shown travel times to the facilities to be significant in rationing demand in rural areas. These demand estimates were restricted to rural adults, to enable the differences between sub-groups of this population to be concisely estimated. However, as discussed in Dow (1995), estimation does not condition on persons having reported themselves sick. This is because price changes may still affect the future welfare of those not currently sick.

The nested logit model is used for the estimation, assuming that the ε_j are distributed type 1 extreme value (McFadden, 1973, 1981), and assuming some unobserved correlation between the modern

care alternatives of clinics and hospitals. Full information maximum likelihood estimation (primarily using Davidson-Fletcher-Powell, with covariance corrections) was carried out using hlogit (c)Axel Boersch-Supan. Elasticities were calculated using sample enumeration (Train, 1985), i.e. averaging the change in predicted choice probabilities over the sample following one percent travel time increases.

REFERENCES

Ainsworth, M. and J. Munoz, 1986, Cote d'Ivoire living standards survey, Living Standards Measurement Study working paper 26 (The World Bank, Washington, DC).

Akin, J., N. Birdsall and D. de Ferranti, 1987, Financing health services in developing countries: an agenda for reform (A World Bank Policy Study, Washington, DC).

Akin, J., C. Griffin, D. Guilkey, and B. Popkin, 1985, The demand for primary health services in the third world (Rowman and Allanheld, Totowa, NJ).

Arrow, K., 1963, Uncertainty and the welfare economics of medical care, American Economic Review 53, 941-973.

Creese, A., 1991, User charges for health care: a review of recent experience, Health Policy and Planning 6, 260-270.

de Bethune, X., S. Alfani, and J. Lahaye, 1989, The influence of an abrupt price increase on health service utilization: evidence from Zaire, Health Policy and Planning 4, 76-81.

Diamond, P. and J. Hausman, 1994, Contingent valuation: is some number better than no number?, Journal of Economic Perspectives 8, 45-64.

Dor, A., P. Gertler, and J. van der Gaag, 1987, Non-price rationing and the choice of medical care providers in rural Cote d'Ivoire, Journal of Health Economics 6, 291-304.

Dor, A. and J. van der Gaag, 1993, Quantity rationing and the demand of adults for medical care in rural Cote d'Ivoire, in:

A. Mills and K. Lee, eds., Health economics research in developing countries, (Oxford University Press, Oxford) 193-213.

Dow, W., 1995, Health care demand in developing countries: theory, econometrics, and welfare impacts of user fees, (PhD dissertation, Yale University).

Gertler, P., L. Locay, and W. Sanderson, 1987, Are user fees regressive? the welfare implications of health care financing proposals in peru, Journal of Econometrics 36(supp), 67-88.

Gertler, P. and J. van der Gaag, 1990, The willingness to pay for medical care: evidence from two developing countries (Johns Hopkins University Press, Baltimore).

Griffin, C., 1991, Welfare gains from user charges for government health services, Health Policy and Planning 7.

Jimenez, E., 1987, Pricing policy in the social sectors: cost recovery for education and health in developing countries, (Johns Hopkins University Press, Baltimore).

Jimenez, E., 1990, Social sector pricing policy revisited: a survey of some recent controversies, Proceedings of the world bank annual conference on development economics 1989.

Jimenez, E., 1995, Human and physical infrastructure: public investment and pricing policies in developing countries, forthcoming in: T.N. Srinivasan and J. Behrman, eds., Handbook of development economics, Vol. 3 (North Holland, Amsterdam).

Lancet, 1988, The bamako initiative, The lancet, 1177.

Litvack, J. and C. Bodart, 1993, User fees plus quality equals improved access to health care: results of a field experiment in Cameroon, Social Science and Medicine 37, 369-383.

Manning, W., E. Keeler, J. Newhouse, E. Sloss, and J. Wasserman, 1991, The costs of poor health habits, (Harvard University Press, Cambridge, MA).

McFadden, D., 1973, Conditional logit analysis of qualitative choice behavior, in: P. Zarembka, ed., Frontiers in econometrics (Academic Press, New York).

McFadden, D., 1981, Econometric models of probabilistic choice, in: C. Manski and D. McFadden, eds., Structural analysis of discrete data with econometric applications, (MIT Press, Cambridge, MA).

McPake, B., 1993, User charges for health services in developing countries: a review of the economic literature, Social Science and Medicine 36, 1397-1405.

Musgrove, P., 1986, What should consumers in poor countries pay for publicly-provided health services?, Social Science and Medicine, 22 329-333.

Mwabu G., 1990, Financing health services in Africa: an assessment of alternative approaches, Policy, Research, and External Affairs working paper 457 (The World Bank, Washington, DC).

Mwabu G., and W. Mwangi, 1986, Health care financing in Kenya: a simulation of welfare effects of user fees, Social Science and Medicine, 22, 763-767.

Mwabu G., J. Mwanzia, and W. Liambila, 1995, User charges in

government health facilities in Kenya: effect on attendance and revenue, Health Policy and Planning, 10, 164-170.

Ramsey, F., 1927, A contribution to the theory of taxation, Economic Journal, 37, 47.

Small, K. and H.S. Rosen, 1981, Applied welfare economics with discrete choice models, Econometrica, 49, 105-130.

Thomason, J., N. Mulou, and C. Bass, 1994, User charges for rural health services in Papua New Guinea, Social Science and Medicine, 39, 1105-1115.

Train, K., 1985, Qualitative choice analysis (MIT Press, Cambridge, MA).

Waddington, C. and K. Enyimayew, 1989, A price to pay: the impact of user charges in Ashanti-Akin district, Ghana, International Journal of Health Planning and Management, 4, 17-48.

Weinstein, M., D. Shepard, and J. Pliskin, 1980, The economic value of changing mortality probabilities: a decision-theoretic approach, Quarterly Journal of Economics, March, 373.

World Bank, 1993, World development report 1993 (Oxford University Press, Oxford).

Yoder, R., 1989, Are people willing and able to pay for health services?, Social Science and Medicine 29, 35-42.

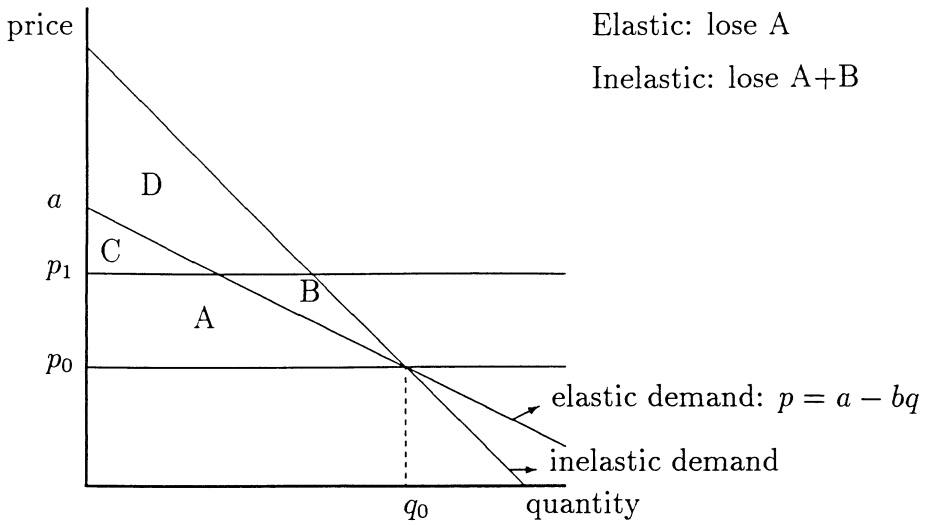

Figure 1: **Smaller Consumer Surplus Loss with Higher Elasticity**

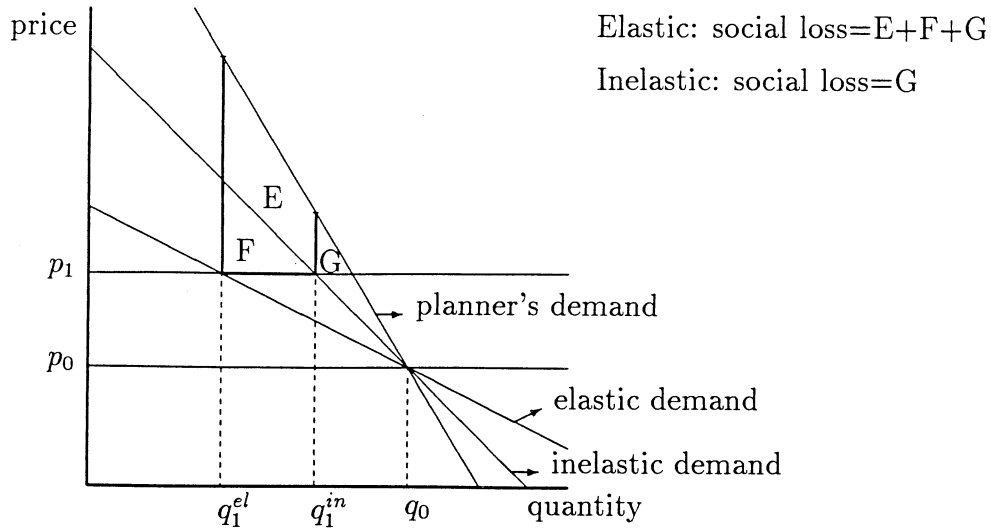

Figure 2: **Larger Social Welfare Loss with Higher Elasticity, when Planner's Demand is Inelastic**

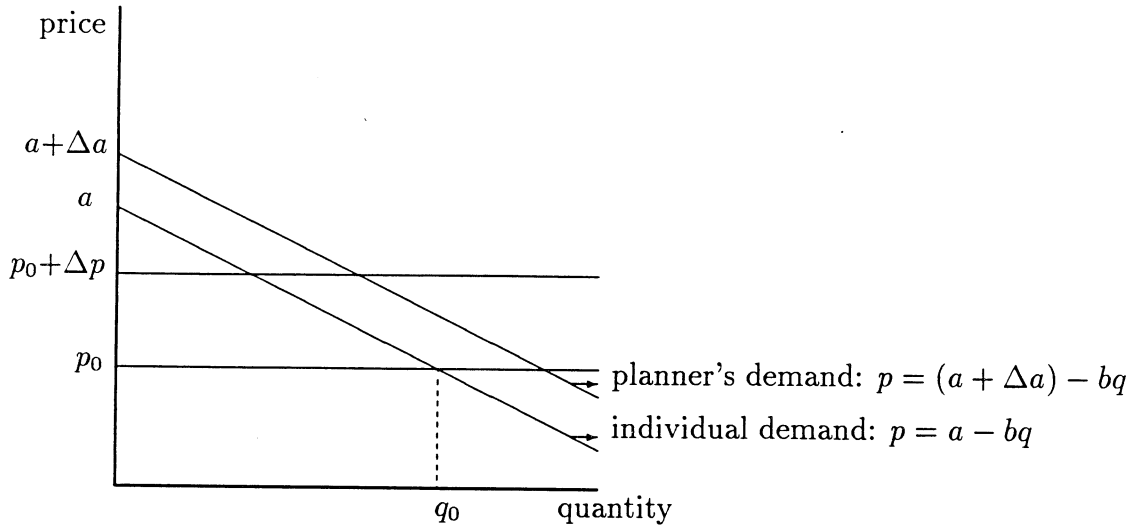

Figure 3: **Planner's Willingness-to-Pay with Constant Marginal External Benefits**

Table 1: Demand Levels and Elasticities by Socioeconomic Group

	Demand Probabilities		(Time)-Price Elasticities			
	Clinic	Hospital	Clinic Demand		Hospital Demand	
			Own	Cross	Own	Cross
Poorest 25%	.07	.02	-.36	.35	-1.32	.93
Top 75%	.08	.06	-.17[1]	.09[1]	-.15[1]	.20[1]
Age 15-55	.07	.05	-.04	.00	.02	.09
Age>55	.11	.06	-.39	.28	-.67	.51
Men	.07	.05	-.10[1]	.13[1]	-.21[1]	.15[1]
Women	.09	.05	-.11	-.01[1]	.31[1]	.02
Women>55	.11	.05	-.48	.21	-.55	.67

[1]Not significantly different from zero at the 10% level.

Table 2: Consumer Surplus Loss for Inelastic Rich and Elastic Poor, When the Hospital Travel Time-Price Increases 15 Minutes

Income	Whole Population		Sick Only	
Quartile	Absolute	As % of Income	Absolute	As % of Income
Lowest	27	.0045	32	.0053
2nd	54	.0042	63	.0049
3rd	86	.0042	97	.0048
Highest	206	.0043	243	.0052

Table 3: Descriptive Statistics for Adult Rural Population

Variable	Mean	Standard Deviation
Probability visit Hospital (last 4 weeks)	.048	.22
Probability visit Clinic (last 4 weeks)	.078	.27
Travel Time: Hospital (hours, round trip)	1.91	2.00
Travel Time: Clinic	1.08	1.23
Wage (hourly, 1985 CFA)[1,2]	64	24
Income (monthly, 1985 CFA)[3]	20,600	17,800
Age[2]	37	16.9
Male	.43	.50
Education (years)	1.14	2.62

Sample Size = 4042

---

[1]Community daily agricultural wage by gender, divided by eight hours.

[2]Divided by 100 for estimation.

[3]Permanent income is proxied by total household consumption, normalized by number of adults in household. Divided by 10,000 for estimation.

Table 4: Nested[1] Logit Demand Results by Income Group

	Low-Income Quartile		Top 75% Income	
	Coeff.	t-stat	Coeff.	t-stat
Time Hosp_h[2]	-.94	(1.72)	.06	(1.10)
Time Clin_c	-.36	(1.65)	.04	(0.50)
TimeH*wage_h[3]	1.02	(0.64)	-.16	(0.76)
TimeC*wage_c	-.79	(1.09)	-.51	(1.04)
Age_h	2.56	(3.77)	1.67	(4.23)
Age_c	2.82	(4.33)	1.64	(4.07)
Male_h	.03	(0.10)	-.19	(1.40)
Male_c	-.09	(0.37)	-.23	(1.78)
Education_h	-.01	(0.17)	.01	(0.56)
Education_c	.00	(0.04)	.00	(0.09)
Wage_h	-1.45	(1.45)	.50	(1.46)
Wage_c	-.41	(0.66)	.34	(1.07)
Income_h	2.07	(2.57)	.08	(1.80)
Income_c	1.80	(2.44)	.09	(2.99)
(Wage*TimeH)^2[4]	-.18	(0.60)	-.00	(0.04)
(Wage*TimeC)^2	.13	(1.48)	.13	(0.99)
Wage*TimeH*Income[5]	-.27	(0.60)	-.00	(0.03)
Wage*TimeC*Income	-.55	(1.53)	.01	(0.55)
Intercept_h	-3.78	(4.46)	-3.04	(10.26)
Intercept_c	-4.17	(5.75)	-2.78	(11.47)
Inclusive value[6]	.09	(14.80)	.16	(5.41)
log-Likelihood	-314.2		-1434.9	
number of obs	1011		3031	

Notes for Tables 4-6:

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[1]All models have been estimated with hospital and clinic being nested separately from self-care.

[2]_h, _c suffixes indicate the coefficient measures the effect of the variable on the hospital, and clinic options, respectively.

[3]This wage*time interaction is the hospital time-price term, divided by 100 for estimation.

[4]This squared time-price term is divided by 10,000 for estimation.

[5]This price*income interaction is multiplied by (-2), allowing informal tests of the possible equality restriction embedded in the quadratic price coefficient discussed in Dow (1995). Divided by 10^6 for estimation.

[6]Coefficient on the inclusive value term of the hospital-clinic nest; t-test is for null hypothesis that coefficient equals one.

Table 5: Nested[1] Logit Demand Results by Age Group

	Age 15-55		Age>55	
	Coeff.	t-stat	Coeff.	t-stat
Time Hosp_h[2]	.11	(1.56)	-.41	(1.56)
Time Clin_c	.06	(.38)	-.23	(1.37)
TimeH*wage_h[3]	-.42	(1.46)	.76	(1.46)
TimeC*wage_c	-1.23	(2.82)	.08	(.20)
Age_h	2.64	(3.86)	-2.08	(1.38)
Age_c	3.57	(6.09)	-3.17	(2.15)
Male_h	-.16	(.97)	.17	(.72)
Male_c	-.40	(2.75)	.13	(.57)
Education_h	.03	(1.22)	.26	(1.97)
Education_c	.02	(.73)	.24	(1.77)
Wage_h	.50	(1.24)	-.35	(.54)
Wage_c	.46	(1.59)	-.01	(.03)
Income_h	.04	(.70)	.15	(1.98)
Income_c	.11	(3.24)	.12	(1.86)
(Wage*TimeH)^2[4]	-.02	(.31)	-.09	(1.03)
(Wage*TimeC)^2	.36	(2.96)	.05	(.38)
Wage*TimeH*Income[5]	-.06	(1.35)	.03	(1.03)
Wage*TimeC*Income	.03	(.86)	.05	(1.12)
Intercept_h	3.79	(10.91)	-.42	(.41)
Intercept_c	3.52	(12.12)	.32	(.30)
Inclusive value[6]	.54	(1.64)	.14	(7.08)
log-Likelihood	-1421.5		-339.7	
number of obs	3405		637	

Table 6: Nested[1] Logit Demand Results by Gender Group

	Males		Females	
	Coeff.	t-stat	Coeff.	t-stat
Time Hosp_h[2]	.02	(.40)	.04	(.28)
Time Clin_c	.01	(.18)	-.05	(.19)
TimeH*wage_h[3]	-.04	(.31)	.06	(.08)
TimeC*wage_c	-.14	(.35)	-2.64	(3.67)
Age_h	2.56	(5.72)	.58	(.78)
Age_c	2.56	(5.77)	1.85	(3.46)
Male_h	--		--	
Male_c	--		--	
Education_h	.04	(1.42)	-.09	(1.19)
Education_c	.03	(.79)	.02	(.49)
Wage_h	.47	(1.34)	.09	(.12)
Wage_c	.46	(1.46)	.07	(.16)
Income_h	.06	(1.59)	.03	(.34)
Income_c	.07	(1.50)	.10	(2.09)
(Wage*TimeH)^2[4]	-.00	(.22)	-.14	(.82)
(Wage*TimeC)^2	.05	(.37)	.94	(4.55)
Wage*TimeH*Income[5]	.00	(.39)	-.11	(2.27)
Wage*TimeC*Income	.02	(.43)	-.01	(.11)
Intercept_h	-3.63	(10.51)	-3.68	(6.06)
Intercept_c	-3.54	(11.05)	-2.62	(7.52)
Inclusive value[6]	.11	(3.15)	1.05	(.11)
log-Likelihood	-744.2		-1023.7	
number of obs	1736		2306	

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