Measuring the Willingness to Pay for Social Services in Developing Countries

Paul Geedler
Jacques van der Gaag
LSMS Working Papers

No. 6  Household Survey Experience in Africa

No. 7  Measurement of Welfare: Theory and Practical Guidelines

No. 8  Employment Data for the Measurement of Living Standards

No. 9  Income and Expenditure Surveys in Developing Countries: Sample Design and Execution

No. 10  Reflections on the LSMS Group Meeting

No. 11  Three Essays on a Sri Lanka Household Survey

No. 12  The ECIEL Study of Household Income and Consumption in Urban Latin America: An Analytical History

No. 13  Nutrition and Health Status Indicators: Suggestions for Surveys of the Standard of Living in Developing Countries

No. 14  Child Schooling and the Measurement of Living Standards

No. 15  Measuring Health as a Component of Living Standards

No. 16  Procedures for Collecting and Analyzing Mortality Data in LSMS

No. 17  The Labor Market and Social Accounting: A Framework of Data Presentation

No. 18  Time Use Data and the Living Standards Measurement Study

No. 19  The Conceptual Basis of Measures of Household Welfare and Their Implied Survey Data Requirements

No. 20  Statistical Experimentation for Household Surveys: Two Case Studies of Hong Kong

No. 21  The Collection of Price Data for the Measurement of Living Standards

No. 22  Household Expenditure Surveys: Some Methodological Issues

No. 23  Collecting Panel Data in Developing Countries: Does It Make Sense?

No. 24  Measuring and Analyzing Levels of Living in Developing Countries: An Annotated Questionnaire

No. 25  The Demand for Urban Housing in the Ivory Coast

No. 26  The Côte d’Ivoire Living Standards Survey: Design and Implementation

No. 27  The Role of Employment and Earnings in Analyzing Levels of Living: A General Methodology with Applications to Malaysia and Thailand

No. 28  Analysis of Household Expenditures

No. 29  The Distribution of Welfare in Côte d’Ivoire in 1985

No. 30  Quality, Quantity, and Spatial Variation of Price: Estimating Price Elasticities from Cross-Sectional Data

No. 31  Financing the Health Sector in Peru

No. 32  Informal Sector, Labor Markets, and Returns to Education in Peru

No. 33  Wage Determinants in Côte d’Ivoire

No. 34  Guidelines for Adapting the LSMS Living Standards Questionnaires to Local Conditions

No. 35  The Demand for Medical Care in Developing Countries: Quantity Rationing in Rural Côte d’Ivoire

No. 36  Labor Market Activity in Côte d’Ivoire and Peru

No. 37  Health Care Financing and the Demand for Medical Care

No. 38  Wage Determinants and School Attainment among Men in Peru

No. 39  The Allocation of Goods within the Household: Adults, Children, and Gender

No. 40  The Effects of Household and Community Characteristics on the Nutrition of Preschool Children: Evidence from Rural Côte d’Ivoire

No. 41  Public-Private Sector Wage Differentials in Peru, 1985–86

No. 42  The Distribution of Welfare in Peru in 1985–86

(List continues on the inside back cover)
Measuring the Willingness to Pay for Social Services in Developing Countries
The Living Standards Measurement Study

The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to explore ways of improving the type and quality of household data collected by statistical offices in developing countries. Its goal is to foster increased use of household data as a basis for policy decisionmaking. Specifically, the LSMS is working to develop new methods to monitor progress in raising levels of living, to identify the consequences for households of past and proposed government policies, and to improve communications between survey statisticians, analysts, and policy makers.

The LSMS Working Paper series was started to disseminate intermediate products from the LSMS. Publications in the series include critical surveys covering different aspects of the LSMS data collection program and reports on improved methodologies for using Living Standards Survey (LSS) data. More recent publications recommend specific survey, questionnaire and data processing designs, and demonstrate the breadth of policy analysis that can be carried out using LSS data.
Measuring the Willingness to Pay for Social Services in Developing Countries

Paul Gertler
Jacques van der Gaag

The World Bank
Washington, D.C., U.S.A.
Measuring the willingness to pay for social services in developing countries / Paul Gertler, Jacques van der Gaag.

Bibliography: p.
ISBN 0-8213-1049-6
RA771.7.I9G47 1988
362.1'0425--dc19 88-14229
CIP
ABSTRACT

We provide a methodology for the *ex ante* evaluation of the welfare effects of proposals to use user fees to finance improved access to social services in developing countries. The analysis requires estimation of demand functions, from which price elasticities and the willingness to pay for improved access can be obtained. The willingness to pay is the maximum price that can be charged without reducing individuals' welfare and utilization of medical services. The estimation is complicated by the problem that governments in developing countries often are the dominant suppliers of social services in their countries, and provide these services free of charge so that there is little price variation in the data. We show how variation in individuals' private time prices can be used to identify all of the parameters of the demand functions.

The methodology is used to evaluate the possible implementation of the user fee plan for medical care clinics in rural Côte d'Ivoire. Our results show that it is likely to have highly regressive welfare effects. Specifically, the policy is shown to increase the welfare and medical care utilization of individuals in the top half of the income distribution, while reducing the welfare and medical care utilization of individuals in the bottom half of the income distribution.
ACKNOWLEDGMENTS

The authors have benefited greatly from comments by John Akin, Angus Deaton, Avi Dor, Paul Glewe, Nancy Birdsall, Bela Balassa, John Newman, T. Paul Schultz, Morton Stelcner, John Strauss and participants of seminars at Erasmus University, Harvard University, Johns Hopkins University, Yale University and the European Econometric Society meetings in Copenhagen, August 1987.
TABLE OF CONTENTS

I. Introduction.................................................................1
II. A Model of the Demand for Medical Care..........................4
III. Empirical Specification......................................................7
    The Conditional Utility Function.......................................7
    Quality...........................................................................9
    The Demand Functions and Welfare.....................................11
IV. The Demand for Medical Care in Côte d'Ivoire.....................14
    Data and Institutional Structure.......................................14
    Estimation Results..........................................................17
    Price Elasticities and Income Effects................................19
    Welfare Neutral Prices....................................................22
V. Conclusions and Policy Reform.........................................25
Endnotes..............................................................................27
References............................................................................29

Table 1: Descriptive Statistics.............................................16
Table 2: Nested Multinomial Logit Coefficient
        Estimates and T-Statistics...........................................18
Table 3: Arc Price Elasticities by Income
        Quartile.....................................................................21
Table 4: Amount Willing to Pay to Avoid Traveling
        for Clinic Care..........................................................24
I. INTRODUCTION

Providing access to social services such as medical care and education is a top priority for many developing countries. Indeed, over the last twenty-five years public medical care centers and schools have proliferated throughout the developing world. These facilities typically charge little or nothing for their services, and tend to be concentrated in urban areas so that rural dwellers must often travel long distances to avail themselves of the services.\(^1\) A large scale expansion of social services to the rural areas is complicated by the current financial crisis in the developing world. Governments faced with huge foreign debt and large fiscal deficits are reluctant, and in many cases unable, to further bloat their budgets by opening new (free) social service programs.

An increasingly popular proposal is to finance social services through user fees (access charges). These fees are a means of recovering some and possibly all of the variable costs of operating facilities, and, if they are set at marginal cost, are likely to improve allocative efficiency. Thus, user fees may allow governments to expand social services to rural areas without adding a permanent increase to their annual budgets.\(^2\)

Any implementation of the user fee plan requires an \textit{ex ante} evaluation of the welfare consequences. This, in turn, requires knowledge of the properties of the demand function, especially price elasticities and the effects of other non-monetary costs such as travel time. The price elasticities provide information about how user fees will affect utilization and revenues. Travel time effects can be used to measure the amount individuals are willing to pay for improved access (reduced travel time). If governments open new social
service facilities in rural areas, then the willingness-to-pay is the maximum price that can be charged without making individuals worse off.

The usually straight-forward exercise of demand estimation is greatly complicated in developing countries by the fact that there is little or no price variation within a country. In many developing countries the vast majority of social services are run by the government who set prices close, and in many cases equal, to zero. Even when prices are positive, they are typically small and uniform within the country. A second issue in modeling the demand for social services is that the decision to use them is discrete. For example, in the case of medical care, individuals choose whether to obtain care from a clinic, hospital, private doctor or to treat themselves.

We derive a discrete choice specification of the demand for medical care from a theoretical model in which private time price variation can be used to identify the parameters necessary to compute monetary price elasticities and willingness-to-pay measures (compensating variations). The model makes use of the well known result that private prices such as the opportunity cost time ration the market when monetary prices are absent or small (Becker, 1965). An added advantage of the model is that it is flexible enough to allow the price elasticities and willingness-to-pay measures to vary by income levels, so that the distributional welfare effects of user fees can also be examined. Moreover, the model is easily adaptable to other social service markets such as education and family planning.

Most studies of the demand for medical care in developing countries have found little impact of prices on demand. These studies typically model demand as a discrete choice with the price effect specified to be independent of in-
This assumption is extremely restrictive, since one would expect the wealthy to be less sensitive to price differences among providers than the poor. Gertler, Locay, and Sanderson (1987) show that these models are inconsistent with utility maximization, and derive a discrete choice specification from a theoretical model that implies a natural interaction between price and income in the demand functions. They find, for the case of Peru, that prices are important determinants of medical care demand and that demand indeed becomes more elastic as income falls.

The studies mentioned above specify time prices as non-monetary nuisance parameters in the utility function, implying that their coefficients reflect the marginal disutility of traveling. Becker (1965) points out that time prices should enter via the budget constraint. Dor, Gertler, and van der Gaag (1987) extend Gertler, Locay, and Sanderson by including time prices in the budget constraint to estimate travel time elasticities. We show that variation in travel time is sufficient to identify all of the parameters necessary to compute monetary price elasticities and compensating variations.

We use this model to evaluate the potential welfare effects of employing user fees to finance an expansion of medical care facilities in rural Cote d'Ivoire. This area is an especially appropriate region for such analysis as income levels are extremely low and the only available medical care is from sparsely-located free government facilities. Our results show that the policy would be highly regressive. Specifically, it would increase the welfare and medical care utilization of individuals in the top half of the income distribution, but reduce the welfare and medical care utilization of individuals in the bottom half of the income distribution.
II. A MODEL OF THE DEMAND FOR MEDICAL CARE

Our framework is a model in which utility depends on health and on the consumption of goods other than medical care. If an illness or accident is experienced, individuals must decide whether or not to seek medical care. The benefit from consuming medical care is an improvement in health, and the cost of medical care is a reduction in the consumption of other goods.

Individuals have to decide not only whether to seek care, but also what type of care. They are able to choose from a finite set of alternative providers one of which is self-treatment. Each provider offers an expected improvement in health (efficacy) for a price. Let us define the quality of an alternative provider as the expected improvement in health as a result of that provider's medical care. The price of an alternative includes both monetary outlays and private access costs such as the opportunity cost of travel time. Based on this information and their incomes, individuals choose the alternative that yields the highest utility.

Formally, let the expected utility conditional on receiving care from provider \( j \), be given by

\[
U_j = U(H_j, C_j)
\]

(1)

where \( H_j \) is expected health status after receiving treatment from provider \( j \), and \( C_j \) is consumption net of the cost of obtaining care from provider \( j \).

The medical care purchased from provider \( j \) is invested in health. The quality of provider \( j \)'s medical care is defined as the expected improvement in health over the health that an individual would expect if he or she treated him or herself. In essence, quality is an expected marginal product. Let \( H_0 \)
be expected health status without professional medical care (i.e. self-treatment). Then, the quality of provider j's care is \( Q_j = H_j - H_0 \), which yields an expected health care production function of the form

\[
H_j = Q_j + H_0. \tag{2}
\]

Quality, as specified, varies by provider, but it may also vary by individual characteristics such as health status and education.

The health production function assumes a simple form for the self-care alternative. Since \( H_j = H_0 \), we have \( Q_0 = 0 \). This implicitly normalizes the health care production function so that the quality of a particular provider's care is measured relative to the efficacy of self-care.

Consumption expenditures (net of medical care) are derived from the budget constraint. The total price of medical care includes both the direct payment to the provider and the indirect cost of access (e.g. the opportunity cost of travel time). Let \( P_j^* \) be the total price of provider j's care and \( Y \) be income, so that the budget constraint is

\[
C_j + P_j^* - Y, \tag{3}
\]

with \( C_j \geq 0 \) required for the jth alternative to be feasible. Substitution of (3) into (1) for \( C_j \) yields the conditional indirect utility function

\[
U_j = U(H_j, Y - P_j^*). 
\]

Notice that income affects utility through the consumption term, and that the price of medical care is foregone consumption.\(^5\)
We are now ready to specify the utility maximization problem. Suppose the individual has $J+1$ feasible alternatives (with the $j=0$ alternative being self-care). The unconditional utility maximization problem is

$$U^* = \max(U_0, U_1, \ldots, U_J),$$

where $U^*$ is maximum utility.
III. EMPIRICAL SPECIFICATION

The solution to (4) yields a system of demand functions, whose forms are probabilities that the alternatives are chosen. The probability that a particular alternative is chosen equals the probability that this choice yields the highest utility among all the alternatives. Thus, the functional form of the demand functions depends on the functional form of the conditional utility function and the distribution of the stochastic variables.

The Conditional Utility Function

Gertler, Locay and Sanderson (1987) show that income can influence the choice of provider only if the conditional utility function allows for a non-constant marginal rate of substitution of health for consumption. A parsimonious functional form that does not impose a constant marginal rate of substitution is the semi-quadratic, which is linear in health and quadratic in consumption. Specifically, let the conditional utility function be

\[ U_j = \alpha_0 H_j + \alpha_1 C_j + \alpha_2 C_j^2 + \epsilon_j \]  

(5)

where \( \epsilon_j \) is a zero mean random taste disturbance with finite variance and is uncorrelated across individuals and alternatives.

Consumption (net of the cost of obtaining care from provider j) is derived from the budget constraint in (3). Specifically \( C_j = Y - P_j^\ast \). The full price of medical care is the direct payment to the provider plus the value of time spent in obtaining the care. Consumption, then, is

\[ C_j = Y - P_j - wT_j \]  

(6)
where $P_j$ is the direct payment to provider $j$, $w$ is the opportunity cost of time, and $T_j$ is the time spent obtaining care from provider $j$.

Substitution of (6) into (5) yields

$$U_j = \alpha_0 H_j + \alpha_1 (Y - P_j - wT_j) + \alpha_2 (Y - P_j - wT_j)^2 + \epsilon_j$$

(7)

Since $P_0 - T_0 = 0$, the conditional utility function in (7) reduces to

$$U_0 = \alpha_0 H_0 + \alpha_1 Y + \alpha_2 Y^2 + \epsilon_0$$

(8)

for the self-care alternative.

The identification of the parameters in (7) requires that the values of expected health and consumption differ across the alternatives. The alternative chosen is the one that yields the highest utility. Therefore, if the contribution of either expected health or consumption to utility is constant across alternatives they cannot influence which alternative is chosen.

If we had assumed a linear utility function, which imposes a constant marginal rate of substitution, the third term on the right-hand side of (7) would not be present. The contribution of income to utility would then reduce to $\alpha_2 Y$, which is constant across alternatives. Since only differences in utility matter, income would not be allowed to influence which alternative is chosen. The second order consumption term implicitly includes a price-income interaction whose value is not constant across alternatives, and therefore is not differenced out of the model. This price-income interaction allows price effects to vary by income.6

At this point it is easy to show that all of the parameters can still be identified if monetary prices are zero. The identification of $\alpha_1$ and $\alpha_2$ in
(9) requires variation in prices and/or travel time across alternatives so that the contribution of consumption varies across alternatives. Hence, it is obvious that it is sufficient to have variation in $T_j$ across alternatives.

Quality

The remaining issue in the specification of the conditional utility function is the measurement of the expected efficacy (quality) of each alternative. Substitution of the health production function (2) into the conditional utility function (7) yields

$$U_j = \alpha_0 H_j + \alpha_0 Q_j + \alpha_1 (Y - P_j - wT_j) + \alpha_2 (Y - P_j - wT_j)^2 + \epsilon_j.$$  \hspace{1cm} (9)

Since $Q_0 = 0$, the conditional utility function in (8) for the self-care alternative reduces to

$$U_0 = \alpha_0 H_0 + \alpha_1 Y + \alpha_2 Y^2 + \epsilon_0.$$  \hspace{1cm} (10)

The $\alpha_0 H_0$ term appears in all the conditional utility functions, and its value is constant across alternatives. Since only differences in utility matter, these terms can be ignored.

In the non-self-care conditional utility functions in (9), quality is unobserved. We solve this problem by letting $Q_j$ be a parametric function of its observable determinants. The expected quality of provider j's care is the expected improvement in health (marginal product) over the expected level of health that would occur from self-treatment. The expected improvement in health can be viewed as being produced through a household production function. The arguments of the household production function are provider charac-
teristics, and individual characteristics such as health status and ability to implement the recommended treatment plan. For example, the expected improvement in health from hospital care relative to self-care may be increasing in education, since individuals with higher education may be better able to implement recommended treatment plans.

The marginal utility of an individual's health may vary by family. For example, the marginal utility of the health of a child may depend on how many children there are in the household. In general, the value of health may vary with many demographic variables such as age, sex, education, and family composition.

The basic determinants of both the quality household production function and the marginal utility of quality are demographic variables. Pollak and Wachter (1975) argue that the separate effects of demographic variables in the household production function and in the marginal utility of quality cannot be identified. We therefore, specify a reduced form model of the utility from quality. Formally, let the utility from quality be given by

$$
\alpha_0 Q_j - \beta_{0j} + \beta_{1j} X + \eta_j,
\tag{11}
$$

where $X$ is a vector of demographic variables and $\eta_j$ is a zero mean random disturbance with finite variance.

To make the specification as general as possible, we let the coefficients in (11) vary by alternative. Allowing for different intercepts permits the baseline quality to vary by alternative, and having different slope coefficients allows the provider's productivity relative to self-care to vary with individual characteristics such as age, education, and severity of illness.
The random disturbance captures unmeasured portions of the quality function such as severity of illness. These disturbances may be correlated across alternatives.

Since $Q_0 = 0$, the utility from quality simplifies to $a_0Q_0 = 0$ for the self-care alternative. Hence, the coefficients in (11) are interpreted relative to the self-care alternative. Notice further that the normalization sets the unobserved portion of quality in the self-care alternative, $\eta_0$, to zero.

Substitution of (11) into the conditional utility functions in (9) yields

$$U_j = V_j + \eta_j + \epsilon_j,$$  \hspace{1cm} (12)

where

$$V_j = \beta_{0j} + \beta_{1j}X + \alpha_1(Y - P_j - wT_j) + \alpha_2(Y - P_j - wT_j)^2$$ \hspace{1cm} (13)

Notice that the intercept and coefficients on the demographic variables vary by alternative, whereas the coefficients on the economic variables are constant across alternatives. Further, the disturbances in the non-self-care conditional utility functions are correlated with each other but are uncorrelated with the disturbance in the self-care conditional utility function.

The Demand Functions and Welfare

The demand function for a provider is the probability that the utility from that alternative is higher than the utility from any of the other alternative. Most of the previous studies on the demand for medical care in developing countries have assumed that these demand functions take on a multinomial logit (MNL) form. As discussed in McFadden (1981), the MNL suffers
from the Independence of Irrelevant Alternatives assumption. This assumption is equivalent to assuming that the conditional utility functions are uncorrelated across alternatives, and imposes the restriction that the cross-price elasticities are the same across alternatives. A computationally feasible generalization of the MNL is the Nested Multinomial Logit (NMNL), which was introduced in McFadden (1981). The NMNL allows for correlation across subgroups of alternatives and, therefore, non-constant cross-price elasticities.

There are three medical care choices in the rural Cote d'Ivoire; let choice 0 be self-care, choice 1 be clinic, and choice 2 be hospital care. The \( \eta_j \)'s imply that the hospital and clinic alternatives may be correlated with each other, but not with the self-care alternative. Therefore, the self-care demand function (i.e. the probability of choosing self-care) is

\[
\Pi_0 = \frac{\exp(V_0)}{\exp(V_0) + \left[ \exp(V_1/\sigma) + \exp(V_2/\sigma) \right]^\sigma}
\]

and the probability of choosing a hospital or clinic is

\[
\Pi_1 = \left[ 1 - \Pi_0 \right] \frac{\exp(V_1/\sigma)}{\exp(V_1/\sigma) + \exp(V_2/\sigma)} \quad (i = 1, 2)
\]

where \( \sigma \) is one minus the correlation between the hospital and clinic conditional utility functions introduced by the \( \eta_j \)'s. McFadden (1981) shows that \( \sigma \) must be between zero and one for the model to be consistent with utility maximization, and when \( \sigma = 1 \) the NMNL reduces to an MNL.

The estimated demand functions can be used to project the impact of user fees on demand (and revenues), and on the number of people who do not seek
health care as a result of user fees. These demand functions also form the basis of our measurement of the willingness to pay for reduced travel time to a medical care facility. The willingness-to-pay measure is calculated as a compensating variation. For example, consider changing the vector of provider travel times from T to T'. Following Small and Rosen (1981), in the case of a nested multinomial logit, the amount of income that an individual must be given to make him as well off at T' as he or she was at T is

$$cv = (1/\lambda)\left\{\ln\left[\exp(V_0) + \left(\exp(V_1/\sigma) + \exp(V_2/\sigma)\right)\right] - \ln\left[\exp(V'_0) + \left(\exp(V'_1/\sigma) + \exp(V'_2/\sigma)\right)\right]\right\}$$

(16)

where $V_j$ and $V'_j$ are evaluated at T and T', respectively, and where $\lambda$ is the marginal utility of income.
IV. THE DEMAND FOR MEDICAL CARE IN COTE D'IVOIRE

Data and Institutional Structure

The data used in this study come from the 1985 Cote d'Ivoire Living Standard Survey (CILSS). This multi-purpose household survey collected data on many socio-economic factors including information on illness and medical care utilization in the four weeks prior to the survey. In addition, the CILSS collected community level information in rural areas. For each village, information on travel time to the nearest available medical facility of every type, and average male and female agriculture wage rates were obtained. When a facility was available in the village, travel time was recorded as zero.

The sample used for estimation excluded non-farm households and households in villages for which the community information was not completed. The exclusion of non-farm households reduced the sample by 7%, and the exclusion of villages without community level data reduced the sample by another 8%. The final sample included 980 adults and 744 children under age 16, all of whom experienced an accident or illness in the four weeks prior to the survey.

Since there are no private health care facilities in rural Cote d'Ivoire, persons who wish to obtain medical care must choose between government clinics and hospitals. These government facilities had no user fees in 1985, implying that the price of care was the opportunity cost of time spent of obtaining care. The opportunity cost of time is calculated as the product of the round-trip travel time and the appropriate village agricultural wage rate. For children the opportunity cost of the mothers' time is used.

Monthly income is measured as the annual value of total household consumption divided by 12, which is a reasonable approximation of household permanent
income. Using consumption rather than reported earning allows us to include the value of home production. Home production is a major non-market source of income in subsistence economies. In rural Cote d'Ivoire, the value of homegrown produce consumed by household amounts to approximately half of the food budget and 30% of total consumption. Another reason to prefer consumption is that transitory shocks affect consumption much less than earnings.

The arguments of the alternative specific utility of quality functions specified in (11) are individual and family characteristics that may affect quality and the marginal utility of quality. Variables that may influence the efficacy of medical care include age, the number of healthy days last month, education, the number of other adults in the household, and the number of children in the household. Age and the number of healthy days proxy for health status. Age is entered in spline form with the break occurring at 40 years old for adults and at 3 for children. The break points were determined by grid searches. Education (years of schooling) is included since more educated individuals may be better able to implement recommended treatments and therefore produce more health relative to self-care than can less educated individuals. In the case of children the mother's education is used. The family composition variables are included because the more adults and fewer children in the household the better able a household may be at self-treating an illness. Variables that may affect the marginal utility of quality include age, sex, household composition, and the size of the farm measured in hectares of land. Descriptive statistics of the variables discussed in this section are presented in Table 1.
## Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Mean</td>
<td>Standard Mean</td>
</tr>
<tr>
<td></td>
<td>Deviation</td>
<td>Deviation</td>
</tr>
<tr>
<td>Clinic a/</td>
<td>0.24 (0.49)</td>
<td>0.30 (0.55)</td>
</tr>
<tr>
<td>Hospital a/</td>
<td>0.15 (0.38)</td>
<td>0.14 (0.37)</td>
</tr>
<tr>
<td>Clinic Travel Time b/</td>
<td>1.18 (1.32)</td>
<td>0.92 (1.16)</td>
</tr>
<tr>
<td>Hospital Travel Time b/</td>
<td>1.90 (.92)</td>
<td>1.56 (1.60)</td>
</tr>
<tr>
<td>Monthly Family Income c/</td>
<td>97.85 (81.19)</td>
<td>108.41 (99.66)</td>
</tr>
<tr>
<td>Hourly Wage d/</td>
<td>75.48 (28.54)</td>
<td>74.89 (26.42)</td>
</tr>
<tr>
<td>Age</td>
<td>44.85 (17.12)</td>
<td>6.33 (3.64)</td>
</tr>
<tr>
<td>Male</td>
<td>0.46 (0.50)</td>
<td>(0.54) (0.50)</td>
</tr>
<tr>
<td>Education</td>
<td>0.85 (2.16)</td>
<td>0.91 (2.88)</td>
</tr>
<tr>
<td>Healthy Days</td>
<td>18.60 (9.94)</td>
<td>22.34 (7.24)</td>
</tr>
<tr>
<td>Number of Adults</td>
<td>4.57 (2.96)</td>
<td>4.62 (3.01)</td>
</tr>
<tr>
<td>Number of Children</td>
<td>4.86 (2.44)</td>
<td>4.97 (2.77)</td>
</tr>
<tr>
<td>Hectares of Land</td>
<td>8.42 (8.75)</td>
<td>9.33 (11.72)</td>
</tr>
<tr>
<td>Sample Size</td>
<td>980</td>
<td>744</td>
</tr>
</tbody>
</table>

a/ Binary variables; equals one if alternative is chosen and zero otherwise.

b/ Round trip travel time; reported in hours.

c/ Reported in thousands of Ivorian CFA's. In 1985, the exchange rate was approximately 461 CFA per U.S. dollar.

d/ Reported in CFA's.
Estimation Results

The NMNL was estimated by full information maximum likelihood separately for the adult and children samples. The results are presented in Table 2, and are generally consistent with economic theory. The estimated value of $\sigma$ is 0.26 for the adult model and 0.47 for the children model. The estimates are both significantly less than one and significantly greater than zero at the 1% level. Therefore, the models are consistent with utility maximization, and the data reject the MNL in favor of the NMNL.

In both models the coefficients on the consumption and its square are significantly different from zero. Prices enter the model via these terms. If the prices did not vary across alternatives, the coefficients of the consumption terms would not be identified, since the value of consumption would then be constant across alternatives. The fact that these coefficients are significant implies that the relative prices of the alternatives are important determinants of provider choice. The direction and magnitude of the price and income effects is examined in the next section.

In the model for adults the coefficients on the first age splines are not significantly different from zero, implying that age differences between 16 and 39 do not influence provider choice. The coefficients on the age forty and over splines are negative and significant, showing that after age 40 the probability of obtaining medical care in case of injury or illness declines with age. The effects of sex and education are not significantly different from zero. The negligible education effect is most likely a result of the small variation in education in the sample. Not surprisingly, the number of healthy days last month significantly reduces the probability of seeking
Table 2: Nested Multinomial Logit Coefficient Estimates and T-Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adults</th>
<th></th>
<th>Children</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coefficient</td>
<td>t-statistics</td>
<td>coefficient</td>
<td>t-statistics</td>
</tr>
<tr>
<td>Consumption ((a_1))</td>
<td>13.67</td>
<td>(5.18)</td>
<td>18.97</td>
<td>(4.47)</td>
</tr>
<tr>
<td>Consumption Squared  ((a_2))</td>
<td>-0.03</td>
<td>(2.56)</td>
<td>-0.02</td>
<td>(1.82)</td>
</tr>
<tr>
<td>Sigma</td>
<td>0.26</td>
<td>(3.07)</td>
<td>0.47</td>
<td>(3.67)</td>
</tr>
<tr>
<td>Clinic Alternative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.07</td>
<td>(0.04)</td>
<td>2.12</td>
<td>(2.21)</td>
</tr>
<tr>
<td>Age 1</td>
<td>0.03</td>
<td>(0.65)</td>
<td>-0.54</td>
<td>(2.19)</td>
</tr>
<tr>
<td>Age 2</td>
<td>-0.14</td>
<td>(2.43)</td>
<td>0.03</td>
<td>(0.55)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.02</td>
<td>(0.14)</td>
<td>0.02</td>
<td>(0.41)</td>
</tr>
<tr>
<td>Healthy Days</td>
<td>-0.13</td>
<td>(2.26)</td>
<td>-0.05</td>
<td>(1.84)</td>
</tr>
<tr>
<td>Male</td>
<td>0.08</td>
<td>(0.15)</td>
<td>0.36</td>
<td>(1.02)</td>
</tr>
<tr>
<td>Children</td>
<td>0.21</td>
<td>(1.65)</td>
<td>-0.12</td>
<td>(1.74)</td>
</tr>
<tr>
<td>Adults</td>
<td>-0.12</td>
<td>(0.90)</td>
<td>-0.22</td>
<td>(2.27)</td>
</tr>
<tr>
<td>Land</td>
<td>0.07</td>
<td>(1.44)</td>
<td>0.03</td>
<td>(1.59)</td>
</tr>
<tr>
<td>Hospital Alternative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.25</td>
<td>(0.68)</td>
<td>2.36</td>
<td>(2.22)</td>
</tr>
<tr>
<td>Age 1</td>
<td>0.00</td>
<td>(0.09)</td>
<td>-0.59</td>
<td>(2.19)</td>
</tr>
<tr>
<td>Age 2</td>
<td>-0.14</td>
<td>(2.54)</td>
<td>0.02</td>
<td>(0.38)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.04</td>
<td>(0.25)</td>
<td>0.02</td>
<td>(0.29)</td>
</tr>
<tr>
<td>Healthy Days</td>
<td>-0.16</td>
<td>(2.78)</td>
<td>-0.08</td>
<td>(2.50)</td>
</tr>
<tr>
<td>Male</td>
<td>0.68</td>
<td>(1.13)</td>
<td>0.09</td>
<td>(0.23)</td>
</tr>
<tr>
<td>Children</td>
<td>0.19</td>
<td>(1.47)</td>
<td>0.14</td>
<td>(1.62)</td>
</tr>
<tr>
<td>Adults</td>
<td>-0.19</td>
<td>(1.31)</td>
<td>-0.20</td>
<td>(1.97)</td>
</tr>
<tr>
<td>Land</td>
<td>0.10</td>
<td>(2.32)</td>
<td>0.04</td>
<td>(1.64)</td>
</tr>
<tr>
<td>Sample Size</td>
<td>980</td>
<td></td>
<td>723</td>
<td></td>
</tr>
<tr>
<td>-Log Likelihood</td>
<td>830.96</td>
<td></td>
<td>655.50</td>
<td></td>
</tr>
</tbody>
</table>
The number of adults in the household has a negative effect on the probability of going to both clinics and hospitals, while the number of children has positive effects. Finally, the coefficient on land is positive for both clinics and hospitals, but significant only in the hospital equation.

In the model for children, the coefficients on the age splines show that demand falls with age from zero to three years old and is flat thereafter. As in the adult model, education and sex do not appear to influence provider choice. Again, better health reduces demand as the number of effect of healthy days is negative and significant. Finally, the number of children, number of adults, and land variables influence children's choices much in the same way as they influence adults' choices.

Price Elasticities and Income Effects

Since prices and income enter the demand functions in a highly non-linear fashion, it is hard to assess the direction and magnitude of their effects on demand. To facilitate this, we present arc price elasticities of the demand for clinic and hospital care by income quartiles in Table 3. The arc elasticities are obtained by sample enumeration within each income quartile. They were calculated for three range of 50 CFA each, covering 0 to 150 CFA. Reading down a column of Table 3 reflects the change in the price elasticity moving down the demand curve, holding income constant. Reading across a row of Table 3 reflects the change in the price elasticity as income rises, holding price constant.

Two types of elasticities are presented in Table 3. The first is the "own" price elasticity which calculates the percentage change in demand with
for a 1% change in price. For example, an increase in the clinic price causes some individuals to substitute hospital care for clinic care, and others to substitute self-care for clinic care. The own price elasticity measures the total change in clinic demand. The second type is the "net" price elasticity, which examines the portion of demand that leaves the professional health care market for self-care. The own elasticity is useful for determining the effect of various pricing policies on a facility's utilization and revenues, and the net elasticity is of interest because it measures the number of individuals forced out of the medical care market as a result of the policies.

We begin with a discussion of the own price elasticities. Clinic and Hospital demand are both substantially more elastic at higher prices as the own price elasticities increase three fold on average over the price range considered. The results also show that demand is vastly more elastic at the lower income levels. The clinic own price elasticities for the lowest income quartile are between three and six times larger than those for the highest income quartile. A similar pattern emerges for hospitals. These results indicate that user fees will be regressive and substantially reduce the facility's utilization by the poor.

The net price elasticities are approximately one-third the price elasticities, but are non-trivial in magnitude in the three lower income quartiles. This implies that increasing user fees will substantially reduce the utilization of any medical care by the poor.
# Table 3: Arc Price Elasticities by Income Quartile

<table>
<thead>
<tr>
<th>Price Range</th>
<th>Quartile 1 (lowest)</th>
<th>Quartile 2</th>
<th>Quartile 3</th>
<th>Quartile 4 (highest)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Own Net</td>
<td>Own Net</td>
<td>Own Net</td>
<td>Own Net</td>
</tr>
<tr>
<td>Adults-Hospital</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-50 CFA</td>
<td>-0.48 -0.14</td>
<td>-0.41 -0.11</td>
<td>-0.35 -0.09</td>
<td>-0.11 -0.03</td>
</tr>
<tr>
<td>50-100</td>
<td>-0.95 -0.24</td>
<td>-0.80 -0.19</td>
<td>-0.66 -0.15</td>
<td>-0.17 -0.04</td>
</tr>
<tr>
<td>100-150</td>
<td>-1.52 -0.43</td>
<td>-1.26 -0.27</td>
<td>-1.03 -0.21</td>
<td>-0.23 -0.05</td>
</tr>
<tr>
<td>Adults-Clinic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-50 CFA</td>
<td>-0.37 -0.15</td>
<td>-0.33 -0.12</td>
<td>-0.30 -0.10</td>
<td>-0.12 -0.04</td>
</tr>
<tr>
<td>50-100</td>
<td>-0.73 -0.25</td>
<td>-0.65 -0.21</td>
<td>-0.59 -0.16</td>
<td>-0.19 -0.06</td>
</tr>
<tr>
<td>100-150</td>
<td>-1.17 -0.37</td>
<td>-1.06 -0.30</td>
<td>-0.94 -0.23</td>
<td>-0.24 -0.08</td>
</tr>
<tr>
<td>Children-Hospital</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-50 CFA</td>
<td>-0.79 -0.29</td>
<td>-0.70 -0.26</td>
<td>-0.61 -0.21</td>
<td>-0.22 -0.07</td>
</tr>
<tr>
<td>50-100</td>
<td>-1.58 -0.51</td>
<td>-1.38 -0.46</td>
<td>-1.18 -0.36</td>
<td>-0.31 -0.09</td>
</tr>
<tr>
<td>100-150</td>
<td>-2.46 -0.73</td>
<td>-2.16 -0.67</td>
<td>-1.83 -0.52</td>
<td>-0.34 -0.10</td>
</tr>
<tr>
<td>Children-Clinic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-50 CFA</td>
<td>-0.58 -0.30</td>
<td>-0.54 -0.27</td>
<td>-0.48 -0.22</td>
<td>-0.20 -0.10</td>
</tr>
<tr>
<td>50-100</td>
<td>-1.22 -0.56</td>
<td>-1.12 -0.50</td>
<td>-0.99 -0.40</td>
<td>-0.31 -0.15</td>
</tr>
<tr>
<td>100-150</td>
<td>-1.99 -0.85</td>
<td>-1.86 -0.74</td>
<td>-1.61 -0.58</td>
<td>-0.36 -0.17</td>
</tr>
<tr>
<td>Mean Income CFA</td>
<td>32,500</td>
<td>62,490</td>
<td>96,350</td>
<td>200,610</td>
</tr>
</tbody>
</table>
Welfare Neutral Prices

In this section we evaluate the effect on consumers' welfare of the proposal to locate clinics in villages that currently have no facilities and then charge user fees for access. To be efficient the user fee should be set at marginal cost. The benefit to individuals from implementing this proposal depends on whether the reduction in welfare resulting from having to pay user fees is less than the improvement in welfare from having access to medical care facilities within the village. The welfare neutral fee is the amount consumers would be willing to pay not to have to travel to the closest free facility in a nearby village (i.e. the compensating variation). If the welfare neutral fee is more than the marginal cost of medical care, then the policy is welfare improving and more individuals will utilize medical care. On the other hand, if the welfare neutral fee is less than marginal cost, then the policy would reduce welfare and medical care utilization. Clearly, the magnitude of the welfare gain (or required subsidy) will vary by income level as relatively well off families are likely to be willing to pay more than are poorer families.

The welfare neutral prices are derived from compensating variation experiments. Four welfare neutral prices are calculated for an average individual in each income quartile; how much an individual is willing to pay not to have to travel to a free clinic that is 0.5 hours away, 1.0 hour away, 1.5 hours away, and 2.0 hours away. The experiments are conducted assuming that the closest hospital is two hours away.

The welfare neutral prices are reported in Table 4. Reading down a column shows the change in the price as the distance of the clinic rises, holding in-
come constant. Reading across a row shows the change in the price as income rises, holding distance constant. The welfare neutral prices increase with distance and income for both children and adults. Adults in the highest income quartile are willing to pay three times as much as adults in the lowest income quartile, and children in the highest income quartile are willing to pay twice as much as children in the lowest income quartile.

Now we assess the welfare implications of locating clinics in villages that currently have no facilities and setting user fees at the marginal cost of supplying medical care. The effect on welfare is determined by comparing the welfare neutral price to the marginal cost of providing clinic care. We consider the effect of a reduction in travel time of two hours. As an estimate of marginal we use the average price of private medical care in urban areas. From the urban component of the CILSS, the average price of visit to a private medical provider was 35 CFA. From Table 4, our estimates show that individuals in lower half of the rural income distribution are not willing to pay 35 CFA, but individuals in the top half are willing to pay that amount and more. Hence, under this scenario, implementing the user fee proposal will improve the welfare of individuals in the top half of the income distribution and increase their utilization of medical care. However, implementing the user fee proposal will also reduce the welfare of individuals in the bottom half of the income distribution and lower their utilization of medical care. Hence, the user fee proposal would be regressive in rural Cote d'Ivoire in that it would benefit the wealthy and hurt the poor.
Table 4: Amount Willing to Pay to Avoid Traveling for Clinic Care

<table>
<thead>
<tr>
<th>Distance to Nearest Clinic</th>
<th>Quartile 1 (lowest)</th>
<th>Quartile 2</th>
<th>Quartile 3</th>
<th>Quartile 4 (highest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.5 hours</td>
<td>7.53</td>
<td>8.37</td>
<td>10.10</td>
<td>17.56</td>
</tr>
<tr>
<td>1</td>
<td>13.82</td>
<td>15.50</td>
<td>18.78</td>
<td>33.57</td>
</tr>
<tr>
<td>1.5</td>
<td>18.82</td>
<td>21.28</td>
<td>25.89</td>
<td>47.95</td>
</tr>
<tr>
<td>2</td>
<td>22.44</td>
<td>25.64</td>
<td>31.33</td>
<td>60.68</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.5 hours</td>
<td>12.36</td>
<td>12.97</td>
<td>14.86</td>
<td>19.56</td>
</tr>
<tr>
<td>1</td>
<td>20.32</td>
<td>21.57</td>
<td>24.69</td>
<td>33.39</td>
</tr>
<tr>
<td>1.5</td>
<td>24.98</td>
<td>26.81</td>
<td>30.59</td>
<td>42.37</td>
</tr>
<tr>
<td>2</td>
<td>27.40</td>
<td>29.61</td>
<td>33.70</td>
<td>47.59</td>
</tr>
<tr>
<td>Mean Income</td>
<td>32,500</td>
<td>62,490</td>
<td>96,350</td>
<td>200,610</td>
</tr>
</tbody>
</table>
V. CONCLUSIONS AND POLICY REFORM

We provide a methodology for the *ex ante* evaluation of the welfare effects of proposals to use user fees to finance improved access to social services in rural areas of developing countries. The analysis requires estimation of demand functions, from which price elasticities and the willingness to pay for improved access can be obtained. The willingness to pay is the maximum user fee (welfare neutral price) that can be charged without reducing individuals' welfare and utilization of medical services. The estimation is complicated by the problem that developing governments often are the dominant suppliers of social services in their countries, and provide these services for free so that there is little price variation in the data. We show how variation in individuals' private time prices can be used to identify all of the parameters of the demand functions.

The methodology is used to evaluate the possible implementation of the user fee plan for medical care clinics in rural Côte d'Ivoire. Our results show that it is likely to have highly regressive welfare effects. Specifically, the policy is shown to increase the welfare and medical care utilization of individuals in the top half of the income distribution, while reducing the welfare and medical care utilization of individuals in the bottom half of the income distribution.

These adverse distributional effects can be avoided by introducing price discrimination into the user fee proposal. User fees at clinics in poorer villages can be set at different levels than user fees in richer villages. As long as the user fees are below the welfare neutral prices, the policy will be welfare improving for everyone. The degree to which the price is below the
welfare neutral price determines the improvement in welfare and medical care utilization achieved by this policy. With this type of price discrimination, the clinics in richer villages are self financing, while the clinics in poorer villages require a subsidy.
ENDNOTES

1 For a detailed description of medical care delivery systems and pricing policies in developing countries see de Ferranti (1985).

2 The user fee proposal is discussed in Jimenez (1987).

3 The role of time prices in theory of the allocation of time was first applied to the demand for in medical care in Phelps and Newhouse (1974) and Action (1975).

4 Studies of the demand for health care in developing countries that employ this specification include Akin et al. (1981, 1985 and, 1986), Birdsall and Chuhan (1986), Dor and van der Gaag (1987), and Mwabu (1986). Heller (1983) and Musgrove (1983) estimate family medical care expenditure functions but do not consider price effects.

5 The time spent obtaining care could, in principle, come at the expense of work in the market place, production work at home or leisure. In that case, income \( Y_j \), and net consumption, \( C_j \), should incorporate the value of the three activities. In an economy that is only partially monetized, such as the one in rural Cote d'Ivoire, non-traded home production is a major source of income. We capture this by including the value of home production consumed by the household into the measure of income. However, adding the value of leisure would greatly complicate the model and is left for future work. The measurement of income is discussed in Section IV.a.

6 Some authors try to include income in the model by allowing alternative specific coefficients on consumption. This specification is inconsistent with stable utility maximization because it implies that two options that have the same quality and price must yield different levels of utility. This specification has been employed by Akin et al. (1981, 1985 and, 1986), Birdsall and Chuhan (1986), Dor and van der Gaag (1987), and Mwabu (1986).

7 The exceptions are Gertler, Locay, and Sanderson (1987) and Dor, Gertler, and van der Gaag (1987) who employ Nested Multinomial Logit specifications.

8 See Deaton and Muelbauer (1980) for discussion of compensating variation and other welfare measures.

9 In order for (16) to be exact, the marginal utility of income \( \lambda \) must be independent of alternative specific characteristics and price. See McFadden (1981) and Small and Rosen (1981) for more discussion on this point. Although \( \lambda \) is independent of quality, it is not independent of price. Specifically

\[
\lambda = \frac{\partial U}{\partial Y} = \alpha_1 + 2\alpha_2(Y - P).
\]

Since the prices are very small relative to income, \( \lambda \) is likely to be approximately constant across small differences is price. Hence, each individual's average marginal utility of income over the alternatives is a good approxima-
tion of $\lambda$. Since this approximation is calculated for each individual, $\lambda$ will vary greatly across individuals as there is substantial variation in income.

10 For detailed information on this survey see Ainsworth and Munos (1985).

11 The male and female village agricultural wage rates are reasonable estimates of the opportunity cost of time. Newman (1987) shows that 97% of all working adults in rural areas of Cote d'Ivoire are engaged in agricultural activities. Moreover individual variation in wage rates within village is likely to be small since over 90% of the adults have less than one year of schooling.

12 For a description on how total household consumption was calculated see Glewwe (1987).

13 Hensher (1986) shows that full information maximum likelihood estimation of the NMNL yields substantial gains in efficiency over the more popular two-step estimator.

14 The number of days an individual was healthy may be endogenous in a model of medical care demand. To ensure the robustness of our price and income effects, we reestimated the model on both adult and children samples. There was no difference in the estimated coefficients.

15 See Train (1986) for a discussion on elasticities and sample enumeration in discrete choice models.
REFERENCES


