NBER WORKING PAPER SERIES

THE DEMAND FOR MEDICAL CARE IN URBAN CHINA

H. Naci Mocan
Erdal Tekin
Jeffrey S. Zax

Working Paper 7673
http://www.nber.org/papers/w7673

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2000

We thank Damba Lkhagvasuren and Paul Niemann for excellent research assistance. The views expressed herein are those of the authors and are not necessarily those of the National Bureau of Economic Research.

The Demand for Medical Care in Urban China
H. Naci Mocan, Erdal Tekin, Jeffrey S. Zax
NBER Working Paper No. 7673
April 2000
JEL No. I1, O52, R22

ABSTRACT

This is the first paper to investigate the determinants of the demand for medical care in the People's Republic of China. It uses a data set that consists of detailed characteristics of 6407 urban households, a continuous measure of health care spending, and price. A two-part model and a discrete factor model are used in the estimation. Household characteristics and work conditions impact the demand for medical care. Income elasticity is around 0.3, indicating medical care is a necessity. Medical care demand is price inelastic, and price elasticity is larger in absolute value for poorer households.

H. Naci Mocan
Department of Economics
University of Colorado at Denver
Campus Box 181, P.O. Box 173364
Denver, CO 80217-3364
and NBER
nmocan@carbon.cudenver.edu

Erdal Tekin
Department of Economics
University of North Carolina
at Chapel Hill
CB# 3305, Gardner Hall
Chapel Hill, NC 27599-3305
etekin@email.unc.edu

Jeffrey S. Zax
Department of Economics
University of Colorado at Boulder
Campus Box 256
Boulder, CO 80309-0256
zax@colorado.edu

The Demand for Medical Care in Urban China

I. Introduction

There has been a growing concern in the United States and elsewhere regarding the rapidly increasing national spending on medical care and rising medical care costs (Newhouse 1992). To suggest policies that may help the financing of the health care delivery system without creating burdens on low income groups, researchers have been investigating the determinants of health care demand and spending in developed countries (e.g. Di Matteo and Di Matteo 1998, Hitiris and Posnett 1992, Milne and Molana 1991, Kenkel 1990, Wedig 1988, Parkin, McGuire and Yule 1987, Manning et al. 1987a, Wagstaff 1986, Colle and Grossman 1978, Newhouse 1977). The issue is especially important for developing nations which face an increasing demand for health services, coupled with a lack of funds to finance the health care system due to adverse macroeconomic conditions (Abel-Smith 1986). Consequently, a significant amount of research has been devoted to the investigation of the determinants of the demand for medical care in developing countries (Akin, Guilkey and Denton 1995, Sauerborn, Nougtara and Latimer 1994, Gertler, Locay and Sanderson 1987, Dor, Gertler and Van der Gaag 1987, Akin et al. 1986, Musgrove 1983).

After China started its economic reforms in the late 1970s, and especially after the State Council approved the "Report on the Permission of Private Medical Practices" submitted by the Ministry of Public Health in 1980, a private medical market began to emerge. For example, in Shanghai four private hospitals appeared in 1984; by 1989 the number rose to 15. There were 110 private hospitals in China in 1990 (Liu, Liu and Meng, 1994). The transition to a more market-oriented health care system in China coincided with increased demand for medical care services, partly due to increased disposable incomes. It also coincided with increased medical care costs (Henderson 1990). China spent 3.5 percent of its GNP on health care in 1990 (World Bank 1993). Since the inception of government and labor health insurance schemes in 1951-52, spending on these insurance programs increased from 270 million yuan in 1952 to 22,440 million yuan in 1989: an average 12.7 percent annual rate of increase (Liu and Hsiao 1995).

Although research on the determinants of health care coverage and health services utilization in China is reasonably extensive (Hu et al. 1999, Henderson et al. 1998, Lin and Bian 1991, Davis 1988), information on the demand for medical care is absent.[1] This is the first paper to investigate the determinants of the demand for medical care in the People's Republic of China. It uses very detailed household-level data, which include a continuous measure of health care spending as well as price. Employing two estimation methods we report the impact of a host of household characteristics on the demand for medical care along with price and income elasticities. Price elasticity is an important piece of information, especially for developing countries where health care is subsidized by the government. For example, in developing countries fees charged at public health facilities are typically below the marginal cost. This is believed to create a superficial demand for services, that can be reduced by raising the price of care (Musgrove 1986). If a price increase does not generate significant reductions in the use of health services, then it constitutes a legitimate option to collect revenue to (partially) finance the health care delivery system.

There is no consensus on the magnitude of the income elasticity of health care obtained from cross-country data (Di Matteo and Di Matteo 1998, Blomqvist and Carter 1997, Hitiris and Posnett 1992, Parkin, McGuire and Yule 1987, Newhouse 1977). This paper is one of the few that exploits a household level data set with alternative measures of income, which enables the estimation of the income elasticity, while addressing the issue of potential endogeneity of income.

Section II describes the theoretical model and Section III presents the empirical framework. Section IV describes the data set, Section V contains the results, and Section VI is the conclusion.

II. The Model

Based on Grossman's seminal work (Grossman 1972a, 1972b) an individual's utility function is assumed to depend on a consumption commodity Z(t) and sick time S(t). More precisely, individuals maximize an inter-temporal utility function of the following form

[1] *Hu et al. (1999) analyzed the determinants of out-of-pocket medical expenditures with a small number of explanatory variables, which did not include price.*

$$(1) \qquad \int_0^T \alpha(t)U[z(t),s(t)]dt$$

where U(.) is a quasi-concave utility function, T is time of death, and α(t) is a time discount factor. It is assumed that $U_z > 0$, $U_s < 0$.

Sick time depends on the level of health capital, H(t), such that

$$(2) \qquad s(t) = f_1[H(t)], \quad f_1' < 0, \ f_1'' > 0.$$

Net investment in the stock of health, depicted in Equation (3) below, is equal to gross investment, I(t), minus depreciation. The rate of depreciation, δ, is a function of *t* (the age of the individual), and environmental factors, X.

$$(3) \qquad \dot{H}(t) = I(t) - \delta[t, X(t)]H(t)$$

Gross investment at time *t*, I(t), is produced according to a household production function, where medical care, M(t), and time input are ingredients. More formally,

$$(4) \qquad I(t) = f_2(M(t), \text{time}, F(t); E),$$

where *E* represents the variables that influence the productivity of health investment, such as the stock of human capital. A novelty of this paper is the consideration that the consumption of nutritious foods, F(t), is another input into the production function. Thus, consumers are assumed to produce gross investment in health by combining their own time with purchased medical care and food. Asset accumulation is described by Equation (5)

$$(5) \qquad \dot{A}(t) = rA(t) + Y[s(t), M(t), F(t), E(t)] \\ - P^z(t)z(t) - P^m(t)M(t) - P^f(t)F(t)$$

The rate of change of financial assets is a function of the stock of assets, A(t), the rate of interest, *r*, earned income Y(.), and the outlays on a consumption commodity, medical care, and food where P^z, P^m , and P^f stand for the prices of the consumption commodity, medical care, and food, respectively. It is assumed that $Y_S \leq 0$, $Y_M \leq 0$, and $Y_F \leq 0$; i.e. being sick, consuming medical care or food cannot increase income directly.

The individual maximizes (1) subject to the conditions presented in (4) and (5), the boundary conditions $H(0)=H_0$, $A(0)=A_0$, $T=\min\{t{:}H(t)\leq H^d\}$, where H^d is the 'death' stock of health, and $A(T)\geq 0$. This yields the following equilibrium condition.

$$(6) \qquad [(\frac{U_s}{8})+Y_s]f_1' = [r+*[t,X(t)]-B_)]B(t)$$

where $\pi(t)$ is the marginal cost of gross investment in health, π_Δ is the percent change in gross investment in health, and λ is the shadow price of initial assets.

Our data set, which consists of households in urban China, includes individuals who are mostly employed at state work units, state enterprises, collective enterprises or similar institutions. This institutional structure implies that days off due to sickness are not associated with a reduction in income up to a high threshold, typically six months. This justifies the assumption that $Y_S=0$, which yields the following formulation of the equilibrium condition.

(6A) $\ln U_s - \ln\lambda + \ln f_1' = \ln\delta + \ln\pi(t) + \ln\psi$, where $\psi = \{r+\delta[t,X(t)]-\pi_\Delta\}/\delta$.

This formulation emphasizes the consumption benefit of health. More precisely, it assumes that the optimality condition involves the equality between the marginal consumption benefit of health and the marginal cost of new investment.

From (2), we obtain that $\ln f_1' = f_3[H(t)]$. The production function of gross investment in health depicted by (4) gives rise to a marginal cots of gross investment function, where the prices of the medical care and food, the opportunity cost of time and E are the ingredients. That is,

(7) $\ln\pi(t) = f_4[P^m, P^f, P^{time}, E]$

Most previous research hypothesized that $r-\pi=0$, which implies $\psi=1$. Alternatively, it can be postulated that $\psi = f_5(t)$ (Grossman 1972a, Muurinen 1982, Wagstaff 1986). These formulations give rise to the structural demand for health function of the form

(8) $H = g(P^m, P^f, P^{time}, \lambda, t, X, E)$.

The derived demand for medical care is

(9) $M = m(H, P^m, P^f, P^{time}, t, X, E)$.

(8) and (9) produce the following reduced form of medical care.[2]

(10) $$M = m_r(P^m, P^f, P^{time}, \lambda, t, X, E)$$

Our empirical analysis involves estimation of equation (10), using a data set that contains information on 6407 households in urban locations of the People's Republic of China.

III. Empirical Implementation

Estimation of a demand for medical care equation requires the treatment of zero expenditures. Researchers have dealt with this issue by either estimating two-part models, or selection models. The use of the two-part model assumes that the decision to spend (the participation equation) is independent of the decision on the level of spending. Although the two-part model can be criticized on the grounds of this potentially restrictive assumption (e.g. Hay and Olsen 1984, Maddala 1985), it has been shown that estimation of a two-part model does not have a significant impact on the results (Duan et al. 1984), and that if the true model is of the selection type, then the two-part model provides a good estimate of the response surface (Manning, Duan and Rogers 1987). In addition to its robustness, another appealing feature of the two-part model is that it allows an investigation as to whether variables of interest have larger impacts on the participation or consumption decisions (Manning et al. 1995). Thus, two-part models are frequently employed benchmarks in health economics research that involves observations with a cluster at zero.

The main objection to the selection models centers around the fact that they assume a bi-variate normal distribution between the error terms (Duan et al. 1983), and they are known to be sensitive to departures from normality (Goldberger 1983). In this paper we estimate a two-part model of demand for medical care. For comparison purposes, we also present estimates from the discrete factor method (DFM) (Heckman and Singer 1984, Mroz 1999) which allows for selection. However, unlike standard selection corrections, DFM estimates a semiparametric distribution to approximate the distribution between the error term of the selection and spending equation. Mroz (1999) demonstrates that when the true correlation of the error terms is normal, DFM performs

[2] *For a detailed derivation of these equations see Grossman (1972a), Muurinen (1982), or Wagstaff (1986).*

well in comparison to estimators which assume normality; and DFM performs better than normality-based estimators when the underlying distribution is non-normal. (See Blau and Hagy (1998), Hu (1999), Blau and Mocan (1999) for applications of this discrete factor model).

The empirical framework can be summarized as follows. The latent variable I_i is a function of a set of explanatory variables X, and error term ϵ_1, where *i* represents the households.

(11) $I_i = X_i\alpha + \epsilon_{1i}$.

A dichotomous variable D_i is defined as $D_i = 1$ if $I_i > 0$ (households with positive health care spending), and $D_i = 0$ otherwise. For those households with positive health care spending, the log-level of spending is determined by

(12) $\ln(S_i \mid D_i = 1) = X_i\beta + \epsilon_{2i}$,

where S stands for spending on medical care (S = MP, where M is the quantity and P is the price of medical care). Identification of the model is discussed in the results section.

Estimation of a two-part model treats the first equation as a logit, where the probability of the discrete event of positive medical care spending is explained as

(13) $\text{Prob}(D_i = 1) = \exp\{X_i\alpha\}/[1 + \exp\{X_i\alpha\}]$, where X is a row vector of explanatory variables. In this framework, the expected value of the unconditional spending is $E(S_i) = \text{Prob}(D_i = 1)E(S_i \mid D_i = 1)$. Taking the natural logarithm of (13) yields

(14) $\ln[\text{Prob}(D_i = 1)] = X_i\alpha\text{-}\ln[1 + \exp\{X_i\alpha\}]$.

If a particular explanatory variable x is in logs, the elasticity of $\text{Prob}(D_i = 1)$ with respect to x is equal to $\alpha[1/(1 + \exp\{X_i\alpha\})] = \alpha[1\text{-Prob}(D = 1)]$. In equation (12), if x is in logs, the elasticity of S with respect to x is β. Thus, the unconditional elasticity is

(15) $\eta = \alpha[1\text{-Prob}(D = 1)] + \beta$.

If the explanatory variable x is not in logs, then using (14) it can be shown that the elasticity of $\text{Prob}(D_i = 1)$ with respect to x is $\alpha[1\text{-Prob}(D = 1)]x$. Using (12) it can be seen that the elasticity of S with respect to x is (βx). Thus, the unconditional elasticity in this case is

(16) $\eta = [\alpha\{1\text{-Prob}(D = 1)\} + \beta]x$.

The unconditional elasticity of medical care with respect to price, on the other hand, is calculated as

(17) $\eta = \alpha[1\text{-Prob}(D = 1)] + (\beta\text{-}1)$.

This can be seen by noting that the demand for medical care is estimated as $ln\mathrm{M} = \gamma + \beta ln\mathrm{P}$, where M is the quantity of medical care, and P stands for its price. Adding *ln*P to both sides of this equation yields $\ln M + \ln P = \gamma + (\beta + 1)\ln P$. The left-hand-side of this equation is *ln*(MP), which represents the logarithm of the spending on medical care, which is the dependent variable to be employed in this paper. Thus, to recover the price elasticity of medical care from the spending equation, -1 should be added to the coefficient of the price in spending equation (12).

Alternatively, the DFM is based on the assumption that the decisions described by Equations (11) and (12) are done jointly, rather than sequentially. In this case, a common unobservable is assumed to influence the decision to spend as well as the amount of spending. To account for this potential correlation in the errors of the two equations, we model the error structure as

$$(17) \quad \epsilon_1 = u_1 + \rho_1 \nu,$$
$$\epsilon_2 = u_2 + \rho_2 \nu,$$

where u_1, u_2 and ν are mutually independent disturbances with mean zero, and ν symbolizes the common factor that impacts error terms ϵ_1 and ϵ_2. ρ_1 and ρ_2 are factor loadings which allow for the impact of the common factor ν to vary among equations. u_1, u_2 and ν are also independent of the explanatory variables. Following Mroz (1999), we assume that ν is governed by a discrete distribution

$$(18) \quad \mathrm{Prob}(\nu = \mu_k) = \pi_k; \quad k = 1, \ldots, K; \quad \pi_k \geq 0, \ \textstyle\sum_k \pi_k = 1.$$

μ_k are the points of support of the distribution, and π_k are the probability weights. The μ_k's, π_k's, ρ_1 and ρ_2 are parameters to be estimated. K is specified a priori, and we estimate the models for alternative values of K. The two equations are estimated jointly with full-information maximum likelihood. The unconditional elasticities are provided by the estimated coefficients of the spending equation.

IV. The Data

A cross-sectional micro-data survey of urban families in the People's Republic of China was conducted in the spring of 1989 for the principal purpose of providing more complete measures of welfare than had previously been available. To this end, the survey collected detailed information regarding demographic characteristics of the members of the household, their income, earnings, food consumption and prices, as well as medical expenditures and types of health insurance held by the members. The survey covered 6407 urban households. The households were themselves part of the national panel of urban households used by the State Statistical Bureau of China for its regular survey program. However, this particular survey was administered to these households by local statistical bureaus. Administrative complexity and financial restrictions limited the survey to 71 cities in 10 of China's 30 provincial-level administrative regions.[3] The provinces were selected to provide a representative sample from the wide variations in geographical conditions and economic development in China.[4]

Total household medical spending depends on the type of insurance used by the members of the household. Health care coverage in urban China is provided through the place of employment, and as explained by Whyte and Parish (1984) and Hsiao (1995), there is significant variation in coverage of workers and their dependents as a function of the sector of employment. There are two main types of health insurance schemes in urban China: the Government Employee Health Insurance System and the Labor Insurance System. In general, those employed at state economic enterprises have almost all their medical expenses covered by the Labor Insurance System, and pay only a nominal registration fee to initiate treatment. They also get half of most medical expenses for their dependents covered. Government employees, such as teachers, government clerks and other workers in noneconomic units are covered by the Government Employee Health Insurance System. In most cases they have to pay for their own dependents. Individuals working in collective enterprises may have similar coverage, partial coverage or no coverage at all depending upon the history and resources of the local unit and neighborhood

---

[3] *The sample provinces are Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Yunnan and Gansu. Khan et al. (1992) discuss the sampling procedures in more detail.*

[4] *This survey was funded by the Ford Foundation, and conducted with extraordinary care under difficult circumstances by economists at the Institute of Economics, Chinese Academy of Social Sciences, led by Zhao Renwai and Li Shi. Western economists led by Keith Griffin, then of Oxford University, and Carl Riskin of Queens College, C.U.N.Y., assisted. This survey and a companion survey of rural households are available in SAS format from the Inter-university Consortium for Political and Social Research as data set 9836.*

(Whyte and Parish 1984, p. 65).

There exist substantial differences regarding the extent of coverage within insurance type and within regions. For example, state-run enterprises with high profits often provide comprehensive benefits, but unprofitable enterprises may only be able to offer partial coverage with high cost-sharing levels. Similarly, poor enterprises often do not cover dependents at all (Grogan 1995, p. 1079). Differences also exist between co-payment policies across regions. For example, individuals with government or labor insurance have on the average 90 percent of their outpatient fees covered in the province of Jiangsu, whereas the rate is 76 percent in the province of Hubei (Henderson et al. 1995).

Individuals who are not covered by health insurance are required to pay for their own health expenses. They include self-employed, the unemployed, the migrant workers and employees of private, foreign and in some cases jointly-owned enterprises (Yuen 1996). Henderson et al. (1995) reports that 30 percent of the individuals living in capital cities or small cities have no insurance.

The descriptive statistics of the variables used in the econometric analysis are reported in Table 1. Insurance type is controlled by four variables. PUBFIN stands for the number of members in the household covered by publicly financed medical care. PARTPAY represents the number of household members who pay part of medical costs. ALLPAY is the number of members who pay all medical costs, and OTHERCARE represents the number of household members who use other forms of provision of care. As explained by Newhouse, Phelps and Marquis (1980), the expected medical care consumption and the choice of the type of insurance may be jointly determined, which would bias the estimated coefficients. In our case, however, the type of health insurance is attached to the job. Therefore, to the extent that workers do not choose sectors of work based on the health insurance concerns, insurance type is an exogenous variable in our analysis.

SPENDING is the annual household spending on medical care in 1988. It includes total medical outlays borne by all members, including hospitalization. 28 percent of the 6407 households report zero medical spending. The sample average of medical spending is 51 yuans per year per household, with a standard deviation of 256, including zero expenditures. The average expenditure on medical care for the households that report positive spending is 71.5 yuans. For this group, the spending at the bottom 25th percentile is 7.3 yuans, the median spending is 26 yuans, and the 75th percentile is 70 yuans.

Most of the members of the zero-spending households are covered by publicly financed health insurance. For example, in 91 percent of these households there is at least one individual who is covered by publicly financed medical care. Seventy-five percent of these households involve at least two individuals who are covered by such insurance. Seventy-eight percent of them report that they have no member who pays all medical costs, and 51 percent declare the absence of members who pay part of the medical costs. The individuals who pay all their own medical expenses are asked about the basic fee they paid for a visit to a local clinic during the last month. Only nine percent of the households with zero spending on medical care answered that question, whereas 53 percent of the relevant households with positive spending provided an answer.[5]

It is well known that the existence of deductibles and coinsurance may generate endogeneity of the price of medical care, which may in turn bias the estimated price elasticity. Studies on the demand for health services have struggled to find an exogenous price measure that is not correlated with usage. It has been observed that it is difficult to find a truly exogenous price measure, unless the consumers are randomly assigned to various insurance categories, as was the case in the Rand Health Insurance Study in the United States. As argued above, the institutional structure of the Chinese health care delivery system suggests the exogeneity of insurance. In this case, the price of medical care net of insurance can be approximated by the average coinsurance rate. Because we implicitly control for the variation in coinsurance by including into the model the four insurance classifications described above, the price of medical care is measured by the unit price in the private market. In the survey that created our data set, household members who pay all their medical costs are asked about the basic fee they paid for their last visit to the local clinic. The average value of the responses to this question is used as the unit price of medical

---

[5] *The medical spending corresponds to outlays in 1988. The fee question pertains to a clinic visit that took place during the month prior to the interview, which is typically early 1989. Hence, we can have households that reported zero spending in 1988, but provided fee information in the questionnaire.*

care, called MEDPRICE. For the households where no response was recorded, the average price of the province is assigned.[6]

For each household, the data set contains information on the monthly average consumption of various food items and their prices. Furthermore, types of food are classified into two categories depending upon whether they are purchased with coupons in state-owned stores, or purchased at the free market. For purchases in state-owned stores, the average price paid in 1988 (in yuan) and the average monthly consumption (in jin) of wheat, rice, and other staple food, edible oil, pork, beef and mutton, poultry, fish and seafood, sugar and vegetables are recorded. The quantities and prices of the same items were recorded for purchases at the free market, with the exception that wheat is replaced by flour. Using these prices and quantities purchased, a food price index is created (FOODPRICE), as follows. $P_i = k_1 P_{1i} + k_2 P_{2i} + \ldots + k_m P_{mi}$, where P_i stands for the food price for the i*th* household, P_{mi} is the price of the *mth* food item for the *ith* household, k_j is the sample share of the j*th* food ($j = 1, \ldots m$). Thus, k_j is total spending on the j*th* food by all households, divided by total food spending of all households).

To measure the opportunity cost of time for the household we included the following variables. WORKING stands for the number of working members of the household. These are the individuals who either declared that they were working, or reported positive labor income. STUDENT represents the number of students in the household, SPOUSE stands for the number of spouses. IRONRICE stands for the number of members who work at state-owned or publicly owned enterprises. OWNER is the number of household members who own private or individual enterprise, or own and manage such enterprise. TECHNICAL stands for the number of people in the household who are professional or technical workers. GOVERNMENT is the count of members who are responsible officials of government offices or institutions. FTRYDIRECTOR represents the number of household members who are factory directors or factory managers.

6 *The data set contains 980 households that paid all their medical expenses and reported a nonzero price for a clinic visit. With respect to other households, these households, on the average, have half less members that are covered by publicly financed medical care (1.5 vs. 2.0), and more than twice as many members who pay all their medical expenses (1.3 vs. 0.6). Their annual medical expenditures are more than twice as high (115 yuan vs. 52 yuan), their labor incomes are lower (326 yuan vs. 350 yuan).*

OFFICEWORKER is the number of household members who are office workers, and LABORER is the number of household members who are laborers. These variables represent the occupation of the members of the household, thus they may proxy market efficiency and therefore the cost of time. They may also represent environmental factors that are represented by the vector X in the gross investment equation (3). Controlling for the occupational affiliation we hope to capture the differing rate of depreciation across the households. Similarly, WORKBATH is a variable that tries to gauge the characteristics of the work environment. It is the number of household members who bathe in the work unit's bathhouse. WORKEAT represents the number of household members who eat at their work unit's dining hall. CITY is a dichotomous variable to represent whether the residence is in a city. This variable may capture the ease of access to medical services. Table 1 demonstrates that 50 percent of the households are in a city.

Nonmarket efficiency is measured by the level of the human capital, which can be approximated by the level of schooling. Each working member of the household is assigned to one of the following eight categories. Less than three years of primary school, three years of more of primary school, primary school graduate, lower middle school graduate, upper middle school graduate, professional school graduate, community college (dazhuan) graduate, college (daxue) graduate or above. Using the reported level of education for each household member who is 25 years of age and older, the average years of schooling for the household (EDUCATION) is calculated. The mean value of education is 10 years.

The number of household members who are national minorities (MINORITY), and the number of Communist Party members in the household (COMMUNIST) are variables that may capture the variation in the access to medical care because of the minority status or communist party membership privileges.

Biological differences, differences in attitudes toward risky and unhealthy behavior, as well as the differences in lifestyles and the efficiency in health production may differ between genders. This suggests inclusion of gender as an explanatory variable into the demand function (Hunt-Mccool, Kiker and Ng 1995, Wilensky and Cafferata 1983, Sindelar 1982, Grossman 1972b). Age captures the depreciation in health capital. Consequently, as presented in Table 1, the number of males and females in the household are categorized into various age intervals. For example, FEMALE6-10 stands for the number of females in the household who are between ages 6 and 10; and MALE60+ represents the number of males who are 60 years of age and older. Other variables that may capture the variation in the rate of depreciation of health capital are: DISABLED, which represents the number of disabled individuals in the household, and RETIRED, which stands for the number of retired people in the household.

Total household labor income, TOTINCOME, is calculated by the sum of regular wage and floating wage income, contract income, all kinds of bonuses, above-quota wages, the sum of housing subsidy, subsidy for non-staple food, heating, water and electricity subsidy, book and paper allowance, bath and haircut subsidy, transportation subsidy, single-child subsidy, one-time only subsidies (bonuses for birth control, creation and invention, etc.), hardship allowances, income from second job, total market value of all coupons (for movies, haircuts, color TV, refrigerator, etc.), retirement pension, supplementary income, other income received by retired members, total income of non-working members, total income in kind received by all household members, total gross income received by the member of the household who is an owner of private or individual enterprise minus total operating cost of the enterprise (including expenditures on wages, raw materials, interest, etc.), minus total taxes paid, minus various fees paid to government departments. VARINCOME stands for variable income, and is a component of TOTINCOME. It is the sum of all kinds of bonuses, above-quota wages, and other wages and income that are not part of regular wage and income. NLABORINC stands for non-labor income. It is the sum of interests on savings accounts, dividends, bond interest, income from house rent, income from leasing out other goods, machinery or tools, other non-labor income, alimony income, transfer income, the value of gifts, boarding fees from relatives and friends, and the value of food coupons received by all household members.

A number of variables that describe housing conditions are included in the analysis. Some of these variables are related to the wealth of the household, and thus aim to capture the impact of wealth on the demand for medical care. Some other housing characteristics may impact the demand for medical care through their influence on the depreciation of health capital. The following housing variables can be though of as related to household wealth. ROOMS stands for per capita number of rooms used by the household. SHRKITCHEN is a dummy variable, which takes the value of 1 if the household shares a kitchen, and zero otherwise. OWNKITCHEN is a dummy variable, which is 1 if the household owns a kitchen, and zero otherwise. Both of these last two variables being zero indicates that the household does not have a kitchen. Similarly three dichotomous variables capture the variation in the configuration of the toilet and bath for the household. BATH1 is a dummy variable which is 1 if the household shares toilet and bath, and zero otherwise. BATH2 is a dummy variable which is 1 if the household has toilet but lacks bath. BATH3 is a dummy variable to indicate the presence of both toilet and bath. The left-out category is the case where the household lacks sanitary facilities. HEAT1 takes the value of 1 if the household has central heating and zero otherwise. HEAT2 is another dummy variable which takes the value of 1 if the household has other means of heating and zero otherwise.

The housing characteristic that may impact the demand for health care through its impact on health status is WATER, which is a dichotomous variable that indicates the presence of own tap water. Other housing characteristics are represented by four dummy variables that control for the main source of energy used for heating and cooking. They are COAL, BOTTLEDGAS, PIPEDGAS and KEROSENE.

V. Results

Since both equations are reduced forms, there is no completely satisfactory way to identify the system. The issue is less troublesome in case of the discrete factor model, because identification can be achieved due to non-linearity (Akin and Rous 1997). However, for both estimation methods, in the benchmark cases we excluded ROOMS from the participation equation, and CITY from the spending equation. This assumes that the location of the household, which may proxy access to health care, may determine whether or not to buy medical care, and the number rooms per capita impacts the amount of spending if it proxies a wealth effect. The results, however, were extremely robust to any alternative identification restriction.

If $K = 1$ in Equation (18), the discrete factor model reduces to a two-part model. Likelihood ratio tests rejected the hypothesis of one point of support in favor of two points. Following Mroz (1999) we increased the number of supports and performed likelihood ratio tests to determine the number of supports that maximizes the likelihood function. The results are based on five points of support ($K = 5$ in Equation 18); however, there was no discernible difference in estimated parameters for three, four, and five points of support. The bottom of Table 2B displays the estimated coefficients and the t-statistics of the common factor in both equations. Although the estimated ρ_1 is not different from zero, ρ_2 is highly significant. Furthermore, we tested and rejected the hypothesis that $\rho_1 = \rho_2 = 0$. The bottom of Table 2B also reports the estimated mass points and the associated probabilities. As can be seen, most of the mass of the distribution is given to two points, indicating a bimodal distribution. This suggests that estimation frameworks based on selection models using normality may not be appropriate. To test the normality assumption, we imposed the following mass points with the associated probabilities that approximate a normal distribution: 0.00 with probability 0.06 , 0.37 with probability 0.24 , 0.50 with probability 0.40, 0.63 with probability 0.24, and 1.0 with probability 0.06. The estimated model yielded a likelihood value of -11,230.61, which generates a likelihood ratio test with a value of 927.4 with 10 degrees of freedom, strongly rejecting the hypothesis of normality.

The coefficients obtained from the spending equation of the discrete factor model are unconditional elasticities, while the calculation of the elasticities based on the two-part model is explained in Section III.

Household Characteristics

Table 2A presents the estimated two-part model. Column I displays the estimated coefficients of the logit model, and Column II presents their z-values. The estimates of the spending equation coefficients and their t-ratios are presented in Columns III and IV, respectively. For both equations robust standard errors are calculated. Table 2B presents the estimated coefficients of the spending equation from the discrete factor model. The unconditional elasticities obtained from both models are displayed in Table 3. We report elasticities if the variable is significant in the discrete factor model, and if it is significant in at least one equation of the two-part model. The elasticities are evaluated at the mean values of the variables and using the mean predicted probability of participation, which is 0.72. The exceptions to this algorithm are noted below. The elasticity of medical care with respect to the number of members who pay part of the medical costs (PARTPAY) is 0.40 in the two-part model, and 0.47 in the discrete factor model (columns I and III of Table 3) The range of the elasticities obtained from both models are 0.43 to 0.58 for the number of members who pay all of the medical costs (ALLPAY), and 0.15 to 0.39 for number of members using other forms of provision of health care (OTHERCARE).

The regressions control for the household size as the sum of PUBFIN, PARTPAY, ALLPAY and OTHERCARE is equal to the size of the household. Thus, some variables need to be dropped to avoid perfect multicollinearity. For example, because the sum of all age categories also adds up to the size of the household, we dropped the category MALE25-60, which is the number of males ages 25 to 60 in the household. Therefore, the coefficients of gender-age categories represent the relative spending associated with an increase in each interval in comparison to the number of males aged 25 to 60 (the left-out category). For example, the elasticity pertaining to FEMALE0-1 obtained from the discrete factor model is 0.63. This indicates that keeping all else constant, if a female child aged 0 to 1 replaces a male aged 25-60, this generates a 63 percent increase in medical care demand. Note that the distribution of this variable is highly skewed. Therefore the elasticity obtained from the two-part model of this variable is evaluated at the value of one.[7]

The number of disabled people, the number minorities, number of communist party members, and average years of schooling have no impact on medical care demand.[8] The presence of a spouse has a negative impact on the demand for medical care of the household in the DFM.. The average education of the adult household members is not significant. On the other hand, the demand for medical care goes down as students replace members of the household who are housekeepers (not retired, not working, not student). In particular, if a housekeeper is replaced by a student, the demand for medical care goes down by 19 to 24 percent (see columns I and III of Table 3).

---

[7] *Along the same lines, if the median of a variable is zero due to skewness, we evaluated the elasticity obtained from the two-part model at the value of 1.*

[8] *It should be cautioned that there are only seven disabled individuals in the whole sample.*

Occupational affiliation is a significant determinant of the demand for medical care. Three occupation categories (FTRYDIRECTOR, OFFICEWORKER and LABORER) have negative elasticities. This indicates that households with members in these occupations spend less on medical care than the ones with members who do not specify an occupation, which may be due to market efficiency and higher opportunity cost of time. The estimated coefficients of IRONRICE demonstrate that workers who are affiliated with state-owned or publicly owned enterprises, demand 8 to 19 percent more medical care than other types of workers. The incomes of these workers may be considered as permanent income in comparison to other workers, because they have tenured employment. Thus, the increased demand for medical care because of the affiliation with state-owned enterprises may be due to this permanent income effect.

An additional household member who uses the work unit's bathhouse reduces annual household medical demand by 15 to 18 percent. Similarly, if the household has its own tap water, this reduced the demand for medical care by 13 percent. These results can be attributed to the impact of sanitation. An additional household member who eats at the work unit's dining hall increases the demand by 6 to 7 percent, which may be due to the additional income that is being created by the provision of meals at the workplace.

As for the housing conditions, both the households that have their own toilet and bath, and households that share sanitary facilities have higher demand for medical care in comparison to households with no bath or toilet. If the household has central heating, the demand for medical care is higher in comparison to households with no heating. Similarly, per capita rooms has an elasticity of 0.13 to 0.17. To the extent that these variables reflect some aspects of wealth, they imply that wealthy households spend more on medical care.

If the main source of heating and cooking is coal, bottled gas or piped gas, the demand for medical care is lower. The elasticity of medical care with respect to food price is between -0.05 and -0.15, which suggests that food and medical care are gross complements (columns II and IV of Table 3).

Price and Income Effects

Most previous work reported insensitivity of medical spending to changes in price for the United States (Wedig 1988, Manning et al.1987a, Feldstein 1977, Newhouse and Phelps 1976, Phelps and Newhouse 1974). The evidence is less clear-cut in developing countries. While the majority of research reported inelastic demand (e.g. Sauerborn, Nougtara and Latimer 1994, Gertler, Locay and Sanderson 1987, Akin, Griffin, Guilkey and Papkin 1986, Heller 1982), there are some studies that found elastic demand for medical services (De Bethune, Alfani and Lahaye 1989, Yoder 1989, Chernichovsky and Meesook 1986). The bottom of Table 3 presents the price and income elasticities. The estimated price elasticity is -0.87 in the two-part model, and -0.66 in the discrete factor model. This suggests that an increase in price would generate an increase in revenues obtained from medical care services.

Most studies which used cross-country data estimated income elasticities that are greater than one (Newhouse 1977, Parkin et al. 1987, Gerdtham et al.1992), which suggests that health care is a luxury good. On the other hand, pooled country cross sections provide income elasticity estimates that are less than or near one (Di Matteo and Di Matteo 1998, Hitiris and Posnett 1992). Thus, no consensus emerged from aggregate data, and the debate on whether or not health care is a luxury good continues (Blomqvist and Carter 1997). Table 3 demonstrates that the estimated income elasticity is 0.82 in the two-part model, and 0.65 in the discrete factor model. Newhouse (1992) points out the possibility that within-country income elasticities may be distorted by the endogeneity of income at the household level. This is because sickness simultaneously depresses income and increases medical spending. To entertain the possibility that household income is endogenous, we instrumented household income with non-labor income (NONLABORINC) and variable income (VARINC). Non-labor income is the sum of interests on savings accounts, bonds and dividends, income from house rent and from leasing out other goods, machinery or tools, as well as other non-labor income, alimony income, transfer income, the value of gifts, boarding fees from relatives and friends, and the value of food coupons received by all household members. VARINC is the sum of all kinds of bonuses, above-quota wages, and other wages and income that are not part of regular wage and income. Sickness of the household members is not likely to significantly impact these items. In the first stage, these variables were significant determinants of total income. The income elasticities obtained from this procedure were 0.80 and 0.58, respectively, from the two-part and discrete factor models. This suggests that medical care is a necessity in urban China, which is consistent with estimates obtained from other within-country data sets.

Province Effects

To investigate the sensitivity of the results to geographic variation, we included nine dummy variables for the 10 provinces and re-estimated the models. The results are reported in Tables 4A and 4B, and the calculated elasticities are presented in columns II and IV of Table 3 for the two-part model, and DFM, respectively. The inclusion of province dummies reduced the magnitude of the elasticities in all cases, expect for the medical care price elasticity. The estimated variances of certain household characteristics increased. For example, in the two-part model, variables such as RETIRED, WORKBATH and HEAT1 are not significant when the province dummies are included; and as a result, column II of Table 3 does not report elasticities for these variables. For the DFM, inclusion of the province dummies eliminated statistical significance of a larger set of variables. For example, the entire set of variables capturing household living and sanitary conditions, (HEAT1, WATER, BATH1, BATH2, BATH3, COAL, BOTTLEDGAS, PIPEDGAS) lost their significance.

The income elasticity estimate became smaller in response to the inclusion of province dummies: it is 0.32 in the two-part model, and 0.28 in the DFM, suggesting strongly that medical care is a necessity in urban China.

Inclusion of province dummies increased the price elasticity of medical care in absolute value. In the case of the two-part model, the estimated elasticity is -1.03. However, its 95 percent confidence interval is -0.95 to -1.11; thus we cannot reject the hypothesis of inelastic demand for medical care. On the other hand, the price elasticity estimated from the DFM is -0.81, with a 95 percent confidence interval of -0.74 to -0.88. Given these results, we conclude that the demand for medical care is price inelastic.

Even though the insensitivity of medical care usage to changes in its price seems like the norm with few exceptions, price elasticity may be different for different groups in the population. In particular, the poor may be more sensitive to changes in price than the rich. In this case, a non-discriminating increase in user fees may have a detrimental impact on health care utilization of the poor. There are only a few studies that investigated the difference in price responsiveness of different income groups. Akin, Guilkey and Denton (1995) found no difference in price elasticity between poor and non-poor in Nigeria, while Gertler, Locay and Sanderson (1987) report that price elasticity is larger for the very poor in Peru, and Sauerborn, Nougtara and Latimer (1994) find that the services used by infants and children, and lowest income quartile are price elastic in Burkina Faso.

To calculate the price elasticity for different income groups, we re-estimated the models with an interaction term of the price of medical care and income. We evaluated the resultant price elasticity at the 10th, 50th and 90th percentiles of the income distribution. In the model with no province dummies the price elasticity of medical care was -0.97 for the 10th percentile, -0.86 for the median income household, and it was -0.80 for the 90th percentile of the income distribution using the two-part model. Discrete factor model provided the same pattern with lower price elasticities. Price elasticity was -0.74 for the 10th percentile, -0.66 for median income, and -0.55 for the 90th percentile. In the models which included province dummies price elasticities were -1.06 for the 10th percentile, -1.03 for the median income household, an -0.98 for the 90th percentile in the two-part model; they were -0.84 for the 10th percentile, -0.81 for the median income household, an -0.77 for the 90th percentile in the DFM. This indicates that poor households are more sensitive to changes in price. Thus, although an increase in the price of medical care would be associated with increased revenues, it would reduce the demand for medical care more for poor households than it would for rich households.

VI. Conclusion

Using a data set that consists of detailed characteristics of 6407 urban households of 10 provinces of the People's Republic of China, this paper investigates the determinants of the demand for medical care. Descriptive statistics reveal that 28 percent of the households report zero spending on medical care. Most members of these households are covered by publicly financed health insurance. The average expenditure on medical care for the households that report positive spending is 71.5 yuans; it is 51 yuans per household per year for all households. Thus, the share of medical care spending is 10 percent of total household income from all sources.

We fit both a two-part model, and a discrete factor model to the data, which provide consistent results. The discrete factor models allows for selection, but estimates a semi-parametric distribution for the error terms between the participation and spending equations. Household characteristics have significant impact on medical care demand. For example, the estimated coefficients for gender-age intervals show that replacing one adult male with a female infant (age 0 to 1) increases the household's demand for medical care, and that replacing one adult male with a female aged 19 to 24 decreases it. The presence of a student in the household has a negative impact on the demand for medical care. Occupation and type of insurance are also significant determinants of the demand for medical care.

Some of the results suggest that sanitary conditions have an impact on the demand for medical care. For example, households in which individuals bathe at the work unit's bathhouse demand less medical care. Similarly, the demand for medical care is lower for the households that have their own tap water.

Households with own toilet and bath, and households that share sanitary facilities have higher demand for medical care in comparison to households with no bath or toilet. If the household has central heating, the demand for medical care is higher in comparison to households with no heating. The elasticity of medical care with respect to per capita rooms in the household is also positive. These results suggest a positive wealth effect on the demand for medical care. Inclusion of province dummies eliminates the significance of most household characteristics in the discrete factor model.

The estimated income elasticity is in the range of 0.65 to 0.82 with no province dummies, and 0.28 to 0.32 in the models which include province dummies. Treating income as an endogenous variable does not impact these results. These estimates suggest that medical care is a necessity in urban China. The demand for medical care is price inelastic. Price elasticity gets larger in absolute for poorer households. This result suggests that although total revenue from the provision of health care can be increased by raising the price of care, poor households would reduce their demand more than rich households.

Table 1
Descriptive Statistics

Variable	Definition	Mean	Standard deviation
SPENDING (yuan/year)	Total cost of medical care borne by all members of the household.	51.457	256.23
MEDPRICE (yuan/visit)	Price of medical care. It is the average basic fee paid for a visit during the last month prior to the interview by household members who paid all medical expenses. If no such member is present, province average fees are substituted.	17.923	22.52
PUBFIN	Number of household members covered by publicly financed medical care.	2.002	1.13
PARTPAY	Number of household members who pay part of medical costs.	0.716	0.89
ALLPAY	Number of household members who pay all medical costs.	0.553	0.91
OTHERCARE	Number of household members using other forms of provision of medical care.	0.295	0.74
FOODPRICE (yuan/jin)	Weighted average of the unit prices (per jin) of wheat, rice, flour and other staple food, and edible oil, pork, beef and mutton, poultry, fish and seafood, sugar and vegetables; weighted by the share in food total expenditures.	0.621	0.30
WORKING	Number of household members who reported labor income or who indicated that they were working.	2.309	0.70
STUDENT	Number of household members who are students.	0.876	0.83
SPOUSE	Number of spouses in the household.	0.934	0.25
IRONRICE	Number of household members who work at state-owned or publicy owned enterprises.	1.701	0.86
OWNER	Number of household members who own private or individual enterprise, or own and manage such enterprise.	0.021	0.17
TECHNICAL	Number of household members who are professional or technical workers.	0.370	0.67
GOVERNMENT	Number of household members who are responsible officials of government office or institutions.	0.102	0.33
FTRYDIRECTOR	Number of household members who are factory directors or factory managers.	0.039	0.20
OFFICEWORKER	Number of household members who are office workers	0.518	0.71
LABORER	Number of household members who are laborers.	1.117	0.99

(Table 1 continued)			
WORKBATH	The number household members who take baths in work unit's bathhouse.	0.862	1.05
WORKEAT	The number of household members who eat in work unit's dining hall.	0.574	0.88
CITY	Dichotomous variable (=1) if the household is located within a city, (=0) otherwise.	0.499	0.50
EDUCATION	Average years of schooling of the household members who are 25 years of age and older.	10.261	2.63
MINORITY	Number of household members who are national minority.	0.088	0.44
COMMUNIST	Number of household members who are communist party members.	0.559	0.68
FEMALE0-1	Number of females in the household who are between ages 0 and 1.	0.013	0.11
FEMALE2-5	Number of females in the household who are between ages 2 and 5.	0.081	0.28
FEMALE6-10	Number of females in the household who are between ages 6 and 10.	0.156	0.38
FEMALE11-18	Number of females in the household who are between ages 11 and 18.	0.293	0.55
FEMALE19-24	Number of females in the household who are between ages 19 and 24.	0.141	0.39
FEMALE25-60	Number of females in the household who are between ages 25 and 60.	1.019	0.28
FEMALE60+	Number of females in the household who are older than 60 .	0.095	0.30
MALE0-1	Number of males in the household who are between ages 0 and 1.	0.015	0.12
MALE2-5	Number of males in the household who are between ages 2 and 5.	0.081	0.28
MALE6-10	Number of males in the household who are between ages 6 and 10.	0.164	0.38
MALE11-18	Number of males in the household who are between ages 11 and 18.	0.306	0.55
MALE19-24	Number of males in the household who are between ages 19 and 24.	0.141	0.40
MALE60+	Number of males in the household who are older than 60.	0.060	0.24

	(Table 1 concluded)		
DISABLED	Number of household members who are disabled.	0.001	0.04
RETIRED	Number of retirees in the household .	0.155	0.45
TOTINCOME (yuan/year)	Total household labor income (see the text for the definition).	349.793	163.39
VARINCOME (yuan/year)	The sum of all kinds of bonuses, above-quota wages, and other wages and income that are not part of regular wage and income.	74.104	84.11
NLABORDINC (yuan/year)	Unearned (non-labor) income (see the text for definition).	74.501	57.37
ROOMS	Total number of rooms by household per capita.	0.730	0.39
SHRKITCHEN	Dichotomous variable (=1) if the household shares kitchen, (=0) otherwise.	0.058	0.23
OWNKITCHEN	Dichotomous variable (=1) if the household has its own kitchen, (=0) otherwise.	0.826	0.38
BATH1	Dichotomous variable (=1) if the household shares sanitary facilities, (=0) otherwise.	0.170	0.38
BATH2	Dichotomous variable (=1) if the household has toilet, but no bath, (=0) otherwise.	0.395	0.49
BATH3	Dichotomous variable (=1) if the household has both toilet and bath, (=0) otherwise.	0.092	0.29
HEAT1	Dichotomous variable (=1) if the household has central heating, (=0) otherwise.	0.167	0.37
HEAT2	Dichotomous variable (=1) if the household has other means of heating, (=0) otherwise.	0.237	0.43
WATER	Dichotomous variable (=1) if the household has its own tap water, (=0) otherwise.	0.813	0.39
COAL	Dichotomous variable (=1) if coal is the main source of heating and cooking, (=0) otherwise.	0.511	0.50
BOTTLEDGAS	Dichotomous variable (=1) if bottled gas is the main source of heating and cooking, (=0) otherwise.	0.278	0.45
PIPEDGAS	Dichotomous variable (=1) if piped gas is the main source of heating and cooking, (=0) otherwise.	0.172	0.38
KEROSENE	Dichotomous variable (=1) if piped gas is the main source of heating and cooking, (=0) otherwise.	0.002	0.04

Table 2A
Estimated Two-part Model

	I	II	III	IV
Variable	**Coefficient**	**z-stat**	**Coefficient**	**t-stat**
CONSTANT	-0.483	-0.69	-1.562***	-3.28
PUBFIN	-0.254**	-1.96	0.093	0.96
PARTPAY	0.027	0.21	0.551***	5.66
ALLPAY	0.343***	2.60	0.679***	7.11
OTHERCARE	0.141	1.04	0.454***	4.51
MALE0-1	0.971***	3.32	0.244	1.16
MALE2-5	1.022***	5.43	0.127	0.96
MALE6-10	0.362**	2.28	0.080	0.68
MALE11-18	0.071	0.51	0.008	0.07
MALE19-24	-0.059	-0.45	-0.104	-1.04
MALE60+	0.087	0.49	-0.151	-1.15
FEMALE0-1	1.006***	3.14	0.654***	3.04
FEMALE2-5	0.413**	2.33	0.067	0.50
FEMALE6-10	0.156	0.98	0.058	0.50
FEMALE11-18	-0.006	-0.04	-0.031	-0.30
FEMALE19-24	-0.007	-0.05	-0.207**	-2.02
FEMALE25-60	-0.111	-0.70	-0.005	-0.04
FEMALE60+	0.149	0.89	-0.048	-0.40
SPOUSE	-0.060	-0.43	-0.161	-1.48
EDUCATION	0.016	1.01	-0.002	-0.21
RETIRED	0.030	0.24	-0.183**	-2.07
STUDENT	0.292***	3.32	-0.300***	-4.78
COMMUNIST	0.029	0.55	0.013	0.32
MINORITY	0.005	0.06	0.030	0.54
DISABLED	0.414	0.68	0.401	0.73
WORKING	0.296***	2.70	-0.050	-0.70
OWNER	-0.306	-1.16	-0.296*	-1.90
TECHNICAL	-0.416***	-3.01	-0.154	-1.60
GOVERNMENT	-0.459***	-2.83	-0.069	-0.58
FTRYDIRECTOR	-0.558***	-2.63	-0.360**	-2.39
OFFICEWORKER	-0.395**	-2.97	-0.189**	-2.07
LABORER	-0.319**	-2.49	-0.227***	-2.62
IRONRICE	0.148***	3.13	0.064*	1.81
WORKEAT	0.093**	2.46	0.096***	3.37
WORKBATH	0.016	0.47	-0.178***	-6.81
HEAT1	-0.880***	-9.00	0.315***	3.70

(Table 2A concluded)

HEAT2	-0.553***	-6.45	0.0720	1.07
WATER	-0.072	-0.76	-0.145**	-2.04
BATH1	-0.224**	-2.39	0.289***	3.99
BATH2	-0.107	-1.19	0.076	1.20
BATH3	0.677***	4.50	0.297***	3.27
CITY	0.140**	2.25	--	--
ROOMS	--	--	0.186***	2.83
SHRKITCHEN	0.192	1.26	-0.224*	-1.76
OWNKITCHEN	0.458***	4.46	0.082	1.01
COAL	0.296	1.39	-0.604***	-4.96
BOTTLEDGAS	-0.205	-0.95	-0.665***	-5.11
PIPEDGAS	-0.210	-0.93	-0.605***	-4.27
KEROSENE	-0.268	-0.36	-0.304	-0.54
MEDPRICE	-0.763***	-12.62	0.341***	10.32
FOODPRICE	0.401***	4.20	-0.166**	-2.34
TOTINCOME	0.553***	4.39	0.668***	7.75
	n=6.407		n=4,611	
	LogL=-3,243.5		R^2=.20	

* indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level.

Table 2B
Estimated Spending Equation
Discrete Factor Model

Variable	Coefficient	t-stat
CONSTANT	-1.650***	-3.05
PUBFIN	0.073	0.79
PARTPAY	0.471***	5.07
ALLPAY	0.578***	6.34
OTHERCARE	0.391***	4.07
MALE0-1	0.335*	1.65
MALE2-5	0.094	0.73
MALE6-10	0.059	0.51
MALE11-18	0.003	0.03
MALE19-24	-0.072	-0.73
MALE60+	-0.148	-1.16
FEMALE0-1	0.632***	3.02
FEMALE 2-5	0.050	0.39
FEMALE 6-10	-0.005	-0.05
FEMALE 11-18	-0.062	-0.61
FEMALE 19-24	-0.185*	-1.85
FEMALE 25-60	0.002	0.02
FEMALE 60+	0.023	0.20
SPOUSE	-0.199*	-1.82
EDUCATION	0.001	0.07
RETIRED	-0.137	-1.57
STUDENT	-0.243***	-3.91
COMMUNIST	0.025	0.62
MINORITY	0.027	0.49
DISABLED	0.411	0.38
WORKING	-0.023	-0.33
OWNER	-0.245	-1.64
TECHNICAL	-0.155	-1.65
GOVERNMENT	-0.134	-1.15
FTRYDIRECTOR	-0.327***	-2.22
OFFICEWORKER	-0.192***	-2.14
LABORER	-0.197***	-2.35
IRONRICE	0.082***	2.35
WORKEAT	0.063***	2.20
WORKBATH	-0.177***	-6.72
HEAT1	0.275***	3.26
HEAT2	0.063	0.94
WATER	-0.130*	-1.87

(Table 2B concluded)

BATH1	0.231***	3.25
BATH2	0.071	1.13
BATH3	0.296***	3.31
ROOMS	0.171***	2.59
SHRKITCHEN	-0.201	-1.58
OWNKITCHEN	0.089	1.11
COAL	-0.476***	-4.08
BOTTLEDGAS	-0.593***	-4.75
PIPEDGAS	-0.559***	-4.11
KEROSENE	-0.276	-0.56
MEDPRICE	0.336***	9.84
FOODPRICE	-0.153***	-2.18
TOTINCOME	0.654***	7.80
	n=6,407	LogL=-11,694.3
ρ_1	-0.072	-0.182
ρ_2	6.427	13.439
	Mass Points	Probabilities
	0.00	0.05
	0.34	0.29
	0.59	0.03
	0.64	0.61
	1.00	0.01

* indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level.

Table 3

Estimated Elasticities

Variable	**I Elasticity (Two-part Model)**	**II Elasticity (Two-part Model)**	**III Elasticity (DFM)**	**IV Elasticity (DFM)**
Province Dummies	**No**	**Yes**	**No**	**Yes**
PUBFIN	0.04	0.09	--	--
PARTPAY	0.40	--	0.47	0.40
ALLPAY	0.43	--	0.58	0.50
OTHERCARE	0.15	--	0.39	0.35
MALE0-1*	0.52	0.35	0.34	--
MALE2-5*	0.41	0.41	--	--
MALE6-10*	0.18	0.15	--	--
FEMALE0-1*	0.93	0.85	0.63	0.63
FEMALE2-5*	0.18	0.17	--	--
FEMALE19-24*	-0.21	-0.19	-0.18	-0.19
SPOUSE	--	--	-0.20	--
RETIRED*	-0.17	--	--	--
STUDENT	-0.19	-0.13	-0.24	-0.18
WORKING	0.08	0.10	--	--
OWNER*	-0.38	--	--	--
TECHNICAL	-0.10	-0.03	--	--
GOVERNMENT*	-0.20	-0.04	--	--
FTRYDIRECTOR*	-0.52	-0.12	-0.33	-0.27
OFFICEWORKER	-0.16	-0.07	-0.19	--
LABORER	-0.35	-0.18	-0.20	--
IRONRICE	0.19	0.04	0.08	--
WORKEAT	0.07	0.06	0.06	--
WORKBATH	-0.15	--	-0.18	-0.05
HEAT1*	0.07	--	0.27	--
HEAT2	0.04	0.03	--	--
WATER	-0.13	-0.13	-0.13	--
BATH1*	0.22	--	0.23	--
BATH3*	0.49	0.11	0.30	--
CITY	0.04	0.03	--	--
ROOMS	0.13	0.12	0.17	0.17
SHRKITCHEN*	-0.17	-0.13	--	--
OWNKITCHEN*	0.21	0.17	--	--
COAL	-0.27	--	-0.48	--
BOTTLEDGAS*	-0.72	--	-0.59	--
PIPEDGAS*	-0.67	--	-0.56	--

(Table 3 concluded)

MEDPRICE	-0.87	-1.03	-0.66	-0.81
FOODPRICE	-0.05	-0.26	-0.15	-0.18
TOTINCOME	0.82	0.32	0.65	0.28

* signifies variables that have highly skewed distributions and that have zero median values. For these variables the elasticities obtained from the two-part model are evaluated at the value of one.

Table 4A
Estimated Two-part Model
with Province Dummies

	I	II	III	IV
Variable	**Coefficients**	**z-stat**	**Coefficients**	**t-stat**
CONSTANT	-0.582	-0.71	1.245**	2.54
PUBFIN	-0.253*	-1.82	0.116	1.13
PARTPAY	0.151	1.09	0.409	4.04
ALLPAY	0.310	2.22	0.536	5.43
OTHERCARE	0.200	1.37	0.354	3.40
MALE0-1	0.899***	2.84	0.130	0.61
MALE 2-5	0.952***	4.77	0.142	1.09
MALE 6-10	0.339**	2.03	0.059	0.50
MALE 11-18	0.055	0.37	-0.015	-0.14
MALE 19-24	-0.073	-0.51	-0.099	-0.99
MALE 60+	0.018	0.10	-0.071	-0.52
FEMALE0-1	0.887**	2.44	0.603***	2.99
FEMALE 2-5	0.367*	1.90	0.072	0.55
FEMALE 6-10	0.243	1.44	-0.003	-0.03
FEMALE 11-18	-0.052	-0.35	-0.049	-0.47
FEMALE 19-24	0.006	0.04	-0.195*	-1.89
FEMALE 25-60	-0.100	-0.59	-0.022	-0.18
FEMALE 60+	0.119	0.68	0.051	0.44
SPOUSE	0.045	0.29	0.058	0.53
EDUCATION	0.008	0.48	0.012	1.09
RETIRED	-0.014	-0.11	-0.041	-0.42
STUDENT	0.236***	2.58	-0.211***	-3.30
COMMUNIST	0.069	1.25	0.005	0.14
MINORITY	0.084	1.06	-0.039	-0.64
DISABLED	0.143	0.23	0.221	0.63
WORKING	0.299***	2.59	-0.041	-0.58
OWNER	-0.238	-0.92	-0.191	-1.23
TECHNICAL	-0.381***	-2.61	0.021	0.19
GOVERNMENT	-0.315*	-1.85	0.047	0.37
FTRYDIRECTOR	-0.490**	-2.24	-0.256	-1.61
OFFICEWORKER	-0.378***	-2.67	-0.033	-0.32
LABORER	-0.290**	-2.13	-0.081	-0.81
IRONRICE	0.116**	2.14	-0.008	-0.23
WORKEAT	0.164***	3.84	0.064**	2.31
WORKBATH	-0.012	-0.32	-0.039	-1.40
HEAT1	0.293	1.44	0.053	0.40
HEAT2	0.350*	1.87	0.049	0.42

(Table 4A concluded)

WATER	-0.141	-1.43	-0.119*	-1.79
BATH1	-0.005	-0.05	0.021	0.31
BATH2	-0.015	-0.16	-0.039	-0.64
BATH3	0.301*	1.82	0.029	0.33
CITY	0.123*	1.82	--	--
ROOMS	--	--	0.162***	2.58
SHRKITCHEN	0.297*	1.75	-0.214*	-1.75
OWNKITCHEN	0.406***	3.78	0.054	0.72
COAL	0.331	1.44	-0.072	-0.64
BOTTLEDGAS	0.183	0.75	-0.202	-1.59
PIPEDGAS	0.222	0.90	-0.061	-0.45
KEROSENE	-0.043	-0.04	-0.319	-0.84
MEDPRICE	-0.761***	-9.67	0.181***	5.21
FOODPRICE	-0.128	-1.26	-0.225***	-2.89
TOTINCOME	0.278	1.97	0.237***	2.79
	n=6,407		n=4,611	
	LogL=-2,934.9		R^2=0.28	

* indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level.

Table 4B
Estimated Spending Equation
Discrete Factor Model with Province Dummies

Variable	Coefficient	T-stat
CONSTANT	0.654	1.24
PUBFIN	0.125	1.31
PARTPAY	0.403***	4.23
ALLPAY	0.500***	5.35
OTHERCARE	0.352***	3.58
MALE0-1	0.220	1.08
MALE2-5	0.135	1.05
MALE6-10	0.063	0.56
MALE11-18	-0.029	-0.28
MALE19-24	-0.103	-1.07
MALE60+	-0.046	-0.36
FEMALE0-1	0.626***	3.03
FEMALE 2-5	0.066	0.51
FEMALE 6-10	-0.043	-0.38
FEMALE 11-18	-0.083	-0.82
FEMALE 19-24	-0.189*	-1.90
FEMALE 25-60	0.013	0.11
FEMALE 60+	0.080	0.69
SPOUSE	0.003	0.03
EDUCATION	0.014	1.26
RETIRED	-0.064	-0.77
STUDENT	-0.178***	-2.98
COMMUNIST	0.016	0.40
MINORITY	-0.036	-0.69
DISABLED	0.103	0.22
WORKING	-0.011	-0.15
OWNER	-0.190	-1.32
TECHNICAL	-0.026	-0.29
GOVERNMENT	-0.040	-0.36
FTRYDIRECTOR	-0.265*	-1.89
OFFICEWORKER	-0.077	-0.91
LABORER	-0.101	-1.25
IRONRICE	0.001	0.03
WORKEAT	0.043	1.50
WORKBATH	-0.049*	-1.83

(Table 4B concluded)

ROOMS	0.172***	2.67
HEAT1	0.149	1.10
HEAT2	0.155	1.29
WATER	-0.097	-1.43
BATH1	0.014	0.20
BATH2	-0.001	-0.02
BATH3	0.109	1.24
SHRKITCHEN	-0.200	-1.63
OWNKITCHEN	0.047	0.60
COAL	-0.023	-0.20
BOTTLEDGAS	-0.187	-1.42
PIPEDGAS	-0.058	-0.43
KEROSENE	-0.392	-0.79
MEDPRICE	0.191***	5.23
FOODPRICE	-0.182**	-2.48
TOTINCOME	0.276***	3.24
	n=6407	LogL=11,157.7
ρ_1	0.421	0.834
ρ_2	6.168	21.632
	Mass Points	Probabilities
	0.00	0.05
	0.31	0.23
	0.49	0.10
	0.61	0.59
	1.00	0.02

* indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level.

REFERENCES

Abel-Smith B. 1986, "The world economic crisis. Part I: Repercussions on Health," Health Policy and Planning, 1: 202-13.

Akin, John S. and, Jeffrey J. Rous, 1997, "Effect of Provider Characteristics on Choice of Contraceptive Provider: A Two Equation Full-Information Maximum-Likelihood Estimation." Demography, 34(4): 513-523.

Akin, John S., Charles C. Griffin, David K. Guilkey and Barry M. Popkin, 1986, "The demand for primary health care services in the Bicol region of the Phillippines," Economic Development and Cultural Change, 755-82.

Akin, John S., David K. Guilkey and E. Hazel Denton, 1995, "Quality of services and demand for health care in Nigeria: A multinomial probit estimation," Social Science and Medicine, 40:11, pp. 1527-37.

Blau, David and Alison Hagy, 1998, "The Demand for Quality in Child Care," Journal of Political Economy, 106(1): 107-146.

Blau, David M. and H. Naci Mocan, 1999, "The Supply of Quality in Child Care Centers," NBER Working Paper 7225.

Blomqvist Å. G, and R. A. L. Carter, 1997, "Is Health Care Really a Luxury?" Journal of Health Economics, 16: 207-229.

Chernichovsky, D. and O. Meesook, 1986, "Utilization of Health Services in Indonesia," Social Science and Medicine, 23: 611-620.

Colle, B. and Michael Grossman, 1978, "Determinants of Pediatric Care Utilization," Journal of Human Resources, 13:115-58.

Davis, D. 1988, "Unequal Chances, Unequal Outcomes: Pension Reform and Urban Inequality," The China Quarterly, 114, 223-42.

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

Di Matteo, Livio, and Rosanna Di Matteo, 1998, "Evidence on the Determinants of Canadian Provincial Government Health Expenditures: 1965-1991," Journal of Health Economics, 17: 211-228.

Dor, Avi, Paul Gertler and Jacques 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.

Duan Naihua, Willard G. Manning, Carl N. Morris and Joseph P. Newhouse, 1983, "A Comparison of Alternative Models for the Demand for Medical Care," Journal of Business and Economic Statistics, 1:2, 115-26.

Duan, Naihua, Willard G. Manning, Carl N. Morris, Joseph P. Newhouse, 1984, "Choosing Between the Sample-Selection Model and the Multi-Part Model," Journal of Business and Economic Statistics, 2(3): 283-289.

Feldstein, Martin S., 1977, "Quality change and the demand for hospital care," Econometrica, 45:7 1689-1702.

Gerdtham, Ulf-G., Jes Søgaard, Frederik Anderson, and Bengt Jönsson, 1992, "An Econometric Analysis of Health Care Expenditure: A Cross-Section Study of the OECD Countries." Journal of Health Economics, 11: 63.84.

Gertler, Paul, L. Locay and W. Sanderson, 1987, "Are user fees regressive? The welfare implications of health care financing proposals in Peru," Journal of Econometrics, 36: 67-88.

Goldberger, Arthur, 1983, "Abnormal Selection Bias," in S. Karlin and T. Amemiya, eds. Studies in Econometrics, Time Series and Multivariate Statistics, Academic Press: New York.

Grogan, Colleen M., 1995, "Urban economic reform and access to health care coverage in the People's Republic of China," Social Science and Medicine, 41:8 1073-1084.

Grossman, Michael, 1972a, The demand for health: A theoretical and empirical investigation, Columbia University Press for the National Bureau of Economic Research; New York.

Grossman, Michael, 1972b, "On the concept of health capital and the demand for health," Journal of Political Economy, 80:223-55.

Hay, Joel W. and Randall J. Olsen, 1984, "Let them eat cake: A note on comparing alternative models of the demand for medical care," Journal of Business and Economic Statistics, 2:3, 279-82.

Heckman , James J. and Burton Singer, 1984, "A Method for Minimizing the Impact of Distributed Assumptions in Econometric Models for Duration Data," Econometrica, March, 52: 271-320.

Heller, P. 1982, "A model of the demand for medical and health services in Peninsular Malaysia," Social Science and Medicine, 16:267-84.

Henderson, G., J. Akin, L, P.S. Hutchinson, S.G. Jin, J.M. Wang, J. Dietrich and L.M. Mao, 1998, "Trends in Health Services Utilization in Eight Provinces in China," Social Science and Medicine, 47:12, 1957-71.

Henderson, Gail, J. Shuigao, J. Akin, L. Zhiming, W. Jianmin, M. Haijiang, H. Yunan, Z. Xiping, C. Ying, and G. Keyou, 1995, "Distribution of medical insurance in China," Social Science and Medicine, 41:8, 1119-1130.

Hitiris, Theo and John Posnett, 1992, "The Determinants and Effects of Health Expenditure in Developed Countries," Journal of Health Economics, 11: 173-181.

Hsiao, W.C., 1995, "The Chinese Health Care System: Lessons for Other Nations," Social Science and Medicine, 41: 1047-55.

Hu, WeiYin, 1999, "Child Support, Welfare Dependency, and Women's Labor Supply," Journal of Human Resources, 34(1): 71-103.

Hu, The-Wei, Michael Ong, Zi-Hua Lin, and Elizabeth Li, 1999, "The Effects of Economic Reform on Health Insurance and the Financial Burden for Urban Workers in China," Health Economics 8, 309-321.

Hunt-Mccool, Janet, B. F. Kiker and Ying Chu Ng, 1995, "Gender and the Demand for Medical Care," Applied Economics, 27: 483-95.

Kenkel, Don, 1990, "Consumer health information and the demand for medical care," Review of Economics and Statistics, 587-95

Khan, Azizur Rahman, Keith Griffin, Carl Riskin and Zhao Renwai, 1992, "Household income and its distribution in China," The China Quarterly, 132, 1029-61.

Lin N, and Y. Bian, 1991, "Getting Ahead in Urban China," American Journal of Sociology, 97, 657-88.

Liu, Gordon, Xingzhu Liu and Qingyue Meng, 1994, "Privatization of the medical market in Socialist China: A historical approach," Health Policy, 27:157-174.

Liu, Xingzhu and William C. L. Hsiao, 1995, "The Cost Escalation of Social Health Insurance Plans in China: Its Implication for Public Policy," Social Science and Medicine, 41(8): 1095-1101.

Maddala, G. S., 1985, “A Survey of the Literature on Selectivity Bias as it Pertains to Health Care Markets,” in Advances in Health Economics and Health Services Research, Vol 6, JAI Press: Greenwich, CT.

Manning, Willard G., Linda Blumberg, and Lawrence H. Moulton, 1995, “The Demand for Alcohol: The Differential Response to Price,” Journal of Health Economics, 14: 123-148.

Manning, Willard G., Joseph P. Newhouse, Naihua Duan, Emmett B. Keeler, and Arleen Leibowitz, 1987a, "Health insurance and the demand for medical care: Evidence from a randomized experiment," American Economic Review, 77:3, 251-77.

Manning, W.G., N. Duan and W. H. Rogers, 1987b, “Monte Carlo Evidence on the Choice Between Sample Selection and Two-Part Models.” Journal of Econometrics, 35: 59-82.

Milne R. and H. Molana, 1991, "On the effect of income and relative price on demand for helath care: EC evidence," Applied Economics, 23: 1221-26.

Mroz, Thomas A. 1999, “Discrete Factor Approximation in Simultaneous Equation Models: Estimating the Impact of a Dummy Endogenous Variable on a Continuous Outcome,” Journal of Econometrics, 92:233-274.

Musgrove, Philip, 1986, "What should consumers in poor countries pay for publicly-provided health services?" Social Science and Medicine, 22:329-33.

Musgrove, Philip, 1983, "Family Health Care Spending in Latin America," Journal of Health Economics, 2:245-57.

Muurinen, Jaana-Marja, 1982, "Demand for health: A generalized Grossman Model," Journal of Health Economics, 1:5-28.

Newhouse, Joseph P., 1992, "Medical care costs: How much welfare loss?" Journal of Economic Perspectives, 6:3, 3-21.

Newhouse, Joseph P., Charles E. Phelps and M. Susan Marquis, 1980, "On having your cake and eating it too: Econometric problems in estimating the demand for health services," Journal of Econometrics, 13:365-90.

Newhouse, Joseph P. 1977, "Medical care expenditure: A cross-national survey" Journal of Human Resources, 126:1, 115-25.

Newhouse Joseph P. and Charles E. Phelps, 1976, "Price and income elasticities for medical care services," in Richard Rosett, (ed.), The Role of Health Insurance in the Health Services Sector. National Bureau of Economic Research.

Parkin, David, Alistair McGuire and Brian Yule, 1987, "Aggregate helath care expenditures and national income: Is health a luxury good?" Journal of Health Economics, 6:109-27

Phelps, Charles E. and Joseph P. Newhouse, 1974, "Coinsurance, the price of time, and the demand for medical services," Review of Economics and Statistics, 56:3, 334-342.

Sauerborn, Rainer, Adrien Nougtara and Eric Latimer, 1994; "The Elasticity of demand for health care in Burkina Faso: Differences across age and income groups," Health Policy and Planning, 9: 186-92.

Sindelar, Jody L., 1982, "Differential use of medical care by sex," Journal of Political Economy, 92: 1003-19.

Wagstaff, Adam, 1986, "The demand for health: Some new empirical evidence," Journal of Health Economics, 5: 195-233.

Wedig, Gerard J, 1988, "Health Status and the demand for health: Results on price elasticities," Journal of health economics, 7: 151-63.

Whyte, Martin King and William L. Parish, 1984, Urban Life in Contemporary China, University of Chicago Press.

Wilensky, G. R. and G. L. Cafferata, 1983, "Women and the use of health services," American Economic Review, 73: 128-33.

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

Yuen, Peter P., 1996, "Reforming Health Care Financing in Urban China," International Journal of Public Administration, 19:2 221-232.