Demand for Outpatient Health Services After the Introduction of Separation of Prescribing and Dispensing in Korea

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This study answers the following question based on a theoretical model proposed by Grossman using data from the 2001 National Medical Care Resources and Utilization Survey: what does the demand for outpatient health services in Korea look like after the introduction of separation of dispensary from medical practice? Two measures of health service utilization are defined in this study: (1) whether a patient used outpatient health services; and (2) frequency of outpatient health service utilization. The probit model was applied to the first demand equation with binary dependent variable because it takes advantage of the convenient properties of the normal distribution. For the next demand equation with a continuous dependent variable with selection problem, the two-stage method with maximum likelihood is applied. In rural area, the number of doctor per 1000 population has significantly positive effect on outpatient health service use. This result suggests that we need to develop several health policies to minimize the effect of the health care resources on health care utilization in rural areas. First of all, it is necessary to develop the surveillance system, which investigates the status of demand for and supply of health services, and the principles of the health resources allocation based on the regional properties. Second, the health resource allocation policy should include reconstruction of manpower policy, developing resource allocation formula, finding self-sufficient catchment area and reinforcing public health services. In short term, the policy goals, such as 'the National Minimum' or 'National Standard' should be performed.

Key Word: Demand for Outpatient Health Services, Health Service utilization, Grossman Model

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I. Introduction

The ultimate goal of a health care system is to raise national health standards of the people. Thus studies concerning public health policy explore the determinants of health and the ways of controlling them. Although there are numerous factors affecting health, we can classify them into ‘biological factors’, ‘environmental factors’, ‘lifestyle-related factors’, and ‘factors related to health care system’. These are factors that can also cause inequity. In order to address the problem of inequity in health, we have to simultaneously deal with all these factors and interactions among them. Such task should be based on sufficient understanding of these factors. However, we can often find the relationship between health and these factors inexplicable. Worse still, it is hard to collect reliable data to verify their relationship. Unlike the case of other factors, however, correlation and causality between health and factors related to health care system has been verified to a certain extent of appropriate possible causation with health. Generally, the inequity field in the health care system can be roughly divided into health care finance system and health care delivery system. Here health care delivery system means efficient and effective offering of health care to the beneficiaries (Il-Soon Kim, 1983).

To resolve inequity resulting from these two parts, one of the policies Korea government introduced is health insurance system. In 1977, Korea introduced health insurance system so that the citizens might use adequate health care through diversification of risks. In July

1989, 12 years after the introduction of health insurance system, Korea achieved national insurance coverage for all the people by expanding coverage to urban self-employers (Kun-Yong Song and others, 1990, 1993; Jung-Soo Choi, 1995; Jung-Ja Nam, 1998). Even though the health insurance coverage expanded nationwide, the social structural problem of severe inequity which appeared first in industrialization process, caused many problems including urban concentration of the health care resources and rural area residents has been put in disadvantaged situation comparing with urban residents though they have been released from economic constraint. That is, rural area residents seem to have less health care use (Kun-Yong Song and Hong-Sook Kim, 1982; Ok-Ryun Moon, 1989). There has been controversy about continuance of health care use difference between urban and rural area even after national health insurance system started (Byung-Ik Kim, 1989; Bong-Min Yang, 1989). However, when we look into health care use rate for regional insurance user from health insurance association, in 1990 & 1991, urban area residents had higher yearly number of visit to doctor per person than rural area residents, but in 1993, 1994 & 1995, rural area residents had higher yearly number of visit to doctor and there was no essential difference in 1992 between urban and rural areas.

Although such results of investigation might be hard to compare directly due to different individuals treated, there appeared similar results from analysis of Korea National Health & Nutrition Survey Data conducted by the Korea Institute for Health and Social Affairs (KIHASA) in every 3 years. That is, the number of visit to doctors including clinics, hospitals and health care institutions per person of urban and rural area in 1989 was 6.65 and 5.67, respectively, so that urban area had higher rate. But rural area had 2.31 times higher in 1992 with 10.58 times of rural residents and 8.27 times of urban residents. In 1995 average number of visit to doctors including drug stores during two weeks period was 2.45 and 2.44 of rural and urban area, respectively, showing a little higher rate in rural area, while in 1998, the number of visiting to doctors during the same 15-days period was 2.26 and 2.47 of urban area so that there was a little decrease in health care use in rural area (The Korea Institute for Health and Social Affairs, 1992, 1993,1995,1998).

In addition, according to the results of difference in health service utilization between urban and rural areas using the most recent data, the 2001 National Medical Care Resources and Utilization Survey, there is difference in outpatient health services between urban and rural areas. That is, there exist region-related inequities in the probability of entry into outpatient health service market. Also, for outpatient health services, region-related inequity exists in the demand for the number of outpatient visits. Next, the degrees of difference between rural and urban areas are as follows: the observed probabilities of outpatient health services in rural and urban areas are 0.28 and 0.21, respectively, so the probability of outpatient health services of rural residents is higher than that of urban residents. But the standardized probabilities of outpatient visits in rural and urban areas are 0.23 and 0.20, respectively when intrinsic health need variables such as gender, age, and health status have been controlled. Though this kind of difference decreased from 1.33 to 1.14. The observed number of outpatient visits in rural and urban areas are 1.82 and 1.96, respectively, so the number of outpatient visit of rural residents is lower than that of urban residents. But the standardized number of outpatient visits in rural and urban areas are 1.72 and 1.54, respectively after controlling intrinsic health need variables such as gender, age, and health status. So in terms of the observed number of outpatient visit, rural residents are lower than urban residents, but in terms of standardized number of outpatient visit, rural residents are higher than urban residents(Oh, 2003).

Therefore, the problem in connection with inequity of health service utilization may be solved through full understanding of demand for health service. In view of this point, the purpose of this study is to analyze the demand for outpatient health services after the introduction of separation of prescribing and dispensing.

II. Theoretical Models

Most of the initial research on demand for health service was based mainly on traditional theory of demand, on the two basic assumptions that health services are not different from other goods and services and that the behavior of consumers in health markets can be explained by the standard model of consumer behavior for competitive markets. However, the above simple model does not take into account the characteristics of health care market such as uncertainty, asymmetric information, external effects, a basic human need, consumption and investment elements, a derived demand, and time cost (Grossman, 1972). Several economists tried a new approach to analyze consumer behavior theory in several directions by taking into account the above characteristics of health services. (Becker, 1965; Lancaster, 1966; Muth, 1966; and Acton, 1975). They introduced “time” concept to consumer behavior theory. In addition to goods and services, they viewed “time” as an economic subject. According to their theories, households are assumed to combine time and market goods to produce more basic commodities that directly enter a utility function. The concept that health care is not consumed for its own sake but for the sake of its effect on health has been emerged explicitly since 1970. Grossman (1972) applied this new theory of demand for health to his study and developed a demand model for health and health services based on Becker's allocation-of-time and human capital framework.[1]

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1) In Grossman's theoretical model, individuals are assumed to inherit a stock of health capital. Therefore the health stock changes over time as shown by: $K_{t+1}^{h} - K_{t}^{h} = I_{t}^{h} - \delta_t K_{t}^{h}$, where K_{t}^{h} is health stock at the period t, I_{t}^{h} is new investment in health and δ_t is a time-dependent rate of depreciation on health. As seen above equation, the amount of health capital investment undertaken in each period, that is, hence the amount of health services demanded, depends on the stock of health capital in the previous period and on the rate at which it depreciates. Formally, the equilibrium stock of health capital is defined by the condition:

$$\frac{U_{\phi}(1+r)^{t}}{\lambda} \frac{\phi_t}{MC_{t-1}^{h}} + \frac{W_t \phi_t}{MC_{t-1}^{h}} = r + \delta_t - \tilde{MC}_{t-1}^{h},$$

where $U_{\phi} = \partial U / \partial \phi_t$ is the marginal utility of healthy time, W is daily wage rate, λ is marginal utility of wealth, ϕ_t is the marginal productivity of health in creating healthy time, or the number of healthy days generated by a unit of health capital, MC_{t-1}^{h} is the marginal cost of health investment in period t-1, $\tilde{MC}_{t-1}$ is the percentage rate of change in marginal costs between periods t-1 and t, r is interest rate forgone by investing in health capital instead of other assets, $\tilde{\pi}_{t-1}$ (= $\tilde{MC}_{t-1}$) is percent change in the marginal cost of health investment from the last period to the current period, and δ_t is a time-dependent rate of depreciation on health. From the above equation, Grossman derives the following fundamental relationship: the marginal cost of investments in health must equal the marginal rate of return to those investments. That is, the above equation can be expressed briefly as the following equation: $\gamma_t + \alpha_t = r + \delta_t - \pi_{t-1}$

Even though the main shortcoming of Grossman model is its strong assumption that consumers are not only certain about the quality of health services at the present, but are also able to judge their quality and benefits in the future (Phelps & Newhouse, 1974), he tried to incorporate health need into his model through the stock of health and the depreciation rate. The pure investment model predicts the signs of two demographic variables, age as a proxy for the depreciation rate of health capital, and education level as a proxy for human capital. In short, Grossman developed a rigorous model of health and health services which provides a better basis for determining which factors should be included in a model of demand for health services. So this study is based on a theoretical model proposed by Grossman (Grossman, 1972).

III. Methods Of Analysis

1. Research Question

The main research question is "What does the demand for outpatient health services look like after the introduction of separation of prescribing and dispensing in the urban and the rural areas in Korea

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where γ_t $(= Wt\phi_t / MC^h_{t-1})$ is marginal monetary rate of return to an investment in health (monetary return), α_t $(= \{(U\phi(1+r)t/\lambda)/(\phi_t / MC^h_{t-1})\})$ is marginal psychic return of improved health (consumption return), $\gamma_t + \alpha_t$ represents the total rate of return to investments in health, and $r + \delta_t - \tilde{\pi}_{t-1}$ represents the user cost of health capital in terms of the price of gross investment. If $\alpha_t = 0$, no utility is derived from health services, and it can be treated solely as investment goods: $\gamma_t = r + \delta_t - \tilde{\pi}_{t-1}$. If $\gamma_t = 0$, there is no monetary return associated with investment in health, and it can be treated solely as consumption goods: $\alpha_t = r + \delta_t - \tilde{\pi}_{t-1}$.

"? More specifically, this study addresses the following issues: Firstly, are the demands for outpatient health services elastic[2] with respect to prices and time? ; Secondly, are the demand for outpatient health services elastic with respect to income? Thirdly, what effects do other factors such as age, education, and health status have on the demand for outpatient health services?

2. The Sample

Data from the 2001 National Medical Care Resources and Utilization Survey will be used for this study. The Survey is a nationwide household interview survey of non-institutionalized civilians and provides national data on the incidence of illness, the prevalence of chronic disease, and the utilization of health services. The household interviews were conducted during the 25-day period from Feb. 12 to Mar. 8, 2001. Through a complex sampling process, 3,521 households were selected. A total of 2,861 households among 3,521 sample households, which have a total of about 11,135 individuals, were interviewed with 81.3 percent response rate.

3. Research Variables

Dependent variables for this study are as follows: (1) whether one used outpatient health services during the last 15 days, which separates outpatient users from nonusers; and (2) the number of outpatient visits (Table 1). Explanatory variables used in this study

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2) In general, absolute values of own-price elasticity greater than one are considered relatively responsive and called elastic. Elasticity less than one in absolute value is called inelastic. In the field of health economics, the demand for health services is known to be price inelastic. So it is meaningful to assess elasticities from the present study based on those from the previous studies.

include price-related variables, time variables, socio-demographic variables, health status variables, economic status variables, health insurance variables, regional variables, regular sources of health services, and health care supply variable (Table 2).

A proxy variable for price[3] is the average out-of-pocket cost per visit for outpatient services. It is calculated by dividing individual's total outpatient out-of-pocket costs by the number of visits. For nonusers

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3) In this data set, no direct information on price is available. So I use average outpatient out-of-pocket costs as price of outpatient health services, which is created by dividing total out-of-pocket costs of outpatient health services by the number of outpatient visits as in other researchers' studies such as Heller (1982), Kwon (1984), and Noh (1987). But, this variable, average outpatient out-of-pocket cost, may have problems when there is measurement error in the number of outpatient visits and/or total outpatient out-of-pocket costs used to create it. First problem is that this new created variable, average outpatient out-of-pocket cost, is no loner exogenous, that is, this variable may be correlated with included repressor. Second problem is that the division bias may occur when it is included in the demand equation for the number of outpatient visits. According to Borjas (1980)'s study, " The relationship between wages and weekly hours of work: the role of division bias", the division bias may occur under the following situation in which there is measurement error in a denominator or/and a numerator to calculate the outpatient out-of-pocket costs and this new created variable is included in the demand equation of one of the a denominator or/and a numerator. However, his study shows that there is no problem in the estimation if there are no measurement error in a denominator or/and a numerator. In this study, the number of outpatient visits and the total outpatient out-of-pocket costs are 15-day period's measures, which have little measurement error. In general, it is known that 15-day period is better one to remember what individuals have done than other periods such as one month, two months, six months or one year, so there is little measurement error in the number of outpatient visits and the total outpatient out-of-pocket costs. Another problem, when out-of-pocket costs, travel cost, and other costs per visit such as food and lodging in the equation as an independent variable at the same time are included, it may cause multicollinearity problems. So only out-of-pocket cost is included in each equation as the price variable.

for last 15 days, prices are estimated from the data of users according to types of health services and regions. Time price required to consume medical care in this study is classified into the two parts: travel time costs and waiting time costs. Time price is determined by multiplying the time required consuming medical care times wage rate.

Table 1. Dependent Variables

Variable Name	Description	Remarks
OP[1)]	Dummy variable: whether individual had at least one outpatient health services instead of no health service use	1=yes 0=no
VST	Total number of outpatient visits including public and private clinics	

Note) This analysis excludes drugstore only users.

Unfortunately, the wage rate is not available in this data set. So time price variable without weighting wage rate in the demand for medical care will be used because the variables relating to wage are not available. However, when we multiply the time by the predicted wage rate, which we estimate by using the instrumental variable estimation, the problem is that the error in estimating opportunity cost (wage rate) may lead to a large bias. In addition to the problem of this bias, the problem caused by using the time variable with a weighted wage rate may be a multicollinearity between time value (=time x foregone income) and cash income. On the other hand, a problem in using the time variable without weighting the wage rate may cause misspecification of the equation, that is, clearly omitted variable case. Even though we are not sure this is the case, it is known that the problem from using time price without weighting the wage rate is smaller than that from using time price with weighting the wage rate.[4]

Socio-demographic variables include age, gender, education, and household size and marital status. Age has five dummy variables.

According to the Grossman Model, the relation of age and the demand for medical care is expected to be positive, if depreciation rates rise with age. The strength of effect of age on the demand for medical care depends on how highly individuals value their health and the rate of return they receive from additional purchase of medical care. However, if health status fully reflects the depreciation rates, there should be no effect of age on medical care. Female is a dummy variable for gender that takes the value of 1, and adjusted for possible underlying differences between the sexes in health service utilization. Education of head of household used as the education variable has 5 categories of no school, elementary school, middle school, high school, technical college and over, which create 4 dummy education variables where the reference group is no school. These education variables are treated as an efficiency parameter that enhances the ability to produce health. So, the higher the level of education is, the higher is the capacity of producing health. And an inverse relation between education and medical care exists if the demand for health is price inelastic. Household size is the number of individuals in the family unit, which might result in a negative effect on the demand for health services because of lower income per capita.

4) The bias from in estimating wage rate is more serious than the one from misspecification of the equation (Joreskog, K.G., 1977).

Table 2. Independent Variables

Variable Name	Definition	Remarks
Gender:		
Male		(Reference group)
Female	Dummy variable for gender	=1 if female, 0 male
Age:		
0- 4	Dummy variable for 0-4	=1 if age 0-4, 0 otherwise
5-14	Dummy variable for 5-14	=1 if age 5-14, 0 otherwise
15-29		(Reference group)
30-44	Dummy variable for 30-44	=1 if age 30-44, 0 otherwise
45-59	Dummy variable for 45-59	=1 if age 45-59, 0 otherwise
60 and over	Dummy variable for 60+	=1 if age 60 and over, 0 otherwise
Marital Status:		
Single	Dummy variable for single	=1 if single, 0 otherwise
Married		(Reference group)
Divorce .	Dummy variable for divorce	=1 if divorce, 0 otherwise
Household Size:	Number of family member	
Education:		
No School		(Reference group)
Elementary School	Years of school 1-6	=1 if elementary school, 0 otherwise
Middle School	Years of school 7-9	=1 if middle school, 0 otherwise
High School	Years of school 10-12	=1 if high school, 0 otherwise
College	Years of school 13 and over	=1 if college, 0 otherwise
Place of Residence:		
Urban Area	Urban Area	=1 if dong, 0 otherwise
Rural Area	*Myun* region	(Reference group)
Health Need Factor 1	Score 1 from Factor Analysis	A kind of acute disease with moveless condition
Health Need Factor 2	Score 2 from Factor Analysis	A kind of chronic disease conditjon
Types of Health Insurance:		
National Health Insurance	Dummy variable for insurance	
Medicaid		(Reference group)
Income	Monthly household income	(A hundred Won)
0~99		
100~199		
200+		
Outpatient Health Services:		
Out-of-pocket Costs	Average out-of-pocket costs	(A hundred Won)
Travel Time	Average travel time	
Waiting Time	Average waiting time	
Regular Source of Care		=1 if yes ,0 no
Doctor	Number of doctor per 1,000	

Measures of health status in this data set include chronic illness, disease for 15 days, sick days and perceived health status. However, the inclusion of all health status variables in one equation may cause a potential multicollinearity problem. Therefore, factor analysis was used to extract a common health index from several health-related variables such as sick days, bed days, disability days and perceived health status to overcome potential multicollinearity. One of the factors is a 'Health Need Factor 1' that is a kind of acute disease status with moveless condition and the other is a 'Health Need Factor 2' that is a kind of chronic disease condition.

As income variable, monthly average household income was included. Health insurance coverage type is included in demand equations as 1 dummy variable: national health insurance. Medical aid is the reference group.

Place of residence and regular source of medical care are included. Place of residence variable is coded into two regions of urban and rural areas, but in this study, this variable is coded as a dummy variable takes the value of 1 if the region is urban area, and zero if not. Regular source of medical care is a dummy variable that takes the value of 1 if the individual has a regular source, and zero if not. In addition to the variables above, one of the most important variables is the number of doctor per 1,000 population included in this models.

4. Econometric Specification and Statistical Method

The probit model will be applied to the first demand equations for outpatient health service use (OP) because it takes advantage of the convenient properties of the normal distribution. For last demand equation with a continuous dependent variable with selection problem, the tobit model is not appropriate under the situation in which censoring occurs because of mainly the choice of consumers, not a result of unobservability (Maddala, 1985). In reality, there may be a lot of factors that can influence whether to obtain health services and what types of health services to use. Among these factors, the individual's perception of the seriousness of the illness may be an influencing factor. If it is assumed that the type of health services and the amount of health care utilization depend on the seriousness of the illness, there is a relationship between the first decision (selection stage) and the second decision (outcome stage), which results in correlation between the error term of the first function and that of the second function. Even in the case that there is no relationship between two equations, it seems realistic to assume that there may be some common omitted variables, which cause the error terms of the two decision functions to be correlated (Van de Ven & van Praag, 1981). The basic formulation for this model is as follows:

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\begin{aligned}
& z^* = \alpha' V + u, \\
& z = 0 \ \text{if} \ z^* \leq 0; \\
& z = 1 \ \text{if} \ z^* > 0, \\
& y^* = \beta' X + \varepsilon, \\
& y = y^* \ \mathit{if} \ z = 1 \\
& y \ \text{not observed} \ \mathit{if} \ z = 0. \\
& \varepsilon, u \sim N[0, 0, \sigma_{\varepsilon}^2, \sigma_u^2, \rho],
\end{aligned}
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where z is a dichotomous dependent variable in the selection equation, which is a realization of the unobserved continuous variable, z^*, having a normally distributed, independent error, ε, with mean zero and constant variance; y is a continuous dependent variable in the outcome equation; and ρ is error correlation. To solve the problem above, we need to model the decisions underlying the individuals' health care utilization. In the case of continuous dependent variable with sample selection, Heckman (1976) proposed the two-stage method. However, Heckman's two-stage estimator involves heteroscedastic errors (the error variance depends on X_i as well as whether y=0 or not) and is very sensitive to the normal distribution assumption. Therefore, we will use the two-stage method with maximum likelihood estimation (MLE), which is known to be robust more than Heckman's two-stage method (1991)).

The following is the log-likelihood function for the two-stage method with MLE:

$$L = \sum_{z=0} \log(1-\Phi_i) + \sum_{z=1} \log\frac{1}{\sqrt{2\pi\sigma_\varepsilon^2}} - \sum_{z=1} \frac{1}{2\sigma_\varepsilon^2}(y_i - x_i'\beta)^2 + \sum_{z=1} \log\Phi\left[\frac{v_i'\alpha + \rho\left(\frac{y_i - x_i'\beta}{\sigma_\varepsilon}\right)}{(1-\rho^2)^{1/2}}\right]$$

It is known that the two-stage estimation is very sensitive to distributional assumptions even though the two-stage method with maximum likelihood is less sensitive than Heckman’s two-stage method. So, for tests for normality and homoskedasticity, the method of Chesher and Irish (1987) will be applied.[5] Also, the efficiency of the method to correct sample-selection bias will be assessed.[6]

5) These tests do not require specific alternative formulations of either heteroskedasticity or nonnormal distribution and can be reduced to a simple regression so that they are easy to compute. The underlying idea is to test the moments of the estimated distribution of the standardized residuals from the regression of the latent variable, Y^*, against what they should be if the assumption of normality or homoskedasticity is correct. To implement Chesher and Irish’s tests requires the computation of estimates of the first four “moment residuals, “ $\hat{e}^{(m)}$, m=1 to 4. Then the first four moment residuals in the probit model are :

$$\hat{e}_{(1)} = -(1 - z_i)h(x'\hat{\beta}) + z_i h(-x'\hat{\beta})$$
$$\hat{e}_{(2)} = -x'\hat{\beta}\hat{e}_{(1)}$$
$$\hat{e}_{(3)} = (2 + (x'\hat{\beta})^2)\hat{e}_{(1)}$$
$$\hat{e}_{(4)} = -(3x'\hat{\beta} + (x'\hat{\beta})^3)\hat{e}_{(1)}$$

IV. Results

This section presents results of the estimation of the demand for outpatient health services. One of the two demand equations estimated the probability of an outpatient health service use rather than

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where $h(.)$ is the standard normal hazard function $\phi(z)/(1-\Phi(z))$ and $z_i = 0$ if $z_i^* \leq 0$ and $z_i = 1$ if $z_i^* > 0$. In the tests for normality and heteroskedasticity of unknown form, the elements of the matrix **R** are $(\tilde{e}^{(1)}x, \tilde{e}^{(2)}, \tilde{e}^{(3)}, \tilde{e}^{(4)})$ and $(\tilde{e}^{(1)}x, \tilde{e}^{(2)}, \tilde{e}^{(2)}xx')$, respectively. After computing the elements of the each matrix **R** to test for normality and heteroskedasticity, then, next regress a vector of ones on each **R** and compute the explained sum of squares. This yields the Lagrange Multiplier (LM) statistic, which has a chi-squared distribution. Thus, if the value of the LM statistic exceeds the critical value, the null hypotheses of normality and homoskedasticity can be rejected. According to the results of nomality and heteroskedasticity tests in this study, Lagrange Multiplier statistics for each test was zero. This means that normality and homoskedasticity for this data could be accepted. However, as White (1978) points out that some package will not apply OLS when the dependent variable is constant. This seems to be the case because the R-squares for these two tests are zeros.

6) According to Nelson (1984), bias in OLS coefficients will increase when neither of the following two conditions is met: (a) if the error correlation, ρ, is zero; or (b) if the estimate of λ is not correlated with the explanatory variables in the outcome equation. However, the error correlation between the selection equation and outcome equation, ρ, is 0.986 in the demand equation for the number of outpatient visits given an outpatient health service use for whole sample, and R-square for regressing λ on the explanatory variables in the outcome equations is 0.8850 for the demand equations for the number of visits. Also, we compared the results from the two-stage estimation with ML with those from Heckman's two-stage method. The results from the sample selection model are more efficient than those from Heckman’s two-stage method. That is, the coefficients are improved and the standard errors from the two-stage method with MLE are smaller than those from Heckman’s two-stage method. Therefore, the sample selection model is preferred to both OLS and the Heckman’s two-stage method for estimating demand. Also the results for the each demand equations for urban and rural areas are similar to the results for all samples.

no health service use; and the other estimated the number of outpatient visits.

1. Descriptive Analysis

This section presents the general characteristics of urban and rural residents. Table 3 shows general characteristics of gender, age and education level and so on of urban and rural area residents. When we compared the ratios between male and female in urban and rural area, there was more female than male in both areas, and age 60 or over in rural area was 28.2%, which was 3 times more than 9.1% of urban area. In education level, urban area had 2.5 times more graduates of two-year college or higher institute than rural area. Medical aid beneficiaries of rural area was 6.7% that was 3.2 times more than urban area of 2.1%.

Table 3. General Characteristics of Urban and Rural Residents.

	Total	Rural Area	Urban Area
N	11,134	2,088	9,046
	%	%	%
Gender:			
Male	48.5	48.0	48.7
Female	51.5	52.0	51.3
Age:	0.0	0.0	0.0
0-4	6.3	4.5	6.7
5-14	15.6	14.5	15.9
15-29	22.5	15.4	24.1
30-44	27.0	19.1	28.8
45-59	15.9	18.3	15.4
60+	12.7	28.2	9.1
Marital Status:	0.0	0.0	0.0
Unmarried	43.7	35.0	45.7
Married	48.9	52.9	48.0
Single	7.4	12.0	6.3
Household Size	3.77	3.72	3.78

Table 3. continue

N	Total 11,134 %	Rural Area 2,088 %	Urban Area 9,046 %
Elementary School	22.8	32.6	20.5
Middle School	12.9	14.0	12.7
High School	32.0	22.5	34.2
College	18.0	8.0	20.3
Health Status			
Health Need Factor 1	0.011	-0.230	0.066
Health Need Factor 2	-0.005	0.016	-0.009
Health Insurance Type			
NHI	97.0	93.3	97.9
Medical Aid	3.0	6.7	2.1
Income(Monthly)			
0～100 ten thousand	27.7	51.4	22.2
100～200	41.1	34.1	42.7
200 +	27.1	11.2	30.8
Regular Source of Care			
No	65.2	53.5	67.9
Yes	34.8	46.5	32.1
Out-of-Pocket Costs (100 Won)	237.79	154.85	262.65
Waiting Time (min)	25.95	31.92	24.16
Travel Time (min)	90.98	125.04	80.77

Note 1: Household size and health status are the average value of all sample, but out-of-pocket costs, waiting time and travel time are the average value of outpatient users (total of 2,501 users, 577 users in rural area and 1,924 users in urban area). 2: Total of all subgroups of each variable may not be 100% because of missing values of individuals.

When we looked into income level, the income group with under one million Won was 51.4% in rural area, which was 2.3 times more than urban area of 22.2%, and two million Won or over income group was about 3 times higher in urban area than rural area. In rural area 46.5% of health care user had regular sources of care, which was little higher than 32.1% of urban area. Urban area had 1.7 times higher out-of-pocket costs than rural area. Waiting time was 31.9 minutes in rural area, but it was 24.6 minutes in urban area to make little longer in rural area, while travel time to health care facilities was 125 minutes in rural area, which was 1.6 times of 80 minutes in urban area.

2. Outpatient Health Service Use

This demand equation estimates the probability of an outpatient health service use rather than no health service use during a 15 day period using a probit model and distinguishes outpatient health service users from nonusers. Table 4 shows the estimated results of the demand equation for outpatient health service use.

First, looking at the effects of age, those 0 to 14 and 45and over were more likely to use outpatient health services while those 15 to 44 were less likely to use outpatient health services. The use of outpatient health services exhibited a U-shaped relationship with age. The youngest age group is not necessarily unhealthy, but they need outpatient health services associated with usual childhood illnesses, injuries, vaccinations and pediatric checkups. The coefficient of household size was negatively related to the probability of an outpatient health service use. This inverse association with household size can be explained as follow: larger household size may be associated with lower income per capita, which itself may be associated with lower demand for health service. Education has an ambiguous effect on the probability of an outpatient health service use. For high school level, education operates as an efficiency effect, that is, the effect of education is inversely related to the demand for health service under the assumption that price elasticity with respect to the demand for health is less than one.

In terms of the underlying theoretical model, health status variables are expected to have an inverse relationship to demand for health service because an individual is expected to increase his/her consumption of health care services when his/her actual stock of health capital falls short of his/her desired health stock.

Table 4. The estimated results of probit models of choice of outpatient health services rather than no health service use

		Coeff.	t-value	p-value.	Elasticity
Gender:	Male	-	-	-	-
	Female	0.176	5.444	0.000	0.113
Age:	0-4	0.792	11.030	0.000	0.062
	5-14	0.355	4.894	0.000	0.069
	15-29	-	-	-	-
	30-44	-0.062	-0.868	0.385	-0.021
	45-59	0.325	4.094	0.000	0.065
	60+	0.759	8.790	0.000	0.120
Marital Status:	Unmarried	-0.366	-5.089	0.000	-0.200
	Married	-	-	-	-
	Single	-0.009	-0.143	0.886	-0.001
Household Size		-0.093	-7.066	0.000	-0.436
Education :	No School	-	-	-	-
	Elementary School	0.081	2.055	0.040	0.452
	Middle School	0.042	1.115	0.265	0.237
	High School	-0.068	-2.287	0.022	-0.373
	College	-0.054	-1.472	0.141	-0.305
Place of Residents:	Urban Area	-0.074	-1.750	0.080	-0.075
	Rural Area	-	-	-	-
Health Status	Health Need Factor 1	0.372	24.593	0.000	0.005
	Health Need Factor 2	-0.010	-0.755	0.450	0.000
Health Insurance Type	NHI	-0.229	-2.575	0.010	-0.277
	Medical Aid	-	-	-	-
Income(Monthly)	0～100 ten thousand	-	-	-	-
	100～200	0.046	1.146	0.252	0.024
	200 +	0.068	1.444	0.149	0.023
Regular Source of Care	No	-	-	-	-
	Yes	0.291	8.888	0.000	0.126
Doctor per 1000		-0.012	-1.386	0.166	-0.028
Constant		-0.487	-3.870	0.000	

Note: -2Log likelihood=8.369.24, Chi-square=1.366.50, p=0.000 n=11,134

There are two health need factors in this study: health need factor 1 and health need factor 2. Health need factor 1 was very significant effect on outpatient health service use, as might be expected. That is, individuals with increase in the scores of health need factor 1, which means decrease in health, are far more likely to use outpatient health services. This health status variable supports the derived demand theory that individuals are expected to increase the probability of using any health services when the actual stock of health decreases. Also, having a regular source of medical care had a positive effect on outpatient health services. The number of doctor per 1,000 for in all samples was not significant because, we might guess, urban area has more doctors per 1000 than rural area does. It means that the number of doctor per 1000 did not any longer affects outpatient use in urban area.

Table 5 shows the results of the demand equation for the probability of an outpatient health service use rather than no health service use during a 15day period using a probit model and distinguishes outpatient health service users from nonusers according to urban and rural areas. The significant variables affecting the probabilities of outpatient health service in urban or rural areas were gender, age, health status, marital status, family size, health insurance, and regular source of care, and the number of doctor so that their influential variables between rural and urban areas are very similar. However, most important variables that distinguish rural and urban areas were the type of health insurance and the number of doctor per 1,000. Unlike the result in all samples, the number of doctor per 1,000 is statistically significant variable affecting outpatient use in rural area, but not in urban area. In general, medical aid beneficiaries in urban area were more likely to use outpatient health services than members of national health insurance, but in rural areas there is no difference between the probabilities of outpatient health services between the types of health insurance. The number of doctor per 1,000 in rural

Table 5. The estimated results of probit models of choice of outpatient health services rather than no health service use of urban and rural areas

	Urban Area			Rural Area		
	Coeff.	t	p	Coeff.	t	p
Gender:						
Male	-	-	-	-	-	-
Female	0.193	5.306	0.000	0.115	1.623	0.105
Age:						
0-4	0.791	10.119	0.000	0.824	4.337	0.000
5-14	0.400	4.818	0.000	0.328	1.973	0.049
15-29	-	-	-	-	-	-
30-44	-0.072	-0.933	0.351	-0.018	-0.093	0.926
45-59	0.321	3.707	0.000	0.308	1.469	0.142
60+	0.778	7.954	0.000	0.597	2.805	0.005
Marital Status:						
Unmarried	-0.347	-4.438	0.000	-0.498	-2.621	0.009
Married	-	-	-	-	-	-
Single	0.006	0.073	0.942	0.016	0.143	0.886
Household Size	-0.088	-5.634	0.000	-0.091	-3.584	0.000
Education :						
No School	-	-	-	-	-	-
Elementary School	0.047	0.984	0.325	0.101	1.413	0.158
Middle School	0.049	1.167	0.243	0.007	0.083	0.934
High School	-0.051	-1.531	0.126	-0.129	-1.705	0.088
College	-0.045	-1.121	0.262	0.023	0.235	0.815
Health Status						
Health Need Factor 1	0.388	22.613	0.000	0.303	9.098	0.000
Health Need Factor 2	-0.046	-2.893	0.004	0.089	3.507	0.001
Health Insurance						
NHI	-0.302	-2.580	0.010	-0.108	-0.782	0.435
Medical Aid	-	-	-	-	-	-
Income(Monthly)						
0～100 ten thousand	-	-	-	-	-	-
100～200	0.047	0.996	0.319	0.089	1.074	0.283
200 +	0.069	1.323	0.186	0.110	0.915	0.360
Regular Source of Care						
No	-	-	-	-	-	-
Yes	0.277	7.428	0.000	0.373	5.412	0.000
Doctor per 1000	-0.017	-1.845	0.065	0.163	3.011	0.003
Constant	-0.522	-3.515	0.000	-0.777	-2.779	0.006
n		9046			2088	

Note) Urban Model:: -2Log likelihood=6.523.00, chi-square=1045.63, p=0.000
Rural Model:: -2Log likelihood=1.806.00, chi-square=272.08, p=0.000

areas is the influential factor that differentiates use and nonuse of outpatient health service, but it is not significant in urban areas. That is, in rural areas, as the number of doctor per 1,000 population increases, the probability of outpatient health service is likely to increase.

3. The Number of Outpatient Visits

This demand equation estimates the number of outpatient visits conditional on outpatient health service use among all sample during the 15 day period. This demand equation is also estimated simultaneously along with a selection equation that estimates the probability that the individual had received outpatient health services during the 15-day period to correct for selection bias. Tables 6 shows the results of models for an outcome equation estimated to assess the influence of demographic, health status, economic status, and price-related variable. We are going to discuss the outcome equation that estimates the number of outpatient visits conditional on an outpatient health service use based on the full model.

First, age affected the number of outpatient visits: only age groups 0-4, 5-14 and 60 and over had significantly positive effects as in the demand for outpatient health service use. The hypothesis that there is no relation between age and the demand for the number of outpatient visits is rejected. We previously discussed the reason for significant effect of age group 0-4 and 5-14. Household size was again significantly related to the number of outpatient health service. Education affected the number of outpatient visits, especially in those with middle school. The place of residence was not an important factor. Health status had an inverse effect on the number of outpatient visits. It means that when health status becomes poor, the number of outpatient visit increases.

Table 6. The estimated results of models of the number of outpatient visits conditional on outpatient health service use among all sample.

	Coeff.	t-value	p-value.	Elasticity
Gender:				
Male	-	-	-	-
Female	0.293	3.729	0.000	0.028
Age:				
0-4	2.581	14.434	0.000	0.051
5-14	1.185	6.733	0.000	0.031
15-29	-	-	-	-
30-44	-0.319	-1.627	0.104	0.030
45-59	0.269	1.224	0.221	0.042
60+	1.111	4.906	0.000	0.079
Marital Status:				
Unmarried	-1.174	-5.910	0.000	0.017
Married	-	-	-	-
Single	0.479	3.021	0.003	0.013
Household Size	-0.196	-6.373	0.000	-0.122
Education :				
No School	-	-	-	-
Elementary School	0.011	0.117	0.907	0.042
Middle School	0.292	3.039	0.002	0.078
High School	-0.122	-1.649	0.099	-0.116
College	-0.179	-1.809	0.071	-0.240
Place of Resident:				
Urban Area	0.097	0.903	0.366	-0.011
Rural Area	-	-	-	-
Health Status				
Health Need Factor 1	0.477	16.855	0.000	0.011
Health Need Factor 2	0.028	1.259	0.208	0.000
Health Insurance				
NHI	0.004	0.017	0.987	0.768
Medical Aid	-	-	-	-
Income(Monthly)				
0～100 ten thousand	-	-	-	-
100～200	0.229	2.207	0.027	0.019
200 +	0.277	2.347	0.019	0.034
Regular Source of Care				
No	-	-	-	-
Yes	0.591	7.101	0.000	0.017
Out-of-Pocket Costs	-0.002	-0.098	0.922	0.999
Waiting Time	-0.001	-0.105	0.917	-0.016
Travel Time	0.001	0.216	0.829	0.042
Doctor per 1000	-0.087	-3.810	0.000	-0.034
Constant	-1.076	-1.645	0.101	
σ	2.495	95.028	0.000	
ρ	0.987	260.000	0.000	

Note) -2Log likelihood=13.855.46 n=2,501.

Table 7. The estimated results of models of the number of outpatient visits conditional on outpatient use according to urban and rural areas.

	Urban Area			Rural Area		
	Coeff.	t	p	Coeff.	t	p
Gender:						
Male	-	-	-	-	-	-
Female	0.067	0.355	0.722	0.096	0.555	0.579
Age:						
0-4	0.812	1.221	0.222	1.122	1.823	0.068
5-14	0.375	0.938	0.348	0.360	0.901	0.367
15-29	-	-	-	-	-	-
30-44	0.352	1.113	0.266	-0.151	-0.270	0.788
45-59	0.268	0.635	0.525	0.445	0.743	0.457
60+	0.445	0.608	0.543	0.722	1.165	0.244
Marital Status:						
Unmarried	0.108	0.258	0.797	-0.587	-1.077	0.281
Married	-	-	-	-	-	-
Single	0.268	1.674	0.094	0.041	0.156	0.876
Household Size	-0.055	-0.650	0.515	-0.198	-4.100	0.000
Education :						
No School	-	-	-	-	-	-
Elementary School	0.025	0.225	0.822	0.005	0.022	0.982
Middle School	0.065	0.490	0.625	0.075	0.224	0.823
High School	0.104	1.130	0.258	-0.317	-1.050	0.294
College	-0.193	-1.438	0.150	0.309	0.817	0.414
Health Status						
Health Need Factor 1	-0.030	-0.092	0.927	0.284	4.894	0.000
Health Need Factor 2	0.089	2.154	0.031	0.135	2.519	0.012
Health Insurance						
NHI	-1.654	-4.612	0.000	-0.166	-0.486	0.627
Medical Aid	-	-	-	-	-	-
Income(Monthly)						
0～100 ten thousand	-	-	-	-	-	-
100～200	0.039	0.284	0.777	0.126	0.625	0.532
200 +	0.244	1.588	0.112	0.122	0.409	0.683
Regular Source of Care						
No	-	-	-	-	-	-
Yes	0.028	0.113	0.910	0.479	3.088	0.002
Out-of-Pocket Costs	0.042	1.119	0.264	0.059	0.925	0.355
Waiting Time	-0.001	-0.585	0.559	0.001	0.273	0.785
Travel Time	-0.001	-1.641	0.101	-0.001	-0.553	0.580
Doctor per 1000	-0.028	-0.873	0.383	0.185	2.120	0.017
Constant	1.454	1.011	0.312	-0.379	-0.466	0.641
σ	1.668	78.078	0.000	1.957	39.634	0.000
ρ	0.578	39.284	0.000	0.980	87.784	0.000
n		1924			577	

Note: Rural Area: -2Log likelihood =3.069.68: Urban Area: -2Log likelihood=12.501.30

Outpatient out-of- pocket costs and outpatient travel time and outpatient-waiting time had no effects on the number of outpatient visits.

Table 7 shows the results of the demand equation for the number of outpatient visits conditional on outpatient health service use among all sample during the 15 day period according to the rural and urban areas. The significant variables affecting the outpatient visits in urban or rural areas are health status, family size, and regular source of care, and the number of doctor so that their influential variables between rural and urban areas are very similar. However, most important variable that distinguishes rural and urban areas is the number of doctor per 1,000 as in the demand for outpatient health service use. The number of doctor per 1,000 in rural areas is the influential factor that affects outpatient visit, but it is not in urban areas. That is, in rural areas, as the number of doctor per 1,000 population increases, the number of outpatient health service is likely to increase. This kind of result suggests policy implications in the establishment of distribution policy of health care resources.

V. Conclusions

This paper answers the following research question using the 2001 National Medical Care Resources and Utilization Survey Data based Grossman Model: what does the demand for outpatient health services in Korea look like after introduction of separation of dispensary from medical practice? Two measures of health service utilization used are defined in this study: (1) whether a patient used outpatient health services; and (2) frequency of outpatient health service utilization. In relation to these two measures, 2 demand equations are estimated. The probit model was applied to the first demand equation for entry into outpatient health service market with binary dependent variable because it takes advantage of the convenient properties of the normal distribution. For the last demand equation for quantity of outpatient health service utilization with a continuous dependent variable with selection problem, the two-stage method with maximum likelihood was applied instead of tobit model because ordinary least squares or tobit model is not appropriate under the situation in which censoring occurs because mainly of the choice of consumers, not a result of unobservability.

The important result from this study is as follows: the important policy variable is the number of doctor per 1000 population. This variable was statistically significant effects on the demand equations for entry into outpatient market and the number of outpatient visit in rural areas, but not in urban area. From above results, we can suggest the following policy implications: residents living in rural areas where distribution of health service resources has been more restrictive might have hard time in seeking and using outpatient health services. Thus, health care facilities and health personnel should be expanded or redistributed to the rural areas.

There are a number of limitations of the data and the measures used. Some of these limitations are the results of using secondary data, e.g., the selection of sampling units and the selection of survey period are given, and price is indirectly measured. First, the sampling unit of the data used for this study is the family, and not the individual. However, the unit of analysis for this study is the person. In the case of this study, there may be a problem of data dependency. For instance, if one of family members is ill from a communicable disease, other family members are more likely to become ill. Also, family members are assigned the same value for some variables, e.g., health insurance premium of household, education of household head, and place of residence. In order to solve this kind of problem, there are two approaches: first, to randomly select one family member per family, or second, to use variance component two-stage probit. The use of the former leads to reduction of sample size and increases in sampling errors. The latter alternative is currently not available. Therefore, the estimators from this study might be underestimated slightly. Second, the individual's health status is a key construct in the theoretical model of this study. That is, adequate measurement of health is crucial if a researcher wants to understand why some individuals demand more health services than others do. Even though I used a health status index as initial health stock, this measure might reflect the health status after rather than before the health services had been utilized, and consequently confound the analysis.

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Summary

의약분업이후 우리나라의 외래의료수요 분석

오 영 호

이 연구는 2001년 국민보건의료실태조사자료를 사용하여 Grossman이 제안한 이론적인 모델에 근거하여 다음 질문에 답한다: 의약분업 시행 이후 우리나라의 외래 의료 수요는 어떠한가? 이 연구에서는 의료이용 측도로 외래 의료이용 여부와 외래 의료이용 횟수를 사용하였다. 첫 번째 외래 의료수요 모델인 외래 의료이용 여부 방정식은 probit model 을 사용하였다. 그리고 나머지 의료수요 방정식에서 종속 변수인 외래 의료방문 횟수는 절단(censored)되었는데, 이는 주로 관측이 안되었다기보다는 선택문제(selection problem)가 있다. 이러한 수요방정식을 추정하기 위해서는 먼저 개인의 의료이용 결정을 방정식화해서 함께 추정해야 하는데, MLE(Maximum Likelihood Estimator)를 이용한 2단계 추정법 (Two-stage method with MLE)을 사용하였다.

본 연구 결과 의료수요에 영향을 미치는 요인은 요구요인에서부터 사회 경제적인 요인과 자원공급 등 여러 가지가 있었지만 가장 중요한 정책적인 변수로는, 농촌의 경우 외래 의료이용 경험률과 외래 의료방문 횟수와 같은 외래 의료이용에 영향을 미치는 중요한 요인 중의 하나가 인구 1,000명당 의사 수였다. 그러나 도시에서는 인구 1,000명당 의사 수는 영향을 미치지 않았다. 이러한 농촌지역에서 인구 1,000명당 의사수가 여전히 중요한 요인이라는 것은 농촌지역에서 의사수가 적은 지역은 의료이용에 제한을 받고 있다는 의미이며, 지금까지 기존 연구에서 지적되어온 도시와 농촌간 자원의 불균형이 원인이라 할 수 있다. 따라서 이러한 문제를 해결하기 위한 정책적인 과제로 자원 지역별 보건의료자원 적정수급을 위한 모니터링체계 구축, 보건의료자원 적정수급을 위한 합리적인 배분원칙과 지역별 최저기준 설정 등을 들 수 있다.