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The Demand for Health Check-up and Uncertainty

by

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The Demand for Health Check-up and Uncertainty

Abstract

Good health enhances market earnings by increasing healthy days for work, and by increasing non-market productivity in allowing greater time availability for household production. The health check-up is one good strategy to secure good health. This study aims to explain the behavior toward the demand for health check-up by the working population in Japan. Using sample data from *the 1995 Comprehensive Survey of Living Conditions of the People on Health and Welfare*, we find a number of socio-economic and demographic factors to be the determinants of the health check-up among the 30-60 age group. These determinants include: age, gender, earnings, type of health insurance cover, firm size, occupation, and objective evaluation of health condition. These variables are shown to be mostly significant in our models. Furthermore, our empirical study shows that health check-up does reduce the probability of becoming ill and an in-patient in hospital and the length of stay in hospital. This study also shows the effects of the reduction of length of hospitalization on society's medical care expenditures to be non-negligible. Our empirical evidence strongly supports that the health check-up is highly cost-effective as preventive medical care for the population in the long run.

The Demand for Health Check-up and Uncertainty

I. Introduction

Good health is by itself valuable. It enhances market earnings by increasing healthy days for work (Grossman 1972), and increases non-market productivity by allowing greater time availability for household production (Becker 1976). Health check-up is a good strategy to secure good health and its maintenance. However, a survey by the Japanese government, *the Comprehensive Survey of Living Conditions of the People on Health and Welfare* ("Kokumin Seikatu Kiso Cyosa" in Japanese) in 1995 shows that only about half of the people had the health check-up. The reasons behind the low demand for health check-up under the comprehensive Japanese medical health care system await clarification.

Health check-up has at least two aspects. First, under uncertainty, one can likely obtain more objective diagnostic health information on health rather than subjective self-evaluation of health. Second, the health check-up will lead to further demand for preventive medical care when necessary. Consequently, early medical care often curtails serious illness. In this respect, the demand for health check-up differs from the demand for health: the former is a derived demand while the latter is the final demand. That is, the health check-up appears in the demand for health, which in turn appears in the individual's utility function; yet, in both demands do similar socio-economic and demographic factors appear as the determinants in their reduced form demand functions (Grossman 1999). In particular, individuals demand more health information as age rises (Kenkel 1990). Time costs are the major determinants of the demand for health check-up, and in turn, will have larger time-price elasticity in the demand for medical inputs (Phelps and Newhouse 1974, Coffey 1983). While income has a positive effect on the demand for

preventive medical care (Kenkel 1994), and better knowledge of own health information increases the demand for preventive medical care (Hsieh and Lin 1997), better health gives less incentive for individuals to collect health information. Furthermore, lack of knowledge on health is responsible for individuals to adapt unhealthy consumption patterns (Kenkel 1991). All these aspects on the individual's behavior on the demand for the health check-up, as well as the demand for health, are due to their involved uncertainty (Arrow 1963).

This study focuses on the demand for the health check-up rather than the demand for health. Its purpose is to clarify the reasons behind the low demand for the health check-up among the Japanese. There had been few empirical studies in this field, which uses the micro-data from *the Comprehensive Survey of Living Conditions of the People on Health and Welfare* in 1995 prior to this present study. The original sample size is about 750,000 observations of population in Japan. Of this number, we narrow our focus on about 310,000 observations of the 30-60 age group since this group is more mainly homogeneous and consists mainly of working people.

We find that the gender differential of the demand for health check-up exist after controlling other socio-economic and demographic variables. Nevertheless, this differential tends to disappear as age increases. The age is one of the major factors to determine the demand over the lifetime from the age of 30s to 50s, but becomes less significant once the age group differences are narrowed. Types of health insurance coverage as well as sizes of organizations the individual work for are also robust factors that affect his demand for health check-up. Finally, we identify a strong negative correlation between the health check-up rate and the probability of becoming ill, as well as the duration of hospitalization.

This paper is organized as follows. The next section provides an overview of the health check-up in Japan. Section III shows the general aspects of the health check-up, based on the 1995 Comprehensive Survey of Living Condition of the People on Health and Welfare. Section IV presents our theoretical model showing comparative static analysis of the demand for health check-up and also explains the highlighted variables of interest in this study. We report empirical results of the demand for health check-up in Section V and finally make our summary and conclusion in Section VI.

II. An Overview of the Health Check-up in Japan

Japan's Medical Insurance System is a comprehensive system covering the entire population through the Employees' Health Insurance, the Seamen's Health Insurance, and the National Health Insurance, which is a community-based insurance plan for local residents who are not covered by the Employees' Health Insurance.[1] Of the Employees' Health Insurance, there are three types: (1) the Society-managed Health Insurance, provided for by an employer with 700 employees or more,[2] (2) the Government-managed Health Insurance, provided for by an employer with less than 700 employees, and (3) the Mutual Aid Associations Insurance covering public employees, and teachers and personnel of private schools.[3] The medical care benefits under the Employees' Health Insurance cover 80% and 70% of medical costs for insured persons and their dependents, respectively. The National Health Insurance covers 70% of the medical costs of all insured persons.[4]

Within the Employees' Health Insurance, as of March in 1997, there were about 15.4 million insured persons and 16.6 million dependents covered by the Society-managed Health Insurance; about 20 million insured persons and 18.2 million dependents were covered by the Government-managed Health Insurance; and 5 million insured persons and 6.5 million dependents were covered by the Mutual Aid Associations

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[1] The detailed outline of Japan's Medical Care Security System is described in the *Outline of Social Insurance in Japan* :1998 (Japan International Social Security Association, 1999), which this section summarizes.

[2] The number of employees are not rigid in practice.

[3] In addition to the mentioned insurance systems, there is the health service system for the elderly aged 70 or more, who receive medical care services at minimum cost.

[4] The contribution rate levied on basic wages of employees varies among different types of health insurance: half of the contribution rate (8.5%) of the Government-managed Health Insurance is paid by the employers (4.25%); employees under the Society-managed Health Insurance are responsible for only 4.736% of their contribution rate (8.394%), the other half being paid for by their employers. National government employees, on the other hand, pay 9.195% of their contribution rate (18.39%). Source: *Outline of Social Insurance in Japan*: 1998, pp. 140-143.

Insurance. There were 0.1 million and 0.2 million dependents covered by the Seamen's Insurance. Finally, the number of insured persons under the National Health Insurance was about 43 million.

Regardless of the type of health insurance, the entire population can receive their health check-up. This is provided for employees at their working sites or at hospitals and clinics within the vicinity of their working places. People with the National Health Insurance, who are not in schools, receive notices for the health check-up from their local governments, and have their health check-up at local health centers and local hospitals. Students, covered by the same insurance scheme, receive their health check-up in schools, colleges, or universities.

Of the various health check-ups provided by firms, there are three classifications: the compulsory health check-up by law, the recommended health check-up, and the discretionary ones in the firms. The general health check-up is usually compulsory prior to the commencement of employment, and once every year during the period of employment. It includes the following items: (1) report of medical history, (2) self-evaluation as well as objective evaluation of medical symptoms, (3) height, weight, optesthesia, color vision (chromatopsia) , and audiometry, (4) chest x-ray radiography, (5) blood pressure, (6) urine examination, (7) anemia, (8) liver function, (9) blood lipids, (10) blood sugar, and (11) electrocardiogram.

Employers must provide additional items to these compulsory items and/or more frequent health checks depending on the job-type. For example, employers must provide for a health check-up once every six months to employees working at night and those having health-hazardous jobs or jobs dealing with poisonous chemicals at the work-place. The employers must supply the results of the health check-up to the district branch of the

Labor Standards Inspections Office concerned. Besides these various health check-ups, firms often provide their employees another type of health check-up as a fringe benefit: half day, one-day or two-day thorough health check-up in hospital once a year in order to find the employee's sickness at an early stage as well as to promote the employees' health condition.[5] This type of medical service for employees, called "Nin-gen Dock (in Japanese)," is not covered by the Employees' Health Insurance. According to *The Situations of Fringe Benefits* (Institute of Labor Administration, 1998), about 81 percent of the surveyed 5,000 firms, sampled from all over the industries, subsidize about 70 percent or more of the incurred medical costs of the comprehensive health check up in hospital (Nin-gen Dock).[6] The average amount of the coverage is about $350 ($1=100 yen), within the range of $100 to $900[7]. About 89 percent of the firms with 3,000 employees or more provide this subsidy, about 84 percent of those with 1,000 – 2,999 employees, and about 74 percent of those with less than 1,000 employees.

Although the law provides that employers must pay half of the insurance payments required of their employees, the survey shows that firms do not only pay this required rate. 84 percent of the firms with Government-managed insurance pay half the rate, while 86 percent of the firms with Society-managed insurance pay more than half that rate. Also, 95 percent of the big firms, those with more than 3,000 employees, pay more than half of the contribution rate.

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[5] This health check-up is often extended to the employee's spouse, parents and children.
[6] The Institute of Labor Administration (1998), *The Situations of Fringe Benefits*, pp. 278-285 and pp. 334-347. The survey period was from October 19 to December 28 in 1995.
[7] All dollar values in this paper are calculated based on the exchange rate of $1 = 100 yen, for brevity. We note that, according to OECD HEALTH DATA 98, per capita health expenditures incorporate the purchasing power parity (PPP), $1 = 195.35 yen, in calculation. However, ours use $1 = 100 yen for two reasons: first, the dollar values in PPP seems to underestimate the reality in Japan; and second, our dollar values can be easily translated into the PPP values if those values are halved

By law, an employer (or an establishment) with more than 1,000 employees must have its own in-house industrial doctor. The law also applies to establishments, with 500 employees or more, dealing with health hazardous and/or poisonous chemicals at the work site. Firms with 50 or more employees must have a contracted medical practitioner or doctor that would act as industrial doctor and oversee the employees' health condition. Furthermore, firms must hire certified sanitary administrators (hereafter abbreviated to SA). The number of SAs vary according to the size of establishment: 1 SA for a 50-200 employees firm, 2 SAs for a 201–500 employees firm, 3 SAs for a 501–1,000 employees firms, 4 SAs for a 1,001–2,000 employees firm, 5 SAs for a 2,001–3,000 employees firm, and 6 SAs for a 3,001 or more employees firm. These indicate that employees in larger firms enjoys better benefits, including health check-up at their work sites, more than their counterparts in smaller-sized firms.

In a similar way, the National Health Insurance also provides for various types of health check-up to local residents who are not covered by the Employees' Health Insurance and other types of health insurance.[8] Generally, the local government notifies their residents about the schedules for the health check-up. These health check-up periods are scattered throughout the year in order to avoid the busy periods for their residents, e.g. farmers. Residents usually go to one of the health centers within the vicinity for their health check-up but go to hospitals and clinics for certain types of medical check-ups. They pay the minimum fee according to the type of health check-up they take.

The types of health check-up provided by local governments are as follows: (1)

[8] Spouses of employees, covered under the Employees' Health Insurance as dependents, may receive this service upon their request to the corresponding local government.

group health check-up at local health centers and individual visits to hospitals or clinics[9], and (2) comprehensive medical health check-up in hospitals or the "Nin-gen Dock." The former includes the basic health check-up items mentioned earlier for a fee of about $10, and tests for the following: gastric cancer ($8), carcinoma of the colon and rectum ($5), lung cancer (no fee; $5 for examination of sputum), tuberculosis (no fee), carcinoma cancer uteri ($6), osteoporosis ($5), breast cancer ($10), and other types of women's medical tests ($5). The latter is inclusive of the basic health check-up items plus other services depending on the length of hospital stay. The subsidies by local governments are, for example, $175 for general medical examination (own out-of-pocket expenses are about $190; that is, the total costs are about $365), $250 for brain examination (own expenses are about $274), and $375 for comprehensive examination, i.e., general plus brain examinations, (private expenses amount to about $410). These examples indicate that employees in larger firms enjoy better and more varied benefits than those in smaller-sized firms do. The provisions for the above-mentioned health check-up have age restrictions, such as the general medical examination for people aged 30 or more, and the brain and comprehensive examinations for those aged 40 or more.

The following section discusses the general aspects of the health check-up program in Japan.

[9] The following items of health check-up and the corresponding fees certainly vary with the locality involved, reflecting the budgetary constraints of their respective local governments.

III. General Aspects of the Health Check-up

In the preceding section, we mentioned the health check-up and its coverage under different types of health insurance. We also indicated that people have adequate opportunities to have health check-ups according to their needs. Here we will report on how people aged 20 to 64 in Japan have the health check-up, based on the *Comprehensive Survey of Living Conditions of the People on Health and Welfare* in 1995 (hereafter, the Survey). "This Survey has been conducted by the Ministry of Health and Welfare every three years, since 1986. The Survey is a sampling survey covering all households and their household members within the stratified sample districts chosen at random from the enumeration districts of the 1990 Population Census, and is conducted by enumerator's interview method through the channels of prefectures, designated cities and health centers. The Survey was taken as of 1 June for about 270,000 households and about 800,000 household members in 5,100 districts, excluding one prefecture, Hyogo."[10]

Let us now refer to Table 1 (also, see Figure 1) for the sample means of the proportion of people having their health check-up by different age groups. The sample sizes are: overall N = 449,051, males N = 219,983, and females N = 229,068. Based on these proportions, there are at least three distinct characteristics. First, the overall average of the health check-up is 0.557, that is, 55.7% of people have their health check-up. Second, the overall proportion of males having their health check-up is 0.607, which is about 10 percentage points above the 0.509 of females. This difference eventually narrows as age progresses, excepting the 30-39 age group. Third, the health check-up rate peaks with the 50-60 age group for both males and females. Concerning the reasons why

[10] This description is taken from the *Japan Statistical Yearbook*: 1999, Statistics Bureau, Management and Coordination Agency, Government of Japan, 1998, p. 616.

the gender differential of the health check-up widens most with the 30-39 age group, we consider, as one possible explanation, that females leave their places of employment to get married and start a family at this age range. Thus, they may have lesser opportunities to have their health check-up. At the most probable, the notification for such an activity now comes from their local government as opposed to the notification for health check-up received from their work places when they were still employed. A similar phenomenon occurs with males as it is observed that there is an abrupt decline of the proportion of health check-up takers from the 50-60 to 61-64 age groups. This probably happens because it is the period for retirement. Yet, we still need to know why the proportion of health check-up increases as age increases. We tend to attribute the causes partially on the depreciation the health stock.

To examine whether there are any differentials of the health check-up rate among the different types of health insurance, we show the averages for each type of insurance cover for each age group in Table 2 (see Figure 2). We note that the health check-up proportion is highest for Mutual Aid Associations Insurance, and second highest for Society-managed Health Insurance in almost all of the different age groups. A reason for the high health check-up rate for both is that employees covered by either health insurance enjoy better and more fringe benefits and, hence, easier to access to the health check-up incurring lesser costs. In fact, firms with 1,000 or more employees, by law, must have their industrial doctor and medical assistance such as nurses in their work places. On the other hand, smaller firms may provide less medical facilities and services at their working sites, and sometimes they may not want employees to leave their jobs simply for their health check-up. The employees themselves may face some peer pressure not to excuse themselves for a day off for their health check-ups. In fact, in order

to avoid small enterprises' employees not having the health check-up, branches of the Supervision of Labor Standards often facilitate informing the employers as well as providing on-site health check-up by parking medical vehicles with x-ray radiation equipment near or at their work sites. As observed in Table 1, we notice that the health check-up rate becomes highest with the 50-60 age group. The age factor must then be underlined in Table 2 as well.

To confirm the existence of opportunities for the health check-up for employees in relatively larger establishments, we provide the health check-up rates according to employment status in Table 3. Again, we find employees in larger firms have very high health check-up rates. For example, employees in enterprises with over 1,000 workers have the highest rate among the general enterprises, i.e., private firms: the proportion of health check-up is 80 percent or more except for the 20-29 age group. The overall rate for all the age groups is highest for public employees with a rate of 0.810. In addition, the highest health check-up rates are those for the 40-49 and 50-60 age groups, as shown in Figure 3. In contrast, the proportion of health check-up takers among the self-employed is largest for the 61-64 age group. This observation also applies to part-time and household workers. A possible reason why the health check-up rate reaches highest with the relatively older age groups, in addition to the obvious reason that they are at higher risk of sickness, may be attributed to the larger time availability they have compared to younger age groups.

Table 4 (see Figure 4) shows the health check-up rates according to employment by industry by different age groups. We see that the Security group has the highest health check-up rate: 0.752 for all age groups. That high rate reflects the occupational requirement mentioned earlier: people who work at night must have their health check-up

twice a year. Hence, the law enforcement industry looks highly effective in encouraging the taking of the health check-up.

Finally, we will examine the attitude of people who have symptoms of sickness, and of people who are regularly visiting the hospital toward the health check-up. As *a priori*, we assume that these people, who are aware of their sickness or who are high risk, are more likely to have their health checked. Table 5 provides a summary of the results of this assumption. First, concerning the 1st and 4th rows of the Table, the overall results, the 20-64 age group, show that the difference between people with no symptom and those with symptoms is about 10 percentage points. The differential does not become clear until the 50-60 age group and older, looking across the board.

In contrast, the difference in the proportion of health check-up takers by gender becomes obscured at the older age group of 61-64 years old, as shown in Table 5. This phenomenon is true for people with both symptoms = 0, and those with symptoms = 1. We do not find any good reason to explain why the difference between the gender groups is so large, regardless of having or not having symptoms, for instance, the 20 percentage point difference within the 30-39 age group, and the 10 percentage point difference between males and females within the 40-49 age group. Especially among those with symptoms, the females have lower health check-up rates than their counterparts. That all these differentials with respect to gender are attributed solely to their employment differentials seem too demanding as well as hasty. At this point, it seems more reasonable to assume that there exists a distinct risk attitude between males and females. Through the use of a similar variable, in this case, visiting or not visiting hospitals, the results

turned out similar results.[11]

For this section, what we have learned from the sample of approximately 450,000 people, aged 20 to 64, obtained from *the 1995 Comprehensive Survey of Living Condition of the People on Health and Welfare* may be summarized as follows.

(1) Males and females have distinctly different attitudes toward the health check-up.

(2) As people grow older, e.g., from the ages 40-49 to 60-64 years, they become more health conscious.

(3) People with the Society-managed Health Insurance and those with the Mutual Aid Associations Insurance have more health check-ups than those covered by other types of health insurance.

(4) Employees in relatively larger establishments, e.g., with 500 workers or more, have better access to a health check-up. This also pertains to public employees.

(5) People employed in the Security and the related jobs industry has the highest health check-up rate, reflecting a tendency for law enforcement employees to have their health checked.

(6) People with symptoms of illnesses take the health check-up more often than those people without symptoms.

(7) Regardless of whether or not they have symptoms of illnesses (visits the hospital or not), males are usually more prone to have their health check-up than the females do.

We shall try to incorporate our observations into our theoretical model in the subsequent section.

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[11] This similarity should be obvious since the diagnoses of symptoms are provided by hospitals.

IV. Theoretical Model

4-1. Model

As was mentioned in the previous section, the average proportion of 20 to 64 year-old Japanese, who had the health check-up in 1995, is about 56%. Nearly half of the population did not take their health check-up despite the fact that the purpose of health check-up is to provide information on the individual's health status by identifying symptoms and illnesses at their early stages.

There are a number of possible explanations as to why people do not take the health check-up. One of the possible reasons could be that most people are risk-lovers, but this is hardly an acceptable explanation. Or that, on the contrary, most people are risk-averse but they feel they have adequate knowledge on their health condition; thus, the marginal benefits of having the health check-up are too little relative to its costs. There are many other explanations that are possible but too many to mention. However, irrespective of the reasons, people are faced with the uncertainty problem of the incidence of an illness. Generally, a person could prevent future financial losses and psychological burdens by having more and better information with regard to his present health condition. This kind of information could be provided by the health check-up.

In this section, we would like to show an application of the theory of insurance under uncertainty. This aims to explain the individual's choice on whether to have or not to have the health check-up in response to the exogenous changes the individual is faced with.

Let us assume that an individual's preferences can be represented by a utility function,

$$U = U(S_1, S_2; \pi_1, \pi_2). \quad \ldots\ldots (1)$$

Here, utility is defined over the contingent earning capacity (S_1, S_2).[12] The corresponding probabilities π_1, π_2 are parameters of the utility function, since the value of a state-contingent earning capacity depends on how likely the state is to occur.[13]

Suppose there is an event S_1, where an individual is faced with probability π_1: he maintains his initial earning health-related endowment S_0 by incurring the cost of preventive activities h, which here we consider as the health check-up.[14] In addition to this, the individual pays the insurance premium (or tax) P required as to the type of his health insurance, whose purpose is to protect him from a loss of his earning endowment S_0 due to sudden illness. Then, S_1 is defined as,

$$S_1 = S_0 - h - P. \quad \ldots\ldots (2)$$

In the second event S_2, the individual is now faced with the probability π_2: he suffers loss L of his earning capacity. We assume further that the value of loss increases as his age A progresses. That is, the individual's opportunity costs rise (at a diminishing rate) as age does.[15] His stock of health eventually depreciates as age increases. Aso, We assume an additional factor in the argument of L: the individual may take some health promoting activities H to increase his health stock HS. Loss L is defined as follows:

$$L = L(A, H), \quad \frac{\partial L}{\partial A} > 0 \text{ and } \frac{\partial L}{\partial H} = \frac{\partial L}{\partial HS}\frac{\partial HS}{\partial H} > 0. \quad \ldots\ldots (3)$$

In equation (3), the size of L depends on types of illnesses.[16] Different illnesses show different measurable symptoms (although some show similarities) such as high

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[12] Normally in a text like Silberberg (1990), wealth rather than earning capacity is used in a typical uncertainty model. However, since we are applying the theory of household production to the model, we prefer the use of "earning capacity," which is assumed to be reflecting monetary units like wealth.

[13] This simple application of the theory of insurance under uncertainty is based on Pauly (1989), pp. 309-319, and Silberberg (1990), pp. 445-447.

[14] Here, we avoid putting subscript i to represent the individual, for brevity.

[15] We implicitly assume here that there is an accumulation of health stock up to a certain age.

[16] For example, the major diseases among the fifty- and sixty-year old Japanese are diseases of the digestive system, circulatory system, musculoskeletal system and connective tissue, and nervous system and sense

blood pressure, high cholesterol, proteinuria, and high white blood cell. Each symptom s_j is associated with a particular illness and, hence, with a particular loss L_j. Having the health check-up is influenced by subjective and/or objective symptoms such that,

$h = h(s_j), \quad j = 1,...,n. \quad \ldots\ldots (4)$

If symptoms are subject to a probability distribution such as $\pi_j(s_j)$, we can assume that having the health check-up is an inverse function of symptoms,

$\pi_j^{-1}(h) = (s_j). \quad \ldots\ldots (5)$

Therefore, we can show the relationship between health check-up h and loss L_j as,

$\pi_j{}^*(h)L_j, \quad \ldots\ldots (6)$

where $\pi_j{}^*$ is probability associated with L_j. The expected loss due to illness can be expressed as,

$$\text{Expected Loss} = \pi^*(h)L(A,H) = \sum_{j=1}^{n} \pi_j{}^*(h)L_j(A,H). \quad \ldots\ldots (7)$$

Finally, if event 2 occurs, the individual receives medical care, which can be considered as earning-capacity-augmenting benefits M. However, the individual may not be able to receive benefits without some negative aspects. That is, during the interim when he is sick and is treated by a medical doctor, he visits the clinic or hospital; he awaits his turn with fatigue.[17] The psychological burden should be considered in the

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organs (*Japan Statistical YearBook*: 1999, pp.670-671.)

[17] About 49% of patients in large-sized hospitals wait for at least an hour and a half; and about 15% wait for more than 3 hours. In medium-sized hospitals, those who wait for more than an hour and a half account for about 44%, and account for 28% in small-sized hospitals. In both hospitals, the patient rates for those who wait for more than three hours are 17.2% and 15.6%, respectively. (*Movements in National Sanitation*, 1999. p.84). However, medical examinations in hospitals last very short: almost 64% of patients in large-

calculations of costs such as that, $-gM$, where $0 < g < 1$. Now, we define event 2 in terms of loss and benefits in money-equivalent units,

$$S_2 = S_0 - h - P - \pi^*(h)L(A,H) + (1-g)M, \quad \ldots\ldots (8)$$

Finally, concerning the probabilities attached to events 1 and 2, π_1 and π_2 are functions of an individual's age A. In other words, as he becomes older, say in his 50s as compared to his 20s or 30s, he becomes more contingent to illness. We express the individual's preference for an uncertain prospect in the form of expected utility function, a Von Neumann-Morgenstern utility function, as follows: [18]

$$EU = (1-\pi(A))U(S_0 - h - P) + \pi(A)U(S_0 - h - P - \pi^*(h)L(A,H) + (1-g)M) \quad \ldots\ldots (9)$$

The value of h that maximizes EU satisfies the following first-order condition:

$$(1-\pi(A))U_x(x) + \pi(A)U_y(y)(1+\pi_h^* L(A,H)) = 0, \text{ at } h > 0, \quad \ldots\ldots (10)$$

$$-\frac{1}{1+\pi_h^* L(A,H)} = \frac{\pi(A)U_y(y)}{(1-\pi(A))U_x(x)}, \quad \ldots\ldots (11)$$

$$x \equiv S_0 - h - P,$$

$$y \equiv S_0 - h - P - \pi^*(h)L(A) + (1-g)M,$$

$$U_x = \frac{\partial U}{\partial x} > 0,$$

$$U_y = \frac{\partial U}{\partial y} > 0, \text{ and}$$

$$\pi_h^* = \frac{\partial \pi^*(h)}{\partial h} < 0.$$

In equation (11), the left-side expression is interpreted as the marginal productivity of health check-up (Ehrlich and Becker 1972, p. 634).[19] The equilibrium condition requires

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sized hospitals take only 10 minutes or less for their examinations, and 18% take less than 3 minutes. About 61% and 57% of patients, respectively in medium-sized and small-sized hospitals, take less than 10 minutes or less for their medical examinations.

[18] Here, we change our notations, such that $1-\pi = \pi_1$ and $\pi = \pi_2$.

[19] According to Ehrlich and Becker (1972), the left-side expression in equation (11) in our presentation is

$1+\pi_h^* L(A,H)<0$. That is, an additional dollar spent on health check-up must reduce the expected loss by more than a dollar.[20] In other words, if an individual does not expect the benefits from the reduction of his expected loss to be greater than the health check-up cost, he will not take the health check-up. To put it differently, based on equation (10), if the maximum of EU occurs when $h=0$, rather than $h>0$, then necessarily $EU'\leq 0$; hence, we will have a corner solution. Furthermore, even if $h>0$ to start with, there may be some range of EU, where $EU'\leq 0$. This may be the case when $-1\leq \pi_h^* L(A,H)\leq 0$. Then, the individual will not have his health check-up, hence, $h=0$ at which $EU(h=0)>EU(h>0)$. For example, when the individual already has adequately good information on his current health condition, it does not make any sense for him to see a medical doctor in hospital for a slight cough.

The second-order condition of equation (10) requires,

$$D=(1-\pi(A))U_{xx}+\pi(A)U_{yy}(1+\pi_h^* L(A,H))^2<0, \quad \ldots\ldots (12)$$

$$U_{xx}=\frac{\partial U_x}{\partial x}<0,$$

$$U_{yy}=\frac{\partial U_y}{\partial y}<0, \text{ and}$$

$$\frac{\partial \pi_h^*}{\partial h}\equiv\frac{\partial^2 \pi^*(h)}{\partial h^2}=0 \text{ (assumed without loss).}$$

We can now find the effect of an individual's age A on the demand for the health check-up h by partially differentiating the first-order optimality condition, equation (10), with respect to A:

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viewed as the slope of the production transformation curve; and the right-side is the slope of the indifference curve of S_1, S_2. Hence, both sides must be equal in equilibrium for $h>0$.

[20] The reduction in this context might be due to "self-protection." In Ehrlich and Becker (1972), "... self-insurance [is] a reduction in the size of a loss, and self-protection [is] a reduction in the probability of a loss (p.633)."

$$\frac{\partial h}{\partial A} = \frac{1}{D}[-\pi_A U_x + (1+\pi_h^* L(A,H))(\pi_A U_y - \pi(A)\pi^*(h)U_{yy}L_A) + \pi(A)\pi_h^* U_y L_A] > 0 \ldots(13)$$

where

$$\pi_A \equiv \frac{\partial \pi(A)}{\partial A} > 0, \text{ and}$$

$$L_A = \frac{\partial L(A,H)}{\partial A} > 0.$$

The above positive sign shows that, as people grow older, they become more health conscious and, hence, have their health check-up.

Let us now consider the case of an increase in the health insurance premium (or tax) P. That is, the coverage of medical care decreases in clinics and hospitals. The effect of an increase in P on the health check-up is negative as the following shows:

$$\frac{\partial h}{\partial P} = \frac{-1}{D}[(1-\pi(A))U_{xx} + \pi(A)U_{yy}(1+\pi_h^* L(A,H))] < 0, \quad \ldots\ldots (14)$$

since $[(1-\pi(A))U_{xx} + \pi(A)U_{yy}(1+\pi_h^* L(A,H))] < 0$.[21]

In other words, as the coverage of medical care increases, an individual is more likely to have his health check-up.

The effect of an increase in an individual's initial endowment S_0 may be found to be positive as,

$$\frac{\partial h}{\partial S_0} = \frac{1}{D}[(1-\pi(A))U_{xx} + \pi(A)U_{yy}(1+\pi_h^* L(A,H))] > 0 \ . \quad \ldots\ldots (15)$$

The above result shows that an individual with higher earning power, for instance, those with a larger stock of human capital, is willing to have the health check-up to secure his earning loss.

Here, let us see whether an individual who is willing to have health stock

augmenting activities will have his health check-up or not. By partially differentiating the first-order optimal condition, we have the following result:

$$\frac{\partial h}{\partial H} = \frac{1}{D}[\pi(A)L_H(\pi_h^* U_y - \pi(A)\pi^*(h)U_{yy}(1+\pi_h^* L(A,H))] > 0, \quad \ldots\ldots (16)$$

$$L_H = \frac{\partial L(A,H)}{\partial H} > 0.$$

Hence, an increase in health stock augmenting activities, which raises earning capacities through an increase in the individual's health stock, will tend to encourage the individual to have the health check-up in order to avoid the earnings loss due to sudden illness.

We can also evaluate the effect of the psychological burden g in terms of $(1-g)M$ in equation (9), which is a burden incurred by an individual due to his illness. When an individual is sick and has to wait many hours at a busy hospital, this creates for him psychological costs, e.g., fatigue. In case of heavy illness, he may have to be hospitalized for cure with medical treatments that may take several hours or days. The effect of an increase in g on h will be positive,

$$\frac{\partial h}{\partial g} = \frac{1}{D}[\pi(A)U_{yy}(1+\pi_h^* L(A,H))(-M)] > 0. \quad \ldots\ldots (17)$$

The above result can be interpreted as: when an individual believes he may be more prone to some serious illness, say, through his job, he is more willing to have his health check-up in order to avoid greater psychological burden should he become ill.

On the other hand, the effect of an increase in the medical benefits M on health check-up is negative,

$$\frac{\partial h}{\partial M} = \frac{1}{D}[\pi(A)U_{yy}(1+\pi_h^* L(A,H))(1-g)] < 0. \quad \ldots\ldots (18)$$

Hence, the individual becomes less self-protective as benefits increase, which is an aspect

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[21] See Appendix A.

of the moral hazard present.

Finally, we will discuss the effect of the gender difference on the health check-up. In the formulation of equation (7), the expected loss, $\pi^*(h)L(A,H)$, can be defined as,

$$\overline{L^f} = \pi^f(h)L^f(A,H) < \overline{L^m} = \pi^m(h)L^m(A,H), \quad \ldots\ldots (19)$$

where $\overline{L^i}$ is a gender-specific expected loss, $(i = f,m)$: $f = females$, and $m = males$.

$\overline{L^i}$ is a positive function of both $\pi^i(h)$ and $L^i(A,H)$ with the assumptions,

$\pi^f(h) < \pi^m(h)$, and

$L^f(A,H) < L^m(A,H)$.

The effect of an increase (or a shift) in the probability distribution on the health checkup is found to be,

$$\frac{\partial h}{\partial \pi^i(\bar{h})} = \frac{1}{D}[\pi(A)U_{yy}(-L^i(A,H))(1+\pi_h^* L(A,H))] > 0, \quad \ldots\ldots (20)$$

following the assumption, $\frac{\partial \pi_h^*}{\partial \pi^i(\bar{h})} = 0$.

The above result indicates that individuals who are more prone to illness are more likely to have the health check-up than those who are not. The positive relationship also can be applied to $\overline{L^i}$; that is, $\frac{\partial h}{\partial \overline{L^i}} > 0$. Therefore, the both results show that males are more likely to have the health check-up than females do.

All these comparative static results must then be evaluated and be operational in an empirical study. For our empirical specifications, we suppose that the decision of an individual to have the health check-up or not depends on an unobservable utility index I_i, defined as,

$$I_i = X\beta + u_i, \quad \ldots\ldots (21)$$

X : a $(1xk)$ row vector of explanatory variables which determine I_i,

β : a $(kx1)$ column vector of parameters to estimate, and

u_i : a normally distributed random term.

In equation (21), the larger the value of the index I_i, the greater the probability of the individual to have the health check-up. Here, we assume that for the individual there is a critical level of the index I_i^*, such that if I_i exceeds I_i^*, he will have health check-up, otherwise he will not. To put it differently, in terms of the notations in our comparative static analyses, $(1+\pi_h^* L(A,H)) < 0$ and $\frac{\partial EU}{\partial h} = 0$ at $h > 0$ imply $I_i - I_i^* \geq 0$. Therefore, let $h = 1$ if the individual has the health check-up, and $h = 0$ if he does not. Since I_i, I_i^*, and $(1+\pi_h^* L(A,H))$ are not observable, if we assume I_i and I_i^* to be normally distributed with the same mean and variance, the probability that the individual has the health check-up may be expressed as,

$$\Pr ob(h=1) = \Pr ob(I_h^* \leq I_i) = F(I_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{X\beta} e^{-t/2} dt, \quad \ldots\ldots (21)$$

where $F(\bullet)$ is the cumulative distribution function, and t is a standardized normal variable, i.e., $t \sim N(0,1)$.[22] We estimate a probit model of the demand for the health check-up and a tobit model for the length of hospital stay. The next section mentions variables of interest in this study.

4-2. Variables

We show the comparative static analyses of the effects of variables of interest on

[22] The presentation of this probit model is from Gujarati (1995, pp. 563-564).

the demand for the health check-up with the previous theoretical model described. The dependent variable used in this study is whether individuals have the health check-up or not, thus, we use a dummy variable (= 1) if the individual has his health check-up, otherwise, the value is 0.[23]

One of the major explanatory variables to explain the variation in the demand for medical health check-up is the age of individuals. As shown theoretically, the relationship between age and the medical health check-up can be described as slowly increasing until the age of 60 and then declines. The reason for this decline in the demand for medical health check-up is the retirement age at 60 years old for those working in relatively large-sized firms (see Table 6).[24] It needs to be mentioned here that persons who retire are still eligible for a type of health insurance that is part Society-managed Health Insurance or Government-managed Health Insurance for the two years following the retirement. Otherwise, these individuals may choose the National Health Insurance cover.

Gender is another major explanatory variable in this analysis such that the males' health check-up rate always exceeds the females' across the 20-64 age range. The differentials in their health check-up rates certainly result from their biological differences, in addition to other socio-economic and demographic variables. We will examine the effect of gender difference on the demand for health check-up, *ceteris paribus*.

Besides the effects of the above demographic variables, the explanatory variable

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[23] As we mentioned in III General Aspects of the Health Check-up, the variables pertaining to individuals in this study are from *the 1995 Comprehensive Survey of Living Conditions of the People on Health and Welfare.*

[24] Employees covered by the Employees' Health Insurance join the National Health Insurance after retirement.

that can be considered as a policy-implication variable is the health insurance coverage. This includes the Government-managed, Society-managed Health Insurance and National Health Insurance (NHI). The coverage rates of the former two types of insurance are 80% (the coverage rate for spouse and family is 70%), while the NHI coverage is 70% for everyone.

To examine the effect of an individual's initial endowment on health check-up, we use the dummy variable for the household's highest income earner (i.e., breadwinner). In addition, we include the household's monthly expenditures, which will have the income effect on the demand for the health check-up. When monthly expenditures is not reported, we use a dummy variable for the individual who did not report the values, since the regression results may be biased if we exclude all who did not report this for the study.

For the measurement of health stock augmenting activities by individuals, we use the frequency of daily practices such as eating regular meals, nutritiously balanced meals and not-too-salty meals, not eating excessively, having physical exercise, adequate hours of sleep, and time to refresh oneself during the activities of the day. We hypothesize that the effect of this variable on the demand for health check-up is positive.

To evaluate the effect of the psychological burden when the individual becomes ill, the numbers of illnesses the individual has is included as an explanatory variable. This number includes diseases of the circulatory system, respiratory system, digestive system, genitourinary system, and so forth. Although the illnesses of each system can be explanatory variables in our regression, we decided not to use this approach because of the difficulty in evaluating the differences of their effects, besides the numbers are too many to be meaningful for our interest. In addition to the illness variable, we also include the number of stressful events the individual has had to face. These two explanatory

variables are considered as objective variables in evaluating the individual's health conditions. To avoid specification errors, the subjective evaluation of an individual's health condition should also be included in the regression analysis. In doing so, we use three dummies to represent: excellent health if one feels his health to be excellent, good health when he considers it good and fair health if he feels he possesses fair health conditions.

As for the effect of the medical benefits on the demand for health check-up, we use the variable on life insurance as proxy for the benefits. There are various types of life insurance sold in these days. Some provide coverage only for costs incurred upon hospitalization and for injuries.

To examine the effect of a change in the likelihood of illness on health check-up, we use a dummy variable for the individual whether he has visited either clinics or hospitals for the past year. If the individual did not visit those institutions at all for one year, we consider the individual healthy, *ceteris paribus*, hence, his tendency to become ill smaller than a counterpart who had been to either a clinic or hospital more often.

Other than these explanatory variables mentioned above, we include the variables on education, sizes of firms, types of employment, sizes of population, and regional dummies. The definition and statistics of the variables used in this study are reported in Table 7.[25] In next section, we will report the empirical results of our probit analysis.

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[25] In our regression analyses, we grouped the population into different categories. In fact, we focus rather mainly on those aged 30 to 60 since this age group is more homogeneous, in addition to the fact that they are the main age group of interest in this project. We report the statistics of both 20-64 and 30-60 age. For gender specific statistics, these are available from the author upon request.

V. Empirical Results

5-1. Health Check-up Results of 20-64 and 30-60 Age Groups

Table 8 reports the results of the Probit and the Ordinary Least Squares (Linear Probability Model) analyses for the populations of the 20-64 and 30-60 age groups. Table 9 reports the results of those for males and females of the 30-60 age group.[26] The over-all results are quite similar in significance of estimated coefficients and are very robust. Since the OLS estimates are shown as a comparative purpose in terms of the sign of estimated coefficients, we will mainly discuss the results of Probit model.

First, concerning those results for the populations of the 20-64 age group (N=438,906) and the 30-60 age group (N = 310,134), the gender difference (MALE) is significant in both age groups and the sign of the estimated coefficient is positive as expected, see Table 8. After controlling other socio-economic and demographic variables, as discussed in Section 4, we do not reject the argument that males are more likely to have their health check-up because their genetic and biological differences make them more prone to illness than the females. For the variables on age, the estimated coefficients on AGE and AGESQ (age^2) are both highly significant. The positive estimated coefficient on AGE and the negative estimated coefficient on AGESQ for both age groups indicate that the profile of their health check-up is concave as age increases. The probit estimate on AGE for the 30-60-year-old group is 0.0840, and is about twice as large as the one for 20-64-year-old group, which is 0.0382. This shows that the former is more concerned with their health than the latter group. The changes in the health check-up rate as age increases, or the estimated coefficient on AGESQ, seem to indicate the individual's loss of health stock.

As mentioned earlier, the health check-up is a time-consuming health input. Hence, the opportunity cost of giving up working hours or days for the sake of health check-up should be a major determinant on individual's decision of health check-up. The sign of the wage rate (WAGE) is negative and highly significant. Again, the probit coefficient for the 30-60-year-old group, which is negative 0.2770, is two times larger than the one for the 20-64-year-old population, which has negative 0.1396, in absolute values. Their t-statistics also indicate stronger significance for the former than the latter.[27] The estimated coefficient on the variable BREADWIN is significantly positive and the robust effect shows, as previously hypothesized, that an individual with the highest earning power in the household is willing to have the health check-up to secure his earning loss. From the estimated coefficient on monthly household expenditures (i.e., MONTHEXP), we see that the income elasticity of the demand for health check-up is positive.

As a policy variable, we include the type of the individual's health insurance coverage in the model: SOCIHI, GOVTHI, MUTUHI, and NHI. As expected, the coefficients on the first three variables are positive while that on the NHI (i.e., National Health Insurance) is negative. All estimates are statistically significant. Hence, the higher the coverage of medical care is, the more the individuals are likely to have the health check-up. If health check-up does play its role as preventive medical care, the individuals with health check-up will be less prone to illness.[28] As of 1995, the life expectancy of Japanese is 77.01 years for males and 83.59 years for females.[29] The

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[26] The description of variables used in the models and their statistics are reported in Table 7.
[27] The results are the same for the OLS estimates.
[28] This issue will be discussed further when we come to the empirical results of the probability of illness.
[29] *Japan Statistical Yearbook*: 1999, p.64.

current health check-up system for population, under the system of comprehensive health (medical) insurance, must then contribute to the high longevity rate for the Japanese population.

Normally, we expect that firms with a larger number of employees are more subject to more legal bindings or rules regarding the employees' working conditions. Therefore, the firms usually provide more and better fringe benefits as compared with firms with smaller numbers of employees. In our study, we use SIZE1000 for institutions with 1,000 employees or more, SIZE500 for those with 500-999 employees, SIZE30 for those with 30-99 employees, SIZE5 for those with 5-29 employees, SIZE1 for those with 1-4 employees, and PUBEMPLY for public employees.[30] The estimated coefficients on the variables SIZE30 to SIZE1000 are highly significant and positive in addition to PUBEMPLY. On the other hand, a small institution like those of SIZE1 has a significantly negative estimated coefficient. These results are indicative of the provision of better working environments for employees in larger sized firms.

We will discuss here the effects of the individual's health conditions on the demand for health check-up, holding constant the subjective evaluation of an individual's health condition (HLTHEXCE, HLTHGOOD, and HLTHFAIR). First, the sign of the estimated coefficient on NOTVISIT is negative, while the one on HLTHPRAC is positive. The former is a dummy variable that equals one if the individual did not visit any medical institutions for the past year. The latter is the number of health-related daily practice (e.g., eating regular meals, nutritiously balance meals and not-too-salty meals, adequate having physical exercise, adequate hours of sleep, so on). The signs for these variables were

[30] For this survey, there are no observations on institutions with 100-499 employees. The omitted dummy variable for firm size is the one for the self-employed, family workers, part-time workers, and the unemployed.

theoretically expected. In other words, the individual with better health (or more health stock) is less likely to have his health check-up. On the other hand, a health conscious person, that is, an individual who practices health stock augmenting activities, tends to have health check-up. For the health conscious person, the health check-up is another way of preventing health deterioration.

To evaluate the effect of psychological burden when the individual becomes ill, the variable SICKNUMB (the number of injuries and illnesses) and STRESS (the number of stressful events encountered) are included as explanatory variables. We hypothesized in the previous discussion that the psychological burdens of being in queue in hospitals and of being ill will force the individual not to become ill. It is thus possible that the individual will tend to have the health check-up in order to avoid being a patient. The signs of both estimated coefficients on SICKNUMB and STRESS are positive and highly significant. The sizes of the coefficients for the 20-64 age group are almost identical to those of the 30-60 age group, *ceteris paribus*.

Finally, we discuss the estimated coefficients on education (EDU) and life insurance (LIFEINSU). The level of an individual's education is considered a factor in increased efficiency of health production. The variable normally has a positive effect on the demand for preventive medical care (Coffey 1983, Kenkel 1994, and Hsieh and Lin 1997, only to name a few). However, it also implies that the coefficient depends on the elasticity of the MEC schedule, or the demand for health stock, according to Grossman (1972). The sign of the level of an individual's education is negative if the elasticity is less than one in absolute values. In this respect, our negative estimated coefficient is not

necessarily wrong.[31] The estimated effect of LIFEINSU on the demand for health check-up is negative. That is, an individual with life insurance is less likely to have the health check-up. This result is like an old story about an individual who buys insurance, but who gambles at the same time, as often discussed within the pages of a regular textbook regarding behavior under uncertainty (see Silberberg 1990, p. 453). From another perspective, it can also be viewed that the significantly negative coefficient reflects the moral hazard of an individual's behavior.

5-2. Other Health Check-up Results

In this section, we will highlight some specific results since we have already discussed extensively on the results of each variable in the model. Table 9 reports the gender-specific results for the 30-60-year-old population; and Table 10 reports the classified-age-group-specific results, these groups divided into the 30-39, 40-49, and 50-60 age groups.

First of all, concerning the gender specific results in Table 9, the age effect (i.e., AGE under probit) is much stronger for females (0.0886) than that for males (0.0414). After controlling all other socio-economic and demographic factors, females are more likely to have the health check-up than males do as age increases. We do not have good justification for the large difference in the estimates. However, if a female's health stock due to her genetic and biological reasons is larger than a male's, then *ceteris paribus* females need more preventive health care. Thus, they are more willing to have health check-up.

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[31] However, the definitive sign must await further study using Japan's micro data, since our survey does not provide the variable. Therefore, we use a proxy variable (see EDU in Table 7).

Another noticeable difference is that the estimated coefficient on MARRIED (i.e., if the individual is married, the value =1) is positive for males (0.1583), while it is negative for females (-0.0075). We may say that a married male bears more responsibilities for his household than a single unmarried male, and thus, the former needs to have the health check-up for preventing his health loss. In the case of females, the sign is not statistically significant, although it is negative.

The male population's estimated coefficient on the NHI is negative and statistically significant, while the female's is positive and not significant. Hence, for policy purposes, it is strongly recommendable to motivate males who are the self-empolyed, farmers, or fishermen to have the health check-up. Perhaps these males will be the target group if the system of health check-up should be more pervasive and more promoted for the prevention of illness.

For the results of employment by industry, the estimates on SALES and SERVICES are negative for males and statistically significant. On the other hand, those estimates are positive and significant for females. Therefore, for the same reasons mentioned for NHI, the governments need to be more concerned with their working conditions, some of which prevent employees from having the health check-up. This group of males may be another target group to be provided for with more incentives to have the health check-up.

Here, we discuss the classified-age-group-specific results, as shown in Table 10.[32] The effect of MARRIED is not important for the younger 30-39 age group, but it becomes a dominant factor for the older 40-49 and 50-60 age groups. However, the effect of WAGE is one of the determinants for the 30-39 age group. Therefore, in targeting this

group, the high opportunity costs for spending hours, or a working day, for having the health check-up need to be put into consideration by policy makers. As mentioned earlier, the effect of NHI (i.e., national health insurance) is significantly negative for both the 30-39 and 40-49 age groups, and should be targeted in the promotion of the health check-up. Similarly, those working in small enterprises, or firms with four or less employees (SIZE1), should be also be put into consideration by policy makers.

According to the results by type of individual health insurance in Table 11, males with SOCIHI, GOVTHI or MUTUI, i.e., those who have an 80% coverage of medical costs, are more likely to have the health check-up than those with the NHI, i.e., those with 70% coverage. Thus, the medical cost coverage also plays a significant role in the decision on whether one has the health check-up or not. One may also view that males with health insurance other than the NHI are more informed about the health check-up, and consequently, have more opportunities to take the health check-up. When the individual is the breadwinner (BREADWIN), or the highest income earner in the household, he (or she) has a higher probability of taking the health check-up, regardless of the type of health insurance among the members of the household. This is probably because of his (or her) responsibilities to the household.

As often mentioned previously, people with the NHI tend to be the self-employed, farmers, fishermen, part-time workers, professionals such as medical doctors and lawyers running their offices, etc. The variables SIZE1000 – SIZE30 may show some inconsistency as it affects the variable NHI. It must be kept in mind that there is quite a number of people who are working in large firms on a temporary basis. The statistically significant estimated coefficients for the SIZE- variables may be explained as

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[32] Gender-specific results of each age group are available upon request.

thus: although individuals have the National Health Insurance, being/working in large firms provides them better and/or more opportunities to have health check-up. In such cases, those with the NHI do not probably using their health insurance for the health check-up, and instead most of health check-up costs are borne by the employers. Or simply, since large-sized firms have on-site medical offices, employees with the NHI have higher accessibility to medical facilities for the health check-up than those who are not working but are covered by the NHI.

We found that the estimated coefficient on LIFEINSU to be significantly negative, as was reported in Table 8. However, the estimate becomes significantly positive under MUTUHI (i.e., Mutual Aid Associations Insurance for public employees and personnel in private schools). The estimate under SOCIHI (i.e., Society-managed Health Insurance for employees working in relatively large-sized firms) is also positive but not significant.

Finally, we also examine the demand according to the size of institution in relation to the health check-up, as shown in Table 12. The effect of each explanatory variable shares mostly the same sign across differently sized institutions but largely varies in significance. On the average, the variables are more robust in institutions with 99 or less employees. We consider these results to stem from the fact that employees in relatively smaller institutions have more room to choose whether they have health check-up or not. From a different perspective, it could also be viewed that small-sized institutions are not providing adequate opportunities for their employees neither are they strongly forced by law to do so, in comparison with large-sized ones. Since health check-up costs, including the opportunity costs, should be borne largely by the employers, the health check-up seems have been left at the discretion of the employee.

5-3. Results of Patient and Hospital

In the previous section, we analyzed the individual's behavior toward the demand for the health check-up. We found a large number of socio-economic and demographic variables to be the determinants on the health check-up decision. Here, we extend our analysis to the probability of being a patient in hospital and, if admitted, probability of the length of hospitalization. The dependent variables used in this section are PATIENT (if an individual is an in-patient, the value = 1) and HOSPITAL (the length of hospitalization in number of months).[33] The results shown in Table 13 are those of the second stage of the Two Stage Least Squares (2SLS). The endogenous variables number seven altogether, from CHECKUP to CHEKPUB. For example, the variable CHEK1000 is the product of CHECKUP and SIZE1000. We will concentrate our discussion on the results of estimated coefficients on these endogenous variables.

First, concerning the results of PATIENT in Table 13, the estimated coefficient on CHECKUP is highly significant and the sign is negative (-9.6757).[34] The product terms are all negative, of which CHEK5, CHEK1 and CHEKPUB are statistically significant. Thus, the health check-up in these sizes of institution does reduce the probability of becoming ill and being a patient in hospital. On the other hand, individuals who do not have the health check-up are exposed to a higher probability of becoming ill, relative to those who do have the health check-up, since the estimated coefficients on

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[33] For brevity, we do not report the statistics of the variables used in these analyses, shown in Table 13. However, the mean (m), standard deviation (s.d.), and minimum and maximum values of PATIENT and HOSPITAL are as follows:

	m	s.d.	minimum	maximum
PATIENT	0.0076	0.087	0	1
HOSPITAL	0.3978	9.426	0	687

[34] Since the endogenous variables are all predicted values from the first stage of probit model of the health check-up, the values are neither 0 nor 1, but in decimal values.

SIZE1000 through PUBEMPLY are all positive and highly significant. Therefore, if institutions are willing to reduce their medical cost expenditures as a part of fringe benefits, they are strongly recommended to encourage their employees to check their health on a regular basis. However, there are certain costs involved with the provision of health check-up, and in the long run how effective as a cost-containment policy this will be for institutions is yet unknown.

Second, with respect to the effects of health check-up on HOSPITAL, we find similar results of their effects as those on PATIENT. CHECKUP is highly significant and it indicates that an individual who had the health check-up can shorten his stay in hospital. The estimated coefficients on the product terms are not so statistically strong: only that of CHECK5 is significant. However, we can say that if an individual who did not have health check-up should become ill and hospitalized, his length of stay will probably be longer than otherwise. We can see these tendencies from the positive estimated coefficients on SIZE1000 through to PUBEMPLY, except for SIZE1.[35]

Concerning the statistical verification on our above results, we report various statistics at the bottom of Table 13. First, about the F-ratio (instrument), in the reduced form equation to estimate CHECKUP (i.e., health check-up), there is a total of 72 instruments, 39 of which (including the 11 regional dummy variables) are included in the structural model of PATIENT. Therefore, there are 32 predetermined variables, which do not appear in the structural model. The four variables such as HLTHPRAC to HLTHFAIR are not included in the model because the inclusion of the variables makes the second stage estimation singular.[36] The F-ratio on the 32 instruments under PATIENT

[35] The estimated coefficient on SIZE1 is not statistically significant,

[36] We may be committing a specification error to some extent if the omitted variables are significantly correlated with other independent variables. However, our concern is rather more on the effects of the

is 873.06 with the degrees of freedom equal to (32, 308406), which indicate that the test on the omitted variables as a set is statistically significant.

Then, we proceed to the next tests for the validity and relevance of instruments, i.e., overidentification test. We employ two types of tests: the Hausman test (1983, p. 433) and the Basmann test (1960) and. The statistics are Hausman Chi-square = 30245 (d.f.=25) and Basmann F-ratio = 1031.34 (d.f.=25, 308407), both of which are statistically significant. Hence, those 32 omitted instruments are statistically valid in the estimation of health check-up at the first stage.[37]

Finally, we test the exogeneity of the seven endogenous variables, from CHECKUP to CHECKPUB, on whether they are relevant in the structural PATIENT model or not.[38] By using the method of OLS, our Hausman F-ratio=1239.65 (d.f.=7, 308424) shows the rejection of the null-hypothesis.

As a summary of this section, we show the relevance of the health check-up (CHECKUP) in both models of PATIENT (i.e., the probability of being an in-patient in hospital) and HOSPITAL (the length of stay in hospital). There are distinguishable differences in the effects of health check-up on PATIENT and HOSPITAL between individuals who took the health check-up and those who did not. An individual who had his health check-up will become ill at much lower risk than one who did not. Furthermore, if the individual should become an in-patient, that person, who took the health check-up, will stay for a much shorter period in hospital than the counterpart who did not.

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endogenous variables on the dependent variable PATIENT. By definition, the estimated values of endogenous variables are orthogonal to the residuals.

[37] The same processes are also applied to the estimation of the Hospital equation in Table 13.

[38] The procedure is explained in Gujarati (1995, pp. 672-673).

5-4. Marginal Effects of Health Check-up on Hospital and Patient

We also reported the marginal effects of health check-up (CHECKUP) on PATIENT and HOSPITAL, under both PATIENT and HOSPITAL, in Table 13. The effects are statistically highly significant at the 1% significance level, and the values are by no means negligible. The marginal effect on PATIENT is negative 0.120, while that on HOSPITAL is negative 0.041.

The negative 0.120 value indicates that a ten-percentage point increase in health check-up will decrease the probability of being a patient in hospital (PATIENT) by 1.2 percentage points.[39] This is an over-all basic effect of health check-up on anyone aged 30-60 when the individual has had the health check-up. In addition to this basic effect, if the individual is an employee in SIZE1000, SIZE500, or SIZE5, an additional reduction in the probability of becoming a patient is nearly 0.1 percentage points for a ten-percentage point change in CHECKUP.[40] In other words, the probability of an individual who had taken health check-up to become ill is about one percent lower as compared to a counterpart who did not.[41] At a glance, this seems to be a negligible value, but it is not necessarily so because, on the average, one out of 100 may be prevented from becoming ill in a typical firm.[42] The effect of health check-up becomes much larger on CHEK1 and

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[39] Since PATIENT=1 if the individual is an in-patient, we may interpret the value as the probability of becoming ill as to need hospitalization. Because regular health check-ups may identify an individual's illness at an early stage, the correlation between health check-up and visiting hospital will be positive as a natural sequence. Whether the individual will be hospitalized or not depends on the degree of seriousness. What we are trying to say here is that an individual who has regular health check-ups will have lesser probability of being hospitalized than those who seldom have their health checked.

[40] The coefficient of CHECK1000 is marginally not significant, while that of CHECK5 is significant.

[41] Here, we make our interpretation in terms of percent rather than percentage points because the original values of CHECKUP in the reduced form equation are either one or zero, from which our interpretation comes.

[42] We are using the word 'firm' as synonymous with 'institution'. The former seems more appealing and concrete than the latter in this section.

CHEKPUB.[43] For these groups, there will be, on the average, three persons (i.e., negative 0.027) out of 100 employees who may be prevented from becoming ill through the health check-up.

For a rationalization of the relatively large marginal effect of CHEK1, it may be not too difficult to point out some possible reasons. Small firms with four employees or less provide fewer fringe benefits to their employees, and poorer working conditions than larger firms. Employees in those small firms normally have lesser chances to have the health check-up than those in larger firms (see Table 3). Having the health check-up plays its role as more preventive and effective for employees in small firms than otherwise. This sort of rationalization, however, may not work in the case of public employees since sizes of public institutions vary quite significantly. Furthermore, the promotion of health check-up among public employees can be rather pervasive.

The marginal effect of health check-up (CHECKUP) on HOSPITAL is negative 0.041, as mentioned earlier. This implies a reduction in hospitalization by about 1.8 months and 2.2 months.[44] For those of the product terms from CHEK1000 through CHEKPUB, the marginal effect of CHEK5 is negative 0.008 and is statistically significant, while others have similar but not significant values. The negative 0.008 value is equivalent to a reduction in the length of hospital stay by 0.35 months (0.008 x 44 months) or 0.42 months (0.008 x 53 months). These reductions will be quite substantial if we consider the consequent total hospital costs, opportunity costs, and psychological

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[43] CHEK1 is the product variable of SIZE1 (an employee of a firm with 1-4 employees) and HCHECKUP (an individual had the health check-up if the value=1). CHECKPUB is the product of PUBEMPLY (a public employee) and HCHECKUP.

[44] When we select only the hospitalized individuals in different age groups, the average length of hospital stay is about 44 months for people ages 30-50 and about 53 months for people ages 30-60. We obtain about 1.8 months by 0.041 x 44 and about 2.2 months by 0.041 x 53. However, the average lengths of hospital stay seem quite long. We might be picking up those in-patients who may use hospitals or equivalent institutions as bed-ridden patients. Therefore, caution is required in interpreting these two figures.

costs. Let us take an example from our survey data of employed individuals who were hospitalized in May 1995. The average hospital cost per month is about 400 dollars ($1=100 yen) for individuals aged 30-50 in hospital and 1,100 dollars for those aged 30-60.[45] Since these sampled individuals are employees in firms, the type of their health insurance must be either the Society-managed Health Insurance or the Government-managed Health Insurance; thus, the costs paid by the individuals reflect only 20 percent of the total hospital costs. The 80% of the total costs are by the Social Insurance Medical Care Fee Payment Fund. Therefore, the entire hospital costs must have been about 2,000 dollars per month for those who paid 400 dollars, and 5,500 dollars for those who paid 1,100 dollars.

These reductions point out to reductions in hospital costs. On an individual basis, the reduction in hospitalization by about 1.8 months or 2.2 months due to a one percentage point increase in health check-up is equivalent to a reduction in hospital expenditures of about 3,600 dollars ($2,000 x 1.8) or 12,100 dollars ($5,500 x 2.2).[46] In comparison to these long run total hospital costs when an individual becomes ill and an in-patient, a general medical examination, the health check-up, costs only a total of about 365 dollars (see Section II). This is the equivalent of the total hospital charges for a one-day stay. Furthermore, if we consider the itemized health check-up items subsidized by the local governments, an individual's out-of-pocket expenses are minimal, such as those for gastric cancer ($8), breast cancer ($10), etc. From these calculations, health check-up seems highly cost-effective in the long run. Therefore, the health check-up

[45] The averages are from the costs paid by individuals who were hospitalized during the month of May, 1995. In terms of Japanese yen, the values are about 41,600 yen for individuals aged 30-50 and about 111,200 yen for those aged 30-60.

[46] If we take the effect of the product term of health check-up and firm size into consideration, about half of a month's costs (i.e., $1,000 or $2,750) may be added to these figures as additional reductions in

needs to be more emphasized for the prevention of illness among the population.

hospitalization costs in the case of the negative 0.008 marginal effect.

VI. Summary and Conclusion

This study aims to explain the behavior toward the demand for the health check-up of the working population in Japan. The overall average health check-up rate of the 20-64-year-old population is about 56 percent, according to the sampled micro data from the 1995 Comprehensive Survey of Living Condition of the People on Health and Welfare. In our analysis, we focus mainly on the 30-60 age group for two reasons: first, the age of 60 is generally the retirement age for employees in Japan; second, this age group is considered more homogenous than the other 20-64 age group. By focusing our analyses toward this age group and narrowing our sample size to 310,134, our empirical results will have direct policy implications for the prevention of illness among the working population. In knowing the cause-and-effect of the health check-up, employers (or firms) can implement specific and appropriate policies to promote the employees' health through various fringe benefits and improving the employees' working conditions. Careful policymaking by firms will help in containing their growing medical expenditures.

In our analysis regarding the individual's health check-up decision, we apply a probit model not only to a classified age group specific sample but also to gender-specific, health insurance type specific and firm size specific samples. Among the socio-economic and demographic variables studied in the models, the major explanatory variables of interest are: age, gender, wage rate, health insurance coverage, affiliated firm size, and objective evaluations of the individual's health condition. We extend our study to examine the effects of the individual's health check-up on his (or her) probability of becoming ill and the consequent length of hospital stay

In our empirical results on the demand for the health check-up, most of the

estimated coefficients of the aforementioned variables have the theoretically predicted signs and are highly significant. The estimated coefficients on age and age-squared are positive and negative, respectively. This reflects that the incentive for an individual to have the health check-up increase at a diminishing rate as his stock of health rises. In other words, an individual's stock of health accumulates as his age increases, and so does the loss of earning ability rise, thus the incentive for the health check-up rise. The gender also plays an important role for the individual's decision on health check-up. Males are more likely to have their health check-up than females because of genetic and biological differences.

Normally, health check-up is a time-consuming health input. For this reason, the opportunity costs for giving up working hours or days should be considered as a major determinant of the health check-up decision. The sign of the individual's wage rate is negative and highly significant and its effect is more dominant for the 30-39 age group than any other age groups. Our findings of the significant and positive effects of the Society-managed Health Insurance, the Government-managed Health Insurance, and the Mutual Aid Associations Insurance on health check-up, given the negative effect of the National Health Insurance, show that the higher the coverage of medical costs is, the more the individuals are willing to have their health check-up. Furthermore, larger-sized enterprises are witnessed to be more encouraging of their employees regarding the health check-up than the smaller-sized enterprises, based on the fact that fringe benefits and working conditions for employees in the former are much more favorable than for those in the latter. Thus, in order to promote the health check-up among employees and consequently among population, a public policy that lowers the opportunity costs of health check-up for working people, which at the same time, targets specific groups, may

be one of the most desirable directions for policymaking.

For the effects of the individual's objective health conditions, the estimated coefficients are always statistically robust. The more the number of illnesses are (and also the number of stress), the more the individuals are likely to have their health check-up. On the other hand, when an individual has had no experience of visiting clinics and hospitals for the past year, which here we consider as reflecting his higher stock of health, the more the health stock is the less the individual's incentive to have health check-up, *ceteris paribus*. Therefore, a promotion of the individual's health stock in society, for instance, by providing better working conditions and lightening the working stress, may help contain the increase in society's medical expenditures.

As far as the above-mentioned results are concerned, it may be claimed that the health check-up reduces an individual's risk of becoming ill and hospitalized. In the short run, the general health check-up increases society's medical expenditures because of its obvious role in identifying symptoms of illnesses. In the second section of our empirical studies, we explore effects of the individual's health check-up on the probability of becoming ill and the consequent length of hospital stay by applying the method of Two-Stage Least Squares (2SLS) our sampled data. The results show the significantly negative and robust health check-up effects on these probabilities. In other words, an individual who has had his health check-up is at much lower risk in becoming ill than one who had not. Furthermore, if this individual should become ill, his probable length of hospitalization tends to be shorter than someone who did not take the health check-up. In the short run, the general health check-up will increase society's medical expenditures. In the long run, however, it will reduce not only monetary expenditures but also relieve an individual's psychological burden through the avoidance of illnesses and shortening any

hospitalization.

Our calculations on the numerical effects of health check-up on the probability of becoming ill and the consequent length of hospital stay show the following. Having the health check-up (i.e., a ten-percentage point increase) will reduce the probability of becoming ill and of being an in-patient in hospital by about 1.2 percent. This is a basic effect of the health check-up for individuals. When we come to the health check-up effects on employees in differently sized enterprises, we find that one out of every 100 employees may be prevented from becoming ill in large-sized enterprises.

In the case of the effect of health check-up on the length of hospital stay, we find the basic effect reductions to be about 1.8 months, on the average, for the 30-39 age group, and about 2.2 months for the 30-60 age group. In the case of the firm size specific effects, there will be an additional 0.4-month approximate reduction in the length of hospital stay. If we translate the above basic effects in terms of cost-savings of medical expenditures, the range will be approximately between 3,600 dollars and 12,100 dollars per month ($1=100 yen). The firm size specific effects will be in the range of 800 dollars and 2,200 dollars. These approximated monetary calculations are solely based on the hospital costs paid by both the individual and his health insurance agency. If we consider the opportunity costs saved and the psychological costs avoided, the entire benefits will well surpass the above approximation of monetary benefits.

As a concluding remark, health check-up among the population is highly cost-effective as a form of preventive medical care in the long run under the current comprehensive system of the National Health Care. Therefore, it is highly desirable if we could improve further the relatively low health check-up rate of about 56 percent of the 20-64 population because good health by itself is of great value.

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Appendix A

$$[(1-\pi(A))U_{xx}+\pi(A)U_{yy}(1+\pi_h^* L(A,H))]<0.$$

From the first-order optimal condition of equation (11), we have,

$$-[1+\pi_h^* L(A,H)]=\frac{(1-\pi(A))U_x(x)}{\pi(A)U_y(y)}.$$

Since the right-side of the above equation shows the slope of the indifference curve (Ehrlich and Becker 1972, p.626), we can express this as follows:

$$MRS=-\frac{(1-\pi(A))U_x(x)}{\pi(A)U_y(y)}.$$

By partially differentiating the optimal condition with respect to P, the results are found to be,

$$\frac{\partial MRS}{\partial P}=-\frac{1}{[\pi(A)U_y(y)]^2}[\pi(A)U_y(y)(1-\pi(A))U_{xx}-(1-\pi(A))U_x\pi(A)U_{yy}]>0.$$

Hence,

$$[\pi(A)U_y(y)((1-\pi(A))U_{xx}-\frac{(1-\pi(A))U_x}{\pi(A)U_y(y)}\pi(A)U_{yy})]<0.$$

This is also expressed as,

$$[\pi(A)U_y(y)((1-\pi(A))U_{xx}+(1+\pi_h^* L(A,H))\pi(A)U_{yy})]<0.$$

Thus, we obtain,

$$[(1-\pi(A))U_{xx}+\pi(A)U_{yy}(1+\pi_h^* L(A,H))]<0.$$

Table 1. Health Check-up: Total Number, Age and Gender Classification

		20～64 Yrs Old	20～29 Yrs Old	30～39 Yrs Old	40～49 Yrs Old	50～60 Yrs Old	61～64 Yrs Old
1	Overall Number	n=449051 0.557	0.457	0.521	0.597	0.620	0.585
2	Male	n=219983 0.607	0.487	0.630	0.652	0.653	0.583
3	Female	n=229068 0.509	0.429	0.415	0.543	0.590	0.587

Table 2. Health Check-up: Type of Insurance Cover

		20～64 Yrs Old	20～29 Yrs Old	30～39 Yrs Old	40～49 Yrs Old	50～60 Yrs Old	61～64 Yrs Old
1	Society-Managed Health Insurance	n=106,593 0.647	0.550	0.610	0.704	0.733	0.666
2	Government-Managed Health Insurance	n=145,452 0.582	0.474	0.532	0.630	0.668	0.654
3	Mutual Aid Association Insurance	n=49,980 0.692	0.563	0.648	0.755	0.775	0.690
4	National Health Insurance	n=141,424 0.419	0.269	0.311	0.396	0.490	0.550
5	Seamen's Health Insurance	n=1,515 0.576	0.443	0.517	0.568	0.682	0.500
6	Other Types of Health Insurance	n=4,087 0.404	0.354	0.464	0.407	0.400	0.404

	20~64 Yrs Old	20~29 Yrs Old	30~39 Yrs Old	40~49 Yrs Old	50~60 Yrs Old	61~64 Yrs Old
1 Self-Employed With Employees	n=16137 0.412	0.269	0.313	0.389	0.456	0.504
2 Self Employed Without Employees	n=25831 0.447	0.256	0.309	0.412	0.481	0.555
3 Family Workers	n=22649 0.416	0.212	0.296	0.412	0.529	0.595
4 Companies and Associations Workers	n=15325 0.617	0.463	0.540	0.608	0.682	0.689
5 Employees of Gen. Enterprises with 1-4 workers	n=10965 0.377	0.250	0.325	0.427	0.477	0.492
6 Employees of Gen. Enterprises with 5-29 workers	n=51347 0.533	0.410	0.516	0.582	0.616	0.625
7 Employees of Gen. Enterprises with 30-99 workers	n=45075 0.660	0.549	0.650	0.705	0.735	0.726
8 Employees of Gen. Enterprises with 100-499 workers	n=41724 0.732	0.638	0.740	0.778	0.789	0.749
9 Employees of Gen. Enterprises with 500-999 workers	n=13063 0.750	0.661	0.748	0.814	0.815	0.748
10 Employees of Gen. Enterprises with over 1,000 workers	n=63248 0.803	0.709	0.810	0.853	0.862	0.811
11 Public Employees	n=26326 0.810	0.695	0.798	0.857	0.857	0.781
12 Part-time workers Contracted by Month	n=10381 0.549	0.348	0.470	0.606	0.456	0.689
13 Part-time workers Contracted by Day	n=2980 0.448	0.262	0.352	0.492	0.529	0.602
14 Household Workers	n=2465 0.432	0.157	0.306	0.473	0.519	0.531
15 Others	n=5470 0.459	0.285	0.388	0.501	0.561	0.575
16 Not Working	n=123065 0.409	0.265	0.286	0.424	0.528	0.552

Table 4. Health Check-up: Employment by Industry by Age Group

	20～64 Yrs Old	20～29 Yrs Old	30～39 Yrs Old	40～49 Yrs Old	50～60 Yrs Old	61～64 Yrs Old
1 Professional	n=49,819					
	0.659	0.594	0.665	0.693	0.696	0.610
2 Administration	n=21,265					
	0.717	0.529	0.652	0.737	0.754	0.726
3 Clerical	n=55,745					
	0.657	0.590	0.683	0.729	0.745	0.707
4 Sales	n=36,534					
	0.517	0.452	0.505	0.541	0.549	0.550
5 Service	n=32,804					
	0.526	0.421	0.490	0.549	0.597	0.600
6 Security	n=3,757					
	0.752	0.639	0.745	0.818	0.774	0.715
7 Agriculture	n=13,811					
	0.567	0.316	0.391	0.533	0.617	0.634
8 Forestry	n=758					
	0.589	0.333	0.390	0.541	0.655	0.694
9 Fishery	n=2,174					
	0.453	0.307	0.328	0.446	0.544	0.500
10 Transport and Communication	n=10,796					
	0.653	0.503	0.633	0.679	0.733	0.680
11 Craftsmen (a)	n=83,173					
	0.602	0.528	0.588	0.623	0.642	0.614
12 None of the Above	n=4,603					
	0.535	0.440	0.520	0.542	0.587	0.580
13 Unknown	n=133,994					
	0.423	0.286	0.314	0.445	0.524	0.560

(a) "Craftsmen" includes craftsmen, mining, production process and construction workers and laborers

Table 5. Health Check-up: Sick/Not Sick by Age and Gender

	20-64 Yrs Old	20～29 Yrs Old	30～39 Yrs Old	40～49 Yrs Old	50～60 Yrs Old	61～64Yrs Old
Symptoms=0 Overall	n=339,013 0.534	0.454	0.515	0.581	0.585	0.524
Male	n=171,577 0.586	0.481	0.622	0.636	0.621	0.524
Female	n=167,436 0.480	0.426	0.405	0.526	0.549	0.523
Symptoms=1 Overall	n=110,038 0.629	0.476	0.549	0.652	0.685	0.655
Male	n=48,406 0.683	0.536	0.676	0.712	0.717	0.654
Female	n=61,632 0.586	0.444	0.456	0.599	0.658	0.655

Table 6. Retirement Age by Size of Enterprise, Industry and Age Group in 1997: %

	Retirement Age				
Size of Enterprise	under 55	56-59	60	61-64	65
30-99	5.7	6.6	78.4	0.9	8.3
100-299	2.7	2.5	88.1	2.9	3.8
300-99	1.9	2.3	91.9	2.0	1.9
1,000-4,999	0.1	0.4	96.8	1.7	1.0
5,000 over	---	---	98.0	0.7	1.3
Industry					
Mining	5.8	8.3	76.7	3.3	5.8
Construction	3.6	1.7	69.6	0.9	23.9
Manufacturing	4.2	4.2	86.8	1.1	3.5
Electricity	3.1	4.7	89.8	1.6	0.8
Transport	3.6	9.4	76.3	5.2	5.6
Wholesale	7.3	6.4	84.5	0.3	1.5
Finance	2.3	1.7	93.8	1.2	1.1
Real State	1.7	2.8	89.2	0.8	5.5
Services	3.9	6.2	77.9	1.9	10.0

Note: Electricity includes also gas, heat supply and water. Transport includes communication, too. Wholesales does retail trade, eating and dringking places. Finance does insurance.
Source: Japan Statistical Yearbook 1999, p94.

Table 7. Description and Statistics (Year=1995)

		Ages	Sample	Ages	Sample
		20-64	N=438906	30-60	N=310134
Variables	**Description**	Mean	Std. Dev.	Mean	Std. Dev.
HCHECKUP	If the individual has health check-up, HCHECKUP=1. Otherwise =0.	0.557	0.497	0.584	0.493
MALE	If the individual is male, MALE=1. Otherwise=0.	0.490	0.500	0.491	0.500
AGE	Age	42.314	12.737	45.250	8.576
AGESQ	Age squared.	1,952.690	1,076.338	2,121.134	777.190
MARRIED	If the individual is married, MARRIED=1. Otherwise=0.	0.722	0.448	0.846	0.361
WAGE	Wage rate per hour (in 1,000 Yen)[a]	1.490	0.454	1.613	0.467
BREADWIN	If the individual is the highest income earner in the household, BREADENR=1. Otherwise=0.	0.438	0.496	0.488	0.500
MONTHEXP	Monthly expenditures (in 10,000 yen)	28.910	38.096	29.581	38.240
MOEXPDUM	If monthly expenditures are not reported, MOEXPDUM=1. Otherwise=0.	0.062	0.240	0.060	0.237
SOCIHI	If the individual has Society-managed Health Insurance, SOCIHI=1. Otherwise=0.	0.237	0.425	0.237	0.425
GOVTHI	If the individual has Government-managed Health Insurance, GOVTHI=1. Otherwise=0.	0.324	0.468	0.326	0.469
MUTUHI	If the individual has Mutual Aid Associations Insurance, MUTUHI=1. Otherwise=0.	0.111	0.315	0.124	0.329
NHI	It the individual has National Health Insurance, NHI=1. Otherwise=0.	0.315	0.465	0.300	0.458
SIZE1000	If the individual is an employee of a firm with 1,000 employees, SIZE1000=1. Otherwise=0.	0.029	0.168	0.028	0.164
SIZE500	If the individual is an employee of a firm with 500-999 employees, SIZE500=1. Otherwise=0.	0.093	0.290	0.091	0.288
SIZE30	If the individual is an employee of a firm with 30-99 employees, SIZE30=1. Otherwise=0.	0.100	0.301	0.100	0.300
SIZE5	If the individual is an employee of a firm with 5-29 employees, SIZE5=1. Otherwise=0.	0.114	0.318	0.113	0.317
SIZE1	If the individual is an employee of a firm with 1-4 employees, SIZE1=1. Otherwise=0.	0.024	0.154	0.025	0.155
PUBEMPLY	If the individual is a public employee. PUBEMPLY=1. Otherwise=0.	0.081	0.272	0.080	0.271
DOCTOR	The number of physicians per 100,000 population in a prefecture.	187.035	35.828	186.946	35.618
PROFES	If the individual is a professional such as engineer, PROFES=1. Othewise=0.	0.111	0.314	0.115	0.319

ADMINI	If the individual is an administrator, ADMINI=1. Otherwise=0.	0.047	0.212	0.058	0.233
CLERIC	If the individual is a clerk, CLERIC=1. Otherwise=0.	0.124	0.329	0.115	0.320
SALES	If the individual is a sales person, SALES=1. Otherwise=0.	0.081	0.273	0.085	0.279
SERVIC	If the individual is an employee of the service industry, SERVIC=1. Otherwise=0.	0.073	0.260	0.076	0.265
SECURI	If the individual has a security-related job, SECURI=1. Otherwise=0.	0.008	0.089	0.009	0.092
TRANSP	If the individual is an employee of the transportation industry, SERVIC=1. Otherwsie=0.	0.024	0.153	0.027	0.163
SICKNUMB	The number of injuries and illnesses.	0.366	0.792	0.372	0.791
STRESS	The number of stressful events had been/being experienced.	0.944	1.556	1.014	1.624
NOTVISIT	If the individual did not visit medical institutions for the past year, NOTVISIT=1. Otherwise=0.	0.084	0.278	0.089	0.285
HLTHPRAC	The number of health-related daily practices.	2.507	1.901	2.545	1.878
HLTHEXCE	Self-evaluation of the individual's health: if excellent, HLTHEXCE=1. Otherwise=0.	0.316	0.465	0.300	0.458
HLTHGOOD	Self-evaluation of the individual's health: if good HLTHGOOD=1. Otherwise=0.	0.175	0.380	0.175	0.380
HLTHFAIR	Self-evaluation of the individual's health: if fair, HLTHFAIR=1. Otherwise=0.	0.385	0.487	0.399	0.490
EDU	The average proportion of high school graduates who went to either college or university in a prefecture.	0.369	0.100	0.368	0.100
LIFEINSU	The average amount of life insurance's contract (in 10,000 Yen) in a prefecture.	780.724	64.988	779.765	64.886
POP1M	If the individual lives in a city with a population of about 1 million or more, POP1M=1. Otherwise=0.	0.139	0.345	0.134	0.340
POP150	If the individual lives in a city with a population of more than150, 000, but less than 1 million, POP150=1. Otherwise=0.	0.268	0.443	0.264	0.441
POP50	If the individual lives in a city with a population of more than 50,000 but less than 150,000, POP50=1. Otherwise=0.	0.094	0.292	0.096	0.295
POPCUNTY	If the individual lives in a city or town with a population of less than 50,000, POPCUNTY=1. Otherwise=0.	0.289	0.453	0.295	0.456
REGIOND1	Regional Dummy: Hokkaido=1, otherwise=0.	0.021	0.144	0.022	0.145
REGIOND2	Regional Dummy: Tohoku=1, otherwise=0.	0.139	0.346	0.142	0.349
REGIOND4	Regional Dummy: Kanto II=1, otherwise=0.	0.111	0.314	0.111	0.314
REGIOND5	Regional Dummy: Hokuriku=1, otherwise=0.	0.087	0.282	0.088	0.283
REGIOND6	Regional Dummy: Tokai=1, otherwise=0.	0.072	0.259	0.072	0.258
REGIOND7	Regional Dummy: Kinki I=1, otherwise=0.	0.046	0.209	0.044	0.206

REGIOND8	Regional Dummy: Kinki II=1, otherwise=0.	0.061	0.240	0.061	0.240
REGIOND9	Regional Dummy: Cyugoku=1, otherwise=0.	0.103	0.305	0.104	0.306
REGIOND10	Regional Dummy: Sikoku=1, otherwise=0.	0.076	0.265	0.077	0.267
REGIOND11	Regional Dummy: Kita Kyusyu=1, otherwise=0.	0.090	0.286	0.090	0.286
REGIOND12	Regional Dummy: Minami Kyusyu=1, otherwise=0.	0.075	0.263	0.076	0.265

Note: [a] The wage rate is the gender specific industry average wage rate for different age groups, namely, 20-24, 25-29,…,55-59, and 60-64.

Table 8. Dependent Variable: Health Check-up: Probit and OLS Methods

	Ages 20 - 64				Ages 30 - 60			
	Probit		OLS		Probit		OLS	
Variable	Estimate	t-statistic*	Estimated	t-statistic*	Estimate	t-statistic*	Estimate	t-statistic*
C	-1.5235	-29.599	-0.0254	-1.446	-2.5467	-28.742	-0.3704	-12.403
MALE	0.0730	7.607	0.0271	8.279	0.2114	15.651	0.0759	16.687
AGE	0.0382	23.687	0.0136	24.804	0.084	24.109	0.0293	24.926
AGESQ	-0.0002	-13.036	-0.0001	-13.798	-0.0007	-18.573	-0.0002	-19.271
MARRIED	-0.0085	-1.525	-0.0047	-2.482	0.0608	8.662	0.0189	7.970
WAGE	-0.1396	-14.020	-0.0554	-16.433	-0.277	-20.363	-0.1028	-22.611
BREADWIN	0.1164	20.157	0.0400	20.210	0.0872	11.514	0.0296	11.578
MONTHEXP	0.0003	5.878	0.0001	5.799	0.0003	4.047	0.0001	4.110
MOEXPDUM	-0.0807	-9.373	-0.028	-9.533	-0.089	-8.580	-0.0308	-8.791
SOCIHI	0.3033	16.453	0.1069	16.789	0.3192	14.656	0.1124	15.076
GOVTHI	0.2063	11.366	0.0742	11.824	0.1983	9.257	0.0727	9.893
MUTUHI	0.5957	31.530	0.2083	32.003	0.5991	26.953	0.2073	27.344
NHI	-0.0708	-3.909	-0.0263	-4.195	-0.1047	-4.897	-0.0401	-5.466
SIZE1000	0.7091	53.063	0.2439	56.079	0.6894	41.203	0.2293	43.861
SIZE500	0.6484	79.025	0.2250	82.616	0.6313	63.485	0.2134	66.527
SIZE30	0.4545	58.916	0.1622	61.579	0.4417	47.848	0.1565	50.598
SIZE5	0.1537	21.608	0.0549	22.152	0.1519	17.973	0.0556	19.052
SIZE1	-0.1456	-11.012	-0.0549	-12.038	-0.1369	-8.880	-0.0525	-9.848
PUBEMPLY	0.8455	88.424	0.2781	91.495	0.8313	70.644	0.2597	72.536
DOCTOR	0.0002	2.304	0.0001	2.990	0.0003	2.966	0.0001	3.908
PROFES	0.2083	29.294	0.0737	30.716	0.2172	25.779	0.0754	27.051
ADMINI	0.2942	27.986	0.0971	28.268	0.2976	25.662	0.0967	25.941
CLERIC	0.2499	35.803	0.0874	37.297	0.2752	32.053	0.0928	33.084
SALES	-0.0034	-0.439	0.0002	0.064	0.0044	0.491	0.0029	0.945
SERVIC	-0.0053	-0.653	-0.0012	-0.440	0.0169	1.786	0.0067	2.088
SECURI	0.4300	17.600	0.1454	18.547	0.4403	15.301	0.1454	16.231
TRANSP	0.0700	5.043	0.0244	5.258	0.0724	4.576	0.0253	4.867
SICKNUMB	0.1376	48.512	0.0459	48.737	0.1388	41.356	0.0458	41.621
STRESS	0.0463	33.836	0.0155	33.498	0.0477	30.396	0.0158	30.246
NOTVISIT	-0.1654	-22.843	-0.0582	-23.364	-0.1875	-22.253	-0.0652	-22.751
HLTHPRAC	0.0800	70.659	0.0273	71.181	0.0787	57.746	0.0263	57.947
HLTHEXCE	0.4177	55.977	0.1428	56.495	0.4132	46.654	0.1412	47.451
HLTHGOOD	0.4793	60.964	0.1637	61.508	0.4798	51.453	0.163	52.208
HLTHFAIR	0.4596	67.074	0.1573	67.842	0.4558	56.543	0.1553	57.410
EDU	-0.6319	-13.799	-0.227	-14.531	-0.7762	-14.115	-0.2802	-15.168
LIFEINSU	-0.0003	-8.660	-0.0001	-8.605	-0.0002	-3.392	-0.0001	-3.090
POP1M	-0.0562	-7.081	-0.0195	-7.229	-0.0514	-5.321	-0.0176	-5.433
POP150	-0.0689	-11.676	-0.0242	-12.008	-0.0742	-10.483	-0.0256	-10.748
POP50	0.1027	12.896	0.036	13.203	0.1203	12.683	0.0411	12.876
POPCUNTY	0.2283	38.853	0.0792	39.608	0.2424	34.601	0.0825	35.195
REGIOND1	-0.2501	-15.038	-0.0900	-15.858	-0.317	-15.591	-0.1135	-16.572
REGIOND2	0.0577	5.133	0.0165	4.346	-0.0017	-0.122	-0.0056	-1.172
REGIOND4	-0.0032	-0.335	-0.0027	-0.825	-0.0341	-2.895	-0.0137	-3.499
REGIOND5	0.0663	6.193	0.0213	5.868	0.0329	2.512	0.0089	2.027
REGIOND6	0.0118	1.107	0.0041	1.119	-0.0002	-0.015	0.0000	0.004
REGIOND7	-0.1194	-9.757	-0.0424	-10.179	-0.1405	-9.412	-0.0498	-9.925
REGIOND8	-0.1801	-15.808	-0.0627	-16.187	-0.2044	-14.806	-0.0706	-15.252
REGIOND9	-0.0597	-5.203	-0.0229	-5.863	-0.1144	-7.955	-0.0422	-8.732
REGIOND10	-0.2218	-17.645	-0.08	-18.648	-0.2833	-18.045	-0.1015	-19.199

REGIOND11	-0.1486	-12.524	-0.0544	-13.447	-0.2029	-13.514	-0.0736	-14.595
REGIOND12	-0.1170	-9.473	-0.0448	-10.633	-0.2037	-12.888	-0.0759	-14.305
R-square	0.1688		0.1648		0.1721		0.1675	
Log Likelihood	-262055		-276121		-182380		-192267	
F-ratio	---		1731.89		---		1248.16	
N	438906		438906		310134		310134	

* Asymptotic t-statistics: the critival value at 1% significance level=2.576;
the critical value at 5% significance level=1.960; and
the critical value at 10% significance level=1.645.

Table 9. Dependent Variable: Health Check-up by Gender

	Ages 30 - 60: Males				Ages 30 - 60: Females			
	Probit		OLS		Probit		OLS	
Variable	Estimate	t-statistic*	Estimated	t-statistic*	Estimate	t-statistic*	Estimate	t-statistic*
C	-1.4558	-9.510	0.0585	1.211	-2.9756	-24.134	-0.5340	-12.378
AGE	0.0414	5.958	0.0123	5.624	0.0886	20.135	0.0305	19.830
AGESQ	-0.0004	-4.809	-0.0001	-4.488	-0.0007	-13.994	-0.0002	-13.523
MARRIED	0.1583	15.607	0.0535	16.363	-0.0075	-0.588	-0.0041	-0.919
WAGE	-0.1155	-4.613	-0.0402	-5.127	-0.0253	-1.024	-0.0107	-1.240
BREADWIN	0.0873	7.980	0.0307	8.782	0.0183	1.341	0.0043	0.917
MONTHEXP	0.0002	2.274	0.0001	2.156	0.0003	3.570	0.0001	3.716
MOEXPDUM	-0.1067	-7.138	-0.0358	-7.495	-0.0773	-5.337	-0.0269	-5.296
SOCIHI	0.3740	12.466	0.1313	13.372	0.3274	10.206	0.1167	10.359
GOVTHI	0.1979	6.784	0.0762	7.931	0.2165	6.818	0.0781	7.004
MUTUHI	0.7529	24.546	0.2417	24.350	0.4830	14.759	0.1724	15.018
NHI	-0.2696	-9.256	-0.1033	-10.755	0.0028	0.087	0.0006	0.055
SIZE1000	0.5547	26.757	0.1738	28.155	0.7094	22.916	0.2439	24.042
SIZE500	0.5225	37.927	0.1658	39.238	0.6249	40.359	0.2170	41.782
SIZE30	0.3490	26.571	0.1161	27.751	0.4401	32.064	0.1587	33.343
SIZE5	0.0743	6.134	0.0214	5.389	0.1610	12.893	0.0604	13.604
SIZE1	-0.1946	-8.875	-0.0776	-10.725	-0.1067	-4.845	-0.0390	-4.979
PUBEMPLY	0.6617	43.634	0.1932	43.659	0.9040	38.805	0.2991	40.561
DOCTOR	0.0001	0.668	0.0000	0.788	0.0000	-0.160	0.0000	-0.005
PROFES	0.0359	3.214	0.0129	3.702	0.3923	28.936	0.1372	29.446
ADMINI	0.1813	13.174	0.0536	12.827	0.2101	8.194	0.0758	8.402
CLERIC	0.1467	11.038	0.0438	11.013	0.2997	25.394	0.1070	26.112
SALES	-0.0966	-7.628	-0.0342	-8.349	0.0415	3.209	0.0158	3.471
SERVIC	-0.0832	-5.610	-0.0289	-6.077	0.0430	3.420	0.0164	3.716
SECURI	0.2132	6.711	0.0694	7.438	0.3281	3.978	0.1155	4.037
TRANSP	-0.0070	-0.415	-0.0024	-0.450	0.1166	1.888	0.0413	1.929
SICKNUMB	0.1421	27.104	0.0442	27.620	0.1317	30.015	0.0452	30.025
STRESS	0.0581	23.169	0.0181	23.529	0.0439	21.650	0.0151	21.398
NOTVISIT	-0.1714	-13.327	-0.0558	-13.521	-0.1971	-17.549	-0.0708	-17.898
HLTHPRAC	0.0777	39.164	0.0244	39.568	0.0811	42.940	0.0286	43.303
HLTHEXCE	0.5023	39.165	0.1685	41.246	0.3373	27.385	0.1165	27.204
HLTHGOOD	0.5806	42.448	0.1919	44.468	0.3977	31.019	0.1379	30.931
HLTHFAIR	0.5488	46.173	0.1822	48.198	0.3784	34.344	0.1314	34.356
EDU	-0.6519	-6.731	-0.1958	-6.449	-0.8103	-8.801	-0.2873	-8.895
LIFEINSU	-0.0002	-3.287	-0.0001	-3.239	-0.0003	-3.887	-0.0001	-3.737
POP1M	-0.0394	-2.768	-0.0130	-2.936	-0.0853	-6.324	-0.0311	-6.556
POP150	-0.0341	-3.263	-0.0111	-3.384	-0.1071	-11.028	-0.0383	-11.196
POP50	0.0668	4.801	0.0218	4.974	0.1622	12.450	0.0575	12.523
POPCUNTY	0.1616	15.702	0.0520	16.194	0.3089	32.101	0.1092	32.351
R-square	0.1917		0.1860		0.1472		0.1444	
Log Likelihood	-83874		-88039		-96970		-102103	
F-ratio	---		710.01		---		543.73	
N	152255		152255		157879		157879	

All equations include the 11 regional dummy variables.

* Asymptotic t-statistics: the critival value at 1% significance level=2.576;
the critical value at 5% significance level=1.960; and
the critical value at 10% significance level=1.645.

Table 10. Dependent Variable: Health Check-up by Age Group

	Ages 30-39		Ages 40-49		Ages 50-60	
	Probit		Probit		Probit	
Variable	Estimate	t-statistic*	Estimate	t-statistic*	Estimate	t-statistic*
C	-1.4210	-1.932	-1.2574	-1.092	2.3267	1.606
MALE	0.2641	10.295	0.0226	0.818	-0.1495	-5.717
AGE	0.0332	0.782	0.0209	0.403	-0.1190	-2.248
AGESQ	0.0000	-0.034	-0.0001	-0.166	0.0012	2.466
MARRIED	-0.0118	-1.032	0.1319	10.605	0.1611	11.467
WAGE	-0.2052	-5.072	-0.0494	-1.738	0.0196	0.836
BREADWIN	0.1383	10.936	0.1018	7.686	0.1347	8.989
MONTHEXP	0.0002	1.356	0.0003	2.639	0.0003	3.010
MOEXPDUM	-0.0662	-3.256	-0.0737	-4.328	-0.1149	-6.680
SOCIHI	0.1538	3.692	0.3722	10.491	0.3877	10.449
GOVTHI	0.0221	0.537	0.2482	7.112	0.2759	7.603
MUTUHI	0.4462	10.586	0.6688	18.488	0.6179	16.076
NHI	-0.2860	-6.895	-0.1087	-3.114	-0.0079	-0.220
SIZE1000	0.6867	24.458	0.6968	25.569	0.6027	18.423
SIZE500	0.7017	39.870	0.5983	37.340	0.5312	28.587
SIZE30	0.4850	28.688	0.4230	28.439	0.3855	23.164
SIZE5	0.2004	12.714	0.1429	10.512	0.0956	6.377
SIZE1	-0.1614	-5.607	-0.1065	-4.425	-0.1453	-5.128
PUBEMPLY	0.8453	41.810	0.7950	42.116	0.7550	32.753
DOCTOR	0.0004	2.250	0.0000	0.198	-0.0005	-2.867
PROFES	0.3075	21.256	0.1953	14.361	0.1147	7.044
ADMINI	0.3567	13.581	0.2953	15.829	0.2594	14.299
CLERIC	0.3618	24.943	0.2477	18.093	0.1788	10.308
SALES	0.0632	3.665	0.0017	0.123	-0.0628	-4.039
SERVIC	0.0365	1.943	0.0061	0.401	-0.0015	-0.093
SECURI	0.4667	9.766	0.4954	10.591	0.2498	4.366
TRANSP	0.0609	2.058	0.0185	0.732	0.1613	5.771
SICKNUMB	0.1147	13.710	0.1349	22.473	0.1446	30.815
STRESS	0.0352	12.932	0.0492	19.370	0.0647	21.589
NOTVISIT	-0.1166	-7.108	-0.1947	-14.867	-0.2311	-15.489
HLTHPRAC	0.0575	21.965	0.0687	30.104	0.1018	45.165
HLTHEXCE	0.3039	17.137	0.4225	28.391	0.4594	31.963
HLTHGOOD	0.3537	19.175	0.4948	31.437	0.5358	35.164
HLTHFAIR	0.3429	20.314	0.4488	32.943	0.5107	40.769
EDU	-0.7508	-7.336	-0.7653	-8.372	-0.4658	-4.894
LIFEINSU	-0.0003	-2.872	-0.0003	-3.267	-0.0003	-3.617
POP1M	-0.0633	-3.488	-0.0692	-4.293	-0.0844	-5.110
POP150	-0.0840	-6.327	-0.0773	-6.640	-0.0696	-5.735
POP50	0.1381	7.794	0.1184	7.552	0.1090	6.728
POPCUNTY	0.2358	17.964	0.2393	20.814	0.2496	20.715
R-square	0.1984		0.1698		0.1525	
Log Likelihood	-52283		-66961		-62145	
N	89041		114567		106526	

All regressions include the 11 regional dummy variables.

* Asymptotic t-statistics: the critival values are the same as those in Table 8.

Table 11. Dependent Variable: Health Check-up by Type of Health Insurance Coverage

	SOCIHI		GOVTHI		MUTUHI		NHI	
	Probit		Probit		Probit		Probit	
Variable	Estimate	t-statistic*	Estimated	t-statistic*	Estimate	t-statistic*	Estimate	t-statistic*
C	-3.2027	-16.976	-2.5210	-16.850	-3.8446	-14.787	-1.5875	-9.996
MALE	0.4662	14.987	0.2279	10.095	0.4624	11.136	-0.0207	-0.861
AGE	0.1208	16.194	0.1026	17.037	0.1528	14.283	0.0433	6.709
AGESQ	-0.0012	-14.028	-0.0009	-13.983	-0.0015	-12.504	-0.0003	-3.768
MARRIED	-0.0374	-2.286	0.0085	0.696	-0.0853	-3.195	0.1440	12.674
WAGE	-0.2494	-8.570	-0.2622	-11.063	-0.3149	-7.576	-0.1788	-7.383
BREADWIN	0.2761	15.593	0.0765	5.829	0.1079	4.219	0.0632	5.087
MONTHEXP	0.0004	2.863	0.0002	1.456	0.0004	2.254	0.0003	2.478
MOEXPDUM	-0.1356	-6.065	-0.1507	-8.105	-0.0007	-0.020	-0.0330	-1.936
SIZE1000	0.1887	8.387	0.7058	24.477	-0.1407	-2.074	0.8867	11.423
SIZE500	0.1521	9.244	0.6318	44.305	0.0581	1.525	0.7051	19.221
SIZE30	-0.0314	-1.665	0.4540	35.950	-0.0270	-0.667	0.3761	14.704
SIZE5	-0.2870	-13.729	0.1533	12.792	-0.2459	-5.421	0.1657	9.871
SIZE1	-0.5551	-11.582	-0.1840	-7.030	-0.5855	-5.881	-0.0188	-0.866
DOCTOR	0.0002	1.034	0.0001	0.481	-0.0002	-0.602	0.0003	1.482
PROFES	0.3361	18.458	0.1882	12.518	0.6604	31.086	0.0892	5.526
ADMINI	0.3380	14.034	0.1935	10.453	0.6683	22.110	0.1272	4.562
CLERIC	0.4598	28.313	0.2441	17.640	0.7290	31.579	0.0580	2.588
SALES	0.2984	14.927	0.0054	0.362	0.3008	5.622	-0.0950	-6.738
SERVIC	0.2212	10.119	0.0083	0.517	0.5223	13.128	-0.0680	-4.482
SECURI	0.2499	3.164	0.1131	1.515	0.6482	15.116	0.1533	1.529
TRANSP	0.1212	3.565	0.0360	1.494	0.6565	14.710	-0.0238	-0.623
SICKNUMB	0.1352	17.623	0.1336	22.327	0.1163	10.260	0.1505	27.715
STRESS	0.0631	18.991	0.0450	16.328	0.0553	11.872	0.0380	13.757
NOTVISIT	-0.2136	-11.805	-0.1606	-11.114	-0.1914	-7.237	-0.2010	-13.688
HLTHPRAC	0.0761	25.762	0.0772	32.346	0.0688	16.617	0.0822	35.082
HLTHEXCE	0.5430	28.762	0.4057	26.009	0.4390	16.251	0.3444	22.508
HLTHGOOD	0.6048	30.650	0.4570	27.831	0.5502	19.643	0.4034	24.758
HLTHFAIR	0.5817	33.514	0.4462	31.345	0.5135	20.679	0.3695	26.890
EDU	-0.7311	-5.740	-1.0094	-10.906	-0.5449	-3.367	-0.6556	-6.697
LIFEINSU	0.0002	1.221	-0.0001	-1.706	0.0003	1.977	-0.0005	-6.194
POP1M	-0.0702	-3.906	-0.0878	-4.907	-0.0615	-2.083	-0.0055	-0.309
POP150	-0.0629	-4.418	-0.0799	-6.511	-0.0743	-3.484	-0.0825	-6.279
POP50	0.1025	4.458	0.1272	8.044	0.0638	2.241	0.1129	6.822
POPCUNTY	0.1715	10.958	0.2302	19.329	0.1668	7.877	0.2872	23.232
R-square	0.1545		0.1230		0.1700		0.0947	
Log Likelihood	-40318		-61050		-19560		-58772	
N	73563		101066		38414		93106	

All regressions include the 11 regional dummy variables.
SOCIHI: Society-managed Health Insurance.
GOVTHI: Government-managed Health Insurance.
MUTUHI: Mutual Aid Associations Insurance.
NHI: National Health Insurance.
* Asymptotic t-statistics: the critival value at 1% significance level=2.576;
the critical value at 5% significance level=1.960; and
the critical value at 10% significance level=1.645.

Table 12. Dependent Variable: Health Check-up by Size of Enterprise

	1000 Employees and more		500 - 999 Employees		99 Employees and less	
Variable	Probit Estimate	t-statistic*	Probit Estimate	t-statistic*	Probit Estimate	t-statistic*
C	-1.7438	-2.848	-1.5305	-4.817	-1.7051	-6.032
MALE	0.1814	1.919	0.1969	4.131	0.0939	2.210
AGE	0.0708	2.864	0.0623	4.845	0.0766	6.624
AGESQ	-0.0007	-2.476	-0.0006	-4.296	-0.0007	-5.649
MARRIED	0.0988	2.320	0.0907	4.026	0.1165	5.955
WAGE	-0.1527	-1.685	-0.1023	-2.119	-0.1708	-3.876
BREADWIN	0.1665	3.603	0.0187	0.765	0.0678	3.138
MONTHEXP	0.0004	0.993	0.0002	0.670	0.0001	0.526
MOEXPDUM	-0.1874	-2.831	-0.1643	-4.422	-0.1747	-5.070
SOCIHI	0.2918	5.366	0.2201	7.729	0.3390	12.861
GOVTHI	0.1808	3.161	0.1397	5.158	0.2805	12.627
DOCTOR	0.0000	-0.025	-0.0005	-1.388	-0.0002	-0.618
PROFES	0.0514	1.055	0.0835	3.113	0.1553	6.060
ADMINI	0.1184	1.710	0.1731	4.098	0.0506	1.112
CLERIC	0.0284	0.621	0.1149	4.649	0.0835	3.568
SALES	0.0654	1.099	-0.0305	-0.973	-0.1187	-4.368
SERVIC	-0.0115	-0.186	-0.1147	-3.813	-0.1288	-4.849
SECURI	-0.4324	-2.220	0.0908	0.775	-0.0460	-0.430
TRANSP	-0.0556	-0.672	-0.0441	-1.066	-0.0419	-1.218
SICKNUMB	0.1475	5.678	0.1436	10.768	0.1187	10.176
STRESS	0.0659	6.078	0.0897	15.391	0.0446	8.708
NOTVISIT	-0.0745	-1.314	-0.1385	-4.624	-0.1056	-3.892
HLTHPRAC	0.0823	8.843	0.0874	17.673	0.0841	18.836
HLTHEXCE	0.6632	11.586	0.5435	17.836	0.4366	15.337
HLTHGOOD	0.7190	11.900	0.6130	18.935	0.5229	17.368
HLTHFAIR	0.7005	13.278	0.5918	21.079	0.5140	19.594
EDU	-0.0272	-0.067	-0.3381	-1.684	-0.9839	-5.611
LIFEINSU	-0.0004	-1.096	-0.0001	-0.388	-0.0003	-1.716
POP1M	-0.0699	-1.188	-0.1072	-3.141	-0.0507	-1.520
POP150	0.0078	0.174	-0.0312	-1.262	-0.0569	-2.479
POP50	0.0676	0.980	0.0777	2.322	0.0758	2.632
POPCUNTY	0.1264	2.660	0.1300	5.351	0.1702	7.737
R-square	0.0765		0.0737		0.0721	
Log Likelihood	-4092		-14434		-17937	
N	8589		28375		31046	

All regressions include the 11 regional dummy variables.

* Asymptotic t-statistics: the critival value at 1% significance level=2.576;
the critical value at 5% significance level=1.960; and
the critical value at 10% significance level=1.645.

Table 13. Dependent Variable: Patient (2SLS) and Hospital (2SLS)

	PATIENT Probit	Ages 30-60		HOSPITAL Tobit	Ages 30-60	
Variable	Estimate	t-statistic	Marginal Effect	Estimate	t-statistic	Marginal Effect
C	-4.6081	-12.932		-405.231	-7.170	
CHECKUP	-9.6757	-65.322	-0.120	-575.622	-24.402	-0.041
CHEK1000	-0.7195	-1.226	-0.009	10.701	0.118	0.001
CHEK500	-0.0496	-0.162	-0.006	45.818	0.910	0.003
CHEK30	-0.2148	-0.666	-0.003	-54.074	-1.070	-0.004
CHEK5	-0.8034	-2.218	-0.010	-118.270	-2.155	-0.008
CHEK1	-2.1855	-2.011	-0.027	-112.444	-0.721	-0.008
CHEKPUB	-2.1956	-5.381	-0.027	-86.151	-1.293	-0.006
SIZE1000	3.7720	10.221		149.822	2.928	
SIZE500	3.1012	17.279		130.085	4.833	
SIZE30	2.3251	14.748		133.779	5.943	
SIZE5	1.2172	9.379		70.173	3.940	
SIZE1	0.0480	0.188		-38.103	-1.159	
PUBEMPLY	5.5127	19.924		258.182	6.177	
PROFES	0.2918	6.290		31.031	4.114	
ADMINI	0.9264	15.937		66.008	7.070	
CLERIC	0.6721	13.303		45.817	5.634	
SALES	-0.3711	-7.811		-12.547	-1.663	
SERVIC	-0.3819	-7.922		-17.624	-2.328	
SECURI	1.0461	7.914		79.401	3.445	
TRANSP	0.1110	1.577		14.978	1.338	
AGRICU	0.2848	4.432		7.601	0.764	
FOREST	-0.1884	-0.862		2.217	0.067	
FISHER	-0.6349	-4.394		-59.232	-2.601	
CRAFTM	-0.1087	-2.958		3.788	0.643	
MALE	0.2470	5.772		36.971	5.361	
AGE	0.1653	11.055		10.951	4.656	
AGESQ	-0.0010	-6.111		-0.056	-2.212	
MARRIED	0.1643	5.527		-6.477	-1.436	
HUSMEMBR	-0.0140	-1.763		-0.458	-0.377	
HLTHPRAC	---	---		-575.870	-0.330	
HLTHEXCE	---	---		-606.536	-0.108	
HLTHGOOD	---	---		-591.539	-0.080	
HLTHFAIR	---	---		-605.429	-0.121	
DOCTOR	-0.0009	-2.004		-0.122	-1.681	
EDU	-1.1625	-4.680		9.848	0.246	
POP1M	-0.3022	-6.801		-33.945	-4.871	
POP150	-0.2131	-6.383		-19.692	-3.721	
POP50	0.3086	6.857		4.391	0.620	
POPCUNTY	0.7794	23.262		47.880	9.092	
Sigma	---	---		133.041		
Log Likelihood	-7305.79			-17580.1		
Hausman F-ratio	1239.65 (d.f.=7,308424)			66.38 (d.f.=7,310076)		
Hausman Chi-square	30245 (d.f.=25)			67964 (d.f.=21)		
Basmann F-ratio	1031.34 (d.f.=25,308407)			6.00 (d.f.=21,310063)		
F-ratio, instrument	873.06 (d.f.=32,308406)			777.64 (d.f.=28,310062)		
N	308478			310134		

All regressions include the 11 regional dummy variables.

* Asymptotic t-statistics: the critival values are the same as those in Table 8.

Figure 1. Health Check-up:
Total Number, Age and Gender

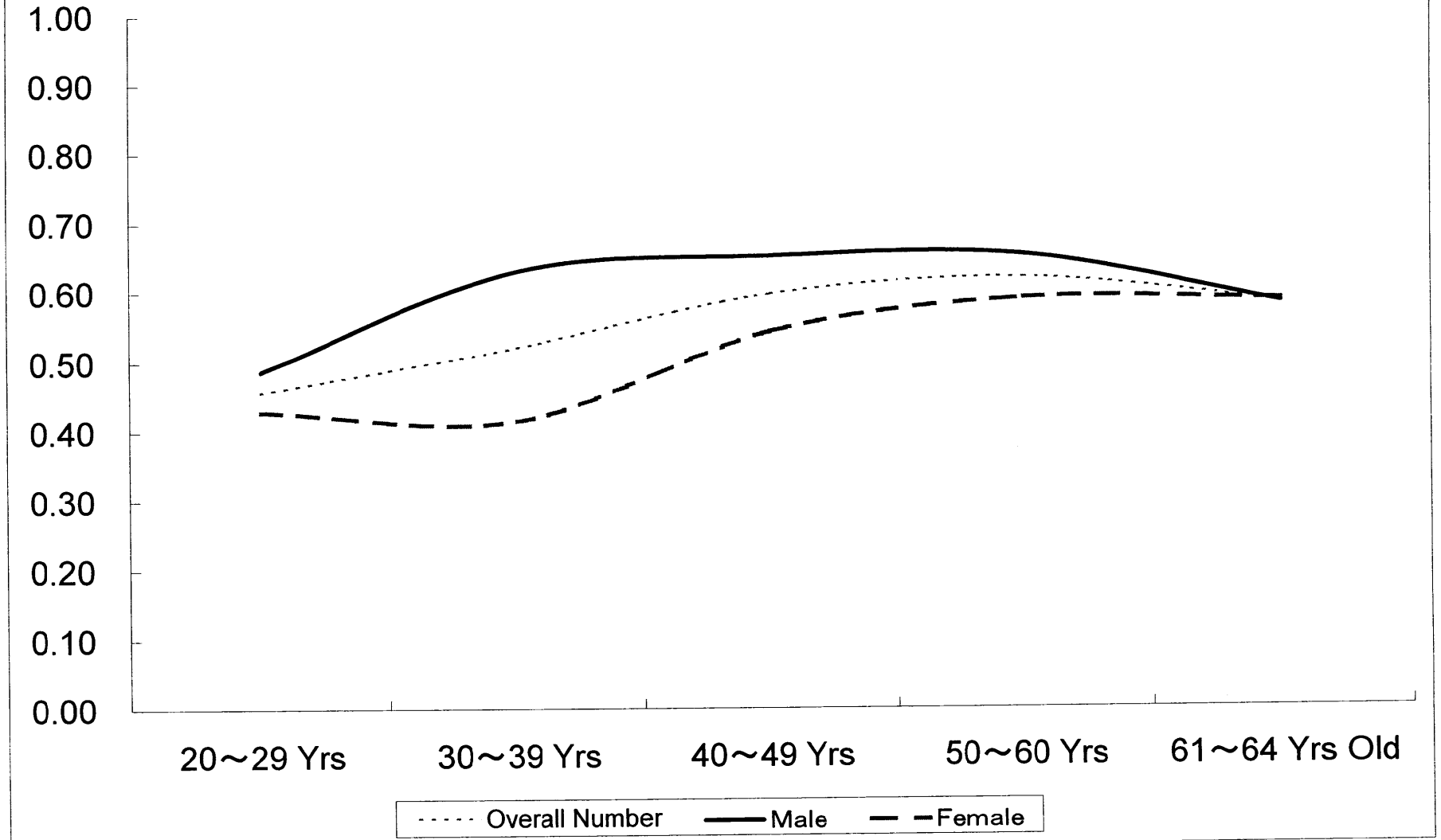

Figure 2. Health Check-up: Insurance Cover

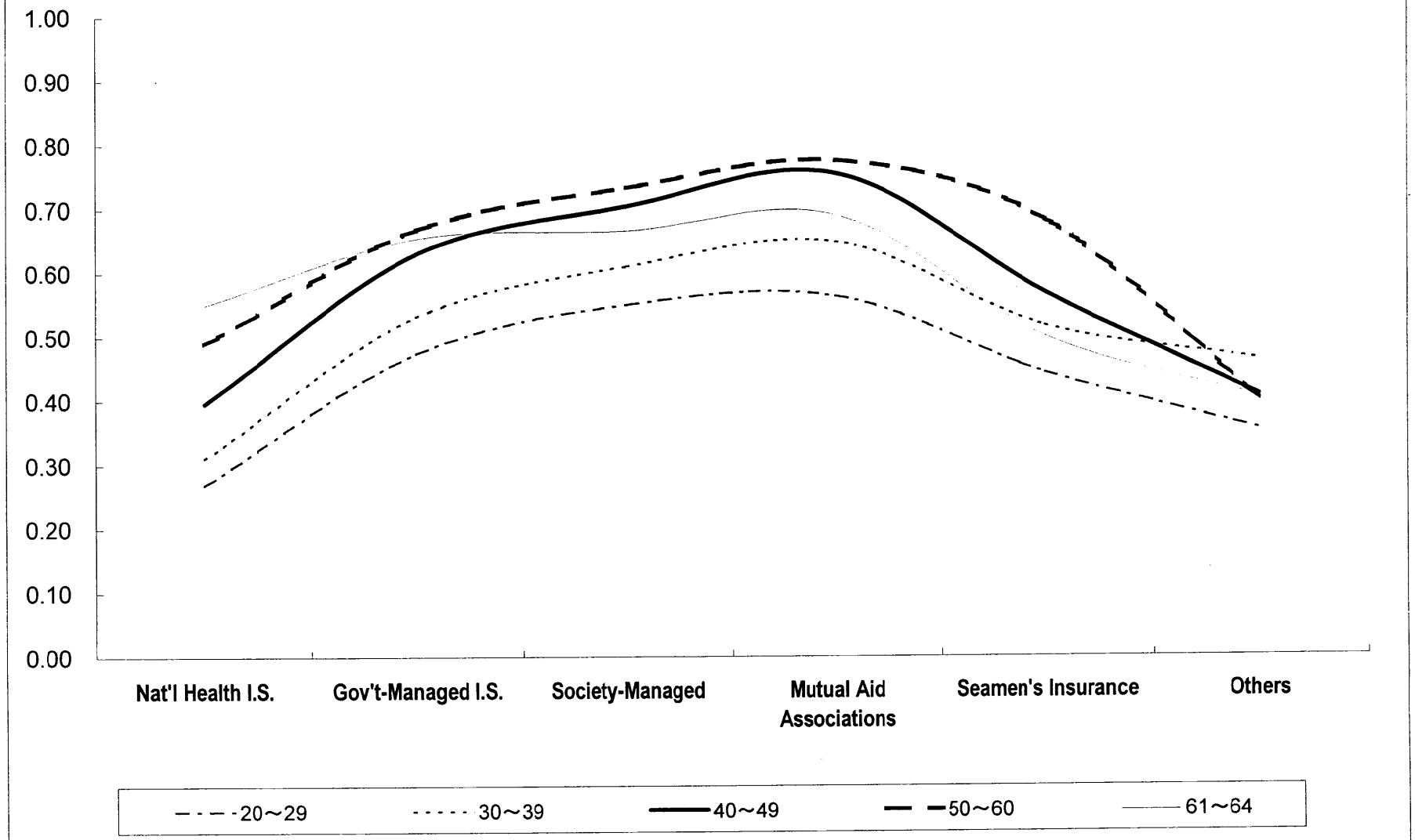

Figure 3. Health Check-up: Employment Status (by Age)

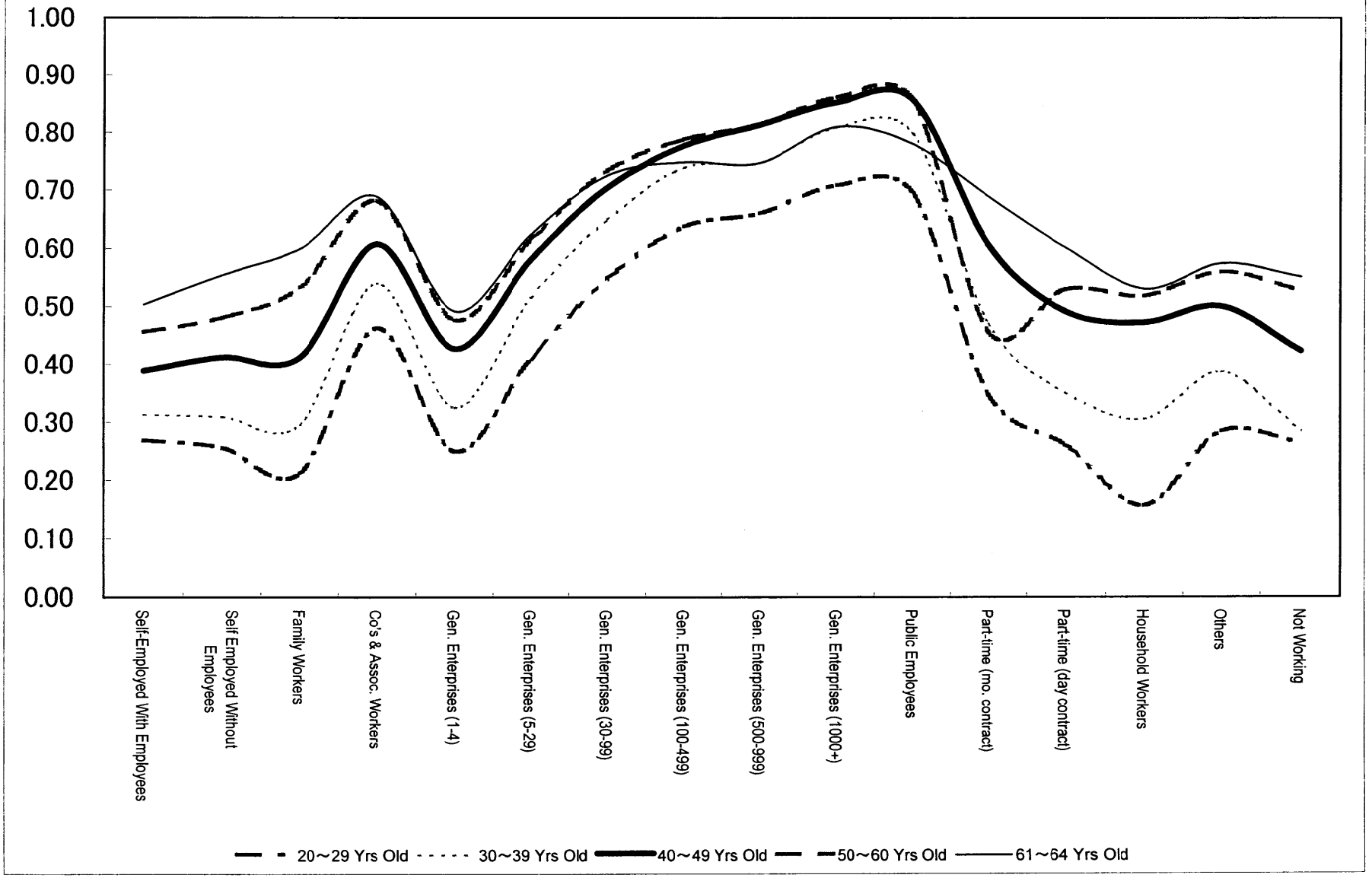

Figure 4. Health Check-up: Employment By Industry (by Age)