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Alternative Methods in Analyzing Economic Policies on the Labor Market and Social Security in Japan

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by

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Chapter 1

Introduction[1]

There are many challenges in the Japanese economic policy on the labor market and social security. In this paper we will focus on some alternative methods in analyzing the related policy issues in Japan.

Chapter 2 provides an overview of the INAHSIM, a microsimulation model developed specially for Japan, with showing some results for a super-aging society in future Japan.

Chapter 3 performs microsimulations on alternative pension policies, using the INAHSIM, and evaluates their effects on future income distribution. It indicates that the number of the late-stage elderly with a low equivalent income will increase in the future, due to the increase in the number of the elderly living alone.

Chapter 4 explores an empirical study on the policy package on child allowance proposed by the new administration by Democrats in Japan. It studies its distributional effects, using the micro data from the *2007 Comprehensive Survey of Living Conditions of the People on Health and Welfare*. It suggests that the major winners will be not the dual-earner households, but those with full-time housewives, on the contrary.

Chapter 5 examines the extent to which poverty in childhood adversely affects success in adulthood, using the microdata from the *Japanese General Social Surveys*, confirming that children from poor families tend to have lower educational attainment, face higher poverty risks, and assess themselves as being less happy and as suffering from poorer health.

Chapter 6 aims at understanding Japanese lifestyle changes by observing the timing of work during the day. Using the microdata from the *Survey on Time Use and Leisure Activities*, it shows

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1 Chapter 1 is written by N. Takayama, Chapters 2 and 3 by S. Inagaki, Chapter 4 by N. Takayama and K. Shiraishi, Chapter 5 by T.Oshio, S. Sano and M. Kobayashi, Chapter 6 by S. Kuroda and I. Yamamoto, Chapter 7 by T. Ikenaga and D. Kawaguchi, Chapter 8 by R. Aoki and R. Vaithianathan and Chapter 9 by S. Ogura and S. Nakazono. The authors are very much grateful to Professors N. Anders Klevmarken and John Karl Scholz for their insightful comments and helpful advices.

that Japan has a secular increase in the share of workers working in the late-night and early-working hours, especially among those with low levels of both education and income.

Chapter 7 examines the training opportunities for marginal workers such as women and non-regular employees by using the microdata from the *2007 Employment Status Survey*, Japan. It tests the hypothesis that workers' predicted labor market attachment determines employer-provided training and self-development.

Chapter 8 points out that families with young children form a small and shrinking voting bloc in Japan, proposing that the country should consider adopting a "Demeny Voting" system under which parents are given proxy votes for their young children. Its proposal is made to address the need for better family policies and to off-set the ageing population.

Chapter 9 estimates smoking rates in Japan, using the microdata from the *National Survey of Family Income and Expenditure*. It indicates that the female smoking rates have been seriously underestimated over the last twenty years and that there is a significant gap in smoking rates of single men and women on one hand, and of married couples on the other.

Chapter 2

Overview of INAHSIM: A Microsimulation Model for Japan

2.1 Introduction

Integrated Analytical Model for Household Simulation (INAHSIM) is a microsimulation model developed specifically for Japan. This model was initially developed in the first half of the 1980s as a tool for household simulation. Following several attempts[2] to improve the model and to add socioeconomic characteristics of the population, the latest version of INAHSIM has been utilized as a microsimulation model for policy simulation.

The first version (Aoi et al., 1986 and Inagaki, 1986) was limited to the household simulation. It simulated only kinship and co-resident relationships. It incorporated the demographic events of birth, death, marriage, and divorce, and a few household movements of "young people leaving home" and "living with elderly parents." The size of the initial population was 32,000 persons and 10,000 households. It took one hour for 50-year simulation by a mainframe computer since the performance of computers at that time was poor for the simulation.

The second version (Inagaki, 2005) was extended its capability for policy simulation. The socioeconomic characteristics of employment status, health status, and earnings are added, and the size of the initial population was increased to 126,000 persons and 46,000 household. Imputation of kinship relationships between the persons living in different households was newly introduced. It improved the quality of the results as household simulation. The impact of the increase in non-regular employment on income disparities (Inagaki, 2007b) was evaluated by using the second version model.

The third version (Inagaki and Kaneko, 2008 and Inagaki, 2009a) was a major revision of INAHSIM. The public pension scheme was incorporated, and it was applied to the evaluation of the effect of some proposals for pension reform on the income distribution of the elderly (Inagaki,

2 Fukawa (1994, 2007, 2009), Inagaki (2005, 2007a, 2007b, 2009), and Inagaki and Kaneko (2008) made attempts to improve INAHSIM.

2009b). It was introduced a new technique to align the initial population with the Population Census, and obtained better consistency with the official population projections (Kaneko et al., 2008), and household projections (IPSS, 2008) prepared by the National Institute of Population and Social Security Research.

The latest version of INAHSIM introduced in this chapter is a minor revision over the third version. Two life events of international migration and payment of pension premium are added, and most transition probabilities are revised based on people's recent behavior. In particular, the transition probabilities of employment status are assumed to be consistent with the assumptions on the 2009 actuarial valuation on Employees' Pension Insurance and National Pension (Actuarial Affaires Division, Pension Bureau, Ministry of Health, Labor and Welfare, 2009). Consequently, the simulation results are very close to the official results.

The key feature of this model is that it can simulate kinship relationships in detail. This model is not limited to parents, children, husbands, and wives, and can simulate all kinds of kinship relationships including those involving uncles, nieces, cousins, sons of separated parents, grandnephews, and great-grandnieces. This information is very important to simulate household changes in Japan since household mergers among family members—for example, adult children resettling to care for their aged parents or returning to their parents' households following divorce—are common.

The kinship relationships are also important to determine the benefits of public assistance for the poor. Under the Public Assistant Law, certain relatives—for example, parents, children, grandchildren, and nephews/nieces—are required to support a person in need. The relatives are investigated as to whether or not they can support the person when the benefit of public assistance for the poor is claimed.

The objective of this chapter is to provide an overview of the latest version of INAHSIM. Section 2.2 describes the database structure of the model population, simulation cycle, transition probabilities, and statistics. Section 2.3 describes the initial population in its source, alignment method, and imputation of the kinship relationships. Section 2.4 shows some results for the future that indicate a super-aging society in Japan. Finally, the author will discuss the future of the

microsimulation models that can be applied to Japan in Section 2.5.

2.2 Structure of INAHSIM

2.2.1 Model population

One of the most important aspects of this microsimulation model is the model population that expresses all individual characteristics. Since the model population defines all the characteristics that the model can simulate, there is a need to incorporate as many characteristics and as much family and household information as possible. On the other hand, keeping the structure of the model population as simple as possible is necessary to develop the model easily and to shorten the execution time of its simulation. This model is carefully designed to meet the abovementioned requirements.

In Japan, the “Family Register” and “Basic Resident Register” have been established as systems for recording such types of information; these registers contain all the particulars pertaining to family and household status. To record the basic changes in families and households, these two registers are updated through six types of notifications: births, deaths, marriages, divorces, move-ins, and move-outs. This system is well suited for the Japanese society and has been working well for more than 100 years. It is also applicable to this model and consequently, the model population is designed on the basis of such registers.

Therefore, the model population comprises three tables that correspond to the Family Register, Basic Resident Register, and individual socioeconomic characteristics. In INAHSIM, these three tables are referred to as “family segment,” “household segment,” and “individual segment,” respectively. As depicted in Figure 2.1, there are links between the family and individual segments and between the household and individual segments.

In this model, a family comprises a couple and their children. The family segment has individual segment ID numbers for the husband, wife, and the youngest child (if any). It also includes certain characteristics of the couple such as the year of marriage, number of children, (if separated) the year the marriage dissolved, and cause of separation (divorce or death of a spouse). A group of children is defined by a list structure. Figure 2.2 depicts a family comprising a

couple—Jim and Mary—and their three children—Ken, Karen, and Tom.

Jim, as a child, is also a member of another family. Let us assume that Jim's father is John, his mother is Liz, and he has a sister named Ann. This family is expressed by Figure 2.3. From these two family segments, we can know the relationships among these persons. For example, Ann is Ken's aunt, Ken is Ann's nephew, John is Tom's grandfather, and so on. In the end, this model structure can define all the kinship relationships in the population.

The individual segment includes individual characteristics such as the year of birth, sex, marital status, health status, employment status, earnings, pension amount, lifetime income, category of the National Pension Scheme, status of premium payment, and history of these characteristics. The employment status is categorized into four different groups[3]—regular employees, non-regular employees, self-employed, and unemployed—on the basis of the category of the National Pension Schemes to which the individual belongs. The individual's health status is divided into two categories—good and poor—on the basis of his/her health awareness or related objective information such as whether or not they have been hospitalized.

The individual segment also includes the family segment ID number that indicates the individual's status as husband or wife, the family segment ID number that indicates the individual's parents, and the household segment ID number that indicates the household to which the individual belongs. These IDs facilitate the specification of the individual's families and households.

The household segment includes household information such as the year of formation of the household, number of household members, private/institutional household, total income of the household, and household structure. It also includes the individual segment ID number that represents one of the members in that household. A person in an institution is treated as a single household. A group of household members is defined by a list structure as depicted in Figure 2.4.

3 Employees covered by the employees' pension insurance (Category No. 2 insured persons under the National Pension Scheme) are classified as regular employees, while other employees and family members working for family-owned businesses are classified as non-regular employees.

2.2.2 Simulation cycle and transition probabilities

2.2.2.1 Simulation cycle

The simulation cycle of this model is shown in Figure 2.5. The life events are assumed to occur in annual cycles. The life events incorporated in this model are marriage, birth, death, divorce, international migration, change in health status, change in employment status, estimating earnings, determining pensions, young people leaving home, living with elderly parents, entering an institution, and payment of pension premiums.

Transition probabilities for each life event are given in advance, and it is possible to take into account their future trends. In the assumptions of the baseline scenario described later, declining trends in first marriage rates and mortality rates are assumed. The future trends in the transition probabilities of employment status are also taken in account. The other transition probabilities of the baseline scenario are assumed to continue in the future.

2.2.2.2 Marriage

First-marriage rates and re-marriage rates by sex and age are used for marriage. With regard to men, the first-marriage rate is differentiated with respect to the employment status, as the first marriage rate of unemployed or non-regular employees is much lower than that of regular employees.

It is necessary to adjust the numbers of brides and grooms since the numbers are not always the same. The adjustment process is as follows. First, select the candidate brides and grooms using the marriage rates twice, and then, calculate the average number of candidates. The number of couples would be the average figure divided by two. Next, take a sampling of the candidate brides and grooms. Finally, form couples between the sampled brides and grooms sorted by their age.

When a marriage takes place, the couple decides to live with the groom’s parents, live with the bride’s parents, or start a new household. This model simulates this decision using the probabilities of the living arrangements at marriage.

2.2.2.3 Birth

Marital fertility rates by parity and mother's age and sex ratio (boys to girls) are used for birth. This model does not take into account illegitimate children since their proportion is very low[4] in Japan. Therefore, the total fertility rate is strongly affected by marriage rates. In fact, one of the major reasons why fertility rates in Japan are declining is the low marriage rate among young women. Newborn babies will belong to their mothers' households.

The nationality of newborn babies is Japanese if at least one of their parents is Japanese. Otherwise, the babies are non-Japanese. The z-score[5] to estimate their future earnings is given as the average of their parents' z-scores plus disturbance term. Therefore, the income level, a kind of social class, is inherited from their parents.

2.2.2.4 Death

Mortality rates by sex and age are used for death. It is also controlled by their health status, and the mortality rates for people with poor health status are higher than those for people with good health status.

In the case of a person's death, if there exists a nominee (the deceased's spouse) who is eligible to a survivors' pension, the pension amount is determined in this life event. The pension amount is principally three-fourths of the earnings-related part of the deceased's pension amount.

2.2.2.5 Divorce

Divorce rates by wife's age are used for divorce. It is also controlled by whether the couple has dependent children. The divorce rates for couples with dependent children are lower than for those without dependent children. The custody of children is determined by the given probabilities. The children will live with the parent who has their custody.

When a divorce takes place, the divorced husband/wife decides to return to his/her parents' household or form a new household. This event is important since around half of the divorcees

4 The percentage of illegitimate births in 2008 is 2.1%.

5 Refer 2.2.2.9 Estimating earnings. Earnings are assumed to conform to a log-normal distribution.

return to their parents' households in Japan.

2.2.2.6 International migration

The number of immigrants is higher than the number of emigrants in Japan. Here, the net migration is taken into account, and it is assumed that all immigrants are non-Japanese. The numbers of immigrants by sex and age are used for international migration.

It is assumed that the immigrants are all single, and the distributions of their employment status and earnings by sex and age are the same as those of Japanese single persons. Their z-scores are determined randomly.

2.2.2.7 Change in health status

The health status is classified as good or poor, and is assumed to deteriorate with age. The deterioration rates are specified by age and sex.

2.2.2.8 Change in employment status

With regard to the employment status, the individual is classified as regular employee, non-regular employee, self-employed, or unemployed. Transition probabilities between these four statuses by sex and age are used for the change in employment status. As for women, the transition probabilities are differentiated with respect to their marital status since the employment pattern among Japanese women differs with their marital status.

They are also controlled by whether the life event of marriage occurred for unmarried women since many women sometimes give up their regular employment at marriage in Japan. With regard to married women, they are controlled by whether the life event of the first birth occurred, and whether they live with their parents. Women in Japan still face difficulty in raising their children and working at the same time.

2.2.2.9 Estimating earnings

Earnings are assumed to conform to a log-normal distribution by sex, age group, and

employment status. In this model, the z-score of the earnings-distribution for each person is given in advance, and the person's earnings are estimated on the basis of one's z-score assuming the earnings-distribution by sex, age group, and employment status each year. The z-score does not change over the lifetime of the individual.

2.2.2.10 Determining pensions

This event is a determination of the pension amount to a pension subscriber who has reached his/her pensionable age. Early and deferred payments are not considered. The amount of basic pension is estimated on the basis of subscription category assuming the distribution of newly awarded pension amounts. The amount of earning related pension is estimated on the basis of the pensioner's z-score.

2.2.2.11 Young people leaving home

Young people leave their parents' household for purposes of higher education, finding employment, or changing jobs. Here, the probabilities of never-married young people leaving home by sex, age, and employment status are used as the transition probabilities of young people leaving home.

2.2.2.12 Living with elderly parents

When elderly people, who do not live with their children, become very old and need care, many children move in with their elderly parents to take care of them. This is still an important life event to secure the life of the elderly in Japan. This life event is referred to as "living with elderly people" in this model, and the probabilities by parent's sex and age are used to simulate it.

2.2.2.13 Entering an institution

Probabilities by sex, age, and marital status of entering an institution are used for this life event.

2.2.2.14 Payment for pension premiums

The payment system of pension premiums differs with subscribers' categories under the National Pension Scheme. Category No. 2 subscribers are regular employees, and their premiums are paid to the government through their employers. Category No. 3 subscribers are dependent spouses of Category No. 2 subscribers, and they are not necessary to pay their premium. Category No.2 and Category No.3 subscribers will receive their pensions in accordance with their subscribing period.

Category No.1 subscribers are self-employed, non-regular employees, or unemployed. Low earners are exempt from the payment of the premiums[6], but others should pay their premiums by themselves. However, some of earners[7] do not pay their premiums. The percentages of people exempt from paying the premiums, paying the premiums, or not paying premiums by sex and age are given to simulate the payment of pension premiums for Category No.1 subscribers.

2.2.3 Compiling statistics

This model produces a longitudinal micro dataset of individuals, families, and households for the future. Many basic statistics such as population statistics or vital statistics are compiled during the simulation process. Other special statistics or statistical analyses, if necessary, can be made using the longitudinal micro data output independently from the simulation process.

Stochastic errors derived from the Monte Carlo method can also be estimated by repeating simulations with different sets of random numbers.

2.2.4 Computer language and execution time

This model is written in FORTRAN90. If the initial population is 127,782 persons, that is, 1/1000 of Japan's population, it takes about 30 seconds to make a 100-year simulation using a PC with 12GB RAM and an Intel® Core i7 975 Extreme Edition 3.33GHz processor. Since the execution time is relatively short, it usually takes an average of 100 simulation runs to evaluate the

6 They will receive a certain percentage of the full amount of the basic pension based on their type of exemption and subscribing period.

7 About 40% of such subscribers did not pay their premiums in the fiscal year 2008.

simulation results.

2.3 Preparation of the Initial Population

2.3.1 Source of the initial population

The Comprehensive Survey of the Living Conditions of People on Health and Welfare (CSLC) conducted by the Ministry of Health, Labor, and Welfare is the main source of the initial population[8]. The survey is conducted every three years using large sample sizes. In the 2004 survey, the sample size was 25,091 households and 72,487 household members. The survey covers kinship relationships within household members, marital status, employment status, health status, earnings, pension amounts, and other socioeconomic characteristics. The initial population of 49,307 private households and 126,570 household members is prepared by resampling with replacement from the micro data. The elderly population of 1,212 persons in institutional households is prepared separately and is added to the initial population. In the end, the initial population is 127,782 persons, and reflects Japan's society on a 1/1000 scale.

However, some information—for example, the kinship relationships between the persons living in different households, histories of employment status and earnings, nationality, and so on—cannot be obtained from CSLC. Such information is imputed.

Another problem with CSLC is its collection rate. It was 54.7% in the 2004 survey; note that this rate varies according to sex, age, and household structure. The collection rate of single-person households was very low, and that of young people was also very low. These differences are adjusted by weighing the resampling rates when the initial population was prepared.

2.3.2 Adjustment of collection rate and resampling with replacement

Since the collection rates of CSLC differs with the characteristics of persons or households, it is necessary to prepare the initial population by resampling the mother sample for consistency with the Population Census. However, the alignment of the initial population is not easy since we should

8 The data used in this study were made available to the author by the Ministry of Health, Labor, and Welfare of Japan, notice number No.0219001 dated 13 January 2009.

align both the number of households and number of persons with census data. The iteration method is used in this model.

Repeat steps (a) to (c) until the adjustment rates are convergent. In our case, it took about 100 times to be convergent.

Estimate (1) the numbers of persons by sex, age group and marital status, and (2) the numbers of household by sex and age group of the head of the household, and household structure using the adjustment rate for each household calculated in step (c).

Compare the estimates with the Population Census, and recalculate the adjustment rates of the sampling fractions for (1) persons by sex, age group and marital status, and (2) households by sex and age group of the head of the household and household structure.

Take an average of the adjustment rates in step (b) for each household and these averages are applied as the new adjustment rates in step (a).

2.3.3 Imputation of kinship relationships between the persons living in different households

As discussed in section 2.2, the two family segments (Figure 2.2 and Figure 2.3) are essential to specify the kinship relationships. This means that all of the kinship relationships will be specified if the parent-child relationships are specified among the initial population. Here, the question is how to impute the parent-child relationships among the persons living in different households. The imputation method is as follows:

List the persons or couples who have children but live separately using the CSLC results. CSLC surveyed the number of children who live separately for each person.

Randomly draw children whose parent(s) would be alive using the probabilities by child's age that his/her mother or father is alive. These probabilities can be estimated from the life tables using the average age difference between parents and children.

Make a match between the couples on the list (a) and the children on the list (b) in order of age.

2.3.4 Imputation of other characteristics

With regard to earnings, the micro data of CSLC is modified because it surveyed the earnings

in the previous year[9]; consequently, the earnings are inconsistent with other characteristics such as employment status. Specifically, the earnings are imputed in the same way as the life event of "estimating earnings."

The personal histories of employment status are imputed by applying the transition probabilities retroactively. Those of earnings are imputed in the same way as the life event of "estimating earnings."

The pension amounts of pensioners are also inconsistent with their age or employment status since it surveyed the amount in the previous year. These are imputed in the same way as the life event of "determining pensions."

Nationality is assigned randomly using the percentage of non-Japanese population[10] by sex and age.

2.4 Some results of the simulation

2.4.1 Baseline scenario

In this article, some simulation results on the basis of a baseline scenario are introduced. The baseline scenario is supposed to serve as a benchmark for assessing the impact of policy change or behavioral changes. The scenario assumes that people's behavior—as it was in 2005—would not, in principle, change in the future. However, the declining trends in mortality and first marriage rates are assumed. The increasing trends of participation rates in the labor market of women, young persons, and aged persons are assumed in order to align with the assumption of the 2009 actual valuation on the public pension scheme.

2.4.2 Population

Table 2.1 shows the simulated future trend in population by age group and compares the same with the official population projections of the National Institute of Population and Social Security

9 The earnings in the survey indicate the amount of earnings in the year 2003, and the employment status indicates the employment status as of June 1, 2004.

10 According to the 2005 Population Census, the percentage of non-Japanese population was 1.2%.

Research (Kaneko et al., 2008). The differences between the two estimates are within 1% or so except for the population under 15. This is because the fertility rates[11] used for this simulation are slightly higher than those used for the official population projections.

In any case, Japan's population will be very old, and the proportion of elderly people will be 30.5% in 2025 and 39.4% in 2050. On the other hand, children and working population will decline sharply.

2.4.3 Number of private households

Table 2.2 shows the simulated future trends with regard to the number of private households and their size and compares the same with the official household projections of the National Institute of Population and Social Security Research (2008). Both estimates are very close, and they show that the size of private households will decrease at least until year 2030. According to the simulation results, the household size will decrease after 2030, and will start stabilizing by 2075.

2.4.4 Number of subscribers of the National Pension Scheme

Table 2.3 shows the future trends with regard to the number of subscribers of the National Pension Scheme by category and compares the same with the 2009 actuarial valuation conducted by the Actuarial Affairs Division, Pension Bureau, Ministry of Health, Labor and Welfare (2009). All residents in Japan between the ages of 20 to 60 are eligible and required to become a subscriber of the National Pension Scheme. Regular employees covered by the Employees' Pension Insurance are classified as Category No. 2, and their dependent spouses are classified as Category No. 3. The others are classified as Category No. 1.

The estimates of the number of Category No. 2 are very close, but the numbers of Category No. 1 and Category No. 3 are slightly different. This simulation estimates more category No. 1 subscribers but less category No. 3 subscribers compared to the official actuarial valuation. In this model, the dependent spouses with their earnings below 1,300,000 yen are classified as Category

11 The recent trends in fertility rates are much higher than the assumptions used for the official population projections.

No. 3. The earnings are assumed to conform to a log-normal distribution. It means that the distribution of these earnings is not exactly log-normal. However, it is noted that the official actuarial valuation does not always provide valid estimates since the proportion of dependent spouses is assumed to be exogenously fixed in the actuarial valuation.

2.4.5 Elderly population by family type

Table 2.4 shows the future trends with regard to the number of elderly people by family type. The elderly people in single-person households or institutions will increase rapidly. By 2050, 35.1% of the elderly people will live in such households. On the other hand, the number of elderly people living with married children will decline sharply. Living with married children was once common for elderly people in Japan. In fact, until 1980, over half of the elderly people were living with their married children. In the near future, Japanese people will experience not only a super-aging society but also dramatic changes in their family type.

2.4.6 Income distribution

Figure 2.6 shows the future trends in income distribution among private households. This income includes earnings and public pensions and excludes property income and social security benefits other than public pensions. This income is gross income, and social security contribution and tax burden are not considered. Since no economic phenomena such as wage increases and inflation rate are considered, the price of this income can be regarded as the price as of the year 2004.

The income distribution will shift to the left, and the number of low-income households will increase considerably. That is because the population is aging and household size shrinking. In the future, the peak of income distribution will be in the group of 1–2 million yen, and the majority of this group will comprise elderly persons living alone or in couple-only households. Their only source of income would be public pensions.

2.4.7 Gini coefficients

Figure 2.7 shows the trends in Gini coefficient. The Gini coefficient in 2004 was 0.426. It will increase yearly, and will reach 0.486 in 2050 and 0.499 in 2100. This implies that income disparities will widen, but this will be mainly caused by the aging of the population and shrinking of the household size.

2.4.8 Lifetime income distribution

Figure 2.8 shows the lifetime income distribution for people born in 1990 by sex. The peak for females will be between 50–74 million yen, and 60.8% of female will earn less than 100 million yen. This is because many females are/will be housewives in Japan, and will not draw salaries. Their main source of lifetime income is the basic pension. The median income for females born in 1990 is estimated to be 83 million yen.

On the other hand, the variation in the lifetime income for males is large, and its peak is around 150 million yen. The median income for males born in 1990 is estimated to be 211 million yen, and it implies that more than half of the males will receive 2 million yen as their lifetime income.

2.4.9 Distribution of the replacement rate of Employees' Pension Insurance

Figure 2.9 shows the distribution of the replacement rate[12] of Employees' Pension Insurance. The definition of "replacement rate" here is the ratio of a couple's pension amounts when the wife's age is 70 to their earnings when the wife's age is 50. If the wife is dependent, i.e., a Category No. 3 subscriber, their replacement rate is higher than that when the wife is not dependent, i.e., a Category No. 1 or No. 2 subscriber. In addition, the replacement rates distribute widely.

2.4.10 Stochastic errors

Table 2.5 shows the stochastic errors derived from the Monte Carlo method. This simulation

12 A replacement rate of a model couple is officially used when the level of pension is discussed. This model couple is defined as follows, and it is unrealistic. The wife and husband are of the same age, and they get married at the age of 20. The husband starts working as an employee (Category No. 2) at the age of 20. The wife is a dependent of her husband for her life (Category No. 3).

takes an average of 100 simulation runs with the initial population of 128,000 persons. Therefore, the substantive size of the initial population is very large—12,800,000 persons, and stochastic errors are negligible.

However, the initial population itself has a sampling error, and the transition probabilities themselves have errors when they are estimated. Moreover, people's behavior may considerably change in the future. It is noted that these figures do not show the level of errors in these simulation results, but merely show the stochastic errors derived from the Monte Carlo method.

2.5 Future Directions

This model is a comprehensive microsimulation model for the Japanese population. As discussed, it provides us plenty of valuable simulation results, which are well aligned with the official projection results. However, it does not make projections for some characteristics such as wealth, education, housing, and health insurance premiums and tax burdens.

Dynamic microsimulation models are not common in Japan. However, the output of microsimulation models, especially that pertaining the distributional aspect of any social change, is more important in Japan than in any other country as Japan will become the most rapidly aging society in the world. Some researchers and policy makers have acknowledged the importance of microsimulation models in social policy making.

Japan is sufficiently well-versed with the development of microsimulation models and has the necessary pre-requisites—availability of suitable micro data, the demands made by policy makers, and computer technologies. A supercomputer may be used for the simulation. The next task is to not only improve the simulation but also introduce the microsimulation models to researchers and policy makers.

References for Chapter 2

Actuarial Affairs Division, Pension Bureau, Ministry of Health, Labor and Welfare (2009), *2009 actuarial valuation on Employees' Pension Insurance and National Pension in Japan* (in Japanese).

Aoi K., Okazaki Y., Fukawa T., and Hanada K. et al. (1986), *Household projection by INAHSIM: A comprehensive approach*, Life Span vol. 6 (in Japanese).

Fukawa T. (1994), "Future trends of Japanese households through micro simulation model: An application of INAHSIM," *The Journal of Population Studies* 18:13-27.

Fukawa T. (2007), *Household projection 2006/07 in Japan using a micro-simulation model*, IPSS Discussion Paper Series No.2007-E02.

Fukawa T. (2009), "Household projections and its application to health/long-term care expenditures in Japan using INAHSIM-II," paper presented to the second general conference of the International Microsimulation Association, Ottawa, June 8 - 10, 17 pages.

Inagaki S. (1986), "An Analytical Model on Household and Family via Micro Simulation (INAHSIM)," *Bulletin of the Institute of Actuaries of Japan* 39:89-188 (in Japanese).

Inagaki S. (2005), *Projections of the Japanese Socio-Economic Structure Using a Microsimulation Model (INAHSIM)*, IPSS Discussion Paper Series No.2005-03.

Inagaki S. (2007a), *Future Socio-Demographic Population Structure of Japan: Projections by a dynamic Microsimulation Model (INAHSIM)*, Tokyo: Japan Statistical Association (in Japanese).

Inagaki S. (2007b), "The Impact of the Increase in Non-regular Employment on Income Disparities," *Journal of Income Distribution* 16:71-87.

Inagaki S. (2009a), "INAHSIM: A Japanese Microsimulation Model," paper presented to the second general conference of the International Microsimulation Association, Ottawa, June 8 - 10, 15 pages.

Inagaki S. (2009b), "Effect of Proposals for Pension Reform on the Income Distribution of the Elderly in Japan," paper presented to the second general conference of the International

Microsimulation Association, Ottawa, June 8-10, 20 pages.

Inagaki S. and Kaneko N. (2008), "Projections of Income Distribution using a Microsimulation Model (INAHSIM)," *Fiscal 2007 Report for Research on Social Security that Pays Attention to the Relationship between Income/Property/Consumption and Contribution/Taxes*, 383-410 (in Japanese).

Kaneko R., Ishikawa A., Ishii F., Sakai S., Iwasawa M., Mita F. and Moriizumi R. (2008), "Population Projections for Japan: 2006-2055 Outline of Results, Methods, and Assumptions," *The Japanese Journal of Population* Vol.6, No.1, 76-114.

National Institute of Population and Social Security Research (2008), *Household Projections for Japan: 2005-2030*, Tokyo: Health and Welfare Statistics Association (in Japanese).

Tables & Figures

Table 2.1: Population by age group (in thousands)

	Simulation results				Population projections 2006			
	Total	0-14	15-64	65+	Total	0-14	15-64	65+
2004	127,782	17,766	84,983	25,033	—	—	—	—
2025	120,057	12,206	71,278	36,574	119,270	11,956	70,960	36,354
2050	96,061	8,524	49,694	37,843	95,152	8,214	49,297	37,641
2075	68,984	5,911	33,908	29,165	68,216	5,732	33,686	28,798
2100	48,133	4,126	24,272	19,735	47,712	4,093	24,144	19,475

Table 2.2: Number and size of private households (in thousands)

	Simulation results			Household projections 2008		
	Population	Number of households	Size of households	Population	Number of households	Size of households
2004	126,570	49,307	2.57	—	—	—
2010	126,037	50,800	2.48	124,460	50,287	2.47
2020	121,204	51,483	2.35	119,039	50,441	2.36
2030	113,193	50,085	2.26	110,637	48,802	2.27
2050	92,810	43,348	2.14	—	—	—
2075	66,153	32,318	2.05	—	—	—
2100	46,153	22,786	2.03	—	—	—

Table 2.3: Number of subscribers of the National Pension Scheme (in thousands)

	Simulation results				Actuarial valuation 2009			
	Total	Category No.1	Category No.2	Category No.3	Total	Category No.1	Category No.2	Category No.3
2004	70,993	24,345	36,536	10,112	—	—	—	—
2025	61,880	18,465	35,878	7,536	61,540	16,319	36,892	8,328
2050	43,169	12,050	25,940	5,179	42,793	10,944	26,244	5,605
2070	29,512	8,193	17,814	3,506	29,289	7,466	17,976	3,847
2100	21,125	5,858	12,771	2,496	20,990	5,364	12,869	2,757

Table 2.4: Elderly population by family type

	Total	Single-person household	Couple only	Living with married children	Living with unmarried children	Others	Institution
2004	25,033	3,746	8,087	5,869	5,177	942	1,212
2025	36,574	7,659	10,134	4,409	9,824	1,984	2,565
2050	37,843	10,050	9,024	3,274	8,913	3,331	3,251
2075	29,165	9,098	6,762	2,090	5,872	2,511	2,832
2100	19,735	6,335	4,498	1,415	3,930	1,575	1,981

Table 2.5: Stochastic errors

	Year 2025			Year 2050		
	Estimate	Standard error	Stasndard error rate	Estimate	Standard error	Stasndard error rate
Population (in thousand)						
Total	120,057	18	0.01%	96,061	66	0.07%
under 15	12,206	5	0.04%	8,524	9	0.11%
15 - 64	71,278	2	0.00%	49,694	22	0.04%
65 and over	36,574	5	0.01%	37,843	9	0.02%
Houshold (in thousand)						
Number	51,057	4	0.01%	43,348	8	0.02%
Average Size	2.30	0.00	0.00%	2.14	0.00	0.00%
Household income (in ten thousand yen)						
Average	522.1	0.8	0.15%	481.5	1.9	0.40%
Median	393.4	0.9	0.23%	328.6	1.7	0.50%
Gini coefficient	0.455	0.000	0.00%	0.486	0.000	0.00%

Figure 2.1: Basic structure of the model population

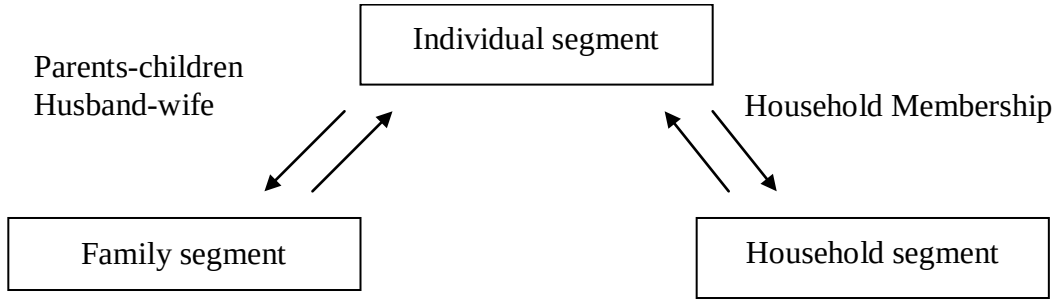


Figure 2.2: A family comprising a couple and three children

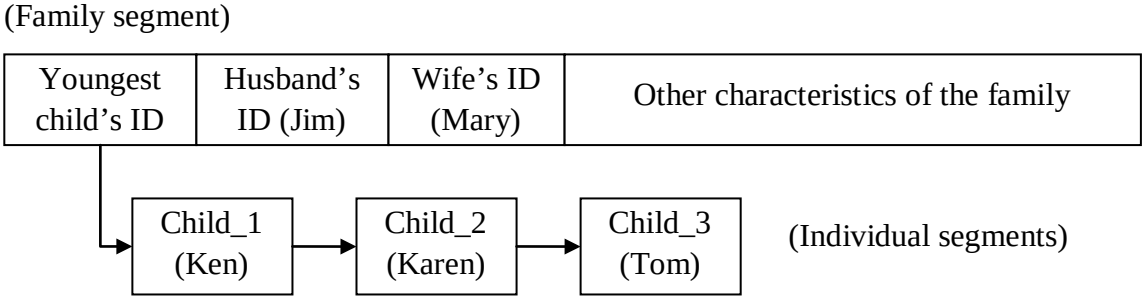


Figure 2.3: Jim's family when he was a child

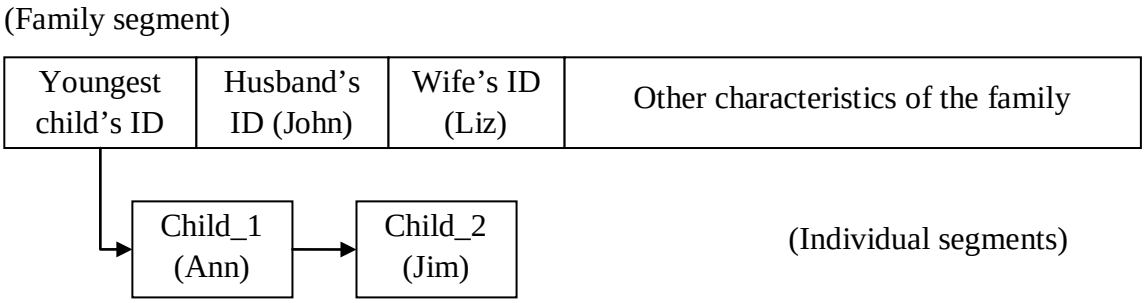


Figure 2.4: Household comprising three persons

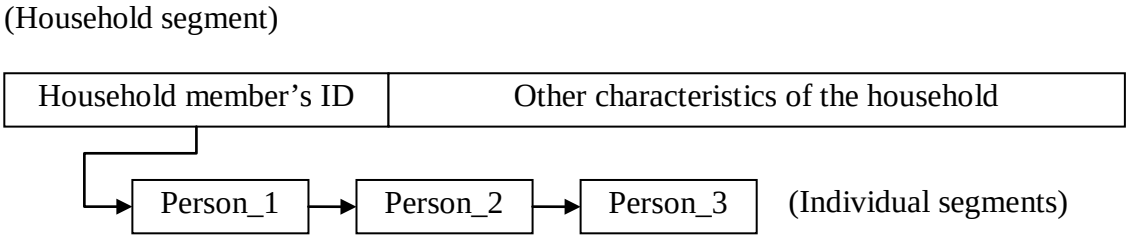


Figure 2.5: Simulation cycle

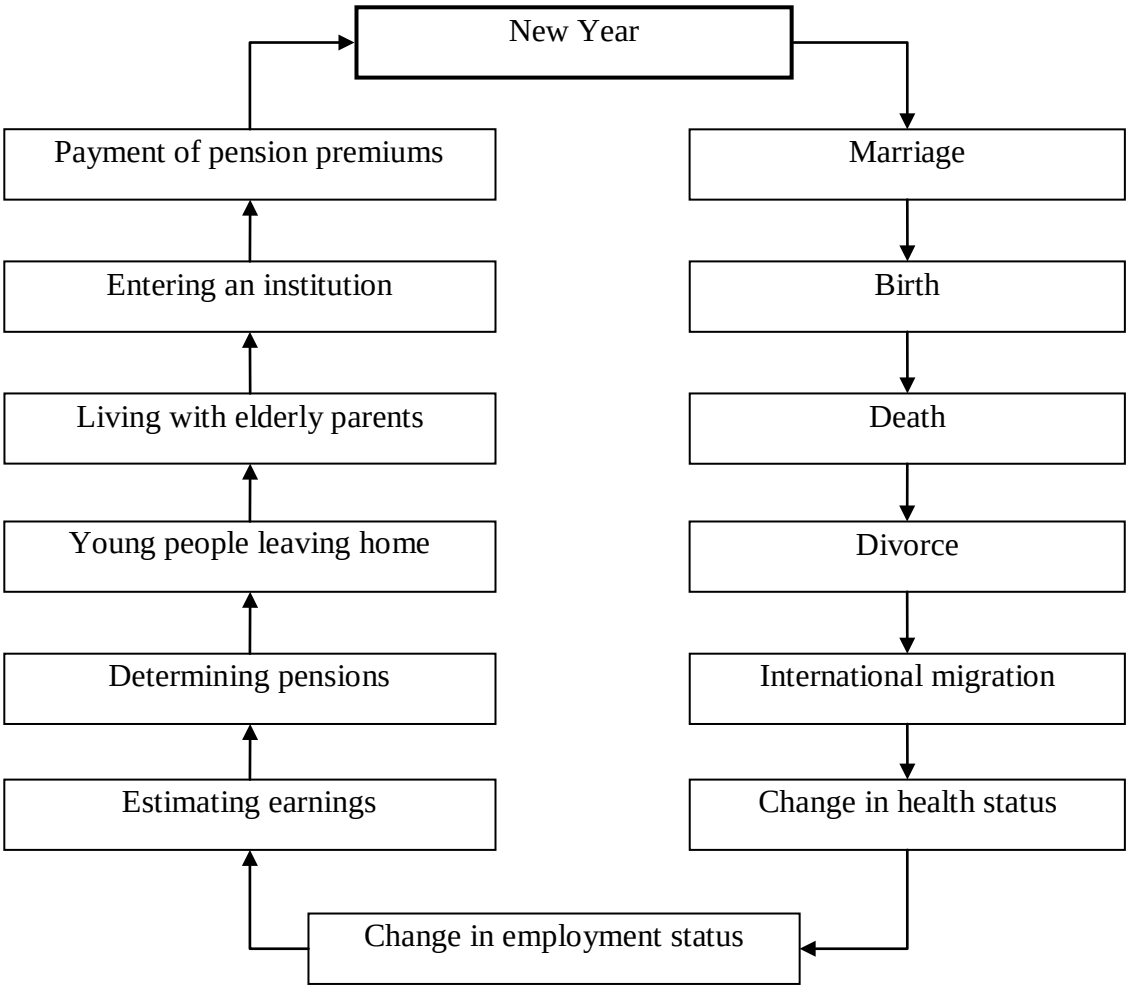


Figure 2.6: Trends in income distribution

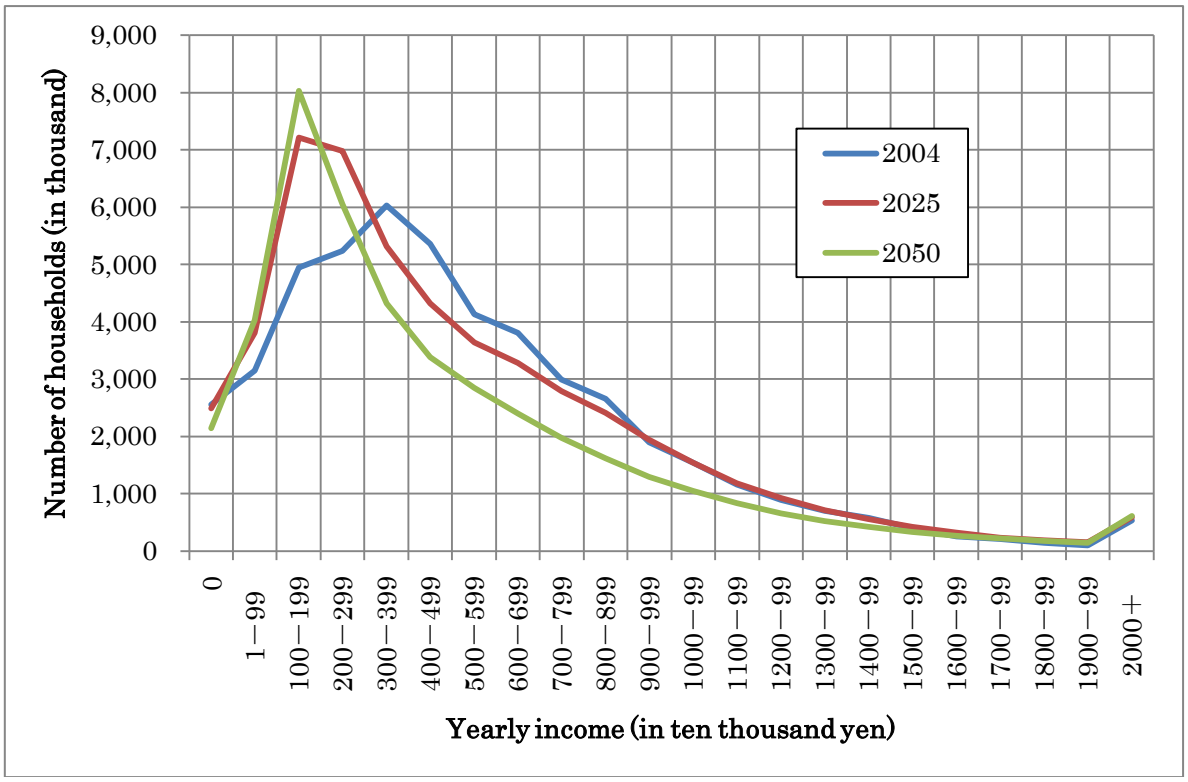


Figure 2.7: Trends in Gini coefficient

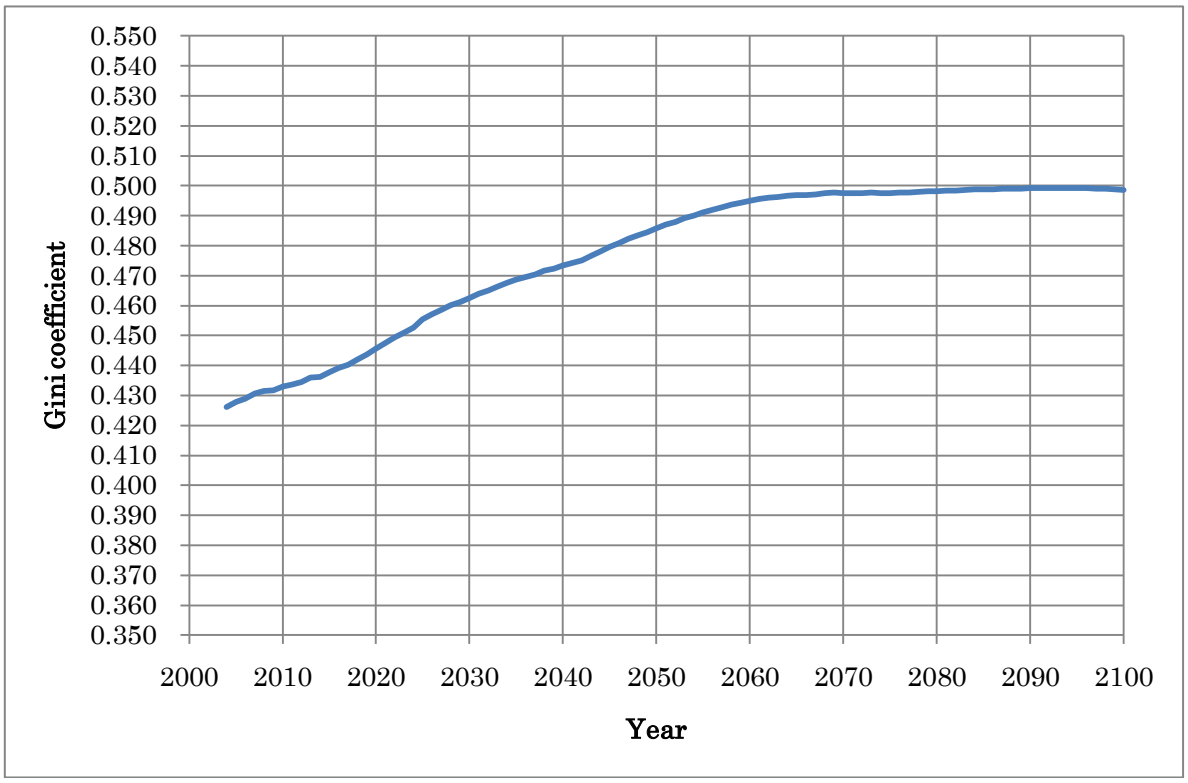


Figure 2.8: Lifetime income distribution by sex

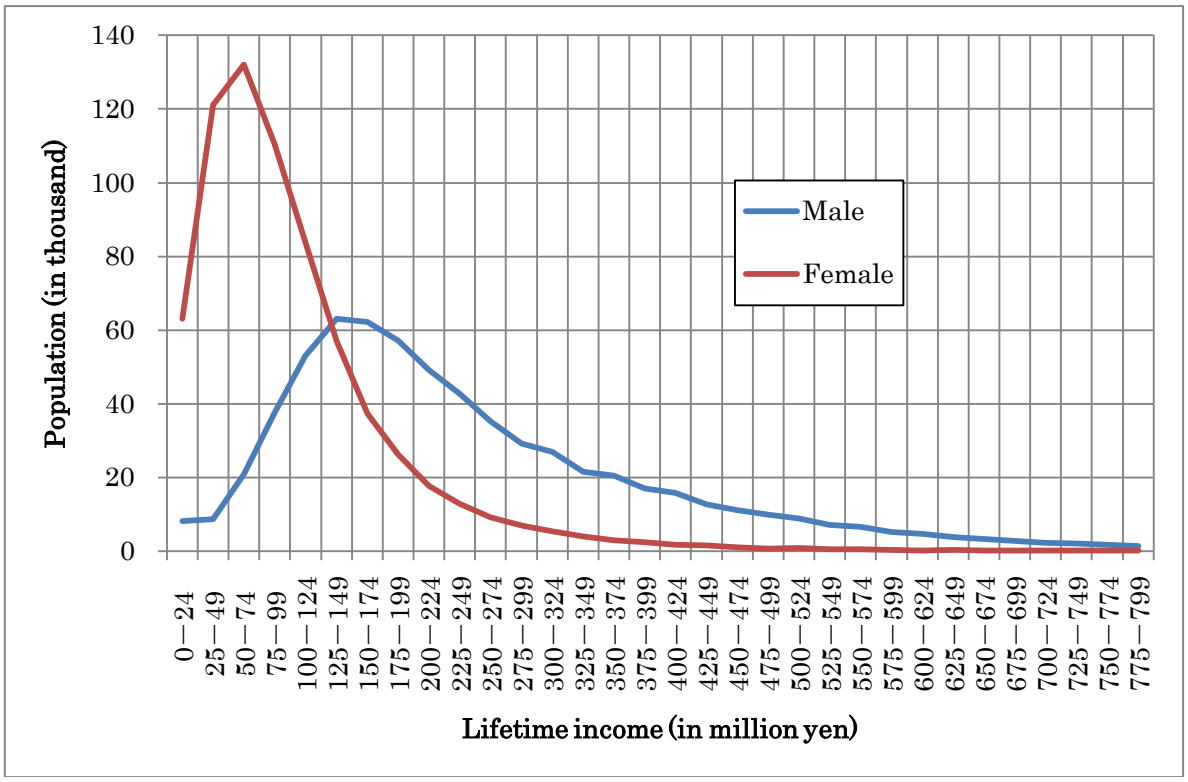
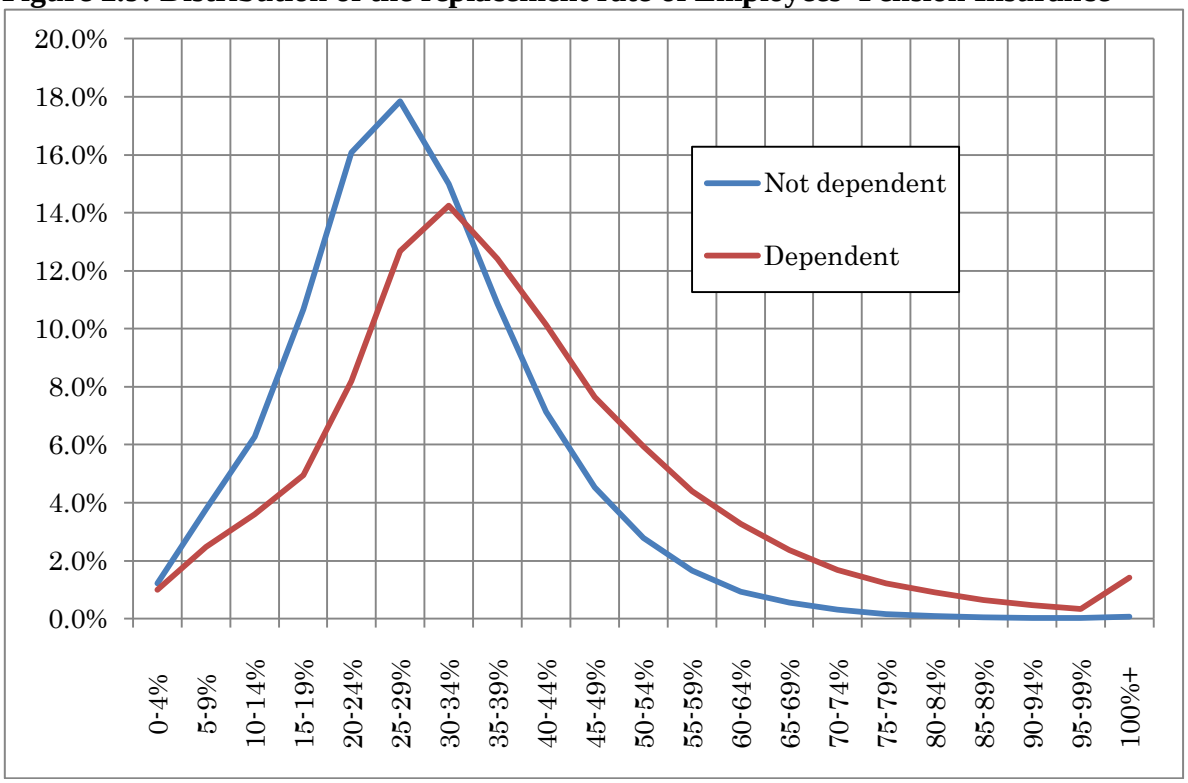


Figure 2.9: Distribution of the replacement rate of Employees' Pension Insurance



Chapter 3

Effects of Proposals for Basic Pension Reform on the Income Distribution of the Elderly in Japan

3.1 Introduction

The advent of a super-aged society unparalleled in the world is forecast for Japan in the near future due to the rapid progress of a declining fertility rate and an aging population. According to an estimate of the National Institute of Population and Social Security Research (Kaneko et al., 2008 and IPSS, 2008), the number of elderly people aged 65 years or older will increase from 25,760,000 (20.2%) in 2005 to 36,670,000 people (31.8%) in 2030. It is projected that there will be a great change to the co-resident of families of elderly people such as those living alone (excluding those institutionalized), which is expected to increase from 3,870,000 people to 7,170,000 people.

The public pension system in Japan is depicted in Figure 3.1. It is a two-tier system that consists of a flat-rate benefit called “the basic pension” and an earnings-related benefit for regular employees. Since the public pension scheme in Japan is based on a social insurance system, and there exist a considerable number of persons who do not pay their premiums, we are concerned about the growing number of the elderly with low pension amounts. Moreover, the number of elderly people living alone, who can expect little private support from their children, will increase significantly.

At the same time, there are significant problems such as mismanaged pension records within the public pension scheme, which contain the main support for the living of those elderly people, resulting in a mistrust and causing a national debate of various issues such as changes in the financing method of the basic pension from a social insurance system to a total taxation system. The report of the Pension Committee of the Social Security Council (2008) held on September 29, 2008 "Viewpoints of the investigation of problems remaining after the revision in 2004" shows 7 viewpoints and the first of these raises the issue of the "revision of pension benefits for the elderly

with low pensions and low incomes." There were differences of opinion of whether or not to use a financing method of the basic pension of either a social insurance system or a total taxation system, but there was no disagreement as to the importance of the first point regardless of each disputant's position on the solution.

Next, what is the current status of elderly people with low pensions and low incomes and will the number of these elderly people increase in the future? Unfortunately, few results of simulations published by the government remain on the several model cases of family finances presently or at a matured stage, and they do not show the results on future estimates such as the distribution of pension amounts. Regarding this point, the interim report of the National Council for Social Security (2008a) points out that "it is difficult to conceive of a great increase in the number of people without pension benefits in the future; rather if the current rate of non-payments for the National Pension continues, a certain proportion (about 2%) of elderly people will be continually without a pension."

The objective of this study is to prepare projections for the income distribution of households containing elderly people using the Japanese microsimulation model, INAHSIM (Integrated Analytical Model for Household Simulation), and evaluate the effect of the proposals on the living standards of the elderly. Section 3.2 mainly describes its simulation cycle and the key life events used in the simulation for the income distribution of the elderly. Section 3.3 first focuses on elderly women living alone and considers their families and the distribution of their pension amounts in the future. Next, expanding the range to all elderly people, by showing quantitatively prospects of the elderly in the year 2030—their families and household, and the distribution of their pension amounts and equivalent income—this section will make clear the problems. Section 3.4 analyzes the effects on the income distribution for the elderly by the public pension reform plans previously proposed and evaluates these effects from the viewpoint of elderly people receiving pensions. Furthermore, based on these quantitative evaluations, we propose a new reform plan. Section 3.5 provides a summary and points out issues and prospects for the microsimulation model.

3.2 Simulation cycle and key life events of INAHSIM

The simulation cycle of INAHSIM is shown in Figure 3.2. The life events are assumed to occur in annual cycles. The life events incorporated in this model are marriage, birth, death, divorce, international migration, change in health status, change in employment status, estimating earnings, determining pensions, young people leaving home, living with elderly parents, entering an institution, and payment of pension premium. The key life events used in the simulation for the income distribution of the elderly are “Living with elderly parents,” “Estimating earnings,” and “Determining pensions.” The first event is “Living with elderly parents.” When elderly people, who do not live with their children, become very old and need care, many children move in with their elderly parents to take care of them. This is an important life event to secure the life of the elderly in Japan. The second event is “Estimating earnings.” Earnings are assumed to conform to a log-normal distribution by sex, age group, and employment status. The z-score of the earnings-distribution for each person is given in advance, and person’s earnings are estimated. The third event is “Determining pensions.” The pension amount is estimated on the basis of a pensioner’s z-score and subscription category assuming the distribution of the newly awarded pension amounts. Early and deferred pensions are not considered. The initial population of this model is scaled down to 1/1000th of the population of Japan, and the size is 127,782 persons and 49,307 private households. As mentioned in chapter 1, an average of 100 simulation runs is taken for the results to reduce the stochastic error. Therefore, the substantial size of the initial population is very large, and the stochastic error derived from using the Monte Carlo method is negligible.

3.3 Simulation results and consideration

3.3.1 Trends of the family and the income of elderly women in the future

In discussions at the National Council for Social Security, elderly women living alone are considered to be low-pension and low-income persons. For that reason, for elderly women 65 years and older, we will discuss the future trends in the marital status, the co-resident families of elderly, and the distribution of their pension amounts.

Table 3.1 shows the future trends in the elderly female population by marital status until the

year 2030. It is expected that the elderly female population will grow 46.3% from 14,435,000 in 2004 to 21,124,000 in 2030. Also, it is expected that the ratio of those married women will decline from 48.0% to 44.7% while the ratio of never-married and divorced will increase, and in 2030, more than 10 million elderly women will be without a husband.

The increasing rates of both never-marrying and divorcing at a mature age are the main contributing factors to the reduction in the married ratio of elderly women. The increasing rate of never-marrying is a phenomenon that has been recently pointed out and, after the year 2020, when those of this generation become elderly, the ratio of never-married will gradually increase. On the other hand, since widows were married when their husbands died, the decline in the ratio of widowed will be a little delayed behind the decline in the married ratio. In other words, if we look at the trends in the elderly female population by marital status until the year 2030, it is expected that the ratio of never-married and divorced will increase while the ratio of married and widowed will decrease.

Elderly women without a husband are not always living alone. Widows often live with their children. Table 3.2 shows the future trends in co-resident families of these women. The elderly female population without a husband will increase by 55.6% from 7,507,000 in the year 2004 to 11,683,000 in the year 2030, but significantly, the increase in those living alone or in an institution will almost double from 3,391,000 to 6,396,000. The reason for this significant increase seems to be the effect of a trend toward nuclear families after high economic growth in the 1960s. The increase in the ratio of never-married and the divorced have also contributed to the trend.

Furthermore, among these elderly women without husbands living alone or in an institution, those women who do not have any children (alone in the world, or only have siblings, nephews or nieces) are expected to total 2,575,000 (22.0%) in the year 2030. Their source of incomes will be their own pensions and property income if any because they seldom expect financial support from their families or relatives.

Table 3.3 shows the distribution of the public pension amounts to elderly women without husbands. We have the impression that the number of those with low pensions or no pension will increase, but it is expected that that ratio will actually decrease. These results presume that the fruits

of the pension reforms so far, in which reforms were targeted at pensions of all citizens in addition to women's pension rights, will appear. Another reason why the number of those with low pensions will decrease is the increase in the number of widows entitled to survivors' pensions for their husbands who were employees. As previously described, however, since the increase in the number of people living alone or in an institution is significant, this does not always mean that the living standard of elderly women without a husband will be improved.

Today's debates about revising the public pension scheme arose from the problem of delinquency in the National Pension premiums, and subsequently, the problem of low pensions and no pension were focused on. Actually, however, if we look at the future trends related to the distribution of pension amounts for elderly women, we can see that this problem does not appear to be growing. Furthermore, it is expected that the ratio of people with low pensions or no pension will decline not only for elderly women but also, as will be described later, will equally apply to all elderly people. Conversely, higher pension amounts will be reduced more appropriately, and disparity in pension benefits will be less serious. In terms of the distribution of the pension amounts, we can consider the public pension scheme as being sufficiently reformed.

The problem of low-income as typified by elderly women will arise because of significant changes in the family type of the elderly women rather than in their pension amounts. The level of pension amounts will certainly be improved, but that improvement does not resolve the problem because the number of elderly living alone or in an institution will increase considerably. This is a problem not only for women, but also for all elderly.

3.3.2 Changes in co-resident families and in income levels of the elderly (Prospects of the elderly in the year 2030)

To evaluate the income security function of the public pension scheme for elderly people, it is essential to make future estimates not only of the level of the public pension, but also of their socioeconomic situation like the economic support received from their children living together. Here, we are targeting the year 2030 in which the so-called baby-boomer generation is attaining the late-stage of old age and the number of late-stage elderly is reaching a level near a peak. We will

examine whether we can expect the current pension scheme to fulfill a sufficient income security function in the future by showing the medium-term prospects of (1) the distribution of public pension amounts received by the elderly (public support), (2) the number of the elderly by family type (private support), and (3) the distribution of equivalent income for the elderly (standard of living) divided into the groups of early-stage elderly (65-74 years old) and late-stage elderly (75 years and older).

Table 3.4 shows future trends in the distribution of pension amounts to the elderly for the case in which the current pension scheme is maintained. It is expected that by the year 2030 both the ratio and the number of the elderly[13] with low pension amounts of less than 0.5 million yen will decline due to the maturity of the public pension and the increase in the rate of subscription to the Employees' Pension Insurance. Another reason for the decline is that a part of the husband's employees' pension was transferred to the wife's name as basic pension for the establishment of women's pension right by the amendment in 1985. In addition, for the late-stage elderly, wives with no pension in their own name or only a small amount of pension will receive a survivors' pension when their husbands die. On the other hand, the ratio of people receiving 2 million yen or more is declining. This decline is thought to be caused by the reduction in the pension level for men due to the pension fairness adjustment and the transfer of a part of husband's employees' pension to the wife's name as basic pension by the amendment in 1985.

Table 3.5 shows future trends in the co-resident families of the elderly divided into household types of, besides those in an institution, those living alone, couple-only households, those living with married children, those living with unmarried children, and others. The increase in the number of those living alone for both early- and late-stage elderly is significant. Looking at the total of those living alone or in an institution, it is expected that the number of early-stage elderly will increase from 2,128,000 (15.3%) in the year 2004 to 3,388,000 (24.0%) in the year 2030 and the number of late-stage elderly will increase from 2,830,000 (25.4%) in the year 2004 to 7,583,000 (33.3%) in the year 2030. Among those living alone or in an institution, late-stage elderly without

13 The pension amounts are presumed to be high because the effects of macroeconomic indexation, which reduces the real value of pension amounts, were not incorporated. Thus, the actual ratio of the elderly with low pensions is expected to be higher than the simulation results.

children will increase to 3,189,000 (1,034,000 in the year 2004)[14]. This means that there will be a considerable number of late-stage elderly who cannot help living alone or in an institution due to no children.

The number of elderly living with unmarried children is also increasing by a large margin. These "unmarried children" are a future case of today's "parasite singles[15]." This is a case of both parents becoming elderly while the children cannot become independent of the parental roof because the children do not have sufficient economic resources due to their unstable employment, and therefore, continue to live with their parents without getting married. Consequently, this family type of the elderly cannot expect sufficient economic support from the unmarried children they are living with.

In this way, changes in the co-resident families of the elderly are significant. Also, when considering the future living standard of the elderly, it is insufficient only to look at the distribution of pension amounts. At this point, we must consider equivalent income, which reduces the total of the public pension of the elderly and the incomes of the family they are living with (including the earnings of the elderly person himself or herself) by the square root of the number of household members.

Table 3.6 shows future trends in the distribution of that equivalent income. For the early-stage elderly, the ratios for the bracket from 1.5 million yen to 2 million yen are increasing; the ratios for the high-income bracket above 2 million yen are declining, and the ratio of the low-income bracket is not changing much until the year 2030. Even though the public pension level will be increased for those with low pensions or no pension, no great change can be seen in the ratio of the low-income bracket. This may be due to the effect of offset with the reduction in private support from their co-resident families as a result of the increase in the number of early-stage elderly living alone.

The same trends can be seen in the equivalent income distribution of late-stage elderly as was found in the early-stage elderly. However, since the numbers of the late-stage elderly almost double from 11,132,000 to 22,796,000, the number of people in the low-income bracket will increase

14 estimate by author using INAHSIM

15 A Japanese-English term for single adults who live with their parents and do not marry until their late twenties or thirties

greatly. Actually, the number of people in the bracket less than 0.5 million yen will grow from 538,000 to 866,000, and those in the 0.5 to 1 million yen bracket will grow from 1,275,000 to 2,561,000. In the midst of the decline in the Japanese population, the increase in the numbers in the low-income bracket causes concern because it will have a significant effect on Japanese society.

3.4 Evaluation of public pension reform plans from the viewpoint of the elderly in 2030

3.4.1 Evaluation of public pension reform plans

As described previously, simulation results for the case in which the current public pension scheme is maintained show that the numbers of the low-income bracket for the early-stage elderly hardly increase, but there is a large margin increase for late-stage elderly. We tried an evaluation, using the microsimulation model, to see what kind of effects several pension reform plans previously proposed would have on this increase in the low-income bracket.

The pension reform plans[16] in this chapter are methods to provide a basic pension financed by taxes from the age of 65 with all plans having the same final form. However, there are differences in the treatment of the past premium payments where Plan A has a uniform pension payment that ignores the past premium payments, Plan B reduces pension amounts in accordance with the period of not paying premiums, and Plan C adds on to the pension amounts in accordance with the period of paying premiums. Thus, for current 20-year-old and older subscribers, all of these interim measures, except for Plan A, will remain until all die.

Table 3.7 is a comparison of the distribution of equivalent income for early- and late-stage elderly in the year 2030. For the current pension scheme, there are 1,317,000 (9.3%) early-stage elderly in the low-income bracket of less than 1 million yen and 3,427,000 (15.0%) late-stage elderly in the low-income bracket. This table shows how much of a decrease there is in this low-income bracket by the year 2030 for the pension reform plans. Since the year 2030 is only about 20 years from now, the differences in the interim measures of each pension reform plan will be largely reflected in the equivalent income distribution of the elderly.

16 Plan A, Plan B, and Plan C are shown in interim report of the first subcommittee of the National Council for Social Security (2008b).

First, looking at the early-stage elderly, the low-income bracket for equivalent income of less than 1 million yen declines for each plan with Plan A having 882,000 people (6.2%), Plan B having 1,195,000 people (8.4%), and Plan C having 256,000 people (1.8%), but Plan B stops at a reduction of 0.9 points and the reform has little effect. Plan B regards insurance premiums for the National Pension as all paid after the year 2009, but it is not effective retroactively. This means that its effect of the raise in pension amounts is still small in the year 2030. Since Plan A and Plan C, on the other hand, provide the full amount of basic pension (about 0.8 million yen) to all the elderly 65 years and older, the low pensions or no pension issue is eliminated and the low-income bracket is reduced by a large margin. Notably, Plan C has a large effect on that reduction since it adds the extra benefit in accordance with past payment periods to the full amount of the basic pension.

On the other hand, the number of early-stage elderly with an equivalent income of 2.5 million yen or more do not increase much under Plan A and Plan B, but in Plan C there is a major increase from the 7,766,000 people (54.9%) under the current scheme to 10,418,000 (73.6%). Since Plan C provides the full amount of basic pension in addition to current incomes, this implies that a new high-income bracket will be born. Thus, it can be thought that, in Plan C, there are many unnecessary benefits in terms of being a countermeasure for people with low pensions and low incomes.

Next, if we look at the late-stage elderly, the low-income bracket for the equivalent income of less than 1 million yen declines for each plan with Plan A having 2,257,000 people (9.9%), Plan B having 3,381,000 people (14.8%), and Plan C having 272,000 people (1.2%). However, Plan B stops at a reduction of 0.2 points and the reform has very little effect because the effect of Plan B will be delayed another 10 years after that for the early-stage elderly. Since neither Plan A nor Plan C have a delay like that of Plan B, their reform becomes effective immediately just as for the early-stage elderly.

When these pension reform plans are thought of as countermeasures for people with low pensions and low incomes, Plan B is seen to have very little reform effect by the year 2030. The additional cost for Plan C will be a significant issue because it provides benefits additionally even to the high-income bracket people. On the other hand, Plan A will be effective as a countermeasure for

people with low pensions and low incomes if we only look at the distribution of equivalent income. However, since Plan A ignores the actual past payments of insurance premiums, and both those people who diligently paid their insurance premiums and those who did not pay them will receive the same amounts of pension for the rest of their lives, it is difficult to think of this plan as convincing from the point of view of fairness.

Thus, none of these pension reform plans suffice as countermeasures for people with low pensions and low incomes and cannot be thought to be especially advantageous compared with the current scheme. In other words, any reform plan that simply changes the current basic pension from a social insurance system to a total taxation system are not thought of as very practical even if they use ingenious interim measures.

3.4.2 A new pension reform plan

We evaluated the current pension scheme and the previously-proposed pension reform plans of a total taxation system using the projected results of the distribution of the future equivalent income of the elderly provided by the microsimulation model as a foundation from the viewpoint of income security for people with low pensions and low incomes. From this viewpoint, Plan A is preferable. However, since Plan A has problems such that fairness cannot be ensured for the people who diligently pay their insurance premiums, none of the previously-proposed reform plans can be judged to be superior to the current scheme. As mentioned earlier, however, we cannot avoid the problem where the number of elderly with a low-income level will increase due to significant changes in the co-resident families of the elderly despite the future increase in pension levels.

What measures can be appropriately taken for these elderly people with such a low-income level? One position suggests on-going Public Assistance (income assistance for the poor) rather than a pension scheme. The cost of the assistance for the elderly poor through this on-going public assistance scheme will be lower than that through any pension scheme because Public Assistance is a supplement to the person's best efforts and available resources. Still, various problems with the Public Assistance scheme have been pointed out, such as the problem of stigmas and the increase in administration burdens brought on by the growth of the number of the public assistance

beneficiaries.

As pointed out at the beginning of this chapter, ‘the revision of pension benefits for the elderly with low pensions and low incomes’ is an important issue and a resolution by means of a pension scheme is being aggressively studied. In the Pension Committee of the Social Security Council, countermeasures at the time of benefits and countermeasures at the time of contributions under the current social insurance system are being proposed, and their problems and effects are summarized.

One countermeasure at the time of benefits is an introduction of a minimum guaranteed pension system. But it is necessary to study whether guaranteeing a certain amount of pension regardless of the non-payment period is appropriate under the social insurance system. Currently, the majority of cases of the elderly with low pensions, excluding older women before the establishment of women’s pension rights, have a long period of non-subscription or non-payment. Many of those who are close to the pensionable age are also part of such cases. Furthermore, the Employees’ Pension Insurance for the second category subscribers already has a component of a fixed amount of benefit, which is regarded as a minimum guaranteed benefit. This new minimum guaranteed pension system carries a suggestion that provides benefits for non-subscription and non-payment periods.

Another countermeasure at the time of contributions reduces a part of the premium in accordance with the subscriber’s income at the time of contribution and the reduced part of the premium is supported by a tax. Pension subscribers of the first category include not only self-employed people, but also many employees. Between these self-employed people and employees there is a strong feeling of unfairness regarding whether information on their incomes is being accurately captured, and that feeling of unfairness is a main reason why pension benefits proportional to incomes cannot be introduced for the pension subscribers of the first category. Given this kind of situation, it is essential to consider whether a fair system can be introduced in reality.

Thus, the revision of the pension benefits for the elderly with low pensions and low incomes is not an easy task from the viewpoint of fairness and its additional cost. However, according to the simulation results of the microsimulation model, the problem is especially serious for late-stage

elderly among all elderly. The previously-proposed reform plans targeted all elderly people 65 years and older, but here we want to propose a revision of the pension benefits for the elderly with low pensions and low incomes implemented only for the late-stage elderly. By narrowing down the targeted people, we intend to resolve simultaneously various problems, for example, (1) interim measures for transitions, (2) fairness based on the actual premium payments, (3) the additional cost, and (4) a shift of the burden from an insurance premium to a tax.

In concrete terms, we want to apply the taxation system of Plan A to the basic pensions of the late-stage elderly while maintaining the framework of the current system for the basic pensions of the early-stage elderly. However, the basic pension for the early-stage elderly[17] is fully financed by an insurance premium (details in Inagaki, 2009). This is a framework that avoids the shift from social insurance premiums to tax burdens by changing the funding system of the early-stage elderly and the late-stage elderly, making implementation immediate, with no interim measures, for the elderly with low pensions and low incomes. Since the social insurance system and the total taxation system under this reform plan are clearly distinguished, this should be an easy-to-understand framework.

First, interim measures are basically unnecessary. From the viewpoint of the beneficiary, the basic pension of the late-stage elderly will merely be revised to the full amount. The changes in financial planning can be accomplished by recalculation in the books, and special interim measures are not necessary.

Secondly, the problem of fairness for the actual payments of insurance premiums rarely occurs. This is because the past actual payments are reflected in the basic pension of the early-stage elderly. Actually, the basic pension benefits for 10 years from the age of 65 to 74 are 8 million yen, and that exceeds the total amount of 40 years of insurance premium contributions[18].

Thirdly, an enormous amount of additional burden is not necessary. Of course, some degree of

17 Under the current system, the cost of the basic pension is financed by an insurance premium and a tax on halves.

18 The National Pension premium in fiscal year 2009 is 14,660 yen a month, and in this case the total amount of the insurance premiums for 40 years will be about 7.04 million yen. Furthermore, since the insurance premiums in the past were lower than this, the total amount of past insurance premiums actually paid is less.

additional burden is needed when supporting the full amount of basic pensions for the late-stage elderly, but that is much smaller than the scale needed when implementing Plan A.

Fourthly, for the time being, the problem of shifting the burden from social insurance premiums to taxes will not likely happen. The current tax burden is one-half of the basic pension benefit expense, but since the population of the early-stage elderly and the late-stage elderly is more or less half and half[19], there is no great change in the proportion of tax burden by this transfer of funding.

Finally, in this new reform plan the problem remains that no measures are taken for the low-pension and low-income people in the early-stage elderly. However, uniform benefits for the early-stage elderly are not always appropriate since there will be large individual differences until the age of about 75, such as one's health status or savings from one's working years. If uniform benefits financed by taxes are introduced to the early-stage elderly such as under Plan A, income tests and means tests are not avoided, and such tests will become a complicated system administratively. In addition, because it is difficult to figure out accurate incomes of self-employed people for the tests, it is not easy to devise a fair system. The current pension scheme based on the social insurance system seems to be more appropriate. Of course, there is the Public Assistance as a final safety net and, even if we look at the simulation results, the number of people does not increase in the low-income bracket of the early-stage elderly.

3.5 Problems and future directions

The Japanese society cannot avoid rapid changes such as aging and a shift toward a depopulating society. In the midst of the increase in the elderly, the need for social security is increasing, and how to efficiently distribute into social security benefits the revenue pie that is feared to be shrinking, is an important policy issue. Still, macro future estimates such as the population projections or the actuarial review of pension schemes are prepared by the government while micro future estimates such as the income distribution are not prepared even though their importance is recognized.

19 Since the number of late-stage elderly greatly exceeds the number of early-stage elderly in the future, the ratio of the tax burden will rise gradually, but no rapid shift will occur.

The microsimulation model is a tool to make future estimates at a micro level. In section 3.3, under the current pension scheme, we drew prospects of the elderly in the future—the form of their families and households, the distribution of pension benefits, and the distribution of equivalent income—by using the Japanese microsimulation model INAHSIM. The simulation results show that the number of late-stage elderly with a low equivalent income will increase by a large margin because of the changes in their families such as the increase in the number of elderly living alone although the level of their pension will be raised. Japan has already become a depopulating society, and we cannot avoid the rapid increase in the rate of a low-income population.

In section 3.4, simulations are performed for each of the previously proposed pension reform plans. The simulation results show that the plans are not always practical as a countermeasure for low-pension and low-income people. Furthermore, focusing on the serious problem of the late-stage elderly in their living standard, section 3.4 proposes an alternative reform plan that limits to the late-stage elderly a countermeasure for low-pension and low-income people, and then confirms the effectiveness of this alternative.

In this chapter, policy simulations related to pension reform plans in Japan were performed, and we evaluated the effect of proposals of pension reform on future income distributions. Problems left for INAHSIM include considering the disposable income covering savings, property income, and social security and tax burdens, and economic growth like the wage increase rate and inflation rate. Hereafter, with the cooperation of experts in each field, this model can be improved and can be widely used. Using the improved microsimulation model and its simulation results, policy makers can enhance their function as policy workers and propose more suitable reform plans towards the depopulation and super-aging society of Japan.

References for Chapter 3

Inagaki S. (2009), "The Introduction of the Minimum Pension for the Elderly Aged 75 and Older," in Komamura K. ed.: *How to Choose Pension System*, forthcoming (in Japanese).

Kaneko R., Ishikawa A., Ishii F., Sasai S., Iwasawa M., Mita F. and Moriizumi R. (2008), Population Projections for Japan: 2006-2055 Outline of Results, Methods, and Assumptions. *The Japanese Journal of Population.* Vol.6, No.1, 76-114.

National Council for Social Security (2008a), *National Council for Social Security Interim Report*, http://www.kantei.go.jp/jp/singi/syakaihosyoukokuminkaigi/chukan/siryou_1.pdf (accessed Dec. 30, 2008) (in Japanese).

National Council for Social Security (2008b), *First Subcommittee of the National Council for Social Security Interim Report*, <http://www.kantei.go.jp/jp/singi /syakaihosyoukokuminkaigi/chukan/siryou_3.pdf> (accessed Dec. 30, 2008) (in Japanese).

National Institute of Population and Social Security Research (2008), *Household Projections for Japan: 2005-2030*. Health and Welfare Statistics Association (in Japanese).

Pension Committee of Social Security Council (2008), "Viewpoints of the investigation of problems remaining after the revision in 2004," 11th meeting, document 3, http://www.mhlw.go.jp/shingi/2008/09/dl/s0929-9n.pdf (accessed Dec. 30, 2008) (in Japanese).

Tables and Figures

Table 3.1: Trends in the elderly female population by marital status (in thousands)

Year	Total	Married	Never-married	Divorced	Widowed
2004	14,435	6,928	513	579	6,415
	100.0%	48.0%	3.6%	4.0%	44.4%
2020	20,466	9,917	947	1,507	8,095
	100.0%	48.5%	4.6%	7.4%	39.6%
2030	21,124	9,441	1,412	1,959	8,311
	100.0%	44.7%	6.7%	9.3%	39.3%

Note: estimate by author using INAHSIM.

Table 3.2: Trends in the elderly female population without a husband by family type (in thousands)

Year	Total	Single / institution		Living with married children	Living with unmarried children	Others
			no children			
2004	7,507	3,391	1,270	2,357	1,387	372
	100.0%	45.2%	16.9%	31.4%	18.5%	5.0%
2020	10,549	5,677	2,130	2,008	2,306	557
	100.0%	53.8%	20.2%	19.0%	21.9%	5.3%
2030	11,683	6,396	2,575	1,908	2,738	641
	100.0%	54.7%	22.0%	16.3%	23.4%	5.5%

Note: estimate by author using INAHSIM. "Single or institution" are those women living alone or in an institution.

Table 3.3: Trends in the distribution of pension amounts to elderly women without a husband (in thousands)

Year	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 and over (million yen)
2004	7,507	1,560	2,353	1,593	1,139	862
	100.0%	20.8%	31.3%	21.2%	15.2%	11.5%
2020	10,549	1,222	2,808	2,574	2,191	1,754
	100.0%	11.6%	26.6%	24.4%	20.8%	16.6%
2030	11,683	1,218	2,844	3,327	2,975	1,320
	100.0%	10.4%	24.3%	28.5%	25.5%	11.3%

Note: estimate by author using INAHSIM.

Table 3.4: Trends in the distribution of pension amounts to early- and late-stage elderly (in thousands)

年次	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 and over
2004	13,901	2,153	4,240	2,470	1,475	3,563
	100.0%	15.5%	30.5%	17.8%	10.6%	25.6%
2020	17,132	1,860	5,827	2,885	4,029	2,532
	100.0%	10.9%	34.0%	16.8%	23.5%	14.8%
2030	14,146	1,852	4,622	2,370	3,385	1,917
	100.0%	13.1%	32.7%	16.8%	23.9%	13.6%

(2) Late-stage elderly (75 years and older)

年次	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 and over
2004	11,132	2,562	3,151	1,793	1,305	2,321
	100.0%	23.0%	28.3%	16.1%	11.7%	20.8%
2020	18,906	2,753	5,025	3,291	3,103	4,734
	100.0%	14.6%	26.6%	17.4%	16.4%	25.0%
2030	22,796	2,434	6,393	4,315	5,448	4,206
	100.0%	10.7%	28.0%	18.9%	23.9%	18.5%

Note: estimated by author using INAHSIM

Table 3.5: Trends in the number of early- and late-stage elderly by family type (in thousands)

(1) Early-stage elderly (65-74 years old)

Year	Total	single	couple only	married children	unmarried children	others	institution
2004 年	13,901	1,875	5,552	2,254	3,355	612	253
	100.0%	13.5%	39.9%	16.2%	24.1%	4.4%	1.8%
2020 年	17,132	3,152	5,681	1,416	5,100	1,339	444
	100.0%	18.4%	33.2%	8.3%	29.8%	7.8%	2.6%
2030 年	14,146	2,962	3,833	1,015	4,470	1,440	426
	100.0%	20.9%	27.1%	7.2%	31.6%	10.2%	3.0%

(2) Late-stage elderly (75 years and older)

Year	Total	single	couple only	married children	unmarried children	others	institution
2004 年	11,132	1,871	2,535	3,615	1,822	330	959
	100.0%	16.8%	22.8%	32.5%	16.4%	3.0%	8.6%
2020 年	18,906	3,892	5,206	3,222	4,171	560	1,856
	100.0%	20.6%	27.5%	17.0%	22.1%	3.0%	9.8%
2030 年	22,796	5,182	5,663	3,216	5,601	733	2,401
	100.0%	22.7%	24.8%	14.1%	24.6%	3.2%	10.5%

Note: estimate by author using INAHSIM. "Married children" are the elderly living with married children, and "unmarried children" are the elderly living with unmarried children.

Table 3.6: Trends in the distribution of equivalent income of early- and late-stage elderly (in thousands)

(1) Early-stage elderly (65-74 years old)

Year	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 - 2.5 (million yen)	2.5 and over (million yen)
2004 年	13,901	416	875	1,319	1,521	2,049	7,721
	100.0%	3.0%	6.3%	9.5%	10.9%	14.7%	55.5%
2020 年	17,132	287	1,108	1,612	2,711	2,317	9,096
	100.0%	1.7%	6.5%	9.4%	15.8%	13.5%	53.1%
2030 年	14,146	398	919	1,289	2,088	1,686	7,766
	100.0%	2.8%	6.5%	9.1%	14.8%	11.9%	54.9%

(2) Late-stage elderly (75 years and older)

Year	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 - 2.5 (million yen)	2.5 and over (million yen)
2004 年	11,132	561	1,275	1,271	1,277	1,228	5,520
	100.0%	5.0%	11.5%	11.4%	11.5%	11.0%	49.6%
2020 年	18,906	807	1,975	2,284	2,760	2,739	8,341
	100.0%	4.3%	10.4%	12.1%	14.6%	14.5%	44.1%
2030 年	22,796	866	2,561	3,025	4,461	3,210	8,674
	100.0%	3.8%	11.2%	13.3%	19.6%	14.1%	38.1%

Note: estimate by author using INAHSIM

Table 3.7: Distribution of equivalent income of early- and late-stage elderly by the pension reform plan in the year 2030 (in thousands)

(1) Eary-stage elderly (65-74 years old)

	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 - 2.5 (million yen)	2.5 and over (million yen)
Current scheme	14,146	398	919	1,289	2,088	1,686	7,766
	100.0%	2.8%	6.5%	9.1%	14.8%	11.9%	54.9%
Plan A	14,146	7	875	991	1,913	2,001	8,360
	100.0%	0.0%	6.2%	7.0%	13.5%	14.1%	59.1%
Plan B	14,146	265	930	1,211	2,082	1,751	7,906
	100.0%	1.9%	6.6%	8.6%	14.7%	12.4%	55.9%
Plan C	14,146	1	255	804	1,052	1,617	10,418
	100.0%	0.0%	1.8%	5.7%	7.4%	11.4%	73.6%

(2) Late-stage elderly (75 years and older)

	Total	0 - 0.5 (million yen)	0.5 - 1.0 (million yen)	1.0 - 1.5 (million yen)	1.5 - 2.0 (million yen)	2.0 - 2.5 (million yen)	2.5 and over (million yen)
Current scheme	22,796	866	2,561	3,025	4,461	3,210	8,674
	100.0%	3.8%	11.2%	13.3%	19.6%	14.1%	38.1%
Plan A	22,796	10	2,247	2,571	4,254	4,052	9,662
	100.0%	0.0%	9.9%	11.3%	18.7%	17.8%	42.4%
Plan B	22,796	825	2,556	2,989	4,468	3,236	8,722
	100.0%	3.6%	11.2%	13.1%	19.6%	14.2%	38.3%
Plan C	22,796	1	271	1,527	2,263	3,376	15,357
	100.0%	0.0%	1.2%	6.7%	9.9%	14.8%	67.4%

Note: estimate by author using INAHSIM.

Figure 3.1: Public pension system in Japan

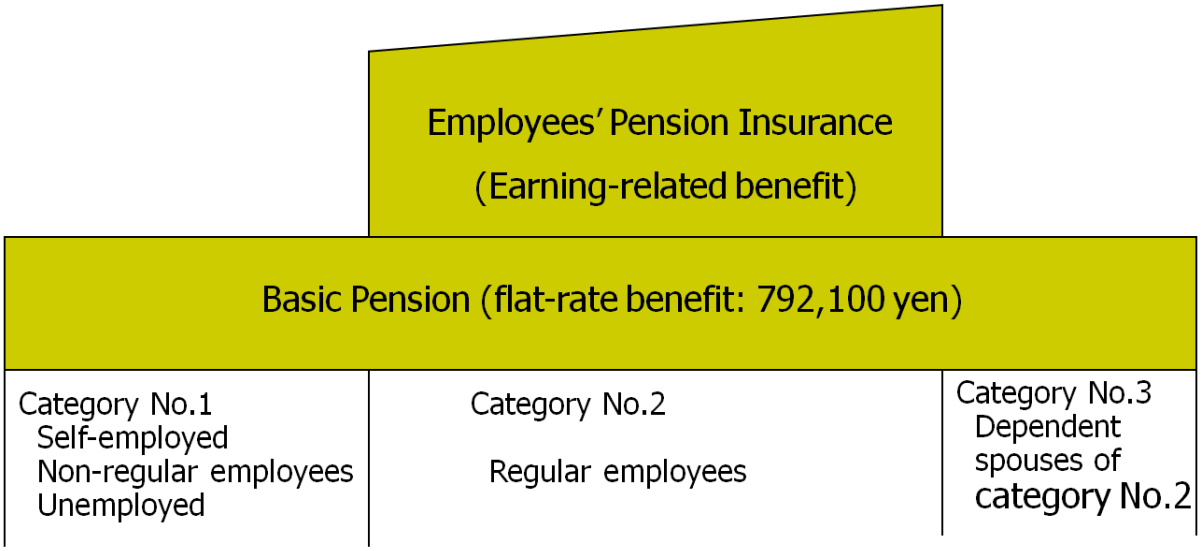
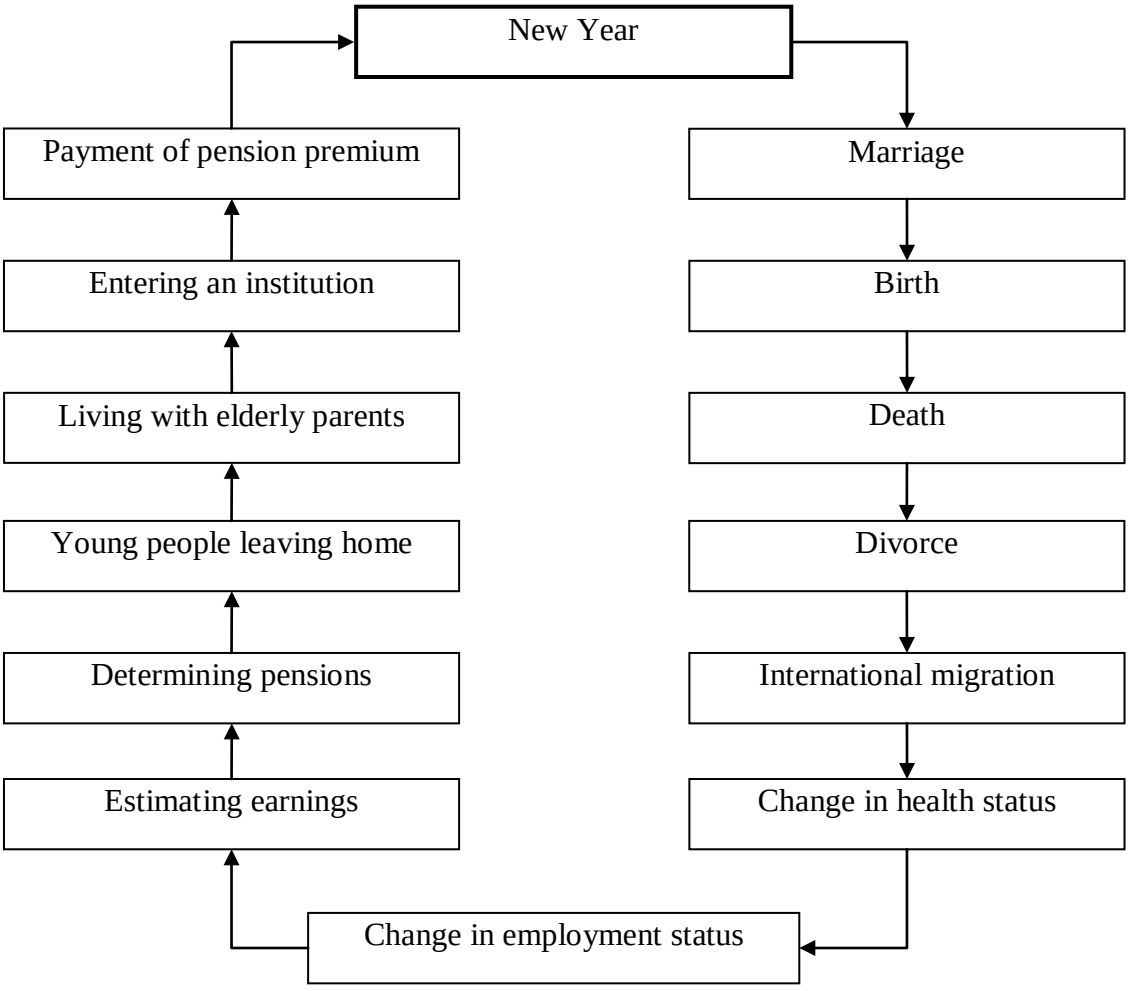


Figure 3.2: Simulation cycle of INAHSIM



Chapter 4

The First Result on Distributional Effects of Introducing Child Allowance in Japan

4.1 Introduction

In August, 2009, the Democrat Party of Japan has won the election of the House of Representatives, with a manifesto that includes the introduction of new child allowance as one of the main policies. The allowance is to be set at 26,000 yen (it will be reduced by half in year 2010) per month per child, until he or she finishes junior high school until the age of 15, regardless of the parents' income levels. In addition, the Democrat Party also promised to entirely exempt the senior high school tuition fee.

In exchange for implementing these programs, tax exemption for dependents, spousal deduction and special spousal deduction will be removed, together with the current ongoing child benefit. On the other hand, tax deduction for the elderly (in the amount of 500,000 yen) will be restored and the minimum amount of tax deductions for public pension benefits will also be boost up by 200,000 yen.

An evidence-based policy is a required norm. However, with Japan's child allowance system, it is obscure at the moment to what extent the reform will cause funding shortage, and who is a winner and a loser. What was said recently in Japan about child allowance was just an example of several representative households, which made it clear that, the households with children under junior high school level and both parents working will mostly benefit from the system[20]. However, these calculations represent nothing more than an example of observations from several "points".

In this chapter, we will explore a micro-simulation based on the nationwide sample, assuming that the policy package of the Democrat's manifesto on child allowance is put into action in 2009. The data used is "The Comprehensive Survey of Living Conditions of the People on Health and

20 See Koreeda (2009) and Atsumi (2009), for example.

Welfare" conducted by Ministry of Health, Labor and Welfare, Japan, in 2007[21].

The structure of this chapter is as follows. Firstly, in section 4.2, we will describe the key points of estimating methods. Then, in section 4.3, we will present the estimated results concerning the above mentioned Democrat's proposal. In this chapter, alternative policies will also be examined, and the estimated results of them will be shown in section 4.4. Section 4.5 gives the concluding remarks.

4.2 Estimation Methods

We build up the following data set. 9,800 households (with a total of 24,851 household members) which represent 1 out of 5,000 (1 out of 5,141 to be exact) of Japanese population were first selected.

The data concerning income and household information including the number of children are extracted from the year 2007 Survey and used unaltered. On the other hand, the estimations are independently made for the amount of income tax, payroll deduction, social security contribution deduction, and so on, which reflect the content of the 2009 system. Based on these estimations, aggregate annual amount of income tax was 9.716 trillion yen.

Regarding child allowance, firstly we extract the 0-14-year-old children from the sample, then identify their household supporter (if both parents are present, either the father or mother with higher income is selected, and if parents are not present, grandparents or someone in the household who generates income is selected). We assume that the selected household supporter will receive 312,000 yen per child per year. As the number of children age 0-14 years old all over Japan are estimated to be about a little less than 17.6 million based on the 2007 Survey, the aggregate amount of child allowance would be a total of 5.48 trillion yen per year (see Table 4.1).

= Table 4.1 about here =

As for the exemption of senior high school tuition fee, the data of those children whose age is

21 This chapter uses micro data from "Comprehensive Survey of Living Conditions of the People on Health and Welfare" conducted by Ministry of Health, Labor and Welfare, Japan. The present authors are grateful to Ms. R. Sashihara from Statistics Information Department, Ministry of Health, Labor and Welfare, Japan.

between 15-17 years old, and who are still in education system are selected from the Survey. We assume that their household supporter is paid 184,000 yen for each of those children per year. The method used to identify the household supporter is exactly the same as the one used in child allowance. The total annual amount needed for the exemption of senior high school tuition fee is estimated to be 680 billion yen.

When child allowance is put into action, the current child benefit will alternatively be abolished. The current child benefits are as follows. The annual benefit of 120,000 yen is to be given to 0-2 year-old children, and for 3-11 year-old children, the annual benefit of 60,000 yen is given for each of the first and second child, and 120,000 yen is given for each of the third child onwards. In addition, the current child benefit system offers a very generous income limit for recipients. At present, about 90% of potential recipients actually receive child benefits, with the exception of those with really high income. The estimated annual amount of money that will become available after the elimination of child benefits will be 950 billion yen.

Along with the proposal for new child allowance, the Democrat also plans to eliminate 3 deductions in income tax, namely tax deduction for dependents (380,000 yen per person per year), spousal deduction (380,000 yen. If the spouse is more than 70 years old, the amount becomes 480,000 yen) and special spousal deduction (maximum of 380,000 yen). However, a new deduction for the elderly (500,000 yen annually) will be introduced for the case where a person is older than 65 years old and his/her income is less than 10 million yen annually. Also, the minimum deduction for public pension benefits is to be raised by 200,000 yen. To make the estimating process simpler, we combine the additional deduction for public pension benefits of 200,000 yen with the 500,000 yen deduction for the elderly. The estimated revenue made available after eliminating 3 tax deductions amounts to an annual 1.57 trillion yen. In contrast, the restoration of tax deduction for the elderly and the increase of the minimum amount of the deduction for public pension benefits will add up to an estimated tax cut of 300 billion yen per year.

4.3 Main Results concerning the Democrat's Proposal

As indicated previously, child allowance is estimated to require a budget of about 5.48 trillion

yen annually, while the exemption of senior high school tuition fee will need a fund of 680 billion yen. Alternatively, the elimination and restoration of tax deductions stated above will set free an amount of 1.2 trillion yen; the elimination of child benefits will make available a fund of 950 billion yen. The shortage of fund therefore, is estimated at 4.0 trillion yen per year. The Democrat Party has said to squeeze out funds to cover this shortage, for the time being, from futile financial thorough removal and abolition of privileged tax measures for corporations. According to the reform above, a household will benefit an increase of 80,000 yen in net income per year, on average.

Below is the list of the main results (see Table 4.2).

= Table 4.2 about here =

1) As a result of the reform, among 50 million households nationwide, 38% of households will enjoy net increase in income, while 43% will remain with no change in income, and the 19% left are the households with net increase in tax burdens. Households with net increase in tax burdens are mostly the ones without any under-17-year-old children. The average net increase in annual income is expected to be about 230,000 yen, while average net increase in annual tax burdens is estimated at 43,000 yen. Surprisingly, even with child allowance introduced, there are still a large portion of households with no change in income.

2) Households with children under 17 years old will almost certainly see a net increase in income. For households with 1 child, the estimated net average increase in income is 180,000 yen per year. With 2 children, the household will benefit an annual net increase of 410,000 yen in income on average (about 6% of the household pre-tax income). Households with 3 or more children will gain a net average increase of 650,000 yen in income (about 9% of the household pre-tax income).

3) On the other hand, households without any children under 17 years old (including those with children 18 years old and above) account for 75% of all the households, a very large portion of the total. For these households, ones without any change in income occupy a comparatively large portion of 57%, while ones with net increase in tax burdens account for an alarming 25% of the group. However, households without children under 17 years old but shows a net increase in

income represent 18% of the group. They are those with heads of household who are older than 65 years old. The net increase of household income in this case, is generally due to the restoration of tax deduction for the elderly.

4) Net change in income largely depends on the age of household head. Majority of households whose head is under 24 years old see no net change in income. More than half of households with heads of age between 25-34 years old also see no net change in income. In the meanwhile, 37% of these households benefit a net increase in income (an average net increase of 310,000 yen per year). Those who benefit the most are the households with head age between 35-44 years old; about 60% of those households see a net increase in income, with average net increase of 370,000 yen (about 6.3% of the household income) per year. For these households, about 30% see no net change in income, and 10% see a net increase in tax burdens. For the next age group of 45-54 years old, households that gain a net increase in income account for 40% of the group, percentage dropping a little from the previous age group. In the meanwhile, households that see no change or a net increase in tax burdens account for 36% and 23% respectively (net annual increase in tax burdens is about 50,000 yen). Households with net increase in tax burdens occupy a comparatively large share, almost half of the group for the heads with the age between 55-64 years old (the net annual increase is about 46,000 yen). The main reason for this increase in tax burdens can be traced to the elimination of 3 tax deductions. Still, there are about 40% of households with no net change in income for this age group. For elderly households with heads who are older than 65 years old, the percentage of those with net increase in income suddenly goes up to over 50% (the net increase is about 80,000 yen), and 40% of the group are those with no net change in income.

5) By their income class, firstly, we see that the majority of the low-income households see no net change in income. For those who earn more than 3 million yen per year, about half of the households gain a net increase in income (which averages to 180,000-280,000 yen per year). The result most worth-mentioning is that there are about 4.9 million households, nationwide (or 9.8% of all households) with annual income of more than 8 million yen, who see a net increase in income. This means that even for these high-income households, a net cash subsidy of 250,000-280,000 yen is to be paid each year.

6) By household type, we see that there is no change at all in income for single worker's households who are under 64 years old (which accounts for 15% of all households). Also for elderly single households (which is 8% of all households), those that see no change in income occupy about 60% of the group, while the remaining 40% gain a net increase in income (about 30,000 yen per year) as a result of the restoration of tax deduction for the elderly. Surprisingly, there are as many as 60% of households with heads under 64 years old and with a full-time housewife (this is about 15% of all households. Here, we will call those spouses who are not involved in any paid job "full-time housewives"), that see a net increase in income (about 300,000 yen per year). In contrast, those households with net increase in tax burdens (about 56,000 yen per year), account for about 40%. This means among those with full-time housewives, there are more households who gain net increase in income than those with net increase in tax burdens. But when we take a look at those households with both parents working (which are about one fourth of all households), we will see that the number of those with net increase in income (averagely 330,000 yen) is unexpectedly low, declining to less than half of the group. This proportion is even less than that of households with a full-time housewife. Conversely, there are about 30% in the dual-earners households who are faced with a net increase in tax burdens (averagely 40,000 yen). More than half of them have no children under 17 years old, and they either see no change in income, or suffer a net increase in tax burdens (altogether 3.3 million households nationwide) because of the elimination of spousal tax deduction and so on. Furthermore, about one fourth of them see no change in income, which largely differs from the 4% of households with a full-time housewife[22].

At any rate, while about 40% of all households will enjoy net increase in income by this new system, we cannot overlook the fact that there will be about 19% of all households that will face net increase in tax burdens, which are mainly those without children under 17 years old and whose head is between 55-64 years old.

22 According to calculations on model households from several "points", those who will benefit greatly from this policy are the households with children in junior high school (or senior high school, to be precise) or lower and with both parents working (see the article from Asahi Shimbun on the 24th Aug. 2009). Our research has proven that there are not many of the households with both parents working who actually enjoy a net income increase.

4.4 Main Results concerning the Alternative Proposals

The Democrat Party has planned to reduce the amount of child allowance by half, making it 13,000 yen per child per month, for the year 2010. Estimations are made for the case of half-reduced amount of child allowance (see Table 4.2). The funding shortage will amount to 1.27 trillion yen per year (which is about one third of the amount when child allowance is paid fully). 35% of all households will see a net increase in income, 43% no net change, and 22% will suffer a net increase in tax burdens. Percentage of those that gain a net increase in income decreases by 3% when compared to the case in which child allowance is fully paid, and consequently that same percentage increases for the households with net increase in tax burdens. The net change in income is estimated at an average of 98,000 yen per year for net increase, and 41,000 yen for net decrease in income. For households with a full-time housewife, those with net increase in tax burdens occupy more than half of the group, a percentage that is larger than that of households with net increase in income (42%). For households with a full-time housewife, the actual amount of child allowance will determine the percentage of those that will end up with net increase in tax burdens. The larger the amount of child allowance, the higher the percentage of households with net increase in income will be, and hence, the smaller the percentage of those with net increase in tax burdens. Again, in the case that the amount of child allowance is halved, the percentage of households that gain an increase in net income will be a little bit higher for those with both parents working, than of those with a full-time housewife.

= Table 4.2 about here =

If the same income limit of the child benefit system is used in this child allowance system and exemption of senior high school tuition fee as well, the financial shortage is estimated to be 3.23 trillion yen, saving a total of 780 billion yen (19%). Also, the number of households with annual income of more than 8 million yen that will gain an increase in income is expected to be reduced to 2.2 million (4.4% of all households). With the income limit, the percentage of households that incur net increase in tax burdens will become 32%, higher than the percentage of those with net increase in income (24%).

= Figure 4.1about here =

The Democrat Party is promoting a shift “from tax deduction to allowance” as its main slogan. By getting rid of income tax deductions that are in favor of higher-income class and changing into allowances, it hopes to hold back the “widening gap for lower-income class”. However, the restoration of tax deduction for the elderly and the boosting of minimum deduction of public pension benefits go in the opposite direction of this slogan, therefore jeopardizing its consistency. Figure 4.1 presents the results of an alternative proposal “elderly allowance” (or it could also be called “Guaranteed Income Supplement”). Required annual revenue will be about 300 billion yen, which is the same amount as needed for the restoration of tax deduction for the elderly and the boosting of minimum deduction of public pension benefits. We will assume that this elderly allowance will be given to 1.25 million people who are over 65 years old and have low income (those with pension benefits less than 500,000 yen per year). Each of them will receive around 240,000 yen per year as elderly allowance. In this case, income will be redistributed from households in high-income class to those in lower-income class.

Consumption-based tax will be raised sooner or later. Estimations are made, just for reference, of the case in which consumption-based tax is raised by 1 percentage point in order to partially secure the revenue needed for child allowance. The case we assumed is that income limit is introduced, and instead of restoring tax deduction for the elderly, elderly allowance is created.

= Table 4.3 about here =

According to estimation results shown in Table 4.3, increases in tax burdens caused by 1percentage point rise in consumption-based tax will be 27,500 yen per household per year on average. Overall the proportion of households with net increase in income will drop to about one fourth, with the remaining three-fourths seeing a net increase in tax burdens. But generally as far as households with 1 or more children under 17-year-old are concerned, there is no change in the fact that they will enjoy net increase in income.

4.5 Concluding Remarks

Child allowance is one of the regimes the Democrat Party promotes heavily which, if put into full practice, will exceed the national defense budget (the initial budget for national defense in fiscal

year 2009 was 4.8 trillion yen). It is the symbolic policy, designed for anybody to easily see the strong support for child-raising by the Party that has never been administered by the former LDP before. Support for child-raising, after the change in political power, has become the most important policy issue.

In the past, bringing up a child is mainly considered parents' responsibility. But child-raising requires an enormous amount of money. By introducing child allowance, a total of around 5 million yen will be paid, by the government, for a child until he or she graduates high school. Through child allowance, part of the burden in bringing up a child will substantially be shifted from "households with children" to "households with no children". Child allowance really plays an important role in adjusting burdens on child-raising[23].

Even without any children of their own, when people get old, they will have to depend on other people's children for pension, health care, and nursing care. Making people with net increase in tax burdens understand this point should be the first thing to do.

If child allowance is put into action according to the Democrat's manifesto, an enormous amount of money will be required constantly. Issuing government bonds to cover for its revenue shortage means that our children will be the ones who carry the burden in the future. Evidently this kind of choice is not at all advisable, unless child allowance is disbursed to human investment.

Introduction of child allowance makes the social involvement of child raising stronger. Recipients of child allowance will have to first be aware of this point. They should be very prudent when spending for their children. The spending should involve investment in the children's future.

Child allowance will be paid to parents in cash. There is some possibility that, with cash allowance, the parents may give priorities to what they themselves want, i.e. liquors, pachinko gambling, leisure, clothes, jewelry, manicures, etc. and consequently the money might not be used for their children. Because it is paid in cash, child allowance could rather be called "parents allowance". One of the measures to avoid such case is "child voucher". It is a benefit in kind whose uses are limited to expectant mother health care, child's medical expenses, vaccination, payments

23 It is still not clear at the moment how much this child allowance will help in raising the birth rate. This problem will have to be carefully studied in a separate context.

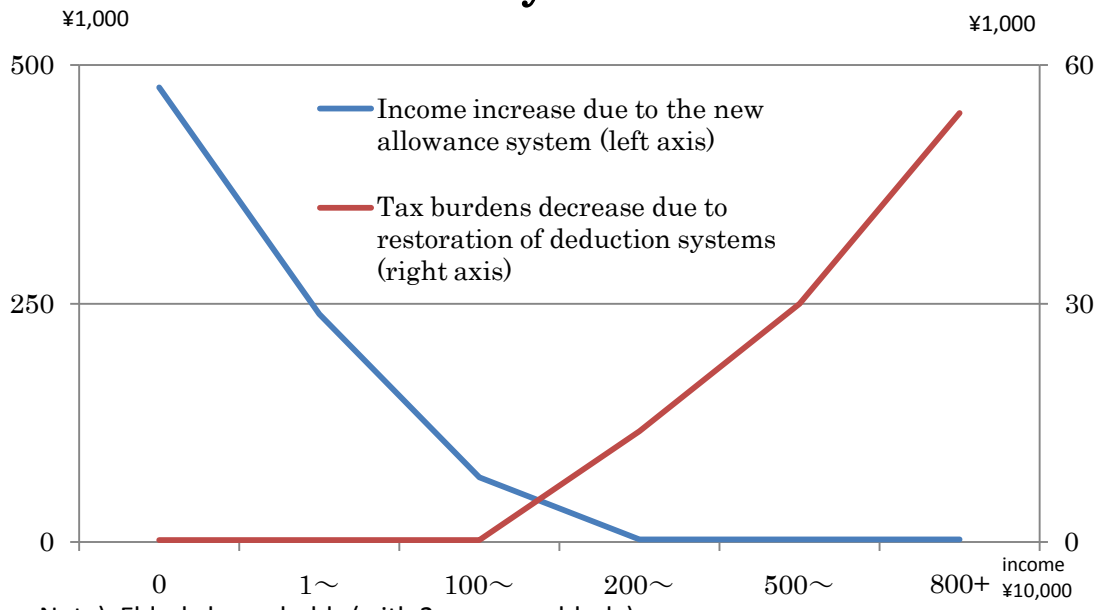
for milk, payments for disposable diapers, payments for children goods, child day care fees, kindergarten fees, school lunch fees, textbook fees, payments for school supplies, payments for school and other uniforms, school trip fees, cram school fees, entrance examination fees, school enrollment fees and so on. However, there is still some remaining possibility that this voucher would be cashed in at some discount-ticket shops.

References to Chapter 4

Atsumi, Y. and Morimoto, Y. (2009), "Distributional Effects of Child Allowance," mimeo., Toray Corporate Business Research, INC.

Koreeda, S. (2009), "Distributional Effects of Child Allowance by DPJ," mimeo., Daiwa Institute of Research.

Fig. 4.1 Elderly Tax Deduction and Elderly allowance



Note) Elderly households (with 2 or more elderly)
Source) The author's calculation from "The 2007 Comprehensive Survey of Living Conditions of the People on Health and Welfare".

Table 4.1 Estimated Amounts of Child Allowance-related Policies

(in billion yen)

	Total amount (per year)
child allowance : Total sum	5,476 (4,830)
exemption of senior high school tuition fee	683 (553)
child benefit	948
3 tax deductions : decreases in tax revenue	1,569
elderly tax deduction : decreases in tax revenue	299
removal of 3 tax deductions + restoration of elderly tax deduction	1,202

Notes) The raised minimum amount of public pension benefits deduction is added to the "elderly tax deduction". Furthermore, the difference between the amount in the last column and the real sum of the "removal of 3 tax deduction systems + restoration of elderly tax deduction" is due to the difference in the applied marginal tax rate in some income classes. The figures in brackets are the amounts in case the income limit is introduced.

Table 4.2 Effects of Policies by the Democrat Party

Types of household	% of households	Net change in income						
		share of households (%)				Net change (average annual amount, in thousan yen)		
		Total	-	0	+	Total	-	+
Total	100.0	100	19	43	38	80	-43	229
No children	75.0	100	25	57	18	-6	-42	27
1 child	11.1	100	1	0	99	176	-67	179
2 children	10.9	100	0	0	100	406	0	407
3 children or more	3.1	100	0	0	100	654	0	654
24 or younger	5.2	100	1	94	5	12	-13	240
25-34 yrs. old	13.5	100	9	54	37	113	-27	308
35-44 yrs. old	15.5	100	10	29	61	223	-37	372
45-54 yrs. old	16.4	100	23	36	41	110	-51	294
55-64 yrs. old	20.9	100	48	41	11	2	-46	227
65 or older	28.6	100	8	41	51	38	-24	79
household yearly income (in ten thousand yen)								
0	0.8	100	0	91	9	28	0	303
1-99	7.3	100	1	95	4	17	-4	400
100-199	12.2	100	7	76	16	34	-12	210
200-299	13.1	100	14	51	34	56	-18	171
300-399	12.8	100	20	35	45	79	-18	183
400-499	10.8	100	21	34	45	93	-21	216
500-599	9.1	100	23	30	47	108	-30	242
600-699	8.0	100	23	26	51	121	-39	256
700-799	5.7	100	26	28	47	105	-58	256
800-899	4.6	100	28	21	52	120	-65	268
900-999	3.9	100	28	25	48	115	-69	282
1000 or higher	11.8	100	29	24	47	95	-82	254
Hh head younger than 64 yrs. old	71.4	100	23	44	33	96	-45	321
*full-time housewife	15.0	100	40	4	56	145	-56	299
*dual-earner couples	23.9	100	27	25	48	146	-41	331
*singles	14.9	100	0	100	0	0	0	0
others	17.6	100	23	55	22	68	-36	341
Hh head 65 yrs. old or more	28.6	100	8	41	51	38	-24	79
more than 2 Hh members	20.4	100	11	35	54	48	-24	94
singles	8.2	100	0	57	43	13	0	30

Note 1) Share of households is the proportion of households with net change in income in each type of household. Figures in the same column will add up to 100.
「-」 means net increase in tax burdens, 「+」 means net increase in income, and 「0」 means no net change at all.
Note 2) "Children" refers to only those under 17 years old. Children who are 18 or more are not included.
Note 3) "full-time housewife" here uses the narrower interpretation of the term, which refers to housewife who does not do any paid jobs at all. On the other hand, "dual-earner couples" includes housewives who are eligible for spousal deduction, even though they have part-time jobs.
Note 4) * are the salaried workers households

Table4.3 Effects of Policies by the Democrat Party
(in the case of reducing child allowance by half)

Types of household	% of households	Net change in income						
		share of households (%)				Net change (average annual amount, in thousand yen)		
		Total	-	0	+	Total	-	+
Total	100.0	100	22	43	35	25	-41	98
No children	75.0	100	25	57	18	-6	-42	27
1 child	11.1	100	24	0	76	67	-29	97
2 children	10.9	100	6	0	94	139	-49	150
3 children or more	3.1	100	3	0	97	228	-45	235
24 or younger	5.2	100	3	94	4	2	-20	63
25-34 yrs. old	13.5	100	19	54	27	19	-25	87
35-44 yrs. old	15.5	100	18	29	53	66	-37	136
45-54 yrs. old	16.4	100	24	36	40	53	-50	165
55-64 yrs. old	20.9	100	49	41	9	-13	-47	104
65 or older	28.6	100	8	41	51	23	-24	49
household yearly income (in ten thousand yen)								
0	0.8	100	0	91	9	16	0	170
1-99	7.3	100	1	95	4	7	-4	169
100-199	12.2	100	7	76	16	16	-12	102
200-299	13.1	100	16	51	33	25	-16	84
300-399	12.8	100	22	35	42	29	-16	77
400-499	10.8	100	24	34	41	31	-20	87
500-599	9.1	100	28	30	42	32	-32	99
600-699	8.0	100	30	26	44	35	-38	106
700-799	5.7	100	35	28	37	19	-55	103
800-899	4.6	100	32	21	47	32	-63	110
900-999	3.9	100	29	25	46	35	-67	117
1000 or higher	11.8	100	33	24	43	23	-79	114
Hh head younger than 64 yrs. old	71.4	100	28	44	29	26	-43	133
*full-time housewife	15.0	100	54	4	42	14	-50	97
*dual-earner couples	23.9	100	30	25	44	53	-39	146
*singles	14.9	100	0	100	0	0	0	0
other	17.6	100	25	55	20	23	-36	156
Hh head 65 yrs. old or more	28.6	100	8	41	51	23	-24	49
more than 2 Hh members	20.4	100	11	35	54	27	-24	54
singles	8.2	100	0	57	43	13	0	30

Table 4.4 Effects of Policies by the Democrat Party with Income Limit

Types of household	% of households	Net change in income						
		share of households (%)				Net change (average annual amount, in thousand yen)		
		Total	-	0	+	Total	-	+
Total	100.0	100	32	44	24	63	-52	336
No children	75.0	100	38	59	3	-7	-38	271
1 child	11.1	100	14	1	85	137	-125	182
2 children	10.9	100	13	0	86	328	-197	410
3 children or more	3.1	100	10	0	90	555	-313	655
24 or younger	5.2	100	1	93	6	14	-13	248
25-34 yrs. old	13.5	100	10	54	36	109	-38	312
35-44 yrs. old	15.5	100	19	30	51	174	-115	383
45-54 yrs. old	16.4	100	32	37	31	73	-79	317
55-64 yrs. old	20.9	100	50	42	8	-2	-49	275
65 or older	28.6	100	42	45	13	31	-30	327
household yearly income (in ten thousand yen)								
0	0.8	100	0	63	37	100	0	272
1-99	7.3	100	1	78	21	65	-4	306
100-199	12.2	100	9	76	14	48	-12	343
200-299	13.1	100	30	56	14	49	-18	377
300-399	12.8	100	42	36	22	69	-21	356
400-499	10.8	100	36	37	27	84	-24	346
500-599	9.1	100	33	34	33	99	-32	333
600-699	8.0	100	33	29	38	113	-39	330
700-799	5.7	100	32	31	37	98	-53	308
800-899	4.6	100	42	23	35	84	-80	336
900-999	3.9	100	49	28	23	29	-102	346
1000 or higher	11.8	100	54	30	16	-13	-115	315
Hh head younger than 64 yrs. old	71.4	100	28	44	28	75	-65	337
*full-time housewife	15.0	100	49	4	47	101	-84	305
*dual-earner couples	23.9	100	34	26	40	120	-58	348
*singles	14.9	100	0	100	0	0	0	0
other	17.6	100	27	55	18	56	-49	377
Hh head 65 yrs. old or more	28.6	100	42	45	13	31	-30	327
more than 2 Hh members	20.4	100	58	28	14	32	-30	359
singles	8.2	100	0	88	12	30	0	239

Table 4.5 Effects of an Alternative Policy with Raising Consumption-based Tax by 1%

Types of household	% of households	Net change in income						
		share of households (%)				Net change (average annual amount, in thousand yen)		
		Total	-	0	+	Total	-	+
Total	100.0	100	76	0	24	35	-49	309
No children	75.0	100	97	0	3	-33	-41	258
1 child	11.1	100	16	0	84	106	-159	155
2 children	10.9	100	14	0	86	296	-244	381
3 children or more	3.1	100	10	0	90	522	-371	625
24 or younger	5.2	100	94	0	6	-3	-16	228
25-34 yrs. old	13.5	100	64	0	36	85	-30	286
35-44 yrs. old	15.5	100	49	0	51	145	-75	354
45-54 yrs. old	16.4	100	69	0	31	40	-71	287
55-64 yrs. old	20.9	100	92	0	8	-33	-57	243
65 or older	28.6	100	87	0	13	7	-39	306
household yearly income (in ten thousand yen)								
0	0.8	100	63	0	37	89	-12	260
1-99	7.3	100	79	0	21	51	-14	293
100-199	12.2	100	86	0	14	32	-17	327
200-299	13.1	100	86	0	14	30	-25	358
300-399	12.8	100	78	0	22	48	-33	334
400-499	10.8	100	73	0	27	60	-37	321
500-599	9.1	100	67	0	33	72	-44	305
600-699	8.0	100	62	0	38	82	-51	299
700-799	5.7	100	63	0	37	64	-61	274
800-899	4.6	100	65	0	35	48	-88	303
900-999	3.9	100	77	0	23	-10	-105	307
1000 or higher	11.8	100	85	0	15	-67	-128	270
Hh head younger than 64 yrs. old	71.4	100	72	0	28	47	-54	309
*full-time housewife	15.0	100	54	0	46	69	-112	277
*dual-earner couples	23.9	100	60	0	40	87	-68	318
*singles	14.9	100	100	0	0	-23	-23	0
Other	17.6	100	82	0	18	31	-41	352
Hh head 65 yrs. old or more	28.6	100	87	0	13	7	-39	306
more than 2 Hh members	20.4	100	86	0	14	5	-47	335
singles	8.2	100	88	0	12	12	-18	226

Chapter 5

Child poverty as a determinant of life outcomes: Evidence from nationwide surveys in Japan

Abstract

We attempt to examine the extent to which poverty in childhood adversely affects success in adulthood, using micro data from nationwide surveys in Japan and taking into account the recursive structure of life outcomes. We use retrospective assessments of income class at the age of 15, because longitudinal data on household income are not available. After controlling for its endogeneity, we confirm that children from poor families tend to have lower educational attainment, face higher poverty risks, and assess themselves as being less happy and as suffering from poorer health.

Keywords: Child poverty; Educational attainment; Poverty risk; Happiness; Self-rated health

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5.1 Introduction

Child poverty is now a central issue to be addressed in most advanced countries. One recent cross-country study by the OECD (2008) revealed that the risk of poverty for young adults and families with children has risen, while poverty among older people has fallen. The child poverty ratio, which is the share of children who live in households with income levels below the poverty line, was approximately 12 percent on average among the OECD member countries in the mid 2000s, which was 1 percent higher than the mid 1990s.

Many studies have examined the effects of family income and family background on developmental outcomes in adolescence and on adult poverty outcomes. Corcoran (1995) and Haveman and Wolfe (1995) provided comprehensive surveys on this issue, and Duncan and Brooks-Gunn (1997) thoroughly examined the ways in which economic deprivation damages children during their development. Numerous other empirical studies have accumulated since then, and it is now widely recognized that there are many possible ways for poverty to transition between parents and children (Seccombe, 2000; Seccombe and Ferguson, 2006).

The effect of family income on child development has been a key issue explored empirically by many studies. It has been observed that family income has a positive association with life outcomes for children, although more so for cognitive outcomes than for child behavior and health, and the effects of income differ across the childhood age span (Duncan, Yeung, Brooks-Gunn, and Smith, 1998; Bowles, Gintis, Groves, 2005). It is difficult, however, to distinguish the effects of family income from preexisting differences between families. Indeed, Mayer (1997) and Blau (1999) found that the effect of income tends to be smaller when including other aspects of family background in empirical models. Shea (2000) also emphasized that the impact of family income is negligible when considering its variation induced by factors that may reflect luck.

Even so, it is reasonable to argue that family income reflects various family factors that determine child development, considering that it reflects parents' educational background and work status, single parenthood, and other family factors. Those who have experienced poverty in childhood, regardless of its causes, are more likely to face circumstances unfavorable to their development. Indeed, Carneiro and Heckman (2003) stressed a limited rate of return from education

in children from poor families. Their analysis strongly underscores the importance of family in creating a difference in both cognitive and non-cognitive abilities that shape success in life, pointing to the risk of a strong transmission of poverty from old generations to young generations.

In this paper, we examine the impact of child poverty on life outcomes using micro data from nationwide surveys in Japan. As in other advanced nations, child poverty has challenged the existing social policies in Japan (Abe, 2008). Indeed, the OECD (2006) showed that more than half of single working parents in Japan lived in relative poverty, as compared with an OECD average of around 20 percent. Moreover, the OECD (2008) showed that the child poverty ratio was about 14 percent in the mid 2000s, which was 3 percentage points higher than that in the mid 1980s, and exceeded the OECD average of 12 percent. At the same time, concerns about the potential transmission of poverty from parents to children have become increasingly heightened in Japan, against the backdrop of widening income inequality and increasing poverty risks (Tachibanaki, 2005).

There have been, however, limited attempts to empirically examine the actual mechanism of transmission between child and adult poverty status in Japan. The main reason is that longitudinal information on socio-economic circumstances at the individual and household levels is not available, in contrast to the United Sates where comprehensive panel datasets such as the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey (NLS) can be used for empirical analysis.

To our knowledge, Oishi (2007) made the only attempt to explicitly explore the outcomes of child poverty in Japan. Her analysis was based on a small-sized survey (with 584 respondents) conducted in one anonymous municipality in the Tokyo metropolitan area. She reported that there is no clear correlation between the retrospective assessment of household income at the age of 15 and current poverty, while those from poor families tend to have lower educational attainment. It is premature, however, to conclude anything clear about the effect of child poverty in Japan, considering that Oishi's analysis relied on quite a small sample. More importantly, as she correctly mentioned, the risk is that the endogeneity of the retrospective assessment of household income in childhood may bias the estimation results.

This paper attempts to examine how and to what extent child poverty affects subsequent life outcomes in Japan, based on micro data from the Japanese General Social Surveys (JGSS). The JGSS is the Japanese version of the U.S. General Social Survey (GSS), which actually served as a model for the JGSS. We focus on the subjective assessment of poverty at age 15 by each respondent and its associations with educational attainment, current income/poverty, happiness, and self-rated health in adulthood. Our analysis, which is based on approximately 7,000 individuals, has three distinguishing features from previous studies.

First, we explicitly deal with the endogeneity of reported child poverty, a common issue to be addressed in countries with no quality longitudinal data about individual-level income. JGSS asks each respondent: "Thinking back to when you were around 15 years old, what would you say about your family income as compared to that of Japanese families in general at that time?" The respondent then chooses from 1 (= far below average), 2 (= below average), 3 (= average), 4 (= above average), and 5 (= far above average). We categorize the respondents who chose 1 or 2 as those from poor families; they accounted for 35.9 percent of the total sample. At age 15, children are at the final stages of nine-year compulsory education and mostly remain dependent on their parents.

The problem of such categorization is that the subjective assessment of income class in childhood may be affected by current and/or past socioeconomic conditions. To tackle this endogeneity problem, we estimate reported child poverty using information from the surveys about the parents' educational background and work status. We also consider residential locations at age 15 and current demographic and socioeconomic factors as instrumental variables when examining the impact of child poverty on outcomes in adulthood. We believe that this is a realistic and reliable method to grasp the impact of child poverty, if no longitudinal data on family income are available.

Second, we extend the analysis to include outcomes of subjective well-being—happiness and self-rated health—as well as educational attainment and poverty. Since the late 1990s, many economists have examined the factors determining happiness, as surveyed by Frey and Stutzer (2002). For example, Blanchflower and Oswald (2004) and Easterlin (2001) showed that income raises happiness, while Clark and Oswald (1994), Winkelmann and Winkelmann (1998) and Di

Tella, MacCulloch, and Oswald (2001) found that unemployment makes individuals unhappy. Various empirical studies have found that other socioeconomic factors including gender, age, marital status, and educational background also have a significant impact on happiness.

Meanwhile, many studies of social epidemiology have investigated the association between health and socioeconomic factors. It is now widely recognized that inequalities in health status associated with socioeconomic status are substantial. In particular, evidence that income and educational attainment significantly affect health has important implications for economic and educational policies (Smith, 1999; Lleras-Muney, 2005). It is, thus, of great interest to explore the extent to which child poverty affects both types of subjective well-being based on the common framework of analysis.

Third, we explicitly investigate the processes through which child poverty affects subsequent life outcomes. Children from poorer families typically quit studying earlier, and lower educational attainment probably reduces income. Lower income together with lower educational attainment is expected to make individuals more inclined to feel less happy and assess their health as being poorer. In addition, experiences in child poverty may directly affect these outcomes; likely affecting non-cognitive ability that is relevant for economic outcomes as well as psychological attributes that influence the subjective assessment of individual well-being. Our empirical analysis attempts to consistently grasp this structure, based on a recursive multiple-equation system. This approach is conceptually similar to the “life course approach” in chronic disease epidemiology (Ben-Shlomo and Kuh, 2002; Kuh, Ben-Shlomo, Lynch, Hallqvist, and Power, 2003), which studies the long-term effects on health, or the disease risk of physical or social exposures during gestation, childhood, adolescence, young adulthood and later adult life.

Our results indicate that child poverty, even after controlling for the endogeneity of its retrospective assessment, adversely affects subsequent life outcomes in line with conventional views and results from previous studies. People raised in poor families are more likely to have lower educational attainment, fall below the poverty line, feel less happy, and to assess their health as being poorer.

We also find that the impact of child poverty is more or less direct. Its impact on poverty risks

in adulthood cannot be entirely explained by its negative impact on educational attainment. Similarly, child poverty substantially reduces happiness and self-rated health on its own—not through current poverty and lower educational attainment. These results clearly underscore the importance of policy measures to directly reduce child poverty, which hinders success in later life.

The remainder of this paper is organized as follows. Section 5.2 explains the methods of our empirical analysis. Section 5.3 provides a brief description of the data on which our analysis is based. Section 5.4 presents our key estimation results. Section 5.5 concludes the paper.

5.2 The empirical model

To grasp the impact of child poverty on subsequent life outcomes, we consider a recursive multi-equation system, the structure of which is illustrated in Figure 1. We focus on four life outcomes—educational attainment, current income/poverty, happiness, and self-rated health—all of which are expected to be affected, directly or indirectly, by child poverty. This life course causal model is analogous to a "pathways model" in life course epidemiology (Kuh et al., 2003).

Child poverty first affects educational attainment, together with other family background such as parents' educational background and social status. As mentioned earlier, countless preceding studies have shown that children from poorer families tend to have lower educational attainment, although the income effect is difficult to identify. Then, educational attainment affects income or poverty. It is reasonable to assume that individuals with a lower educational background cannot easily obtain a high income. In addition, we consider the possibility that child poverty affects income directly—not through educational attainment. Child poverty may hinder a wider range of skills than those that are obtained or screened in school education.

In this analysis, we do not explicitly consider the impact of educational attainment on work status, because their relationship is not straightforward. For example, more highly-educated women tend to marry highly-educated, higher-income men, and their higher household income likely discourages these women from working as regular full-time employees. A combination of higher educational attainment and non-regular employment could make any association between educational attainment and work status less straightforward. Even if that is the case, however,

educational attainment and household income are expected to be positively correlated. Education attainment probably plays a key role in raising income, regardless of its mechanism: for example, through enhancing labor productivity and skill levels, raising the pace of promotion, providing more chances to meet and marry a wealthy partner, and so on.

Finally, we examine the extent to which two key subjective outcomes—happiness and self-rated health—are affected by outcomes at earlier stages: educational attainment, income/poverty, and child poverty. Some preceding studies point to the positive impact of good health on happiness, while others find the reverse causal relationship. This may reflect their similar associations with common factors; for example, income may raise both happiness and self-rated assessments of health. Moreover, child poverty may affect views on life and society, attitudes towards others, and other psychological attributes that are relevant for the subjective assessment of individual well-being.

To make this recursive structure of life outcomes empirically tractable, we first dichotomize each outcome, as discussed later in more detail. We consider five binary variables: "poor at age 15," "graduated from college or above," "below the poverty line," "feel happy," and "good health." We then consider the recursive multivariate probit model, a full version of which is expressed as

Poor at age 15: $y_1^* = \boldsymbol{X}_1\boldsymbol{\beta}_1 + u_1$,

Graduated from college or above: $y_2^* = \alpha_{21} y_1 + \boldsymbol{X}_2\boldsymbol{\beta}_2 + u_2$,

Below the poverty line: $y_3^* = \alpha_{31} y_1 + \alpha_{32} y_2 + \boldsymbol{X}_3\boldsymbol{\beta}_3 + u_3$,

Feel happy: $y_4^* = \alpha_{41} y_1 + \alpha_{42} y_2 + \alpha_{43} y_3 + \boldsymbol{X}_4\boldsymbol{\beta}_4 + u_4$,

Good health: $y_5^* = \alpha_{51} y_1 + \alpha_{52} y_2 + \alpha_{53} y_3 + \boldsymbol{X}_5\boldsymbol{\beta}_5 + u_5$

and $y_g = 1$ if $y_g^* > 0$; $= 0$ otherwise, for $g = 1, 2, \ldots, 5$.

Here, y_g***** is a latent variable for the binary variable y_g. $\boldsymbol{X}_g$ is a vector of exogenous variables to explain y_g, and $(u_1, \ldots, u_5)'$ is a vector of five-variate normally distributed disturbances with var $(u_g) = 1$ for $g = 1, 2, \ldots, 5$. Ten covariances between a pair of five disturbances, which are denoted as ρ_{gk} ($g, k = 1, 2, \ldots, 5$; $g > k$), are also to be estimated. The estimation of the multivariate probit model is carried out using Stata software, which applies the simulated maximum likelihood estimation method (Cappellari and Jenkins, 2003). If the disturbances are independent, this estimation is

equivalent to the separate maximum likelihood probit estimation. The signs of the coefficients are expected such that:

$\alpha_{21} < 0$; $\alpha_{31} > 0$, $\alpha_{32} < 0$; $\alpha_{41} < 0$, $\alpha_{42} > 0$, $\alpha_{43} < 0$; $\alpha_{51} < 0$, $\alpha_{52} > 0$, $\alpha_{53} < 0$.

Two things should be noted regarding this five-variate probit model. First, it completely reflects the life course structure illustrated in Figure 1. Educational attainment and income/poverty are cumulatively added as explanatory variables for outcome at higher stages, while child poverty is included in each estimation equation. Happiness and poor health are two final and simultaneous outcomes to be explained by all other outcomes and child poverty.

Second, estimation of a recursive multivariate probit model requires some considerations for the identification of the model parameters. Maddala (1983) proposed that at least one of the reduced-form exogenous variables is not included in the structural equations as explanatory variables. Following Maddala's approach, we impose exclusion restrictions: (i) to make $\boldsymbol{X}_1$ include at least one exogenous variable that is not included in $\boldsymbol{X}_2$, (ii) to make both $\boldsymbol{X}_1$ and $\boldsymbol{X}_2$ include at least one exogenous variable that is not included in $\boldsymbol{X}_3$, and (iii) to make all $\boldsymbol{X}_1$, $\boldsymbol{X}_2$, and $\boldsymbol{X}_3$ include at least one exogenous variable that is not included in $\boldsymbol{X}_4$ and $\boldsymbol{X}_5$[24].

To examine the robustness of this five-variate probit model—referred to as Model 1 hereafter—we additionally consider three alternative models. First, Model 2 is a combination of a probit equation for "poor at age 15" and a four-variate probit model which treats "poor at age 15" as exogenous. Comparing this model to Model 1 examines the biases of estimated coefficients caused by the endogeneity of reported child poverty.

Second, Model 3 consists of two bivariate probit models (for "graduated from college or above" with "poor at age 15" and "below the poverty line" with "poor at age 15") and one trivariate probit equation (for "feel happy," "good health," and "poor at age 15"). In each model, "poor at age 15" is treated as endogenous and the outcomes at earlier stages are treated as exogenous; for example, when estimating "below the poverty line" along with "poor at age 15," we treat "graduated from

24 Wilde (2000) argues that one varying exogenous regressor in each equation is sufficient to avoid identification problems in multi-equation probit models with endogenous dummy regressors. As mentioned by Wilde, this argument depends on the assumption of a multivariate normal distribution of the disturbances.

college or above" as exogenous. In contrast to Model 1, this model estimates outcomes separately, instead of considering the cumulatively recursive structure across the outcomes. If the disturbances in each model of Model 1 are correlated, Model 3 provides biased estimations.

Finally, Model 4 consists of three probit models (for "poor at age 15," "graduated from college or above," and "below the poverty line") and one bivariate probit model (for "feel happy" and "good health,"). In each model, we treat all other outcomes as exogenous. The difference between Models 3 and 4 reflects the endogeneity of reported child poverty.

5.3 Data

Our empirical analysis is based on the six-year (2000–03 and 2005–06) pooled data from Japanese General Social Surveys (JGSS), which are conducted and compiled by the Institute of Regional Studies at the Osaka University of Commerce, in collaboration with the Institute of Social Science at the University of Tokyo[25].

The JGSS divided Japan into six blocks, and subdivided those, according to population size, into three (in 2000–05) or four (in 2006) groups. Next, the JGSS selected 300–526 locations (varying each survey year) from each stratum using the Population Census divisions. Then, the JGSS randomly selected 12 to 16 individuals aged between 20 and 89 from each survey location. Data was collected through a combination of inter and self-administered questionnaires. The number of respondents for each survey year ranged between 1,957 (in 2003) and 2,953 (in 2002), with a response rate ranging between 50.5 percent (in 2005) and 64.9 percent (in 2000). The total sample size for the six years was 14,750. From these surveys, we obtain information about child poverty, educational attainment, income and poverty, happiness, self-rated health, and other socioeconomic factors.

In the empirical analysis, we excluded respondents aged 60 or above—who were born in 1940 or before—for two reasons. First, a substantial portion of them had retired by the survey year, because most private firms and public-sector institutions in Japan have a mandatory retirement age of 60, or slightly above. Their income conditions differ substantially from those of the younger

25 The 2004 Survey was not conducted.

respondents, and would distort estimation results if the two age groups are not separated.

Second, most of those aged 60 or above experienced a different education system from the one currently in place, which was established in 1947. This is crucial because we focus on age 15, when the current compulsory education system finishes. Excluding those aged 60 or above, ensures that all respondents experienced the same compulsory education system for the six years between the ages of 7 and 15.

We also removed students, as well as those with missing key variables. As a result, the total sample size was reduced to 7,002, about a half of the original sample. The summary statistics for all variables are presented in Table 5.1. We briefly explain the dependent and independent variables used in our empirical analysis below.

For the first equation for "poor at age 15" (y_1), we defined the lowest two income groups as being poor, as previously mentioned. The explanatory variables ($\boldsymbol{X}_1$) are divided into two groups. The first group provided information about situations at age 15. We first consider whether the family was a single-mother or single-father one. We also collected data on each parents' educational background—graduated from college or above or from junior high school (graduated from high school as a reference)—and work status—non-regular employee, self-employed, non working, and others (regular employee as a reference). In addition, we collected data on the size of the area where the respondent lived at age 15, living in a large city or small town/village (living in a middle-sized city as a reference)[26].

The second group in the explanatory variables provided the key attributes of the respondent and his/her current situation, which may affect his/her retrospective assessment of family income. As key demographic factors, we included the dummy variables for gender (female = 1), age groups (aged 30–39, 40–49, and 50–59; aged 20–29 as a reference), marital status (never married, and divorced/widowed; married as a reference), the number of children (one, two, and three or more; zero as a reference). Next, we included the respondent's work status (retired, home, and

26 The number of siblings was not collected in the 2003 JGSS. We repeated the estimations by including it in "poor at age 15" and "graduated from college or above" equations and using data from the 2000–2002 and 2005–2006 surveys. We confirmed its significant impact (positive for "poor at age 15," and negative for graduated from college or above") but no substantial difference in the other estimated parameters.

unemployed; working as a reference). In addition, we collected data on the size of the area where the respondent lives; living in a large city or small town/village (living in a middle-sized city as a reference). We also included real prefecture income per capita in the year prior to each survey year, which we collected from the Cabinet Office and evaluated at 2005 prices, in order to grasp the standard level of living in the prefecture where the respondent resided.

For the second equation relating to educational attainment (y_2), we divided the respondents into those who graduated from college or above (40.2 percent of the total, including two-year college graduates) and those who did not. As for explanatory variables, $\boldsymbol{X}_2$, in addition to "poor at age 15," we used dummy variables for gender (female = 1), ages groups 30–39, 40–49 and 50–59 (age of 20–29 as a reference) for each respondent. The age dummies were used to capture the cohort effect on educational attainment, because educational attainment was completed by the survey years, after students were excluded from the sample. We also utilized information about the educational background of each parent; graduated from college or above, high-school or junior high school (high-school as a reference). In addition, we considered the size of the area where the respondent lived at age 15, living in a large city or small town/village (living in a middle-sized city as a reference).

The third equation relates to income/poverty in adulthood. The JGSS asked respondents to choose their pre-tax annual household income for the previous year from nineteen possible categories. We took the median value for each category and equivalized it by dividing it by the root of the number of household members, and evaluated it at 2005 prices. Then, we set the poverty line as 1.478 million yen at 2005 prices, which is equal to 50 percent of the median of equivalized household income for all respondents in all survey years. We define those whose income was below this poverty line (9 percent in the sample) as "below the poverty line." The set of explanatory variables, $\boldsymbol{X}_3$, includes the dummy variables for gender, age, residential area, and real prefectural income per capita, all of which have been explained above.

The last two equations relate to happiness and self-rated health. With respect to happiness, the JGSS asked the respondents to choose from among 1 (= happy), 2, 3, 4 and 5 (= unhappy) in response to the question "How happy are you?" With respect to self-rated health, the survey asked

them to choose from among 1 (= good), 2, 3, 4 and 5 (= poor) in response to the question "How would you rate your health condition?" We categorize the top two categories in each question as "feel happy" and "good health," respectively. The percentages of those in the total sample who feel happy or who assess their health as being good were 65.0 and 52.2 percent, respectively. These two subjective outcomes have common explanatory variables—dummies for gender, age, and marital status (never married and divorced/widowed)—for $\boldsymbol{X}_4$ and $\boldsymbol{X}_5$, while $\boldsymbol{X}_4$ additionally included dummy variables for the number of children, which are supposed to be at least partly determined by health.

In addition, we included dummy variables for prefectures where the respondents live and those for survey years when estimating "poor at age 15," "below the poverty line," "feel happy," and "good health" to control for possible idiosyncratic effects. We also added dummy variables for prefectures where the respondent was living at age 15 when estimating "poor at age 15" and "graduated from college or above." Finally, we used JGSS-provided sampling weights and computed robust standard errors to correct for potential heteroscedasticity in all estimations.

5.4 Results and Discussion

Before discussing the regression analysis, Figures 2–4 provide an overview of the observed associations between child poverty and subsequent life outcomes, comparing those who answered that their income classes at age 15 belonged to the lowest groups 1 and 2, to those from higher income classes (3–5). It is clear from Figure 2 that those from poor families tended to leave school education before college and a higher proportion of them did not go to high school. Figure 3 divides all respondents into five income classes and compares the share of each income class between those from poor families and those from rich families. Income distribution is clearly skewed towards the lower end for those from poor families. The differences in population shares are most remarkable at the top and bottom ends of income distribution. Finally, Figures 4 and 5 confirm the persistent effects of child poverty; those from a poor family feel less happy and assess their health as being poorer, even after they reach adulthood.

Next, Table 5.2 summarizes the estimation results from recursive models, Models 1 and 2,

where child poverty is endogenous in the former and exogenous in the latter. This table presents how the probability of each outcome responds to a change in each dummy regressor from zero to one, while it reports the marginal effect only for real prefecture income per capita. The results for dummy variables for current prefectures, prefectures at age 15 and survey years are not shown because of space limitations.

The first column at the top of the table shows the result of the "poor at age 15" equation in Model 1. In line with expectations, those from single-parent families tend to be poor in childhood. Low educational background and an unstable work status for the parents also raise the risk of child poverty. At the same time, the assessment of poverty in childhood is affected by the respondent's demographic factors and current situation. Females tend to assess income conditions in childhood more positively. An increase in age tends to add to the negative assessment of them. Improving standards of living along with increased age are likely to affect the subjective assessment of income in childhood relative to other families. Divorced or widowed respondents tend to provide more negative assessments of their childhood, and an increasing number of children somewhat improves the retrospective assessment. Finally, currently unemployed respondents tend to report that their families were poor when they were young. The fact that reported child poverty is significantly affected by a respondents current situation points to the risk that estimation results are biased if endogeneity is not properly dealt with.

The second part of Table 5.2 compares the results of "graduated from college or above" between Models 1 and 2. Poverty at age 15 reduces the probability of graduating from college or above by 20.8 percent in Model 1 and by 12.5 percent in Model 2, indicating that the endogeneity of child poverty puts a downward bias on its estimated impact on educational attainment. There is no substantial difference between the two models in relation to the estimated effects of other explanatory variables and their statistical significance. Women and older cohorts tend to have lower educational attainment, while those whose parents have higher educational attainment tended to graduate from college or above. Living in a large city versus a small town or village at age 15 made going to college a more likely prospect. These findings are all reasonable.

The third part of Table 5.2 relates to poverty in adulthood, which is explained by child poverty

and educational attainment as well as other controls. The impact of child poverty is not significant in Model 2, consistent with the result in Oishi (2007), but controlling for the endogeneity of its retrospective assessment makes it positive (3.0 percent) and significant at the 5 percent level in Model 1. It should be noted that this impact is observed even after controlling for the negative and significant impact of educational attainment. As in the case of educational attainment, there is no substantial difference in the observed impacts of gender and age. Females and younger individuals tend to face higher poverty risks. The factors related to the residential area have a limited impact.

The fourth part of Table 5.2 covers the impact on happiness. In both models, higher education attainment raises happiness and poverty reduces it, this is in line with expectations and the results of previous studies. In addition to these effects, child poverty has a negative impact on happiness, although it is significant only at the 10 percent level, and is much stronger in Model 1 in relation to endogenous child poverty. Female and younger individuals tend to feel happier, and marriage contributes to happiness. The number of children does not matter in this estimation.

The fifth part of Table 5.2 shows the impact on self-rated health. Most strikingly, child poverty has a strong, negative impact on it, while the negative impact of current poverty is not significant. Many previous studies indicate the negative effect of current poverty on self-rated health, but most of them did not add child poverty as an explanatory variable. Our estimation results point to the persistent and traumatic effect of poverty experiences in childhood, although more detailed analyses are needed to distinguish it from the effect of current poverty. As in the case of happiness, females, younger, and married individuals tend to assess their health status more positively.

Finally, we notice strong correlations between the disturbances of the equations for (i) child poverty and educational attainment, (ii) child poverty and poverty in adulthood, (iii) educational attainment and self-rated health, and (iv) happiness and self-rated health. Indeed, the likelihood ratio test can reject the null hypothesis that all ρ's equal zero for both Models 1 and 2. These results imply that non-recursive models may lead to biased estimations.

Table 5.3 compares the estimated impact on the probability of each outcome for key explanatory variables across four models in order to check how sensitive the estimation results are sensitive to model specifications. Models 1 and 2 are recursive while Models 3 and 4 are not, and

child poverty is endogenous in Models 1 and 3 and exogenous in Models 2 and 4. Three things are noteworthy from Table 5.3 in terms of the estimated impact of child poverty. First, the impact of child poverty tends to be smaller in the recursive models (Models 1 and 2) than in the non-recursive models (Models 3 and 4). This is a reasonable result, given that the recursive models explicitly capture the indirect impact of child poverty that works through the outcomes at earlier stages. Second, the impact of child poverty tends to be larger in the models with endogenous child poverty (Models 1 and 3) than in the models with exogenous child poverty (Models 2 and 4). The endogeneity of reported child poverty engenders a downward bias on its estimated impact on life outcomes. Third, the impacts of educational attainment and poverty in adulthood on self-rated health are strongly significant in the non-recursive models but insignificant or less significant in the recursive models. This suggests that their impacts, which have been reported by many previous studies, originate largely from child poverty rather than from themselves.

Finally, based on the estimated results from Model 1, let us roughly calculate the total impact of child poverty on subsequent life outcomes. As illustrated in Figure 1, child poverty affects life outcomes in multiple ways. For example, child poverty leads to lower education attainment, and lower education attainment leads to poverty risks in adulthood, while child poverty affects poverty risks in adulthood directly—not through educational attainment—as well.

As presented in the top two panels of Table 5.4, let m_{ij} denote the estimated impact of variable j on the probability of outcome i, where i = 1 for "poor at age 15"; = 2 for graduated from college or above"; = 3 for "below the poverty line"; = 4 for "feel happy"; and = 5 for "good health." Let M_i denote the total impact of child poverty on the probability of outcome i. Then, M_i is calculated as

Graduated from college or above: $M_2 = m_{21}$,

Below the poverty line: $M_3 = m_{31} + M_2 m_{32}$,

Feel happy: $M_4 = m_{41} + M_2 m_{42} + M_3 m_{43}$,

Good health: $M_5 = m_{51} + M_2 m_{52} + M_5 m_{53}$,

where the first term on the right of each equation indicates the direct impact, and the second and third terms indicate indirect impacts.

The bottom two panels report the estimation results obtained from Model 1, which has a

recursive structure with endogenous child poverty. Child poverty reduces the probability of graduating from college or above by 20.8 percent, close to the result in Figure 2, which shows that the share of college graduates is 19.5 percent lower for those from poor families than those from a wealthier background.

Then, child poverty raises the probability of falling below the poverty line by 3.0 percent. To be sure, those from poor families can overcome the adverse impact of child poverty; if they graduate from college or above, they can reduce the probability of falling below the poverty line by 4.9 percent, which dominates the direct impact of child poverty of 3.0 percent. Without any additional effort by the individual or policy support, however, lower educational attainment adds 1.0 percentage point to the negative impact of child poverty on poverty in adulthood, raising its total impact to 4.0 percent.

In the same way, child poverty reduces the probabilities of feeling happy and of having good health by 6.1 percent and 10.1 percent, respectively. The estimated magnitudes of the impact are in line with those observed in Figures 4 and 5, which show that the probabilities of feeling happy (happiness = 1 or 2) and having good health (self-rated health = 1 or 2) are 6.0 percent and 8.2 percent lower, respectively, for those from poor families relative to those from a wealthier background .

More strikingly, 75 percent of the impact of child poverty on poverty risk in adulthood is attributable to an impact that is not related to education attainment. Similarly, 65 percent and 87 percent of the impact of child poverty on happiness and self-rated health, respectively, do not result from education attainment or poverty risk. To be sure, if our recursive structure includes additional pathways through which child poverty affects life outcomes, the direct impact of child poverty could decrease. At the same time, however, the indirect impact could become more important, probably leaving the total impact of child poverty largely intact. In all, our estimation results reveal that child poverty has a persistent, negative impact on subsequent life outcomes.

5.5 Conclusion

We examined how poverty in childhood adversely affects success in adulthood, using micro

data from nationwide surveys in Japan. Having no longitudinal data on household income, we used retrospective assessments of income class at age 15. Our empirical analysis has three features. First, we control for the endogeneity of reported child poverty by using information about the respondent's parents and his/her current socioeconomic condition. Second, we extend the analysis to two outcomes of subjective well-being—happiness and self-rated health—from educational attainment and poverty. Finally, we explicitly investigate the processes through which child poverty affects subsequent life outcomes by estimating recursive, multivariate probit models.

Our empirical analysis found that child poverty has a persistent impact on subsequent life outcomes. In line with conventional wisdom and the results from many previous studies, those from poor families tend to have lower educational attainment, face more poverty risk, and consider themselves to be less happy and to assess their health as being poorer. In addition, we found that child poverty strongly affects life outcomes even after controlling for its impacts on previous outcomes. These empirical results suggest that the adverse effect of child poverty cannot be easily overcome and that policy measures to reduce child poverty are required to ensure that children have equal opportunities to achieving success in life.

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References for Chapter 5

Abe, A. (2008), *Kodomo no Hinkon* [Child Poverty]. Iwanami Shoten, Tokyo [Japanese].

Ben-Shlomo Y. and D. Kuh (2002), "A life course approach to chronic disease epidemiology: Conceptual models, empirical challenges and interdisciplinary perspectives," *International Journal of Epidemiology*, vol. 31, pp. 285-293.

Blanchflower, D.G. and A.J. Oswald (2004), "Well-being over time in Britain and the USA," *Journal of Public Economics*, vol. 88, pp. 1359-1386.

Blau, D.M. (1999), "The effect of income on child development," *Review of Economics and Statistics*, vol. 81, pp. 261-276.

Bowles, S., H. Gintis, and M.O. Groves (2005), *Unequal Chances: Family Background and Economic Success*. Princeton University Press, Princeton.

Cappellari, L. and S.P. Jenkins (2003), "Multivariate probit regression using simulated maximum likelihood," *The Stata Journal*, vol. 3, pp. 278-294.

Carneiro, P., and J.J. Heckman (2003), "Human Capital Policy," In: Heckman, J., Krueger, A. (Eds), *Inequality in America: What Role for Human Capital Policies*. MIT Press, Cambridge, pp. 77-239.

Clark, A.E. and A.J. Oswald (1994), "Unhappiness and unemployment," *Economic Journal*, vol. 104, pp. 648-659.

Corcoran, M. (1995), "Rags to rags: Poverty and mobility in the U.S.," *Annual Review of Sociology*, vol. 21, pp. 237-267.

Di Tella, R., R.J. MacCulloch, and A.J. Oswald (2001), "Preferences over inflation and unemployment: Evidence from surveys of happiness," *American Economic Review*, vol. 91, pp. 335–341.

Duncan, G.J. and J. Brooks-Gunn eds. (1997), *Consequences of growing up poor*. Russell Sage, New York.

Duncan, G.J., J.W. Yeung, J. Brooks-Gunn, and J.R. Smith (1998), "How does childhood poverty affect the life chances of children?" *American Sociological Review*, vol. 63, pp. 406-423.

Easterlin, R.A. (2001), "Income and happiness: Towards a unified theory," *Economic Journal*, vol. 111, pp. 465-484.

Frey, B.S. and A. Stutzer (2002), "What can economists learn from happiness research?" *Journal of Economic Literature*, vol. 40, pp. 402-435.

Haveman, R. and B. Wolfe (1995), "The determinants of children's attainments: A review of methods," *Journal of Economic Literature*, vol. 33, pp. 1829-1878.

Kuh, D., Y. Ben-Shlomo, J. Lynch, J. Hallqvist, and C. Power (2003), "*Life course epidemiology*," *Journal of Epidemiology and Community Health*, vol. 57, pp. 778-783.

Lleras-Muney, A. (2005), "The relationship between education and adult mortality in the United States," *Review of Economic Studies*, vol. 72, pp. 189-221.

Maddala, G.S. (1983), *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge University Press, Cambridge.

Mayer, S. (1997), *What Money Can't Buy: Family Income and Children's Life Chances*. Harvard University Press, Cambridge.

OECD (2006), *Economic Survey of Japan 2006*. OECD, Paris.

OECD (2008), *Growing Unequal? Income Distribution and Poverty in OECD Countries*. OECD, Paris.

Oishi, A. (2007), "Kodomo no hinkon no doko to sono kiketsu [Child poverty: Its trends and consequences]," *The Quarterly of Social Security Research*, vol. 43, pp. 54-64 [Japanese].

Seccombe, K. (2000), "Families in poverty in the 1990s: Trends, causes, consequences, and lessons learned," *Journal of Marriage and Family*, vol. 62, pp. 1094-1113.

Seccombe, K. and S. J. Ferguson (2006), *Families in Poverty: Volume I in the "Families in the 21st Century Series.*" Allyn & Bacon, Boston.

Shea, J. (2000), "Does parents' money matter?" *Journal of Public Economics*, 77, 155-184.

Smith, J.P. (1999), "Healthy bodies and thick wallets: The dual relation between health and economics status," *Journal of Economic Perspectives*, 13, 145-166.

Tachibanaki, T., 2005. *Confronting Income Inequality in Japan*. MIT Press, Cambridge.

Wilde, J. (2000), "Identification of multiple equation probit models with endogenous dummy

regressors," *Economics Letters*, 69, 309-312.

Winkelmann, L. and R. Winkelmann, R. (1998), "Why are the unemployed so unhappy? Evidence from panel data," *Economica*, 65, 1-15.

Table and Figures

Table 5.1 Summary statistics for selected variables

Variables	Share	Variables	Share
Demographic factors and current situation		***Situations at age 15***	
Female	0.522	Poor at age 15	0.359
Aged 20-29 (reference)	0.131	Single-mother family	0.068
Aged 30-39	0.244	Single-father family	0.018
Aged 40-49	0.272	Father: graduated from junior high school	0.378
Aged 50-59	0.352	graduated from high school	0.469
Graduated from junior high school	0.144	graduated from college or above	0.154
Graduated from high school	0.490	Mother: graduated from junior high school	0.392
Graduated from college or above	0.402	graduated from high school	0.527
Regular employee (incl. management)	0.516	graduated from college or above	0.081
Non-egular employee	0.200	Father: regular employee	0.545
Self-employed	0.077	non-regular employee	0.006
Others	0.032	self-employed	0.358
Retired	0.003	other jobs	0.080
Home	0.153	non-working	0.011
Unemployed	0.020	Mother: regular employee	0.150
Below the poverty line	0.090	non-regular employee	0.212
Never married	0.151	self-employed	0.317
Divorced/widowed	0.060	other jobs	0.024
No child	0.235	non-working	0.297
One child	0.157	Living in a large city at age 15	0.150
Two children	0.416	Living in a small town/village at age 15	0.365
Three children or more	0.192		
Living in a large city	0.201		
Living in a small town/village	0.174		

Real prefecture income per capita	Mean	S.D.	Min	Max
(2005 prices, million, yen)	2.664	0.394	1.940	4.656

Sample size=7,002 (total): 1,324 (in 2000), 1,183 (in 2001), 1,244 (in 2002), 759 (in 2003), 707 (in 2005), and 1,785 (in 2006).

Table 5.2 Estimation results from Models 1 and 2

N =7,002

	Model 1		Model 2	
	dPr /dx	Robust Std. Err.	*dPr /dx*	Robust Std. Err.
1. *Poor at age 15*				
Situations at age 15				
Single-mother family	0.327	(0.068) ***		
Single-father family	0.294	(0.105) ***		
Father: graduated from college or above	-0.135	(0.023) ***		
Father: graduated from junior high school	0.052	(0.019) ***		
Mother: graduated from college or above	-0.086	(0.032) ***		
Mother: graduated from junior high school	0.057	(0.019) ***		
Father: non-regular employee	0.519	(0.087) ***		
Father: self-employed	0.062	(0.018) ***		
Father: non-working	0.445	(0.061) ***		
Father: other jobs	0.074	(0.061)		
Mother: non-regular employee	0.080	(0.022) ***		
Mother: self-employed	-0.048	(0.023) **		
Mother: non-working	-0.034	(0.021)		
Mother: other jobs	-0.136	(0.079) *		
Living in a large city at age 15	-0.032	(0.024)		
Living in a small town/village at age 15	0.013	(0.016)		
Demographic factors and current situation				
Female	-0.036	(0.014) **		
Aged 30-39 (reference = Age 20-29)	0.089	(0.025) ***		
Aged 40-49	0.127	(0.026) ***		
Aged 50-59	0.143	(0.026) ***		
Never married	-0.039	(0.028)		
Divorced/widowed	0.066	(0.030) **		
One child	-0.032	(0.026)		
Two children	-0.036	(0.024)		
Three children or more	-0.035	(0.026)		
Retired	0.012	(0.098)		
Home	-0.029	(0.020)		
Unemployed	0.117	(0.052) **		
Living in a large city	-0.082	(0.092)		
Living in a small town/village	-0.008	(0.020)		
Real prefecture income per capita	0.017	(0.019)		
2. *Graduated from college or above*				
Poverty at age 15	-0.208	(0.036) ***	-0.125	(0.014) ***
Female	-0.065	(0.013) ***	-0.062	(0.013) ***
Aged 30-39 (reference = Age 20-29)	0.017	(0.023)	0.012	(0.023)
Aged 40-49	0.023	(0.023)	0.014	(0.023)
Aged 50-59	-0.081	(0.022) ***	-0.092	(0.022) ***
Father: graduated from college or above	0.267	(0.024) ***	0.281	(0.023) ***
Father: graduated from junior high school	-0.039	(0.020) **	-0.041	(0.019) **
Mother: graduated from college or above	0.188	(0.031) ***	0.196	(0.031) ***
Mother: graduated from junior high school	-0.111	(0.019) ***	-0.118	(0.019) ***
Living in a large city at age 15	0.052	(0.024) **	0.055	(0.024) **
Living in a small town/village at age 15	-0.045	(0.015) ***	-0.046	(0.015) ***

(to be continued)

Table 5.2 Estimation results from Models 1 and 2 (continued)

	Model 1		Model 2	
	dPr/dx	Robust Std. Err.	dPr/dx	Robust Std. Err.
3. ***Below the poverty line***				
Poor at age 15	0.030	(0.014) **	0.004	(0.007)
Graduated from college or above	-0.049	(0.011) ***	-0.052	(0.010) ***
Female	0.040	(0.007) ***	0.039	(0.007) ***
Aged 30-39 (reference = Age 20-29)	-0.063	(0.008) ***	-0.061	(0.008) ***
Aged 40-49	-0.070	(0.008) ***	-0.067	(0.008) ***
Aged 50-59	-0.053	(0.009) ***	-0.050	(0.009) ***
Living in a large city	0.024	(0.011) **	0.023	(0.011) **
Living in a small town/village	-0.001	(0.009)	-0.001	(0.009)
Real prefecture income per capita+	-0.023	(0.043)	-0.024	(0.042)
4. ***Feel happy***				
Poor at age 15	-0.061	(0.033) *	-0.023	(0.013) *
Graduated from college or above	0.132	(0.026) ***	0.145	(0.025) ***
Below the poverty line	-0.143	(0.065) **	-0.150	(0.066) **
Female	0.024	(0.012) *	0.027	(0.012) **
Aged 30-39 (reference = Age 20-29)	-0.104	(0.024) ***	-0.107	(0.024) ***
Aged 40-49	-0.178	(0.025) ***	-0.184	(0.025) ***
Aged 50-59	-0.167	(0.025) ***	-0.172	(0.024) ***
Never married	-0.306	(0.029) ***	-0.305	(0.029) ***
Divorced/widowed	-0.137	(0.026) ***	-0.140	(0.026) ***
One child	-0.013	(0.026)	-0.011	(0.025)
Two children	0.006	(0.023)	0.007	(0.023)
Three children or more	0.029	(0.025)	0.030	(0.025)
5. ***Good health***				
Poor at age 15	-0.101	(0.050) **	-0.058	(0.015) ***
Graduated from college or above	0.063	(0.041)	0.085	(0.034) **
Below the poverty line	-0.054	(0.077)	-0.059	(0.077)
Female	0.036	(0.014) **	0.039	(0.014) ***
Aged 30-39 (reference = Age 20-29)	-0.103	(0.025) ***	-0.106	(0.025) ***
Aged 40-49	-0.135	(0.026) ***	-0.141	(0.025) ***
Aged 50-59	-0.143	(0.026) ***	-0.147	(0.025) ***
Never married	-0.045	(0.021) **	-0.045	(0.021) **
Divorced/widowed	0.016	(0.029)	0.013	(0.028)
ρ_{21}	0.147	(0.057) ***		
ρ_{31}	-0.117	(0.051) **		
ρ_{41}	0.066	(0.053)		
ρ_{51}	0.070	(0.071)		
ρ_{32}	-0.015	(0.041)	0.003	(0.041)
ρ_{42}	-0.094	(0.047) **	-0.122	(0.043) ***
ρ_{52}	-0.036	(0.065)	-0.074	(0.051)
ρ_{43}	0.069	(0.089)	0.081	(0.090)
ρ_{53}	-0.039	(0.096)	-0.030	(0.095)
ρ_{54}	0.353	(0.019) ***	0.354	(0.020) ***

Note: 1. dPr/dx indicates a change in the probability of each outcome in response to a change in each dummy variable from 0 to 1. For real prefecture income per capita, it indicates its marginal effect.

2. Dummy variables for prefectures and survey years are included in parts 2-5, and dummy variables for prefectures at age 15 are included in parts 1 and 2, but their results have not been reported to save space.

3. The null hypthotehis that all $\rho_{gk} = 0$ can be rejected for both Model 1 ($\chi^2(10) = 1.3e+09$), and Model 2 ($\chi^2(6) = 1.0e+09$).

4. ***, **, and * are significant at the 1, 5, and 10% level, respectively.

Table 5.3 Estimated impact of child poverty, low education attainment, and poverty in adulthood

	Recursive models		Non-recursive models	
	Model 1	**Model 2**	**Model 3**	**Model 4**
1. *Poor at age 15*	endogenous	exogenous	endogenous	exogenous
2. *Graduated from college or above*				
Poor at age 15	-0.208 ***	-0.125 ***	-0.461 ***	-0.128 ***
	(0.036)	(0.014)	(0.037)	(0.015)
3 *Below the poverty line*				
Poor at age 15	0.030 **	0.004	0.163 ***	0.004
	(0.014)	(0.007)	(0.040)	(0.007)
Gradated from college or above	-0.049 ***	-0.069 ***	-0.047 ***	-0.053 ***
	(0.011)	(0.013)	(0.008)	(0.007)
4. *Feel happy*				
Poor at age 15	-0.061 *	-0.023 *	-0.093 ***	-0.035 ***
	(0.033)	(0.013)	(0.029)	(0.013)
Gradated from college or above	0.132 ***	0.145 ***	0.084 ***	0.090 ***
	(0.026)	(0.025)	(0.013)	(0.013)
Below the poverty line	-0.143 **	-0.150 **	-0.091 ***	-0.092 ***
	(0.065)	(0.066)	(0.023)	(0.023)
5. *Good health*				
Poor at age 15	-0.101 **	-0.058 ***	-0.111 ***	-0.063 ***
	(0.050)	(0.015)	(0.037)	(0.014)
Gradated from college or above	0.063	0.085 **	0.039 ***	0.043 ***
	(0.041)	(0.034)	(0.014)	(0.014)
Below the poverty line	-0.054	-0.059	-0.082 ***	-0.082 ***
	(0.077)	(0.077)	(0.024)	(0.024)

Note: 1. This table summarizes changes in the probability of each outcome in response to a change in each dummy variable from 0 to 1.

2. All models use the same explanatory variables as reported in Table 2.

3. The figures in the parentheses are robust standard errors.

4. The null hypothesis that all covariances of disturbances equal zero can be rejected at the 1% level for all models.

5. ***, **, and * are significant at the 1, 5, and 10% level, respectively.

Table 5.4 Subsequent life outcomes after child poverty

	i = 2	3	4	5
	Graduated from college or above	Below the poverty line	Feel happy	Good health
Impact of variable j on the probabilitry of outcome i (m_{ij})				
j = 1 Poor at age 15	m_{21}	m_{31}	m_{41}	m_{51}
2 Graduated from college or above		m_{32}	m_{42}	m_{52}
3 Below the poverty line			m_{43}	m_{53}
Impact of Poverty at age 15				
Poor at age 15	m_{21}	m_{31}	m_{41}	m_{51}
Graduated from college ot above		$M_2 m_{32}$	$M_2 m_{42}$	$M_2 m_{52}$
Below the poverty line			$M_3 m_{43}$	$M_3 m_{53}$
Total	M_2	M_3	M_4	M_5
Based on Model 1				
Estimated values of m_{ij}				
j = 1 Poor at age 15	-0.208	0.030	-0.061	-0.101
2 Graduated from college or above		-0.049	0.132	0.063
3 Below the poverty line			-0.143	-0.054
Estimated impact of poverty at age 15				
Poor at age 15 (A)	-0.208	0.030	-0.061	-0.101
Graduated from college or above		0.010	-0.027	-0.013
Below the poverty line			-0.006	-0.002
Total (B)	-0.208	0.040	-0.094	-0.117
((A)/(B), %)	(100.0)	(74.8)	(64.6)	(86.8)

Note: m_{ij} indicates a change in the probability of outcome i in response to a change in the dummy variable j from 0 to 1.

Figure 5.1 Life course causal model

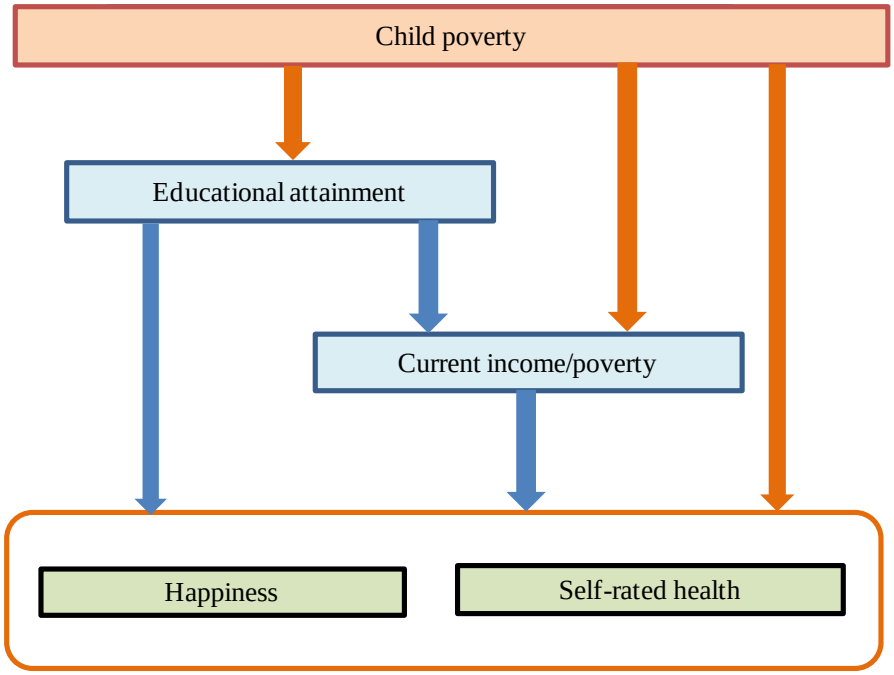


Figure 5.2 Poverty at age 15 and educational attainment

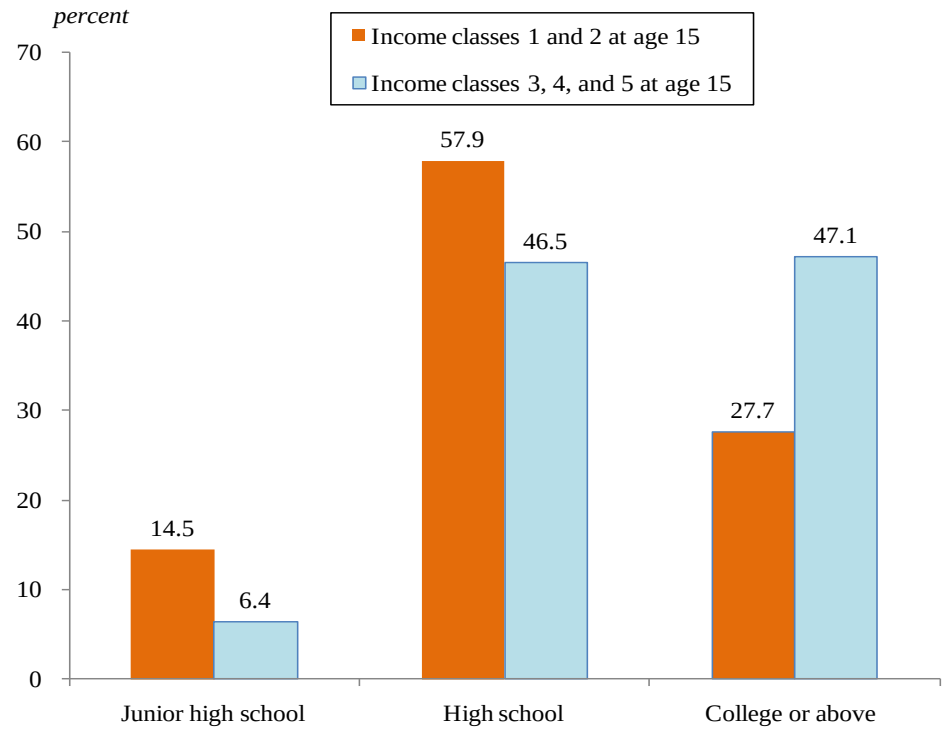


Figure 5.3 Poverty at age 15 and income classes in adulthood

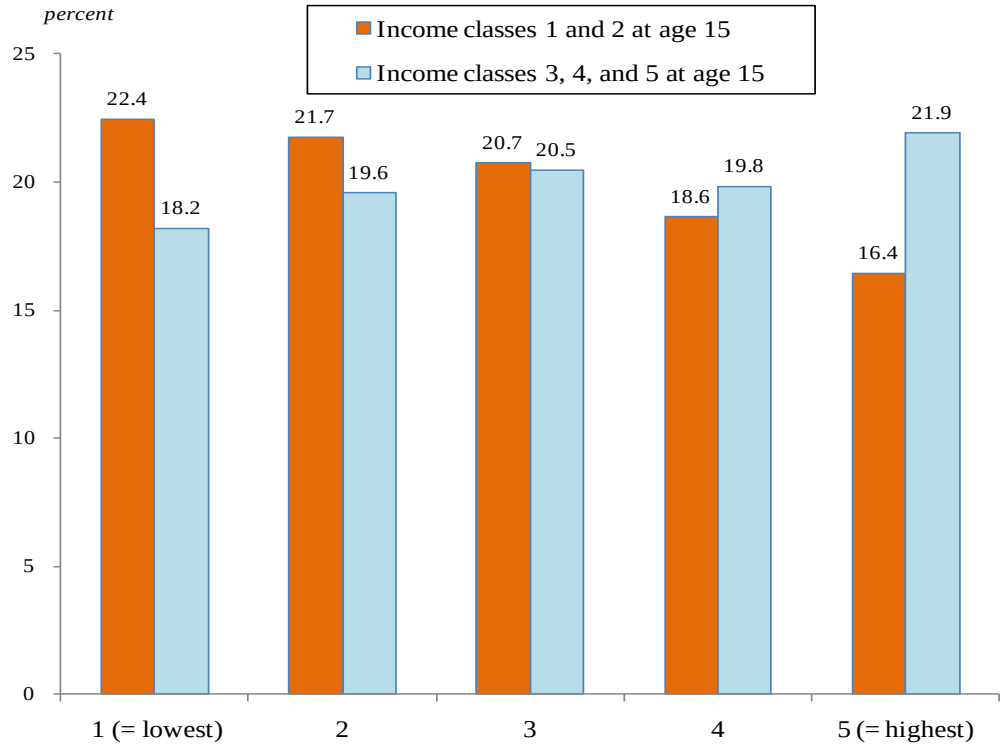


Figure 5.4 Poverty at age 15 and happiness in adulthood

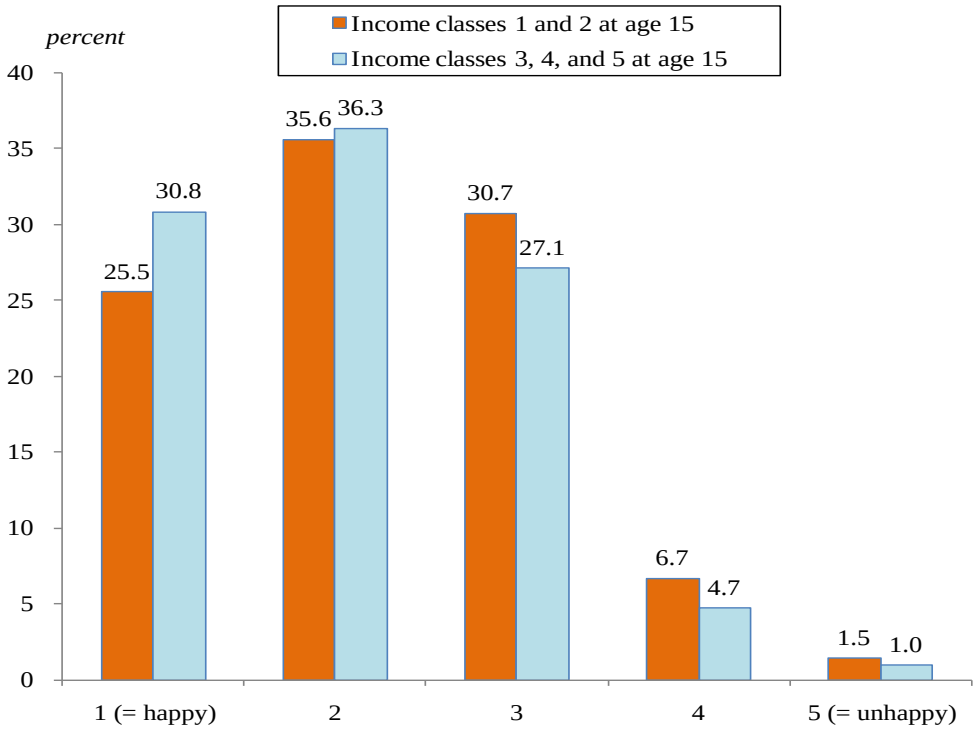
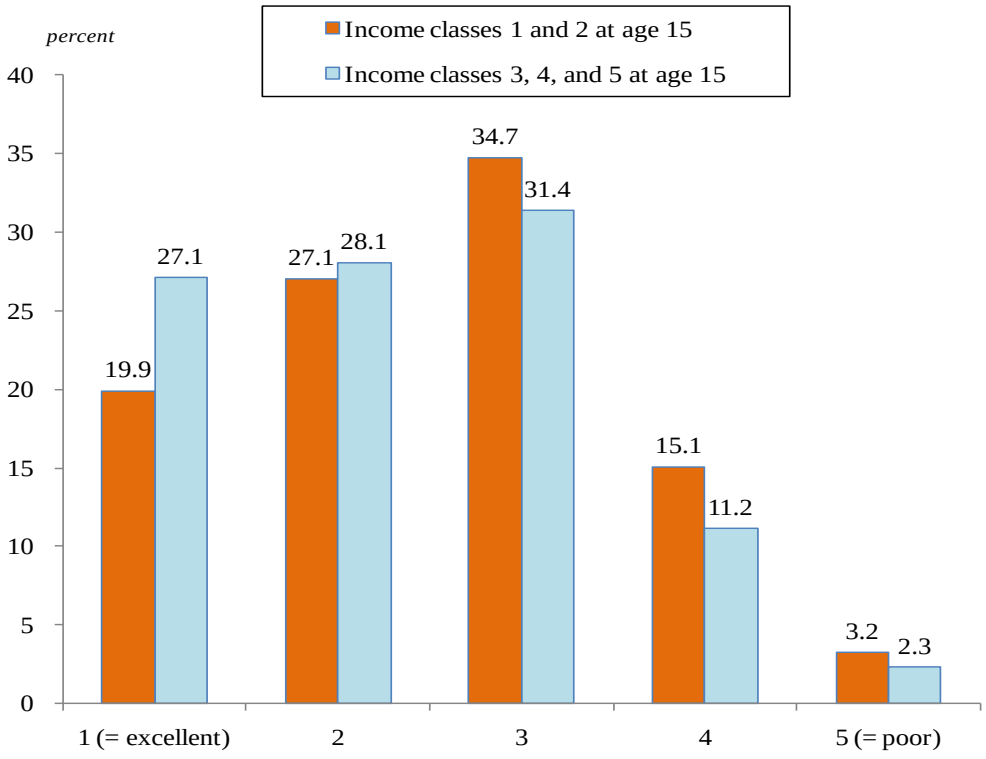


Figure 5.5 Poverty at age 15 and self-rated health in adulthood



Chapter 6

When do people work?: Measuring trends in work timing with a Japanese time-use survey[27]

6.1 Introduction

This paper is aimed at understanding Japanese lifestyle changes over two decades by observing the timing of work during the day.

Although originated in the US, convenience stores have increased tremendously in Japan since the 1980s. According to a report issued by the Japan Franchise Association (JFA), there were 6,308 convenience store outlets in all of Japan in 1983, and rapid growth since then brought the total to 43,228 stores in 2007[28]. In Metro Tokyo, where Japan's population density is at its greatest, there are some areas where it is impossible to walk 30-40 meters without passing a convenience store. These stores are open twenty four hours a day, seven days a week, including Sundays and public holidays. They sell not only beverages, sandwiches, and snacks, but also relatively decent meals with a self-service micro-wave oven for heating purchased food, cold medications, and such consumer staples as laundry detergent. They also offer a service to pay utility bills, a venue for purchasing tickets for concerts and airlines, and bank ATMs. As their name implies, the service they provide is "convenience."

In 2008, the City of Kyoto, where the Kyoto protocol was adopted, proposed legislation that would prevent convenience stores from operating during late-night hours. The city's aim in proposing this bill was to (1) reduce CO2 emissions and save on lighting bills by cutting back on nighttime operation and (2) force Japanese who are active late-night to alter their lifestyles. The JFA strongly opposed the bill, arguing that 24-hour operation was in tune with consumer needs, and

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27 Micro data used in this paper are data from the Survey of Time Use and Leisure Activities (Statistics Bureau, Ministry of Internal Affairs and Communications; MIAC). The Authors deeply appreciates the MIAC for letting us use the valuable data. The remaining errors are solely of our own.

28 Among them, 7-eleven leads the market with 12,105 stores (as of December 2008) in Japan, compare with only 6,320 stores in the US.

that such a baseless and unfair regulation made no sense. It also argued that a late-night lifestyle was deeply rooted in the social norm and that as long as this norm itself does not change, that lifestyle would not go away, even if late-night operations were banned.[29] The two sides have adhered to their arguments without compromising, and the proposed bill to restrict the late-night operation of convenience stores remains in limbo.

There are legitimate questions as to whether the late-night lifestyle, as typified by convenience stores, has strong roots in Japan. That being said, to what extent do the Japanese actually work during late-night hours, and how far has the shift of both employment and leisure toward late-night hours actually gone? Detailed answers to these questions remain elusive. In this paper, we use a Japanese time-use survey to examine how the timing of work in Japan changed over a 20-year period from 1986 to 2006.

Much of the literature that makes use of time-use surveys is based on analysis that measures an aggregate of work time and leisure time, and there is precious little research that focuses on the timing aspect.[30] The pioneering works analyzing the timing of work are Hamermesh (1999ab, 2002). Hamermesh (1999a), using the Current Population Survey (CPS) for 1973-1991, finds that the share of US workers working late-night hours declined gradually over time. As we explain in more detail in the next section, the paper is based on the idea, expressed in Winston (1982), that the perceived disutility of labor should differ depending on the timing of that labor. Hamermesh (1999a) finds a secular decline in the number of workers who worked during the night with a high marginal disutility of labor, along with an increase in average real wages. He also finds this trend to be stronger for individuals with higher incomes, and consequently suggests a widening discrepancy in the timing of work based on income level. Hamermesh (1999b), using the CPS and

29 Regarding reductions in CO2 emissions, the JFA argued that economizing on the lighting bill would only reduce emissions by about 4%. The association reasons that although the elimination of lighting during late-night hours would reduce CO2 emissions by 5-6%, shifting the delivery of goods from nighttime to daytime would require a larger fleet of trucks and increase traffic congestion. This would increase emissions by 2%, leaving the net CO2 reduction from restrictions on late-night operations at only 4%.

30 Sociology has a longer history of literature analyzing activities by time of the day. For example, Szalai (1972) showed that in the US, activities for each time slot differed depending on the city, while Presser (1987) analyzed the timing of the work of spouses. The survey by Gershuny and Sullivan (1996) is also of interest.

data from the FBI crime report on the number of murders by region, showed that the late-night fraction of people at work was lower for regions with higher murder rates. This could be interpreted as corroboration that late-night work has a high marginal disutility of labor. Additional trials in Hamermesh (2002), which extended the CPS data set to 1997, also showed a secular decline in late-night work by US males. If Hamermesh's conjectures are correct, the share of workers who work during hours with a high marginal disutility should also decline in other countries as average real wages rise, and vice versa.

This paper uses micro data from the *Survey on Time Use and Leisure Activities*, a time-use survey taken by the Japanese government's Statistics Bureau within the Ministry of Internal Affairs and Communications. Respondents to the survey, which is conducted over a nine-day period from Monday through Sunday in September-October, annotate their activities in 15-minute increments over two consecutive 24-hour periods. The survey was first taken in 1976, and nearly 200,000 Japanese citizens have been surveyed every five years since then. The most recent survey (seventh survey) was taken in 2006, and this paper uses data from the last five surveys taken from 1986 until 2006.

The advantages of our data are that (1) they are from a relatively long time series spanning the 20 years from 1986 until 2006, and thus permit an understanding of trends from the 1980s until recently; (2) they are from a large sample and contain a large quantity of information; and (3) rather than assume the usual start and end times of the work day, the survey makes it possible to know whether the respondent was working for each 15-minute increment.[31] Another unique aspect of this paper is that it also focuses on the distribution of time slots across days of the week.

The summary of this paper is as follows: We show that Japan had a secular increase in the share of workers working in the late-night and early-morning hours over the two decades since mid 1980s. This trend remains when controlling for changes in hours worked associated with the business cycle and for changes in demography and the occupational mix. In addition, the notable increase in the fraction of people at work in the evening (until about 10 pm) was for highly educated,

31 The series of papers by Hamermesh analyzed not time-use surveys but rather information on the usual start and end time of working hours extracted from questions in the CPS.

high-income workers, whereas the increase in the fraction of people working late-night or early-morning hours was for workers with low levels of both education and income. Although this diversification of work timing is similar to the trend found in the US, a major difference is that in Japan, it was an increase in the share of workers working late-night or early-morning hours that drove this diversification. We also confirm compensating wage differentials for late-night work, which implies that people choose to work at undesirable hours because they can make higher wages than when working in desirable hours.

This paper is organized as follows. In section 6.2, we explain the theoretical underpinnings of our analysis, and in section 6.3, we explain the data we use. In section 6.4, we look at how the timing of work in Japan has changed over a 20 year period from 1986 to 2006. In section 6.5, we further analyze the data to identify the main group working late-night or early morning, by focusing on differences in education and income level. In Section 6.6, we estimate hedonic wage models to investigate why more people have begun working during undesirable times in Japan. We end with our conclusions in section 6.7.

6.2 Theoretical underpinnings

Following Winston (1982) and Hamermesh (1999a), we assume that individual *i* chooses daily the timing of work so as to maximize the following utility function,

$$V_i = \sum_t U_{it}(1 - L_t, C_t), \quad \textit{subject to} \ \sum_t (w_{it} L_t - C_t) = 0, \quad t = 1, \cdots, 96, \qquad 1)$$

where L_t is an index function that takes the value 1 if individual *i* is working at time *t* (a 15-minute block of time within the 24-hour day), and 0 if not; w_{it} is the wage rate if individual *i* is working at time *t*, C_t is consumption at time *t*, and the consumer goods price is 1 for simplicity. We assume here that leisure and consumption are intertemporally additively separable, and thus that leisure and consumption are separable at each *t*. Because we are considering a utility function for one day only, we do not use a discount rate. We also assume that fatigue does not impact the choice between consumption and leisure for individual *i* at time *t*, since we are addressing decisions for

each time block. When the following equation is satisfied, individual *i* works at time *t*.

$$(-\Delta U_{it} / \Delta L_t) / (\Delta U_{it} / \Delta C_t) \leq w_{it}. \qquad 2)$$

The above equation is based on the same logic as the corner solution in a standard labor supply model for an individual's decision on whether to participate in the labor market (whether to work or not work), with the only difference being that the decision is on whether to work at time *t*. The right-hand-side term in equation (2) is the reservation wage of individual *i* at time *t*. Just as each individual has a different reservation wage, each time *t* has a different reservation wage, even for the same individual.

We next consider the demand side. We assume that the firm engages in profitable production activity during various blocks of time throughout the day. The profit function of firm *j* is given by

$$\Pi_j = \Pi_j(a_{j1}N_1, \cdots, a_{j96}N_{96}; w), \qquad 3)$$

where Nt is the number of workers at time t, ajt is labor's contribution to firm j's profit at time t, and w is the average wage of workers employed by firm j.

The equilibrium is shown by the standard implied contract model of Rosen (1986). That is, the labor demanded by firm j at time t, holding other conditions constant, is going to be supplied by the worker, out of those with the lowest reservation wage at time t, with the highest ajt.

The labor market's wage premium θ_t at time t is determined by the distribution of workers' reservation wages at time t and by the distribution of ajt. The wage at each t is given by $w_{it} = w_i(1+\theta_t)$. Like Hamermesh (1999a), we assume that there are ts where firms cannot fully meet their demand for labor when θ_t=0. In other words, there are ts that are undesirable as a time to work for a large number of workers although firms can profit from operating at those times, and the wage premium ($\theta_{t'} > 0$) then serves to motivate workers to supply labor at those times. Holding other conditions constant, it is lower-income workers who will be motivated by a wage premium to work at times when the marginal disutility of labor is high, i.e., at the undesirable work time t.32

32 Here, we assume that θ_t is determined by the labor market, although the overtime premium

Following Hamermesh (1999a), we make the following three assumptions: (1) Workers' preferences do not change over time, (2) the higher the proportion of workers with relatively low human capital endowment working at a given time, the less desirable is that time for workers as a time to work, (3) technical innovations have a uniform impact across different time blocks on the average productivity of workers, and do not only impact the productivity of workers in a given time block.

Using these assumptions, Hamermesh (1999a) argues that within a national economy when average real wages rise, the share of workers who work at undesirable times should decline because of income effects. Furthermore, the paper argues that, under conditions of rising income inequality, high-income individuals will shift their work to desirable times, and low-income workers will remain working at undesirable times, and this should lead to a widening of the discrepancy in the timing of work based on income level. In fact, Hamermesh (1999a) showed that in the US, the share of workers working late-night hours has declined over time and this trend was more pronounced among high-income workers, which results in widening differences in the timing of work across income levels.

Japan experienced a long-term economic slump that began with the bursting of its economic bubble in the early 1990s, and conditions were bad enough for this period to be called "Japan's lost decade and a half." During this time, average real hourly wages have declined. If the hypothesis in Hamermesh (1999a) holds in Japan, late-night work by workers with declining real wages should increase, and this should lead to differences in time-specific employment rates across income levels. We take a closer look at this below.

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that applies to hours worked beyond the legal workweek is actually prescribed by law in many countries, and Japan is no exception to this. According to Japan's Labor Standards Act, legal work hours are eight hours per day and 40 hours per week, and firms must pay an overtime premium of at least 25% for any hours that exceed this. If this overtime work in done during late-night hours (defined as from 10:00 pm to 5:00 am), the required premium is at least 50% (a 25% premium for late-night work and a 25% premium for overtime work). Kawaguchi, Naito, and Yokoyama (2009) showed that nearly all of the wage premia actually paid in Japan were at the 25% level. It is unclear whether the legally prescribed wage premium is higher than that determined by the labor market (i.e., than the potential wage premium).

6.3 Data

Our data comes from the Survey on Time Use and Leisure Activities (STULA), a Japanese time-use survey taken by the Ministry of Internal Affairs and Communications (MIAC). First taken in 1976, STULA is taken every five years in the year following the MIAC's Population Census. It is a large-scale survey that first selects approximately 6000 survey districts from those established for the *Population Census*, out of which it selects approximately 70,000 to 100,000 households, in which live about 200,000 to 270,000 household members who are at least 10 years old. The sample size (number of households and household members) varies each survey year. The survey is based on answers from individuals regarding a consecutive two-day period that is set for each survey district, and thus the sample size is approximately twice the number of household members surveyed. Another notable characteristic is that the survey covers every day of the week during a nine-day period from late September to early October. We use data from the third through seventh STULAs taken (in 1986, 1991, 1996, 2001, and 2006).

As shown in Appendix Table 6.1, the survey respondents record their activities, chosen from a list of 20 possibilities, for each 15-minute increment within the 24-hour day. Our measure of hours worked corresponds to the "work" category in STULA. The examples/notes column in the table gives detailed examples of the various types of work, such as regular work, preparatory work and clean-up work, overtime, take-home work, part-time work, moonlighting, and help with the family business. It does not include time taken for rest breaks or meals during the work day. Other questions asked of respondents in addition to their activities include such basic information as age, level of education, marital status, whether they have children, number of persons in household, household annual income, number of employees at workplace, and length of usual work week. For more about STULA, see Kuroda (2009).

Because we limit our analysis to full-time employees, we only use samples with a usual work week of at least 35 hours, and exclude the self-employed.[33] The basic statistics for our sample are shown in Table 6.1.

33 Our results are generally unchanged when including in our sample those workers with a shorter work week (less than 35 hours).

6.4 Timing of work

6.4.1 Over the 20 years from 1986 to 2006

Figures 6.1(1) and 6.1(2), which show 15-minute intervals in a 24-hour day on the horizontal axis and the fraction of people at work (employment rate) for each time on the vertical axis, plots the distribution of employment rates in 1986, 1996, and 2006[34] . The overall shape of the distribution shows the employment rate is over 50% from 8:00 am to 9:00 am, and rises to close to 70% after 09:00 am. It then drops to about 20% around noon (lunch time), returns to nearly 70% from 1:00 pm to 5:00 pm, and then gradually declines from the early evening. The slight declines around 10:00 am and 3:00 pm can probably be attributed to the large number of employees who take a break around those times.

A time series of these employment rates by time of day shows some common trends for both males and females. First, the daytime employment rate has declined by approximately 10% over the past 20 years. Second, the tails at both ends of the distribution became fatter, as the employment rate from 6:00 pm until 6:00 am (evening, late night, and early morning) increased. Third, the decline in the employment rate during the lunch hour became smaller.

To examine this more closely, Table 6.2 shows the employment rate for six times of day every five years. As seen in Figure 6.1, the employment rate at 11:00 am declined 7.5% for males and 9.4% for females, while the fraction of employees working in the early-morning, evening, and late-night hours has shown a secular increase over the 20-year period.

It is important to note that Japan's Labor Standards Act was revised in 1988, and the legal workweek shortened from 48 hours to 40 hours. This led to wider adoption of the five-day work week, and suggests the possibility that the decline in the daytime employment rate is related to the decline in the number of work days caused by the change in legislation. To examine this, Figure 6.2 separates the samples by the day of the week surveyed, and plots the employment rate by time of day for weekdays (Monday to Friday), Saturdays, and Sundays.

Looking at weekdays in Figure 6.2 (1), although the magnitude is much smaller, we still

34 Unless noted otherwise, all analysis from this point forward is based on calculations using weights provided by the Statistics Bureau of the MIAC.

observe a similar trend to that in Figure 6.1, i.e., a decline in daytime employment rates and increases in both tails of the distribution for males. On Saturdays, on the other hand, the daytime employment rate shows a large decline from 1986 to 1996 as a result of wider adoption of the five-day work week, then increases from 1996 to 2006. On Sundays, there was a decline in the daytime employment rate, while the employment rate rose during the times corresponding to the distribution's two tails.

For females, in Figure 6.2 (2), we also observe a slight decline in the daytime employment rate, and an increase in the employment rate during the evening, late-night, and early morning hours for weekdays, with the trend more pronounced than that for males. Saturdays and Sundays for females were like Saturdays for males, showing a large decline in the daytime employment rate between 1986 and 1996, and then an increase from 1996 until 2006. The employment rate for females on Sunday afternoons in 2006 had recovered to about the same level as in 1986, and there was a notable increase in the employment rate on Sunday evenings.

To examine this more closely, Tables 6.3 (1) and 6.3 (2) show the employment rate for six times of day for each day of the week. Like Table 6.2, Tables 6.3 could be taken as evidence of the deagglomeration of the timing of work in Japan. That is, the employment rate at the daytime hour of 11:00 am showed a declining trend for all days of the week, whereas we see a rising trend for the evening, late-night, and early-morning hours for all days of the week. It is interesting that, despite widespread adoption of the five-day work week following revision of the Labor Standards Act in 1988, the late-night, early-morning employment rate increased not only on weekdays but also on Saturdays and Sundays. This is the opposite of findings for the US by Hamermesh (1999), which found a secular decline in night-time work. Furthermore, it is also noteworthy that the late-night, early-morning employment rate increases seem to have occurred mostly in the last decade, from 1996 to 2006.

In Table 6.3, the biggest increase in employment rate occurred at 7:00 pm on weekdays. The percentage of males working at 7:00 pm increased from 26.6% in 1986 to 35.6% in 2006, a nine percentage point increase over 20 years. Females exhibited the same trend, with their employment rate at that time increasing from 8.4% in 1986 to 19.6% in 2006, an 11.1 percentage point increase.

This means that one out of every three to four full-time workers in Japan worked at 7:00 pm in 2006, and implies an increase in evening work.

6.4.2 Adjustments in hours worked

Time-series shifts in the employment rate by time of day are also affected by changes in hours worked resulting from the business cycle or regulatory changes. Table 6.4 shows changes over time in the average hours worked per day Monday through Friday, Saturday, and Sunday, as well as the average for all days. As shown by Kuroda (2009), although there was no statistically significant change in hours worked per week over the 20-year period in Japan, widespread use of the five-day work week has resulted in a substantial change in the allocation of work hours between weekdays and weekends (or Saturday). Specifically, the hours worked per weekday from Monday through Friday averaged 8.74 hours for males and 7.37 hours for females in 1986, but averaged 9.15 hours for males and 7.71 hours for females in 2006, an increase of about 0.4-0.5 hours per weekday. In contrast, there was a substantial decline in the hours worked on Saturday, owing to the large number of people taking Saturday off. Thus, one may argue that the observed change in the timing of work was due only to the change in the length of work. To account for this, we check to see if there was any change in the timing of work after adjusting for the length of hours worked.

Following Hamermesh (1999), we make this adjustment as follows.

$$L_{its} = \alpha_{ts} HOURS_{is} + e_{its}, \quad t = 1, ..., 96, \quad s = 1991, 1996, 2001, 2006. \qquad 4)$$

Here, L_{its} is the variable that indicates whether individual i is working at time t (a 15-minute interval in a 24-hour day), taking the value of 1 for working and 0 for not working, s is the survey year (s > 1986), $HOURS_{is}$ is the daily work hours of individual i in year s, and e_{its} is the error term. To adjust for hours worked, we estimate equation (4) for four survey years (1991, 1996, 2001, and 2006) to obtain the $\hat{\alpha}_{t,s}$ for each time those years. Next, by substituting in the average hours worked per day in 1986 ($HOURS_{86}$), we calculate the employment rate by time ($\hat{L}_{t,S}$) for each survey year if the hours worked were at the same level as in 1986, as in equation (5).

$$\hat{L}_{t,91} = \hat{\alpha}_{t,91} HOURS_{86} \qquad 5)$$

Table 6.5 shows employment rates by time after adjusting for hours worked. It indicates that the trend shown in Table 6.3 is virtually unchanged even after the adjustment. In fact, the adjusted series shows a more pronounced trend, for both males and females, of a declining employment rate during daytime hours and a rising employment rate for the late-night and early-morning hours. In addition, although the Saturday sample for males shows a declining trend in the unadjusted employment rate at 7:00 pm, it shows a substantial increase after adjusting for hours worked. There was also a substantial increase in the late-night and early-morning employment rate on Saturdays. Despite the large decline over the 20-year period in average hours worked on Saturday, the estimation results suggest that the employment rate would probably have been higher if work hours were the same as in 1986.

6.4.3 Controlling for other characteristics

Besides the length of working time, the change in the timing of work could also be brought about by other factors, such as demographic changes in which people marry later in life and have less children (which leads the society towards aging), or changes in the occupational mix resulting from growth in the service industry. For example, if there were a trend for single workers to work late-night hours and elderly workers to work early-morning hours, the demographic changes of population aging and marrying later in life could possibly cause the late-night and early-morning employment rates to increase, even without any change in individuals' lifestyles. It is also conceivable that an increase in the crime rate could necessitate more late-night workers such as security guards, thereby raising the late-night employment rate. The theory presented in section 6.2 assumed no changes in either demographics or the mix of occupations, and no change in worker preferences over time. We therefore check below to see if the trends seen in the previous section still hold even after holding such changes constant.

Following Hamermesh (1999a), we make this adjustment as follows. We first estimate the following equation by using the 1986 samples:

$$L_{it,\,86} = \beta_0 + \sum_j \gamma_{ijt,86} X_{ij,86} + e_{it,86}, \qquad t = 1, \ldots, 96. \tag{6}$$

where X_{ij} is attribute j (age, education level, marital status, employment dummy, residence dummy, and weekly time off dummy) for individual i.[35] Our data specifies the prefecture of residence, making it possible to use a prefecture dummy as a variable to indicate location (Japan has 47 prefectures). To control for the tightness of labor market supply-demand in 1986, we categorize the 47 prefectures into 10 regional blocks, and assign an unemployment rate for each block.

We then use the parameter $\hat{\gamma}_{j,86}$, estimated from equation (6), to find the average impact for each age group from changes in the attribute mix, as shown in equation (7) below.

$$\hat{L}_{t,\,s} = \beta_0 + \sum_j \hat{\gamma}_{jt,86} \overline{X}_{j,s} + e_{t,s}, \qquad t = 1, \ldots, 96, \qquad s = 1991, 1996, 2001, 20 \tag{7}$$

Provided, however, that $\overline{X}_{j,S}$ is the average value for attribute j in year s. Using the solution $\hat{L}_{t,s}$, we adjust for the impact on the employment rate from changes in the attribute mix, and then further apply the adjustment for work hours obtained in equation (4), as follows.

$$L_{its} - \hat{L}_{t,s} = \alpha_{ts} HOURS_{is} + e_{its}, \quad t = 1, \ldots, 96, \quad s = 1991, 1996, 2001, 20 \tag{8}$$

Table 6.6 shows the employment rates after adjusting for changes in the attribute mix and in hours worked. The table confirms that there is virtually no change from the trend found in Table 6.5. That is, even after controlling for changes in demographics and the occupational mix, Japan experienced a deagglomeration of employment rates by time of day, and an increase in the late-night and early-morning employment rate.

35 Ideally, structural changes in industry should also be controlled for, but we do not do that here because STULA contains no information on industry.

6.5 What type of person works at undesirable hours? – focusing on the differences in education and income level

To identify the type of person who works at undesirable hours, we look at changes in the employment rate by time of day for different levels of (1) education and (2) income. We limit our sample in this section to male full-time workers in their thirties and forties to control for age effects such as seniority wages or decline in stamina[36]. In addition, we focus on the two survey years of 1996 and 2006, since the increase in employment rate at undesirable times has mostly taken place in the last decade, as we saw in the previous section.

6.5.1 Education level

Figure 6.3 looks at the employment rate by time of day for both 1996 and 2006 after dividing the sample into university graduates and other. For weekdays (Monday to Friday), the employment rate from early evening until around 10:00 pm has followed a rising trend over the past 10 years regardless of education level, but the increase was particularly large for university graduates. The sample of non-university graduates showed a greater decline in the proportion of individuals working during daytime hours than did the university graduates, but that group's increase occurred in the late-night to early-morning hours of 11:00 pm until 7:00 am.

Looking next at Saturdays, the proportion of individuals working before noon was roughly the same for university graduates and for others in 1996, but in 2006 it was the university graduates that showed the greatest drop in daytime employment, the opposite of the trend for Monday to Friday. In addition, the group of non-university graduates showed an increase in their employment rate around both Saturday early morning until 7:00 am and evening after 8:00 pm .

On Sundays, there was a fairly stark difference in daytime employment rates between the university graduates and the others in 1996, and the employment rate declined in 2006 by way of a

36 Wages in Japan are normally tied to seniority, and thus as workers get older their wages tend to increase. Accordingly, because of the income effect from wages rising with age, we would expect as one ages he/she would work less during hours of high marginal disutility. In addition, because overall stamina decreases with age, the reserve wage for work during late-night hours should also increase. Note that our findings in this section do not differ greatly when including other age groups.

downward shift for all. Also true, however, is that the group of non-university graduates had an increase in its employment rate during night and early-morning hours in 2006. For this group, the proportion of daytime work declined throughout the week, while the share of work from late night until early morning followed a rising trend. Although not shown in the table because of a lack of space, the fraction of full-time male workers in their twenties without a university degree working at midnight on Saturday nearly doubled, from 5% in 1986 to 9.6% in 2006. The fraction of full-time male workers in their twenties with a university degree working at midnight also increased, but only from 2.1% in 1986 to 3.6% in 2006. This evidence suggests that education-based differences in the timing of work have gotten larger. Although not shown, these trends remain the same even after adjusting for hours worked and demographic changes as was done in the previous section.

6.5.2 Income

To look at the above trend from a different angle, Figure 6.4 divides a sample of full-time male workers in their thirties and forties into four groups based on annual income, and then calculates the employment rate for each quartile. Because STULA only shows annual income for the whole household, we limit our sample to households with a single wage earner.[37]

Figure 6.4(1) shows the employment rate Monday to Friday for the bottom 25 percent and top 25 percent income quartiles for 2006, indicating that there are income-based differences in employment rates. The employment rates from noon until early evening for the lowest income quartile are lower than those of the highest income quartile by at least 10 percentage points. Conversely, the lowest income quartile had a higher late-night to early-morning employment rate.

Figure 6.4(2) shows, for both 1996 and 2006, a fraction with the employment rate by time of

37 The only question relating to income in STULA was a multiple choice question on total annual income for the household, and no information on the annual incomes of individuals can be gleaned from the survey. Our sample is limited to those full-time male employees in their thirties and forties who answered that either they are single or their wives were not working. There is a possibility of the sample being biased if there were a tendency for males whose wife was exclusively a homemaker to work longer hours. Nevertheless, Kuroda (2009), which divided a sample of full-time male employees in their thirties into those with an employed spouse and those with a non-employed spouse to check for significant differences between the two groups in the husband's average hours worked, used matching estimation to find no statistically significant difference between the two groups.

day for the 4th (top) quartile in the denominator and that for the 1st (bottom) quartile in the numerator. This gives a picture of the employment rate gap between income groups for both 1996 and 2006. The gap in the late-night employment rate between the lowest income group and highest income group increased between 1996 and 2006, with the fraction almost doubling in many time slots. Conversely, this fraction for the day to late evening hours, which was below unity in both years, became smaller. This is consistent with the drop in the employment rate for non-university graduates at noon and sharp rise in the employment rate for university graduates at night seen in subsection (1) of this section. The increase in late-evening work by the highly educated, high-income group may be related to an increase in the fraction of employees working from home as a result of wider use of the Internet. This is an area for further study.

Figures 6.4(3) through (6) give the same information as Figures 6.4 (1) and (2), except that the samples are limited to Saturday and Sunday, and show that the trend for Saturday and Sunday is clearly different from that for weekdays. Specifically, on Saturday and Sunday both daytime and night-time employment rates are higher for lower income groups. In addition, the gaps between employment rates for the lowest-income group and the highest-income group are getting bigger for nearly all times. In other words, it has mostly been high-income workers who stopped working on Saturday and Sunday as a result of the spread of the five-day work week, while the relative frequency of Saturday and Sunday work remained flat or even increased for low-income workers

6.6 Why more people started working at undesirable hours

In the previous section, we saw the high-income group worked increasingly longer hours until the late evening during weekdays, while the low-income group started working more during undesirable hours (midnight to early morning) on weekdays. For weekends, we saw that the high income group started working less compared with the low income group. These observations suggest that inequality in the timing of work between high and low income earners has widened, especially over the decade ending 2006. In this last section, we try to see why working times differ across income levels. Specifically, we focus on the question of why low income earners have started working at undesirable hours.

In order to investigate this question, we look first at trends in the real hourly wage distribution for full-time males in their 30s and 40s. Real hourly wages are the annual income of single-earner households (used in section 6.5) divided by annual hours worked (=usual weekly hours of work*4*12), converted to real terms using the CPI by prefecture. Figure 6.5 plots trends in the real hourly wage at the 25^{th}, 50^{th}, and 75^{th} percentile from 1986 to 2006. Looking at this figure, we see that after increasing from 1986 to 1996, the average real hourly wage showed a secular decline from 1996 to 2006.

Japan experienced a long-term economic slump that began with the bursting of its economic bubble in the early 1990s, and conditions became bad enough for this period to be called "Japan's lost decade and a half." Deflation had started in the mid-1990s in Japan. Kuroda and Yamamoto (2005) find that although nominal wages were downwardly rigid in the mid-1990s, this rigidity disappeared when the recession deepened around the late 1990s, and wages were adjusted downward. This finding accords with what we observe in Figure 6.5.

If the theory in Hamermesh (1999a) holds in Japan, the decline in real wages would have caused more people to work at undesirable hours due to (negative) income effects. As is shown in Figure 6.5, real wages declined for all three percentiles over the 10 years ending 2006, which implies that it would not be surprising for everyone to shift more of their work to undesirable hours, even if they perceive more disutility of labor. However, considering the findings in the previous section that it is the lower income earner who typically works at undesirable hours, we also assume that lower income earners with a lower reservation wage are more likely to work at undesirable hours since they would tolerate the disutility of labor to earn more income. In addition, if there is an increase in the wage premium for such hours due to an increase in the services and goods demanded then, the supply of labor at the undesirable hours would increase further due to price effects.

Therefore, we investigate the possibility that workers who work at undesirable hours choose to do so because their wages are high enough to compensate their disutility from working late night or early morning. Specifically, we examine whether there exist any compensating wage differentials across the time of day by estimating the hedonic wages of Rosen (1986).

Previous studies have found that compensating wage differentials are hard to find, especially

because of heterogeneous worker preferences. Some may choose to work in undesirable hours because of compensating wage differentials, while others may do so just because they generally prefer to work in those hours. That is, the workers observed working at undesirable hours may convey a selection bias when estimating hedonic wages.

We take care of this selection bias by following Lanfranchi, Ohlsson, and Skalli (2002). First, we estimate the selection function for each time interval, which determines whether or not people choose to work at that time interval:

$$\Pr(L_{i,h}=1)=\sum_{j}\gamma_{h,j}Z_i+e_{i,h}, \qquad h=1,\ldots,8. \tag{8}$$

where h stands for three-hour time intervals (starts from midnight-3:00 am, 3:00-6:00 am, $\cdots$, 9:00-midnight), $L_{i,h}$ takes 1 if the person works during the time interval, and 0 if not, $Z_{i,}$ is the individual's characteristics[38] with parameters $\gamma_{h,j}$, and $e_{i,h}$ is an error term. Then, we compute mills' ratio, $\phi(\hat{\gamma}_{h,j}Z)/\Phi(\hat{\gamma}_{h,j}Z)$, by using the estimated $\hat{\gamma}_{h,j}$. Second, we estimate the following wage equation including mills' ratio, by which the differences in preferences among heterogeneous workers are adjusted:

$$W_{i,h}=\sum_{m}\mu_{h,m}V_i+\sigma_{i,h}(\phi/\Phi)+e_{i,w}, \qquad h=1,\ldots,8. \quad if \quad L_{i,h}=1. \tag{9}$$

where $W_{i,h}$ is log real hourly wage for worker *i* who is working in *h*, V_i is individual characteristics[39], $\mu_{h,m}$ and $\sigma_{i,h}$ are parameters, and $e_{i,w}$ is an error term. Third, we compute the potential wage of each time interval for every sample using the parameter obtained in equation (9): $\hat{W}_{i,h}=\delta_w+\sum_{m}\hat{\mu}_{h,m}V_i$. This enables us to obtain each individual's potential real hourly wage for each time interval regardless of whether the person is working during that time interval. Our main

38 Specifically, Z includes age, education dummies (3 categories), occupation dummies (11 categories), number of employee dummies (4 categories), employment status dummy (takes 1 if a person is a regular employee), marital status, children dummy (takes 1 if a person has less than 6 years old child), weather dummies (3 categories), number of hours worked during the interviewed day, usual commute time for each way (4 categories), regional unemployment rate, and prefecture dummies.

39 Specifically, V includes age, age squared, education dummies, occupation dummies, number of employee dummies, employment status dummy, marital status, regional unemployment rate, and prefecture dummies.

contribution is that, unlike most hedonic models, we calculate the same person's hourly wage for each time period within a day.

Unfortunately, we cannot identify the real hourly wage for each time interval from STULA. Instead, we only observe each worker's average real hourly wage (calculated from annual real income divided by annual hours worked) and whether or not the worker is working in each time interval. Therefore, $W_{i,h}$ does not necessarily reflect the true real hourly wage of time *h*. To account for this in our estimation, we put more weight on those who work a shorter day[40]. This is because the observed hourly wage is averaged out together with other time intervals' hourly wages, and therefore contains more information from other time intervals when the work day is longer.

Tables 6.7 and 6.8 show the results of equations (8) and (9) for weekday samples. In Table 6.7, we find that lower educated workers are more likely to take work during midnight-9:00 am interval, while higher educated workers are more likely to work in the afternoon (noon-6:00 pm) and early evening (6:00-9:00 pm). A similar trend is observed for occupation types; highly skilled workers are more likely to work from noon until the early evening. This is consistent with our casual observation in Section 6.5 that the increase in the employment rate in early evening was particularly large for university graduates, while the employment rate of non-university graduates showed an increase in the late-night to early-morning hours. Our results also indicate that non-regular workers tend to work during undesirable hours.

Table 6.8 shows the wage equation results. Most human capital variables have the expected signs. Those who are more highly educated, more highly skilled, and working at larger firms and as regular employees tend to earn more. Regional unemployment rates are mostly significantly negative, suggesting that real wages are low in with a weak economy. Since mills ratios are not significant, we can regard the selection bias as not severe.

Figure 6.6(1) plots the average potential real hourly wage across time intervals (adjusted for selection bias) for those who actually work during midnight-3:00 am period, and shows that time period has the highest average potential wage. This result implies that people working at undesirable hours choose to do so because they can earn more then. This supports the concept

40 In estimation, we also use sampling weights.

behind Rosen's compensating wage differential story.

It is important here to consider the reason why the late-night hourly wage is highest for those workers. In the estimation result of selection equation (8) and in the previous section, we showed that the employment rate of university graduates (or higher income earners) in the early evening has increased, possibly as a result of the spread of the five-day work week. This fact implies that there should be plenty of demand for services and goods at later hours, since many of the workers who work those hours need services and goods on their way home, such as trains, buses, taxies, convenience stores, supermarkets, bars, restaurants, fast food shops, and coffee shops. To motivate enough non-university graduates (low income earners) to work at those times and meet this demand, service-sector firms would need to raise the late-night wage premium.

We also compare the potential wages of weekdays with those of weekends as well as those of day and night. Tables 6.9 and 6.10 are results obtained by using samples interviewed on Friday (1^{st} day) -Saturday (2^{nd} day) and on Sunday (1^{st} day)-Monday (2^{nd} day). Since the samples are limited, we divide time into four intervals: (1) weekdays (6:00 am – 6:00 pm), (2) weeknights (6:00 pm – 6:00 am), (3) weekend days (6:00 am – 6:00 pm), and (4) weekend nights (6:00 pm – 6:00 am). Table 6.9 shows that the higher educated are more likely to work during prime time (i.e., weekdays), while the lower educated are more likely to work on weekends, both day and night. By occupation, teachers, sales workers and protective service workers are more likely to work on weekends. These results are also consistent with what we observed in the previous section.

Using parameters obtained in the wage equation in Table 6.10, we plot the average potential real hourly wage for those who work weekend days (6:00 am – 6:00 pm), and weekend nights (6:00 pm – 6:00 am) in Figure 6.6(2). The figure suggests that those who work 6:00 am – 6:00 pm on weekends choose such hours to earn the highest wage possible within the week. Compared with weekdays and weeknights, weekend day wages include a weekend day premium, presumably because that is when many people want to spend time with their family and friends. On the other hand, those who work on weekend nights (6:00 pm – 6:00 am) seem to earn the lowest wages. Keep in mind that in Table 6.10, most of the variables in the wage equation for weekend nights are not significantly estimated, suggesting that some important variables are missing from the equation.

Another interpretation is that since the more highly educated, higher income workers take up all the desirable daytime hours, the other workers are being squeezed out, and have no choice but to work at the less desirable, less compensated times. Furthermore, the fact that many people do not work on weekends suggests that there is less demand for services and goods on weekend nights, unlike on weeknights. This is another possible reason why no wage premium is observed for weekend nights.

6.7 Conclusion

This paper is aimed at understanding Japanese lifestyle changes by observing the timing of work during the day, using a Japanese time-use survey to examine changes in the timing of work in Japan from 1986 until 2006.

We find a secular increase in the share of workers who work in the late-night and early-morning hours. This trend remains when controlling for changes in hours worked associated with the business cycle and for changes in demography and the occupational mix. This increase in the employment rate at late night and early morning, which seem to be inferior hours with a high marginal disutility of work, is an interesting result, since Hamermesh (1999a) finds the opposite results: a decline in the late-night and early-morning employment rate in the US. We also find that the notable increase in the employment rate for evening work (until about 10 pm) was for highly educated, high-income workers, whereas the increase in the employment rate of those working late-night, early-morning hours was for workers with low levels of both education and income. In addition, we observed a notable decline in the fraction of highly educated, high-income individuals working on Saturday, but an increase in the employment rate of less educated, low-income workers in the early morning and late-night hours on Saturday.

Why has the employment rate in the late-night, early-morning hours increased in Japan? The sustained recession in post-bubble Japan reduced the number of regular employees working daytime hours, while there was a trend among businesses, particularly in the service industry, to greatly expand operating hours in the hope of sparking at least some demand. There is a possibility that this resulted in the more highly educated, higher income workers working in the desirable daytime hours, while the other workers, having been squeezed out, had no choice but to work at other times.

However, our results suggest that most of those who have begun working at undesirable hours are compensated with an undesirable time wage premium. The exception to this is the bottom group, which works at the most undesirable hours (weekend nights) without any wage premium. Furthermore, we consider these wage premiums a reflection of the increase in demand for services and goods from the highly educated, higher income workers who work into the evening.

Meanwhile, this growth in work timing differences during a sustained economic slump could probably be seen as evidence that people were happy just to have the opportunity to work, even at undesirable times. If that is the case, then another possible interpretation of these results is that income inequality is lower than it would have been with absolutely no change in the work timing gap. In other words, another way to frame these results is that although gaps in the timing of work arose during Japan's lost decade, this was a successful way to avoid unemployment and brought the added benefit of suppressing the increase in income inequality.

There has been an increase in health problems related to overwork and stress in Japan in the last several years, however, and this may be related to the rising number of people working late-night and early-morning hours. Some interesting questions for further study could concern the causes of differences in the timing of work and whether late-night work has anything to do with Japan's increase in overwork- and stress-related health problems.

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References for Chapter 6

Gersbuny, Jonathan and Oriel Sullivan (1998), "The sociological uses of time-use diary analysis", *European Sociological Review*, vol. 14, pp.69-85.

Hamermesh, Daniel S. (1999a), "The Timing of Work over Time," *The Economic Journal*, vol. 109, pp. 37-66.

——— (1999b), "Crime and the Timing of Work," *Journal of Urban Economics*, vol. 45, pp.311-330.

——— (2002), "Timing, togetherness and time windfalls," *Journal of Population Economics*, vol.15, pp.601–623.

Kawaguchi, Daiji, Hisahiro Naitou, and Izumi Yokoyama (2008), "Labor Market Responses to Legal Work Hour Restriction: Evidence from Japan," ESRI Discussion Paper Series No.202.

Kuroda, Sachiko (2009), "Do Japanese Work Shorter Hours than before? Measuring Trends in Market Work and Leisure Using 1976-2006 Japanese Time-Use Survey," Discussion paper No. 419, Hitotsubashi University.

———, and Iasmu Yamamoto (2005), "Wage Fluctuations in Japan after the Bursting of the Bubble Economy: Downward Nominal Wage Rigidity, Payroll, and the Unemployment Rate", *Monetary and Economic Studies*, 23 (2), Institute for Monetary and Economic Studies, Bank of Japan, pp.1-29.

Lanfranchi, Joseph, Henry Ohlsson, and Ali Skalli (2002), "Compensating Wage Differentials and Shift Work Preferences," *Economic Letters*, vol.74, pp.393-398.

Presser, Harriet B. (1987), "Work shifts of full-time dual-earner couples: patterns and contrasts by sex of spouse," *Demography*, vol. 24, pp. 99-112.

Rosen, Sherwin (1986), "The theory of equalizing differences," *Handbook of Labor Economics*, in Orley Ashenfelter and Richard Layard, eds., Amsterdam: North-Holland, pp. 641-692.

Szalai, Alexander (1972), *The Use of Time*, The Hague: Mouton.

Winston, Gordon C. (1982), *The Timing of Economic Activities*. NewYork: Cambridge University Press.

Tables & Figures

Table 6.1: Basic Statistics

		Male					Female				
		1986	1991	1996	2001	2006	1986	1991	1996	2001	2006
Age	Average	39.88	40.64	40.80	41.10	41.77	39.11	39.50	39.28	39.13	39.64
	20s	0.20	0.20	0.21	0.20	0.16	0.25	0.27	0.30	0.30	0.26
	30s	0.34	0.27	0.26	0.28	0.30	0.27	0.21	0.21	0.23	0.27
	40s	0.25	0.29	0.28	0.24	0.24	0.27	0.29	0.27	0.22	0.22
	50s	0.18	0.20	0.20	0.24	0.24	0.18	0.19	0.19	0.22	0.22
	60s	0.03	0.04	0.05	0.04	0.05	0.03	0.03	0.04	0.03	0.03
Education	Junior High	0.22	0.18	0.15	0.11	0.09	0.26	0.20	0.16	0.10	0.06
	High School	0.45	0.47	0.47	0.45	0.44	0.46	0.50	0.48	0.46	0.44
	Junior College	0.07	0.06	0.07	0.09	0.10	0.20	0.20	0.24	0.28	0.30
	University/Graduate school	0.26	0.29	0.31	0.34	0.37	0.07	0.09	0.12	0.15	0.20
Marital status	(Married=1)	0.78	0.75	0.72	0.71	0.71	0.64	0.60	0.54	0.51	0.48
Occupation	Professional	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00
	Technical workers	0.06	0.10	0.09	0.12	0.11	0.07	0.08	0.09	0.12	0.13
	Teachers	0.03	0.03	0.03	0.03	0.04	0.07	0.07	0.07	0.08	0.09
	Other professional and technical workers	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	Managers and officials	0.05	0.06	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00
	Clerical and related workers	0.19	0.18	0.18	0.18	0.17	0.33	0.36	0.38	0.37	0.36
	Sales workers	0.13	0.13	0.14	0.16	0.15	0.11	0.11	0.11	0.11	0.10
	Craftsman, manufacturing and construction workers	0.39	0.35	0.36	0.36	0.36	0.25	0.22	0.19	0.15	0.13
	Labourers	0.07	0.07	0.08	0.05	0.05	0.05	0.04	0.05	0.04	0.04
	Service workers	0.03	0.03	0.03	0.04	0.05	0.10	0.09	0.09	0.11	0.12
	Protective service workers	0.02	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00
	Others	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Employment Status	Regular employees	-	-	0.95	0.94	0.92	-	-	0.75	0.74	0.70
	non-regular employees	-	-	0.02	0.03	0.04	-	-	0.20	0.20	0.22
	temporary staff	-	-	0.00	0.01	0.03	-	-	0.01	0.03	0.06
	Others (incl. contract workers)	-	-	0.03	0.02	0.02	-	-	0.04	0.02	0.03
Sample sizes		103,168	104,107	102,821	67,756	60,797	53,431	57,811	55,793	38,307	35,373

Table 6.2: Employment rate by time (full-time employees)

(1) Male

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.034		0.023		0.045		0.763		0.223		0.064	
1991	0.034		0.023		0.041		0.734		0.229		0.065	
1996	0.035		0.023		0.041		0.708		0.246		0.067	
2001	0.041		0.025		0.043		0.688		0.270		0.079	
2006	0.044		0.029		0.047		0.687		0.286		0.082	
change												
2006-1986	0.010	**	0.006	**	0.002	*	-0.075	**	0.063	**	0.018	**

(2) Female

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.015		0.006		0.019		0.759		0.077		0.029	
1991	0.015		0.006		0.018		0.733		0.098		0.033	
1996	0.016		0.007		0.016		0.701		0.119		0.032	
2001	0.021		0.010		0.021		0.669		0.134		0.035	
2006	0.021		0.013		0.027		0.665		0.166		0.042	
change												
2006-1986	0.006	**	0.007	**	0.008	**	-0.094	**	0.090	**	0.013	**

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.3: Employment rate by time (Full-time employees, weekdays and weekends)

Male

(A) Weekdays

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.035		0.024		0.047		0.878		0.266		0.071	
1991	0.034		0.023		0.044		0.867		0.277		0.072	
1996	0.035		0.023		0.044		0.856		0.300		0.076	
2001	0.043		0.025		0.046		0.841		0.332		0.090	
2006	0.045		0.029		0.051		0.848		0.356		0.093	
change												
2006-1986	0.010	**	0.005	**	0.003	*	-0.029	**	0.090	**	0.023	**

(B) Saturday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.037		0.025		0.045		0.729		0.158		0.053	
1991	0.039		0.026		0.042		0.596		0.140		0.051	
1996	0.041		0.026		0.041		0.481		0.136		0.051	
2001	0.042		0.028		0.041		0.433		0.141		0.057	
2006	0.051		0.035		0.046		0.408		0.141		0.057	
change												
2006-1986	0.014	**	0.009	**	0.000		-0.321	**	-0.018	**	0.004	*

(C) Sunday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.029		0.017		0.030		0.222		0.075		0.043	
1991	0.030		0.019		0.029		0.197		0.073		0.042	
1996	0.030		0.021		0.026		0.184		0.079		0.040	
2001	0.035		0.020		0.027		0.176		0.090		0.048	
2006	0.034		0.022		0.031		0.179		0.092		0.049	
change												
2006-1986	0.005	**	0.005	**	0.001		-0.043	**	0.017	**	0.006	**

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.3: Employment rate by time (Full-time employees, weekdays and weekends; continued)

Female

(A) Weekdays

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.014		0.006		0.019		0.867		0.084		0.030	
1991	0.015		0.006		0.018		0.865		0.110		0.035	
1996	0.015		0.007		0.016		0.848		0.139		0.034	
2001	0.023		0.010		0.022		0.815		0.154		0.037	
2006	0.021		0.013		0.029		0.810		0.196		0.044	
change												
2006-1986	0.006	**	0.008	**	0.011	**	-0.058	**	0.111	**	0.014	**

(B) Saturday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.016		0.006		0.021		0.762		0.071		0.028	
1991	0.018		0.007		0.017		0.602		0.077		0.031	
1996	0.018		0.009		0.017		0.479		0.079		0.030	
2001	0.017		0.008		0.017		0.415		0.089		0.031	
2006	0.023		0.012		0.022		0.394		0.101		0.038	
change												
2006-1986	0.007	**	0.006	**	0.001		-0.368	**	0.030	**	0.010	**

(C) Sunday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.016		0.008		0.017		0.214		0.046		0.025	
1991	0.017		0.006		0.016		0.194		0.056		0.026	
1996	0.019		0.008		0.014		0.183		0.059		0.022	
2001	0.019		0.010		0.017		0.178		0.073		0.029	
2006	0.022		0.013		0.021		0.192		0.081		0.032	
change												
2006-1986	0.006	**	0.005	**	0.003	*	-0.022	**	0.035	**	0.007	**

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.4: Average weekly hours worked and average days off per month (Full-time employees)

	Male					Female				
	1986	1991	1996	2001	2006	1986	1991	1996	2001	2006
Average hours of work per day										
Weekly ave.	7.53	7.36	7.33	7.25	7.48	6.39	6.27	6.23	6.10	6.37
	(3.89)	(4.11)	(4.33)	(4.46)	(4.55)	(3.37)	(3.56)	(3.79)	(3.90)	(4.05)
Weekday	8.74	8.72	8.83	8.82	9.15	7.37	7.42	7.52	7.40	7.71
	(2.82)	(2.98)	(3.15)	(3.30)	(3.26)	(2.55)	(2.63)	(2.85)	(3.05)	(3.17)
Saturday	6.61	5.62	4.91	4.55	4.49	5.85	4.82	4.11	3.64	3.74
	(4.03)	(4.45)	(4.75)	(4.79)	(4.86)	(3.29)	(3.82)	(4.04)	(4.04)	(4.22)
Sunday	2.39	2.20	2.13	2.15	2.23	2.04	1.90	1.84	1.93	2.13
	(3.98)	(3.93)	(3.95)	(4.02)	(4.08)	(3.48)	(3.43)	(3.43)	(3.53)	(3.74)
Average days off per month										
8 days or more	0.18	0.28	0.47	0.50	0.52	0.15	0.23	0.42	0.48	0.56
6-7 days	0.36	0.37	0.27	0.23	0.19	0.27	0.32	0.30	0.24	0.17
4-5 days	0.34	0.28	0.18	0.16	0.16	0.49	0.38	0.20	0.15	0.12
not determined	0.11	0.08	0.08	0.12	0.13	0.09	0.08	0.08	0.13	0.15

Note)（ ）indicates standard errors.

Table 6.5: Employment rate by time (Full-time employees, adjusted by hours worked)

(1) Male

(A) Weekdays

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.035		0.024		0.047		0.878		0.266		0.071	
1991	0.034		0.024		0.046		0.840		0.315		0.087	
1996	0.035		0.024		0.046		0.769		0.335		0.089	
2001	0.042		0.025		0.048		0.806		0.367		0.104	
2006	0.042		0.028		0.050		0.785		0.376		0.104	
change												
2006-1986	0.008	**	0.004	**	0.003	+	-0.092	**	0.110	**	0.033	**

(B) Saturday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.037		0.025		0.045		0.729		0.158		0.053	
1991	0.042		0.031		0.053		0.652		0.195		0.073	
1996	0.050		0.034		0.058		0.569		0.212		0.081	
2001	0.052		0.039		0.062		0.596		0.237		0.099	
2006	0.065		0.049		0.068		0.574		0.235		0.093	
change												
2006-1986	0.028	**	0.023	**	0.023	**	-0.155	**	0.077	**	0.040	**

(C) Sunday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.029		0.017		0.030		0.222		0.075		0.043	
1991	0.028		0.020		0.031		0.204		0.091		0.050	
1996	0.028		0.021		0.028		0.185		0.100		0.048	
2001	0.032		0.019		0.026		0.189		0.111		0.054	
2006	0.030		0.022		0.032		0.187		0.108		0.052	
change												
2006-1986	0.001		0.005	**	0.002		-0.035	**	0.034	**	0.009	**

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.5: Employment rate by time (Full-time employees, adjusted by hours worked; continued)

(2) Female

(A) Weekdays

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.014		0.006		0.019		0.867		0.084		0.030	
1991	0.014		0.006		0.020		0.836		0.127		0.039	
1996	0.015		0.008		0.017		0.764		0.156		0.037	
2001	0.022		0.010		0.022		0.792		0.174		0.040	
2006	0.019		0.013		0.029		0.754		0.211		0.047	
change												
2006-1986	0.005	**	0.007	**	0.011	**	-0.114	**	0.127	**	0.017	**

(B) Saturday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.016		0.006		0.021		0.762		0.071		0.028	
1991	0.021		0.009		0.023		0.680		0.111		0.040	
1996	0.025		0.014		0.026		0.604		0.128		0.044	
2001	0.024		0.015		0.029		0.627		0.163		0.054	
2006	0.033		0.022		0.037		0.580		0.179		0.061	
change												
2006-1986	0.017	**	0.016	**	0.016	**	-0.181	**	0.108	**	0.032	**

(C) Sunday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.016		0.008		0.017		0.214		0.046		0.025	
1991	0.014		0.007		0.017		0.204		0.065		0.023	
1996	0.015		0.009		0.016		0.184		0.072		0.023	
2001	0.016		0.011		0.018		0.185		0.082		0.028	
2006	0.019		0.013		0.021		0.180		0.083		0.030	
change												
2006-1986	0.003	*	0.005	**	0.003	*	-0.033	**	0.037	**	0.005	**

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.6: Employment rate by time
(Full-time employees, adjusting hours worked + compositional changes)

(1) Male

(A) Weekdays

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.035		0.024		0.047		0.878		0.266		0.071	
1991	0.034		0.020		0.041		0.858		0.292		0.091	
1996	0.034		0.023		0.053		0.824		0.320		0.086	
2001	0.041		0.033		0.076		0.779		0.365		0.087	
2006	0.039		0.029		0.063		0.785		0.364		0.091	
change												
2006-1986	0.004	**	0.006	**	0.016	**	-0.092	**	0.098	**	0.021	**

(B) Saturday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.037		0.025		0.045		0.729		0.158		0.053	
1991	0.042		0.029		0.048		0.701		0.201		0.076	
1996	0.047		0.032		0.064		0.699		0.219		0.081	
2001	0.047		0.037		0.086		0.679		0.234		0.091	
2006	0.059		0.045		0.081		0.673		0.236		0.086	
change												
2006-1986	0.022	**	0.020	**	0.035	**	-0.056	**	0.078	**	0.033	**

(C) Sunday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.029		0.017		0.030		0.222		0.075		0.043	
1991	0.028		0.020		0.032		0.222		0.094		0.051	
1996	0.028		0.021		0.029		0.205		0.099		0.047	
2001	0.031		0.019		0.030		0.174		0.103		0.050	
2006	0.030		0.022		0.034		0.183		0.103		0.049	
change												
2006-1986	0.001		0.005	**	0.004	*	-0.039	**	0.028	**	0.006	**

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.6: Employment rate by time
(Full-time employees, adjusting hours worked + compositional changes; continued)

(2) Female

(A) Weekdays

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.014		0.006		0.019		0.867		0.084		0.030	
1991	0.012		0.002		0.028		0.894		0.107		0.045	
1996	0.014		0.010		0.017		0.802		0.147		0.032	
2001	0.019		0.019		0.009		0.709		0.178		0.017	
2006	0.014		0.015		0.025		0.757		0.192		0.033	
change												
2006-1986	0.000		0.009	**	0.007	**	-0.110	**	0.108	**	0.003	*

(B) Saturday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.016		0.006		0.021		0.762		0.071		0.028	
1991	0.024		0.017		0.024		0.835		0.131		0.053	
1996	0.023		0.010		0.029		0.690		0.121		0.041	
2001	0.016		-0.004		0.033		0.497		0.121		0.030	
2006	0.030		0.015		0.037		0.637		0.164		0.053	
change												
2006-1986	0.013	**	0.009	**	0.016	**	-0.125	**	0.093	**	0.024	**

(C) Sunday

	midnight		AM03:00		AM06:00		AM11:00		PM07:00		PM10:00	
1986	0.016		0.008		0.017		0.214		0.046		0.025	
1991	0.014		0.008		0.017		0.227		0.070		0.024	
1996	0.014		0.008		0.016		0.201		0.070		0.022	
2001	0.015		0.008		0.021		0.157		0.071		0.025	
2006	0.018		0.012		0.021		0.176		0.078		0.027	
change												
2006-1986	0.002		0.004	**	0.004	**	-0.037	**	0.032	**	0.003	+

Note) $^{+}$, *, ** indicate 10, 5, 1 percent statistically significance respectively.

Table 6.7: Results of Probit Models
(Full-time male workers in their 30s and 40s, weekday samples; continued)

(1) AM

		midnight-AM0300		AM0300-AM0600		AM0600-AM0900		AM0900-noon	
Age		0.001	(0.67)	0.001	(1.39)	0.003	(0.00)	-0.001	(-1.66) +
Education	High School + Junior College	-0.017	(-1.25)	0.005	(0.40)	-0.212	(0.08) *	-0.020	(-1.30)
	University/Graduate school	-0.030	(-2.01) *	-0.017	(-1.23)	-0.236	(0.09) **	-0.012	(-0.68)
Occupation	Professional	-		-		-0.007	(0.08)	0.011	(1.14)
(base=Craftsman,	Technical workers	-0.010	(-1.01)	-0.032	(-4.19) **	-0.212	(0.05) **	0.014	(2.04) *
manufacturing +	Teachers	-0.017	(-1.07)	-0.011	(-0.86)	-0.104	(0.07) +	0.010	(0.92)
construction	Other prof. & tech.workers	-		-		-0.657	(0.07) **	-0.010	(-0.57)
workers)	Managers and officials	-0.022	(-0.96)	-		-0.108	(0.09)	0.016	(1.72) +
	Clerical and related workers	-0.028	(-2.97) **	-0.035	(-5.72) **	-0.151	(0.04) **	0.020	(4.18) **
	Sales workers	-0.023	(-2.52) *	-0.021	(-2.96) **	-0.239	(0.04) **	0.024	(5.11) **
	Labourers	-0.015	(-0.95)	-0.022	(-2.14) *	0.101	(0.03) *	0.014	(1.70) +
	Service workers	0.006	(0.32)	-0.012	(-1.06)	-0.587	(0.08) **	-0.102	(-3.03) **
	Protective service workers	0.030	(0.96)	0.018	(0.71)	0.082	(0.05)	0.008	(0.53)
No. of Employees	101-999 employees	0.012	(1.08)	0.012	(1.33)	0.015	(0.03)	-0.019	(-2.28) *
(base=	more than 1000-	0.011	(1.12)	0.008	(0.94)	-0.008	(0.03)	-0.037	(-3.95) **
less than 100)	public service	0.003	(0.16)	0.005	(0.31)	0.094	(0.03) **	0.002	(0.20)
Employment status	(Regular=1)	-0.062	(-2.44) *	-0.050	(-2.40) *	0.163	(0.06) **	0.030	(1.84) +
Marital status	(Married=1)	0.005	(0.53)	-0.012	(-1.24)	-0.029	(0.03)	-0.004	(-0.53)
Children	(less than 6 years old child=1)	-0.002	(-0.24)	0.005	(0.59)	-0.017	(0.02)	-0.006	(-0.85)
Weather	some shower	0.979	(3.87) **	0.972	(2.83) **	-0.868	(0.01) **	-0.964	(-3.27) **
(base=Raining)	fair	0.048	(3.75) **	0.040	(2.90) **	-0.245	(0.02) **	-0.028	(-3.30) **
Number of hours worked during the day		0.008	(5.82) **	0.005	(4.41) **	0.066	(0.00) **	0.018	(21.14) **
Commute time	30-60 min.	-0.017	(-2.00) *	-0.036	(-4.85) **	-0.037	(0.03)	0.027	(4.91) **
(base=less than	60-120 min.	-0.015	(-1.57)	-0.018	(-2.15) *	-0.050	(0.04)	0.003	(0.47)
30 min.)	more than 120 min.	-		-		-0.130	(0.14)	0.003	(0.10)
Regional Unemployment rate		-0.012	(-0.67)	-0.013	(-0.66)	-0.012	(0.04)	0.020	(2.05) *
Prefecture dummies		yes		yes		yes		yes	
Log likelihood		-561.7808		-577.297		-1337.133		-506.4846	
Psudo R^2		0.145		0.193		0.324		0.602	
Number of observations		3142		3234		3529		3529	

Notes)
(1) marginal effects.
(2) t-values within parentheses.
(3) +, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.7: Results of Probit Models
(Full-time male workers in their 30s and 40s, weekday samples; continued)

(2) PM

		noon-PM0300		PM0300-PM0600		PM0600-PM0900		PM0900-midnight	
Age		0.000	(-0.77)	0.000	(0.02)	0.001	(0.51)	0.001	(0.47)
Education	High School + Junior College	0.002	(0.42)	-0.001	(-0.06)	0.167	(3.11) **	0.016	(0.50)
	University/Graduate school	0.010	(1.87) +	0.019	(1.64)	0.246	(4.25) **	0.023	(0.64)
Occupation	Professional	-0.002	(-0.27)	-0.047	(-1.54)	0.130	(0.94)	0.068	(0.87)
(base=Craftsman,	Technical workers	0.007	(1.94) +	0.018	(3.41) **	0.166	(3.68) **	-0.002	(-0.09)
manufacturing +	Teachers	0.008	(3.91) **	0.001	(0.06)	0.034	(0.51)	-0.023	(-0.66)
construction	Other prof. & tech.workers	0.009	(4.58) **	0.016	(4.44) **	0.275	(3.57) **	0.352	(3.90) **
workers)	Managers and officials	0.008	(4.61) **	0.015	(3.22) **	0.087	(1.10)	-0.077	(-2.21) *
	Clerical and related workers	0.012	(5.55) **	0.019	(4.92) **	0.063	(1.62)	-0.063	(-3.15) **
	Sales workers	0.012	(4.51) **	0.010	(1.54)	0.093	(2.20) *	-0.023	(-1.17)
	Labourers	0.009	(4.81) **	0.015	(3.08) **	-0.044	(-0.63)	-0.058	(-1.46)
	Service workers	-0.011	(-1.25)	-0.022	(-1.37)	0.052	(0.53)	0.180	(2.94) **
	Protective service workers	-0.009	(-1.02)	-0.105	(-2.38) *	-0.043	(-0.38)	-0.048	(-1.06)
No. of Employees	101-999 employees	-0.015	(-2.70) **	-0.023	(-2.73) **	0.011	(0.30)	0.071	(3.49) **
(base=	more than 1000-	-0.012	(-2.35) *	-0.019	(-3.03) **	0.067	(1.65) +	0.091	(4.22) **
less than 100)	public service	-0.005	(-0.86)	-0.002	(-0.14)	-0.063	(-1.19)	0.030	(0.83)
Employment status	(Regular=1)	0.007	(1.06)	0.025	(1.83) +	-0.037	(-0.56)	-0.190	(-3.25) **
Marital status	(Married=1)	0.013	(2.55) *	-0.004	(-0.62)	-0.001	(-0.02)	0.044	(2.21) *
Children	(less than 6 years old child=1)	-0.008	(-2.25) *	0.001	(0.18)	0.098	(3.05) **	0.014	(0.85)
Weather	some shower	-0.841	(-2.62) **	-0.829	(-2.53) *	0.272	(3.31) **	0.022	(0.29)
(base=Raining)	fair	-0.012	(-2.70) **	-0.022	(-2.91) **	0.408	(2.86) **	0.017	(0.27)
Number of hours worked during the day		0.010	(19.20) **	0.016	(14.23) **	0.153	(13.17) **	0.063	(11.58) **
Commute time	30-60 min.	0.011	(5.01) **	0.014	(3.33) **	0.072	(2.26) *	-0.024	(-1.43)
(base=less than	60-120 min.	0.009	(3.30) **	0.011	(1.52)	0.023	(0.52)	0.017	(0.79)
30 min.)	more than 120 min.	0.008	(2.42) *	0.015	(2.55) *	-0.057	(-0.46)	0.067	(0.95)
Regional Unemployment rate		0.011	(2.24) *	0.030	(3.97) **	0.017	(0.34)	-0.070	(-2.23) *
Prefecture dummies		yes		yes		yes		yes	
Log likelihood		-397.3047		-397.305		-397.305		-456.194	
Psudo R^2		0.602		0.678		0.678		0.646	
Number of observations		3529		3529		3529		3529	

Notes)
(1) marginal effects.
(2) t-values within parentheses.
(3) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.8: Results of Wage Equations
(Full-time male workers in their 30s and 40s, weekday samples)

(1)AM

		midnight-AM0300			AM0300-AM0600			AM0600-AM0900			AM0900-noon		
Age		0.089	(0.88)		0.160	(1.37)		0.051	(2.16)	*	0.007	(0.28)	
Age^2		-0.001	(-0.66)		-0.002	(-1.23)		0.000	(-1.17)		0.000	(0.61)	
Education	High School + Junior College	0.115	(0.52)		0.144	(0.78)		0.050	(1.34)		0.101	(2.89)	**
	University/Graduate school	0.004	(0.01)		0.050	(0.21)		0.135	(3.26)	**	0.224	(5.88)	**
Occupation	Professional	-			-			0.302	(2.77)	**	0.265	(2.65)	**
(base=Craftsman,	Technical workers	0.302	(3.12)	**	0.455	(1.83)	+	0.187	(5.84)	**	0.223	(7.53)	**
manufacturing +	Teachers	0.222	(0.94)		0.288	(1.25)		0.067	(1.47)		0.025	(0.51)	
construction	Other prof. & tech.workers	-			-			0.087	(0.70)		-0.037	(-0.45)	
workers)	Managers and officials	0.698	(2.63)	*	-			0.340	(5.24)	**	0.357	(5.32)	**
	Clerical and related workers	0.329	(1.35)		0.327	(1.15)		0.169	(5.61)	**	0.163	(5.74)	**
	Sales workers	0.193	(1.11)		0.351	(2.98)	**	0.086	(2.52)	*	0.084	(2.76)	**
	Labourers	-0.494	(-2.46)	*	0.033	(0.16)		-0.010	(-0.18)		-0.049	(-0.89)	
	Service workers	0.015	(0.07)		0.301	(0.92)		-0.229	(-2.60)	**	-0.126	(-2.19)	*
	Protective service workers	-0.104	(-0.56)		-0.099	(-0.83)		0.096	(2.02)	*	0.086	(2.00)	*
No. of Employees	101-999 employees	0.296	(2.66)	**	0.227	(2.05)	*	0.085	(3.50)	**	0.107	(4.20)	**
(base=	more than 1000-	0.509	(4.56)	**	0.434	(3.19)	**	0.293	(10.78)	**	0.267	(8.92)	**
less than 100)	public service	0.788	(4.34)	**	0.721	(4.67)	**	0.293	(10.06)	**	0.274	(10.03)	**
Employment status	(Regular=1)	0.642	(3.48)	**	0.662	(5.15)	**	0.473	(8.17)	**	0.391	(7.22)	**
Marital status	(Married=1)	-0.081	(-0.76)		0.004	(0.04)		0.126	(5.18)	**	0.118	(5.17)	**
Regional Unemployment rate		-0.021	(-0.61)		-0.036	(-2.05)	*	-0.021	(-2.84)	**	-0.034	(-5.39)	**
mills ratio		-0.087	(-0.23)		0.011	(0.05)		0.119	(1.49)		-0.147	(-1.46)	
Constant		-9.569	(-4.37)	**	-11.591	(-4.45)	**	-8.074	(-15.67)	**	-6.975	(-13.73)	**
Prefecture dummies		yes			yes			yes			yes		
R^2		0.736			0.741			0.445			0.423		
Number of observations		173			195			2769			3142		

(2) PM

		noon-PM0300			PM0300-PM0600			PM0600-PM0900			PM0900-midnight		
Age		0.005	(0.18)		0.003	(0.12)		0.025	(0.78)		-0.010	(-0.19)	
Age^2		0.000	(0.65)		0.000	(0.69)		0.000	(-0.08)		0.000	(0.72)	
Education	High School + Junior College	0.055	(1.56)		0.071	(2.00)	*	-0.009	(-0.15)		0.141	(1.40)	
	University/Graduate school	0.176	(4.56)	**	0.167	(4.17)	**	0.107	(1.69)	+	0.213	(1.97)	*
Occupation	Professional	0.283	(2.84)	**	0.289	(2.85)	**	0.279	(2.65)	**	0.240	(2.24)	*
(base=Craftsman,	Technical workers	0.222	(7.03)	**	0.192	(6.50)	**	0.175	(4.87)	**	0.067	(1.11)	
manufacturing +	Teachers	0.042	(0.82)		0.056	(1.07)		0.012	(0.18)		-0.149	(-1.40)	
construction	Other prof. & tech.workers	-0.053	(-0.69)		-0.081	(-1.02)		-0.092	(-1.05)		0.122	(0.74)	
workers)	Managers and officials	0.351	(5.26)	**	0.278	(4.08)	**	0.313	(3.81)	**	0.039	(0.30)	
	Clerical and related workers	0.167	(5.80)	**	0.143	(5.11)	**	0.120	(3.19)	**	0.003	(0.03)	
	Sales workers	0.099	(3.44)	**	0.092	(3.17)	**	0.042	(1.14)		-0.082	(-1.22)	
	Labourers	-0.054	(-1.00)		-0.084	(-1.53)		-0.162	(-1.64)		-0.061	(-0.50)	
	Service workers	-0.152	(-2.95)	**	-0.170	(-3.41)	**	-0.232	(-4.93)	**	0.088	(0.79)	
	Protective service workers	0.129	(3.02)	**	0.119	(2.27)	*	-0.042	(-0.48)		-0.262	(-1.28)	
No. of Employees	101-999 employees	0.105	(4.20)	**	0.119	(4.79)	**	0.098	(3.29)	**	0.337	(4.75)	**
(base=	more than 1000-	0.245	(8.91)	**	0.262	(9.73)	**	0.247	(7.61)	**	0.485	(6.46)	**
less than 100)	public service	0.273	(9.99)	**	0.282	(10.62)	**	0.288	(5.82)	**	0.551	(4.55)	**
Employment status	(Regular=1)	0.380	(7.25)	**	0.341	(6.53)	**	0.216	(3.18)	**	0.159	(1.39)	
Marital status	(Married=1)	0.107	(4.67)	**	0.112	(4.91)	**	0.080	(2.75)	**	0.157	(2.48)	*
Regional Unemployment rate		-0.027	(-4.78)	**	-0.031	(-5.74)	**	-0.030	(-2.51)	*	0.071	(1.98)	*
mills ratio		-0.066	(-0.72)		-0.198	(-2.64)	**	-0.088	(-1.12)		0.320	(2.45)	*
Constant		-6.868	(-12.66)	**	-6.698	(-12.45)	**	-6.975	(-10.35)	**	-8.317	(-6.49)	**
Prefecture dummies		yes			yes			yes			yes		
R^2		0.410			0.404			0.375			0.370		
Number of observations		3181			3174			2310			688		

Notes)

(1) t-values within parentheses.

(2) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Table 6.9: Results of Probit Models
(Full-time male workers in their 30s and 40s, Friday-Saturday and Sunday-Monday samples)

		Weekday						Weekend					
		PM0600-AM0600			AM0600-PM1800			PM0600-AM0600			AM0600-PM0600		
Age		0.008	(0.01)		-0.002	(-0.40)		0.000	(0.10)		0.001	(0.77)	
Education	High School + Junior College	0.171	(0.13)		0.342	(3.14)	**	-0.036	(-1.52)		-0.072	(-2.45)	*
	University/Graduate school	0.281	(0.14)	+	0.325	(2.86)	**	-0.051	(-2.03)	*	-0.076	(-2.42)	*
Occupation	Professional	0.290	(0.13)	*	0.017	(0.17)		-			-		
(base=Craftsman,	Technical workers	-0.003	(0.09)		0.071	(1.00)		-0.011	(-0.61)		-0.017	(-0.80)	
manufacturing +	Teachers	0.183	(0.14)		-0.113	(-0.95)		0.101	(1.80)	+	0.131	(2.07)	*
construction	Other prof. & tech.workers	0.073	(0.24)		-0.059	(-0.40)		0.009	(0.24)		0.042	(0.85)	
workers)	Managers and officials	-0.164	(0.15)		-0.014	(-0.13)		-0.033	(-2.13)	*	0.048	(0.80)	
	Clerical and related workers	0.106	(0.09)		0.050	(0.75)		-0.023	(-1.50)		-0.026	(-1.29)	
	Sales workers	0.027	(0.08)		-0.202	(-2.59)	*	0.032	(1.87)	+	0.032	(1.45)	
	Labourers	0.190	(0.15)		0.101	(1.00)		-0.023	(-1.16)		-0.040	(-2.26)	*
	Service workers	-0.036	(0.15)		-0.333	(-2.50)	*	0.049	(1.38)		0.067	(1.44)	
	Protective service workers	-0.118	(0.18)		-0.520	(-2.33)	*	0.125	(1.96)	+	0.091	(1.65)	+
No. of Employees	101-999 employees	-0.024	(0.07)		-0.071	(-1.22)		0.021	(1.34)		0.015	(0.84)	
(base=	more than 1000-	-0.056	(0.07)		0.015	(0.26)		0.014	(0.85)	+	0.014	(0.74)	
less than 100)	public service	-0.228	(0.07)	**	-0.027	(-0.37)		-0.011	(-0.50)		0.009	(0.33)	
Employment status	(Regular=1)	-0.444	(0.09)	**	-0.101	(-1.13)		0.026	(1.77)	+	0.019	(0.61)	
Marital status	(Married=1)	0.074	(0.08)		-0.104	(-1.81)	+	0.031	(2.52)	*	0.031	(1.81)	+
Children	(less than 6 years old child=1)	0.081	(0.07)		0.083	(1.47)		-0.011	(-0.92)		-0.016	(-1.07)	
Weather	some shower	0.733	(0.05)	*	0.444	(3.56)	**	-0.029	(-2.28)	*	-0.174	(-4.83)	**
(base=Raining)	fair	0.520	(0.08)	+	0.847	(2.99)	**	-			-0.987	(-4.44)	**
Number of hours worked during the day		0.132	(0.01)	**	0.118	(21.74)	**	0.003	(3.00)	**	0.003	(2.15)	*
Commute time	30-60 min.	0.076	(0.07)		0.014	(0.26)		-0.017	(-1.36)		-0.015	(-0.93)	
(base=less than	60-120 min.	-0.029	(0.09)		0.085	(1.35)		-0.007	(-0.45)		-0.014	(-0.67)	
30 min.)	more than 120 min.	0.047	(0.27)		-0.077	(-0.28)					0.053	(0.32)	
Regional Unemployment rate		-0.238	(0.13)	+	-0.209	(-2.20)	*	0.024	(1.14)		0.077	(2.60)	**
Prefecture dummies		yes			yes			yes			yes		
Log likelihood		-419.0499			-271.508			-199.0845			-199.085		
Psudo R^2		0.502			0.651			0.147			0.142		
Number of observations		1213			1213			1055			1146		

Notes)
(1) marginal effects.
(2) t-values within parentheses.
(3) $^{+}$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

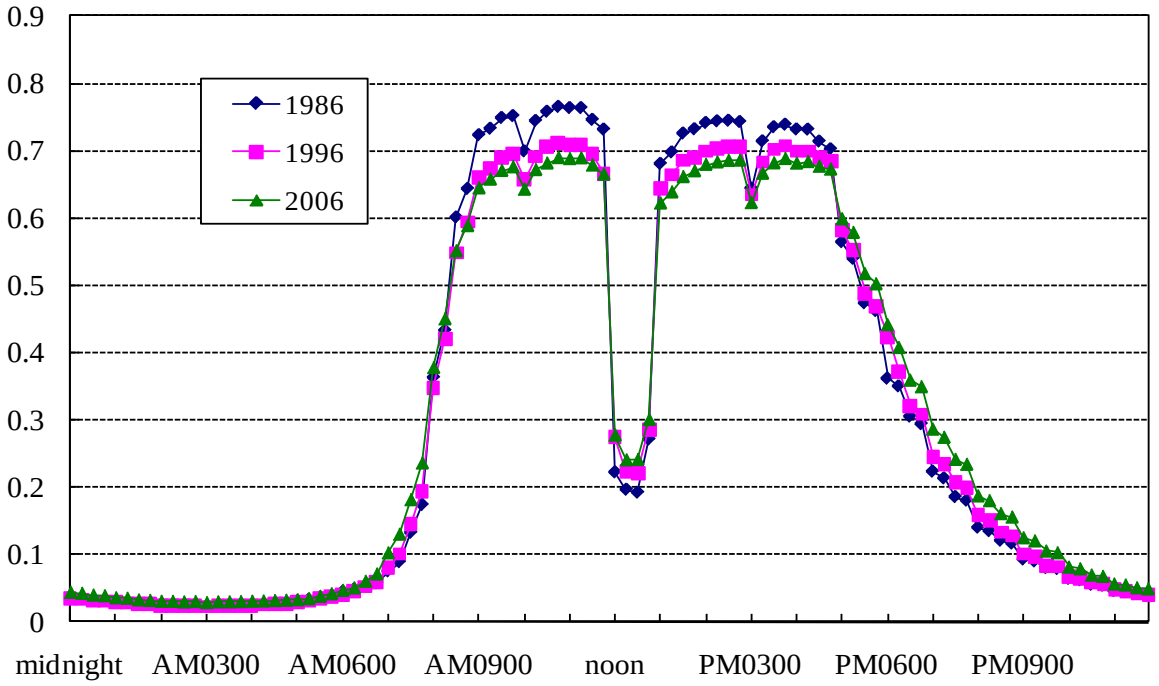
Table 6.10: Results of Wage equations
(Full-time male workers in their 30s and 40s, Friday-Saturday and Sunday-Monday samples)

		Weekday						Weekend					
		PM0600-AM0600			AM0600-PM1800			PM0600-AM0600			AM0600-PM0600		
Age		0.096	(1.51)		0.059	(1.25)		-0.232	(-1.39)		0.216	(2.30)	*
Age^2		-0.001	(-1.29)		-0.001	(-0.88)		0.003	(1.39)		-0.002	(-1.98)	+
Education	High School + Junior College	0.093	(0.64)		0.218	(2.19)	*	-0.225	(-0.79)		0.072	(0.38)	
	University/Graduate school	0.157	(1.05)		0.247	(2.34)	*	-0.101	(-0.26)		0.083	(0.42)	
Occupation	Professional	0.160	(1.26)		0.230	(1.82)	+	-			-		
(base=Craftsman,	Technical workers	0.214	(2.80)	**	0.175	(3.00)	**	0.178	(0.87)		0.130	(1.08)	
manufacturing +	Teachers	0.253	(2.30)	*	0.261	(2.91)	**	0.782	(1.79)	+	0.181	(1.11)	
construction	Other prof. & tech.workers	-0.079	(-0.55)		-0.146	(-1.20)		0.223	(0.90)		0.063	(0.23)	
workers)	Managers and officials	0.813	(6.04)	**	0.581	(5.72)	**	-0.492	(-0.99)		0.395	(2.09)	*
	Clerical and related workers	0.095	(1.32)		0.095	(1.71)	+	0.250	(0.92)		0.127	(0.73)	
	Sales workers	0.078	(1.18)		0.092	(1.68)	+	0.002	(0.01)		-0.197	(-1.77)	+
	Labourers	-0.440	(-2.49)	*	-0.241	(-2.37)	*	-0.099	(-0.31)		0.338	(2.17)	*
	Service workers	-0.059	(-0.32)		-0.045	(-0.30)		-0.427	(-1.12)		-0.407	(-1.87)	+
	Protective service workers	0.354	(1.97)	*	-0.002	(-0.02)		0.168	(0.47)		-0.156	(-0.68)	
No. of Employees	101-999 employees	0.100	(1.52)		0.102	(1.92)	+	0.242	(1.36)		0.104	(0.96)	
(base=	more than 1000-	0.284	(4.58)	**	0.349	(7.26)	**	0.197	(1.18)		0.185	(1.44)	
less than 100)	public service	0.158	(1.76)	+	0.245	(3.97)	**	0.686	(3.60)	**	0.312	(2.24)	*
Employment status	(Regular=1)	0.313	(2.03)	*	0.477	(4.41)	**	0.628	(1.46)		0.080	(0.30)	
Marital status	(Married=1)	0.232	(2.88)	**	0.201	(3.83)	**	-0.307	(-1.32)		0.015	(0.15)	
Regional Unemployment rate		-0.065	(-2.85)	**	-0.034	(-2.81)	**	-0.003	(-0.12)		-0.016	(-1.48)	
mills ratio		-0.210	(-1.42)		0.196	(1.67)	+	0.281	(0.58)		-0.298	(-1.60)	
Constant		-8.451	(-6.14)	**	-8.020	(-8.19)	**	-4.012	(-1.09)		-11.612	(-5.39)	**
Prefecture dummies		yes			yes			yes			yes		
R^2		0.524			0.540			0.810			0.774		
Number of observations		2769			3142			3181			3174		

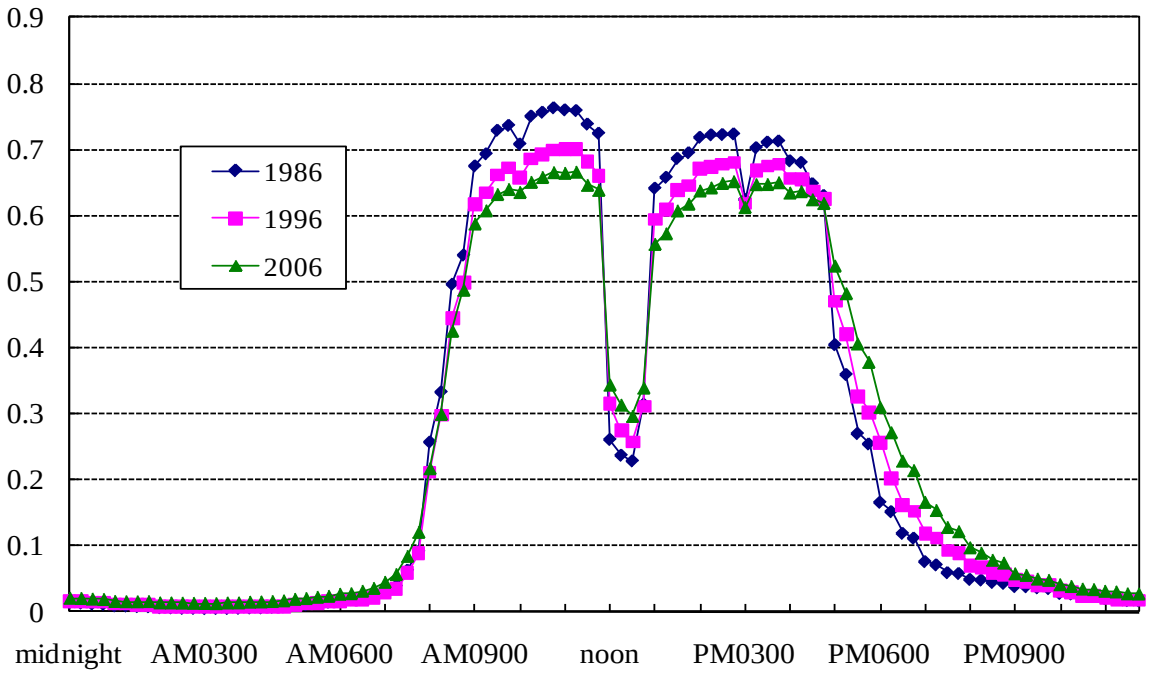
Notes)
(1) t-values within parentheses.
(2) $^+$, *, ** indicate 10, 5, 1 percent statistical significance, respectively.

Figure 6.1: Employment rate by time (Full-time workers)

(1) Male



(2) Female

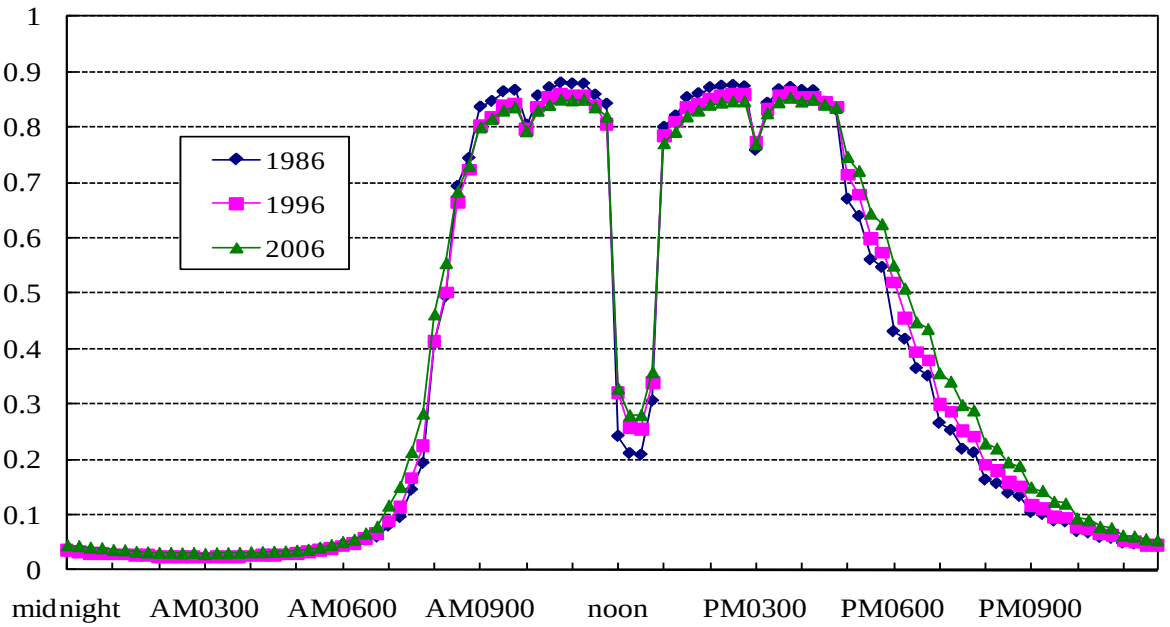


Note) Using samples with a usual work week of at least 35 hours, excluding students and the self-employed

Figure 6.2: Employment rate by time (Full-time workers, weekdays and weekends)

(1) Male

(A) Weekdays



(B) Saturday

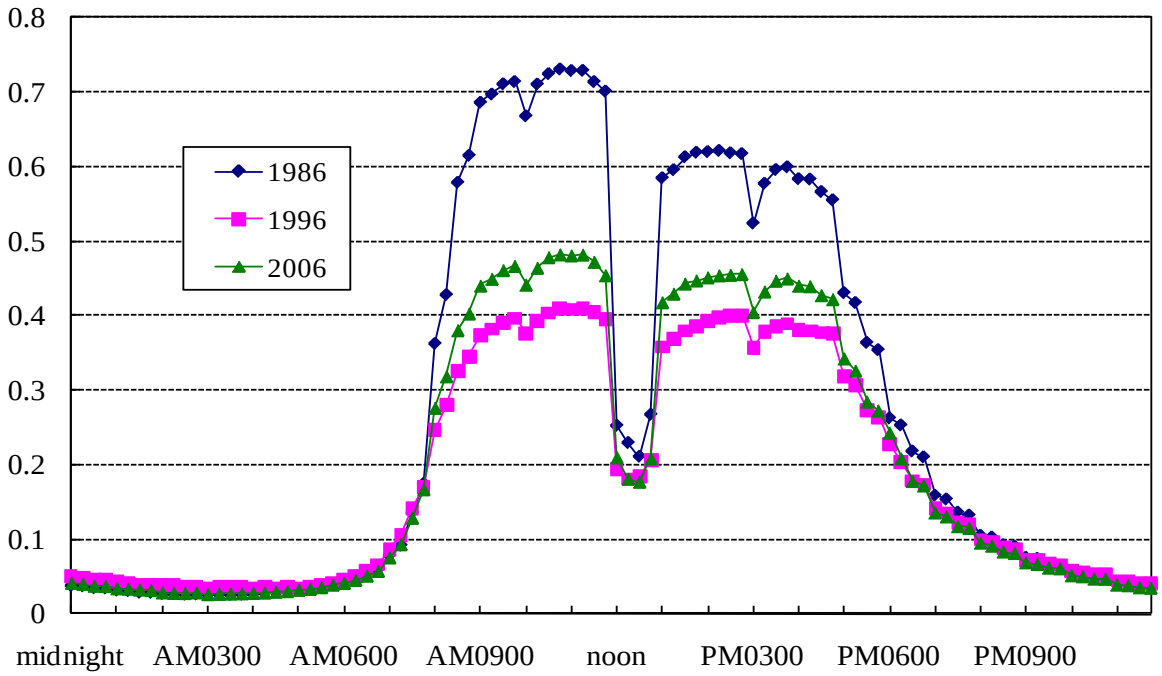


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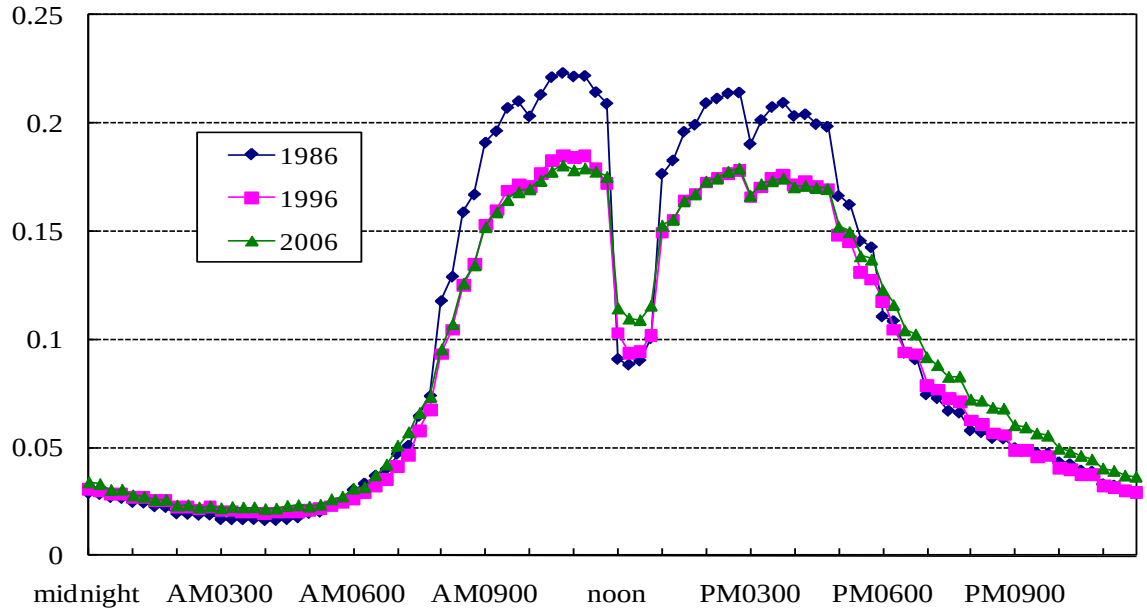
Figure 6.2: Employment rate by time (Full-time workers, weekdays and weekends; continue)

(C) Sunday



(2) Female

(A) Weekdays

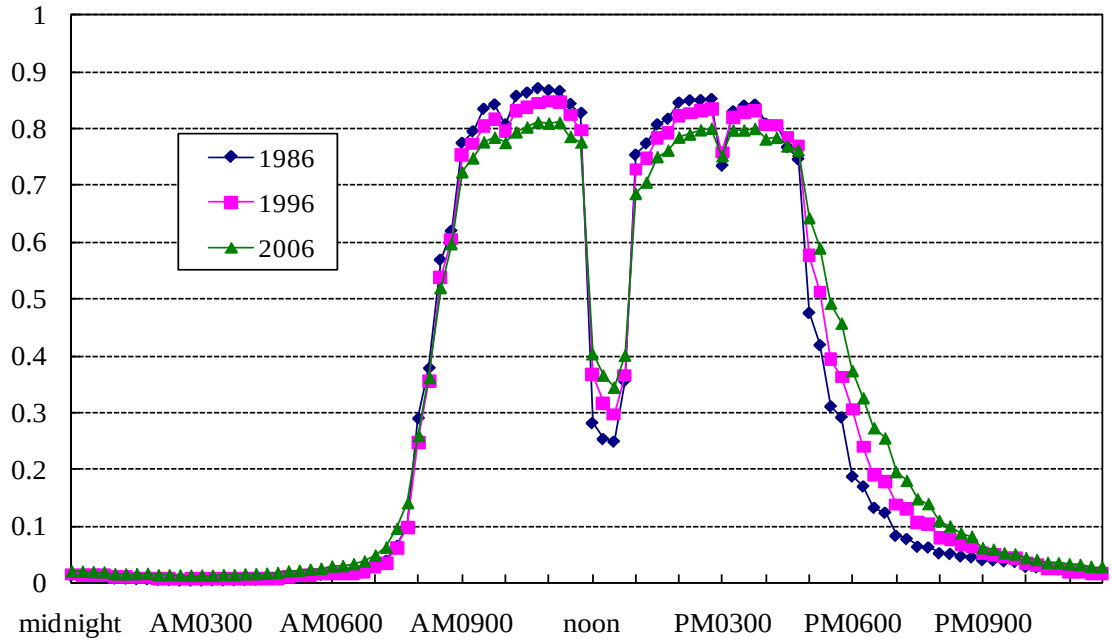
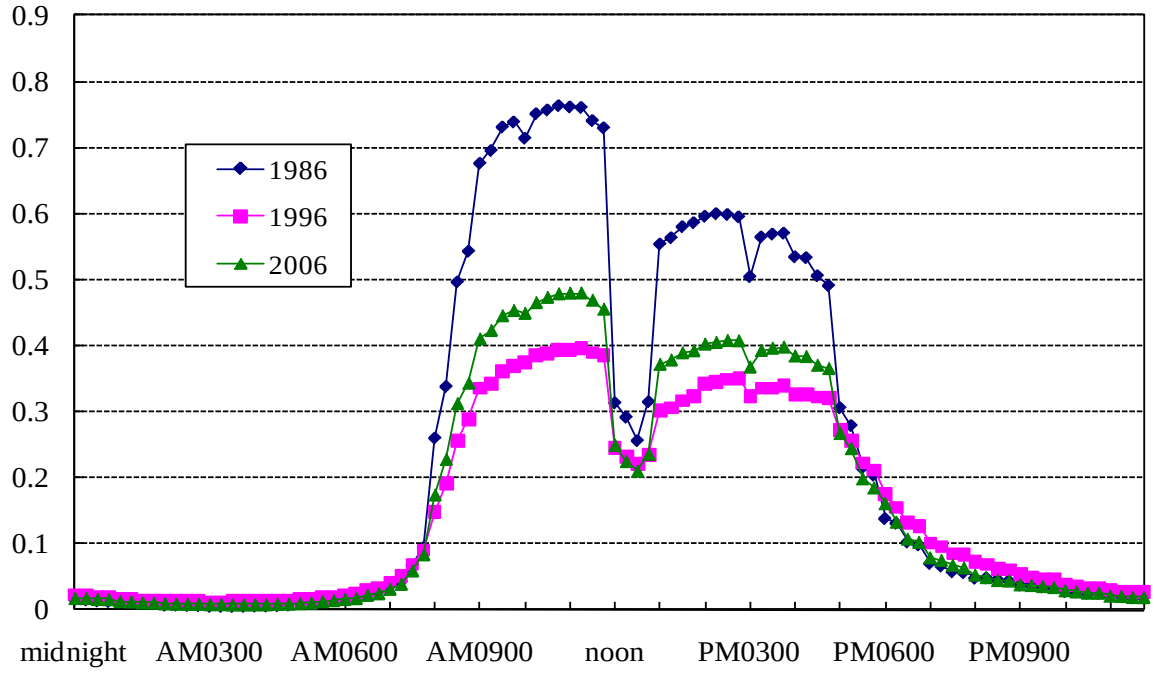


Figure 6.2: Employment rate by time (Full-time workers, weekdays and weekends; continued)

(B) Saturday



(C) Sunday

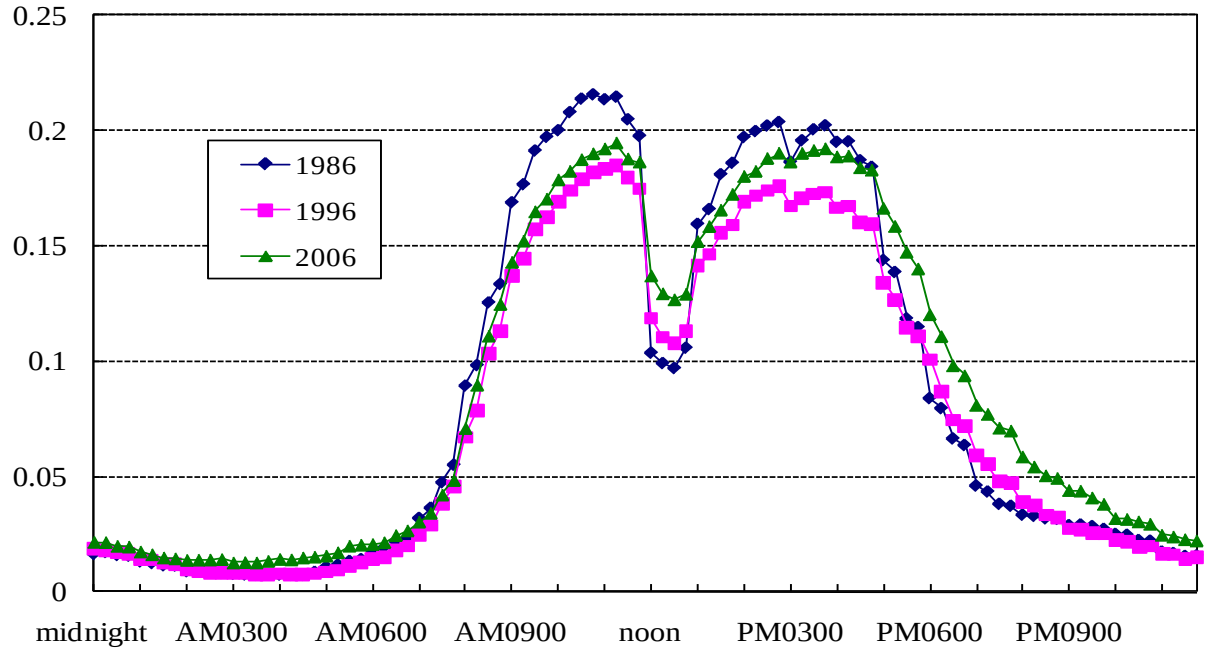
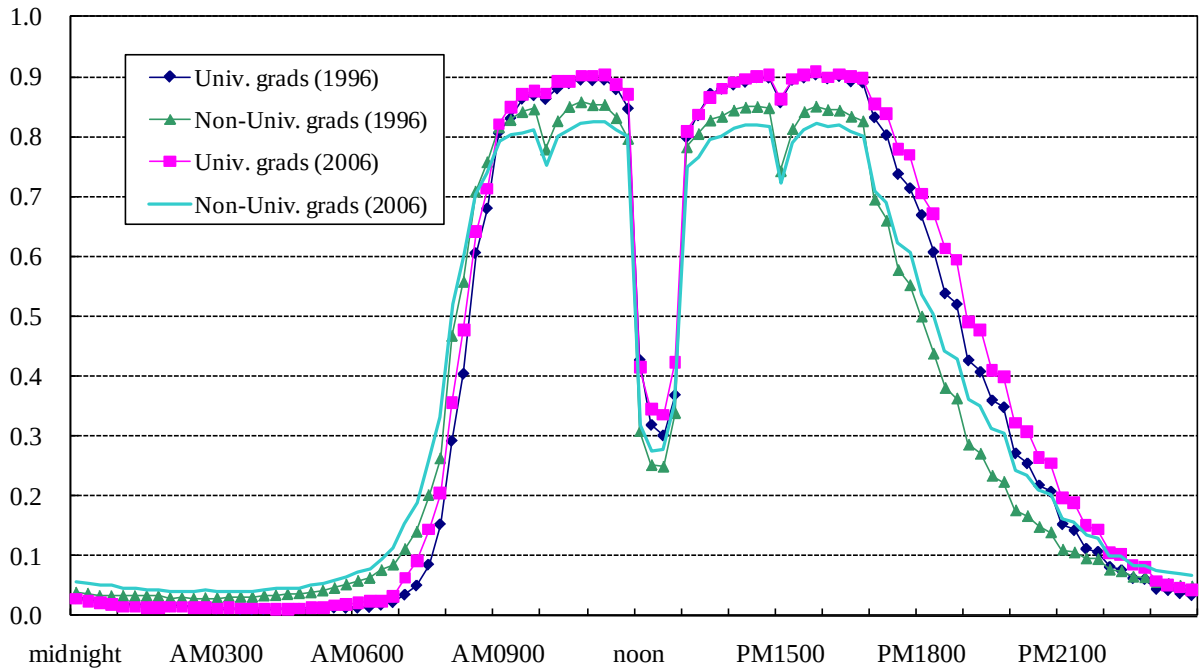


Figure 6.3: Employment rate by time, education (Full-time male workers in their 30s and 40s, weekdays and weekends)

(A) Weekdays



(B) Saturday

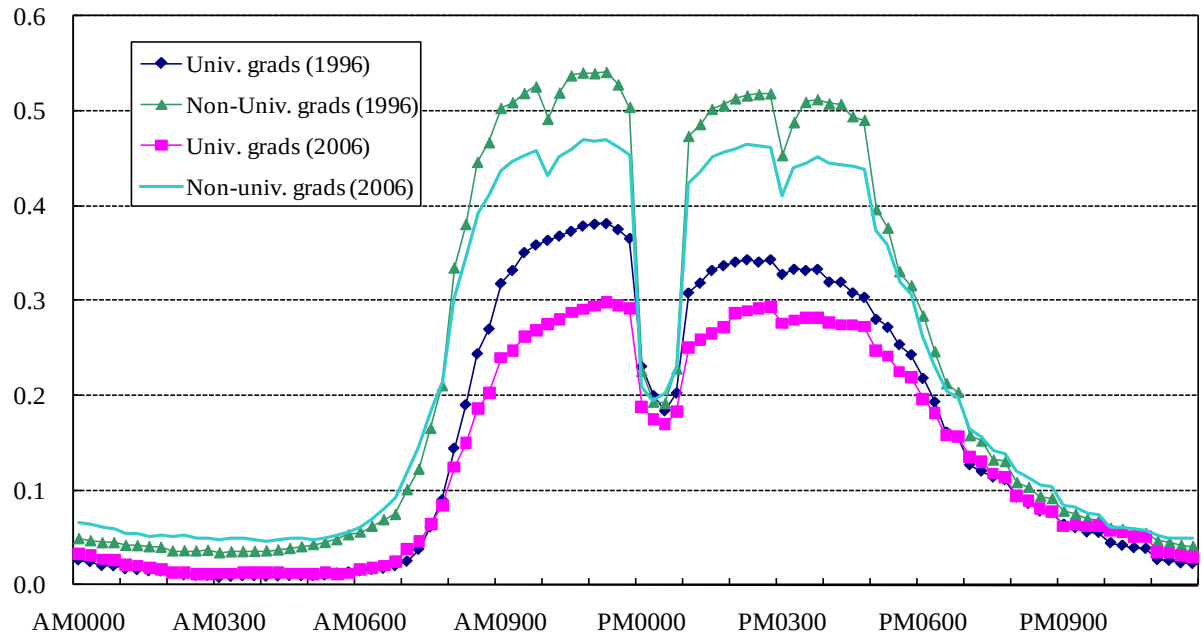


Figure 6.3: Employment rate by time, education (Full-time male workers in their 30s and 40s, weekdays and weekends; continued)

(C) Sunday

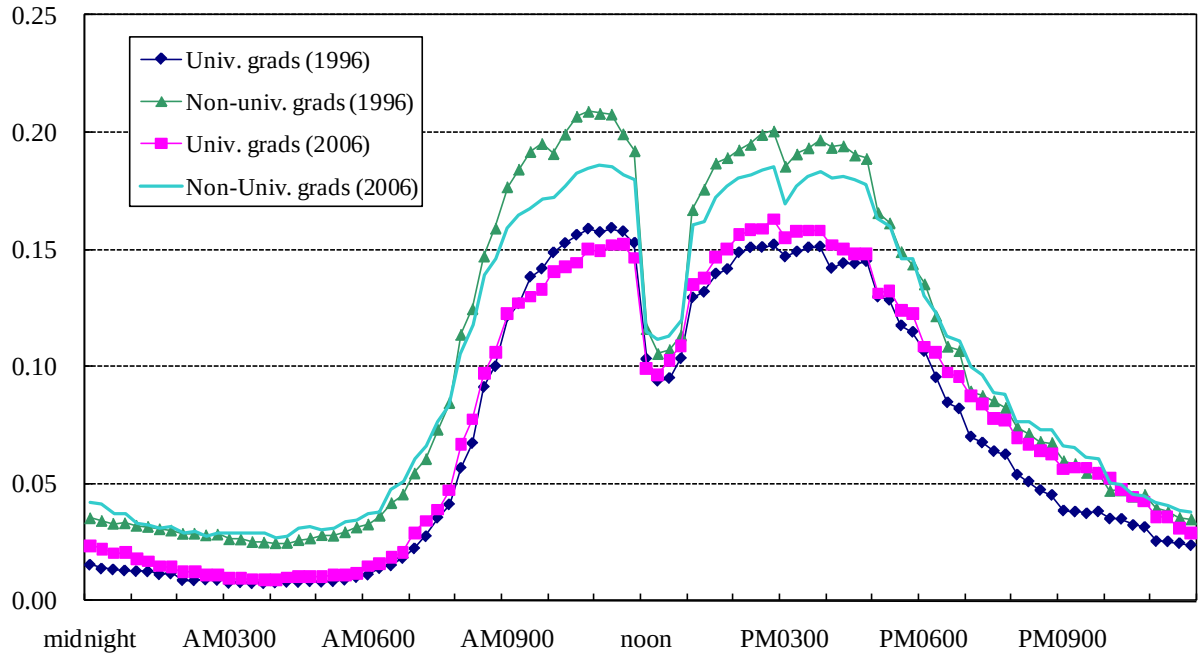
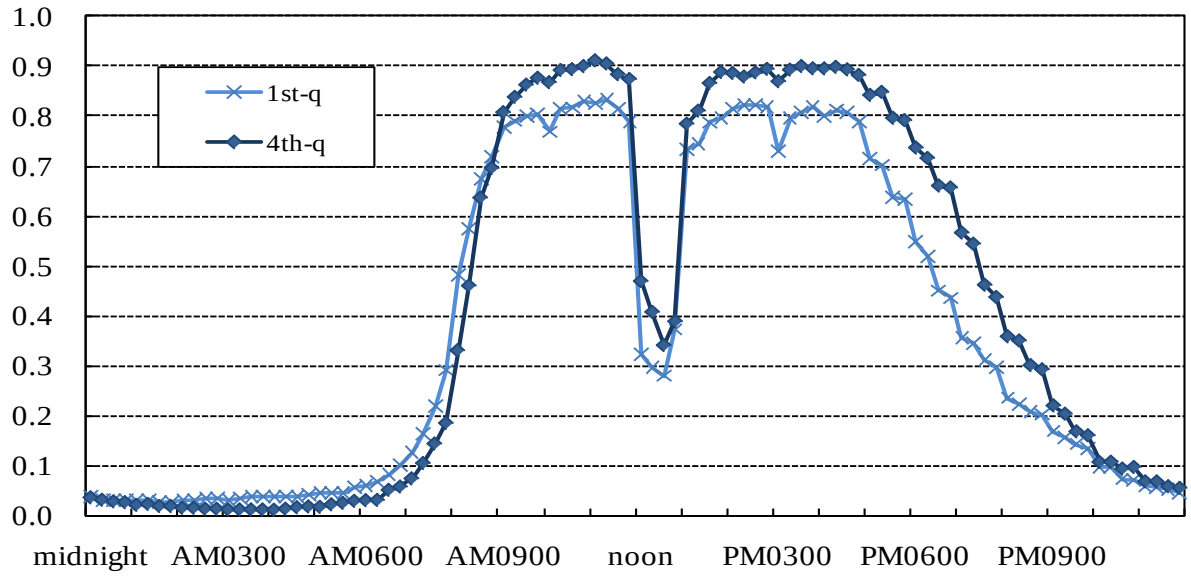


Figure 6.4: Employment rate by time, income level (Full-time male workers in their 30s and 40s, weekdays)

(1)Employment rate by time in 2006



(2) 1st- q's Employment rate by time ／4th-q's Employment rate by time

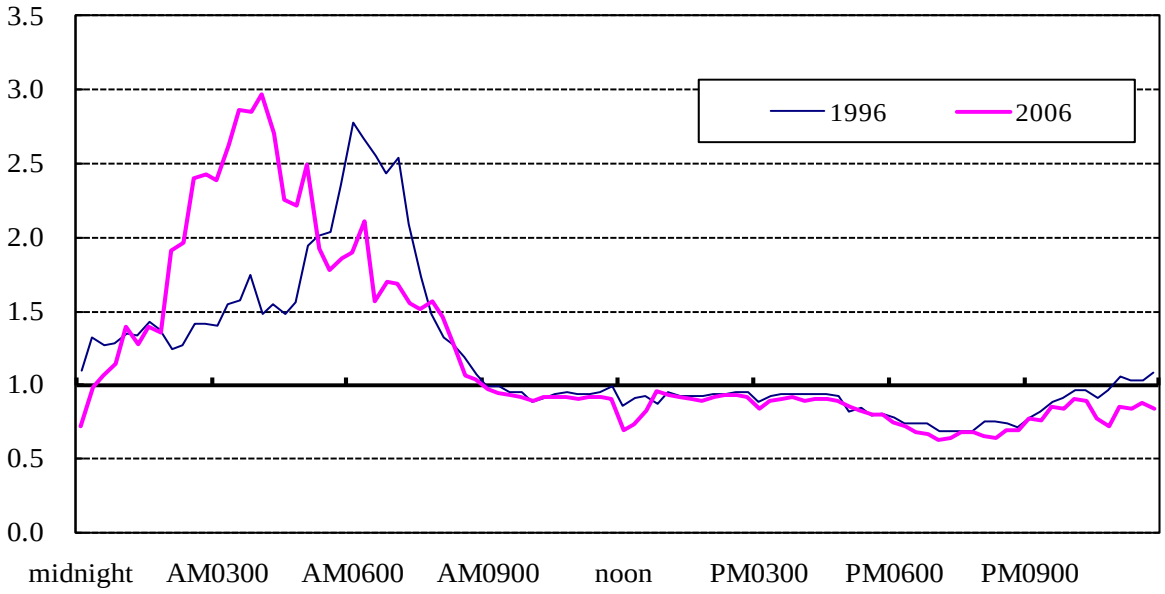
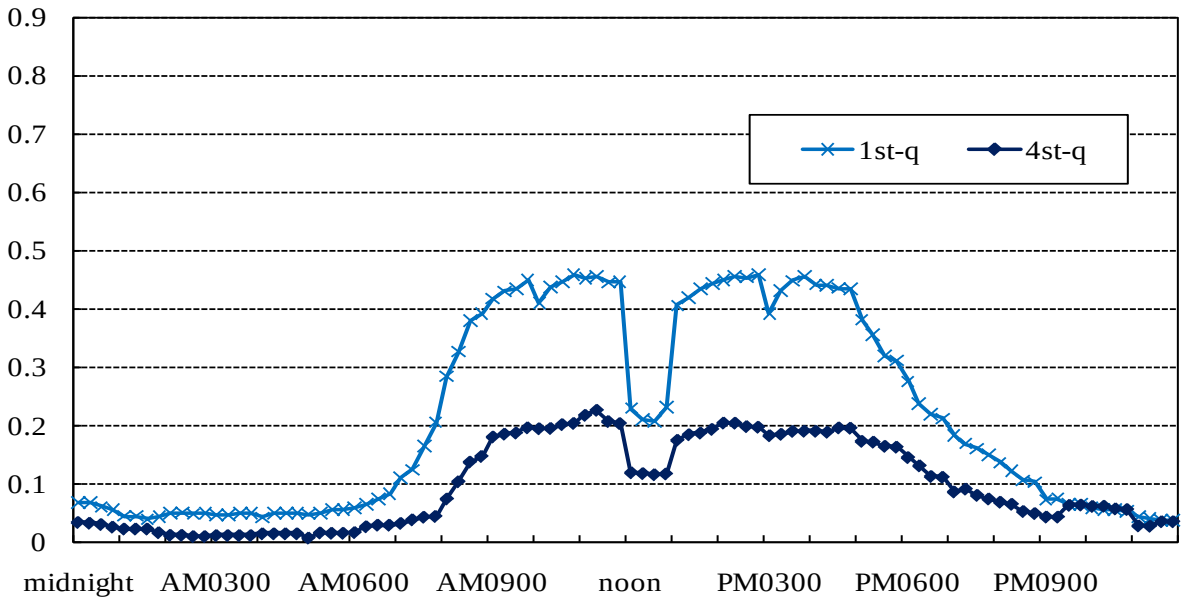


Figure 6.4: Employment rate by time, income level (Full-time male workers in their 30s and 40s, Saturday; continued)

(3) Employment rate by time in 2006



(4) 1st- q's Employment rate by time ／4th-q's Employment rate by time

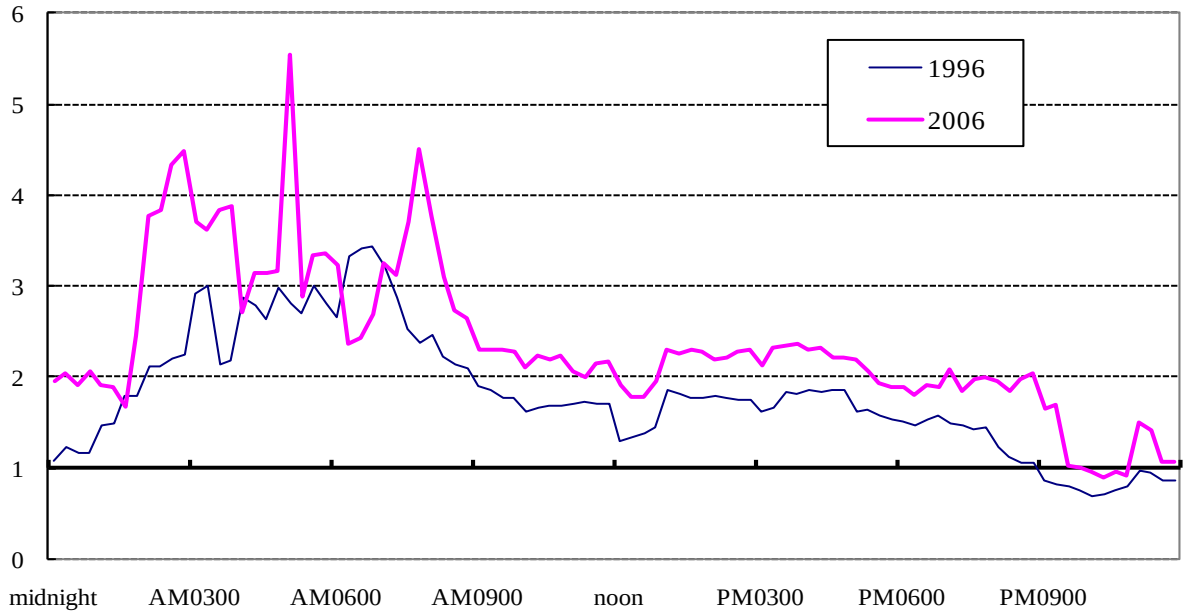
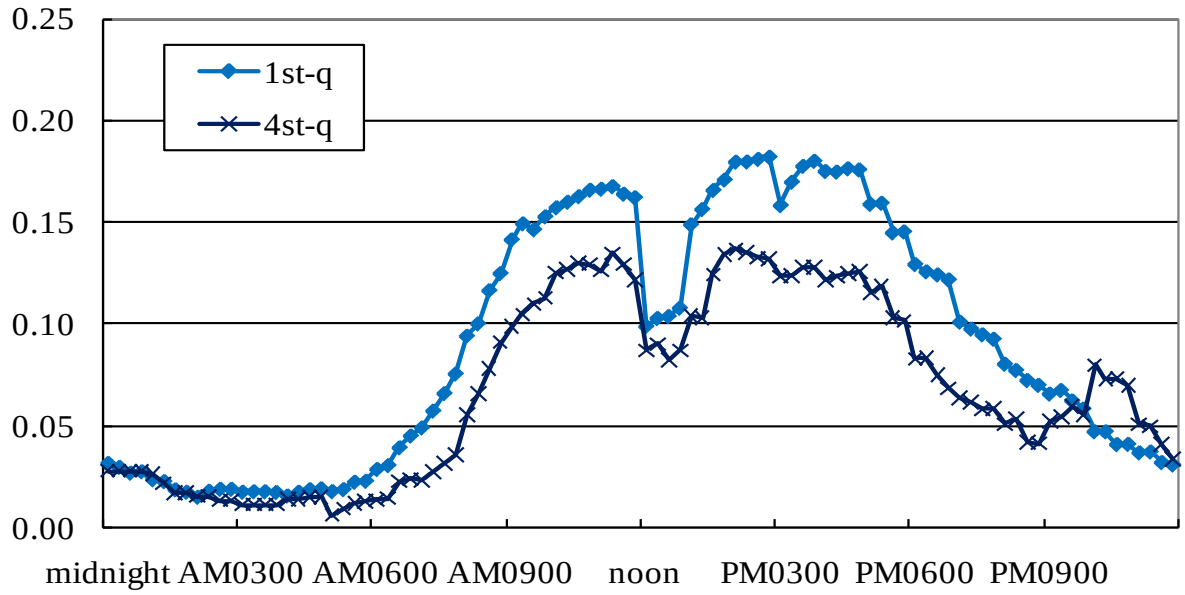


Figure 6.4: Employment rate by time, income level (Full-time male workers in their 30s and 40s, Sunday; continued)

(5)Employment rate by time in 2006



(6) 1st- q's Employment rate by time ／4th-q's Employment rate by time

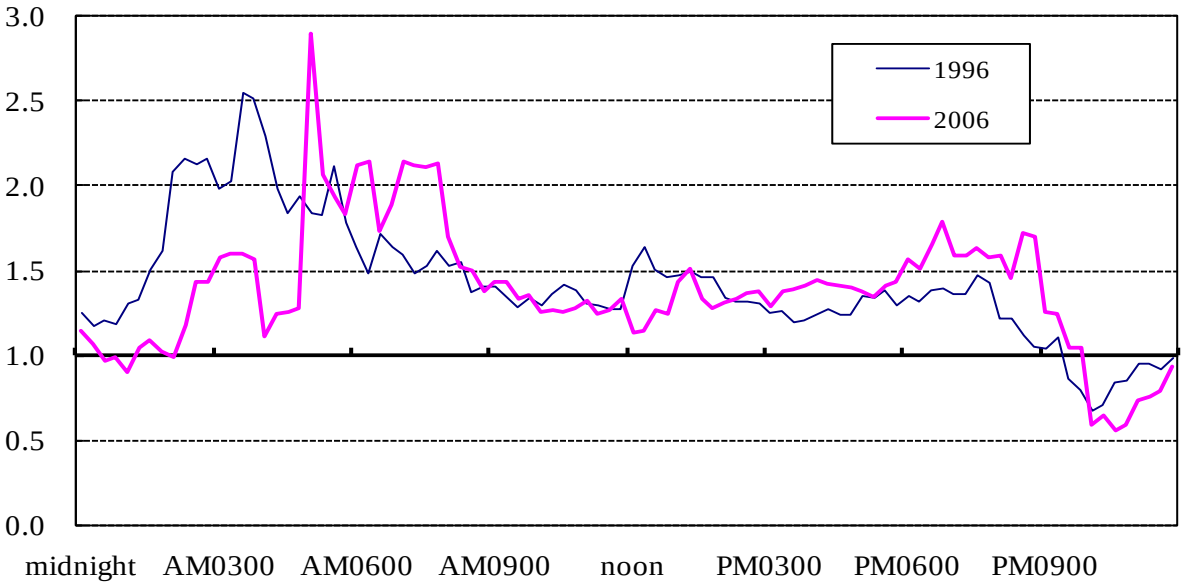


Figure 6.5: Real hourly wage distribution (Full-time male workers in their 30s and 40s)

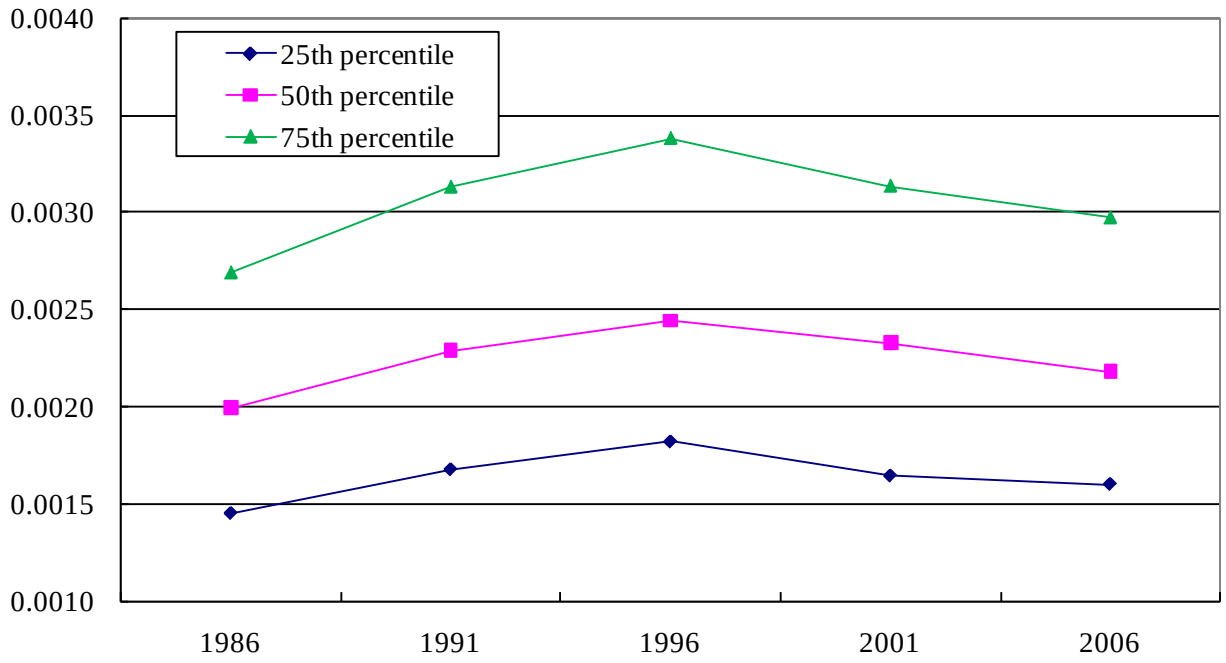
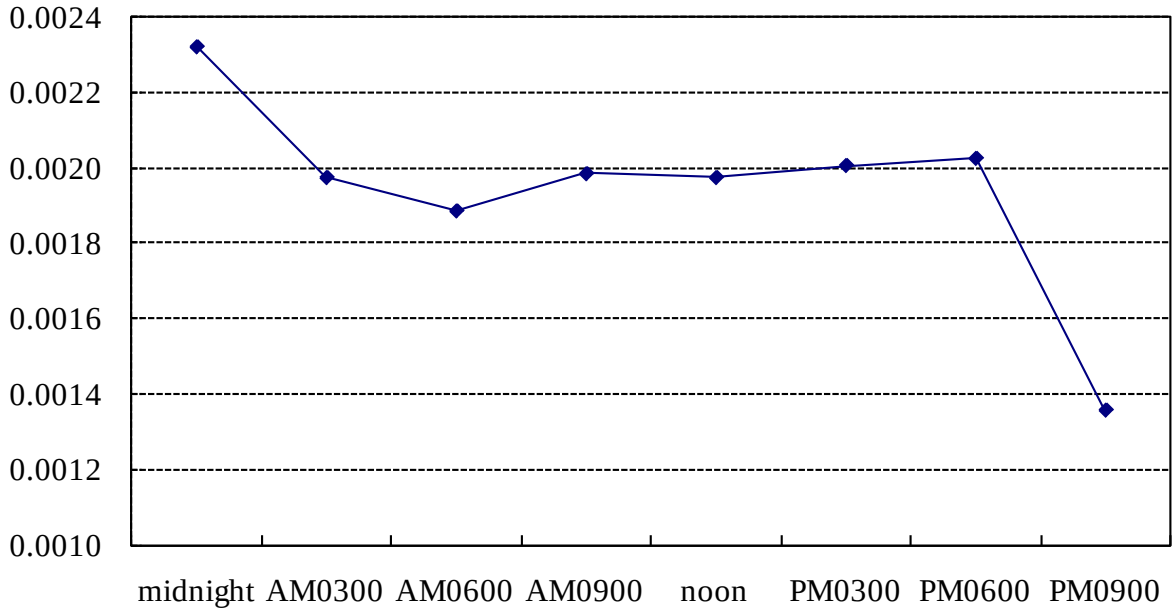
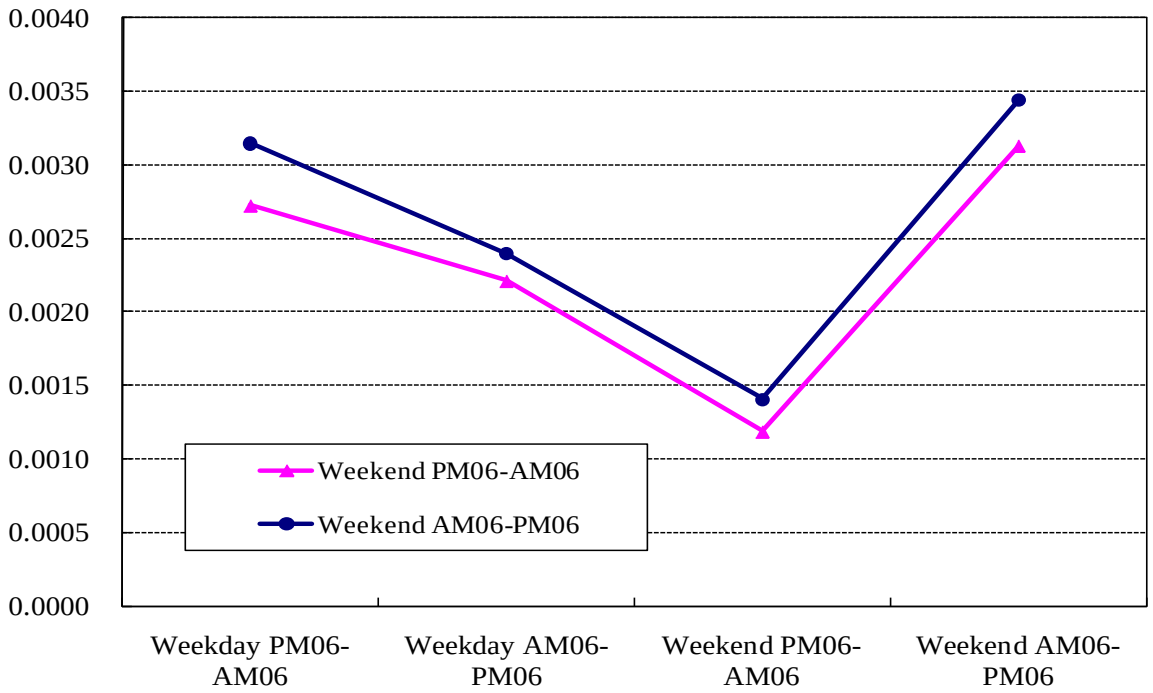


Figure 6.6: Estimated wages for each time period

(1)Weekday



(2) Weekday and weekends



Appendix Table 6.1：Kind of Activities

Activities	Examples and/or notes
1.Sleep	Time from going to bed till getting up
2.Personal care	Washing face, bathing, dressing, hair-dressing, etc.
3.Meals	Includes drinking before or after meals. If the main purpose is socializing, included "18. Social life".
4. Commuting to and from school or work	Going to work or school and returning
5.Work	Work for pay or profit Includes helping family business. Rest between work time should be classified according to the activity actually done.
6.Schoolwork	Studying by students at school, such as high school, college and university Homework is included.
7.Housework	Cooking, table setting, cleaning house, caring for family members other than little child, keeping the family account, visits to the public office on personal or family matters
8.Caring or nursing	Helping family or related person to have a meal, take a bath, dress, move, and to do other
9.Child care	Caring for little child(ren) Including activities concerning education of the child(ren).
10.Shopping	Purchase of food, clothes, or other goods Includes window-shopping.
11.Moving	Moving other than "4. Commuting to and from school or work"
12.Watching TV, listening to the radio, reading newspapers or magazines	Includes watching TV programs recorded on videotape
13.Rest and relaxation	Conversation with family, office colleagues, etc.
14.Studies and researches	Studies and researches other than "6. Schoolwork" Those as a part of work are included in "5. Work".
15.Hobbies and amusements	Seeing a movie or a play, playing or listening to music, caring for pets, gardening, flower arrangement, chess, mahjong, etc.
16.Sports	Athletic amusements such as baseball, volleyball, tennis, etc. Includes light exercises and outdoor leisure such as jogging, hiking, etc.
17.Volunteer and social activities	Voluntary activities or other social activities to promote social welfare by providing one's effort, skill and time without pay
18.Social life	Seeing friends, taking with neighbours, attending meetings, funerals, wedding, receiving friends at home, etc.
19.Medical examination or treatment	Stay in bed due to illness, seeing a doctor for treatment, etc.
20.Other activities	Activities not classified elsewhere

Source: Statistics Bureau, MIAC (http://www.stat.go.jp/english/data/shakai/2001/kodobua.htm)

Chapter 7

Training Opportunities for "Marginal Workers" in Japan

Abstract

Using microdata from the 2007 *Employment Status Survey*, this study empirically examines the situation concerning workers' participation in employer-provided training and in self-development (activities pursued by workers to improve their skills on their own). Controlling for individuals' attributes, we estimate the probabilities that workers pursue either kind of training, focusing in particular on how much lower the training probabilities for marginal workers (women, the less educated, and nonregular workers) are than for the relevant reference groups. Further, employing a standard human capital theory framework, we test the hypothesis that workers' predicted labor market attachment – that is, how much time a worker will spend in the labor market – and, similarly, workers' remaining tenure – that is, how many years a worker will continue to work for their present employer – determines employer-provided training and self-development. We find the following. First, controlling for age, employer size, years of tenure, industry, and occupation, the training probabilities for women, the less educated, and nonregular workers are lower than for the relevant reference groups. The differences are particularly large for employer-provided training. On the other hand, for self-development, there is almost no difference by sex, and the differences by age and by employer size are also small. In addition, differences in employer-provided training probabilities across levels of educational achievement and employment status are largest for the young. Second, while greater predicted labor market attachment increases participation in job training at the initiative of both employers (i.e., employer-provided training) and workers themselves (i.e., self-development), longer predicted remaining tenure increases participation in job training mainly at the initiative of employers. Third, the disadvantages for women and the less educated with regard to employer-provided training diminish to some extent once we control for labor market attachment and remaining tenure. However, the disadvantages for nonregular workers

remain largely unchanged even when controlling for labor market attachment and remaining tenure.

7.1 Introduction

An issue that in recent years has attracted growing attention in Japan is that although the share of women and nonregular employees in the workforce has increased, job training opportunities for them remain limited when compared to male and regular employees. Yet, as numerous studies have shown, job training and skill development play a central role in the formation of job skills and consequently are a key element underpinning wages (e.g., Kurosawa, 2001; Kawaguchi, 2006). Thus, as has been pointed out, the fact that so-called "marginal workers" such as women and nonregular employees receive little job training and skill development is an important reason for wage inequality.

To examine differences in the participation in job training by sex and employment status, Hara, Kurosawa, and Yamamoto (2009), for example, looked at employer-provided training for nonregular employees directly employed by firms on fixed-term contracts (part-time, casual, and contract workers) using the *Basic Survey of Human Resources Development* by the Ministry of Health, Labour and Welfare.[41] Among other things, they showed that even at the same workplace, there exist large differences between regular and nonregular employees in terms of the probability that they would attend off-the-job training courses and the time spent on training courses, and those differences are smaller at workplaces with well developed human resource management systems. Meanwhile, Kosugi and Kimura (2009), using, like the present study, the 2007 *Employment Status Survey* by the Ministry of Internal Affairs and Communications, and focusing on the young, examined the relationship between their employment status and job career on the one hand and job

41 However, although the Basic *Survey* of Human Resources Development provides comprehensive information on job training and skill development in Japan, it suffers from a number of limitations. For example, the survey focuses only on private enterprises and establishments that employ 30 or more people on a regular basis. As a result, it covers less than one-tenth of all establishments and less than half of all employees. Moreover, the survey also does not include temporary workers (i.e., workers employed on a daily basis or for a determined period within a month who were employed for less than 18 days in either of the two months before the day of the implementation of the survey). Further, while the survey does ask firms and establishments questions on dispatched and workers, no information on individuals is available. Finally, the survey also does not include those not in employment.

skill development on the other. They found that the percentage of so-called “freeters” (job-hopping part-timers) that did any training provided by the employer or any self-development, i.e., pursued activities to improve their skills on their own, was much lower than that for regular employees.

These studies clearly illustrate the low rates of participation in job training by women and nonregular workers. The purpose of this study is to look at the reasons for this low participation rate from the perspective of economic theory by examining the patterns of employer-provided job training as well as self-development using microdata from the 2007 *Employment Status Survey*, which has a wider coverage of workers than the *Basic Survey of Human Resources Development*. Specifically, we estimate the probability that a worker did any training or self-development controlling for individual attributes and examine how this probability differs particularly for marginal workers (women, less-educated workers, and nonregular workers).

Standard human capital theory suggests that because job training represents investment in the future, important determinants of such investment are how much longer a given worker will remain in the labor market and how much longer that worker will continue to work for a specific firm. This is because the longer a worker is expected to remain in the labor market, the longer the payback period for any such investment in human capital will be. In addition, standard human capital theory also suggests that where, for technological reasons or because of market frictions, skills are firm-specific, the costs involved in human capital investment will be paid by firms or shared between firms and employees in the form of lower wages (see, e.g., Acemoglu and Pischke 1998, 1999). Under these circumstances, firms are likely to investment more in employees that are expected to stay at the firm for a longer time.

These predictions of human capital theory are well known, but empirical investigations of these issues are scarce. An important reason for this is that it is difficult to gauge future expectations from existing data sources. One notable example is Royalty (1996), who used the panel data of the *National Longitudinal Survey of Youth 1979* of the United States to estimate job-to-job and job-to-nonemployment turnover probabilities and showed that the estimated probabilities provide a good explanation of the probability of receiving training. In this paper, we take a somewhat similar approach, although we have to rely on cross-section data. What we do is to calculate the

"attachment index" for each worker, that is, how much time each worker can be expected to spend in the labor market until retirement by adding up the average working time until the standard retirement age for each of the worker's attributes. In addition, we similarly calculate each worker's expected "remaining tenure," that is, how many more years each worker can be expected to continue to work at the current firm. Greater attachment to the labor market as a whole implies a longer payoff period for investment in general human capital and we would therefore expect this to be associated with more job training initiated by both employers and workers themselves. On the other hand, because longer remaining tenure implies a longer payoff period for firm-specific human capital investment, we would expect this to be associated with more job training initiated mainly by employers. In order to test these hypotheses, we examine to what extent these indicators proxying the length of the payoff period of investment explain differences in job training participation by sex and by employment status.

The main conclusions of our analysis are as follows. First, when we hold workers' age, size of employer (measured in terms of the number of employees), tenure, industry, and occupation fixed, the job training probabilities for women, the less educated, and nonregular workers are smaller than for the respective reference groups. The difference is particularly large for employer-provided training. On the other hand, with regard to self-development, there is almost no difference by sex, and differences by workers' age and size of employer are also small. Moreover, differences in job training probabilities for employer-provided training by educational attainment and employment status are greater among the young.

Second, whereas differences in the expected degree of workers' labor market attachment (i.e., the predicted future employment period overall) affect participation in both employer-provided training and training initiated by workers themselves (self-development), differences in remaining tenure (i.e., the predicted future employment period at a particular firm) mainly affect participation in employer-provided job training.

Third, expected labor market attachment and expected remaining tenure, i.e., the proxy variables for the payoff period of human capital investment, explain more than half of the difference between men and women in the probability of participation in employer-provided training. In

contrast, these proxy variables explain very little of the difference in training probabilities between regular and nonregular workers. These results suggest that a considerable part of the difference in job training participation between men and women is due to differences in the length of the payoff period of investment, but the differences in job training participation between regular and nonregular workers arise largely because the type of work they are engaged in differs and there are fundamental differences between the two groups in the quality and quantity of required human capital accumulation.

The remainder of this study is organized as follows. In Section 7.2, we outline the data we use and start our analysis by presenting the ratios of workers involved in training (employer-provided and self-development) for each worker attribute based on an aggregation of our microdata. In Section 7.3, we then estimate training probabilities controlling for worker attributes. Next, in Section 7.4, we test various hypotheses regarding the relationship between labor market attachment and remaining tenure on the one hand and job training on the other and look at the extent to which this influences the training probabilities for marginal workers. Section 7.5 concludes.

7.2 Data and basic patterns

The source of our data is the 2007 *Employment Status Survey*, which surveys job training and self-development useful for work conducted in the preceding one year. Distinguishing between whether training was conducted at the initiative of the employer or the worker himself, it provides a breakdown of such training into the following categories: (a) training at the workplace (this category applies only to employer-provided training); (b) attendance of college or graduate school courses; (c) attendance of courses at a special training school or other vocational school; (d) attendance of courses at a public occupational skills development facility; (e) attendance of short courses or seminars; (f) participation in study group meetings or workshops; (g) taking distance learning courses; (h) self-learning (this category applies only to self-development), and (i) other. In this study, we will refer to training initiated by the employer as “employer-provided training” and training initiated by the worker as “self-development.”

To start with, we calculate the training ratios by workers’ attributes. We limit our sample to

those aged 15-59 and exclude those in enrolled in full-time education. Moreover, we exclude from all occupied persons company executives, the self-employed (with or without employees), family workers, and those doing piecework at home, because their work status is somewhat different in nature from the concept of a "worker" we focus on here. As for those not in employment, we only include those wishing to work. Furthermore, we exclude observations for individuals where we think there are recording errors.[42] We then calculate the training ratio for each of a number of aggregate categories, distinguishing by sex, age group, educational attainment, etc.[43] We do so for a sample consisting of occupied persons and those not in employment but wishing to work as well as a subsample consisting only of occupied persons, and for the latter calculate training ratios for additional aggregate categories, distinguishing by industry, occupation, size of employer (measured in terms of the number of employees) and tenure.

Table 7.1 shows, for the comprehensive sample consisting of occupied persons and those not in employment but wishing to work, the training ratio by sex, employment status, educational attainment, and age bracket in five-year intervals. As Table 7.1 indicates, the job training ratio for women is about 10 percentage points lower than that for men, and this difference is mainly due to differences in participation in employer-provided training. The training ratios for nonregular employees are lower than those for regular employees, with the difference being more pronounced for employer-provided training. Because the ratio of those not in employment receiving employer-provided training is, for obvious reasons, very low, the job training ratio for this group is also very low. Nevertheless, a closer look shows that when it comes to self-development, the ratio is higher than that for part-time and casual workers and not that different from dispatched workers. Looking at educational attainment, both the employer-provided training ratio and the self-development ratio increase with the level of education, and the size of the discrepancies between the different groups is quite striking. Next, by age group, we find that the training ratio

42 For example, cases where the years of tenure are greater than 45, the age at which the present job was taken up is less than 15, etc.

43 For the calculation, we use the simple number of observations for occupied persons plus those not in employment but wishing to work, occupied persons only, as well as for each aggregate category. The training ratios for each category as well as the average age and tenure are calculated as weighted averages.

overall is highest for those in their 20s and early 30s and then gradually declines with age. However, taking a closer look, we find that with regard to employer-provided training, the ratio is highest, at 35.8 percent, for those in their early 20s and then declines, but it remains stable at around 30 percent for those in their 30s to early 50s, pointing at a pattern in which employed workers continuously receive employer-provided training. On the other hand, self-development peaks at around 25 percent for those in their late 20s, then remains stable at around 20 percent for those in their 30s and 40s, and then declines again for those in their 50s.

Next, Table 7.2 shows the training ratios for occupied persons only, considering additionally training ratios by industry (broken down into 16 broad industry categories), by occupation (broken down into 10 broad occupational categories), by size of employer (in terms of number of employees), and by years of tenure in five-year brackets. Although the gap between women and men is somewhat smaller than in Table 7.1, the overall pattern for sex, employment status, education, and age group remains virtually unchanged by focusing on occupied persons only. By industry, the highest ratios can be found in the education and learning support sector; moreover, employer-provided training is particularly widespread in finance and insurance as well as electricity, gas, heat supply, and water, while self-development is especially common in medical, health care and welfare as well as information and communications. By occupation, the overall ratio is high for specialist and technical occupations as well as administrative and managerial occupations, with employer-provided training especially widespread in administrative and managerial occupations and self-development especially widespread in specialist and technical occupations. By size of employer, the larger the employer, the higher is the training ratio. Although this applies to both types of training, the pattern is particularly pronounced for employer-provided training. The highest ratios, though, are found for those working at government offices.

Finally, looking at the role of tenure, contrary to our expectation that investment in job training would concentrate on those with a shorter tenure, we find that the longer workers have been working for their current employer, the higher is the ratio of those doing any training, with a peak of about 50 percent for those with a tenure of 25-29 years. We suspect that this reflects increased training for career development within firms, such as in the form of management training programs,

as is indicated by the different patterns for employer-provided training and self-development, with the latter being relatively stable at around 20 percent and showing comparatively little variation across tenure groups. Overall, the patterns with regard to training ratios for the different aggregate categories by sex, age group, education, or employment status confirm once again that training ratios for marginal workers (women, nonregular workers, and the less educated) are low.

7.4 Estimation of training probabilities

Next, using probit estimation, we examine the probability that workers will do any employer-provided training or self-development, controlling for the attributes discussed in Section 7.2. To begin with, we use the pooled sample consisting of occupied persons and those not in employment but wishing to work in order to discover to what extent being in employment affects training probabilities. In the next step, we then confine our sample to occupied persons only to examine how workplace attributes such as industry, occupation, and employer size affect training probabilities.[44]

Starting with the pooled sample, we use as dependent variables of our probit estimation whether a person received employer-provided training or not and whether a person engaged in any self-development or not. As explanatory variables, we include a female dummy, employment status dummies (setting regular employees as the reference group), education dummies (with high school graduates as the reference group), and dummies for five-year age brackets (with 20-24 year-olds as the reference group). Table 7.3 shows the estimation results. In contrast with Tables 7.1 and 7.2, where the training ratio for women was lower than that for men, here we find that the probability of receiving employer-provided training is actually higher for women, and this difference is statistically significant. For self-development, the coefficient is even larger and indicates that the probability of this kind of training is 2.6 percentage points higher for women than for men.

Turning to the employment status, we find that the training probabilities for nonregular workers are lower than those for regular workers, and the difference is larger for employer-provided training than for self-development. Among nonregular workers, the probabilities are lowest for part-time

44 For basic statistics of the variables, refer to Appendix Tables 1(a) and 1(b).

and casual workers. For example, the probability of receiving employer-provided training is roughly 20 percentage points lower for such workers than for regular employees. For contract employees, the gap vis-à-vis regular employees is roughly half the size of that of part-time and casual workers (8 percentage points). As for those not in employment, it is only natural that their probability of receiving employer-provided training is very small: it is 30 percentage points below that for regular employees. On the other hand, when it comes to self-improvement, the gap vis-à-vis regular workers for those not in employment is only 3 percentage points, which is a smaller gap than that for part-time and casual workers and for dispatched workers. It could be said that this shows that those not in employment but wishing to work engage in self-development to improve their employability.

Turning to the effects of educational attainment, we find that even when we hold other factors fixed, the training probabilities of the highly educated are very high both with regard to employer-provided training and self-development. This is a phenomenon already well documented in previous research on Japan, the United States, Germany, and other countries. As highlighted by Altonji and Spletzer (1991), it can be interpreted as suggesting that because for those with greater learning ability the rate of return to education and job training is higher, there is a positive correlation between years of education and receiving job training. In addition, we find that differences in training probability by educational attainment are more pronounced for self-development than for employer-provided training.

Looking at the role of age, the results generally indicate that the younger workers are, the more likely they are to receive training. However, that probability does note decline monotonically with age, and for employer-provided training the probability is actually highest for those in their 40s and early 50s. For self-development, the probability declines with age from the 40s onward.

Next, limiting our sample to occupied persons and using the same dependent variables as above, we conduct the same estimation but in addition to the female dummy and the employment status, education, and age group dummies, we also include employer size (using workers working for firms with 1-9 employees as the reference group) and tenure, i.e., the number of years a worker has worked for the present employer (using 0-4 years as the reference group). The estimation results are

presented in Table 7.4, with column (2) showing the results when the dummies to control for industry (major classification, 16 industries), column (3) showing those when the dummies to control for occupation (major classification, 10 occupations), and column (4) showing those when both sets of dummies are included.

Starting again by looking at the female dummy, we find that for employer-provided training, the coefficient is positive when the industry and occupation dummies are not included, but becomes negative when they are. Especially controlling for industry has a large impact on the coefficient. This indicates that it is likely that women tend to work in industries where the probability of receiving training is high. On the other hand, when it comes to self-development, there are almost no differences between men and women once industry and occupation are controlled for. As for the employment status, the probability of receiving employer-provided training is lower for nonregular than for regular employees, but when it comes to self-development, the differences by employment status are much smaller. Next, looking at the role of education, we find that the higher the educational attainment, the higher is the training probability. However, when the industry and occupation dummies are included, that difference becomes considerably smaller. This means that more highly educated workers are more likely to work in industries and occupations where the training probability is high. Moreover, the differences by educational attainment are larger for self-development than employer-provided training. This suggests that, as mentioned earlier, it is likely that the return on learning a new skill is higher for the more educated. Looking at the effect of age, while the probability of employer-provided training decreases with age from the late 20s onward, for self-development no significant differences can be observed until the early 40s.

Turning to the role of employer size, the results indicate that the larger the employer, the higher is the training probability. The probability of receiving employer-provided training is about 30 percentage points higher for workers at firms with more than 1,000 employees or at government offices than for workers at firms with fewer than 10 employees. However, with regard to self-development, differences by employer size are quite small. Next, looking at tenure, the probability of employer-provided training increases with tenure and reaches a peak in the neighborhood of 30-39 years. This is a finding that differs from our theoretical expectation and

implies that workers receive continuous employer-provided training as part of a process of career development with length of service. The fact that this pattern can also be found in the estimation including the occupation dummies and hence a dummy for administrative and managerial occupations suggests that this employer-provided training for career development continues to takes place across occupations.[45] On the other hand, the longer workers' tenure, the less likely it is that they engage in self-development.

Summarizing these findings, we can say that the training probabilities of women, less educated workers, and nonregular workers are still lower when controlling for age, employer size, tenure, industry, and occupation. The differences are particularly large when it comes to employer-provided training. And comparing the results for these groups of marginal workers, the disadvantage is largest for nonregular workers. On the other hand, when it comes to self-development, there is almost no difference between the sexes, while differences by age or size of employer are also small. Taken together, these results suggest that the probability of receiving employer-provided training is noticeably smaller for women, those at small firms, those not in employment, and nonregular employees, though on the other hand it seems that women and those employed at small firms compensate for this by pursuing self-development. In contrast, the difference between the less educated and the better educated is even greater for self-development than for employer-provided training.

To examine the relatively large differences in employer-provided training probabilities by sex, employment status, and education in greater detail, we additionally estimate the coefficients separately for each age group (Appendix Table 7.2). Doing so, we find that for women, the negative estimated value is largest for those in their 30s. With regard to education, the positive value for the highly educated becomes more pronounced for the young. And with regard to the employment status, we find that for part-time and casual workers and for dispatched workers, the negative estimated values are especially large for those in their 20s. These results indicate that differences in training probability by educational attainment and employment status are more pronounced among

45 Pischke (2001) arrives at a similar finding regarding this kind of continuous training, showing that in Germany training remains high for workers into their 40s.]

the young.

7.4 The relationship between labor market attachment, remaining tenure, and job training

7.4.1 Theoretical framework and empirical methodology

According to standard human capital theory models, the amount of investment in general human capital at a particular point in time is determined by the marginal rate of return on investment and marginal cost. The marginal rate of return on investment is determined by the length of the payoff period, the future price of human capital, and workers' learning ability. On the other hand, marginal cost of investment is mainly determined by the opportunity cost of training, that is, the current wage rate.

When human capital is firm-specific as a result of technological factors or market frictions, there is a divergence between workers' outside option (the wage rate in the labor market) and their marginal productivity because they cannot sell those skills to other firms. Depending on the bargaining power of the firm, the firm reaps part of this divergence as rent and the discounted present value of that rent determines the amount of human capital investment undertaken by the firm. The discounted present value of that rent depends on workers' remaining employment period, the future value of commodities made with firm-specific human capital, workers' learning ability, and the difficulty with which workers can switch jobs (i.e., the degree of market friction).

The purpose here is to examine whether we can explain the differences in training probabilities for marginal workers found in the preceding section with differences in workers' remaining employment period. Differences in training probabilities between men and women and across workers with different employment statuses are often explained with differences in expected employment periods in the labor market and/or lengths of employment at a specific firm. Royalty (1996), as mentioned above, using the *National Longitudinal Survey of Youth* panel dataset of the United States, examined the effect of turnover probabilities on receiving job training. Specifically, she estimated turnover probabilities, that is, the probability of staying in the current job, of

job-to-job turnover, and of job-to-nonemployment turnover, and compares the estimated[46] training probabilities when job turnover probabilities are included and when they are not. She finds that the probability of receiving employer-provided training is higher for men, but when turnover probabilities are included, that effect declined by 25 percent.[47] She also shows that, on the other hand, the probability of receiving employer-provided training for the highly educated is no longer significantly higher when turnover probabilities are taken into account.

The approach we take in this study is to examine whether differences in the length of future employment and differences in predicted years of tenure with a specific firm can explain training probabilities, and moreover, to what extent they explain differences in training probabilities of marginal workers. Specifically, we examine whether, as human capital theory predicts, differences in the length of future employment (expected labor market attachment) affect the probabilities of both employer- and worker-initiated training and, moreover, whether differences in remaining employment at the same firm (expected remaining tenure) affect the probability mainly of employer-initiated training. In addition, we examine to what extent taking these factors into account changes the gap in training probabilities of marginal workers vis-à-vis their reference groups.

7.4.1.1 The attachment index (AI)

Even if they change their job, the more workers are attached to the labor market (that is, work for a longer period or more hours), the higher is their incentive to participate in training and raise their job skills. To gauge this labor market attachment, we calculated the total amount of time each worker can be expected to spend in the labor market, i.e., whether he or she can be expected to continue working for many years, and taking into account whether he or she works full-time or part-time, by adding the average labor time until standard retirement age for each of the attributes of each worker.

Specifically, we divide the sample of 15-59 year-olds (sample A) into 442 groups according to

46 Setting those receiving no training as the reference group, she conducted multinomial probit regressions between training conducted by the employer and off-the-job training (vocational training school, business school, courses, etc.).

47 I.e., the coefficient for the male dummy declined from 0.011 to 0.008.

their attributes (age, sex, education). In this sample, in contrast with the sample used in Sections 7.2 and 7.3, we include those in full-time education. This time, occupied persons also include company executives, the self-employed (with or without employees), family workers, and those doing piecework at home, while those not in employment also include those not wishing to work. We want to calculate the average annual working time for each group (in the case of those not in employment we apply zero). Further, dividing the cumulative annual working hours until age 59 of each group by 2000 hours (corresponding to one year of full-time work, i.e. 40 hours per week times 50 weeks), we construct the attachment index (AI).[48] Next, we divide the sample of occupied persons used in the estimation in Section 7.3 (sample B) into groups according to the same attributes (age, sex, education) (415 groups). We then apply the AI of a particular group in sample A to each of the same 415 groups in sample B. Further, from the AI we then construct a set of interval dummies (from 0 to 15).[49]

This index is an indicator showing how many years a worker of a given sex and with a given education will work in the period that remains from his or her age until age 59. It should be noted that what we are doing here is to take the average employment patterns for the observations in the *Employment Status Survey* and assume that the cross-section observations represent the observations of the employment patterns for individuals over time. This is a strong assumption, but it is a standard one made, for example, in estimations of wage functions using cross-section data.

7.4.1.2 The remaining tenure (RT)

In the case that for some reason a skill acquired through job training is not perfectly valued in the market, firms will have an incentive to invest in workers because workers will not change their job even if the firm does not offer a wage increase commensurate with the increase in skill, thus allowing the firm to reap profits that exceed the cost of the investment. Consequently, how long a worker with given attributes is expected to continue working for the present employer is likely to be

48 For example, in the case of a 15 year old, we sum up the work time for each year from age 16 to 59. For a 59 year-old, we set it to 0. The AI value shows the corresponding years of full-time employment.

49 The 0 interval dummy is for AI values from 0 to less than 1, the 1 interval dummy is for AI values from 1 to less than 2, etc., while the 15 interval dummy is for AI values of 15 and greater.

an important determining factor of employer-provided training. Therefore, as our second measure, we calculate the expected remaining tenure (RT) for each attribute, which gauges how long a worker with given attributes can be expected to continue working for the present employer.

Specifically, we use the sample of occupied persons from Sections 7.2 and 7.3 (labeled sample B in the preceding subsection) and divide this into 6,151 groups according to workers' attributes (sex, education, employment status, industry, size of employer, and whether workers entered a firm directly upon graduation).[50] Because for some groups the number of observations may be very small, we employ not the average years of tenure but the median to avoid any distortion from outliers. We subtract from the median value of years of tenure for each group the actual years of tenure and set this as remaining tenure (RT). If the value thus obtained is negative, we set RT to zero. Moreover, we use a dummy that takes a value of 1 if RT is set to zero to represent strong attachment to a firm that is unascertainable from workers' observable attributes. In addition, we also construct interval dummies (from 0 to 15) from RT.[51]

The reason that we distinguish whether workers took up their current employment directly upon graduation is that there is a strong tendency for fresh graduate recruits to follow a career path through promotion within the firm, while mid-career recruits represent a much more fluid working force and can be expected to subsequently follow a career through job changes. Here, we mechanically regard as having started their present job as fresh graduate recruits those for whom the age at which they took up the job (current age minus years of tenure) was 15-16 years in the case of junior high school graduates, 18-19 years in the case of high school graduates, 20-21 years in the case of graduates of vocational schools, junior colleges, or technical colleges, and 22-25 in the case of graduates of colleges and graduate schools.

Figure 7.1 shows the distribution as well as the average and median for the RT of 30-year old male regular employees who graduated from college or graduate school, with the upper panel for fresh graduate recruits and the lower panel for mid-career recruits. Whereas the RT of graduate recruits is around 12 years, that for mid-career recruits, even though they otherwise have the same

50 We do not consider occupation as one of workers' attributes because workers' occupation can change with age, such as when they change into administrative and managerial occupations.
51 The RT interval dummies are constructed in exactly the same way as the AI interval dummies.

attributes in terms of sex, education, and employment status, is strikingly lower at around 2 years. Based on this, we expect that those recruited upon graduation are in jobs in which they will continue to work for a long time and the probability that they receive employer-provided training is consequently high.

7.4.2 AI, RT, and training probabilities

We start by looking at the relationships between AI and RT on the one hand and training probabilities on the other. As before, we use a probit estimation, with the dependent variables being whether a person received employer-provided training or not and whether a person engaged in any self-development or not. As explanatory variables, we use the interval dummies for AI and RT.

The results are presented in Figures 7.2 and 7.3, which on the horizontal axis show the values of the interval dummies and on the vertical axis the size of the coefficient (training probabilities) from the probit estimation. As can be seen, for AI, the higher the index (i.e., the greater the predicted future labor market attachment), the higher is the training probability. What is more, there are no great differences in the shapes of the curves for employer-provided training and for self-development. For RT, we also find that the higher the value, the higher is the training probability, but there is a considerable difference in the shapes of the curves for the two types of training. That is, whereas the probability of employer-provided training displays a steep increase, the probability of self-development moves sideways until 6 years of RT and after that rises relatively gently. This result shows that whereas greater length of future employment as represented by AI is associated with an increase job training at the initiative of both workers and firms, greater length of predicted employment at a specific firm, represented by RT, is associated mainly with an increase in job training at the initiative of firms.

The preceding results show that the length of the expected payoff period for investment in human capital affects participation in job training. But what we also want to know is what explanatory power the various factors determining training probabilities have. In Section 7.3, we showed that the training probabilities for marginal workers such as women, nonregular employees, and the less educated were significantly lower than for the reference groups. Moreover, it is

sometimes claimed that these patterns are attributable to the fact that the attachment of marginal workers to the labor market as a whole and to a specific firm is comparatively low and that a long investment payoff period cannot be expected. Therefore, in our next step, we look at the extent to which the negative coefficient for marginal workers changes when we estimate training probabilities controlling for AI and RT. If short expected investment payoff periods explain why the job training probabilities of marginal workers are low, then we would expect that by controlling for the AI and RT variables, the gap vis-à-vis the references groups, that is, the size of the negative coefficient, should shrink.

Table 7.5 shows the estimation result for the probabilities of employer-provided training and self-development using sex, employment status, and education as explanatory variables. Moreover, we also include the industry, employer size, and fresh graduate recruit dummies used for the construction of groups in the calculation of RT. This is to take into account the possibility that these factors directly affect workers' job training probability through technological aspects of production activities and worker heterogeneity. The results in columns (1) and (3) do not include AI and RT, while those in columns (2) and (4) do.

Comparing the results for employer-provided training, we find that in column (1) the difference between men and women is 3.5 percentage points, but by controlling for AI and RT in column (2), the different shrinks by two-thirds to 1.4 percentage points. That is, more than half of the difference between men and women in the probability of receiving employer-provided training can be explained by the two factors of how much longer someone will continue to be employed in the labor market (AI) and how much longer he or she will continue to work for the present employer (RT). On the other hand, only about one-fifth of the low training probability for the less educated can be explained by these factors. This suggests that while the length of the investment payoff period explains some of the difference in training probabilities by level of educational attainment, a large part of the difference is due to differences in the returns from job training (that is, differences in learning efficiency) and differences in the discount rate for future earnings. Finally, for nonregular workers, the differences do not diminish even when AI and RT are included. We suspect that a large part of the difference in training probabilities between regular and nonregular workers is

due to differences in the type of work they do and the resulting need or otherwise for long-term skill formation.

In sum, our results indicate that differences in labor market attachment and expected remaining tenure at the present employer affect training probabilities in a way that is consistent with the predictions of human capital theory. Moreover, the results show that these factors partly explain the low training probabilities for women and the less educated. However, concerning the low training probability of nonregular workers, other factors are more important. While we do not clearly know the reasons for the difference in training probabilities between regular and nonregular workers, what we now do know is that this difference cannot be explained with differences in expectations regarding their future employment behavior. Our hunch therefore is that there are fundamental differences in the need for skill accumulation in the work of regular and nonregular employees that bring about the large differences in job training probabilities.

7.5 Conclusion

Using microdata from the 2007 *Employment Status Survey*, this study empirically examined the situation concerning workers' participation in employer-provided training and in self-development. We began by calculating training ratios for different worker attributes and then, controlling for individuals' attributes, estimated training probabilities. Doing so, we particularly focused on how much lower than for the relevant reference groups the participation probabilities for marginal workers (women, the less educated, and nonregular workers) were. Further, employing a standard human capital theory framework, we investigated for each worker attribute how differences in participation in employer-provided training and in self-development could be explained. Specifically, calculating each workers' expected labor market attachment – that is, how much time that worker will spend in the labor market until retirement – and, similarly, each worker's remaining tenure – that is, how many years each worker with given attributes will continue to work for his/her present employer – we examined the relationship of these variables with training probabilities. Further, we estimated to what extent these factors explain the low training probabilities of marginal workers.

Our main findings were as follows. First, controlling for age, employer size, years of tenure, industry, and occupation, we found that training probabilities for women, the less educated, and nonregular workers were lower than for the relevant reference groups. The differences were particularly large for employer-provided training. On the other hand, for self-development, there was almost no difference by sex, and the differences by age and by employer size were also small. This pattern could be interpreted as suggesting that women and workers at small firms try to make up for receiving less employer-provided training through self-development. On the other hand, the differences between the less educated and the better educated were even greater for self-development than for employer-provided training. A likely explanation for this is that learning ability and discount rates for future earnings differ across those with different levels of educational attainment. In addition, we found that differences in employer-provided training probabilities across levels of educational achievement and employment status were greatest for the young.

Second, we estimated the relationship between training probabilities on the one hand and, on the other, workers' attachment to the labor market, represented by the attachment index (AI), and how long a worker can be expected to continue working for his current employer, represented by remaining tenure (RT). The results indicated that the higher the AI (i.e., the greater the predicted future labor market attachment), the higher are the training probabilities. In addition, there were no great differences in the shapes of the curves for employer-provided training and self-development For RT, we also found that the higher the value, the higher is the training probably, but the slope of the curve showing the effect of RT was much greater for employer-provided training than for self-development. Conforming with the predictions of human capital theory, this shows that whereas greater length of future employment increases job training participation at the initiative of both workers and employers, differences in predicted years of employment at a specific firm raise job training participation mainly at the initiative of firms. Moreover, these results suggest that there is firm-specificity in the formation of skills through employer-provided training due to technology-related factors and/or market frictions.

Third, the disadvantages for women and the less educated with regard to employer-provided training diminish once we control for AI and RT in the estimation. On the other hand, for

nonregular workers, the negative coefficient remains largely unchanged even when controlling for AI and RT.

Based on the above results, we can derive the following policy implications and issues for future research.

First, although it appears that women are more likely to be employed in occupations or industries with a high training probability, once we control for employment status and educational attainment in the same industry or occupation, women's training probability is still lower than that for men. This can be thought to be an example of statistical discrimination arising from differences in work duties and, based on this, differences in expected future employment spans. Consequently, policies to promote that women remain in employment will simultaneously have the effect of reducing the gap between women and men in job training participation.

Second, although part of the overall difference in training probabilities by educational attainment can be explained by the fact that the better educated tend to be employed in occupations with higher training probabilities, there remain differences even in the same industry or occupation. This is possibly because educational attainment captures unobserved differences such as with regard to individual learning ability or the discount rate for future earnings. Consequently, efforts should be made from the stage of school education onward to raise individuals' learning ability.

Third, we found that the higher the labor market attachment (AI) and the longer the remaining tenure at a firm (RT), the higher is the probability of job training. Especially for high values of RT, a remarkable rise in the training probability is observed. This shows that marginal workers, for whom RT is low, have little hope of receiving employer-provided training. On the other hand, although such workers do not receive much employer-provided training, the probability that they engage in self-development is also low. It would therefore be difficult to claim that the fact that they receive insufficient employer-provided training is compensated for by self-development. This suggests that in order to raise the skills and hence the incomes of marginal workers, further policy measures are required to provide training opportunities that serve as an alternative to employer-provided training.

Fourth, the low training probabilities for nonregular workers show almost no change even when

we control for RT and AI. Moreover, although RT and AI partly explain the low training probabilities for women and the less educated, gaps remain even when controlling for these two factors. This shows that the scarcity of training opportunities for marginal workers has deep-seated reasons other than attachment to the labor market and the expected length of work for a particular employer. Although at this point in time it is only conjecture, a likely reason seems to be that marginal workers are only assigned to tasks that require little training to begin with. The fact that differences in training probabilities by employment status are all the larger for the young, who have many training opportunities, is likely to give rise to large differences in the subsequent accumulation of job skills. These findings mean that more in-depth research on the causes of disparities in job training between regular and nonregular workers is necessary.

References for Chapter 7

Acemoglu, Daron and Jörn-Steffen Pischke (1998), "Why do Firms Train? Theory and Evidence," *Quarterly Journal of Economics*, Vol. 113, No. 10, pp. 70-119.

Acemoglu, Daron and Jörn-Steffen Pischke (1999) "The Structure of Wages and Investment in General Training," *Journal of Political Economy*, Vol. 107, No. 3, 539-572.

Altonji, Josheph. G. and James. R. Spletzer (1991) "Worker Characteristics, Job Characteristics and the Receipt of On-the-Job Training," *Industrial and Labor Relations Review*, Vol. 45, No. 1, pp. 58 - 79.

Hara, Hiromi, Masako Kurosawa and Yuzo Yamamoto (2009), "Hiseishain no Kigyonai Kunren ni tsuite no Bunseki [Analysis of Firm Provided Training of Nonregular Workers in Japan]," *JILPT Labor Policy Research Report* No. 110.

Kawaguchi, Daiji (2006) "The Incidence and Effect of Job Training among Japanese Women," *Industrial Relations*, Vol. 45, No. 3, pp. 469-477.

Kosugi, Reiko and Yuko Kimura (2009), "Jakunensha no Shugyo Jokyo, Kyaria, Shokugyo Noryoku Kaihatsu no Genjo [The Employment Situation, Career, and Job Training of the Young," *JILPT Reference (Shiryo) Series* No. 61.

Kurosawa, Masako (2001) "The Extent and Impact of Enterprise Training: The Case of Kitakyushu City," *Japanese Economic Review*, Vol. 52, No. 2, pp. 224-241.

Pischke, Jörn-Steffen (2001) "Continuous Training in Germany," *Journal of Population Economics*, Vol. 14, No. 3, pp. 523-548.

Royalty, Anne B. (1996) "The Effects of Job Turnover on the Training of Men and Women," *Industrial and Labor Relations Review*, Vol. 49, No. 3, pp. 506-521.

Tables & Figures

Table 7.1: Job training ratios, occupied persons and persons not in employment but wishing to work (%)

		Any job training (employer-provided or self-development)	Employer-provided training	Self-development
Occupied persons plus persons not in employment but wishing to work		38.7	29.9	19.5
Sex	Male	43.6	35.3	20.3
	Female	33.5	24.2	18.8
Employment status	Regular employees	47.9	40.3	22.5
	Part-time and casual workers	22.5	15.1	11.5
	Dispatched workers from temporary labor agencies	29.6	16.9	17.9
	Contract employees	40.6	29.1	21.7
	Persons not in employment	18.8	4.7	15.9
Education	Primary or junior high school	16.4	12.5	6.0
	Senior high school	29.8	23.8	11.8
	Vocational school, junior college	41.5	31.3	22.2
	College, graduate school	57.5	43.9	33.8
Age	Average	38.4	38.7	37.8
	15 to 19	33.4	26.7	12.1
	20 to 24	45.7	35.8	22.9
	25 to 29	44.3	33.0	24.7
	30 to 34	40.2	29.8	21.8
	35 to 39	37.7	28.3	19.5
	40 to 44	38.6	30.1	19.5
	45 to 49	39.7	31.7	19.5
	50 to 54	35.8	29.1	16.3
	55 to 59	29.8	24.0	13.0

Source: Authors' calculation based on data from the 2007 *Employment Status Survey*, Ministry of Internal Affairs and Communications.

Table 7.2: Job training ratios, occupied persons (%)

		Any job training (employer-provided or self-development)	Employer-provided training	Self-development
Occupied persons		41.7	33.6	20.1
Sex	Male	44.8	37.1	20.2
	Female	37.7	29.3	19.9
Employment status	Regular employees	47.9	40.3	22.5
	Part-time and casual workers	22.5	15.1	11.5
	Dispatched workers from temporary labor agencies	29.6	16.9	17.9
	Contract employees	40.6	29.1	21.7
Education	Primary or junior high school	17.9	14.9	5.5
	Senior high school	32.1	26.8	11.8
	Vocational school, junior college	45.4	36.0	23.2
	College, graduate school	59.3	47.0	33.9
Age	Average	38.5	38.7	37.9
	15 to 19	36.7	32.0	11.3
	20 to 24	48.2	39.5	23.1
	25 to 29	47.2	36.7	25.4
	30 to 34	43.9	34.2	22.7
	35 to 39	41.5	32.7	20.4
	40 to 44	41.8	33.9	20.2
	45 to 49	42.2	35.0	19.8
	50 to 54	38.2	32.0	16.6
	55 to 59	32.1	26.9	13.2
Industry	Agriculture, forestry and fisheries	21.7	13.7	11.8
	Mining, construction	35.2	27.8	15.2
	Manufacturing	34.4	28.6	13.3
	Electricity, gas, heat supply and water	63.6	55.5	28.3
	Information and communications	52.4	38.7	30.9
	Transport	28.5	23.9	9.9
	Wholesale and retail trade	33.1	26.5	13.9
	Finance and insurance	62.9	55.8	27.8
	Real estate	44.1	31.2	25.7
	Eating and drinking places, accommodations	23.6	15.4	12.4
	Medical, health care and welfare	59.1	49.2	33.2
	Education, learning support	69.3	56.6	43.6
	Compound services	58.9	54.2	20.5
	Services not elsewhere classified	40.3	30.2	20.9
	Government not elsewhere classified	58.3	49.7	27.5

（continued）

		Any job training (employer-provided or self-development)	Employer-provided training	Self-development
Occupation	Specialist and technical workers	66.3	54.2	40.6
	Administrative and managerial workers	65.8	60.0	27.6
	Clerical workers	42.8	33.1	21.3
	Sales workers	41.0	34.3	16.8
	Service workers	37.8	29.0	18.8
	Security workers	57.8	49.5	25.0
	Agriculture, forestry and fishery workers	24.5	15.8	13.4
	Transport and communication workers	25.9	22.2	7.9
	Production process and related workers	28.9	23.9	10.2
Size of employer (number of employees)	1 to 9 persons	25.2	15.3	14.6
	10 to 29	29.4	21.3	14.7
	30 to 99	33.9	25.9	16.1
	100 to 299	40.4	32.9	18.4
	300 to 499	44.7	36.7	20.3
	500 to 999	47.2	39.7	21.1
	1000 and over	51.1	43.9	22.6
	Government	64.3	55.9	34.9
Tenure	Average	11.5	12.3	10.5
	0 to 4 years	38.7	28.6	20.7
	5 to 9	39.5	31.9	19.2
	10 to 14	41.2	34.4	18.7
	15 to19	44.8	38.1	19.8
	20 to 24	48.8	42.5	22.0
	25 to 29	50.9	45.5	21.9
	30 to 34	49.5	44.0	20.6
	35 to 39	44.1	39.5	16.0
	40 and over	35.1	31.1	10.8

Source: See Table 7.1.

Table 7.3: Job training probabilities, occupied persons and persons not in employment but wishing to work

		Employer-provided training	Self-development
	Female	0.007 (0.002)	0.026 (0.001)
Employment status	Regular employees (reference)		
	Part-time and casual workers	-0.196 (0.001)	-0.072 (0.001)
	Dispatched workers from temporary labor agencies	-0.170 (0.003)	-0.035 (0.003)
	Contract employees	-0.080 (0.003)	-0.001 (-0.003)
	Persons not in employment	-0.292 (0.001)	-0.031 (0.002)
Education	Primary or junior high school	-0.108 (0.003)	-0.069 (0.002)
	Senior high school (reference)		
	Vocational school, junior college	0.099 (0.002)	0.104 (0.002)
	College, graduate school	0.167 (0.002)	0.214 (0.002)
Age	15 to 19	0.035 (0.008)	0.000 (-0.006)
	20 to 24 (reference)		
	25 to 29	-0.043 (0.003)	-0.009 (0.002)
	30 to 34	-0.058 (0.003)	-0.019 (0.002)
	35 to 39	-0.056 (0.003)	-0.024 (0.002)
	40 to 44	-0.036 (0.003)	-0.017 (0.002)
	45 to 49	-0.023 (0.003)	-0.019 (0.002)
	50 to 54	-0.037 (0.003)	-0.033 (0.002)
	55 to 59	-0.061 (0.003)	-0.044 (0.002)
	Observations	427,558	427,558
	Pseudo R2	0.111	0.067

Notes: Marginal effects at the means of the independent variables. Standard errors robust to some types of misspecification in parentheses.

Table 7.4: Job training probabilities, occupied persons

		Employer-provided training				Self-development			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Female	0.024	-0.036	-0.014	-0.037	0.035	0.000	0.000	-0.009
		(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(-0.002)	(-0.002)	(0.002)
Employment status	Regular employees (reference)								
	Part-time and casual workers	-0.193	-0.171	-0.185	-0.168	-0.075	-0.062	-0.064	-0.056
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
	Dispatched workers from temporary labor agencies	-0.199	-0.171	-0.176	-0.163	-0.044	-0.020	-0.018	-0.012
		(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
	Contract employees	-0.102	-0.100	-0.096	-0.096	-0.016	-0.017	-0.010	-0.012
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Education	Primary or junior high school	-0.077	-0.067	-0.061	-0.062	-0.064	-0.059	-0.053	-0.052
		(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
	Senior high school (reference)								
	Vocational school, junior college	0.108	0.059	0.063	0.047	0.105	0.069	0.063	0.054
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
	College, graduate school	0.126	0.085	0.068	0.064	0.187	0.151	0.130	0.124
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age	15 to 19	0.019	0.032	0.019	0.031	-0.021	-0.015	-0.020	-0.015
		(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
	20 to 24 (reference)								
	25 to 29	-0.050	-0.049	-0.048	-0.048	0.002	0.003	0.003	0.003
		(0.003)	(0.003)	(0.003)	(0.003)	(-0.003)	(-0.003)	(-0.003)	(-0.003)
	30 to 34	-0.073	-0.073	-0.070	-0.072	0.002	0.004	0.004	0.003
		(0.003)	(0.003)	(0.003)	(0.003)	(-0.003)	(-0.003)	(-0.003)	(-0.003)
	35 to 39	-0.083	-0.086	-0.081	-0.084	-0.003	-0.003	-0.002	-0.003
		(0.003)	(0.003)	(0.003)	(0.003)	(-0.003)	(-0.003)	(-0.003)	(-0.003)
	40 to 44	-0.075	-0.083	-0.076	-0.082	-0.002	-0.005	-0.003	-0.005
		(0.003)	(0.003)	(0.003)	(0.003)	(-0.003)	-0.003	-0.003	(0.003)
	45 to 49	-0.077	-0.087	-0.076	-0.086	-0.010	-0.015	-0.009	-0.013
		(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	50 to 54	-0.101	-0.110	-0.097	-0.107	-0.028	-0.031	-0.024	-0.028
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	55 to 59	-0.126	-0.133	-0.122	-0.131	-0.041	-0.044	-0.037	-0.040
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)

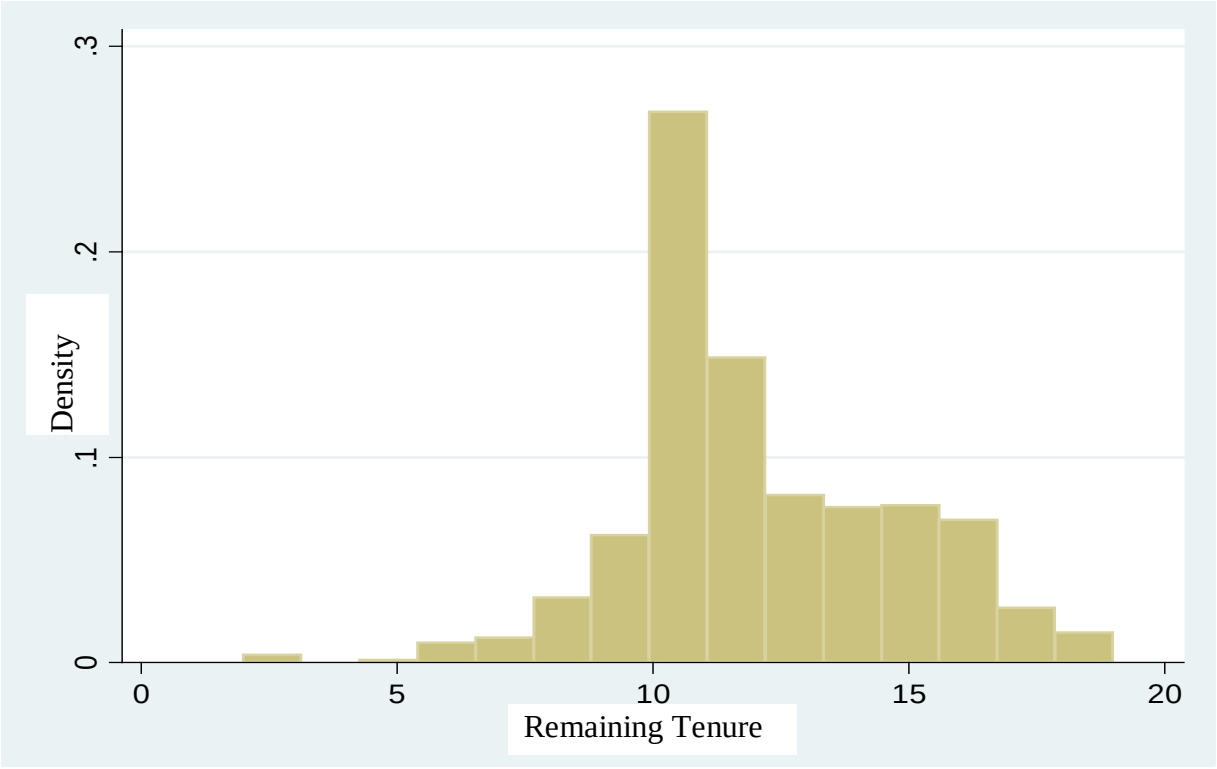
(continued)

		Employer-provided training				Self-development			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Size of employer (number of employees)	1 to 9 persons (reference)								
	10 to 29	0.090	0.084	0.085	0.082	-0.003	-0.005	-0.006	-0.006
		(0.004)	(0.004)	(0.004)	(0.004)	-0.002	(0.002)	(0.002)	(0.002)
	30 to 99	0.140	0.136	0.135	0.134	0.002	-0.001	-0.002	-0.001
		(0.003)	(0.004)	(0.004)	(0.004)	(-0.002)	(-0.002)	-0.002	-0.002
	100 to 299	0.201	0.200	0.195	0.198	0.009	0.008	0.004	0.006
		(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	-0.002	(0.003)
	300 to 499	0.243	0.244	0.238	0.241	0.023	0.026	0.018	0.023
		(0.004)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
	500 to 999	0.258	0.266	0.255	0.262	0.026	0.035	0.022	0.030
		(0.004)	(0.005)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
	1000 and over	0.300	0.314	0.304	0.309	0.043	0.060	0.046	0.054
		(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
	Government	0.362	0.287	0.316	0.278	0.118	0.047	0.065	0.037
		(0.004)	(0.005)	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.004)
Tenure	0 to 4 years (reference)								
	5 to 9	0.020	0.022	0.020	0.021	-0.024	-0.023	-0.025	-0.024
		(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
	10 to 14	0.029	0.036	0.032	0.035	-0.032	-0.028	-0.031	-0.029
		(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
	15 to 19	0.042	0.055	0.042	0.052	-0.028	-0.021	-0.030	-0.025
		(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
	20 to 24	0.070	0.081	0.066	0.076	-0.017	-0.011	-0.023	-0.018
		(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
	25 to 29	0.093	0.100	0.086	0.094	-0.010	-0.007	-0.019	-0.015
		(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
	30 to 34	0.099	0.105	0.089	0.096	-0.005	-0.002	-0.016	-0.012
		(0.005)	(0.005)	(0.005)	(0.005)	(-0.003)	(-0.003)	(0.003)	(0.003)
	35 to 39	0.098	0.108	0.085	0.098	0.002	0.007	-0.010	-0.005
		(0.006)	(0.006)	(0.006)	(0.006)	(-0.004)	(-0.004)	(0.004)	(-0.004)
	40 and over	0.084	0.092	0.071	0.083	0.006	0.010	-0.005	-0.001
		(0.010)	(0.010)	(0.010)	(0.010)	(-0.008)	(-0.008)	(-0.008)	(-0.008)
Industry dummies		No	Yes	No	Yes	No	Yes	No	Yes
Occupation dummies		No	No	Yes	Yes	No	No	Yes	Yes
Observations		374,468	374,468	374,468	374,468	374,468	374,468	374,468	374,468
Pseudo R2		0.109	0.135	0.125	0.140	0.080	0.103	0.104	0.111

Notes: See Table 7.3.

Figure 7.1. Remaining Tenure: 30 year-old male regular employees graduated from college or graduate school

Fresh graduate recruits (median=12.000, mean=12.126)



Mid-career recruits (median=2.000, mean=2.203)

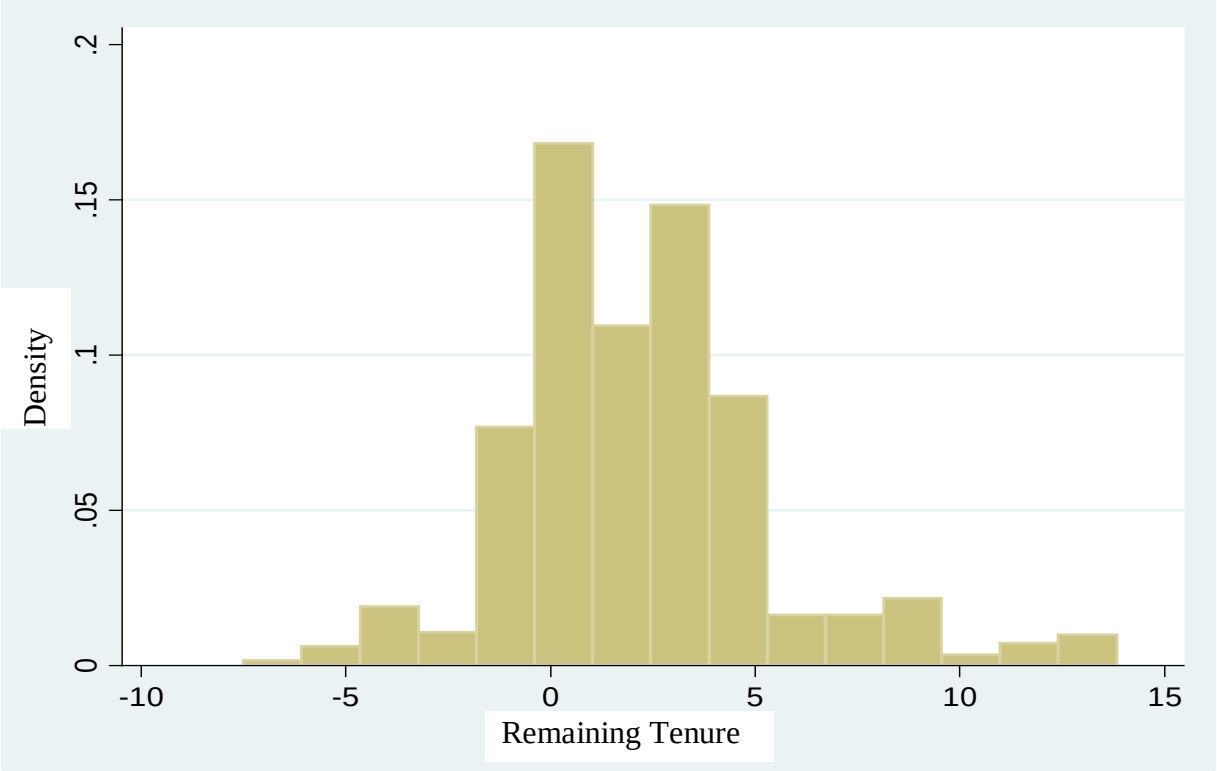
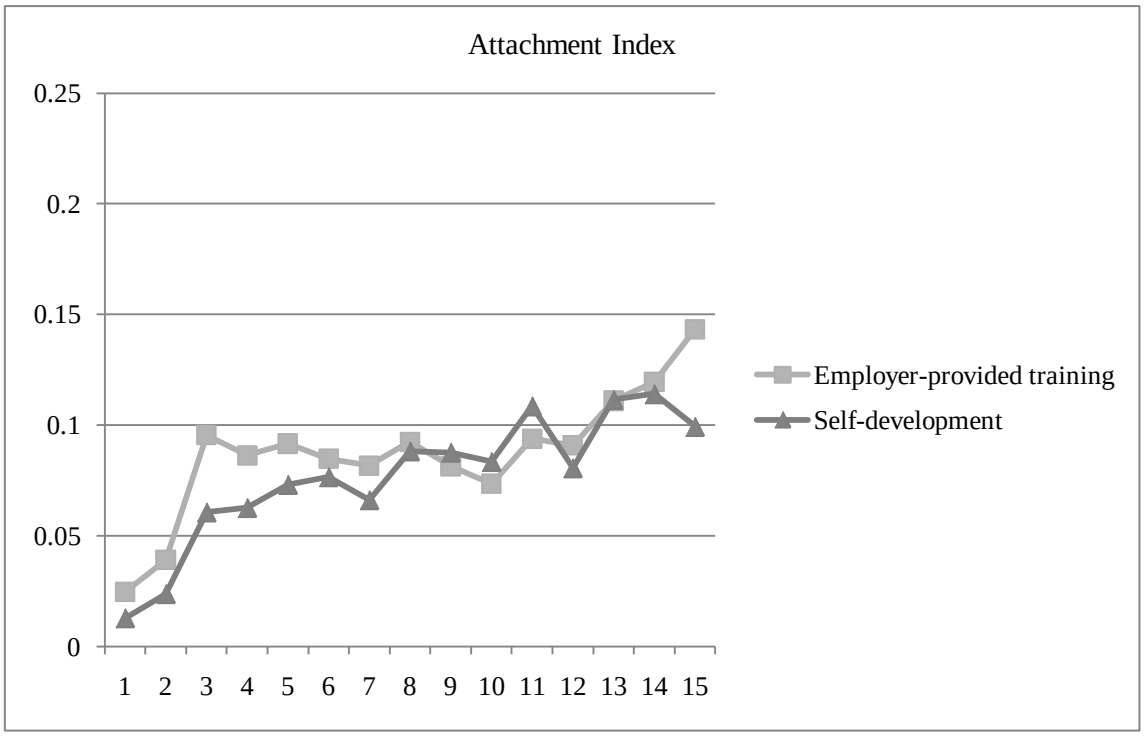
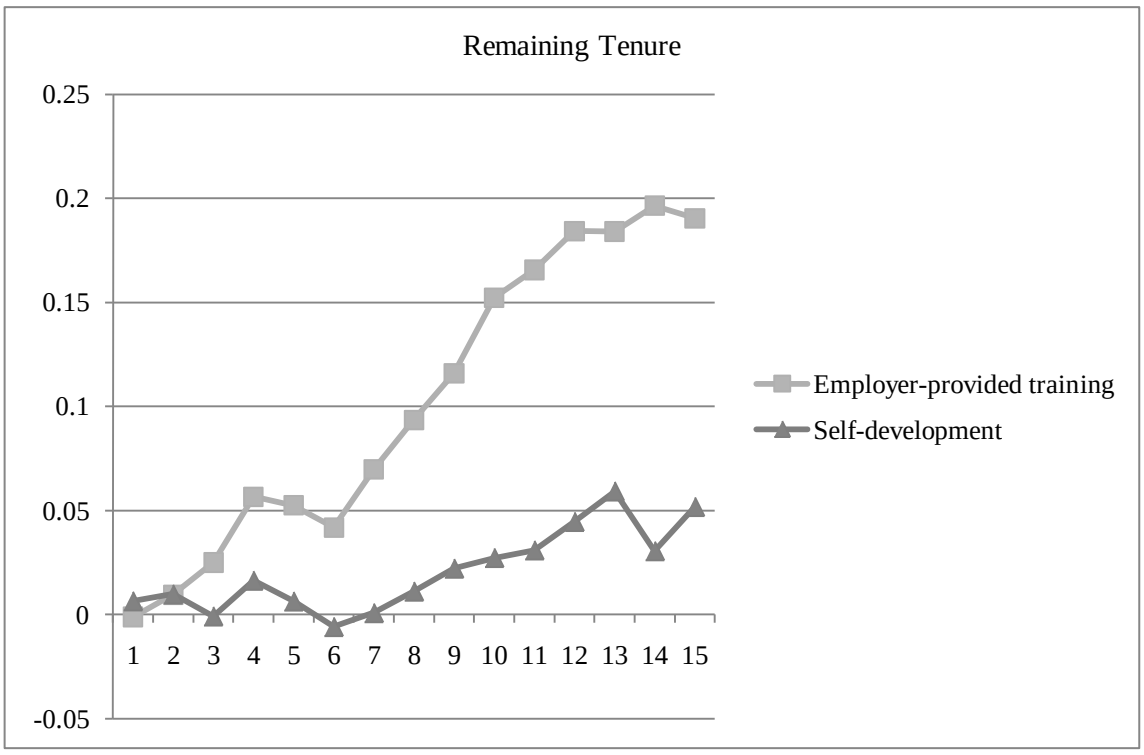


Figure 7.2: The Attachment Index (AI) and training probabilities



Note: All coefficients are significant.

Figure 7.3. Remaining Tenure (RT) and training probabilities



Note: The coefficients for "Employment-provided training" are significant for RT values from 2 and up. The coefficients for "Self-development" are significant for RT values of 1, 2, 4, and 8 and up.

Table 7.5: The Attachment Index (AI), Remaining Tenure (RT), and training probabilities

	Employer-provided training		Self-development	
	(1)	(2)	(3)	(4)
Female	-0.035	-0.014	0.001	0.006
	(0.002)	(0.002)	-0.002	(0.002)
Regular employees (reference)				
Part-time and casual workers	-0.186	-0.185	-0.060	-0.058
	(0.002)	(0.002)	(0.002)	(0.002)
Dispatched workers from temporary labor agencies	-0.174	-0.180	-0.005	-0.007
	(0.004)	(0.004)	-0.004	(0.004)
Contract employees	-0.108	-0.111	-0.011	-0.011
	(0.003)	(0.003)	(0.003)	(0.003)
Primary or junior high school	-0.070	-0.057	-0.064	-0.059
	(0.003)	(0.003)	(0.002)	(0.003)
Senior high school (reference)				
Vocational school, junior college	0.063	0.054	0.076	0.072
	(0.002)	(0.002)	(0.002)	(0.002)
College, graduate school	0.075	0.065	0.157	0.154
	(0.002)	(0.002)	(0.002)	(0.002)
AI	No	Yes	No	Yes
RT	No	Yes	No	Yes
Observations	374,468	374,468	374,468	374,468
Pseudo R2	0.133	0.135	0.100	0.103

Note: Industry, size of employer, and new graduate dummies are also included in every estimation.

Appendix Table 7.1(a). Basic statistics, occupied persons and persons not in employment but wishing to work

N=427,558

		Mean	Std. Dev.	Min.	Max.
	Female	0.499	0.500	0	1
Employment status dummies	Regular employees (reference)	0.611	0.488	0	1
	Part-time and casual workers	0.183	0.387	0	1
	Dispatched workers from temporary labor agencies	0.024	0.152	0	1
	Contract employees	0.043	0.204	0	1
	Persons not in employment	0.124	0.330	0	1
Education dummies	Primary or junior high school	0.076	0.266	0	1
	Senior high school (reference)	0.469	0.499	0	1
	Vocational school, junior college	0.233	0.422	0	1
	College, graduate school	0.211	0.408	0	1
Age group dummies	Age	40.6	11.271	15	59
	15 to 19	0.011	0.104	0	1
	20 to 24	0.079	0.269	0	1
	25 to 29	0.112	0.315	0	1
	30 to 34	0.134	0.340	0	1
	35 to 39	0.136	0.342	0	1
	40 to 44	0.127	0.332	0	1
	45 to 49	0.129	0.335	0	1
	50 to 54	0.130	0.336	0	1
	55 to 59	0.145	0.352	0	1

Appendix Table 7.1(b). Basic statistics, occupied persons

N＝374,468

		Mean	Std. Dev.	Min	Max
	Female	0.464	0.499	0	1
Employment status dummies	Regular employees (reference)	0.697	0.460	0	1
	Part-time and casual workers	0.209	0.407	0	1
	Dispatched workers from temporary labor agencies	0.027	0.162	0	1
	Contract employees	0.050	0.217	0	1
Education dummies	Primary or junior high school	0.070	0.255	0	1
	Senior high school (reference)	0.468	0.499	0	1
	Vocational school, junior college	0.228	0.419	0	1
	College, graduate school	0.222	0.416	0	1
Age group dummies	Age	40.8	11.242	15	59
	15 to 19	0.010	0.099	0	1
	20 to 24	0.078	0.269	0	1
	25 to 29	0.111	0.314	0	1
	30 to 34	0.130	0.336	0	1
	35 to 39	0.133	0.339	0	1
	40 to 44	0.127	0.333	0	1
	45 to 49	0.133	0.339	0	1
	50 to 54	0.133	0.340	0	1
	55 to 59	0.145	0.352	0	1
Size of employer (number of employees) dummies	1 to 9 persons (reference)	0.138	0.345	0	1
	10 to 29	0.136	0.343	0	1
	30 to 99	0.159	0.366	0	1
	100 to 299	0.136	0.343	0	1
	300 to 499	0.056	0.230	0	1
	500 to 999	0.061	0.240	0	1
	1000 and over	0.189	0.391	0	1
	Government	0.118	0.322	0	1
Tenure dummies	Duration Engaged in Work	11.47	10.677	0	44
	0 to 4 years (reference)	0.382	0.486	0	1
	5 to 9	0.169	0.374	0	1
	10 to 14	0.120	0.325	0	1
	15 to19	0.108	0.310	0	1
	20 to 24	0.069	0.253	0	1
	25 to 29	0.062	0.241	0	1
	30 to 34	0.050	0.218	0	1
	35 to 39	0.033	0.177	0	1
	40 and over	0.008	0.089	0	1
	New graduates dummies	0.235	0.424	0	1
	AI	11.73	8.409	0.0	32.8
	RT	-1.73	8.353	-42.9	35.0

Appendix Table 7.2. Probability of receiving employer-provided training by age group

		15 to 19	20 to24	25to29	30 to34	35to39	40to44	45to49	50to54	55to59
	Female	-0.042	-0.013	-0.022	-0.065	-0.053	-0.036	-0.023	-0.012	-0.027
		(0.018)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
Employment status	Regular employees (reference)									
	Part-time and casual workers	-0.246	-0.227	-0.215	-0.174	-0.164	-0.149	-0.165	-0.145	-0.117
		(0.017)	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.005)
	Dispatched workers from temporary labor agencies	-0.214	-0.192	-0.193	-0.169	-0.157	-0.146	-0.131	-0.104	-0.079
		(0.022)	(0.012)	(0.009)	(0.010)	(0.010)	(0.013)	(0.015)	(0.018)	(0.017)
	Contract employees	-0.080	-0.114	-0.122	-0.076	-0.106	-0.084	-0.078	-0.098	-0.056
		(0.036)	(0.010)	(0.008)	(0.010)	(0.010)	(0.011)	(0.011)	(0.009)	(0.008)
Education	Primary or junior high school	-0.077	-0.045	-0.024	-0.027	-0.046	-0.052	-0.089	-0.066	-0.053
		(0.024)	(0.015)	(0.014)	(0.012)	(0.012)	(0.013)	(0.012)	(0.008)	(0.006)
	Senior high school (reference)									
	Vocational school, junior college		0.109	0.057	0.044	0.043	0.037	0.044	0.051	0.041
			(0.008)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
	College, graduate school		0.148	0.098	0.069	0.064	0.057	0.071	0.060	0.030
			(0.010)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
	Observations	3,670	29,380	41,428	48,706	49,738	47,718	49,762	49,795	54,268
	Pseudo R2	0.138	0.126	0.120	0.115	0.131	0.146	0.164	0.167	0.150

Note: Tenure, size of employer, industry, and occupation dummies are also included in every estimation.

Chapter 8

Is Demeny Voting the Answer to Low Fertility in Japan?

Abstract[52]

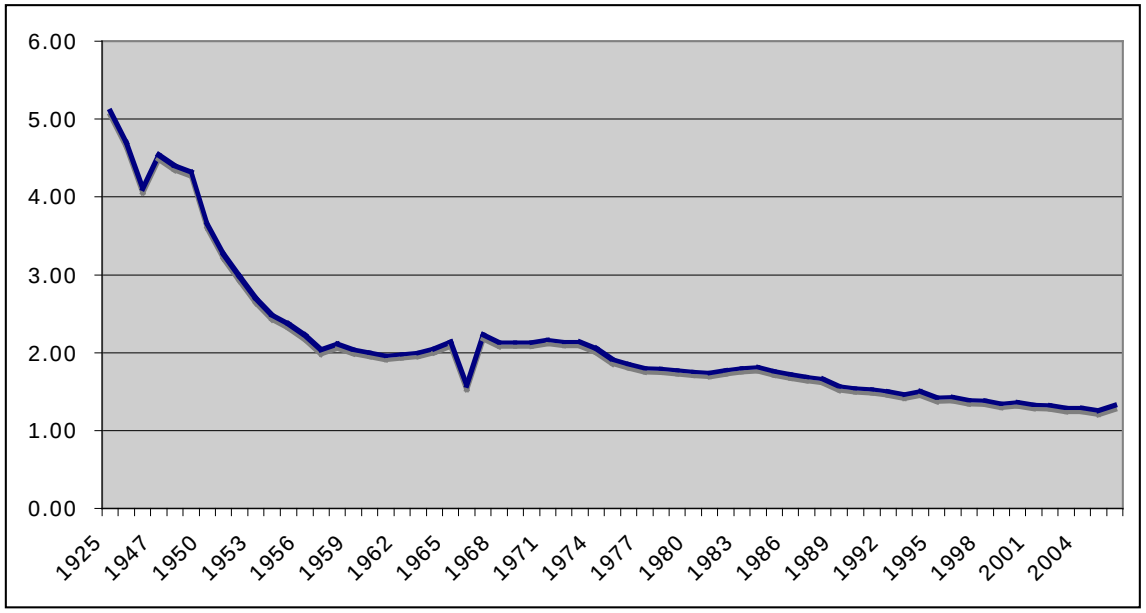
Japan has the oldest population in the world, and experienced an unprecedented decrease in fertility rates during the post-war period. Despite the well recognized need to provide pronatalist policies, Japan lags behind other developed countries in the generosity of its family benefits. Part of the reason for this is the large voting bloc presented by those in, or close to, retirement, and the weak political power of parents and children. We argue that to reverse the trend, Japan should introduce a Demeny Voting rule, which allows parents to vote on behalf of their children. Such a change would signal a commitment to ongoing generous family policies which in turn would increase fertility.

52 We are grateful to Matthew Ryan and Warren Sanderson for their advice at various stages of our work. Rhema Vaithianathan grateful for the generous hospitality of the Institute of Economic Research, Hitotsubashi University.

8.1 Introduction

The problem of low and declining fertility in the Japanese population, coupled with long life-expectancy, has meant that Japan's proportion of population over 65 years is the highest in the world (Ogawa *et al.*, 2008). The post-war decline in fertility was also one of the most rapid in the world (Figure 8.1). However, despite the recognition by Japan since the 1980s of the need to increase fertility rates, Japan has been very slow to institute family friendly policies.

Figure 8.1: Total Fertility Rate,[53] 1925 – 2006



Source: National Institute of Population and Social Security Research. The data for 1947-1972 do not include Okinawa Prefecture.

In Japan, as in all Parliamentary democracies, children are the one exception to the rule of "no taxation without representation". Japan, with a minimum voting age of 20, is at the extreme end of democracies in terms of the age of enfranchisement. In Japan, 20 years coincides with the age at which people are allowed to purchase alcohol or tobacco. However, men may legally marry at 18 – meaning that there are many households in Japan where no-one in the household is eligible to vote.

53 The "total fertility rate" measures the average number of children a woman would be expected to have over her lifetime.

This has lead to recent discussion in Japan of whether the voting age should be lowered and the new law for national referendums defines the voting age as 18. In this paper we suggest that the recent interest offer an opportunity to consider more radical reform. We argue that the lack of political will on the part of successive Governments to address the need for better family policies is due to the fact that families with young children form such a small and shrinking voting bloc in Japan.

We propose that Japan should consider adopting a "Demeny voting" system, under which parents are given proxy votes for their children until they reach a certain age (such as 18). Demeny (1986) suggested this as an admittedly radical approach to encouraging pronatalist policies. Sanderson (2007) takes up this suggestion as a way of off-setting the ageing population and the political impediments to pension reform in countries such as Germany and Japan where there is a large and growing percentage of the population who are above pension age.

8.2 Sub-Optimal Fertility and Pay as You Go Social Security (PAYG)

The important question for many demographers is whether the decline in fertility will continue unabated. Authors such as Lutz, Skirbekk and Testa (2005) argue that there are conditions under which below replacement fertility levels would be a long term stable equilibrium, in effect trapping the economy into below-replacement fertility and a declining population.

However, one could ask: if low fertility does not correct itself and population levels fall, is this really a problem? As Warren Sanderson points out, Japan's currently projected population in 2050 is the same as its population in 1965 (Sanderson, 2009). To the extent that the 1965 population was viable and acceptable to Japan, declining population ought not to be, *ipso facto*, a reason to support population policies.

It is not purely population size that is at issue. Low fertility and long life expectancy mean that the Japanese population will not just shrink, it will also age. At a fertility rate of 1.39, the old-age dependency ratio (the ratio of those aged over 65 to the working aged population) is expected to double from 34 in 2009 to 76 in 2050 (Kaneko *et al.*, 2008). Moreover, Japan's elderly rely heavily on a PAYG public pension system, which is funded through pension contributions of those of

working age (Ogawa *et al.*, 2008). The PAYG system under such large dependency ratios starts looking very fragile, possibly leading to its demise. Recently, some younger Japanese have refused to contribute to the pension, arguing that the demographic squeeze means that there would be no pension when they retire even if they continue to contribute.

With globally integrated labor markets, however, using projected dependency ratios alone to estimate the magnitude of the social security deficit is misleading. With a sufficiently flexible immigration policy, we would expect that as the locally born working age population declines and the capital-to-labor ratio rises, there will be an increase in immigration from countries with a surfeit of young workers and a deficit of capital (Sinn, 1997). However, there are claims that the size of immigration required to correct for the worsening dependency ratio is very large and therefore unlikely to occur. Japan is estimated to need around 600,000 net immigrants per annum through to 2050 in order to maintain the dependency ratio at its 1995 level (UN, 2000). Additionally, Japan has long been reluctant to utilize immigration as a device to correct for the ageing population and has traditionally had high barriers to naturalization.

From an economic welfare point of view, the question is not whether fertility rates are above or below replacement level, but rather whether the private costs and benefits of having children deviate from its social costs and benefits. In other words, is there "market failure" in the child bearing decision? Given that the incentive for children are heavily influenced by economic policy such as housing, taxation and employment, the salient question is not whether population will fall or dependency rates will rise, but whether there are distortions in the economy which keep fertility below optimal levels.

Many of the private costs of having children (medical care and schooling) are not faced directly by parents, so one could argue that children are "subsidized", leading to higher levels of fertility than would occur in a "free market" (Palvios and Scotese, 1996). On the other hand, in a PAYG system, the benefits derived from having children are also taxed. In particular, when children enter working age, their taxes will be used to support retirees' pensions and health care costs regardless of whether those retirees had children themselves. Public access to social security no longer depends on whether one has children. As long as others are having children, old age

security is assured through the tax and transfer system. Moreover, any additional financial support that one's own children provide is paid from their after-tax income, reducing the children's willingness to support parents.

As long as child-rearing is costly, there exists an incentive for adults to free-ride on other's children. With a PAYG pension system, this implies that, in general, fertility rates will be lower than optimal.

Van Groezen, Leers and Meijdam (2003) model this externality effect of children and show how a child-care subsidy is needed in order to internalize the external benefits conferred by having children. Such a subsidy is Pareto improving. Interestingly, they also argue that once society has adopted a PAYG system, reduction in pensions *per se* does not solve the problem of inadequate fertility. Under a PAYG scheme, pension reform always leads to one cohort suffering a loss – this is the cohort who pays retirees the higher pension while working, but are paid a lower pension when they themselves retire. To compensate this cohort, Government debt will have to rise. However, such a rise is perfectly off-set by the rise in future taxes required to pay the debt and its interest. They show that this debt matches the gain from pension reform, leaving fertility rates unchanged. This suggests that recent discussion of pension reform might be misdirected.

To solve the market failure requires an instrument which allows taxes or subsidies to be a function of the number of children a person has. Child care subsidies do exactly that – while pension reforms (unless they are reforms aimed at allowing pensions to vary with the number of children) do not.

Indeed, in our opinion there is an excessive focus on pension reform in Japan and an inadequate focus on fertility policies.

8.3 Family Policy and Fertility

The question then is whether Japan provides a subsidy to children which is sufficient to off-set the costs of raising children and also to internalize the sizeable externality that bearing children has on restoring the viability of the pension system.

One approach to measuring the extent to which children are subsidized is to compare the

average fertility rate with the desired fertility rate (ideal family size). If we interpret the desired family size as the number of children at which the respondent is satiated, then the gap between desired and actual is a measure of the price of children faced by parents.

Table 8.1 provides survey data for Japan on the ideal family size. It comes from the five-yearly fertility survey of married persons conducted by the National Institute of Population and Social Security Services Research. The sample size ranges from 5,603 to 8,624 (depending on the year).

Table 8.1: Ideal Family Size and Fertility Rates, Japan 1977- 2005

	1977	**1982**	**1987**	**1992**	**1997**	**2002**	**2005**
Ideal Number (1)	2.42	2.49	2.51	2.4	2.33	2.31	2.3
Actual Fertility Rate (2)	1.8	1.77	1.69	1.5	1.39	1.32	1.26
Difference (1 -2)	0.62	0.72	0.82	0.9	0.94	0.99	1.04

In most developed countries, achieved fertility is considerably lower than ideal fertility rates. While the ideal number of children in Japan is comparable to the 2006 EU average of 2.3, in Japan the gap between the fertility rate and the ideal family size has been steadily expanding between 1977 and 2005. Actually fertility has dropped by 0.54 children but ideal family size had dropped by only 0.12. This suggests that the "cost" of raising children over this period has increased.

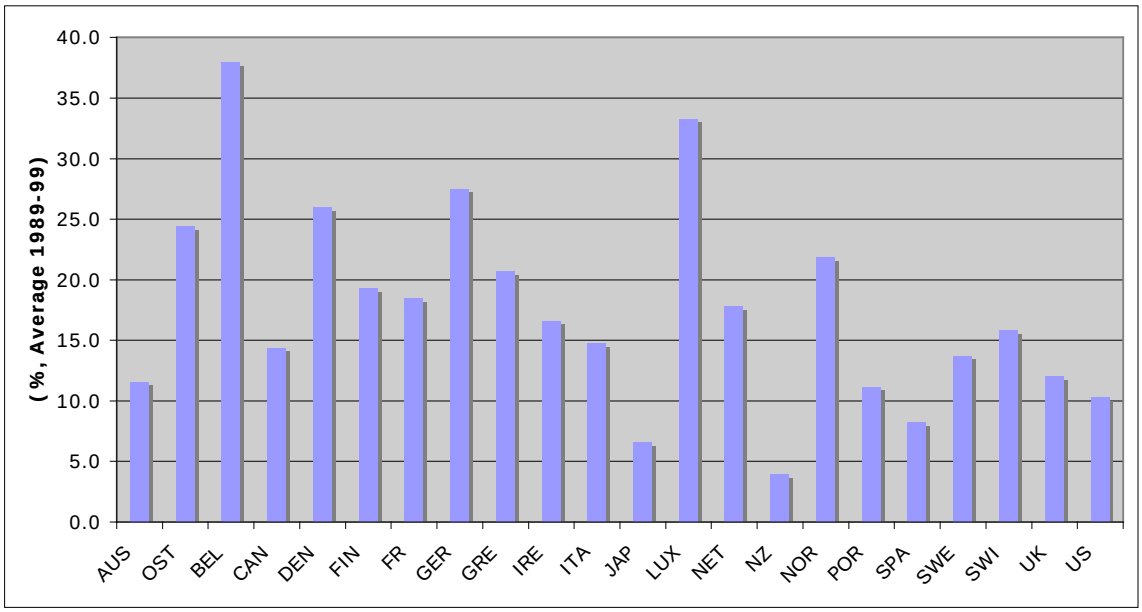
The gap between fertility and desired family size is also a measure of the extent to which pronatalist policies such as subsidized child care or child cash benefits could be expected to increase fertility.

The financial costs of raising children in Japan were estimated at ¥832,000 per annum in 2002 (Cabinet Office, 2002). Given the positive externalities arising from children in a PAYG system, one would expect these private costs to be offset by the tax and transfer system. An "idealized" tax-transfer system should redistribute towards households with young children through

child-related support, and towards older people through social security payments.

Figure 8.2 gives the average additional disposable income (after taxes and cash transfers) of a one-earner, two-parent, two-child family as compared to the disposable income of a childless single earner (expressed as a percentage of the disposable income of the childless single earner.) We provide the average for the 1989–99 decade. All reported countries are over 0, implying that they transfer in favor of families with a non-earning spouse and children. The average for all countries is 18%, but Japan's rate over this period is 6.5%, the second-to-lowest in the sample.

Figure 8.2: Pro-family Transfers in OECD Countries (Average 1989–1999)



Source: Gauthier (2003).

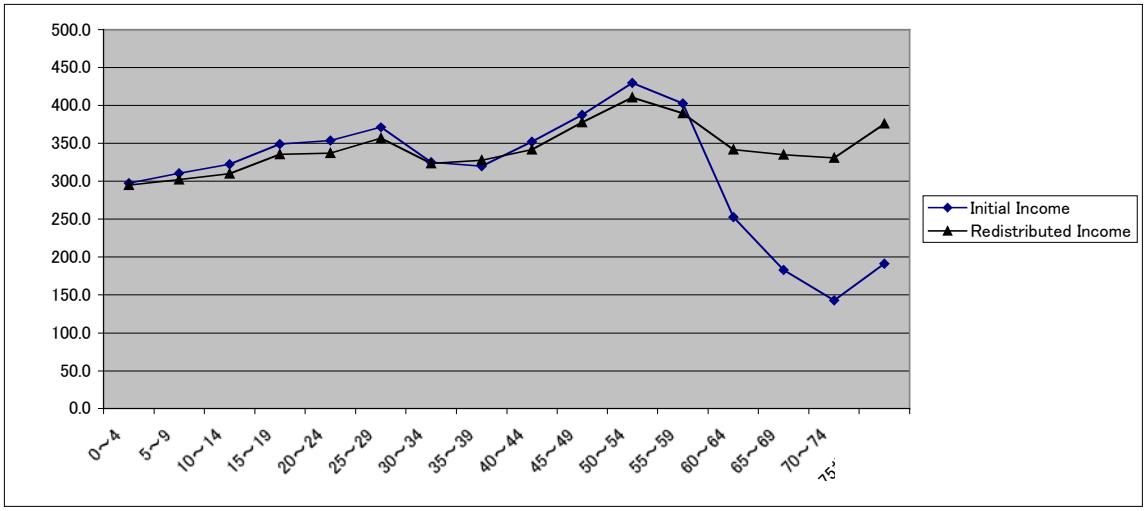
The low level of transfers for families with children is reflected in the low equivalent incomes of families with young children. In Figure 8.3 we plot the 2005 equivalent household income (household income divided by the square root of the number in the household) before taxes and transfers ("Initial Income") and after all taxes and transfers ("Redistributed Income") by age of household member.[54] The data is based on a survey of 5,688 households. Redistributed income deducts all taxes and social security premiums for healthcare, long-term residential care and pension

54 That is, for each age group, the figure reports the average equivalent household income over all households occupied by persons in that age group.

contributions paid by the household, and adds all in-kind benefits, including transfers, pensions, medical care, long-term and home child care.

The size of the difference between redistributed and initial income indicates the extent to which that age group is taxed or subsidized. If parents are rewarded for having children, we would expect to see children's redistributed income being higher than initial income. Overall, Japanese children live in households which *pay* tax rather than receive a subsidy and they also have the lowest equivalent income of any age group – including retirees (¥2.94m versus the average across the population of ¥3.04m). While the high levels of equivalent incomes amongst retirees as opposed to children is partly due to the fact that medical expenditure (which is concentrated in old age) is included whereas publicly funded education is not, the data does provide evidence that in Japan, families with young children are badly off compared to retirees.

Figure 8.3: Equivalent Household Income, Japan (2005)



Source: Income Redistribution Survey, Japanese Ministry of Health, Labor and Welfare

The Japanese Government has long been aware of the need to improve family policy and low fertility rates. In 1989, for instance, there was a public outcry when for the first time, the fertility rate fell below its 1966 level, the last Hinoe-uma year (meaning Year of the Horse). In Hinoe-uma years, people avoid having children due to the superstition that one should not marry people born in that year (see the large downward spike at 1966 in Figure 8.1). While people expect Hinoe-uma

years to exhibit low fertility, to observe normal year fertility rates below a Hinoe-uma year shocked the Japanese.

Government responded to the growing concerns over low fertility with the 1994 “Angel Plan”, which included an expansion of child allowances, an increase in the number of day-care facilities for 0 to 2 year olds, and an extension of the hours and range of services offered by these facilities (Cabinet Office, 2009).

In 1999, as fertility rates continued to drop, there was the New Angel Plan. This included changes to employment regulations, the introduction of mother-and-child health and advice centers and the provision of education in addition to day-care centers.

In 2004, the Government launched a pro-family “declaration” which attempted to set out four crucial for promoting families and increasing fertility. This was termed the “Shoshika Shakai Taisaku Taiko” which translates as a Social Plan for Low Fertility. This plan emphasized (1) increasing the independence of young people; (2) re-evaluation of work to promote co-existence of work and family; (3) understanding the value of life and the family; and (4) new support and solidarity for raising children

While these were high-sounding principles, the policy interventions were slow in coming and inadequate. Family-related public assistance in Japan continues to lag the rest of the OECD. Japan spends only 0.75% of GDP, compared to 1.21% in Germany, 3.54% in Sweden, and 3.93% in England (Ministry of Health, Labor and Welfare, 2009).

Services for children are also struggling. For example, provision of pre-school centers continues to be inadequate. The waiting list for entry into an accredited nursery is reported to be 360,000 in Tokyo alone (Editorial, Kyodo News, 8 June 2009).

Prime Minister Taro Aso announced low fertility as one of his priority areas. In his 2008 budget, the following measures were announced:

- a fund to increase the number of day-care centers;

- increased subsidies for health checkups for pregnant women;

- a one-off payment for families with more than 2 children: ¥36,000 yen (US$367) for each child aged between 2 and 5.

These are short term measures which apply to the 2008-09 fiscal year.

The question of the extent to which family policies increase fertility has been well researched. There is now considerable evidence that family-friendly policies including direct cash transfers and tax advantages increase fertility, although the size of the effect is debated (Holtz, Klerman and Willis, 1997). Recent evidence from a single payment offer of up to CAN$8,000 in 1997 (approximately ¥900,000 in 2009 Yen) was shown by Kevin Milligan (2005) to have large effects on fertility. He finds that fertility increased on average by 12%, and amongst those eligible to receive the maximum payment, fertility rose by 25%.

Feyrer, Sacerdote and Stern (2008) use OECD data to perform cross-country regressions on the effect of public expenditure on children on fertility rates. They find that a 1% point increase in spending as a percentage of GDP is associated with an increase of 0.12 children per woman. They also find that of all types of public expenditure, the provision of free day-care for young children is the most effective, with an increase in fertility of 0.13 for every additional 1% point of GDP spent on day-care. They conclude that the effect of pro-family policies on fertility are quite strong, and might be due not just to the direct effect of lowering the costs of bearing children but also to the additional "demonstration" effect of having many friends and family who also have young children.

8.4 The Greying Voter Problem in Japan

Previous theoretical and empirical work has established a positive correlation between the age of the median voter and the fraction of GNP spent on pensions (Tabellini, 1990; Breyer and Craig, 1997). The median age of the Japanese voter is 51 years and will increase over the next 15 years. The existence of this strong elderly voter bloc implies that any re-direction of public resources from the elderly to the young will face political difficulties.

To get an idea of how strong the elderly are in determining party platforms in Japan, we list the LDP party manifestos for the 2003, 2005 and 2007 parliamentary elections in Table 8.2. The LDP became the governing party in all these elections. Two of the three election manifestos lead with pensions as the principal issue, and there is no mention of child or family policies at all – despite the general consternation and numerous working parties publishing "White Papers" on the issue.

Table 8.2: Top Issues for LDP Manifesto in National Elections

2007	Pensions
	Civil Service Reform
	Education
2005	Privatisation
	International Competitiveness
	Civil Defence
2003	Pensions & Health
	National Security
	Privatisation

Source: LDP Manifestos, various years.

The most recent example of redistribution is the proposal to "tax" existing insurance plans that have large surpluses ("Koureishairyouzaigen Shikumi Minaoshi - Kouroushou Kentou" (Re-examination of elderly health insurance funding considered by Ministry of Health, Labor and Welfare) June 19, 2009). If implemented, this will increase burden on insurance plans for "salary man" who have a retirement age. This proposal exacerbates the redistribution from the young to the old, because the insurance plans that will be taxed the most will be those that have low numbers of elderly and therefore small pay-outs relative to their premium income.

Using the 2005 household census we calculate that approximately 24% of eligible voters are parents of children under 18 years of age. On the other hand, those who are concerned about pension levels (i.e., those aged over 55), constitute 43% of the voters and are therefore more powerful in the minds of politicians. This latter group gains nothing from increasing fertility since any children born will not be productive in time to support their retirement. Indeed, children who are born will be an additional drain on public expenditure leading to potential reduction in social security payments.

In light of the lack of political will or interest in improving family policy, Japan should consider Demeny voting, which allows parents to cast a proxy vote on behalf of their children (Demeny, 1986). This would automatically increase the voting power of parents. By our calculation, it would increase the parent-bloc to 37% and reduce the over-55-years bloc to 35%, thus creating a more balanced incentive for politicians to take family policy seriously.

The major advantage we see is that this provides a commitment device by which Government can make a credible long-term commitment to subsidizing children. The history of family policy in Japan has been inconsistent. The decision to have children is a long-term commitment, and it is unlikely that fertility will respond to pro-family policy unless people believe these policies will continue. A constitutional change which expands franchise to children will prevent the arbitrary erosion of commitments as social security costs rise.

Historically, Japanese families have effected inter-generational redistribution within the family structure, thorough a multi-generational structure to the family. However, the Government has played an increasingly important role in this re-distribution (Yamato, 2006). This makes it vital that each generation has "equal political representation". Under the present political system, the children's generation risk getting unfairly disadvantaged and disenfranchised. Indeed, one could argue that given that the future taxes from children are being relied upon to support the pensions of the old, and that children work extremely hard educating themselves in order to be able to provide this, the old adage of no taxation without representation is very relevant to this debate.

Isn't our proposal – giving parents the power to vote on behalf of their children -- tantamount to giving parents two votes? While this is obviously true, it is also true that society expects parents to make other choices on behalf of, and in the interests of, their children – such as the choice of schools, doctors, reading matter, etc. Every day we rely on parents to choose what is best for their children – most of these choices are far more crucial to children's welfare than a vote. Moreover, it is likely that whatever vote is cast by a parent on behalf of their child, still provides better representation than denying children any representation at all.

References for chapter 8

Breyer, Friedrich and Ben Craig (1997). "Voting on Social Security: Evidence from OECD Countries," *European Journal of Political Economy*, vol. 13(4): 705-724.

Cabinet Office (2009), *White Paper on Society with Low Fertility*. Cabinet Office, Tokyo.

Cabinet Office (2002), *Report on the Social Cost of Raising Children*. Director General of Kyosei Shakai Seisaku Tanto, Tokyo.

Demeny, Paul (1986). "Pronatalist Policies in Low-Fertility Countries: Patterns, Performance and Prospects," *Population and Development Review*, vol. 12 (Supplement): 335-358.

Feyrer, James, Bruce Sacerdote and Ariel Dora Stern (2008). "Will the Stork Return to Europe and Japan? Understanding Fertility within Developed Nations," *Journal of Economic Perspectives*, vol. 22(3): 3-22.

Gauthier, A.H. (2003). *Comparative Family Benefits Database* (Version 2). University of Calgary.

Goldstein, Joshua, Wolfgang Lutz and Maria-Rita Testa (2004). "The Emergence of Sub-Replacement Fertility Ideals in Europe," *Population Research and Policy Review*, vol. 22(5-6): 479-496.

Holtz, J., J. Klerman and R. Willis (1997). "The Economics of Fertility in Developed Countries", in Rosenzweig, M. and O. Stark (eds), *Handbook of Population and Family Economics*. Elsevier: Amsterdam.

Kaneko, Ryuichi, Akira Ishikawa, Futoshi Ishii *et al.* (2008). "Population Projections for Japan: 2006–2055: Outline of Results, Methods and Assumptions," *Japanese Journal of Population*, vol. 6(1).

Lutz, Wolfgang, Vegard Skirbekk and Maria Rita Testa (2005). *The Low Fertility Trap Hypothesi : Forces That May Lead to Further Postponement and Fewer Births in Europe*, Economic Demographic Research Papers, Vienna Institute of Demography.

Milligan, Kevin (2005). "Subsidizing the Stork: New Evidence on Tax Incentives and Fertility," *Review of Economics and Statistics*, vol. 87(3): 539-555.

NIPSSR (2002). *Population Projections for Japan: 2001–2050*. National Institute of Population and Social Security Research.

Ogawa, Naohiro, Andrew Mason, Amonthep Chawla and Rikiya Matsukura (2008). *Japan's Unprecedented Aging and Changing Intergenerational Transfers,* Paper presented at NBER conference, June 19-21.

Palvios, Theodore and Carol A. Scotese (1996). "Fertility, Growth and Financing of Public Education and Health," *Journal of Population Economics,* vol. 9(4).

Sanderson, Warren (2007). "A New Prospective on Population Ageing," *Demographic Research,* vo1. 6(2): 27-58.

Sanderson, Warren (2009). "Low Fertility and Population Aging in Germany and Japan: Prospects and Policies," in Takayama, Noriyuki and Martin Werding (eds), *Fertility and Public Policy: How to Reduce the Trend in Declining Birth Rates*. MIT Press (forthcoming).

Sinn, Hans-Werner (1997). "The Value of Children and Immigrants in a Pay-As-You-Go Pension System: A Proposal for a Partial Transition to a Funded System," NBER Working Papers 6229, National Bureau of Economic Research.

Tabellini, Guido (1990). "A Positive Theory of Social Security," CEPR Discussion Papers 394, Centre for Economic Policy Research.

UN (2000). *Replacement Migration: Is It a Solution to Declining and Aging Populations?* UN Development Program.

Van Groezen, Bas, Theo Leers and Lex Meijdam (2003). "Social Security and Endogenous Fertility: Pensions and Child Allowances as Siamese Twins," *Journal of Public Economics,* vol. 87(2): 233-251.

Yamato, Reiko (2006). "Changing Attitude Towards Elderly Dependence," *Current Sociology,* vol. 54(2): 273-291.

Chapter 9

What Do We Actually Know about Smoking Behavior in Japan?: Testing the Reliability of Japanese Smoking Data by a Representative Japanese Consumer Survey Data

9.1 Introduction

There are two representative data for smoking behavior in Japan. One is the **National Health and Nutrition Survey in Japan** (hereafter Nutrition Survey) conducted by **Ministry of Health, Labor and Welfare** and the other is the **Japan Smoking Rate Survey** of **Japan Tobacco Inc**. (hereafter JT Survey). Each has serious reliability problems. The former survey suffers mostly from modest-sized samples, and from very limited number of survey districts. The problem of the latter arises mainly because it is conducted by the tobacco manufacturer and hence may contain significant response biases, and JT refuses to release detailed information on the survey. Moreover, in both surveys, it has been pointed out that female smoking rates had been seriously under-estimated (Akiyama et al. (2000)), presumably because female smokers, afraid of negative social perception, tended to give false answers to such a simplistic question as “Do you smoke?”. Moreover, socio-economic information about smoking behavior has seldom been released in these surveys.

Needless to say that it is absolutely essential to have the correct information on smoking behavior to design efficient public interventions; precise and correct information reduces the uncertainty and increases the efficiency of new policy interventions against smoking. It is also important to have internationally comparable data as tobacco epidemic is not a country specific issue but a worldwide phenomenon. The amount of experience each country has is naturally limited, but, given the internationally comparable data, it can draw on the collected experiences of all the countries taken together, particularly of those of developed countries that had started tobacco control policies much earlier. Japan is one of these countries that are far behind in many aspects of tobacco control than other developed countries.

In view of these shortcomings of the representative Japanese smoking data, in this paper, we examine National Survey of Family Income and Expenditure (hereafter National Expenditure Survey), conducted by Ministry of Internal Affairs and Communications every five years, as a possible new source of information for smoking behavior in Japan. The survey has considerable statistical advantages over the two existing data. Compared with Nutrition Survey, it has about 10 times more samples, collecting them from 15 times more survey districts, and, as we argue later, the respondents give more true answers as to smoking habit. Furthermore, since the Expenditure Survey comes with rich social and economic information on households, it is capable of providing important socio-economic information on smoking behaviors that have been absent in the public data so far.

Relying on 1989, 1994, 1999, and 2004 National Expenditure Survey data, we will show that the male smoking rates have most likely been over-estimated in both smoking surveys, and that married men and women jointly have reduced smoking rate very significantly between 1989 and 1994. We will also show that smoking rates of younger single women had been around 30% in 1989, but they too dropped sharply between 1989 and 1994. The downward adjustment is still continuing for single men.

The rest of the paper is structured as follows; in 2., we point out that we actually know very little about the prevalence of smoking in Japan, by comparing the changes in smoking rates of the two most frequently used data since 1989: in 3., we examine the sampling process of these data, and locate the sources of the problems: in 4., we present the smoking rates computed from the National Expenditure Survey data and compare them with the other two smoking surveys: in 5., we offer our conclusions.

9.2 Changes in Smoking Rates

In Figure 9.1, Figure 9.2 and Figure 9.3, we have shown the changes in smoking rates of Nutrition Survey and JT Survey since 1989. As for overall smoking rate Nutrition Survey shows lower rates in every survey year for both male and female (Figure 9.1). As for male smoking rate, the patterns of changes are different in these two surveys. The JT Survey shows the male smoking rate was stable around 60% until 1993, and, in 1994, it started its long decline that lasted for a decade. The Nutrition Survey shows, however, the male smoking falling sharply from 1989 to 1994, then experiencing a steep recovery in 1995, and finally its long downward move. As for female smoking rate, both surveys seem to show fluctuations around some stable values, with the Nutrition Survey rates fluctuating from 8% to 12 %, and the JT Survey rates fluctuating from 11% to 16%.

In Figure 9.2, we have shown the smoking rates of each 10 year age-class in the JT Survey, and in Figure 9.3, those in the Nutrition Survey. For men, it is clear that the differential overall smoking rate pattern is reflected directly in the smoking rate patterns of many age-classes in these two surveys. Again the JT smoking rates of all the age-classes follow a single consistent declining trend, with those of 20's, 30's and 40's closely packed (Figure 9.2). Smoking rates of almost all the age-classes in the Nutrition Survey show a short and steep decline until 1993, followed by sharp recovery until 1995, and then by a long gradual decline (Figure 9.3). For women, unlike the overall rate, both surveys show very divergent trends for different age-classes during this period. Both surveys show the smoking rate of those in their 20's peaking around year 2000, and those in their 60's or older steadily declining. In the rest of the age-classes, the smoking rate seems to be still on a slightly increasing trend.

For international comparison, the most frequently used data is the OECD health data[55] (Fig.9.4.1, 9.4.2). Average smoking rate for male is 28.7 % in OECD countries and that of Japan is 39.1% which far exceeds the average. On the contrary Japanese female average smoking rate is

55 Daily smokers is defined as the percentage of the population aged 15 or more who report that they are daily smokers.
Note: International comparability is limited due to the lack of standardization in the measurement of smoking habits in health interview surveys across OECD countries. There is variation in the wording of the question, the response categories and the related administrative methods. Source: OECD Health Data definition

12.7% which is below that of OECD of 18.6%. We note here that JT's data is used in OECD Health data without verification, and it is clearly inconsistent with the Framework Convention on Tobacco Control for Japan to keep on relying on unverified tobacco manufacturer's data.

9.3 Survey Overview and Problems

9.3.1 Japan Smoking Rate Survey

The JT Survey has been conducted annually since 1965. JT explained the outline of its 2009 survey on its homepage as follows;

"The survey was conducted in May 2009 using a stratified two-stage sampling method, mailed to 32,000 adult men and women nationwide, and JT collected 20,807 (65.0 percent) valid responses from the population surveyed".

The summary of age structure is shown in Table 9.1.[56] JT disclosed only the summary of results and outline of survey. It is almost impossible to obtain detailed data because JT has no obligation to disclose all data as JT is private company. Moreover JT changed survey method from re-collected the questionnaires to mail-in survey. In line with this changes collection rate dropped from 65% in 2005 to 58% in 2006 and slightly recovered in 2007 (60%).

Problems: there are 3.5% decrease in male smoking rate between 2005 and 2006. It is very likely to attributable to changes in survey method. JT indicated "The survey method, along with the sample number, was modified this year, resulting in a lack of comparability with previous results."

9.3.2 The national health and nutrition survey in Japan

The first National Nutrition Survey was conducted in 1945 by the Ministry of Health and Welfare on a directive from GHQ, as a prerequisite for applying for food-aid from other countries. The Nutrition Survey was conducted four times a year to obtain information on the deficiency of nutrition intake of people who were starving in the post-war famine. Since 1965, the Nutrition Survey became an annual survey, and in 1986, it added simple drinking and smoking questions to

56 http://www.jti.co.jp/investors/press_releases/2009/0814_01/appendix_01/index.html accessed on Jan. 2010

its interview items. Currently, this survey is called National Health and Nutrition Survey, and, every year, it randomly selects 300 districts out of the 5,200 survey districts of its mother survey, the Comprehensive Survey of Living Condition of People on Health and Welfare (hereafter Comprehensive Survey), and collects data from all the households in these districts. The total number of households surveyed amounts to approximately 5,000 households with 15,000 individuals.

The geographic units of Comprehensive Survey are identical to those of National Census, which partitions Japan into more than 940,000 survey districts. Thus the sampling ration of the Nutrition Survey is only 0.03% (=300/940,000). Since this ratio is quite small, variations across districts should be carefully evaluated to compute the confidence intervals, for example, for smoking rates. As of now, little is known for cross-district variations in smoking behaviors, but, we expect them to be fairly large, as there are many factors which influence smoking habit.

9.3.3 Other studies

There are several studies on smoking prevalence as described on Table 9.2. However these surveys are conducted at a specific point in time and unable to give information on changes over time. The Survey conducted by Meiji Yasuda Life Insurance was the first to show the serious underestimation in the public female smoking rate data. This survey covered people who purchased life insurance policies of the company between 1993 and 1998 who were at age 20 or older at the time. All of them were asked about their smoking habit at the bottom of the notification page. In the survey, non-smoking was defined as either having "never smoked" or having "quitted smoking more than one year". The sample size was huge, totaling 4,162,838 individuals (male: 2,331,925, female: 1,831,543), and so was the number of valid response, totaling 4,021,475 (male: 2,250,783, female: 1,770,692), yielding the response rate of 96.6% (male: 96.5%, female: 96.7%). Although this data is presumably biased toward urban, higher income, more educated, and smoking[57], its huge sample-size and the fact that the information was collected for life insurance lead us to believe that

[57] One should expect for the classical adverse selection to work in this case as well: if smokers believe that their life is at a higher risk than non-smokers, it seems reasonable to assume that they have higher demand for life insurance.

it is one of the most reliable smoking rate estimation available so far. Figure 9.5 shows their smoking rate by sex in 1998. As shown in Figure 9.6, both male and female smoking rate are significantly higher than that of the Nutrition Survey. Male smoking rate is higher that of JT Survey for 20's and 30's and female smoking rate are higher than that of JT Survey from 20's to 40's and there are huge gap for 30's.

We should note that the Comprehensive Survey of the Living Conditions (CSLC), the mother survey of the Nutrition Survey, also asks about smoking behavior in its questionnaire. In spite of its large sample size, however, this survey has not been frequently by public health experts to analyze Japanese smoking behavior. The exception is Fukuda et al. (2004) who explored the relationship between socioeconomic patters and smoking behavior. We will touch this paper at discussion.

9.4 The National Survey of Family Income and Expenditure

9.4.1 Overview

The National Survey of Family Income and Expenditure (hereafter the Expenditure Survey) is widely regarded as one of the most important government surveys in Japan, as it had been extensively used by economists to analyze household consumption behaviors. Accuracy of the information in the survey is secured because the survey collects complete information on income sources, goods and services purchased, savings, debts, and asset holdings of households. As families participating in the Expenditure Survey must present complete records on both incomes and all the items purchased for a month, it should be much more difficult to remove records of cigarette purchases from the housekeeping book, than to answer by a false "no" to "Do you smoke?" question. Thus, we can reasonably expect for the tobacco purchase data in the Expenditure Survey to be more "true" than the smoking rate data in the Nutrition Survey or in the JT Survey.

The Expenditure Survey is administered every 5 years and the latest one was in 2009[58]. The survey selects the samples in three stages: first it chooses cities and towns/villages, then it selects survey districts[59] within the cities and towns/villages, and finally, it selects households in the

[58] The results will appear in the summer of 2010.

[59] Two adjacent survey districts of National Census form one survey district of Expenditure Survey.

survey districts. For example, in the 2004 survey, all the 680 cities, and 458 towns/villages (out of total 2496 towns/villages) in Japan were selected. In these cities or towns or villages, 4,531 survey districts were randomly chosen, and 12 households were serially chosen in each survey district[60]. The survey selects single-person households and households with two or more individuals at different sampling rates. The number of single-person household samples was 5,002, and that of two or more person household samples was 54,373, respectively.

9.4.2 Smoking Rates in Single-Person Households

The number of samples of single-person households is roughly between 4,000 and 5,000 for each survey-year. In Table 9.3 we list some key statistics. In Fig.9.7.1 and 9.7.2, we show the age distribution of samples for different survey years for both sexes. We note here that age distributions for male and for female are quite different. Whereas male sample distributions have a sharp peak in their 20's, female distributions have a small peak in their 20's and a large peak in their 60's and 70's. Furthermore, we observe a sharp drop in the number of 20's in the male samples in 2004, and small increases in 40's, 50's, and 60's samples. For females, the samples in their 60's and 70's have been increasing over time.

Smoking rate was calculated for each of the (sex, age-class, survey year) combination (or cell) as the proportion of individuals in the cell who had purchased tobacco products during the survey month. Due to the limited sample sizes of many of the cells, however, these raw proportions were subject to large volatility and it was difficult to make direct cross survey-year comparisons. In order to control the volatility, we dropped the (data from) cells that contain less than 30 samples. We then ran a regression with the indicator variable for tobacco purchase as the dependent variable, and the dummy variables for each age-class for both sexes as well as the dummy variables for survey-years as the independent variables. Total number of samples was about 15,000 for the regression. Finally from the regression, we obtained the coefficient and its 95% confidential interval for each of these cells. Table 9.4 and Table 9.5 show results of male and female respectively and we draw graph on

[60] In the Expenditure Survey data we were authorized to use, location information had been hidden and replaced by very broad region information to protect the household identity.

Figure 9.8 for male and Figure 9.9 for female.

9.4.3 Smoking Rates in Households with Two or More Members

The numbers of households with two or more members are about 55,000 for each Expenditure Survey. Summary statistics of the data are shown in Table 9.6. There are several types of households in this category; married couples, elderly couples, parents with unmarried children, two generations, three generations and so on. To simplify our analysis, we specially selected married couple households with only one male adult and only one female adult. We identify a "smoking household" as a household that had purchased tobacco products during the survey month. From the data, however, we have no way of knowing who actually smoked within the household, and we have simply calculated the “household smoking rate” as the proportion of smoking households within a given cell.

Like single-person households, we pooled 4 years (1989, 1994, 1999 and 2004) samples of households with two or more members. We classified each household by the combination of the age-class of its first male adult, the age-class of its first female adult, and the survey year. We then limited our samples to married couple household, and dropped households with other adult members present. Also to avoid volatility, we dropped cells (male age-class, female age-class, survey year) with less than 30 samples.

Unlike in single-person households, however, in married couple households, more than 60% of them have some money husband had spent for unspecified items called husband’s "pocket money". To be as precise as possible, we dropped those households from our analysis, retaining only the households with complete expenditure records. Thus our smoking rate estimates may contain a bias coming from this incidental truncation. Since we can never rule out the possibility that some of this money may have been spent on tobacco, our smoking rate estimates contains a downward bias. We argue, however, the order of magnitude of the bias is not very large, and, most likely, it is independent of the size of “pocket money” for the following two reasons. First, while the proportion of smoking households without “pocket money” is 32.2%, it is 35.8% in households with “pocket money”, with the difference of only about 3% points between them. Secondly, although statistically

significant, the size of pocket money has extremely small positive effect ($5.6*10^{-6}$) on smoking probability.

With these qualifications, we show our estimates of household smoking probability for married couples in Table 9.7 and Figure 9.10.

9.4.4 Decomposition Analysis

It is tempting to find out who is (are) actually smoking in the married couple households. Conceptually, we can breakdown "households smoking rate" into each member, using the following probability relationship;

P(Smoking Household (i,j)) = P(Smoking Husband (i)) + P(Smoking Wife (j))

$-$P(Smoking Husband(i) AND Smoking Wife(j)),

where i and j denote age-classes of husband and wife, respectively. If the smoking probability of married man at age i does not depend on wife's age j, then we can estimate this equation, by the age-class dummies for both sex and cross-age-class dummies. In practice, however, there is no guarantee for the coefficients of age-class dummies to be positive in the estimated equation, and we have to find a more practical approach.

We have specified that

$$P(i,j) = \alpha \cdot q_m(i) + \beta \cdot q_f(j) + \gamma,$$

where P(i,j) is the household smoking probability, q_m is the smoking probability of single male, and q_f is the smoking probability of single female. The first term on the right hand side stands for P(Smoking Husband(i)), the second for P(Smoking Wife(j)) and the third for the average value of the intersections of the two events. We expect the third term to have a negative value. In Table 9.8, we show our estimated equation. According to the results, smoking rates of both married men and married women are only 60% of single men and women. This result is hardly surprising: the household smoking rate of married couple is about 64% of smoking rate of single male. Since male is the dominant smoker in our society, and in the household, the reduction must be realized by the reduction in male smoking rate. The result in Table 9.8 further shows that married women also show a proportionate reduction in their smoking rate as well.

9.4.5 Results

As for single-person households, overall smoking rate of female and male are 20.9% (95% CI: 0.206, 0.212) and 58.2% (0.578, 0.585) in 1989, 13.5% (0.128, 0.141) and 51.3% (0.505, 0.522) in 1994, 12.7% (0.122, 0.133) and 46.3% (0.455, 0.471) in 1999, 10.3% (0.097, 0.109) and 39.3% (0.385, 0.402) in 2004, respectively (Table 9.9). For married couples, overall smoking rates are 51.3% (0.511, 0.514) in 1989, 31.0% (0.309, 0.312) in 1994, 27.1% (0.270, 0.273) in 1999 and 22.6% (0.224, 0.227) in 2004 (Table 9.10). Also our decomposition analysis shows that the smoking rates of married men and married women had been about 60% of single men and women through these periods.

Plotting those obtained data on Figure 9.1 (see Figure 9.12), there arise four interesting points. First, downward trend is observed for the smoking rate of single men as in the smoking rate of all men in the other two surveys, but ours stays below the other two. Second, smoking rate of married couples is significantly lower than that of the single male. These two observations together imply that the true smoking rate of all men is somewhere between the triangle markers and the square markers, and hence it must be significantly lower that JT's rate, or Nutrition Survey's rate. Thirdly, the smoking rate of married couple fell very sharply between 1989 and 1994, but that of single male decreased more slowly. Fourthly, the under-estimation of female smoking existed in 1989, but probably it does not exist anymore.

As drawn on Figure 9.13 (four surveys comparison), female smoking rate is high at young and middle age and this result is completely different from existing surveys. As we have estimated, single women smoke more often than married women and have less incentive to quit smoking. Thus, single women face higher risk of health.

To look closely at the male smoking rate (Fig. 9.14.1 – 9.14.4); while smoking rate of single men increase from 20 to 40 age group and gradually decrease, smoking rate of married men start to decline from 20 age group and slightly recover from 40 to 50 age group and steadily decrease.

9.5 Discussion

Our findings reveal that smoking behavior varies significantly by household types, single or

married. In general, married men are less likely to smoke and more likely to quit smoking than single men. From the theoretical viewpoint, this makes sense. Married men should have lower rate of time discount and higher risk aversion than single men because they have longer-living wives and younger children. From Figure 9.14.1 to Figure 9.14.4, we have shown that married men over the age 30 had significantly lower smoking rates than single men, although they may have much higher smoking rates between the age 20 and age 24. This pattern is consistent through 1989 to 2004. In contrast, Fukuda et al. (2005) showed very different results. They pointed out that married men aged 13-39 showed significantly higher smoking habits than single men. Their conclusion is probably due to the homogeneity of the single men and married men in their data set.

The same phenomenon should be applied to women as well, as our preliminary regression indicates that smoking rate of married women had been less than 60% of single women. Other studies using more traditional questionnaire based studies agree: Ohida et al. (2000 and 2001) stated that the prevalence of smoking in women was significantly related to household size and married couple was less likely to smoke than single person household. Although their study in 2000 focused on only one area, Mie prefecture, the number of samples was about 10,000, and the study in 2001 used the Active Survey of Health and Welfare which contains 38,710 habitants. Similarly, contrary to men, Fukuda et al. (2005) agrees that married women aged 25-54 showed lower prevalence of smoking compared to others including never married, separated and divorced.

9.6 Conclusion

The results we have shown for single men and women and married couples point to the source of problem in the smoking rate data in Japan. There are very important heterogeneities in the smoking behavior, of which sex, age, and marital status are just a part. There are many other known factors that influence smoking behavior; education, job, regions, cultures etc.. Given so many dimensions of heterogeneities, a well-designed random sampling strategy such as the one the Expenditure Survey adopts is the only practical way to obtain a representative national data for estimating smoking prevalence. We have argued that the two well-known Japanese smoking data, the JT Smoking Survey and the Nutrition Survey, are producing upwardly biased estimates because

of their biased samples.

On the other hand, there are still some technical problems to solve before we can comfortably use the Expenditure Survey to obtain prevalence rate, particularly for women. Even without them, as we have seen, enough information can be extracted from the Expenditure Survey to check the biases in the national prevalence data. In any case, it will be worthwhile to check the smoking rates of earlier years using the Expenditure Survey, as they can go back to 1959.

References for chapter 9

Akiyama N, Saitou H, Nagino H (2000), Examination the smoking habit of insurance applicants, The Association of Insurance Medicine of Japan, Vol 98: 69-75

Anzai Y, Ohkubo T, Nishino Y, Tsuji I, Hisamichi S. (2000), Relationship between health practices and education level in the rural Japanese population. Journal of Epidemiol. vol.10:149–156.

Cabinet Office (1988), Public opinion poll of smoking and health problem in 1988

Fukuda Y, Nakamura K, Takano T (2005), Socioeconomic Pattern of Smoking in Japan: Income Inequality , Annals of Epidemiology, vol.15:365–372

Japan Tobacco Inc. . Japan Smoking Rate Survey (annual survey)

Local Health Center, Health Service for the elderly (annual survey)

Ministry of Health, Labour and Welfare, National Health and Nutrition Survey in Japan (annual survey)

Ministry of Health, Labour and Welfare (1998), Smoking and health problem survey in 1998 Ministry of Internal Affairs and Communications, National Survey of Family Income and Expenditure (every 5 years survey)

Nakamura Y, Sakata K, Kubo N, Akikawa Y, Nagai M, Yanagawa H. (1994), Smoking habits and socioeconomic factors in Japan, Journal of Epidemiology vol. 4:157–161.

OECD (2009), OECD Health Data 2009

OECD (2009), Health at a glance 2009

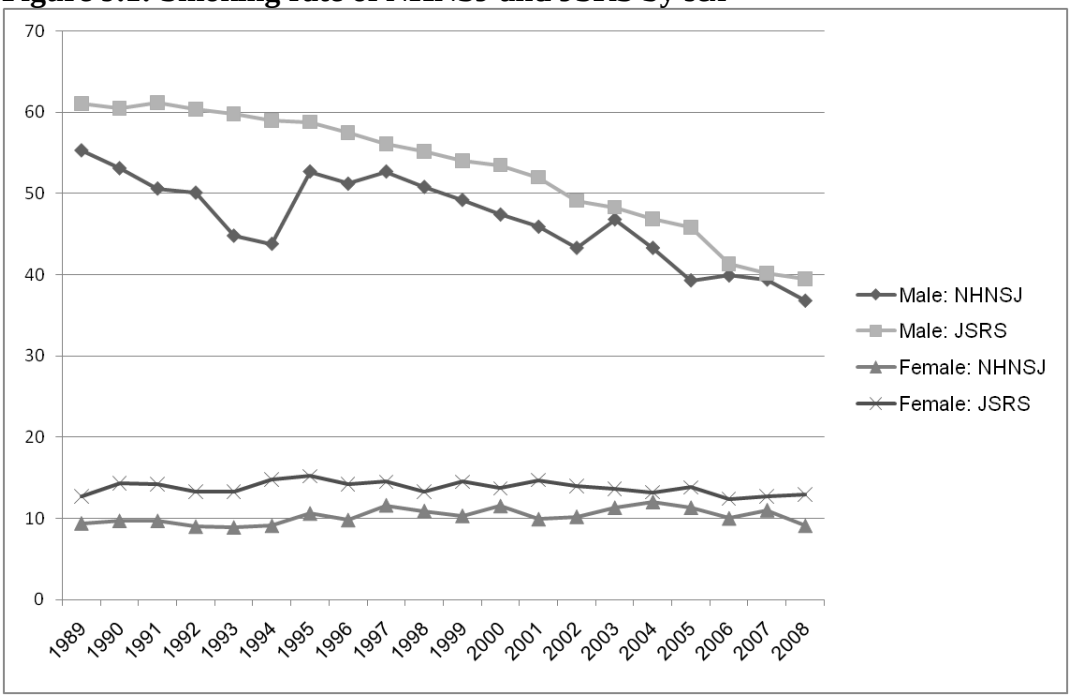
Ohida T, Sone T, Mochizuki Y, Kawaguchi T, Kido M, Harita A, et al.(2000), Household size related to prevalence of smoking in women in Japan., Journal of Epidemiology, vol.10:305–309. Ohida T, Kamal AM, Takemura S, Sone T, Mochizuki Y, Kawaminami K. (2001), Relation between smoking prevalence and various social factors in Japan, Keio Journal of Medicine, vol. 50:263–268.

Uehata et al (2001) National survey of Smoking and drinking habit of juveniles

World Health Organization (2008), WHO Report on the Global Tobacco Epidemic, 2008

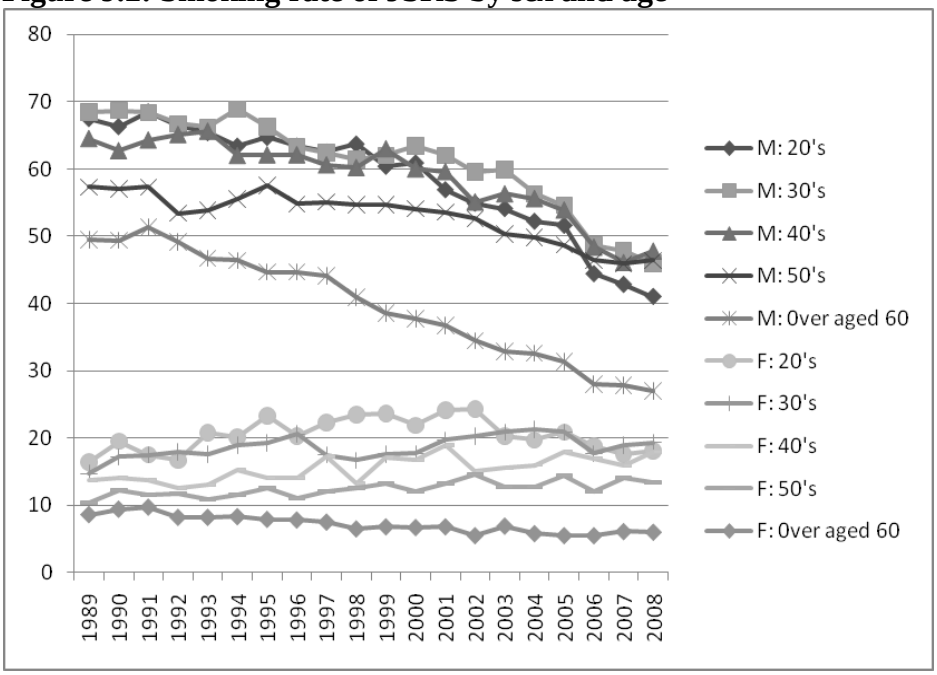
Tables & Figures

Figure 9.1: Smoking rate of NHNSJ and JSRS by sex



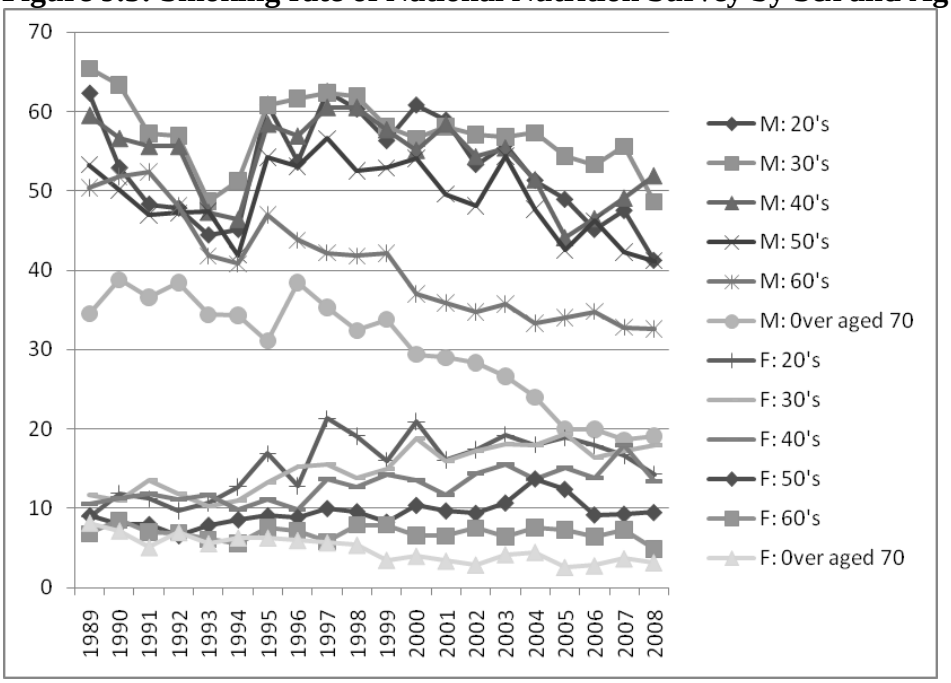
Source: the national health and nutrition survey in Japan, NHLW
Japan Smoking Rate Survey, Japan Tobacco Inc

Figure 9.2: Smoking rate of JSRS by sex and age



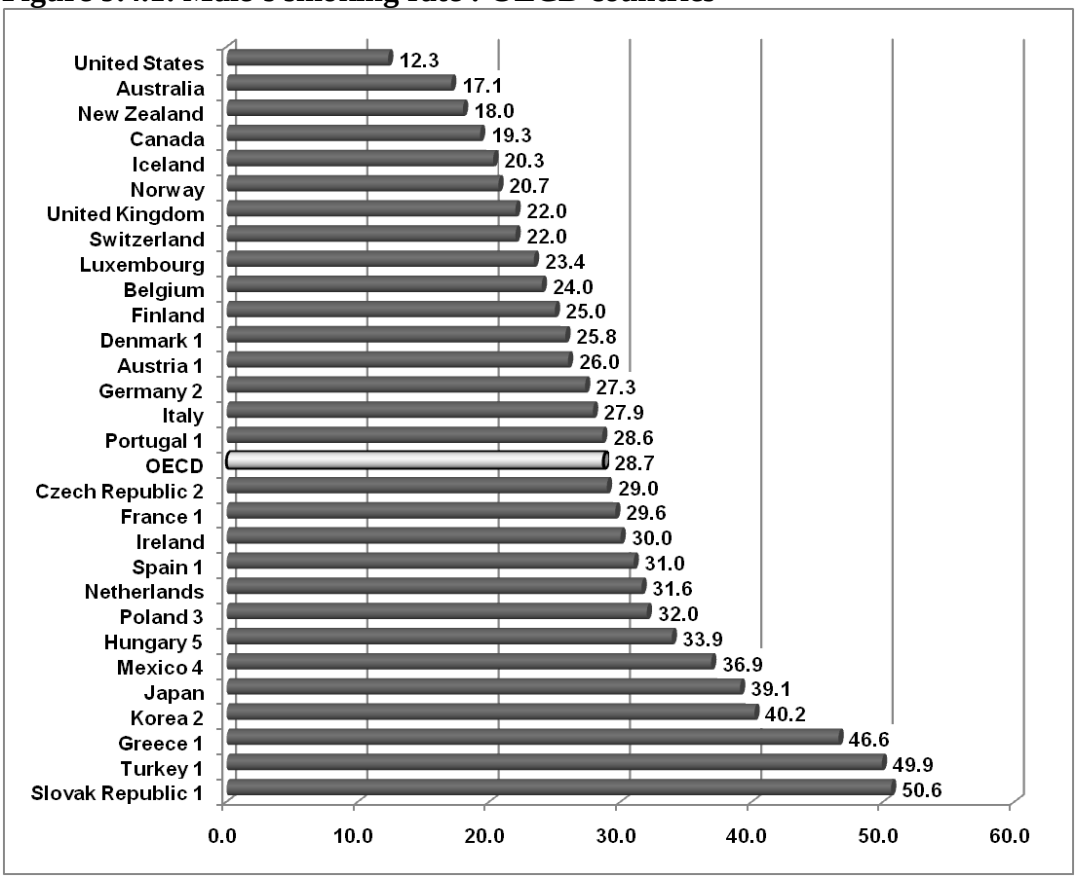
Source: Japan Smoking Rate Survey , Japan Tobacco Inc

Figure 9.3: Smoking rate of National Nutrition Survey by Sex and Age



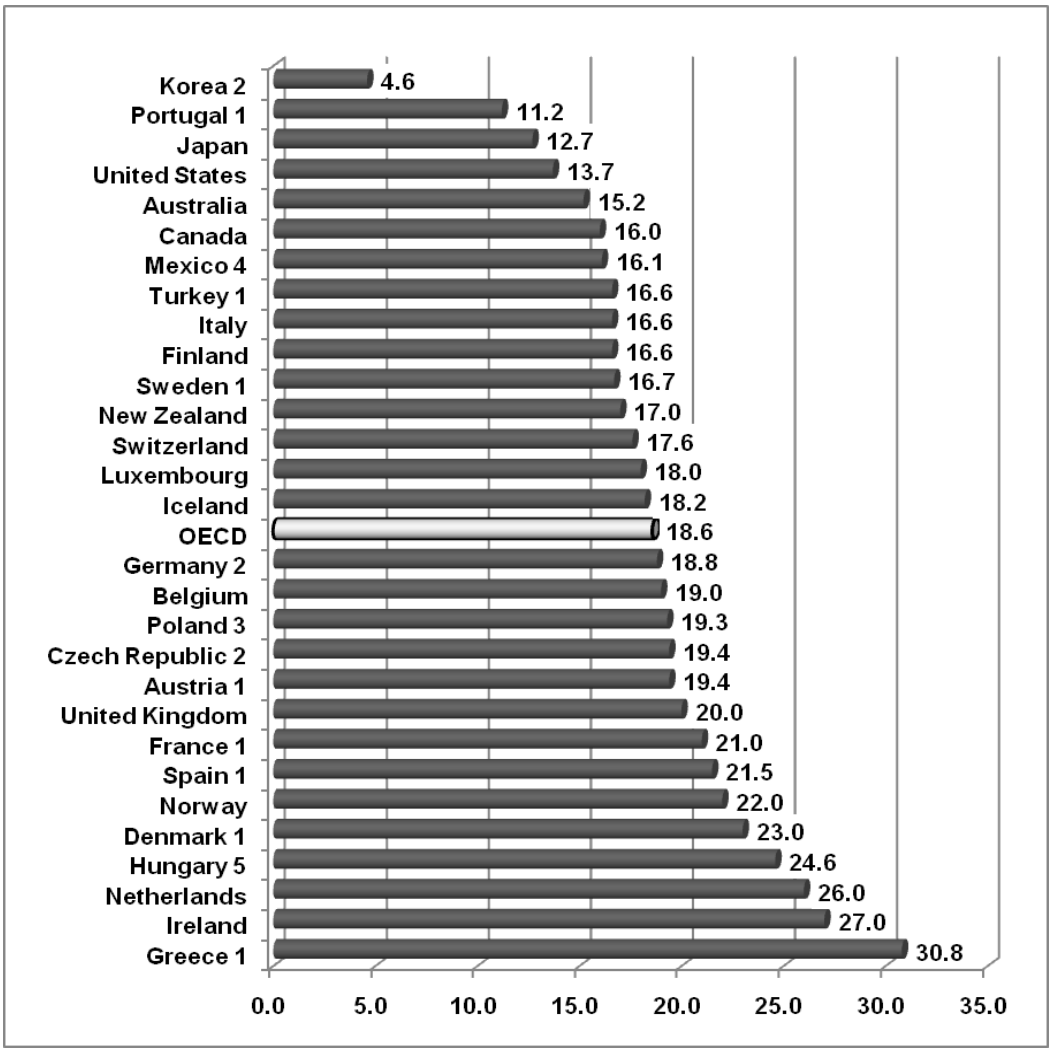
Source: the national health and nutrition survey in Japan, NHLW

Figure 9.4.1: Male's smoking rate : OECD countries



Source: OECD Health at a glance 2009

Figure 9.4.2: Female's smoking rate : OECD countries



Source: OECD Health at a glance 2009

Table 9.1: Age structure of JSRS

		20's	30's	40's	50's	over aged 60	Total
Male	%	17.8	15.9	16.1	16.9	33.4	100
	number	1,869	1,672	1,688	1,774	3,510	10,513
Female	%	11.7	17.5	16.9	17.6	36.3	100
	number	1,204	1,803	1,741	1,814	3,732	10,294
Toal	%	14.8	16.7	16.5	17.2	34.8	100
	number	3,073	3,475	3,429	3,588	7,242	20,807
※ smoking rate is calculated with adjustment of adult population structural rate							

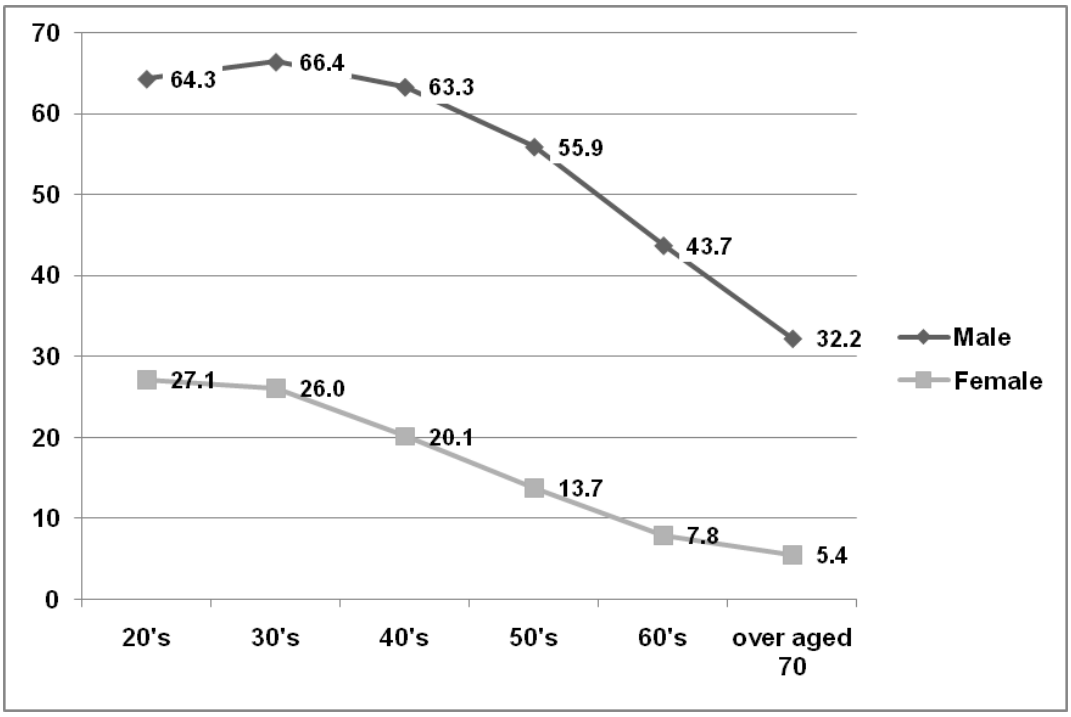
Source: Japan Smoking Rate Survey , Japan Tobacco Inc

Table 9.2: Survey about smoking rate

Study Name	conductor	survey period	methods	number of sample
National survey of family income and expenditure	Ministry of Internal Affairs and Communications	every 5 years	Random sampling in 4,531 from from the National Census (in 2004)	households with two or more persons (about 55,000) households with one person (about 5,000)
The national health and nutrition survey in Japan	Ministry of Health, Labour and Welfare	every year	Random sampling from selected districts (about 300 districts)	5,000 households and about 15,000 members
Japan Smoking Rate Survey	Japan Tobacco, Inc.	every year	Stratified two-stage sampling method Mail-in survey	32,000 adult persons
Public opinion poll of smoking and health problem in 1988	Cabinet Office	1988	Stratified two-stage sampling method	3,000
Smoking and health problem survey in 1998	Ministry of Health, Labour and Welfare	1998	Random sampling from selected districts (about 300 districts) placement method	12,868
Examination the smoking habit of insurance applicants	Meiji Yasuda Life Insurance Company	1992-1998	Questionnaire	about 4 million
Health Service for the elderly	Local health center	every year	Questionnaire at the regular health check	about 3 million
National survey of Smoking and drinking habit of juveniles	Study group	1990, 1996, 2000	Stratified one-stage sampling method	junior high school: 99 (47,246) high school:102 (60,661)
Comprehensive Survey of Living Conditions*	Ministry of Health, Labour and Welfare	Large-scale survey every three years and Small-scale survey in each interim year of Large-scale survey year	Random sampling in 5,440 districts from the National Census (in 2005)	large scale survey: household (about 290,000) and its members (about 760,000) small scale survey: household(abuot 50,000) and its members (about 150,000)

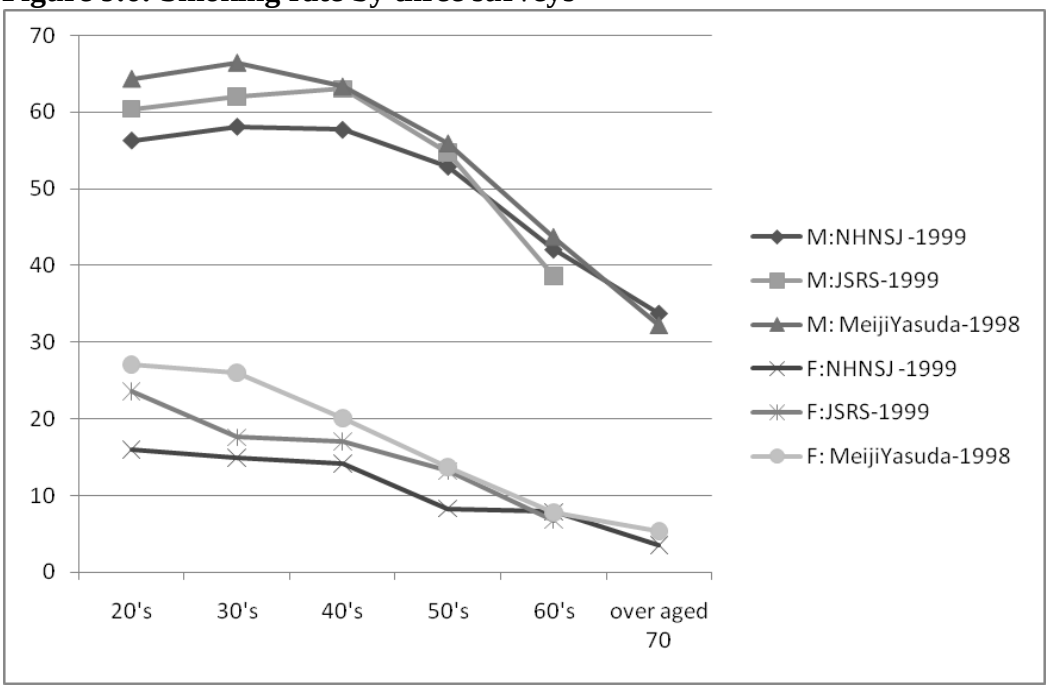
source: Ministry of Internal Affairs and Communications, Cabinet Office,
Ministry of Health, Labour and Welfare、Japan Tobacco, Inc.
Meiji Yasuda Life Insurance Company、Local health center

Figure 9.5: smoking rate in 1998 by Meiji Yasuda insurance



Source: Meiji Yasuda Life Insurance

Figure 9.6: Smoking rate by three surveys



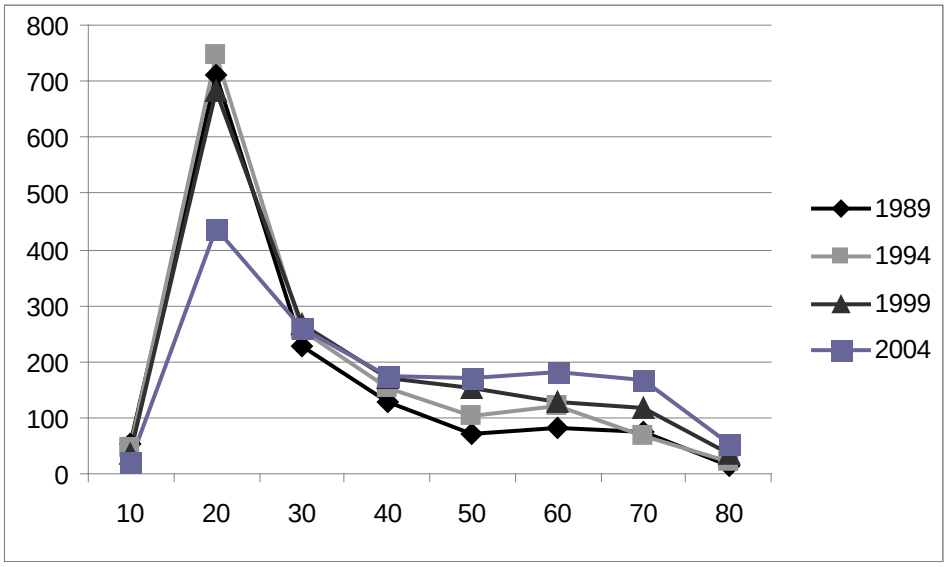
Source: the national health and nutrition survey in Japan, NHLW
Japan Smoking Rate Survey, Japan Tobacco Inc
Meiji Yasuda Life Insurance

Table 9.3: Households with one person of NSFIE

survey year	male	female	total
1989	1,365	1,923	3,288
1994	1,518	2,254	3,772
1999	1,593	2,423	4,016
2004	1,469	2,532	4,001
total	5,945	9,132	15,077

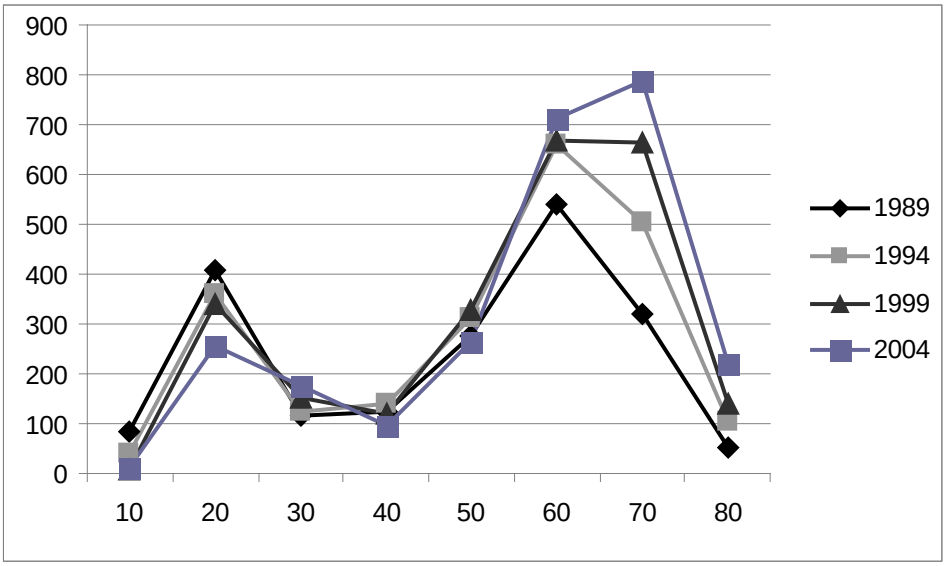
source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.7.1: Single-Person Households: Male Age Distribution



source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.7.2: Single-Person Households: Female Age Distribution



source: National Survey of Family Income and Expenditure (NSFIE)

Table 9.4: Single-Person Households: Male Smoking Rate

source: National Survey of Family Income and Expenditure (NSFIE)

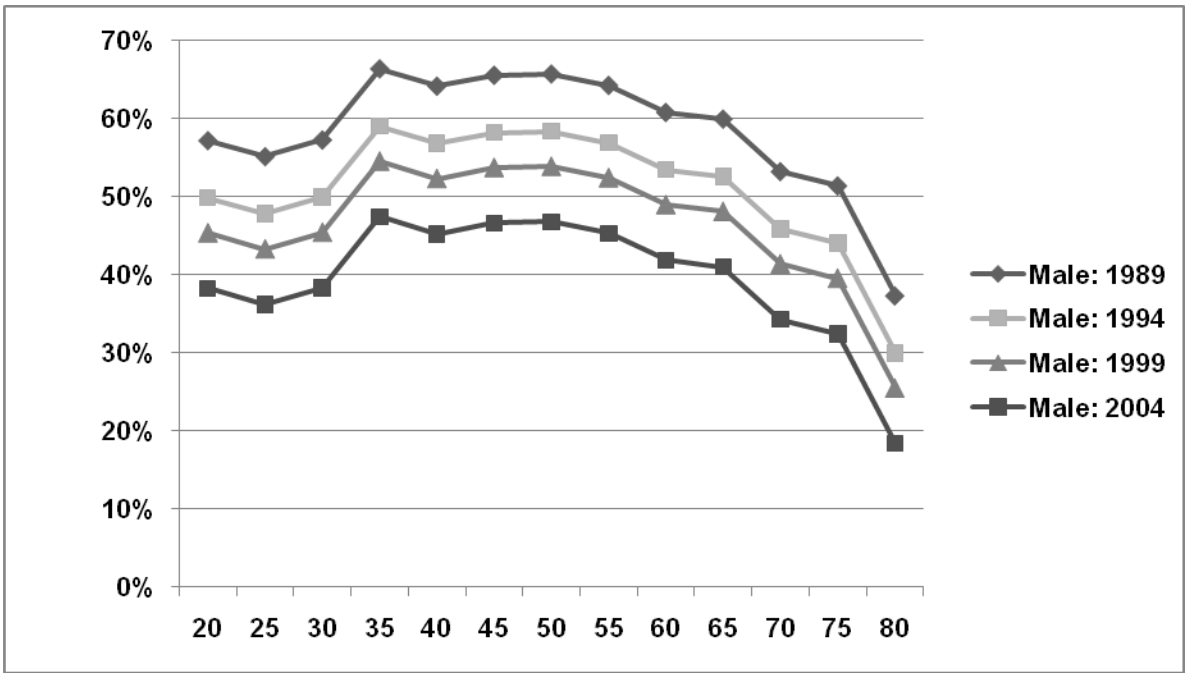
		survey year			
age group	age	Male: 1989	Male: 1994	Male: 1999	Male: 2004
20	20-24	57.1%	49.8%	45.3%	38.2%
25	25-29	55.1%	47.7%	43.2%	36.1%
30	30-34	57.2%	49.9%	45.3%	38.3%
35	35-39	66.3%	58.9%	54.4%	47.4%
40	40-44	64.1%	56.7%	52.2%	45.1%
45	45-49	65.4%	58.1%	53.6%	46.5%
50	50-54	65.6%	58.3%	53.8%	46.7%
55	55-59	64.2%	56.8%	52.3%	45.2%
60	60-64	60.7%	53.4%	48.9%	41.8%
65	65-69	59.9%	52.5%	48.0%	40.9%
70	70-74	53.1%	45.8%	41.3%	34.2%
75	75-79	51.3%	44.0%	39.5%	32.4%
80	80-	37.3%	30.0%	25.4%	18.4%

Table 9.5：Single-Person Households: Female Smoking Rate

source: National Survey of Family Income and Expenditure (NSFIE)

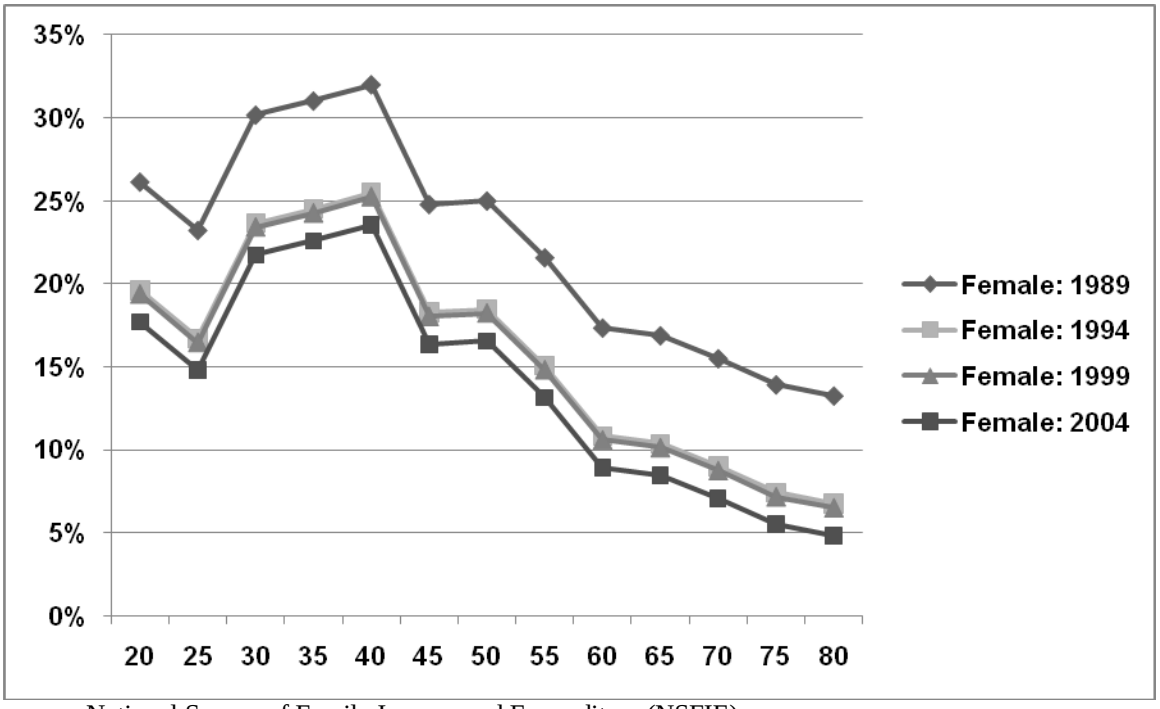
		survey year			
age group	age	Female: 1989	Female: 1994	Female: 1999	Female: 2004
20	20-24	26.1%	19.6%	19.4%	17.7%
25	25-29	23.2%	16.7%	16.5%	14.8%
30	30-34	30.2%	23.6%	23.4%	21.7%
35	35-39	31.0%	24.5%	24.3%	22.6%
40	40-44	32.0%	25.5%	25.2%	23.6%
45	45-49	24.8%	18.3%	18.0%	16.4%
50	50-54	25.0%	18.5%	18.2%	16.6%
55	55-59	21.6%	15.1%	14.8%	13.1%
60	60-64	17.4%	10.8%	10.6%	8.9%
65	65-69	16.9%	10.4%	10.1%	8.5%
70	70-74	15.5%	9.0%	8.7%	7.1%
75	75-79	13.9%	7.4%	7.2%	5.5%
80	80-	13.3%	6.7%	6.5%	4.8%

Figure 9.8: Single-Person Households: Male Smoking Rate



source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.9: Single-Person Households: Female Smoking Rate



source: National Survey of Family Income and Expenditure (NSFIE)

Table 9.6: Households with two or more person of NSFIE

survey year	households
1989	44,006
1994	44,537
1999	44,803
2004	44,778
total	178,124

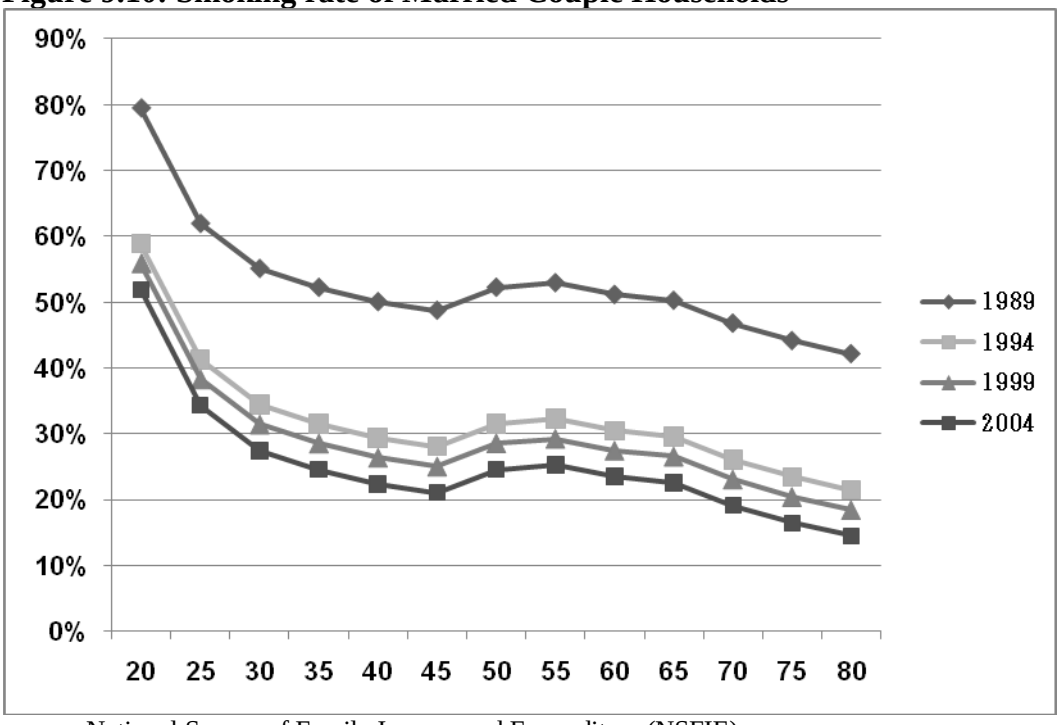
source: National Survey of Family Income and Expenditure (NSFIE)

Table 9.7: Married Couple Households: Household Smoking Rate

source: National Survey of Family Income and Expenditure (NSFIE)

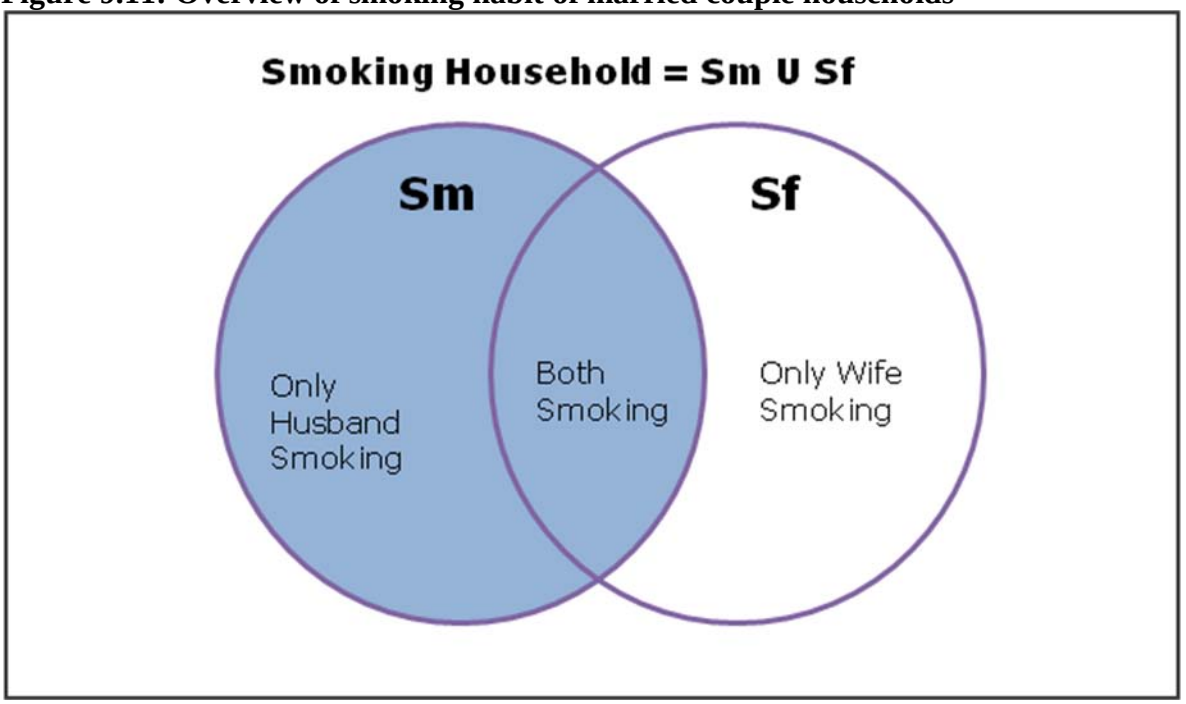
		surveyyear			
age group	age	1989	1994	1999	2004
20	20-24	79.5%	58.9%	55.9%	51.9%
25	25-29	61.9%	41.3%	38.3%	34.3%
30	30-34	55.1%	34.4%	31.4%	27.4%
35	35-39	52.2%	31.6%	28.5%	24.6%
40	40-44	50.0%	29.4%	26.4%	22.4%
45	45-49	48.7%	28.1%	25.0%	21.1%
50	50-54	52.2%	31.6%	28.6%	24.6%
55	55-59	52.9%	32.3%	29.2%	25.3%
60	60-64	51.1%	30.5%	27.5%	23.5%
65	65-69	50.2%	29.6%	26.6%	22.6%
70	70-74	46.7%	26.1%	23.1%	19.1%
75	75-79	44.1%	23.4%	20.4%	16.4%
80	80-	42.1%	21121.5%	18.4%	14.5%

Figure 9.10: Smoking rate of Married Couple Households



source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.11: Overview of smoking habit of married couple households



source: presented by authors

Table 9.8: Regression result of attribution analysis

Source	SS	df	MS
Model	225.74462	2	112.87231
Residual	300.276504	34303	.008753651
Total	526.021124	34305	.015333658

Number of obs = 34306
F(2, 34303) =12894.31
Prob > F = 0.0000
R-squared = 0.4292
Adj R-squared = 0.4291
Root MSE = .09356

P(Smoking Household)	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
P(Smoking Husband)	.610826	.0072166	84.64	0.000	.5966811	.6249708
P(Smoking Wife)	.5735094	.0102235	56.10	0.000	.5534709	.5935479
P(Smoking H&W)	-.0911302	.0029559	-30.83	0.000	-.0969239	-.0853365

Table 9.9: Household with one person: overall smoking rate

	smoking rate					
survey year	male	95% CI		female	95% CI	
1989	58.2%	0.555	0.609	20.9%	0.193	0.225
1994	51.3%	0.488	0.539	13.5%	0.120	0.149
1999	46.3%	0.438	0.487	12.7%	0.113	0.141
2004	39.3%	0.368	0.419	10.3%	0.090	0.117

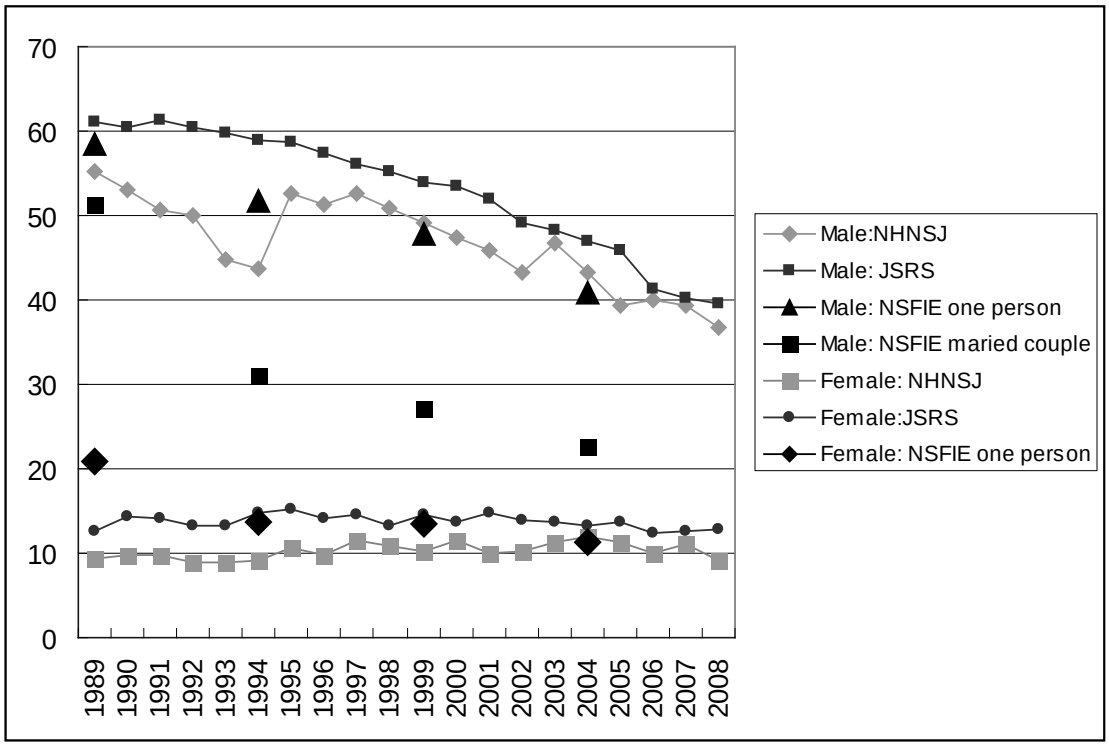
source: National Survey of Family Income and Expenditure (NSFIE)

Table 9.10: Overall smoking rate of married couple household

	smoking rate		
survey year	household	95% CI	
1989	51.3%	0.503	0.522
1994	30.3%	0.293	0.313
1999	26.9%	0.261	0.278
2004	22.5%	0.217	0.234

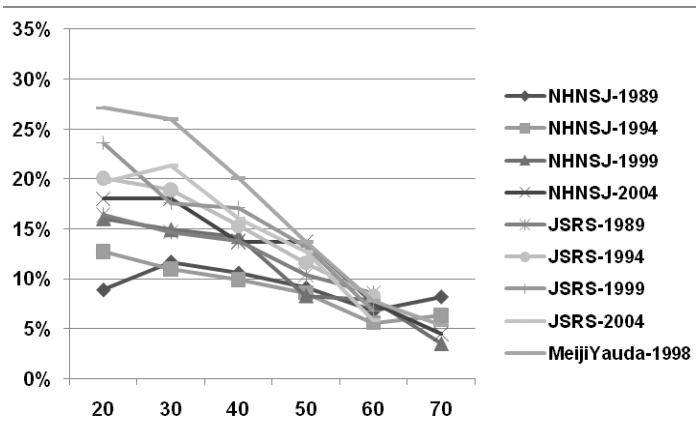
source: National Survey of Family Income and Expenditure (NSFIE)

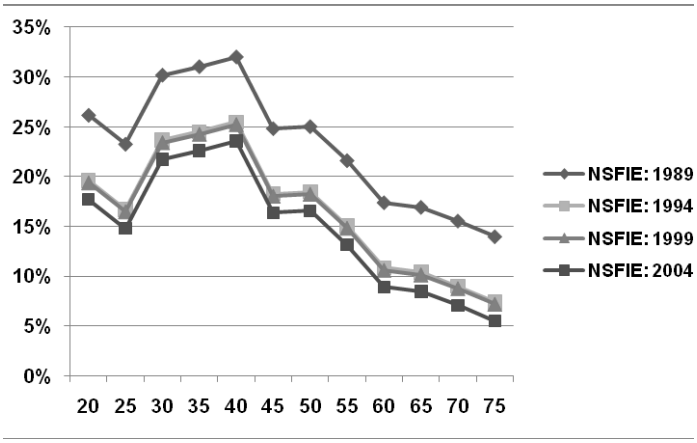
Figure 9.12: Overall smoking rate by three surveys



source: the national health and nutrition survey in Japan, NHLW
Japan Smoking Rate Survey , Japan Tobacco Inc
National Survey of Family Income and Expenditure

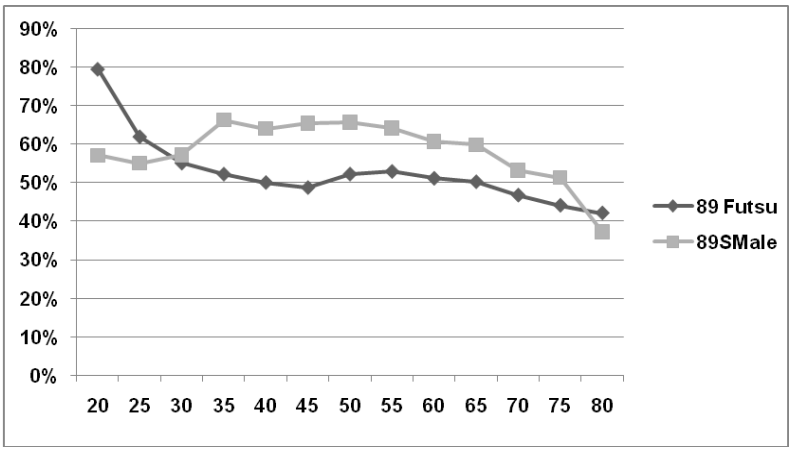
Figure 9.13: Female Smoking Rates of Four Surveys





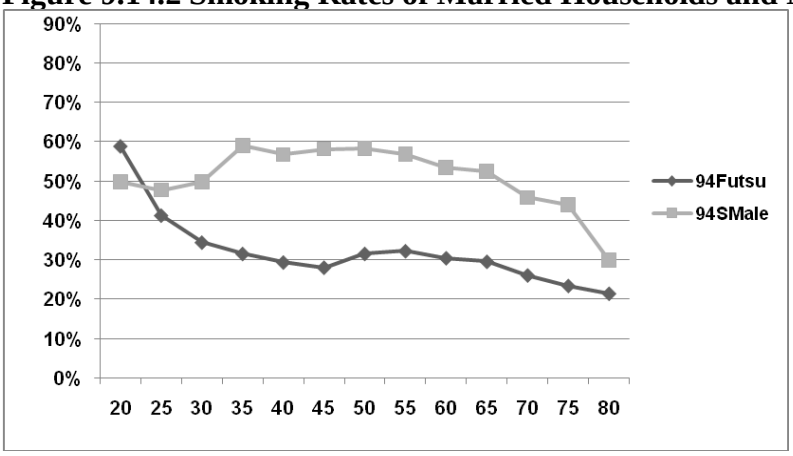
source: the national health and nutrition survey in Japan, NHLW
Japan Smoking Rate Survey , Japan Tobacco Inc
National Survey of Family Income and Expenditure
Meiji Yasuda Life Insurance

Figure 9.14.1 Smoking Rates of Married Households and Male Single Households in 1989



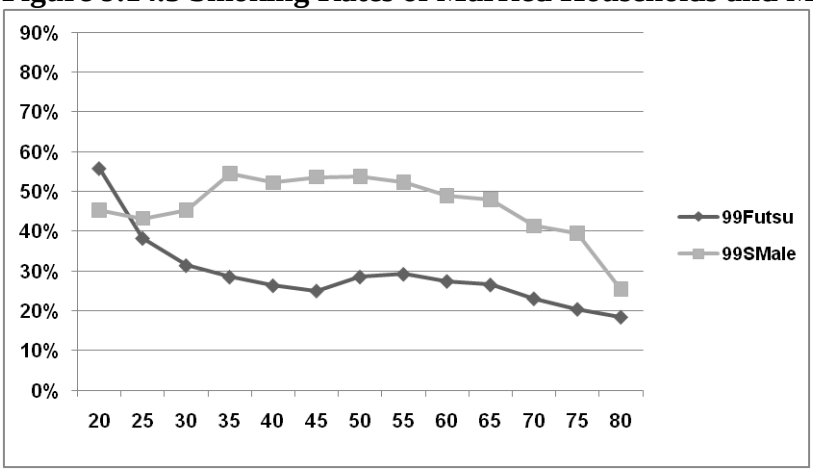
source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.14.2 Smoking Rates of Married Households and Male Single Households in 1994



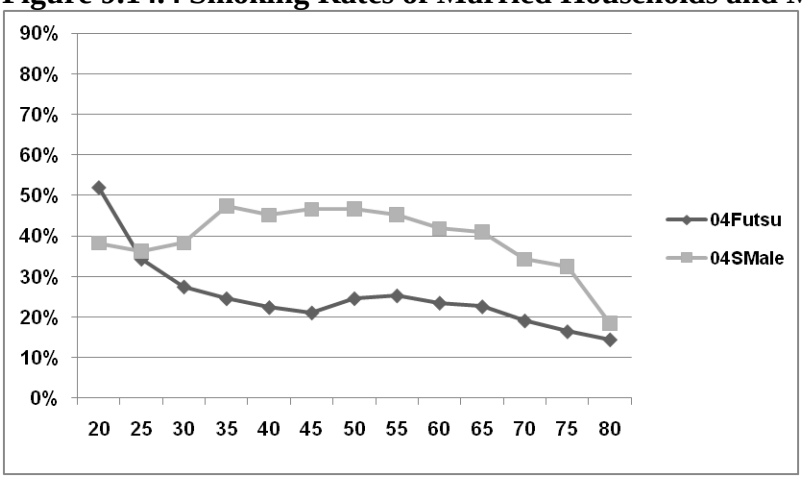
source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.14.3 Smoking Rates of Married Households and Male Single Households in 1999



source: National Survey of Family Income and Expenditure (NSFIE)

Figure 9.14.4 Smoking Rates of Married Households and Male Single Households in 2004



source: National Survey of Family Income and Expenditure (NSFIE)