

WAGES, HOURS OF WORK AND JOB SATISFACTION OF RETIREMENT-AGE WORKERS*

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I analyse, theoretically and empirically, the effects of pension benefits, family conditions and the personal characteristics of older individuals on their labour supply, wages, hours worked and job satisfaction, in the framework of the Nash bargaining condition whereby an older worker and a firm bargain over employment conditions such as wages, hours of work and job investment. It is stressed that as workers become older they tend to give greater priority to the number of hours worked, work environment and type of job than to wages, and try to improve these through job investment, even at the cost of lower wages.
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1. Introduction

Most workers in their sixties are in the process of retiring from the labour market. As their physical strength, memory and work incentives decline with age, those still in employment try to adjust their working circumstances, perhaps by decreasing the number of hours worked, even if this means a decrease in wages. At the same time, they have to prepare for their life after retirement. If they are unsatisfied with the preparations they have made, they will continue to work for higher incomes. In this paper I aim to analyse how wages, hours of work and job satisfaction of retirement-age workers are determined, focusing on the effects of the pensions, family conditions and personal characteristics.

Many previous studies¹ have stressed that pensions suppress the labour supply of retirement-age workers, not only because they have an income effect on leisure, but because the Employees' Pension Plan, which is widely applied to employees in private companies, reduces the amount of pension a recipient receives according to the number of hours still worked and the income earned. Controlling for the income effect of pension benefits and endogeneity, I analyse the effect of this type of pension scheme by comparing it with a fixed-benefits scheme such as the Government Mutual Aid. I also focus on how the effects of pensions differ between those in their early sixties and in their late sixties, taking into consideration that the pension reduction scheme means that those in the two age groups will receive different pensions.

In order to make their working circumstances more comfortable, retirement-age workers try to improve the nature of their work and the human relationships in their workplace,

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¹ See e.g. Yamada (1990); Seike (1993); Tachibanaki and Shimono (1994); Seike and Shimada (1995); Seike *et al.* (1997); Ogawa (1998a; 1998b); Abe (1998); Mitani (2001) and Higuchi and Yamamoto (2002).

either by bargaining with their employers or by moving to another place of work. The concept of job investment, i.e. investment in job satisfaction, is important for these older workers. There are basically two ways an older worker can achieve more job satisfaction. One is by moving to a more satisfactory job either within the current firm or with a different firm; the other is by persuading the firm to improve the working environment and the physical requirements of the job by investing in equipment, tools and/or workplace surroundings, for example by improving the lighting of the workplace, using a robot for physically difficult work or slowing down work speed. Both solutions are costly. Transfer to a more favourable job may decrease a worker's productivity; on the other hand, improving the working environment requires capital investment. Therefore, retirement-age workers and their employers bargain over (i) how much to invest in their jobs, (ii) their wages and (iii) the number of hours worked. As a result, the older workers may be required to bear a part of the costs of job investment in the form of lower wages or longer hours of work.

In consideration of these issues, I analyse how pensions and family conditions of retirement-age workers affect their job satisfaction on the basis of factors such as work circumstances. Since job investment is costly, it is expected that job satisfaction is closely related to wages and hours of work—and also to pensions, personal characteristics and the family situation of these older workers.

I adopt a Nash bargaining approach. That is, I assume that a retirement-age worker and a firm bargain over wages, hours of work and the job investment. Previous studies have usually relied on the traditional framework, assuming that an older person determines his labour supply after comparing his reservation wage with the market wage.² There are two main reasons why I have adopted the Nash bargaining approach in this paper. First, as workers become older, not only their physical and mental strength but also their family circumstances come to differ widely among them; that is, the factors affecting their disutility of work are quite different and are likely to change every year, hence they cannot be treated uniformly. Thus, their way of working and their economic conditions need to be changed individually and carefully through frequent renegotiations, particularly for older workers re-employed after mandatory retirement. Second, there is in general a wide range of rent between a firm and an older worker, possibly because he has worked for a long time at the current firm and accumulated firm-specific skills and is familiar with the workplace and the job. It is also possible that workers of retirement age have settled down to live near the firm at which they are employed.

The paper is organized as follows. Section 2 overviews the present state of old-age pensioners and presents the distribution of these older workers among the different pension plans and hours worked. Section 3 presents the Nash bargaining model to analyse the determinations of wages, hours of work and the job investment. Section 4 explains the data and methodology used for estimations and tests the implications of the model, focusing on the effects of pensions, family conditions and personal characteristics of retirement-age workers. Section 5 discusses the determinants of satisfaction from wages, hours worked and job characteristics for such workers. Section 6 concludes the paper.

² See Gordon and Blinder (1980) as a seminal work. Since their static life-cycle models of the retirement behaviour of the elderly were developed, based on the dynamic programming method by Gustman and Steinmeier (1986), Rust (1987) and Berkovec and Stern (1991), Stock and Wise (1990) have formulated the option value model in a dynamic setting.

2. Old-age pensioners in Japan today

This section begins with a review of the different kinds of pensions administered in Japan at present. Japanese public pensions are basically categorized according to three occupational groups: the Employees' Pension Plan (EPP), the National Pension Fund (NPF) and the Government Mutual Aid (GMA). In addition, there are private pension plans such as company pensions and individual pension plans.

With regard to the public pension plans, which are supposed to cover workers throughout Japan, it is important to note that they differ in the way they reduce their payouts to those of retirement age who continue to work. Under the EPP, those of retirement age who are still working may or may not have their pension benefits reduced, depending on the number of hours worked and the amount earned; under the GMA or the NPF their pensions are not reduced. Since the EPP covers most of those individuals who have worked as employees in private companies, it is often stated that the Japanese pension system has a strong impact on the labour supply of older individuals.³

The EPP applies the Pension System of Reduction for Retirement-Age Workers (ZAIROU) to those employees whose aged 60–64 and working more than three-quarters of the normal hours of work per week.⁴ This implies that, if older employees want to avoid the ZAIROU reduction, they will want to work for fewer than three-quarters of the hours that make up the normal working week (and earn commensurately less); otherwise their pension benefits will be reduced by 20% or more, depending on their earnings.

With this in mind, let us check the data obtained from the *Work Survey of the Elderly*, which was conducted by Ministry of Health, Labour and Welfare (Japan) in 2000⁵ for those aged 55–69. Table 1 shows the composition of employed pensioners in their early sixties who were working as employees at the age of 55. It is interesting to see that retired workers who were receiving pensions only from the EPP comprise the largest group, i.e. 40.1% of the 1599 respondents, while those receiving the ZAIROU-reduced pension account for 19.6% of the sample. These proportions do not change much even if we include those who were receiving pensions from other pension plans at the same time. This seems to imply that many older employees decrease the number of hours worked to avoid having their pension reduced under the ZAIROU regulations. But we should not rush to this conclusion, because it is possible that they want to work fewer hours simply to ease their way, physically and mentally, into retirement. The next section will deal with this problem.

Figure 1 shows the distribution of hours worked per month, by pension plan. As expected, the distribution of hours worked by older employees under ZAIROU is higher than for those under the EPP. More specifically, the average number of hours worked per month is 162.4 for employees under the ZAIROU and 114.0 for those under the EPP. It is interesting that the standard deviation of the former is 41.1, which is smaller than that of the latter, although the average of the former is larger. This implies that there are many older employees who are working long hours without being subjected to the ZAIROU

³ See the works listed in fn. 1.

⁴ Individual firms can determine the normal hours by themselves within the standard hours of work, i.e. 40 hours a week, which is regulated by the law.

⁵ The survey was also conducted in 1980, 1983, 1988, 1992 and 1996. The reasons why this paper analyses only the survey for 2000 are that information concerning the work satisfaction of retirement-age workers could not be obtained from the other surveys, and that many previous studies have already analysed them.

TABLE 1
Employed Pensioners in their Early Sixties (numbers and percentages)

Type of pension	EPP (100%)	ZAIROU	NPF	GMA	Company PP	Private PP	Total
EPP	654 (40.1%)	0	0	27 (1.7%)	80 (5.0%)	13 (0.8%)	774 (48.1%)
ZAIROU		315 (19.6%)	0	10 (0.6%)	51 (3.2%)	4 (0.2%)	380 (23.6%)
NPF			55 (3.4%)	0	0	1 (0.0%)	56 (3.5%)
GMA				206 (12.8%)	6 (0.4%)	1 (0.0%)	213 (13.2%)
Company PP					152 (9.5%)	8 (0.5%)	160 (10.0%)
Private PP						25 (1.6%)	25 (1.6%)

Notes:

1. PP = pension plan"; EPP = Employees' Pension Plan; NPF = National Pension Fund; GMA = Government Mutual Aid.

2. Each of the diagonal elements of the table shows the number (%) of pensioners receiving benefits from only one pension plan, and the non-diagonal elements relate to those receiving pensions from two plans.

3. EPP includes plans for the injured and widows/widowers, and incumbent pension plans for those who postphone receiving benefits.

The national pension fund excludes pensioners receiving benefits from other plans. "Company pension plans" refers to pension plans of individual companies, including retirement pensions. Workmen's compensations are included in private pension plans.

The total number of employed respondents in their early sixties is 1,599, but among them are 9 who are receiving benefits from three different types of pension. They are double-counted in this cross table.

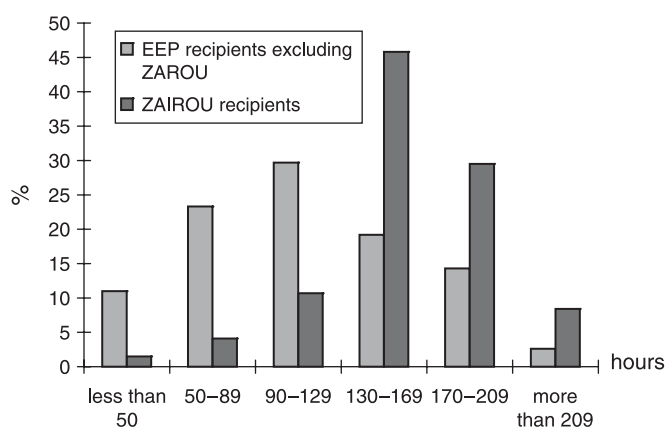


FIGURE 1. Distributions of Monthly Hours Worked

pension reductions. For example, 17.2% of the employees under the EPP work more than the standard number of hours per month, which is 160. There can be two reasons for this. First, it may be that in the surveyed month that they worked for more hours than usual. Second, they may habitually work for long hours but not report them to the Social Insurance Office, to avoid having their pension reduced by the ZAIROU restrictions. The problem is that the self-application system tends to be adopted for EPP employees in determining whether or not they should be subjected to ZAIROU.⁶

⁶ According to a staff member of the Social Insurance Office, they sometimes conduct a sample survey in the area over which they have jurisdiction.

TABLE 2

Suppressive Effects of the Pension Reduction Scheme on the Labour Supply of Those in Their Early Sixties

Answer	ZAIROU recipients	EPP recipients
"I do not care about it at all"	186 (76.5%)	183 (28%)
"I control hours and days of work"	57 (23.5%)	169 (25.9%)
"I do not work at all"		301 (46.1%)

There is additional evidence showing that the extent of reduction under the ZAIROU scheme is exaggerated by those affected. The survey conducted in 2000 asked if retirement-age workers controlled the number of hours and days of work to avoid the ZAIROU pension reduction scheme. Table 2 reports respondents' results, distinguishing between those of retirement age who are working under the EPP and those who are working under ZAIROU. Among those working under ZAIROU, 76.5% answered "I do not care about it at all", while 23.5% agreed that "I control my number of hours and days of work". In turn, 28% of those under the EPP answered "I do not care at all", 25.9% said "I control my number of hours and days of work" and 46.1% said "I do not work at all". These results seem to indicate that the suppression effect on labour supply of the ZAIROU pension reduction scheme is large. However, caution must be exercised in interpreting the results obtained from a survey of this kind. According to the replies to other questions, many who answered "I do not work at all" were actually looking for a job; that is, to the question of "Why don't you work?" 45.4% of them said "I cannot get a job although I want to work". Furthermore, in answer to the question concerning why they could not get a job, 68.6% replied "because I cannot find a job suitable to me". These results reveal that, even if they do not actually care much about the reductive aspect of their pension scheme, they are likely to exaggerate its negative effect on their labour supply. Most workers do not like their income to be reduced.

It is also noteworthy that the present pension system can *promote* the labour supply of retirement-age workers, for several reasons. First, if workers choose to postpone receiving their pensions, even if they are entitled to draw them, they will receive a higher pension rate later: the rate of return for the postponed amount of pension is said to be around 8%, which is good higher than the interest rates currently prevailing in Japan. If they postpone receipt of their pensions to enable them to draw higher benefits later, and try to finance their living expenses by working during the period of postponement, then the pension system can be seen to stimulate the labour supply of workers of retirement age. Second, in order to qualify for a pension a worker has to have paid premiums for a certain length of time, and those older workers who have not yet fulfilled this qualification will therefore wish to continue working. Thus, the present pension system has some features that encourage the labour supply of retirement-age workers.

3. A bargaining model

Now assume that a worker and a firm meet and bargain over employment conditions. The bargaining is of the Nash type, so they share a rent arising from firm-specific skills and/or familiarity with the workplace. Generally speaking, with age individuals become weaker in physical strength and memory, and are also more unlikely to have family members

to care for. Therefore, many older people are employed after mandatory retirement as non-regular workers, and they bargain with their employing firm every year, in adjusting to their changing physical and family conditions. It is assumed that, if there is no rent between a worker and a firm, the bargaining breaks down and the worker quits the labour market at least for a year.⁷

For simplicity of analysis, it is assumed that the worker's utility defined as U is represented by a separable function,

$$U = W + F - G(W, F) + Y^0 - hD(c, \alpha), \quad (1)$$

where W is defined as the wage, h as hours of work, F as the full amount of the pension the worker can receive, $G(W, F)$ as the reduced amount of the pension, Y^0 as non-labour income and D as the marginal disutility of hours of work expressed in monetary terms. The marginal disutility of hours of work is a function of the amount of job investment in improving the employee's life at work, c , and a shift parameter, α , in the following way. ($D_c < 0$ and $D_\alpha > 0$, where the subscript implies differentiation.) The shift parameter represents factors such as age, sex, health, the pension and the number of other income earners in his family, which are supposed to affect the marginal disutility. This simplified specification makes it easier to analyse how each of the exogenous variables affects the determination of the wage, hours of work and the job investment without serious loss of generality.⁸ If the worker does not work, then it holds that $W = 0$, $h = 0$, $c = 0$, $G = 0$ and $D = 0$. It is also assumed that $G_W \geq 0$ and $G_F \geq 0$.

Let us define the worker's marginal productivity as p , which is measured by the maximum value he can produce in an hour. It is possible that if he is transferred to a physically more favourable job he will not be able to achieve this maximum productivity, and then his productivity will be $ph - c$. It is also possible that the new job will require some training. This means that job investment includes not only the cost of improving the quality of work, e.g. the working environment, but also the reduction in productivity resulting from the job transfer.

The firm's profit, Π , is given by

$$\Pi = ph - c - W = R_f, \quad (2)$$

where R_f stands for the rent the firm receives from employing the worker. Note here that the 'rent' is equal to the profit. This is because if the firm does not employ the worker its profit is zero. In turn, considering that the worker can receive his full pension and $h = 0$ if the negotiation breaks down, we define his rent, R_w , as

$$R_w = W - G(W, F) - hD(c, \alpha). \quad (3)$$

⁷ It is not denied that the worker may find work the following year if economic conditions change.

⁸ In particular, the separable function assumed here can be criticized on the ground that the pension is assumed to affect the marginal disutility of hours of work while the wage is not. This criticism is reasonable if the worker is assumed to use the pension only for consumption. However, it may be thought that the worker feels secure with the pension because he can obtain it whenever he retires from the labour market. The income of another family member can be interpreted similarly.

Then the Nash product is given by

$$\log(R_f) + \log(R_w) = \log(ph - W - c) + \log(W - G - hD). \quad (4)$$

In this specification it is assumed, for simplicity of analysis, that the bargaining powers of worker and employer are equal.

The first-order conditions are given by differentiating (4) with respect to W , h and c as follows:⁹

$$-\frac{1}{R_f} + \frac{1}{R_w}(1 - G_w) = 0; \quad (5)$$

$$\frac{1}{R_f}p - \frac{1}{R_w}D = 0; \quad (6)$$

$$-\frac{1}{R_f} - \frac{1}{R_w}hD_1 = 0. \quad (7)$$

Rearranging the above system, we obtain

$$W = \frac{1}{1 + (1 - G_w)}[(ph - c)(1 - G_w) + G + hD]; \quad (5')$$

$$D = p(1 - G_w); \quad (6')$$

$$-hD_c = 1 - G_w. \quad (7')$$

Under the current EPP system, G_w and G_F increase stepwise as W increases. More specifically, if a worker works for three-quarters of the firm's regular hours or less, then $G_w = 0$ and $G_F = 0$; in other words, the pension will be fully paid. If a worker works for more than three-quarters of his regular hours and F is 22 or less, then $G_w = 0$ and $G_F = 0.2$ in the range $W < 22 - 0.8F$, $G_w = 1/2$, and $G_F = 0.6$ in the range $22 - 0.8F \leq W \leq 34$, and $G_w = 1$ and $G_F = 0.6$ when $W > 34$ unless $F < G$. Note here that the unit is ¥10,000 and that where $F > 22$ the scheme is a little different from the above.¹⁰

As is well known, the worker and the firm are likely to choose as a bargaining solution one of the kinked points on the pension scheme. However, here I focus not on the problem of which point they choose, but rather on how the scheme affects the wage, the number of hours worked and the job investment in improving working conditions, assuming that they have chosen some solution. That is, my aim is to learn how these endogenous variables differ depending on the level of G_w , on where the worker decides to work and on the level of F that he is qualified to receive.¹¹

⁹ It is assumed here that the second-order conditions are satisfied.

¹⁰ See Ohashi (2000) for a more precise formula of the present pension system.

¹¹ See Ohashi (2000) for the analysis on the Nash bargaining solutions.

In order to know the effects of G_w , I conducted a comparative-statics analysis on the system consisting of (5'), (6') and (7'). To begin with, differentiating (6') with G_w ,

$$\frac{dc}{dG_w} = -\frac{p}{D_c} > 0,$$

where $D_c < 0$, as assumed before. Thus, we can easily see that it is rational for the employee who works at a higher level of G_w to invest more in the improvement of his working conditions. We next differentiate (7') with G_w , and get

$$\frac{dh}{dG_w} = -\frac{1}{D_c} \left(hD_{cc} \frac{dc}{dG_w} - 1 \right).$$

This shows that the effect of G_w on h depends on D_{cc} . Although the size of D_{cc} is an empirical question, let us assume that it is negligibly small; then the effect of G_w on h is negative. As for the effect of G_w on W , differentiating (5) with G_w , we can obtain

$$(2 - G_w) \frac{dW}{dG_w} = -p - (ph - c - W) + (1 - G_w) \frac{dh}{dG_w} - (1 - G_w) \frac{dc}{dG_w} < 0.$$

In words, an increase in G_w has the effect of decreasing W *directly* by changing the income share between the firm and the worker and *indirectly* by raising c and decreasing h . This implies that the worker who works at the peak of G_w , because he can receive a high wage owing to his high productivity, has an incentive to work fewer hours and to improve his working conditions even if he has to accept a lower wage relative to his productivity.

The full amount of pension does not appear explicitly in the system, but it can affect the bargaining solution through its effect on the disutility of labour. That is, since an increase in F can be considered to make the worker choose to reduce the disutility of labour further, it means an increase in the shift parameter, whose effects are assumed to be $D_\alpha > 0$ and $D_{c\alpha} < 0$.

I now analyse the effects of the shift parameter by conducting a comparative-statics analysis on the system. Differentiating (6') with α , I obtain

$$\frac{dc}{d\alpha} = -\frac{D_\alpha}{D_c} > 0.$$

This implies that an increase in F , accompanied by an increase in α , raises the job investment.

Next, the differentiation of equation (7') with α gives us

$$\frac{dh}{d\alpha} = -\frac{1}{D_c} \left(hD_{c\alpha} + hD_{cc} \frac{dc}{d\alpha} \right).$$

The effect of α on hours of work is ambiguous because we assume $D_{c\alpha} < 0$ here; that is, we assume that an increase in α strengthens the decreasing effect of the job investment on the disutility, while an increase in c brought about by an increase in α raises the number of hours worked, as shown in the second term in parentheses. It is an empirical question which effect dominates. The next section will show that the effect of a pension payment on hours worked is negative and statistically significant at the ordinary level of

confidence. If the effect of α on hours worked is negative, then it is decisively determined from equation (5') that an increase in F accompanied by an increase in α will decrease the wage by increasing the job investment and decreasing the hours worked.

The number of other income earners in the worker's family, the non-labour income and any mortgage repayments, which are used as explanatory variables in the empirical sections, also do not appear explicitly in this system, but they are assumed to affect the bargaining solution through α , along with the pension. In turn, the sex, age, tenure and health of the worker are assumed to affect labour productivity.

The social rent, which is shared between the worker and the firm, is defined as R . If this social rent is negative, the bargaining breaks down. Therefore, R must be non-negative for the bargaining to reach an agreement; i.e.,

$$R = R_f + R_w = ph - c - hD(c, \alpha) \geq 0. \quad (8)$$

If this relation does not hold, we cannot observe the employment relation.¹² That is, we can observe wages and hours worked only for the bargaining in which equation (8) holds. Thus, this relation will be used to remove selection bias in the empirical analysis.

4. Empirical results

This section analyses how wages, hours of work and labour supply of retirement-age workers are determined, focusing on the effects not only of ordinary factors such as age, sex, health, education, tenure, industry and occupation, but also on pension payments and family factors. The micro data used are from the *Work Survey of Older People*, conducted by Ministry of Health, Labour and Welfare (Japan) for those aged 55–69. Since the main aim of the present paper is to analyse the effects of pension payments, I focus here employees aged 60 or over. The sample size is 12,752 at this stage, but those who were not participating in the labour market were dropped from the analysis. More precisely, I dropped those who were not working for the following reasons: “I cannot work physically”; “I have family members who need care”; and “I want to devote myself solely to enjoying my hobby or doing volunteer work”. This data restriction reduced my sample size to 8,581. Furthermore, those who were working as company executives or were self-employed were dropped, because their positions are determined not only by their discretionary choices but also by uncontrollable factors such as company decisions, their own assets and family conditions; because their incomes are biased downward because of tax measures; and because hours worked are ambiguous and are determined by themselves. The sample size at this stage is therefore reduced to 5,172.

Since the aim of this paper is to analyse how workers decide to retire as they get older, those who were not working when they were 55 were deleted from the sample. This reduced the sample size to 5,125. It should be noted here that 232 individuals who were

¹² Note that in equation (8) that $G(W, F)$ does not appear. This is because it is effective only for those of retirement age who are working more than three-quarters of the normal hours. In other words, if the right-hand side of (8) is negative, it is difficult for these older workers to get a job for any number of hours of work.

not working at the age of 55 said that they were “usually in work” at the time of being surveyed.¹³

In the empirical analysis that follows two points should be noted. First, wage and hours equations are estimated in the reduced form. This is because the Nash bargaining model simultaneously determines wages, hours of work and job investment, and gives the reduced-form equations for the dependent variables. Second, since the dependent variables are incidentally selected and observed only when the social rent is positive, the sample selection bias can be generated. Thus, Hickman’s two-step estimation procedure is used. In so doing, equation (8) with a random term added is used as a selection equation. The precise form of the estimation equation for wages is

$$W_i = \beta'X_i + u_i, \quad (9)$$

$$R_i = \alpha'Y_i + v_i, \quad (10)$$

$$W_i > 0 \quad \text{if } R_i \geq 0 \quad \text{and} \quad W_i = 0 \quad \text{otherwise,} \quad (11)$$

where β' and α' are the row vectors of coefficients for the wage and the selection equations, respectively; X_i and Y_i are the column vectors of the independent variables; and u_i and v_i are the random terms that are assumed to have a bivariate normal distribution with $E(u_i) = 0$ and $E(v_i) = 0$. If the correlation between the two random terms is zero, there will be no sample selection bias. However, it is expected that the correlation between two random terms is positive because the Nash bargaining determines the wage at a higher level, the greater is the social rent. Thus, we can expect that the estimated coefficient of the inverse Mills ratio defined as *lambda* is positive. Similarly, we can estimate hours equations, but in this case it is ambiguous whether or not the correlation between the two random terms is positive. This is because the theoretical effect of the social rent on hours of work is not straightforward.

On estimating wage and hours equations, the data are separated into those whose are aged between 60 and 64 and those between 65 and 69. Summary statistics on the variables used for analysing the two groups are reported in Table 3. Table 4 shows the estimated results of wages and hours equations for those in their early sixties, and Table 5 shows the same for those in their late sixties. Each of the related selection equations is shown in the lower part of the tables. In the estimations of equations (T1) in Table 4 and (T4) in Table 5, the logarithm of *wage* (whose data comprise the total amount of wages, including taxes, paid in September 2000) is used as the dependent variable; and in equations (T6) and (T7) in Table 6 the logarithm of hourly wage rate is used as the dependent variable to make it easy to interpret the results of the bargaining. The data used for *hours* are the total hours worked in September (days worked \times no. of hours worked per day).

Tables 4 and 5 provide some interesting findings. First, the effects on wages and numbers of hours worked of *pension*, i.e. the total amount of pension benefits,¹⁴ are negative and

¹³ Since the number of these individuals is relatively small, the inclusion of them did not essentially change my results.

¹⁴ The “total amount of pensions” means the full amount that retirement-age workers are entitled to receive. The 2000 Survey reports the reduced amount of the pension when the ZAIROU reduction is enforced.

TABLE 3
Summary Statistics

Observation variable	Workers in their early sixties				Workers in their late sixties			
	Mean	Std dev.	Min.	Max.	Mean	Std dev.	Min.	Max.
<i>wage</i>	16.06	15.19	0	166	10.88	11.71	0	125
<i>hours</i>	138.58	56.44	2	312	118.8	59.93	2	300
<i>sex</i>	0.621	0.485	0	1	0.678	0.467	0	1
<i>age</i>	61.92	1.420	60	64	66.80	1.401	65	69
<i>tenure</i>	14.77	13.89	0	49	13.73	14.06	0	53
<i>school_u</i>	0.112	0.315	0	1	0.134	0.341	0	1
<i>school_j</i>	0.422	0.494	0	1	0.468	0.499	0	1
<i>b_health</i>	0.196	0.397	0	1	0.232	0.422	0	1
<i>m_retire</i>	0.517	0.499	0	1	0.620	0.485	0	1
<i>prof</i>	0.013	0.117	0	1	0.009	0.095	0	1
<i>manage</i>	0.019	0.137	0	1	0.035	0.184	0	1
<i>office</i>	0.008	0.093	0	1	0.004	0.067	0	1
<i>sale</i>	0.021	0.143	0	1	0.021	0.146	0	1
<i>service</i>	0.009	0.094	0	1	0.009	0.095	0	1
<i>maint</i>	0.039	0.195	0	1	0.028	0.166	0	1
<i>trans</i>	0.053	0.225	0	1	0.038	0.191	0	1
<i>commu</i>	0.084	0.278	0	1	0.062	0.242	0	1
<i>dig</i>	0.019	0.139	0	1	0.026	0.160	0	1
<i>agri</i>	0.085	0.279	0	1	0.057	0.233	0	1
<i>l_scale</i>	0.065	0.247	0	1	0.029	0.170	0	1
<i>public_scale</i>	0.058	0.235	0	1	0.044	0.206	0	1
<i>m_scale</i>	0.133	0.340	0	1	0.098	0.297	0	1
<i>h_loan</i>	0.193	0.395	0	1	0.153	0.361	0	1
<i>edu_cost</i>	0.077	0.267	0	1	0.076	0.266	0	1
<i>ZAIROU_d</i>	0.102	0.302	0	1				
<i>kyou_d</i>	0.096	0.295	0	1	0.144	0.351	0	1
<i>pension</i>	10.16	10.30	0	54	15.81	9.289	0	59
<i>n_earn</i>	1.318	0.940	0	5	1.384	0.974	0	5
<i>ZAIROU_d</i>	0.102	0.303	0	1				
<i>s_EPP_d</i>	0.452	0.498						
<i>EPP_d</i>	0.530	0.499	0	1	0.622	0.627	0	1
<i>GMA_d</i>	0.095	0.294	0	1	0.132	0.338	0	1

Notes:

1. The units of *wage* and *pension* are ¥10,000, and those of *tenure* and *age* are years.
2. The definitions of variables that are not explained in the text are follows: *school_u* is the dummy variable (taking 1 for university graduates), and *school_j* is the dummy variable for junior high school graduates); *prof*, *manage*, *office*, *sale*, *service*, *maint*, *trans*, *commu*, *dig* and *agri* are dummy variables representing occupations of elderly workers: professional and technical work is abbreviated as *prof*, managerial as *manage*, security-related as *maint*, transportation-related as *trans*, communication as *commu*, mining as *dig* and agricultural as *agri*. The reference occupation is manufacturing work. *l_scale* and *m_scale* are dummy variables showing the size of the private company at which each old worker is employed: *l_scale* represents the companies employing more than 1,000 employees and *m_scale* the ones employing between 300 and 999 employees. *public_scale* is governmental officers including local ones. The reference group is elderly workers who are employed at the small-scale companies with fewer than 299 employees.

statistically significant at the 5% level of confidence. These are consistent with the findings obtained by many previous studies, including Seike (1993), Tachibanaki and Shimono (1994) and Abe (2001).

There are three possible explanations of the negative effects. (i) The first is given by the traditional theory of labour supply. If leisure is a normal good, an increase in an older

TABLE 4
Determinants of Wages and Hours of Work for those in their Early Sixties

Dependent variable	Equation								
	(T1) <i>ln_wage</i>			(T2) <i>ln_hours</i>			(T3) <i>ln_hours</i>		
	coef.	s.e.	p-value	coef.	s.e.	p-value	coef.	s.e.	p-value
<i>sex</i>	0.765	0.071	0.00	0.289	0.054	0.00	0.298	0.057	0.00
<i>age</i>	-0.019	0.014	0.17	-0.004	0.010	0.66	-0.010	0.010	0.33
<i>tenure</i>	0.011	0.001	0.00	0.004	0.001	0.00	0.006	0.001	0.00
<i>b_health</i>	-0.312	0.101	0.00	-0.213	0.078	0.01	-0.226	0.079	0.00
<i>school_u</i>	0.204	0.069	0.00	-0.117	0.050	0.02	-0.111	0.050	0.03
<i>school_j</i>	-0.068	0.045	0.13	0.036	0.033	0.27	0.031	0.033	0.35
<i>m_retire</i>	-0.288	0.096	0.00	-0.077	0.075	0.30	-0.096	0.076	0.21
<i>same_j</i>	0.096	0.043	0.02	0.060	0.038	0.11	0.091	0.039	0.02
<i>prof</i>	0.343	0.110	0.00	0.128	0.091	0.16	0.080	0.093	0.39
<i>manage</i>	0.410	0.129	0.00	-0.029	0.110	0.79	-0.044	0.114	0.70
<i>office</i>	0.199	0.129	0.13	-0.456	0.112	0.00	-0.456	0.116	0.00
<i>sale</i>	0.158	0.099	0.11	-0.195	0.086	0.02	-0.251	0.089	0.01
<i>service</i>	0.002	0.133	0.99	-0.047	0.117	0.69	-0.023	0.120	0.85
<i>maint</i>	0.404	0.070	0.00	0.136	0.060	0.02	0.149	0.062	0.02
<i>trans</i>	0.184	0.077	0.02	0.039	0.066	0.56	0.039	0.068	0.57
<i>commu</i>	0.063	0.061	0.30	0.054	0.053	0.31	0.052	0.055	0.35
<i>dig</i>	0.110	0.095	0.25	0.128	0.084	0.13	0.142	0.086	0.10
<i>agri</i>	0.239	0.055	0.00	0.034	0.048	0.48	0.033	0.050	0.51
<i>public_scale</i>	0.193	0.126	0.13	0.045	0.112	0.68	-0.054	0.116	0.64
<i>l_scale</i>	0.153	0.056	0.01	0.064	0.049	0.19	0.027	0.050	0.59
<i>m_scale</i>	0.147	0.042	0.00	0.049	0.036	0.17	0.061	0.037	0.10
<i>h_loan</i>	0.283	0.073	0.00	0.100	0.055	0.07	0.096	0.058	0.10
<i>edu_cost</i>	0.143	0.075	0.06	0.087	0.053	0.10	0.086	0.053	0.11
<i>n_earn</i>	-0.219	0.079	0.01	-0.065	0.062	0.30	-0.066	0.062	0.29
<i>pension</i>	-0.023	0.005	0.00	-0.015	0.004	0.00	-0.013	0.005	0.00
<i>ZAIROU_d</i>	0.194	0.051	0.00	0.230	0.073	0.00			
<i>cross_pz</i>				0.005	0.004	0.23			
<i>s_EPP_d</i>	-0.250	0.041	0.00	-0.122	0.036	0.00			
<i>EPP_d</i>							0.034	0.043	0.43
<i>GMA_d</i>							0.183	0.100	0.07
<i>_const.</i>	3.103	0.873	0.00	4.899	0.621	0.00	5.181	0.642	0.00
Selection equation									
<i>sex</i>	0.314	0.064	0.00	0.314	0.064	0.00	0.329	0.065	0.00
<i>age</i>	-0.004	0.020	0.85	-0.004	0.020	0.85	-0.005	0.020	0.79
<i>school_u</i>	0.121	0.090	0.18	0.121	0.090	0.18	0.054	0.092	0.56
<i>school_j</i>	-0.020	0.059	0.73	-0.020	0.059	0.73	0.002	0.060	0.97
<i>b_health</i>	-0.473	0.068	0.00	-0.473	0.068	0.00	-0.469	0.068	0.00
<i>m_retire</i>	-0.497	0.059	0.00	-0.497	0.059	0.00	-0.501	0.059	0.00
<i>h_loan</i>	0.326	0.075	0.00	0.326	0.075	0.00	0.351	0.076	0.00
<i>edu_cost</i>	0.098	0.105	0.35	0.098	0.105	0.35	0.065	0.106	0.54
<i>pension</i>	-0.021	0.003	0.00	-0.021	0.003	0.00	-0.026	0.004	0.00
<i>n_earn</i>	-0.413	0.029	0.00	-0.413	0.029	0.00	-0.408	0.030	0.00
<i>EPP_d</i>							0.028	0.082	0.73
<i>GMA_d</i>							0.485	0.125	0.00
<i>_cons</i>	1.432	1.205	0.24	1.432	1.205	0.24	1.500	1.219	0.22
λ	0.857	0.345	0.01	0.195	0.280	0.49	0.203	0.281	0.47
Wald chi ²	1198.42			749.40			650.88		

Notes:

No. of obs = 2,544; censored obs. = 987; uncensored obs \geq 1,557.

Although the estimated results are not reported to save space, industry dummies are used in estimating wage and hours equations but not in the selection equation.

TABLE 5
Determinants of Wages and Hours of Work by those in their Late Sixties

Dependent variable	Equation								
	(T4) <i>ln_wage</i>			(T5) <i>ln_hours</i>			(T6) <i>ln_hours</i>		
	coef.	s.e.	p-value	coef.	s.e.	p-value	coef.	s.e.	p-value
<i>sex</i>	0.856	0.121	0.00	0.364	0.089	0.00	0.364	0.089	0.00
<i>age</i>	-0.031	0.026	0.23	-0.023	0.019	0.23	-0.023	0.018	0.21
<i>tenure</i>	0.013	0.002	0.00	0.010	0.002	0.00	0.010	0.002	0.00
<i>b_health</i>	-0.490	0.197	0.01	-0.225	0.148	0.13	-0.215	0.147	0.15
<i>school_u</i>	0.290	0.115	0.01	0.055	0.086	0.52	0.053	0.085	0.53
<i>school_j</i>	0.113	0.120	0.35	0.069	0.088	0.43	0.063	0.088	0.48
<i>m_retire</i>	-0.282	0.106	0.01	-0.123	0.079	0.12	-0.125	0.078	0.11
<i>same_j</i>	0.132	0.067	0.05	-0.009	0.057	0.87	-0.006	0.057	0.92
<i>prof</i>	0.510	0.198	0.01	0.164	0.168	0.33	0.156	0.168	0.35
<i>manage</i>	0.703	0.157	0.00	0.279	0.138	0.04	0.272	0.139	0.05
<i>office</i>	0.262	0.249	0.29	0.000	0.219	1.00	-0.014	0.219	0.95
<i>sale</i>	0.329	0.154	0.03	-0.664	0.130	0.00	-0.677	0.131	0.00
<i>service</i>	-0.391	0.207	0.06	-1.079	0.179	0.00	-1.075	0.179	0.00
<i>maint</i>	0.480	0.122	0.00	0.248	0.105	0.02	0.245	0.105	0.02
<i>trans</i>	0.108	0.134	0.42	0.215	0.113	0.06	0.207	0.113	0.07
<i>commu</i>	0.069	0.103	0.50	0.135	0.087	0.12	0.135	0.087	0.12
<i>dig</i>	0.306	0.137	0.03	0.259	0.116	0.03	0.256	0.116	0.03
<i>agri</i>	0.399	0.098	0.00	0.116	0.083	0.16	0.104	0.084	0.22
<i>public_scale</i>	-0.500	0.200	0.01	-0.425	0.167	0.01	-0.441	0.168	0.01
<i>l_scale</i>	0.029	0.121	0.81	0.098	0.103	0.34	0.096	0.103	0.35
<i>m_scale</i>	0.078	0.073	0.28	0.050	0.062	0.41	0.056	0.062	0.37
<i>h_loan</i>	0.345	0.177	0.05	0.268	0.130	0.04	0.259	0.129	0.05
<i>edu_cost</i>	0.267	0.160	0.10	0.139	0.115	0.23	0.137	0.114	0.23
<i>n_earn</i>	-0.317	0.169	0.06	-0.159	0.126	0.21	-0.152	0.126	0.23
<i>pension</i>	-0.020	0.009	0.03	-0.014	0.007	0.04	-0.015	0.007	0.03
<i>EPP_d</i>	-0.122	0.062	0.05	-0.117	0.046	0.01	-0.072	0.068	0.29
<i>GMA_d</i>							0.123	0.134	0.36
<i>_const.</i>	3.472	1.756	0.05	5.895	1.281	0.00	5.946	1.271	0.00
Selection equation									
<i>sex</i>	0.273	0.083	0.00	0.273	0.083	0.00	0.273	0.083	0.00
<i>age</i>	0.024	0.024	0.31	0.024	0.024	0.31	0.024	0.024	0.31
<i>school_u</i>	-0.003	0.106	0.98	-0.003	0.106	0.98	-0.003	0.106	0.98
<i>school_j</i>	0.274	0.076	0.00	0.274	0.076	0.00	0.274	0.076	0.00
<i>b_health</i>	-0.525	0.079	0.00	-0.525	0.079	0.00	-0.525	0.079	0.00
<i>m_retire</i>	-0.223	0.074	0.00	-0.223	0.074	0.00	-0.223	0.074	0.00
<i>h_loan</i>	0.507	0.097	0.00	0.507	0.097	0.00	0.507	0.097	0.00
<i>edu_cost</i>	0.308	0.139	0.03	0.308	0.139	0.03	0.308	0.139	0.03
<i>pension</i>	-0.025	0.005	0.00	-0.025	0.005	0.00	-0.025	0.005	0.00
<i>n_earn</i>	-0.485	0.036	0.00	-0.485	0.036	0.00	-0.485	0.036	0.00
<i>EPP_d</i>	-0.102	0.092	0.27	-0.102	0.092	0.27	-0.102	0.092	0.27
<i>GMA_d</i>	-0.056	0.180	0.76	-0.056	0.180	0.76	-0.056	0.180	0.76
<i>_cons</i>	-0.615	1.576	0.70	-0.615	1.576	0.70	-0.615	1.576	0.70
λ	1.125	0.571	0.05	0.533	0.434	0.22	0.505	0.432	0.24
Wald chi ²		569.75			518.13				

Notes:

No. of obs = 1,665; censored obs. = 856; uncensored obs. = 809.

See also Table 4 notes.

TABLE 6
Determinants of Hourly Wage Rates

Object	Equation					
	(T7)			(T8)		
	Workers in their early sixties			Workers in their late sixties		
	coef.	s.e.	p-value	coef.	s.e.	p-value
<i>sex</i>	0.461	0.059	0.00	0.492	0.075	0.00
<i>age</i>	-0.014	0.011	0.22	-0.008	0.016	0.60
<i>tenure</i>	0.006	0.001	0.00	0.003	0.002	0.08
<i>b_health</i>	-0.074	0.080	0.36	-0.268	0.123	0.03
<i>school_u</i>	0.296	0.054	0.00	0.236	0.072	0.00
<i>school_j</i>	-0.097	0.036	0.01	0.045	0.074	0.54
<i>m_retire</i>	-0.182	0.078	0.02	-0.158	0.066	0.02
<i>same_j</i>	0.034	0.037	0.36	0.141	0.045	0.00
<i>prof</i>	0.222	0.093	0.02	0.348	0.131	0.01
<i>manage</i>	0.447	0.111	0.00	0.426	0.106	0.00
<i>office</i>	0.652	0.112	0.00	0.266	0.168	0.11
<i>sale</i>	0.367	0.086	0.00	0.997	0.102	0.00
<i>service</i>	0.052	0.115	0.65	0.687	0.138	0.00
<i>maint</i>	0.264	0.060	0.00	0.233	0.081	0.00
<i>trans</i>	0.148	0.066	0.02	-0.104	0.089	0.24
<i>commu</i>	0.004	0.053	0.95	-0.065	0.068	0.34
<i>dig</i>	-0.016	0.083	0.84	0.048	0.091	0.60
<i>agri</i>	0.207	0.047	0.00	0.286	0.065	0.00
<i>public_scale</i>	0.140	0.058	0.02	-0.071	0.132	0.59
<i>l_scale</i>	0.091	0.048	0.06	-0.068	0.080	0.39
<i>m_scale</i>	0.096	0.036	0.01	0.026	0.048	0.59
<i>h_loan</i>	0.173	0.061	0.00	0.080	0.110	0.47
<i>edu_cost</i>	0.050	0.059	0.40	0.129	0.098	0.19
<i>n_earn</i>	-0.131	0.063	0.04	-0.160	0.106	0.13
<i>pension</i>	-0.008	0.005	0.07	-0.006	0.006	0.32
<i>ZAIROU_d</i>	-0.122	0.053	0.02			
<i>s_EPP_d</i>	-0.133	0.044	0.00			
<i>EEP_d</i>				-0.018	0.059	0.76
<i>GMA_d</i>	0.071	0.099	0.47	-0.035	0.115	0.76
<i>_const.</i>	-1.840	0.696	0.01	-2.438	1.084	0.03
Selection equation						
<i>sex</i>	0.329	0.065	0.00	0.273	0.083	0.00
<i>age</i>	-0.005	0.020	0.79	0.024	0.024	0.31
<i>school_u</i>	0.054	0.092	0.56	-0.003	0.106	0.98
<i>school_j</i>	0.002	0.060	0.97	0.274	0.076	0.00
<i>b_health</i>	-0.469	0.068	0.00	-0.525	0.079	0.00
<i>m_retire</i>	-0.501	0.059	0.00	-0.223	0.074	0.00
<i>h_loan</i>	0.351	0.076	0.00	0.507	0.097	0.00
<i>edu_cost</i>	0.065	0.106	0.54	0.308	0.139	0.03
<i>pension</i>	-0.026	0.004	0.00	-0.025	0.005	0.00
<i>n_earn</i>	-0.408	0.030	0.00	-0.485	0.036	0.00
<i>EEP_d</i>	0.028	0.082	0.73	-0.102	0.092	0.27
<i>GMA_d</i>	0.485	0.125	0.00	-0.056	0.180	0.76
<i>_cons</i>	1.500	1.219	0.22	-0.615	1.576	0.70
λ	0.559	0.280	0.04	0.600	0.359	0.09
Wald chi ²		966.3			705.61	

Notes:

No. of obs. = 2,544, censored obs. = 987, uncensored obs. = 1557 for (T7); no. of obs. = 1,665, censored obs. = 856 and uncensored obs. = 809 for (T8).

See also Table 4 notes.

worker's pension will raise his non-labour income so that he will prefer leisure to wages and thereby wish to reduce the number of hours worked. On this definition of the income effect, it is assumed that the hourly wage rate is fixed. But equation (7) in Table 6 shows that the effect of *pension* on the wage rate for those in their early sixties is negative and statistically significant at the 10% level of confidence, and equation (8) shows that it is negative, although not significant, for those in their late sixties. These results are not inconsistent with the standard theory of labour supply if marginal productivity decreases with a decrease in hours worked. However, if marginal productivity remains constant or increases as hours worked decrease, the wage rate will not fall in the framework of the standard theory. (ii) The second explanation of the negative effects is that, according to the bargaining model developed here, retirement-age worker who found that his non-labour income was raised by an increase in his pension, and so decided to work in favour of greater job investment, would accept a decrease in his wage rate. In the bargaining model, the wage rate can decrease so long as marginal productivity is not observed to increase disproportionately with each decrease in hours worked. Thus, in the bargaining model that incorporates job investment, the pension can have a negative effect on the wage rate. (iii) A third explanation, which was stressed by previous studies, focuses on the reduction scheme of the pension plan, as explained in Section 2. Whether this explanation is effective or not is an empirical question, and will be discussed below.

Second, as shown in Table 4, the effect on wages and hours worked of the dummy variable, i.e. *zairou_d*, which represents whether each elder employee will work if he is subject to the ZAIROU restrictions, is positive and statistically significant at the ordinary level of confidence. This implies that older employees working whose pensions are reduced by ZAIROU work longer hours and earn more than those who are working without having their pensions reduced. Note here that the dummy variable *s_EPP_d*, showing the recipients of the EPP pension without a reduction, has a negative effect on hours worked that is statistically significant at the 1% level. This means that the pension system requires those drawing their pensions to work fewer hours if they want to avoid a pension reduction, so the introduction of *zairou_d* as an explanatory variable is not appropriate because it is an endogenous variable in the determination of wages and hours of work.

It is interesting to notice in Table 4 that the cross-term of *zairou_d* and *pension*, i.e. *cross_pz*, is not statistically significant at the 10% level of confidence in the hours equation; moreover, its coefficient is positive. This means that the ZAIROU pension reduction scheme has no effect on the number of hours worked, provided that individuals choose to work under the scheme. But we should not draw too hasty a conclusion here, because the application of ZAIROU automatically reduces the pension by 20% regardless of the wage level, and so such workers will decrease the number of hours worked to three-quarters of the firm's standard hours. In other words, the effect of the automatic reduction in pension remains to be determined.

In order to ascertain the effect of the 20% reduction in pension, I focused on the pension system of the Government Mutual Aid (GMA), which is paid to eligible civil servants. Under this system the pensioners are exempt from any reduction if they continue to work, regardless of the number of hours worked and the wage received. Therefore, comparing the effects of the EPP and the GMA pensions makes sense. In equation (3) the dummy variable for the recipients of the GMA, *GMA_d*, is introduced as an explanatory variable along with that for the EPP, *EPP_d*, which combines *zairou_d* and *s_EPP_d*,

allowing us to observe the effect of the EPP as a whole.¹⁵ As can be seen in equation (3), the effect of *GMA_d* on hours worked is positive and significant at the 10% level of confidence, while that of *EPP_d* is not significant. It is also interesting to note from equation (3) that the recipients of GMA pensions are more likely to participate in the labour market. This implies that recipients of a GMA pension are more inclined to work than other individuals of a similar age. It can be presumed that, since civil servants can find favourable jobs after mandatory retirement, more of them wish to work. It is noteworthy in equation (7) that the effects of *zairou_d* and *s_EPP_d* on hourly rates of wage are negative and statistically significant at the ordinary level of confidence, while the effect of a GMA pension is positive although not significant. In addition, many GMA recipients work in government sectors where wages are relatively high. This is seen in the positive and large coefficient of *public_scale*, which is the dummy variable relating to those of retirement age who are working as civil servants. According to our data, 42% of GMA recipients are still working as civil servants. But it is interesting that these effects seem to disappear for those in their late sixties. In equation (8) you can see that the effect of *GMA_d* on hourly wages is negative and not significant at the ordinary level of confidence; at the same time, its effect on labour supply also disappears, as is shown by its selection equation.

The EPP too has a pension reduction scheme that is applied to recipients aged 65–69, but it is less restrictive. More specifically, under the EPP, if 80% of the full pension plus earnings of the recipient exceed ¥480,000, his pension is reduced by half of the amount of the excess. Therefore, it is meaningful to compare the effects of the EPP between those in their early sixties and late sixties. Interestingly, the findings are contrary to expectation. From (3) and (6) we can see that the effects of *EPP_d* on hours worked and labour participation are positive for those in their early sixties but negative for those in their late sixties, although neither is statistically significant at the ordinary level. If the pension reduction scheme were effective, the above relation would be reversed.

Two points should be stressed here. One is that, since *EPP_d* and *GMA_d* represent the feature of each pension system when the income effect is controlled for by *pension*, their effects on wages and hours worked can be either positive or negative, *a priori*. Second, the EPP pension reduction scheme does not work if the number of hours worked drop sufficiently; that is, it does not affect decisions on labour participation of the retired so long as the hours restriction imposed by the firm is less than three-quarters of the normal number of hours worked.

To sum up, I could not find any strong indication of the suppressive effects of the EPP pension reduction scheme in the year 2000. Abe (2001) found that the impact of this reduction scheme lay in the trend of decreasing from 1983 to 1992. The findings in the present paper are in line with this, and imply that the effect of the EPP pension reduction scheme had disappeared by 2000. In part at least, this trend may be due to the reforms of EPP scheme.¹⁶

¹⁵ As is known from Table 1, some retirement-age individuals receive pensions from both the EPP and the GMA; they are classified under the fund from which they receive the greater pension. The reference group consists mainly of recipients from the NPF and retirement-age workers who are not receiving pensions, including those who are entitled to do so. Seike and Shimada (1995) and Abe (2001) focused on the existence of those who were not receiving pensions although they were entitled to do so, because the number of such persons is not small. According to the data, among those in their early sixties who are entitled to receive the EPP, 19% are not receiving pensions and 76% are working. In the reference group the proportion who are working amounts to 34%.

¹⁶ The EPP pension reduction scheme was reformed in 1986, 1989 and 1994, so as to mitigate its suppressive effect on the labour supply of retirement-age individuals.

Third, it is often argued that pensions function as a subsidy to employment of those of retirement age, but the theoretical implications of this argument are elusive.¹⁷ In particular, according to this interpretation it is difficult to understand how such a subsidy works. If the argument describes a subsidy to firms paying wages, then pensions should have a positive effect on elderly employment.¹⁸ But in fact they have a negative effect, not only on the hourly wages of retirement-age workers, but also on their labour supply, as is shown in Tables 4, 5 and 6. The bargaining model in this paper does not regard pensions as a subsidy, but simply as a kind of non-labour income that makes older workers prefer more leisure and/or job investment to income. Note that pensions have no effect on social rent in equation (T8), and hence none on the promotion of the employment of older workers. Therefore our bargaining model can rationalize the negative effects of pensions on both labour supply and the hourly wages of workers of retirement age.

Fourth, Tables 4 and 5 show that the number of other income-earners in the family, *n_earn*, is an important factor for older individuals determining their labour supply. More specifically, it has a negative effect on wages and labour market participation, and the effects of these are statistically significant at the ordinary level of confidence. But the effect of *n_earn* on hours worked cannot be ascertained statistically, either for those in their early sixties or for those in their late sixties. Presumably, having additional income-earners in the household decreases the economic need for those of retirement age to work and increases the need of the household for someone to devote time solely to housework, if not for extra care. But it seems that *n_earn* has some effects that differ from the income effect of pensions. For example, a wife can easily be supported by her working husband.¹⁹ It is also interesting to find from Table 6 that the effect of *n_earn* on the hourly wage is negative and statistically significant at the 5% level for those in their early sixties. This can be interpreted as indicating that older workers, along with other income earners, invest in jobs to increase their job satisfaction in the same way as those with large pensions do.

Fifth, as for the wage equations estimated by the Hickman's two-step estimation procedure in Tables 4, 5 and 6, the inverse Mills ratio defined as *lambda* is positive and statistically significant at the ordinary level of confidence for those in both their early and late sixties. This implies that the random term of the wage function is positively correlated with that of the selection equation, because the wage level and the hourly wage are likely to be higher, the larger is the social rent, as we would expect. In turn, *lambda* in the hours equations are positive but not statistically significant. Accordingly, it can be said that the selection bias is serious in the estimations of the wage functions but not in the hours equations.

Sixth, Tables 4 and 5 show that the experience of mandatory retirement, *m_retire*, has negative effects on the wages, hours worked and labour supply of retirement-age individuals, of which those on wages and labour supply are statistically significant at the ordinary level of confidence. According to Table 6, it also decreases hourly wages, implying that its effect on hours worked is weaker than that on wages. In turn, as shown in Tables 4

¹⁷ See e.g. Tachibanaki and Shimono (1994); Ogawa (1998b) and Mitani (2001).

¹⁸ One of the reasons why they propose the subsidy hypothesis is that, in the estimated equations of hours worked or labour supplied, *ziron_d* has a positive effect. However, as discussed above, *zairou_d* is endogenous.

¹⁹ See Chuma (1991) for joint retirement decisions of elderly couples in Japan.

and 5, the dummy variable, *same_j*, which indicates whether retirement-age employees are working at the same job as when they were 55, has positive effects on wages, and is statistically significant at the 10% level. It is interesting that the effect of this dummy variable on hours worked is positive for those in their early sixties but negative for those in their late sixties. This may lead us to conclude that the positive effect of *same_j* on the hourly wages of those in their late sixties is statistically significant while for those in their early sixties it is not. Put another way, those in their early sixties who are working at the same occupation as before earn more by working longer hours, while those in their late sixties earn more by receiving higher hourly rates.

Finally, workers' physical and economic conditions, which are shown by the dummy variables *b_health* (with 1 for older workers in bad health and 0 otherwise) and *h_loan* (with 1 for older workers paying a house loan and 0 otherwise), have the expected effects on wages, hours worked and labour supply of the retired, and these are consistent with the results of previous studies such as Seike (1993) and Higuchi and Yamamoto (2002). In turn, the effects of *edu_cost* (with 1 for older workers having to bear educational costs and 0 otherwise) are not clear except for their positive effect on wages. This seems to imply that the role of older workers in paying for the family's educational costs is not significant.

5. Determinants of job satisfaction

The work satisfaction of older employees depends on a number of factors, including the type of job, the working environment and economic conditions, not to mention wages and hours of work. It is quite possible that as workers grow older they come to place greater value on fewer hours of work, jobs that they feel are worth doing, a good working environment and pleasant workplace relationships; in other words, for retirement-age employees job satisfaction may be more important than wages. Among the factors affecting job satisfaction, hours of work were chosen as a dependent variable for analysis above because they are observable and are explicitly related to the social rent and to wages in the model, while the factors that can be improved by job investment are unobservable; furthermore, job investment itself is unobservable. Therefore, to test the implications of the model, I focused on the job satisfaction that job investment affects.

The survey used in this paper asked retirement-age employees how satisfied they are with their working environment, with workplace relationships, with the application of their ability and knowledge, their perceived value of their work, the number of hours worked and the wage level of their current job. They were asked to choose one out of the four responses: "very satisfied", "somewhat satisfied", "not very satisfied" and "not at all satisfied". From the answers given to these questions, I shall now analyse the determinants of each satisfaction.

Tables 7(A) and (B) indicate the results estimated by ordered probit models on job satisfaction. The findings can be summarized as follows. First, the effect of the total amount of pensions on work satisfaction is positive and statistically significant at the 1% level except for satisfaction with wages and the use of the worker's ability and experience. These results are consistent with the implications of the bargaining model developed in this paper. That is, older workers who receive higher pensions can obtain greater job satisfaction at the cost of lower wages. They can afford to look for more satisfying jobs and good working relationships, or to demand that firms invest more in their jobs in compensation for lower wages. From equation (T13), we can see that it is also possible that

TABLE 7(A)
Analysis of Work Satisfaction: Ordered Probit Models

Dependent variable	Equation								
	(T9) Satisfied with wages			(T10) Satisfied with hours worked			(T11) Satisfied with work circumstances		
	coef.	s.e.	p-value	coef.	s.e.	p-value	coef.	s.e.	p-value
<i>sex</i>	-0.104	0.060	0.08	-0.124	0.064	0.05	-0.152	0.064	0.02
<i>age</i>	0.034	0.009	0.00	0.001	0.010	0.91	0.000	0.010	0.99
<i>tenure</i>	0.001	0.002	0.66	0.002	0.002	0.32	0.003	0.002	0.15
<i>b_health</i>	-0.135	0.062	0.03	-0.104	0.065	0.11	-0.248	0.064	0.00
<i>school_j</i>	0.103	0.078	0.19	0.019	0.082	0.82	0.071	0.081	0.38
<i>school_u</i>	0.063	0.053	0.24	0.060	0.056	0.28	-0.010	0.055	0.85
<i>m_retire</i>	-0.044	0.053	0.41	0.005	0.056	0.92	-0.037	0.055	0.51
<i>same_j</i>	-0.026	0.060	0.67	-0.005	0.063	0.94	-0.092	0.063	0.14
<i>prof</i>	0.173	0.154	0.26	0.096	0.163	0.55	0.261	0.162	0.11
<i>manage</i>	0.418	0.162	0.01	0.193	0.169	0.25	0.374	0.167	0.03
<i>office</i>	0.406	0.195	0.04	0.532	0.208	0.01	0.437	0.203	0.03
<i>sale</i>	0.535	0.137	0.00	0.195	0.145	0.18	0.358	0.143	0.01
<i>service</i>	0.053	0.187	0.78	0.362	0.196	0.06	0.333	0.196	0.09
<i>maint</i>	0.372	0.100	0.00	0.147	0.106	0.17	0.411	0.105	0.00
<i>trans</i>	0.168	0.110	0.13	0.074	0.116	0.52	0.091	0.116	0.43
<i>commu</i>	-0.095	0.087	0.27	-0.119	0.091	0.19	-0.088	0.091	0.33
<i>dig</i>	-0.209	0.128	0.10	-0.347	0.134	0.01	0.175	0.133	0.19
<i>g_scale</i>	0.106	0.085	0.21	0.136	0.090	0.13	0.160	0.089	0.07
<i>m_scale</i>	0.030	0.060	0.61	0.039	0.063	0.54	0.058	0.063	0.36
<i>h_loan</i>	-0.106	0.057	0.06	-0.131	0.060	0.03	-0.129	0.059	0.03
<i>edu_cost</i>	-0.059	0.083	0.47	0.086	0.087	0.32	-0.114	0.085	0.18
<i>n_earn</i>	0.062	0.027	0.02	0.113	0.028	0.00	0.046	0.028	0.10
<i>pension</i>	0.004	0.003	0.20	0.011	0.003	0.00	0.014	0.003	0.00
<i>EPP_d</i>	-0.104	0.055	0.06	-0.016	0.058	0.78	-0.111	0.058	0.05
<i>cross_zai</i>	-0.150	0.081	0.07	-0.005	0.086	0.95	-0.154	0.085	0.07
No. of obs.	2367			2360			2352		
Log likelihood	-3029			-2468			2567		
Pseudo R^2	0.021			0.020			0.032		

Note:

Industry dummies are used for estimations, but most of them are not statistically significant at the 10% level of confidence.

the wages of such workers are lower if they are not fully using their ability and experience in their current job.

Second, according to Tables 7(A) and (B), the number of other income earners in his household has an important effect on the work satisfaction of an respondent, similar to the effect of the pension; that is, both have a generally positive effect on work satisfaction, although the positive effects on workplace relationships and the use of ability and experience are not statistically ascertained. In particular, it is interesting that the effect of *n_earn* on wage satisfaction is large and statistically significant at the 5% level while *pension* is not. This seems to imply that those who are living with other income earners are more likely to accept lower wages and to look for a better job than those receiving higher pensions but continuing to participate in the labour market.

Third, Tables 7(A) and (B) indicate that the effects of the dummy variable relating to employees receiving EPP pensions are generally negative and statistically significant at the 10% level on work satisfaction, apart from hours worked. One of the reasons for this

TABLE 7(B)
Analysis of Work Satisfaction: Ordered Probit Models

Dependent variable	Equation								
	(T12) Satisfied with workplace relationships			(T13) Satisfied with use of experience			(T14) Satisfied with worth of the job		
	coef.	s.e.	p-value	coef.	s.e.	p-value	coef.	s.e.	p-value
<i>sex</i>	-0.169	0.064	0.01	-0.010	0.063	0.87	-0.119	0.063	0.06
<i>age</i>	0.012	0.010	0.23	0.018	0.010	0.07	0.022	0.010	0.02
<i>tenure</i>	0.003	0.002	0.19	0.002	0.002	0.20	0.002	0.002	0.32
<i>b_health</i>	-0.275	0.065	0.00	-0.182	0.065	0.01	-0.276	0.064	0.00
<i>school_j</i>	0.048	0.081	0.56	-0.078	0.080	0.33	-0.025	0.080	0.75
<i>school_u</i>	-0.056	0.055	0.31	-0.020	0.055	0.71	-0.061	0.055	0.26
<i>m_retire</i>	0.002	0.056	0.97	0.021	0.056	0.71	-0.042	0.055	0.45
<i>same_j</i>	-0.107	0.063	0.09	0.016	0.062	0.80	-0.091	0.062	0.14
<i>prof</i>	0.153	0.164	0.35	0.385	0.159	0.02	0.460	0.159	0.00
<i>manage</i>	0.275	0.169	0.10	0.524	0.170	0.00	0.824	0.169	0.00
<i>office</i>	0.391	0.206	0.06	0.598	0.205	0.00	0.595	0.203	0.00
<i>sale</i>	0.215	0.143	0.13	0.647	0.141	0.00	0.646	0.141	0.00
<i>service</i>	0.536	0.199	0.01	0.809	0.196	0.00	0.791	0.195	0.00
<i>maint</i>	0.196	0.104	0.06	0.249	0.104	0.02	0.157	0.102	0.12
<i>trans</i>	0.089	0.116	0.44	0.056	0.115	0.63	0.177	0.114	0.12
<i>commu</i>	-0.083	0.091	0.36	-0.079	0.091	0.38	-0.099	0.090	0.27
<i>dig</i>	0.044	0.134	0.74	-0.305	0.134	0.02	-0.080	0.131	0.54
<i>agri</i>	0.311	0.084	0.00	0.315	0.083	0.00	0.276	0.083	0.00
<i>g_scale</i>	0.070	0.089	0.43	0.165	0.088	0.06	0.080	0.088	0.36
<i>m_scale</i>	0.011	0.063	0.86	-0.002	0.062	0.98	0.039	0.062	0.53
<i>h_loan</i>	-0.032	0.059	0.59	-0.053	0.059	0.37	-0.008	0.058	0.89
<i>edu_cost</i>	-0.138	0.086	0.11	0.027	0.085	0.75	-0.053	0.085	0.53
<i>n_earn</i>	0.041	0.028	0.14	-0.007	0.028	0.80	0.070	0.028	0.01
<i>pension</i>	0.011	0.003	0.00	0.001	0.003	0.84	0.007	0.003	0.03
<i>EPP_d</i>	-0.098	0.058	0.09	-0.118	0.057	0.04	-0.111	0.057	0.05
<i>cross_zai</i>	0.031	0.085	0.71	0.019	0.085	0.82	0.087	0.084	0.30
No. of obs.	2350			2359			2360		
Log likelihood	-2580			-2622			-2708		
Pseudo R ²	0.024			0.025			0.032		

Note:

See Table 7(a) notes.

is that in general the EPP pensioners receive lower pensions. More specifically, from our data the average amount of pensions of EEP pensioners who are working, including those to which ZAIROU applies, is about ¥146,000 per month, while GMA pensioners receive an average of ¥219,000. A part of the effect of this difference seems to be captured by *EPP_d*, although the amount of pension is controlled in the estimations. Another reason is that EPP pensioners earn lower hourly wages than other elder employees, including non-pensioners, as was shown in Table 6. These factors make the EPP pensioners not only dissatisfied with their wages, but less interested in job investment. Note also that the cross term of *EPP_d* and *zairou_d*, defined as *cross_zai*, has a negative and significant effect on wage satisfaction. This is consistent with the result that the effect of *zairou_d* on hourly wage rates is negative and statistically significant at the ordinary level of confidence, as shown in Table 6.

Fourth, the need to pay a mortgage has negative effects on work satisfaction. Specifically, the effects on satisfaction of wages, hours of work and the working environment are statistically significant at the 5% level, while those concerning workplace relationships, the use of ability and experience, and the value of work performed are not significant. As was shown in Tables 4 and 5, those who are still paying a mortgage are more likely to participate in the labour market and to work longer hours. It is possible that they feel impelled to earn more in order to pay off the mortgage, and hence work for even longer hours and in less favourable circumstances. These factors make them dissatisfied with their wages, hours of work and work circumstances. As for the effects of household educational costs, we can expect that these would be the same as those pertaining to a mortgage, but the obtained results are vague. This is probably because the role of those over 60 regarding the educational costs for grown-up children or grandchildren is only supplemental, hence the need to earn for household educational costs is not as strongly felt.

Fifth, as was indicated in Tables 4 and 5, those who have a health problem are more likely to retire from the labour markets. Unfortunately, if they have to continue to work for some economic or other reason, their choice of work conditions may be considerably limited and, accordingly, their work satisfaction will be lower. Tables 7(a) and 7(b) show that the effects of *b_health* on work satisfaction are widely negative and statistically significant at the 5% level of confidence except for satisfaction with hours worked.

6. Conclusions

This paper has attempted to analyse the effects of pension benefits, family conditions and personal characteristics of the retirement-age workers on their labour supply, wages, hours worked and work satisfaction, in the framework of bargaining between the workers and firms over employment conditions including job investment. It was stressed that as workers become older they come to place greater priority on number of hours worked, the working environment, workplace relationships and the nature of the job rather than on wages—as far as their economic constraints allow. The main results obtained in this paper can be summarized as follows.

1. Pensions and the presence of other income earners in the family do have an income effect, not only decreasing the number of hours worked but also increasing job investment with a view to obtaining greater satisfaction from the non-financial characteristics of the job. Evidence that pensions and the presence of other income earners in the family have an effect of decreasing the hourly wage rates earned by those of retirement age can be interpreted as indicating that more job investment is bargained for.

2. Many previous studies have explained the suppressive effect of public pensions on labour supply, arising from the pension reduction scheme of the Employees' Pension Plan, i.e. the ZAIROU. However, while those retirement-age individuals who are working while receiving ZAIROU-reduced pensions do work longer hours than the recipients of other pensions, the suppressive effect of the pension reduction scheme on hours worked cannot be ascertained statistically. The ZAIROU is supposed to come into effect if those aged 60–64 are working more than three-quarters of the employer's normal hours per week. Therefore, there is a possibility that these older workers avoid being subjected to it by reducing the number of hours worked. To ascertain this possibility, I compared the suppressive effects of the EEP for those in their early and late sixties, since the reduction scheme is less restrictive for the latter. In addition, I also focused on the effects of the

Government Mutual Aid scheme, which does not reduce pensions even if the recipients continue to work. My results did not give any indication that the EEP pension reduction scheme acts to suppress the labour supply of retirement-age individuals. It seems that any suppressive effect of the ZAIROU scheme had disappeared by 2000.

3. There is a theory that pensions work to subsidize employment. If this is correct, pensions should increase the labour supply of those of retirement age and hence their employment. But I have shown that pensions have a negative effect on labour supply and decrease hourly wage rates. Pensions can however be interpreted as a “subsidy” to retirement-age workers to help them increase their job satisfaction, as does the number of other income earners in the household.

4. Workers of retirement age who are still paying a mortgage work longer hours and earn more, but generally are more dissatisfied with their wages, the number of hours worked and other job characteristics. It was also found that those who have a health problem work for lower wages and fewer hours per week, and derive less work satisfaction. This implies that those who for some reason are forced to work in spite of ill health are more likely to be dissatisfied with their jobs.

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