Empirical Analysis of the Incidence of Employer's Contributions for Health Care and Long Term Care Insurances in Japan*

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1. Introduction

In the last two decades, social insurance taxes for health care and long-term care insurances have been raised repeatedly in Japan to pay for the increasing costs of benefits for its aging population. Almost all the laws governing the social insurance programs for the employed workers mandate the firms to contribute one half of the social insurance taxes, leaving the rest to their employees. Recent increases in employer's contributions, most firms complain, have been draining corporate profits, and hurting their competitiveness in international markets. If these rates keep on increasing, the firms will eventually have to close many domestic production sites or move them to other countries, most probably to China. These claims have to be examined carefully, however, as the firms are capable of reducing workers wages or salaries by the increase in employer's contributions and maintain the labor costs constant. In other words, employer's contributions can be shifted and borne ultimately by the workers.

Japan has been financing most of the bulging costs of the health care for the elderly, not by the general tax revenue, but by the social insurance taxes of the employed workers. Many economists, including the present authors, have been critical of this financing policy because it puts too much burden on the working generation, and they recommend replacing it by consumption tax, at least part of which is borne by the elderly. If the employer's contributions are in fact absorbed, or at least a significant part is borne, by the corporate profits, we may have to adjust our prescription for an equitable financing too. Under the circumstance, the affluent elderly, who own a large part of the corporate stocks, bear most, or a significant proportion, of their own health care costs in the form of a lower rate of return on their stock investment.

This problem is a part of the general problem known as the incidence analysis of social insurance taxes. As we will see shortly, the incidence of social insurance taxes on wages or salaries depends theoretically on the price elasticity of demand for labor and the price elasticity of supply of labor. Thus how much of the past increases in social insurance taxes have been shifted to labor is primarily an empirical question. In this paper, based on a representative Japanese survey data on wages/salaries, we will analyze the incidence of employer's contributions for health insurance and long-term care insurances.

2. Preceding Studies

According to a simple economic theory, the incidence of employer's contributions for social insurance depends on the elasticity of demand and supply curves. Thus economists regard the

problem as primarily an empirical issue.

There are a significant number of studies concerning the incidence of employer's contributions for the U.S. and the countries in Europe. For example, Brittain(1971), Vorman(1974), and Holmlund(1983) have analyzed the effects of social insurance taxes on the wages and employment, using aggregated data. According to these results, almost all or at least half of the social insurance contributions are shifted to employees in the form of reduced wage rates. In the 1990's, economists have started using microdata for such an analysis, and in order to avoid endogeneity bias they relied on exogenous changes in social insurance contributions as a result of reforms in social insurance programs. They include such studies as Gruber and Krueger(1991), Gruber(1994), Gruber(1997), and Anderson and Meyer(2000), most of which confirm the shifting of employer's contributions to the workers. Most recently, Sommers(2005) has analyzed the incidence problem in conjuction with wage rigidity.

In Japan, the number of empirical studies on this problem is limited. The examples are Tachibanaki and Yokoyama(2008)、Komamura and Yamada(2004)、Iwamoto and Hamaaki（2006）, Sakai and Kazekami（2007）. Tachibanaki and Yokoyama(2008) analyzed the macro time series data of social insurance taxes and wage data, found no statistically significant negative correlation between them, and concluded that social insurance taxes are not shifted on the workers. Komamura and Yamada (2004) analyzed the data of health insurance associations, and found that most of the employer's contributions are shifted on the workers in the form of lower wages. Iwamoto and Hamaaki（2006）provided a theoretical model and an empirical survey of the literature on the incidence problem, and they pointed out, among other things, that the results in the existing studies are susceptible to the endogeneity bias of employer's contributions. Sakai and Fujin （2007） used aggregated data to analyze the incidence problem, but took advantage of the introduction of the Long Term Care Insurance as a natural experiment. They have found that after LTCI was introduced, relative wages of male workers who had to start paying for LTCI insurance taxes have gone down, possibly due to the shifting of employer's contribution in the LTCI.

3. The Model

Before going into the empirical estimation, we will present analytical frameworks for the incidence of the employer's contributions to social insurance using simple theoretical models. As a point of departure, we will present a standard one-sector model, and then we will frame the problem in a model with two labor markets, one for regular workers, and the other for irregular workers.

3.1 Standard Model

The tax incidence is usually analyzed in a standard model using a linear demand function and a linear supply function. The demand for labor is given as

$$D = \alpha_0 + \alpha_1 w,$$

and the supply of labor is given as

$$S = \beta_0 + \beta_1 w,$$

where D stands for the demand for labor, S stands for the supply of labor, and w stands for the wage rate.

Let us assume that a social insurance tax equal to τ is imposed on the employer. The employer now finds the cost of unit labor as $(w+\tau)$, paying w to the workers, and τ to the government. As a result, the demand for labor now is expressed as

$$D = \alpha_0 + \alpha_1(w+\tau) \tag{3}$$

In a market equilibrium, demand equals supply, and hence we have the following equilibrium condition,

$$\alpha_0 + \alpha_1(w+\tau) = \beta_0 + \beta_1 w. \tag{4}$$

Solving this condition for w, we obtain the reduced form equation for wage rate. Denoting the determinants of wage rates other than the social insurance tax by x1,x2,..,xn, we have the reduced form equation for the wage rate that needs to be estimated;

$$w = \gamma_0 + \gamma_1 x_1 + \ldots + \gamma_n x_n + \delta\tau. \tag{4a}$$

Naturally, we are interested in the sign and the magnitude of delta, the coefficient of tau. Differentiating both sides of (4) by tau, we have

$$\alpha_1 \frac{\partial w}{\partial \tau} + \alpha_1 = \beta_1 \frac{\partial w}{\partial \tau}. \tag{5}$$

Collecting the terms, we have

$$\frac{\partial w}{\partial \tau} = \frac{\alpha_1}{(\beta_1 - \alpha_1)} \tag{6}$$

Since we have $\alpha_1<0$ and $\beta_1>0$ from the properties of demand and supply functions, we have $\partial w/\partial \tau < 0$, or, the wage rate paid to the workers will be reduced as the social insurance tax payment increases. For a unit increase of the insurance tax, the magnitude of reduction in the wage rate depends on the ratio of α_1 to $(\alpha_1-\beta_1)$, or on $(1-\beta_1/\alpha_1)$. If the demand elasticity α_1 is much larger than supply elasticity β_1 in absolute values, then $|\beta_1/\alpha_1|$ will be smaller, and the ratio will be closer to 1. However, if the supply elasticity is large compared with the demand elasticity, then the ratio may be substantially smaller than 1. Realistically speaking, in labor market, workers have to choose a firm from a relatively limited number of firms, but firms can choose a worker from a large number of workers with the same ability but with different reservation wages. As a result, we expect the firms

to be far more sensitive to wage rates than the workers, or α_1 will be much larger than β_1. This is the reason why, in the context of a standard market model, we expect the wages to absorb most of the social insurance taxes.

3.2 Model with a Market for Irregular Workers

In the standard model, the increase in the employer's contribution of the social insurance tax automatically leads to the increase in unit labor cost. In addition to these regular workers, however, firms in Japan and in many other countries have an option of employing irregular workers who are exempt from the social insurance. By increasing the employment of irregular workers, firms can reduce the increase in the employer's contributions. We will take account of the effects on irregular workers and analyze the incidence of employer's contributions of social insurance tax.

Since the market for regular workers and the market for irregular workers are interdependent, we will write the demand and supply of the regular workers in log-linear forms;

$$d^f = d^f(w^f, w^t) \tag{7}$$

$$s^f = s^f(w^f, w^t) \tag{8}$$

where d^f is the demand for regular workers, s^f is the supply of regular workers, w^f is the wage rate of regular workers, w^t is the wage rate of irregular workers.

Let us assume now that social insurance tax T is imposed on the firm. To make the analysis simpler, let us assume that the firm has to pay the government a fixed proportion τ of the wage rate paid to each regular worker, but nothing for irregular workers. Under the assumption, the cost of a regular worker is given by $(1+\tau)w^f$, while it is w^t for an irregular worker. Assuming the market equilibrium for regular workers, $d^f = s^f$ has to hold, and hence we have,

$$d^f((1+\tau)w^f, w^t) = s^f(w^f, w^t) \tag{9}$$

Furthermore, since the demand and supply functions have to be homogenous of degree zero,

$$d^f\left(\frac{(1+\tau)w^f}{w^t}, 1\right) = s^f\left(\frac{w^f}{w^t}, 1\right) \tag{9a}$$

Likewise, in the market equilibrium for irregular workers, $d^t = s^t$ has to hold, and hence we have

$$d^t(w^f, w^t) = s^t(w^f, w^t) \tag{10}$$

$$d^t(\frac{w^f}{w^t},1) = s^t(\frac{w^f}{w^t},1) \tag{10a}$$

We have a system of two equations, but only one relative price (w^f/w^t) to solve the system. This is because the two equations, (9) and (10), are not independent because of Walrus Law. One simple way to solve the system explicitly is to assume that the two kinds of labor are perfect substitutes and that total supply is fixed. For example, if the sum of the two labor supplies must be a constant, L, then we can solve the following condition for (w^f/w^t);

$$d^f(\frac{(1+\tau)w^f}{w^t},1) = L - s^t(\frac{w^f}{w^t},1) . \tag{11}$$

This condition has an extra advantage in that we can use (11) even when the market for regular workers is not in equilibrium and rationed by demand; namely, instead of (9a), we may have

$$d^f(\frac{(1+\tau)w^f}{w^t},1) < s^f(\frac{w^f}{w^t},1) \tag{9b}$$

We will write this reduced-form equilibrium condition (11) as follows;

$$\ln\left(w^f/w^t\right) = \beta_0' + \gamma_2\tau + \varepsilon_i'$$

In Figure 1, we have analyzed the markets for regular workers and irregular workers simultaneously. On the common vertical axis, the relative wage rate of regular workers to that of irregular workers (w^f/w^t) is measure. On the horizontal axis of the first quadrant, quantities of regular workers are measured from origin to the right, and on the horizontal axis of the second quadrant, quantities of irregular workers are measured from origin to the left. Firstly, a higher relative wage rate of regular workers increases the supply of regular workers, but reduces the demand for them. Hence we have an upward-sloping supply curve and a downward-sloping demand curve in the first quadrant. Secondly, a higher relative wage rate of regular workers increases the demand for irregular workers but reduces the supply of irregular workers. Hence we have an upward-sloping supply curve and a downward-sloping demand curve in the second quadrant.

Let us now assume that the government increased the employer's contribution for social insurance. At any given relative wage rate, the increase in the employer's contribution increases the relative

unit cost of labor of regular workers to that of irregular workers, and hence it reduces the demand for regular workers. Consequently, the demand curve shifts downward in the first quadrant.

What will happen in the second quadrant when the social insurance contribution is increased? At any given relative wage rate, the higher unit cost of labor imposes the firm to secure higher marginal product of labor from their regular workers. But assuming that regular workers and irregular workers are substitutes, in the firm, the marginal product of labor of irregular workers must be higher, too. Thus the firm must be willing to hire more irregular workers at a given relative wage rate. Consequently, in the second quadrant, the demand curve for irregular workers shifts downward.

Combining the changes in the two markets, in Figure 1, the increase in employer's contribution induces a reduction in the employment of regular workers, an increase in the employment of irregular workers, and a decrease in the relative wage rate of regular workers.

4. Estimation Model and Data

4.1 Estimation Model

In what follows, we will provide an empirical analysis on the incidence of the contributions for the health care insurance and long term care insurance by using micro data of "Employment Status Survey" and "Annual Business Report" of society-managed employment-based health insurance. In the empirical incidence literature of social insurance taxes/fees of Japan, all the previous studies have relied on the aggregated wage data, but, as far as we know, none has used micro data yet. By using a large-scale, national micro data on wages, we will be able to have more precise estimates of the social insurance fees/taxes, by a better control of the attributes of individual workers, the characteristics of firms, the regions, and the industry. The basic specification of the wage equation in our model is given as follows;

$$\ln w_i = \beta_0 + X_i\beta + \gamma_1\tau_j + \varepsilon_i, \qquad (12)$$

where w_i is the wage rate of worker i, $\ln w_i$ is the logarithm of w_i, and β_0 is the constant term, X_i is a vector of such individual attributes as age, sex, education, size of the workforce, the industry, the region of the location, respectively of the firm the individual works, and τ_j is employer's contribution rate of health and long term care that individual belongs. If the coefficient γ_1 is negative, then we know that the employer's contributions for the two social insurances are shifted to the employees. In Employment Status Survey, regarding the firm the individual works, information is available about

the industry, the rough classification of the size of its total employment, and the region of its location, but not the exact identity of the firm. For this reason, instead of using the individual firm's contribution rates, we first computed the average of the employer's contribution rate of all the firms in each industry in each region, and used the average rates for all the firms of a given industry in a given region as their contribution rates.

Although the equation given by (12) is a standard textbook specification in an incidence analysis, it fails to take account of the developing duality of changes that have been taking place in the labor market of Japan; the number of regular workers has been decreasing rapidly but the number of irregular workers has been increasing equally rapidly. Suppose that an employer, instead of reducing regular worker's wage rate by a constant percentage across the board, replaces less productive regular workers with irregular workers. Such a substitution may involve some productivity loss to the employer, but presumably, some of it, or most of it, will be taken care of by the differential unit labor costs of the two types of workers. By replacing enough number of regular workers, the employer may even be able to keep the wage rates of regular workers intact and keep the total labor costs unchanged, in spite of the increased contribution rates of the employer. For this case, the specification in (12) will not find any incidence on wages.

If we take the income from a standardized unit of labor as a criterion, the substitution of a regular worker by an irregular worker will involve a substantial reduction in the income, and hence the increased social insurance contribution should involve a very significant incidence on labor income. For this reason, we consider effects of irregular workers, and we formulate estimation model as follow;

$$\ln\left(w_i / wt_j\right) = \beta_0' + X_i\beta' + \gamma_2\tau_j + \varepsilon_i' \qquad (13)$$

where wt_j is the average wage of irregular workers in industry j to which individual i belongs. Other notations are identical to those in (12). By estimating the equation (13), we can analyze the effects of employer's contributions on the relative wage rate of regular worker i to the average wage rate of irregular workers in the same industry. If γ_2 is negative, the employer rein in the wage growth of regular workers lower than that of irregular workers. In this case, we can interpret as incidence of employer's contribution to regular workers wage.

We use those estimation models and above-mentioned data, and analyze empirically incidence of employer's contribution of health and long term care in Japan.

4.2. Data and Descriptive Statistics

The data on individual wage rates used in our analysis are obtained from XX% samples of the three waves of "Employment Status Survey" (1992, 1997 and 2002). The contributions data for health care insurance and long term care insurance are taken from the Annual Business Report of the National Federation of Health Insurance Societies of the same years.

The annual income, annual worked days and weekly worked hours are given as categorical data in the Survey, and we have used their medium values to represent each individual[1][2]. We have used log of hourly wage as explained variable, and hourly wage was calculated as follows: hourly wage = individual annually income ÷ (annual worked days × hours worked per week ÷ 5). We made dummy variables for sex (male, female), education levels (elementary or junior high school graduate, high school graduate, junior college or technical college graduate, college or graduate school graduate), occupations (profession or engineer, management position, clerical post, sales people, service, peace preservation, agriculture and forestry and fishery, traffic and communications, digging and manufacture and construction and non-office worker), and six regions (Hokkaido and Tohoku, Kanto, Hokuriku and Tokai, Kinki, Chugoku and Shikoku, Kyusyu and Okinawa). Since industry classification of the Business Report is far more detailed than those in the Survey, we took a weighted average of employer's contribution rates of the industries in the Business Report using the number of employees of the each industry as weights to compute the industry contribution rates of the Survey.

We have shown the important descriptive statistics in Table 2. The average annual income is 5,869 thousand, wage per hour is 2,954.8 yen. The combined employer's contribution rate of health care and long term care is 4.83%. In terms of education achievement, the proportion of elementary or junior high school graduate is 7%, that of high school graduate is 52.2%, and that of collage or graduate school graduate is 10.8%. In terms of age, average is 38.94.

5. Estimation Results

Let us first show the OLS estimation result of the relationship between the wage rate of regular workers and the employer's contributions for health care insurance and long term care insurance (TTTT). In the column (1), we have used individual income per hours as the dependent variable. Our estimation result shows that the coefficient of the employer's contribution rate is negative, but not statistically significant.

Next, in column (2), we have shown the estimation result with the relative wage as the dependent

[1] In terms of annual income, category of 15 million yen over is set as 15 million yen. In annual worked days, category of 250 days over is set as 250 days. In terms of week worked time, category of 60 hours over is set as 60 hours.

[2] In terms of working periods, category of 30 years over is set as 360 months.

variable. The relative wage rate used are obtained as the ratio of individual income per hours of regular workers to the average income per hours of irregular workers in the same industry and in the same region. We have not controlled for the sex and age of the irregular workers, or the size of the firms, because we did not have enough samples of irregular workers in many of the hypothetical cells.

According to our estimation results, the employer's contribution rate variable has a statistically significant (at 5 % confidence level) negative coefficient in the relative wage rate equation of regular workers. Thus, the gap between the wages of regular workers and irregular workers narrows as a result of an increase in employer's social insurance contribution rate. According to the results in (1) and (2), such an increase in employer's contributions will have little effect on the wage rate of regular workers, but it will increase the demand for the irregular workers and hence their wage rate. Thus, the wage gap between regular and irregular workers decreases.

Legally, employers can share the burdens of health care insurance and long term care insurance equally with the employees, but, in significant number of firms, they pay more than half of the total insurance contributions, paying all of the total contributions in an extreme case. In general, employers prefer to stick to the legal lower limit, employees prefer to have their employer to contribute at higher rates, and the outcome may depend on the relative bargaining power of the two. The wage rate may depend on the relative bargaining power of the two, too. Consequently, the variable, the employer's contributions, may be not be exogenous, being possibly correlated with the error term of the wage rate (or relative wage rate) equation.

In order to deal with the endogeneity problem of the employer's contribution variable, we have used previous year's contribution rate and the proportion of the elderly in the enrollment of the insurance association as our instruments. We have shown the IV estimation results in column (4), column (5) and column (6). Coefficients of employer's contribution are larger in the IV estimation than those of OLS estimation given by (1), (2) and (3), respectively.

6. Summary

In this paper, we analyzed the empirical incidence of employer's contributions for health . Particularly, we focus on those for health care and long term care insurance. Previous works that have estimated the empirical evidence of social insurance burdens in Japan have not used micro wage data, but used aggregated wage data. From our estimation results, we have not found statistically significant negative effect on regular workers wage rates, but found statistically significant negative effect on relative wage rates of regular workers to those of irregular workers. Thus, we conceive that employer's contribution leads to substitution of regular workers by irregular workers, reduces the relative wage rate of regular workers to irregular workers, and finally reduces the labor income.

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Table 1 Explanation of variables

shotoku	annual income
wage_h	wage rate per hours （10,000 yen）
age	age
age2	square of age
keizokunen	number of months worked for the current firm
shuugyounisu	yearly days worked
shuugyoujikansu	week working hours
sex	male=1, female=0
dist_dum1	district dummy （hokkaido･tohoku）
dist_dum2	district dummy （kanto）
dist_dum3	disutrict dummy （hokuriku･tokai）
dist_dum4	district dummy （kinki）
dist_dum5	district dummy （chugoku･shikoku）
dist_dum6	district dummy （kyusyu･okinawa）
gakureki1	education dummy （elementary school･junior high school）
gakureki2	education dummy （high school）
gakureki3	education dummy （junior college･technical college）
gakureki4	education dummy （college･graduate school）
fhrate_w	employer's contribution rate in per mill
roken_w	contribution for health care of aged （yen）
rojin_w	enrollment rate of aged person
hyojun_w	standard monthly remuneration （yen）
unemp_yd	unemployment rate
dyear92	year dummy (1992)
dyear97	year dummy (1997)
dyear02	year dummy (2002)
lag_fhrate	employr's contribution rate in previous period
lwage_h	log of wage rate
wagep	ratio of wage rate to the average wage rate of irregular workers
lwagep	log of wagep
hyojunp	average standard monthly remuneration divided by average wage rate of irregular workers
lhyojunp	log of hyojunp
rokenph	contribution for health care of the elderly divided by standard monthly remuneration

Table 2　Descriptive Statistics

	Obs	Mean	Std. Dev.	Min	Max
sex	130443	0.233113	0.422815	0	1
age	130443	38.93983	11.17114	16	80
keizokunen	130443	26.18883	8.214349	0	30
shuugyounisuu	130443	230.0476	20.94192	25	250
shuugyoujikan	130443	45.11034	7.797244	7.5	60
shotoku	130443	586.8774	299.8032	25	1500
wage_h	130443	0.295475	0.232068	0.008333	40
dist_dum1	130443	0.084267	0.277788	0	1
dist_dum2	130443	0.345001	0.475371	0	1
dist_dum3	130443	0.200057	0.400044	0	1
dist_dum4	130443	0.153968	0.360919	0	1
dist_dum5	130443	0.123709	0.329251	0	1
dist_dum6	130443	0.092999	0.290431	0	1
gakureki1	130443	0.070314	0.255677	0	1
gakureki2	130443	0.521684	0.499532	0	1
gakureki3	130443	0.108262	0.310712	0	1
gakureki4	130443	0.297739	0.457266	0	1
fhrate_w	130443	48.30265	5.14603	0	76.75071
roken_w	130443	957164.3	1810159	0	9618349
rojin_w	130443	2.840256	0.924435	0.52	7.54
hyojun_w	130443	346157.9	43164.01	215128	482368.7
unemp_yd	130443	3.299365	1.356721	1.6	6.7
dyear92	130443	0.382389	0.485973	0	1
dyear97	130443	0.353679	0.478113	0	1
dyear02	130443	0.263931	0.440764	0	1
lag_fhrate	80563	47.81489	6.130647	0	76.75071
lwage_h	130443	−1.37479	0.555921	−4.78749	3.688879
age2	130443	1641.104	892.4652	256	6400
lwagep	130443	0.591292	0.575979	−3.30464	5.792193
hyojunp	130443	2508108	532914.8	450343.3	7054197
lhyojunp	130443	14.71276	0.214053	13.01777	5.76913
rokenph	130443	2.865504	5.530402	0	30.49316

Table 3 Estimation results (OLS estimation)

(1) lwage_h	coefficient	standard deviation		(2) lwagep	coefficient	standard deviation		(3) lwagep	coefficient	standard deviation	
fhrate_w	−0.000143	0.000316		fhrate_w	−0.0007	0.000321	**	fhrate_w	−0.0022	0.00032	***
								rokenph	0.002277	0.000285	***
								lhyojunp	0.513279	0.011364	***
age	0.0776751	0.00072	***	age	0.07728	0.00073	***	age	0.077338	0.000724	***
age2	−0.0006689	8.97E−06	***	age2	−0.00066	9.10E−06	***	age2	−0.00067	9.02E−06	***
sex	−0.3228261	0.003023	***	sex	−0.32114	0.003064	***	sex	−0.32238	0.00304	***
keizokuner	0.0105013	0.000229	***	keizokuner	0.010286	0.000232	***	keizokuner	0.010251	0.00023	***
gakureki2	0.2277141	0.004489	***	gakureki2	0.226981	0.004551	***	gakureki2	0.227054	0.004515	***
gakureki3	0.3248698	0.00562	***	gakureki3	0.323252	0.005697	***	gakureki3	0.322343	0.005652	***
gakureki4	0.3888203	0.004904	***	gakureki4	0.388407	0.004972	***	gakureki4	0.38707	0.004932	***
unemp_yd	−0.0074533	0.00451	*	unemp_yd	0.00828	0.004572	*	unemp_yd	0.00983	0.004546	**
dist_dum1	0.0155956	0.005298	***	dist_dum1	0.009105	0.005371	*	dist_dum1	0.020839	0.005336	***
dist_dum2	0.1302939	0.005605	***	dist_dum2	0.143188	0.005683	***	dist_dum2	0.066299	0.005897	***
dist_dum3	0.067699	0.0075	***	dist_dum3	0.099571	0.007603	***	dist_dum3	0.051114	0.007621	***
dist_dum4	0.1219917	0.004803	***	dist_dum4	0.104979	0.004869	***	dist_dum4	0.040093	0.005066	***
dist_dum5	0.0202207	0.006151	***	dist_dum5	0.038461	0.006236	***	dist_dum5	0.027658	0.006196	***
dyear97	0.0721883	0.005882	***	dyear97	0.013402	0.005963	**	dyear97	0.00188	0.006136	
dyear02	0.1225421	0.014744	***	dyear02	0.034939	0.014947	**	dyear02	0.009543	0.014876	
cons	−3.861757	0.040874	***	cons	−3.15564	0.041438	***	cons	−9.88891	0.154199	***
Numbe of sample		130443				130443				130443	
Adj R−squared		0.5092				0.5301				0.5377	
F value		2820.36				3066.4				3033.56	
Prob > F		0				0				0	

note 1)***, ** and * express that coefficient statistically differ from 0 at siginificant leve of 1%, 5% and 10% respectively
note 2)cons is constant term

Table 4 Estimation results (IV estimation)

(4) lwage_h	coefficient	standard deviation		(5) lwagep	coefficient	standard deviation		(6) lwagep	coefficient	standard deviation	
fhrate_w	−0.00102	0.000999		fhrate_w	−0.00529	0.001012	***	fhrate_w	−0.00403	0.001109	***
								rokenph	0.220056	0.043919	***
								lhyojunp	0.530188	0.016009	***
age	0.075431	0.000958	***	age	0.075268	0.00097	***	age	0.075206	0.000963	***
age2	−0.00065	1.18E−05	***	age2	−0.00065	0.000012	***	age2	−0.00065	1.19E−05	***
sex	−0.31817	0.003818	***	sex	−0.31638	0.003866	***	sex	−0.31774	0.003836	***
keizokunen	0.011056	0.000242	***	keizokuner	0.010828	0.000245	***	keizokuner	0.01073	0.000243	***
gakureki2	0.208168	0.006141	***	gakureki2	0.208944	0.006218	***	gakureki2	0.208508	0.00617	***
gakureki3	0.30012	0.007388	***	gakureki3	0.299748	0.007481	***	gakureki3	0.298998	0.007425	***
gakureki4	0.362237	0.006591	***	gakureki4	0.363748	0.006673	***	gakureki4	0.362329	0.006623	***
unemp_yd	−0.00532	0.005935		unemp_yd	0.013052	0.006009	**	unemp_yd	0.008054	0.005991	
dist_dum1	0.017223	0.00691	**	dist_dum1	0.014668	0.006997	**	dist_dum1	0.037142	0.007016	***
dist_dum2	0.117647	0.009236	***	dist_dum2	0.108788	0.009352	***	dist_dum2	0.075658	0.008771	***
dist_dum3	0.053352	0.011787	***	dist_dum3	0.081342	0.011934	***	dist_dum3	0.05413	0.011506	***
dist_dum4	0.106382	0.007156	***	dist_dum4	0.075223	0.007246	***	dist_dum4	0.046691	0.006996	***
dist_dum5	0.024494	0.009118	***	dist_dum5	0.029653	0.009232	***	dist_dum5	0.036786	0.008994	***
dyear97	−0.05631	0.01246	***	dyear97	−0.02228	0.012616	*	dyear97	−0.02005	0.01258	
cons	−3.59579	0.073851	***	cons	−2.68638	0.074774	***	cons	−9.93481	0.219424	***
Numbe of sample		80563				80563				80563	
Instrument variable		lag_fhrate, rojin_w				lag_fhrate, rojin_w				lag_fhrate, rojin_w	
Centered R2		0.5072				0.5376				0.5445	
F value		1763.28				1996.83				1966.36	
Prob > F		0				0				0	

note 1) ***, ** and * express that coefficient statistically differ from 0 at siginificant leve of 1%, 5% and 10% respectively
note 2) cons is constant term

Figure 1 Effects of employer's contribution and labor markets of regular and irregular workers