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The Effect of Implicit Contracts on the Wages: Evidence from Japanese Labor Market

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1 Introduction

OECD (2005) points out that a labor market dualism has been growing rapidly in Japan and that this is creating both efficiency and equity concerns. According to OECD (2005), although the total compensation of employees is increasing, hiring of new graduates has been cutting during the decade of economic stagnation in Japan. This suggests that the positions and wages of incumbent workers are relatively guaranteed in Japanese labor market.

Beaudry and DiNardo (1991) focus a role of an employment contract which can protect incumbent workers from external shocks. They develop two simple contract models in which risk averse workers use employment contracts to avoid unexpected shocks to wages. In their first model in which assumes workers' mobility is limited, it is optimal that wages are determined at the time a worker is hired because the employment contract can guarantee wages that depend not on the current external shocks like business conditions, but on the worker's productivity. In another model which assumes workers' mobility is not limited, employers need to update wage contracts in every period to keep away workers from possible external offers of another employer. Beaudry and DiNardo (1991) show that actual movements of wages in the U.S. labor market are consistent with the contract model in which employment contracts may be revised to keep away workers from external offer.

The aim of this paper is to test which of the models proposed by Beaudry and DiNardo (1991) best fits actual wage movements in the Japanese labor market. This paper also aims to compare the empirical results for the Japanese labor market with those for the U.S and Canadian labor markets studied by McDonald and Worswick (1999) and Grant (2003), who both follow Beaudry and DiNardo (1991), where labor market dualism is not as serious a problem as in Japan, .

To test which of the models best fits actual wage movement in the Japanese labor market. In order to obtain more robust test results in testing this paper employs a non-nested test introduced by Davidson and MacKinnon (1981) which has not employed by previous researches as well as the artificial nesting employed by Beaudry and DiNardo (1991).

Genda et al. (2007) compare the effect of unemployment rate at entry on wages in the U.S, and Japan. They demonstrate that although there is no effect of the unemployment rate at entry on wages for the less educated men in the U.S, there is a persistent strong negative effect on wages for less educated men in Japan. Unlike Genda et al. (2007), this paper does not compare the effect of the unemployment rate on wages across workers differing in their level of education or countries. Rather this paper uses panel data that contains detailed information on individuals' work histories. The estimation results demonstrate that the unemployment rate at the time of a worker's entry significantly decreases wages for Japanese men. The result for men is is consistent with Genda et al. (2007), but not for women.

The estimation results suggest that the contract model with costly mobility describes the Japanese labor market better than models with costless mobility and spot market models. In contrast to findings for Canada and U.S where the contract model with costless mobility is found to fit the data best, is rejected for the Japanese labor market. The remainder of this paper is as follows. Section 2 explains the empirical model and the data briefly. Section 3 presents the empirical results, and Section 4 contains a conclusion.

2 Estimation

Beaudry and DiNardo (1991) develop simple contract models that demonstrate how actual wage movements could be affected by business conditions. Because workers are more vulnerable to various risks than their employer, the employer offers fixed, business-condition free wage contracts. In such a contract, called an implicit contract with limited mobility, wages will depend not on current tightness of the labor market, but rather on past tightness of the labor market at the time a worker agree with the contract. Beaudry and DiNardo (1991) also take account of another possibility that workers' mobility is costless and not limited. When workers' mobility is not limited, employees need to update wage contracts in every period to keep away workers from possible external offers of another employees. As a result, wages will depend on the most favorable labor market conditions after a worker has been employed. This model is called the implicit contract with costless mobility.

Beaudry and DiNardo (1991) test which model, a standard spot market, implicit contracts with limited mobility, or implicit contracts with costless mobility, best explain actual wage movements best in the U.S. They demonstrate empirically that the actual movement of wages in the U.S labor market can be explained not by a standard spot market model, but by the implicit contracts model with costless mobility. The same approach is also employed by McDonald and Worswick (1999) who analyze the Canadian labor market, and Grant (2003) who analyze the U.S. labor market. Both papers are consistent with the implicit contract model with costless mobility.

This paper estimates the following wage function proposed by Beaudry and DiNardo (1991).

$$lnW_{i,t+j} = X_{i,t+j}\Omega_1 + \Omega_2 C(t,j) + \epsilon_{i,t+j}, \tag{1}$$

where $lnW_{i,t+j}$ is the logarithm of hourly wage rate in the period $t+j$ for an individual i who started the current job in period t. $C_{t,j}$ is defined as:

$$C(t,j) = \begin{cases} U_{t+j} & \text{Current unemployment rate: (Spot market model)} \\ U_t & \text{Unemployment rate at the time of hiring: (Contracts with costly mobility)} \\ \min\{U_{t+k}\}_{k=0}^{j} & \text{Minimum unemployment rate between the time of hiring and the present: (Contracts with cost} \end{cases}$$

and X is a vector of the worker's characteristics. X includes regular worker experience, non-regular worker experience, regular worker experience in the current workplace, non-regular worker experience in the current workplace, years not in employment and education, the square of those variables, schooling dummies, regional dummies, and industry dummies.

Our interest is in whether Ω_2 is significantly negative or not. If the spot market model describes actual movement of the wages, the current unemployment rate should significantly affect the current wage. If the implicit contract model with costly mobility describes actual movement of the wages, the unemployment rate at the time of a worker's hiring should significantly affect the current wage. If the implicit contract model with costless mobility describes actual movement of the wages, the minimum unemployment rate between hiring and the present should significantly affect the current wage. Since three models are non-nested, this paper tests which model best describe the actual movements of wages by using the non-nested test introduced by Davidson and MacKinnon (1981), in addition to the artificial nesting test used by Beaudry and DiNardo (1991).

This paper utilizes data from the Keio Household Panel Survey (KHPS) conducted by Keio University in 2004, 2005, 2006 and 2007. An important of the KHPS survey is that each respondent is asked when he/she started to work in his/her present job if he/she is a worker. Data for respondents who provide contradictory responses to questions about their work history and the year they started to work are deleted from the analysis. In this paper, the sample is restricted to regular workers aged between 18 and 59 who are not self-employed (jieigyo). The reason for imposing the upper age limit is that most Japanese workers face retirement at age 60, and post-retirement wages tend to be set quite differently from pre-retirement wage (See Ohashi (2005)). The reason why non-regular workers are excluded from the sample is because it is hard to identify which model fits the data the best since the tenure of non-regular workers is short, there is little difference between the three unemployment rates. Hourly wage rates are calculated by dividing an individual's reported income by their hours worked. Descriptive statistics for the variables used in estimation are summarized in Table 1.

Beaudry and DiNardo (1991) and McDonald and Worswick (1999) point out that labor markets need not be similar across the industries. Beaudry and DiNardo (1991) allow unemployment rates to vary across industries. McDonald and Worswick (1999) allows the effect of unemployment rates to vary across age cohorts. Because age discrimination is not prohibited in the Japanese labor market, this paper allows the unemployment rates to vary across age cohort and and compares the result with the case when the aggregate unemployment rate used. Unemployment rate used in estimation are taken from Labor Force Survey.

To remove possible bias arising from unobserved heterogeneity, this paper employs the panel GMM approach introduced by Hausman and Taylor (1981) as auxiliary in addition to OLS and the fixed effect estimators. Japanese workers rarely change their jobs, it is expected the estimated coefficient of the unemployment rate will be difficult to identify using a fixed effect estimator. (Of the 1700 males in the sample, only about 60 workers change their job during the four years of sampling.) The GMM approach introduced by Hausman and Taylor (1981) can identify the coefficients of time invariant variables under appropriate assumptions.

3 Results

Because our interest is in whether Ω_2 is significantly negative or not, other estimated coefficients, which are generally consistent with theoretical predictions, are not reported. Table 2 and Table 3 show key results of this paper, estimates Ω_2 in equation (1). Table 2 shows the estimation results when the aggregate unemployment rate is used. Table 3 shows the estimation results when the unemployment rate varies according to the age of the workers.

For males, estimated coefficients of the unemployment rate at the time of hiring significantly affect wages in both tables regardless estimation methods. The point is illustrated by the results shown in (1), (8), and (15) in both tables for males. However, the other two unemployment rates, the current unemployment rate and the minimum unemployment rate, do not show significantly negative sign when the model is estimated using the fixed effect estimator and GMM estimator in Table 3 shown in (9), (10), (16) and (17) in Table 3 for males. F-tests that the null hypothesis that all individual specific effects in the fixed effect estimation are zero are rejected in all cases.

For females, only the estimated coefficients of the current unemployment rate when the model is estimated using OLS are significantly negative in both tables for female. In Table 2, both the minimum unemployment rate and the unemployment rate at the time hiring are show theoretically incorrect (positive) sign.

F-tests that the null hypothesis is that all individual specific effects in the fixed effect estimation are zero are rejected in all cases. This suggests the OLS results are likely to be unreliable.

To determine which of these models fits the data the best for males, this paper employs two methods. One is the artificial nesting approach which is employed in the original research by Beaudry and DiNardo (1991). Another is the non-nested J-test introduced by Davidson and MacKinnon (1981). Using the artificial nesting approach to test which model fits the data the best, it is difficult to determine which unemployment rate fits better than the others in table 2, because in some cases both estimated coefficients are insignificant ([4], [11], and [18]), and in other cases both estimated coefficients are significant ([5], [6], [12], [13], [19], and [20]). In Table 3, unemployment rate at the time of hiring the data fits better than the other models when OLS is not used. In contrast to U.S and Canada labor market case studied by Beaudry and DiNardo (1991) and McDonald and Worswick (1999), the minimum unemployment rate minimum since a worker was hired does not fit best in Japanese labor market.

The non-nested J-test results are shown in Table 4 and Table 5. Since all F-tests testing the null hypothesis that all individual specific effects in the fixed effect estimation reject the null hypothesis, the result of J-test results for the OLS are omitted. Table 4 presents J-test results, corresponding in Table 2, when the aggregate unemployment rate is used. All three models reject each other for males. This suggests that using the aggregate unemployment rate may not be suitable to analyze relationship between current/past labor market condition and wages for males. For females, the model using the current unemployment rates is rejected.

Table 5 presents J-test results, corresponding in Table 3, when the unemployment rate varies across age cohorts. The results suggest that the model using the unemployment rate at the time of hiring is not rejected by the other models, and indicate that this model best fits the data for males. For males, the model using the minimum unemployment rate since hiring, which according to Beaudry and DiNardo (1991), McDonald and Worswick (1999) and Grant (2003) best describes the actual movement of wages in U.S and Canada , is rejected. For females, all three models are not rejected each other.

4 Conclusion

Following the approach of Beaudry and DiNardo (1991) who analyze the U.S labor market, this paper tests whether wages in Japanese Labor market are determined by current labor market condition or by past labor market conditions. The test results here show that in contrast to Beaudry and DiNardo (1991), McDonald and Worswick (1999), and Grant (2003), the use of unemployment rate at the time of hiring fits the data the best for males. This implies that mobility in the Japanese labor market for males is unlike the U.S. and Canada, where a model based on costless mobility has been found to best explains wage movement. The empirical results are consistent with a model suggesting that labor market mobility may be limited and costly in Japan for males. For females, all three models does not fit the actual movement of wages in Japan.

The result, which implies that mobility is costly and limited in Japanese labor market, is consistent with OECD (2006) which points out that it is widening mismatch between demand and supply in Japanese labor market. This is one possible reason why a labor market dualism has been growing rapidly and creates both efficiency and equity concerns in Japan, as OECD (2005) points out.

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Table 1: Descriptive Statistics

	Male		Female	
	Mean	Std. Err	Mean	Std. Err
Hourly Wage Rate	2252.7	1480.5	1665.5	1125.0
Full-time Experience	19.4	10.1	14.3	9.2
Part-teime Experience	0.4	1.6	1.5	2.9
Full-time Experience in Current Place	14.4	10.7	10.0	9.1
Part-teime Experience in Current Place	0.0	0.6	0.1	1.0
Years in Not in Employment and Education	0.2	0.7	1.2	3.0
Junior High	2.1%		1.1%	
University	43.3%		21.3%	
2-year College	9.4%		38.1%	
Sample Size	1944		638	

Note: Source: KHPS 2004, 2005, 2006, and 2007 .

Table 2: Estimation Results of Wage Function: using Unemployment rate varied by sex

	Male				Female		
	U_t	U_{t+j}	$\min\{U_{t-k}\}_{k=0}^{j}$		U_t	U_{t+j}	$\min\{U_{t-k}\}_{k=0}^{j}$
OLS	-0.035*			[1]	0.036		
	[0.020]				[0.048]		
		-0.078**		[2]		-0.157**	
		[0.033]				[0.066]	
			-0.049**	[3]			0.006
			[0.023]				[0.054]
	0.037		-0.088	[4]	0.115		-0.105
	[0.052]		[0.059]		[0.092]		[0.104]
		-0.071**	-0.044*	[5]		-0.165**	0.032
		[0.034]	[0.023]			[0.067]	[0.055]
	-0.035*	-0.078**		[6]	0.035	-0.157**	
	[0.020]	[0.033]			[0.048]	[0.066]	
	0.009	-0.070**	-0.054	[7]	0.044	-0.154**	-0.012
	[0.054]	[0.035]	[0.061]		[0.097]	[0.071]	[0.112]
Fixed Effect	-0.114*			[8]	0.336**		
	[0.063]				[0.133]		
		-0.382**		[9]		-0.352	
		[0.152]				[0.268]	
			-0.095*	[10]			0.229*
			[0.052]				[0.118]
	-0.055		-0.058	[11]	0.318		0.022
	[0.113]		[0.093]		[0.194]		[0.173]
		-0.371**	-0.090*	[12]		-0.424	0.252**
		[0.152]	[0.052]			[0.269]	[0.119]
	-0.107*	-0.370**		[13]	0.346***	-0.388	
	[0.063]	[0.152]			[0.133]	[0.266]	
	-0.049	-0.369**	-0.057	[14]	0.301	-0.399	0.055
	[0.113]	[0.152]	[0.092]		[0.194]	[0.269]	[0.174]
Hausman and Taylor	-0.096*			[15]	0.228**		
	[0.049]				[0.100]		
		-0.164*		[16]		-0.249	
		[0.091]				[0.166]	
			-0.088**	[17]			0.169*
			[0.043]				[0.096]
	-0.038		-0.06	[18]	0.229		0.005
	[0.086]		[0.075]		[0.148]		[0.141]
		-0.134*	-0.097**	[19]		-0.281*	0.174*
		[0.072]	[0.043]			[0.145]	[0.093]
	-0.127**	-0.154**		[20]	0.220**	-0.287*	
	[0.052]	[0.072]			[0.101]	[0.166]	
	-0.091	-0.148**	-0.034	[21]	0.173	-0.206*	0.048
	[0.092]	[0.073]	[0.077]		[0.151]	[0.124]	[0.141]

Notes:

(1) Standard errors are in brackets.

(2) *, **, *** indicate significance at the 10%, 5%,and 1% levels, respectively.

(3) U_{t+j} U_t, and $\min\{U_{t-k}\}_{k=0}^{j}$ mean Current unemployment rate, Unemployment rate at start of job, and Unemployment rate minimum ever hired, respectively.

(4)The dependent variable is log hourly wages.

(5) Other explanatory variables are full-time experiences, part-time experiences, full-time tenure, part-time tenure, years in NEE, and these experience variables squared, and schooling, region, and industry dummies.

(6) All statistics of F-test that all individual specific effects in the fixed effect estimation are zero is above 2.74.

Table 3: Estimation Results of Wage Function: using Unemployment rate varied by sex and age cohorts

	Male				Female		
	U_t	U_{t+j}	$\min\{U_{t-k}\}_{k=0}^{j}$		U_t	U_{t+j}	$\min\{U_{t-k}\}_{k=0}^{j}$
OLS	-0.020**			[1]	-0.007		
	[0.009]				[0.027]		
		-0.052***		[2]		-0.065*	
		[0.017]				[0.035]	
			-0.045***	[3]			-0.029
			[0.016]				[0.035]
	-0.009		-0.037**	[4]	0.006		-0.032
	[0.011]		[0.018]		[0.031]		[0.040]
		-0.035	-0.021	[5]		-0.072*	0.012
		[0.024]	[0.022]			[0.042]	[0.042]
	-0.009	-0.044**		[6]	0.006	-0.067*	
	[0.011]	[0.019]			[0.028]	[0.036]	
	-0.007	-0.033	-0.017	[7]	0.003	-0.072*	0.01
	[0.011]	[0.024]	[0.023]		[0.031]	[0.042]	[0.047]
Fixed Effect	-0.119***			[8]	0.096		
	[0.041]				[0.082]		
		-0.006		[9]		-0.072	
		[0.029]				[0.056]	
			-0.04	[10]			-0.005
			[0.031]				[0.062]
	-0.116***		-0.007	[11]	0.118		-0.041
	[0.044]		[0.033]		[0.089]		[0.068]
		0.062	-0.093*	[12]		-0.098	0.054
		[0.047]	[0.051]			[0.067]	[0.074]
	-0.125***	0.017		[13]	0.116	-0.084	
	[0.042]	[0.030]			[0.083]	[0.057]	
	-0.112**	0.054	-0.053	[14]	0.109	-0.092	0.017
	[0.044]	[0.047]	[0.053]		[0.090]	[0.067]	[0.080]
Hausman and Taylor	-0.083***			[15]	0.065		
	[0.031]				[0.067]		
		-0.01		[16]		-0.083*	
		[0.024]				[0.048]	
			-0.037	[17]			-0.021
			[0.026]				[0.054]
	-0.072**		-0.016	[18]	0.106		-0.057
	[0.033]		[0.029]		[0.071]		[0.059]
		0.027	-0.058	[19]		-0.112**	0.043
		[0.034]	[0.037]			[0.047]	[0.058]
	-0.077**	-0.007		[20]	0.069	-0.086*	
	[0.030]	[0.024]			[0.062]	[0.048]	
	-0.073**	0.008	-0.022	[21]	0.07	-0.096*	0.009
	[0.034]	[0.036]	[0.042]		[0.069]	[0.051]	[0.069]

Notes:

(1) Standard errors are in brackets.

(2) *, **, *** indicate significance at the 10%, 5%,and 1% levels, respectively.

(3) U_{t+j} U_t, and $\min\{U_{t-k}\}_{k=0}^{j}$ mean Current unemployment rate, Unemployment rate at start of job, and Unemployment rate minimum ever hired, respectively.

(4)The dependent variable is log hourly wages.

(5) Other explanatory variables are full-time experiences, part-time experiences, full-time tenure, part-time tenure, years in NEE, and these experience variables squared, and schooling, region, and industry dummies.

(6) All statistics of F-test that all individual specific effects in the fixed effect estimation are zero is above 2.74.

Table 4: J-Test Results: using aggregate unemployment rate varied by sex

sex	Null Model	Alternative hypothesis U_t	U_{t+j}	$\min\{U_{t-k}\}_{k=0}^{j}$
Male	U_t		2.43*	0.62
	U_{t+j}	1.69†		1.75†
	$\min\{U_{t-k}\}_{k=0}^{j}$	0.49	2.44*	
Female	U_t		1.46	0.13
	U_{t+j}	2.61**		2.12*
	$\min\{U_{t-k}\}_{k=0}^{j}$	1.64	1.58	

Notes:
(1) †, *, ** indicates significance at the 10%, 5%,and 1% levels, respectively.

Table 5: J-Test Results: using unemployment rate varied by sex and age cohorts

		Alternative hypothesis		
sex	Null Model	U_t	U_{t+j}	$\min\{U_{t-k}\}_{k=0}^{j}$
Male	U_t		-0.56	0.21
	U_{t+j}	2.98**		1.83*
	$\min\{U_{t-k}\}_{k=0}^{j}$	2.64**	-1.32	
Female	U_t		1.49	0.61
	U_{t+j}	1.4		-0.73
	$\min\{U_{t-k}\}_{k=0}^{j}$	1.32	1.47	

Notes:
(1) †, *, ** indicates significance at the 10%, 5%,and 1% levels, respectively.