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Why Do Real Wages Deviate from Labor Productivity?

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Abstract

We investigate the reasons why real wages deviate from marginal labor productivity. Using a panel dataset of Japanese sectors over the period of 1973-2002, we find that the wage gap, that is, the difference between the real wage and marginal labor productivity, depends on the utilization rate, the degree of goods market regulations, and the composition of workers. Specifically, our results suggest that the wage gap occurs due to 1) sticky wage and labor hoarding, 2) rents due to entry restrictions, 3) employment protections for regular workers, and 4) seniority-based wage system as an incentive contract, among others.

Key words: wage gap, regulation in goods markets, regulation in labor market, Japan

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1. Introduction

In the perfectly competitive market where the price and wage are flexible, the real wage is equal to the marginal productivity of labor. In the actual economy, the real wage deviates from the marginal productivity of labor. The wage gap, the difference between the two, causes the misallocation of resources and the future inflation. As such, it is now an important indicator for central bankers guiding monetary policies and a building block for economists studying the inflation dynamics[1]. The presence of the wage gap also casts doubts on the traditional measurement of total factor productivity (TFP) that assumes no wage gap[2]. Nonetheless, as far as we know, there is scarce evidence about the determinants of the wage gap. We try to bridge this gap.

The wage gap in Japan has recently fluctuated greatly. It widened in the early 1990s, stayed at a high level over the decade, and rapidly shrank in the early 2000s (Figure 1)[3]. Such a large fluctuation over time, as well as the wide variation among industries, offers us a good opportunity to study the causes of the wage gap.

The potential reasons for the wage gaps vary from the sticky wage to the goods and labor market regulations as well as the informational frictions concerning workers' efforts. We start by presenting various theoretical hypotheses for the causes of the wage gaps in Section 2. Motivated by the preceding theoretical studies, we conduct empirical analyses. In Section 3, we discuss our dataset and methodology. In Section 4, we present our empirical results. Concluding remarks are in Section 5.

2. Hypotheses

As a benchmark, we first show how the relationship between the real wage and the marginal productivity of labor is observed in a competitive spot market,

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[1] For New-Keynesian economics, the following three gaps are key building blocks: the gap between the real wage and the marginal productivity of labor, the gap between the actual GDP and the potential GDP, and the gap between the real interest rate and the natural rate of the real interest rate (e.g., Woodford, 2004).

[2] Asako and Takizawa (2008) finds a significant bias suffered when TFP is measured based on the assumption that there is no wage gap

[3] In Figure 1, the mean values over the sample period are normalized to zero. Therefore, it tells the movement of the wage gap but not the level itself. Kimura and Koga (2005) estimated the wage gap by assuming that the labor productivity follows a trend and found a similar trend after 1985.

allowing for the heterogeneity of labor. Then we discuss how the wage gap emerges when the labor or goods market have some frictions.

2.1 A competitive spot market

To allow for the heterogeneity of labor and yet to keep the presentation as simple as possible, we assume that there are two types of labor, skilled and unskilled, and that they are perfectly substitutable with the labor productivity of the skilled labor being a times as high as that of the unskilled labor. In addition, we assume that the production technology is represented by the following CES function,

(1) $Y = F(K,L) = \left[\alpha K^{\rho} + (1-\alpha)(aL_S + L_U)^{\rho}\right]^{\frac{1}{\rho}}, \quad \rho < 1,$

where Y denotes output, K capital stock, L_S skilled labor, and L_U unskilled labor. Under the assumptions that the goods and labor market are competitive spot markets and that there is no adjustment costs for capital or labor, the cost minimization implies that

(2) $W_S = aW_U$, and

(3) $W_U = (1-\alpha)\left(\frac{Y}{aL_S + L_U}\right)^{1-\rho}$,

where W_S and W_U are the real wages of skilled labor and unskilled labor, respectively. Taking logarithms of Equation (3), we get

(4) $\ln(W_U) = \ln(1-\alpha) + (1-\rho)\ln\left(\frac{Y}{aL_S + L_U}\right).$

Equation (2) implies that the wage ratios of different types of labor are proportional to their labor productivity ratios. The Divisia index of labor input, which we use in the empirical analysis, is adjusted for the quality of various workers by educational attainment, age and sex, based on their wage differences. It corresponds to $aL_S + L_U$. On the other hand, the Divisia index of wage, which we also use below, is adjusted for the quality of various workers so as to make it the index of wage for the worker with the same quality. It corresponds to W_U (or W_S). Denoting the Divisia index of labor input by L^* and the Divisia index of wage by W^*, respectively, Equation (4) implies that

(5) $\ln(W^*) = \ln(1-\alpha) + (1-\rho)\ln\left(\frac{Y}{L^*}\right)$

Equation (5) suggests that the real wage measured by the Divisia index is equal to the marginal productivity of labor measured by the Divisia index. In the competitive spot market, we should observe no wage gap.

2.2 Hypotheses concerning the wage gaps

The actual labor market is not necessarily characterized as a competitive spot market. A long-term labor contract with sticky wages, bargaining with the firm and the labor union over the distribution of rents emerging from the goods market regulation, among others, may cause a wage gap. We discuss such possibilities in details in this section. The first two are related to business cycle phenomena while the rests are based on more structural phenomena.

A. *Price and wage rigidity*

If price and wage are sticky, they are determined based on expected inflation rate. As a result, unexpected inflation lowers real wage as compared to marginal labor productivity. Because an expansionary monetary policy tends to cause a high capital utilization rate, we should observe a negative correlation between a capital utilization rate and a wage gap.

B. *Labor hoarding*

If changing labor input needs adjustment costs or time, firms responds to an increase in demand for goods by raising labor intensity instead of labor quantity (e.g, Burnside et al, 1993). As a result, an increase in output causes a rise in labor productivity, while wages do not rise with labor intensity as long as wages are rigid. Because labor intensity is likely to be correlated with capital utilization, we should observe a negative correlation between a capital utilization rate and a wage gap.

C. *Entry restrictions*

Entry restrictions and other regulations in the goods market affect firms' rents either through the entry costs or the price elasticity of demand, which determines the degree of competition. As long as a part of rents are distributed to workers through the bargaining process between the firm and workers, wages should increase at least in the short-run as goods-market regulations are imposed (Blanchard and Giavazzi, 2003)[4]. We should observe a positive correlation between

[4] Blanchard and Giavazzi (2003) show that in the long run, the firm entry is dampened and the real wage decreases. However, this reversal effect entails a

the degree of regulations in goods market and the wage gap.[5]

D. Employment protection and bargaining power of unions

Labor regulations protect workers and give them a bargaining power when they negotiate the distribution of the firm's rents with the management (Blanchard and Giavazzi, 2003). In many countries, regular workers are more strongly protected than non-regular workers. They collectively demand a high wage as compared to non-regular workers. Management accepts their demand because it is difficult to substitute non-regular workers for regular workers under regulations on firing regular workers. Especially in Japan, most of the unions restrict membership to regular workers and demand a wage hike only for regular workers[6]. Consequently, we should observe a positive correlation between the proportion of regular workers or union members with the wage gap.

Even though employment protections are legally identical across industries or regions, the actual effectiveness of them may vary greatly. In Japan, Okudaira et al, (2008) found that Tokyo is more favorable to employees than Osaka, judging from judicial decisions on the effectiveness of the adjustment dismissal.

E. Seniority-based wage system

Firms sometimes pay wages that are dependent on workers' age or years of experience. A typical example is the seniority-based pay. Though the present value of real wages may coincide with the present value of labor productivity over the workers' career, a wage gap emerges at least at a point of time. There are two competing hypotheses concerning why firms link wages to age or years of experience and not necessarily to productivity.

Becker (1964) posits that in order to give workers incentives to invest in

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decrease in the aggregate productivity. Hence the long-run implications for the wage gap are ambiguous.

[5] Bank of Japan (2007) found that industries tend to pay low wage relative to labor productivity if the proportion of the industries' equity share held by foreigners is high. This evidence seems to be consistent with the competition view because there is a positive correlation between the export share and the share of equity held by foreigners.

[6] Tsuru et al, (2008) found evidence that union wage premia are observed only for male workers, using data from Japan Cabinet Office's original survey in 2007. They pointed out the possibility that unions resisted nominal wage cuts during the "lost decade." Considering that most male workers are regular workers while a large proportion of female workers are non-regular workers, their evidence is consistent with the regular workers' bargaining power hypothesis.

firm-specific human capital, firms pay high wages to young workers and low wages to senior workers as compared to their productivity. Because workers who have acquired firm-specific skills cannot find a job with high wages outside the firm, firms pay low wages to senior workers as compared to their productivity. According to this human capital theory, when the proportion of young workers decreases and the proportion of senior workers increases, we should observe a negative wage gap.

On the other hand, Lazear (1981) insists that to prevent workers from shirking, workers are initially paid less than marginal productivity and as they work effectively, earnings increase and finally exceed marginal productivity. The upward slope of the age-earnings profile provides the incentive to avoid shirking. According to this incentive contract theory, when the proportion of young workers decreases and the proportion of senior workers increases, we should observe a positive wage gap.

Okazaki (1993), comparing the age-wage profiles and the age-productivity profiles using Japanese industry-level data, found evidences that are consistent with the human capital hypothesis for large firms and with the incentive contract hypothesis for small firms. Fukao et al, (2006), comparing the two age profiles at Japanese establishments, supported the incentive contract hypothesis. In particular, they found that wages continue to increase at a higher pace than the increase in labor productivity.

F. Sex discrimination by employers

Male-female wage differentials may occur by employer sex discrimination. If there are a sufficiently large number of discriminatory employers in the labor market so that the marginal female worker is employed by a discriminatory employer, a male-female wage differential emerges in the equilibrium (Becker, 1971). This hypothesis suggests that females are paid less than their productivity. As a result, we should observe a negative correlation between the proportion of female workers and the wage gap.

Though male-female wage differentials may emerge as a result of productivity differentials (as for the statistical discrimination hypothesis by Phelps,1972), there are some empirical evidences that support the employer sex discrimination hypothesis both for the U.S. (e.g., Hellerstein et al, 2002) and Japanese labor markets (Sano, 2005; Kawaguchi, 2007; Asano and Kawaguchi, 2007). In particular, Asano and Kawaguchi (2007), using panel data of Japanese firms, found that female

workers' marginal productivity is 45 percent of male workers', while female wage is only 30 percent of male wage.

3. Methodology and Data

3.1 Methodology

To test the hypotheses presented in section 2, we augment the competitive spot market wage equation (5) to allow for various industry-specific variables to affect the wage gap. In particular, we adopt the following two approaches. The first one is the one-step approach:

$$(6)\quad \ln W_{i,t}^{*} = \beta_0 + \beta_1 \ln\left(\frac{Y_{i,t}}{L_{i,t}^{*}}\right) + \beta_2 X_{i,t} + f_i + year_t + \varepsilon_{i,t},$$

where $W_{i,t}^{*}$ denote the Divisia index of wage, $L_{i,t}^{*}$ the Divisia index of labor, $X_{i,t}$ the industry-specific vectors, f_i the industry fixed effect, y_t the time dummies and $\varepsilon_{i,t}$ the error term, respectively. Note that the elasticity of substitution between capital and labor, $\frac{1}{1-\rho}$, is derived from the estimate of $\beta_1 = 1-\rho$.

The second method is the two-step approach, where we first estimate the wage gap and then estimate the determinants of the wage gap. Specifically, we identify the wage gap with the residual from the first-step regression and use it as a dependent variable in the second-step regression:

$$(7)\quad \ln W_{i,t}^{*} = \alpha_0 + \alpha_1 \ln\left(\frac{Y_{i,t}}{L_{i,t}^{*}}\right) + f_i + year_t + u_{i,t},$$

$$(8)\quad Gap_{i,t} = \gamma_0 + \gamma_1 X_{i,t} + \nu_{i,t}, \text{ where } Gap_{i,t} = \hat{u}_{i,t}$$

In both approaches, the industry-specific vector $X_{i,t}$ includes the following variables.

1) The utilization rate (*Utilization*)

This variable should have a negative sign if the sticky price and wage hypothesis and/or the labor hoarding hypothesis are valid.

2) The regulation index for the goods market (*Regulation*)

This variable should have a positive sign if the rent sharing hypothesis is valid.

3) The proportion of part-time workers (*Part-timer*)
4) The proportion of workers with university background (*Univ*)
5) The intersection of the proportion of male workers and the proportion of workers with university background (*Male*Univ*)

These variables are included to capture the regular workers' bargaining power hypothesis. Unfortunately, the data of the union organization rate at the industry level is not available for a reasonable time period. *Part-timer* should have negative coefficients while *Univ* and *Male*Unive* should have positive coefficients.

6) The proportion of workers aged 40 or more (*Aged 40+*).

This variable is included to capture the seniority-based wage system. If the human capital hypothesis is valid, the coefficient should be negative, while if the incentive contract hypothesis is valid, the coefficient should be positive. We choose the threshold of age at 40 based on Fukao et al, (2007), who suggest that wages paid to workers aged 40 or experiencing for 20 years are approximately equal to their productivity.

7) The proportion of female workers (*Female*).

If the employer sex discrimination hypothesis is valid, this variable should be a negative coefficient. On the other hand, if most of the wage differentials by the sexes reflect the productivity differentials, this variable should be insignificant.

3.2 Data

The main data sources are *JIP Database 2006* and *JIP Database 2008* (abbreviated as *JIP 2006* and *JIP 2008*, respectively below) compiled by Research Institute of Economy, Trade and Industry (RIETI) and Hitotsubashi University[7]. *JIP 2006* and *JIP 2008* contain annual data on 108 sectors that can be used for total factor productivity (TFP) analyses. These sectors cover the whole Japanese economy.

[7] *JIP 2006* and *JIP 2008* were complied in a collaboration between RIETI as part of its "Study on Industry-Level and Firm-Level Productivity in Japan" research project and Hitotsubashi University as part of its Hi-Stat (21st-Century COE Program, "Research Unit for Statistical Analysis in the Social Sciences") project. See Fukao and Miyagawa (2008) or http://www.rieti.go.jp/jp/database/JIP2008/index.html

The database includes detailed information on sectoral output, intermediate goods, value-added, capital stock and labor as well as some supplementary tables. Real values are based on 2000 prices.

The Divisia index of labor input is constructed from the number of workers, hours worked and wages for 128 types of workers categorized by sex, position in employment, educational attainment and age[8].

Though *JIP 2008* covers the period of 1970-2005, it does not contain the supplementary tables that we use below. On the other hand, *JIP 2006* covers the period of 1970-2002 and publishes all the supplementary tables. We decided to set our sample period from 1973 to 2002[9] and use *JIP 2008* for all the variables except for the utilization rate and the regulation index, contained in the supplementary tables of *JIP 2006*.

Our sample covers 106 sectors, all the sectors in *JIP 2008* except for "housing" (for which no labor data is available) and "unclassified sector" (for which no capital data is available).For a robustness check, we restrict our sample to market economies by excluding government and non-profit organization sectors.

The details of our data are described in Data Appendix. See Table 1 for descriptive sample statistics.

4. Estimation Results

Panel A of Table 2 shows the estimation results for the one-step approach. The results for all the sectors are presented from columns 1 to 4.

In columns 1, only the labor productivity is included in the explanatory variable as well as fixed industry and time dummies. The implied elasticity of substitution between capital and labor, the inverse of the coefficient on labor productivity, is 1.781, well above unity in the case of Cobb-Douglas production function.

In column 2, all the explanatory variables are included except for *Male*Univ*, which is strongly correlated with *Female* and *Univ*. The coefficient on *Utilization* is negative and significant, consistent with the price and wage rigidity hypothesis and the labor hoarding hypothesis. The coefficient on *Regulation* is positive and significant, suggesting that entry restrictions and other goods market regulations increase the firm rents, a proportion of which go

[8] Workers are categorized by the two sexes, the three positions (self-employed workers or their family, full-time workers and part-time workers), the four educational attainment (graduates from junior high school, senior high school, higher professional school or two-year college, and university) and eleven age groups (aged 15-19, 20-24,,,,60-64, and 65 or more).

[9] Most of the data for 1971 and 1972 are dropped in *JIP 2006* and *JIP 2008*.

to workers. The coefficient on *Part-timer* is negative and significant while the coefficient on *Univ.* is positive and significant, together consistent with the union power hypothesis. The coefficient on *Aged 40+* is positive and significant, suggesting that the incentive contract theory accounts for the seniority-based wage system. Lastly, the coefficient on *Female* is negative and marginally significant, which weakly suggests that the employer discrimination hypothesis is valid.

In column 3, we drop Female, which is strongly correlated with *Part-timer*. All the results are both qualitatively and quantitatively the same with the results in column 2. In column 4, we drop *Female* and *Univ.* from and add *Male*Univ*. to the explanatory variables. The coefficient on *Male*Univ*. is positive and significant, again consistent with the union power hypothesis. The remaining variables have similar coefficients to those in column 1.

Columns 5 to 8 present results for the market economy sectors. All the results are similar to those for the all sectors except for the coefficient on *Female*, which is negative but not significant for the market economy sectors.

In Panel B of Table 2, we show the results for the two-step approach. The dependent variables are the residuals from the estimation results shown in columns 1 and 5 of Panel A for all the sectors and the market economy sectors, respectively.

All the results are qualitatively the same with the one-step approach shown in Pane A, except for the coefficient on Female for all the sectors, which is almost zero and insignificant.

In sum, we have obtained evidences suggesting all the hypotheses presented in section 2.2 are valid and robust, though the evidence for the employer sex discrimination hypothesis is weak.

5. Conclusion

We investigate the reasons why real wages deviate from marginal labor productivity. Using a panel dataset of Japanese industries over the period of 1973-2002, we find that the wage gap, that is, the difference between the real wage and marginal labor productivity, depends on the utilization rate, the degree of goods market regulations, and the composition of workers. Specifically, our results suggest that the wage gap occurs due to 1) sticky wage and labor hoarding, 2) rents due to entry restrictions, 3) employment protections for regular workers, and 4) seniority-based wage system as an incentive contract, among others. On the other hand, we find weak evidence suggesting that employer sex discrimination causes the wage gap.

Our results suggest deregulations in goods and labor market affect the wage gap and labor allocations across industries, which will improve the aggregate

productivity. It also affects the transmission mechanism of monetary policy. To quantify these effects is left for future work.

Data Appendix

1) The Divisia labor input index

The sectoral Divisia index of labor input is available in *JIP 2008*.

2) The Divisia index of real wage

The sectoral Divisia index of nominal wage is not published in *JIP 2008*. We construct it by subtracting the rate of change in the Divisia index of labor input from the rate of change in the nominal labor cost and setting the level as of 1995, the base year, to unity. The sectoral Divisia index of real wage is the sectoral Divisia index of nominal wage divided by the sectoral output deflator, which is defined as the ratio of the secotral nominal output to the sectoral real output.

3) Output

We use the sectoral real output published in *JIP 2008*.

4) The utilization rate (*Utilization*)

We use the capital utilization index including the estimates based on *Tankan* DI statistics of Bank of Japan, published in a supplementary table of *JIP 2006*.

5) The regulation index for the goods market (*Regulation*)

We use the regulation index (regulated sectors are those where some relevant sub-sectors are subject to regulation) published in a supplementary table of *JIP 2006*.

6) The proportion of part-time workers (*Part-timer*)
7) The proportion of workers with university background (*Univ*)
8) The intersection of the proportion of male workers and the proportion of workers with university background (*Male*Univ*)
9) The proportion of workers aged 40 or more (*Aged 40+*).
10) The proportion of female workers (*Female*).

These variables of labor composition are available from *JIP 2008* except for the proportion of workers aged 40 or more, which the authors estimate from the basic labor statistics used in constructing *JIP 2008*.

References

Asako, Kazumi and Miho Takizawa (2008) “Marginal Productivity Principle and the Bias of TFP: International Comparisons using Productivity Database,” (in Japanese, Genkai seisansei genri to TFP no biasu, seisansei detabesu wo mochiita kokusai hikaku) *Financial Review,* August 2008, 73-93.

Asano, Hirokatsu and Daiji Kawaguchi(2007) "Male-Female Wage and Productivity Differentials: A Structural Approach Using Japanese Firm-level Panel Data" *RIETI Discussion Paper Series* 07-E-020.

Bank of Japan, Research and Statistics Department(2007) "Recent Developments of Japan's External Trade and Corporate Behavior" *BOJ Report & Reseach Papers*.
http://www.boj.or.jp/en/type/ronbun/ron/research07/data/ron0710a.pdf

Becker, Gary.(1971) *The Economics of Discrimination* .University of Chicago Press.

_____ (1964) *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Columbia University Press.

Blanchard,Olivier and Francesco Giavazzi(2003) "Macroeconomic Effects Of Regulation And Deregulation In Goods And Labor Markets" *The Quarterly Journal of Economics,*Vol.118(3),pp.879-907.

Burnside,Craig, Eichenbaum,Martin and Rebelo,Sergio(1993) "Labor Hoarding and the Business Cycle," *Journal of Political Economy*,Vol.101(2),pp.245-73.

Fukao, Kyoji, Ryo Kambayashi, Daiji Kawaguchi, Hyeog Ug Kwon, Young Gak Kim, and Izumi Yokoyama(2006)"Deferred Compensation Evidence from Employer-Employee Matched Data from Japan" *Hitotsubashi Discussion Paper Series* No.187.

Fukao, Kyoji, Tsutomu Miyagawa (Eds.) (2008)*Productivity and Japan’s Economic Growth: Industry-Level and Firm-Level Studies Based on the JIP Database* .Tokyo University Press.

Hellerstein,J,K., D.Neumark, and K.R.Troske(2002)"Market Forces and Sex Discrimination" *Journal of Human Resources*,Vol.37,No.2,pp.353-380.

Kawaguchi Daiji(2007)"A Market Test of Sex Discrimination: Evidence from Japanese Firm-Level Panel Data" *International Journal of Industrial Organization*,Vol.25,No.3,pp.441-460.

Kimura Takeshi and Maiko Koga(2005)"Economic changes and the three Gaps, GDP Gap, Real Interest Rate Gap and Real Wage Gap(in Japanese)*Bank of Japan Review*.
http://www.boj.or.jp/type/ronbun/rev/rev05j03.htm

Okazaki Keiko(1993)"Why Is the Earnings Profile Upward-Sloping? The Sharing Model vs the Shirking Model" *Journal of the Japanese and International Economies*,vol.7,issue 3,pp.297-314.

Okudaira Hiroko, Miho Takizawa and Kotaro Tsuru(2008)"Does Employment Protection Reduce Productivity?: An analysis using Basic Survey of Japanese Business Structure and Activities microdata"(in Japanse) *RIETI Discussion Paper Series 08-J-017*.

Phelps,E.S.(1972)"The Statistical Theory of Racism and Women." *American Economic Review*, Vol.62, No.4,pp.414-445.

Sano Shinpei(2005)"Does Employer Discrimination Cause Female-Male Wage Differences?"(in Japanse)*The Japanese Journal of Labour Studie*s No.540.

Tsuru Tsuyoshi, Takashi Yoshinaka, Hiroyuki Enoki and Hidenobu Tokuda(2008)"Economic effects of labor union and Non-Union Worker's hope for unionization"(in Japanese) *Hitotsubashi Discussion Paper Series* A No.505.

Woodford,Michael(2004),*Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton University Press.

Table 1. Descriptive Statistics

A. All Sectors

	Mean	Std. Dev.
Log Real Wage	-0.270	0.423
Log Labor Productivity	15.022	1.307
Female Ratio	0.341	0.169
Part-time Worker Ratio	0.110	0.076
Ratio of Workers over 40 Years Old	0.530	0.125
Ratio of University Educated Workers	0.183	0.128
Ratio of University Educated, Male Workers	0.163	0.110
Regulation Ratio	0.502	0.450
Utilization Ratio	0.891	0.078

B. Market Economy

	Mean	Std. Dev.
Log Real Wage	-0.286	0.433
Log Labor Productivity	15.080	1.192
Female Ratio	0.323	0.149
Part-time Worker Ratio	0.107	0.072
Ratio of Workers over 40 Years Old	0.537	0.126
Ratio of University Educated Workers	0.170	0.114
Ratio of University Educated, Male Workers	0.154	0.097
Regulation Ratio	0.460	0.443
Utilization Ratio	0.886	0.079

Note
Market economy exludes government and non-profit organization sectors.

Table 2. Estimation Results

A. One-Step Appraoch
Dependent Valiable: Real Wage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sector	All	All	All	All	Market Economy	Market Economy	Market Economy	Market Economy
Labor Productivity	0.562 ***	0.541 ***	0.546 ***	0.536 ***	0.579 ***	0.560 ***	0.561 ***	0.553 ***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)	(0.013)
Utilization		-0.131 **	-0.150 ***	-0.131 **		-0.136 ***	-0.138 **	-0.116 **
		(0.057)	(0.055)	(0.055)		(0.058)	(0.057)	(0.057)
Regulation		0.672 ***	0.669 ***	0.662 ***		0.664 ***	0.664 ***	0.654 ***
		(0.051)	(0.051)	(0.051)		(0.051)	(0.051)	(0.051)
Part-timer		-0.274 **	-0.318 ***	-0.402 ***		-0.199	-0.202	-0.229 *
		(0.112)	(0.109)	(0.109)		(0.129)	(0.128)	(0.127)
Univ.		0.727 ***	0.723 ***			0.844 ***	0.844 ***	
		(0.168)	(0.168)			(0.187)	(0.187)	
Male * Univ.				1.463 ***				1.678 ***
				(0.187)				(0.220)
Aged 40+		0.368 ***	0.375 ***	0.332 ***		0.315 ***	0.315 ***	0.252 **
		(0.100)	(0.100)	(0.100)		(0.105)	(0.105)	(0.105)
Female		-0.233 *				-0.027		
		(0.138)				(0.145)		
R-Square	0.402	0.426	0.426	0.433	0.423	0.447	0.447	0.454
F-Statistics	2258.7	322.2	375.2	387.5	2232.4	317.2	370.2	381.6
p-value	(0.016)	(0.000)	(0.000)	(0.000)	(0.017)	(0.000)	(0.000)	(0.000)
Period	1973-2005	1973-2002	1973-2002	1973-2002	1973-2005	1973-2002	1973-2002	1973-2002
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. 1: Figures in parentheses are standard errors.
Note. 2: ***, **, * indicate 1%, 5%, 10% rejection levels.

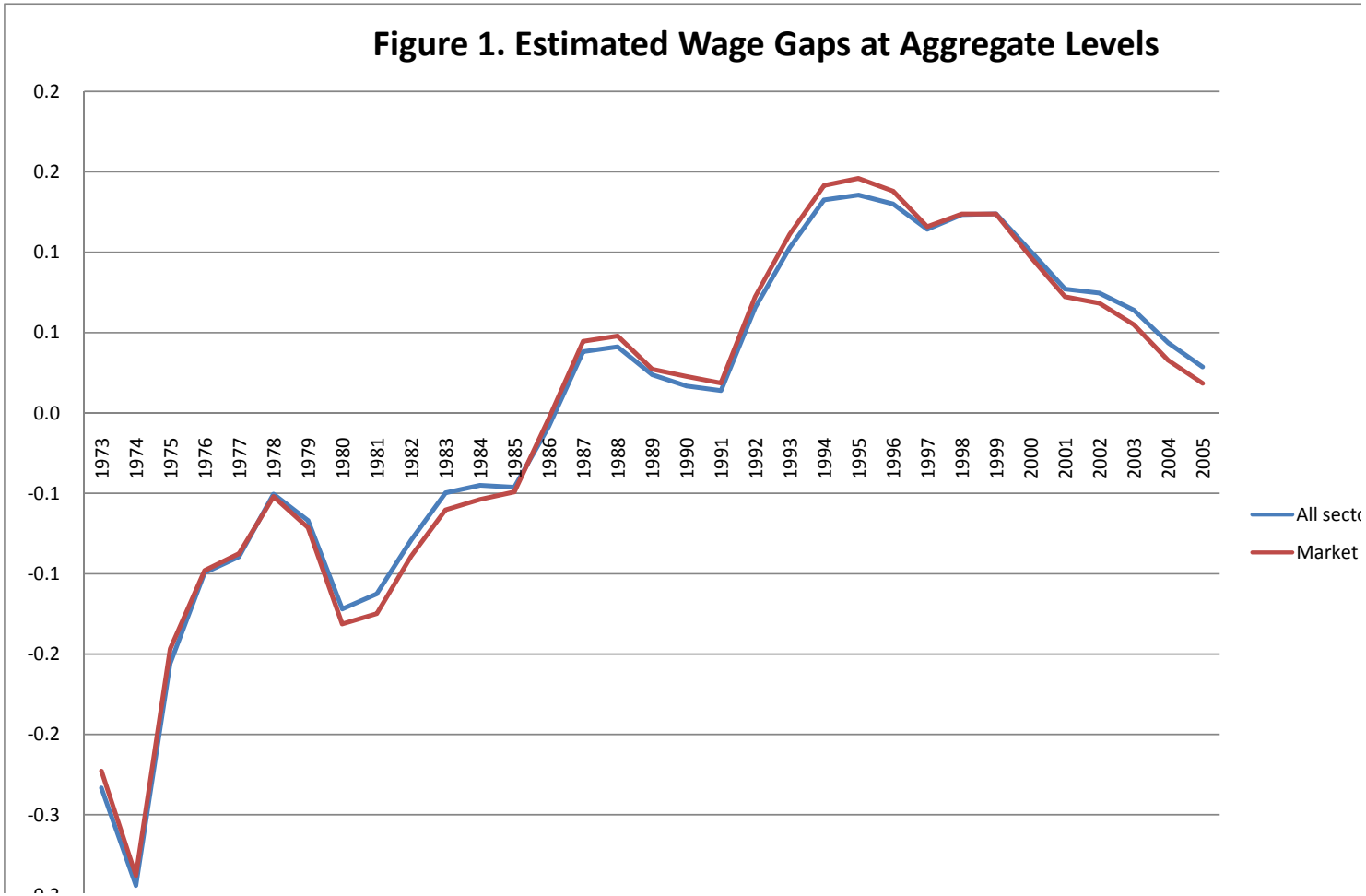
B. Two-Step Approach

Dependent Valiable: Real Wage Gap

	(1)	(2)	(3)	(4)	(5)	(6)
Sector	All	All	All	Market Economy	Market Economy	Market Economy
Constant	0.036	0.036	0.031	0.022	0.022	0.014
	(0.041)	(0.041)	(0.041)	(0.043)	(0.043)	(0.043)
Utilization	-0.118 ***	-0.116 ***	-0.116 ***	-0.105 **	-0.102 **	-0.101 **
	(0.045)	(0.044)	(0.044)	(0.046)	(0.045)	(0.045)
Regulation	0.041 ***	0.041 ***	0.041 ***	0.043 ***	0.042 ***	0.043 ***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Part-timer	-0.172 ***	-0.168 ***	-0.167 ***	-0.164 ***	-0.156 ***	-0.153 ***
	(0.053)	(0.048)	(0.048)	(0.059)	(0.054)	(0.053)
Univ.	0.063 **	0.062 **		0.092 ***	0.090 ***	
	(0.028)	(0.028)		(0.034)	(0.033)	
Male * Univ.			0.086 ***			0.122 ***
			(0.032)			(0.039)
Aged 40+	0.103 ***	0.102 ***	0.106 ***	0.096 ***	0.096 ***	0.101 ***
	(0.027)	(0.027)	(0.027)	(0.028)	(0.028)	(0.028)
Female	0.004			0.009		
	(0.022)			(0.026)		
R-Square	0.014	0.014	0.015	0.014	0.014	0.015
F-Statistics	7.7	9.2	9.7	6.8	8.2	8.7
p-value	(0.008)	(0.010)	(0.009)	(0.010)	(0.013)	(0.011)
Period	1973-2002	1973-2002	1973-2002	1973-2002	1973-2002	1973-2002
Year Dummy	No	No	No	No	No	No
Fixed Effect	No	No	No	No	No	No

Note. 1: Figures in parentheses are standard errors.

Note. 2: ***, **, * indicate 1%, 5%, 10% rejection levels.



Note. The coefficients of the year dummies in columns 1 and 5 of Panel A in Table 2 are depicted with the mean values over the sample period normalized to zero.