The Externality of Human Capital and Labor Share: Evidence from Japan

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Abstract

In recent years, as the importance of intangible assets has been pointed out, the accumulation of human capital, which is inseparable from intangible assets, attract attention again. Even in analyzes of the labor share, which become popular against the backdrop of a long-term downward trend in the labor share in developed countries, some analyzes consider the effects of intangible assets and human capital on the labor share.

On the other hand, it has been recognized that human capital not only contributes to the firm in question, but also has an externality within the same industry. Taking this point into consideration, this paper defines human capital in an industry as the proportion of employees with university or graduate school degrees among the workers in the industry and analyzed the impact in a firm's labor share.

As a result of estimating the determinants of a firm's labor share using a fixed effect model and the generalized product moment method, we found that even after controlling for various factors such as firms' investment in intangible assets, the accumulation of human capital within an industry has a statistically significant positive effect. The result supports the existence of an externality associated with human capital accumulation. If human capital is accompanied by an externality, firms will underinvest in human capital, so the recent trend of decline in human capital in Japan has led to a further decline in the labor share compared to the case where no external effects exist. considered to be a thing.

Keywords: Labor share, firm-level analysis, Japan, panel data
JEL Classification: D33, F61, J30, L11

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1. Introduction

A long-term downward trend in labor share has been observed in many developed countries, and various analyzes have been conducted on the factors behind this. Labor share is the proportion of income distributed to workers out of a company's added value, and the value obtained by subtracting the labor share from 1 is the capital share. Since employee incomes do not fluctuate rapidly in a country, rent a company incurs is calculated as capital income. Therefore, the factors that brought about the downward trend in labor share can be interpreted as factors that brought about rents for companies.

Factors that are assumed to have brought rents to companies over the long term include technological progress such as information and communication technology (ICT) and intangible assets such as property rights.

However, the importance of ICT and intangible assets complicates the discussion of determinants of labor share. As the use of ICT and intangible assets increases, the role of normal workers will be reduced, which is thought to be a factor pushing down the labor share. On the other hand, skilled workers called human capital who can utilize ICT and intangible assets will become a valuable asset for a firm, and the remuneration for these workers is expected to increase. Hence this will not necessarily be a factor pushing down the labor share. To clarify the impact of ICT and intangible assets, empirical research is

required.

We need to think more deeply about the impact of human capital. It has been pointed out that human capital has externalities to other companies within the same industry. It is based on the idea that the movement of human capital between companies in the same industry increases the level of human capital in the industry as a whole, which in turn increases productivity. If this idea is correct, it is expected that human capital across industries will have the effect of boosting labor productivity, independent of the effects of ICT and intangible assets within a company.

In this paper, our analysis focuses on the influence of ICT investment, intangible asset investment, and the external economy of industry-specific human capital on a company's labor share.

2 Previous research

The downward trend in the labor share has been noted since around the 2000s, and research into the causes of this has gradually begun to be conducted.

Several analyses stress the role of technological progress. Since the 1990s, ICT has been continuously evolving. The expectation was that this would result in a decline in investment goods prices, encouraging corporate investment, while reducing new worker

hiring and lowering the labor share. Lawless and Whelan (2011) and Karabarbounis and Neiman (2014) stressed that the decrease in the relative price of investment goods induces firms to shift their factor of content from labor to capital.

ICT has the direct effect of lowering firms' labor share as the analyses mentioned above revealed while it also affects firms' labor share through other channels. For example, Autor et al. (2020), known as a representative study that analyzes labor share dynamics between companies, states that the emergence of rapidly growing “superstar” firm s is the main reason for the decline in the labor share in US. The superstar firms are those that belong to the IC industry or those that make full use of ICT. Kehrig and Vincent (2021), who similarly studied the dynamics between companies, emphasize the large weight of companies with a low labor share, which are in the ICT industry or companies that utilize ICT. Some studies such as Elsby (2013) and Perugini et al. (2017) analyze the impact of globalization activities like trade and foreign direct investment on lowering the labor share. The influence of ICT is an essential factor when discussing the background to the acceleration of firms’ global activities.

Regarding intangible asset, O’ Mahony et al. (2019) analyzes the effect on industry-level labor share separately from the effect of traditional tangible capital asset and finds intangible investments increase the labor share while those related to the organization of

firms contribute to its decline.

To utilize ICT and intangible assets, human capital is inevitable. The concept of human capital was proposed by Becker (1964) and has spread to various fields of economics. It has attracted attention in macroeconomics as a source of growth, and in recent years in Japan, the importance of ``human capital management'' has been pointed out, making it a concept that is attracting attention in the field of business administration.[2]

According to Becker, it refers to people's personal resources such as education, training, and health, and is a means of obtaining income and employment opportunities. Just as companies optimize their investment and other actions with the aim of maximizing profits, individuals can improve their income and move to a better workplace by maximizing their human capital. it is conceivable that.

Becker argues that there are two types of human capital: general human capital and company/industry-specific human capital. The former are skills (communication skills, problem-solving skills, etc.) that are commonly required in all companies and industries. On the other hand, the latter is human capital that is useful only in a specific company or industry, and includes building human connections within the company, knowledge about company-specific information systems, knowledge about specific products and services,

[2] Ministry of Economy, Trade and Industry (2022).

and specialized industries. Considering the meaning of human capital in the context of labor share, any type of human capital will be evaluated if its effectiveness is demonstrated within a company, and therefore there is a possibility that it will be reflected in the wages of employees.

On the other hand, it has also been pointed out that human capital has external effects. As Kato (2008) summarizes, it is generally defined as the influence of individuals who have received formal education on the utility of others who have not received formal education through informal or social learning. Since there is a limit to the external effects that a single highly educated worker can have, the higher the proportion of highly educated workers in the workplace, the higher productivity will be, which will be reflected in wages. Furthermore, if the proportion of highly educated people in an industry increases, the human capital of the industry as a whole will increase through labor mobility, which is expected to lead to improved productivity within the industry.

Regarding the driving force of the labor share in Japan, empirical research have been implemented since the 2000s (see Takeuchi, 2005; Wakita, 2006; Agnese & Sala, 2011; Fukao & Perugini, 2021). Fukao et al. (2019) was the first microeconomic-level analysis in Japan. It also examines the effect of tangible and intangible asset while the external economy of human capital is not focused.

Building on existing research in the field (Fukao et al., 2019; Ito, 2021), this paper aimed to: (i) construct a cross-sectional employer-employee dataset that merges data on plants in Japan with employee data to calculate average industry-level employee characteristics; and (ii) evaluate the impact of industry-level human capital on the firm-level labor share.

3. Methods

3.1 Construction of cross-sectional employer-employee data in the Japanese manufacturing sector

The micro data on Japanese manufacturing plants from the Basic Survey on Wage Structure (BSWS) was merged with data from the Census of Manufactures (CM), from 2000 to 2015, to construct a cross-sectional employer-employee datafile. The data from the Establishment and Enterprise Census and the Economic Census for Business Activity (ECBA) were also used to integrate the BSWS and the CM, which have different identification numbers for plants.

3.2 Calculation of industry-level employee characteristics

Using the matched cross-sectional employer-employee data, average industry-level employee characteristics (y_t^j) are calculated, such as the proportion of university graduates, average years worked, etc.

$$y_t^j = \frac{1}{N_t^j} \sum_s y_t^{j,s} \quad (1)$$

where superscripts *j*, *t*, and *s* denote industries, years, and employees, respectively. N_t^j and $y_t^{j,s}$ are the number of employees in industry *j,* and characteristics of employee *s*, respectively.

3.3 Analysis on the drivers of firm-level labor share

Panel sample regressions are calculated based on the Basic Survey of Japanese Business Structure and Activities (hereinafter "the JBSA survey"), which has rich information on Japanese firms' activity. Similar to Bentolila and Saint-Paul (2003) and Fukao et al. (2019), we estimate the labor share using the following function and analyze the drivers of the labor share in the Japanese manufacturing sector.

$$LS_t^{i,j} = g(\boldsymbol{X}_t^{i,j}, A_t^{i,j}) h(\boldsymbol{Z}_t^{i,j}) \quad (2)$$

where superscript *i*, denotes firms, and the function g(.) describes the labor share determinants, which we can strictly derive from the production function. $\boldsymbol{X}_t^{i,j}$ is a vector of firm production factors and structural characteristics (age, international engagement,

etc.). $A_t^{i,j}$ is a measure of technical change. The separate exponential function h (.) means the other potential factors and $\boldsymbol{Z}_t^{i,j}$ is a vector of potential factors that could shift the production function.

Among other factors, we seek to understand how employees' characteristics mediate how labor share responds to greater firm exposure to automation (Acemoglu and Restrepo 2019), digitalization, or intangibles adoption (O' Mahony et al. 2019).

A regression analysis is used to account for various econometric issues and possible confounding factors. In particular, to address endogenous regressors and reverse causality issues, the generalized method of moments (GMM) estimation system is adopted.

3.5 Data

The following data were used in the analysis of this paper.

2.5.1 Basic Survey of Japanese Business Structure and Activities

The firm-level panel data were constructed from the JBSA survey, conducted annually by the Ministry of Economy, Trade, and Industry (METI). The JBSA survey targets all firms with at least 50 employees or 30 million yen of paid-in capital in the Japanese manufacturing, mining, and most service sectors. The questionnaire of the JBSA survey covers a firm's broad activities and characteristics, such as sales, number of employees,

tangible assets, intangible investments, and international activities.

3.5.2 Basic Survey on Wage Structure

The JBSA survey only has data on permanent employees for worker attributes, so we obtained the worker attributes from the BSWS implemented annually by the Ministry of Health, Labour, and Welfare (MHLW). The objective of the BSWS is to identify actual situation of employees' wages in major industries according to categories, such as type of employment, type of labor, occupation, gender, age, level of education, length of service, and occupational career.

In the BSWS, extracted samples of private establishments employing five regular employees or more and public establishments employing 10 regular employees or more in major industries are required to report information on the establishment and its employees. The information includes attributes of the establishment, employment size of a firm to which a plant belongs, employees' employment types, types of labor, levels of education, days and hours worked, cash earnings, and so on. [3]

3.5.3 Census of Manufactures and the Economic Census for Business Activity

Since the BSWS only presents the general information of the 24 industries, we merged the micro data on individual plant data from the CM (administered by METI) for 2004-2010 and 2012-2014, and the ECBA, for 2011, which is administered by the Ministry of

[3] It was not possible to construct panel employee-employer data because different identification numbers were assigned to each employee each year.

Internal Affairs and Communications (MIC) and METI. [4] [5]

Using the merged cross-sectional data from 2004 to 2014, we calculated the average value for employee information by industry. Then, we calculated concordance between industry classification of the CM and JBSA survey, and allocated industry-level employee information for the JBSA panel data.

4. Results and discussion

4.1 Descriptive statistics

Table 1 indicates descriptive statistics for the variables used in our analysis.[6] The size of the unbalanced panel of firms (pooled, all years) is 144,010. The number of firms in each year changed from 12,450 to 13,394. We define labor share (variable LS) as the total worker payroll over the value added. The average labor share during the study period was 64%. We estimate the total factor productivity (TFP) following the method of Olley and Pakes (1996) and normalize it by subtracting the sector average of TFP in 2000.

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[4] The ECBA is administered once every few years for business establishments in all industries. Since the ECBA covers subjects from the CM, the CM is not conducted in a year when the ECBA is administered. ECBA 2012 was administered in 2011 and reflects the 2011 manufacturing establishment information.

[5] The identification numbers of business establishments are different for the BSWS and CM. Therefore, to merge the plant data, we used individual data from the Establishment and Enterprise Census and the Economic Census for Business Frame (implemented by MIC), which have the same identification number as the BSWS. We merged this with micro data from the CM using the plants' telephone numbers and addresses.

[6] See Appendix 1 for variable information.

Table 1. Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
LS	144,000	0.64	1.50	-272	185
TFP	96,776	2.23	1.00	0.00	28.22
K/Y	144,000	4.21	24.80	-2798.39	5328
real K/Y	97,044	4.49	26.41	-3960.77	1793.99
Regular_employee_ratio	144,010	0.63	0.41	0	1
Invest_Intangible_ratio	119,870	1.10	1.29	1	228.56
Invest_ICT_ratio	119,870	1.02	0.08	1	2
D_EXP	144,010	0.33	0.47	0	1
D_IMP	144,010	0.29	0.46	0	1
D_FDI	144,010	0.08	0.27	0	1
D_Foreign	144,010	0.10	0.29	0	1
EXP_ratio	144,010	0.05	0.13	0	1
IMP_ratio	144,009	0.03	0.09	0	1.3741
FDI_ratio	144,010	0.00	0.02	0	0.9160
Foreign_ratio	144,010	0.00	0.04	0	1
Female_ratio	139,183	0.30	0.15	0.06	0.86
Line_ratio	139,183	0.12	0.04	0	0.28
Univ_ratio	139,183	0.16	0.05	0.03	0.39
Experience_ratio	139,183	0.08	0.05	0	0.29
Invest_deflator	144,010	1.02	0.01	0.99	1.07
Ipenn	144,010	0.16	0.14	0	0.77
HH_index	144,010	2.35	38.26	8.1E-09	4384.44

Note: 1 Author's calculation based on the JBSA survey

2 See Appendix 1 for the information of each variable.

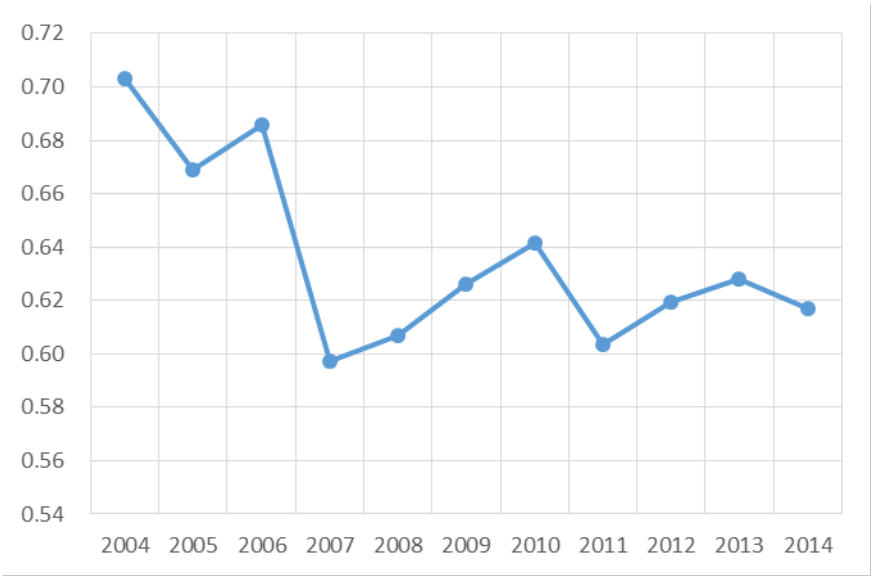
For the capital coefficient, a nominal value and real value were calculated. Real capital was calculated by (i) adding annual acquisition of assets deflated by investment deflator (obtained from the JIP database deducted to the capital asset amount at the beginning of each year and (ii) deducting eliminated asset amounts from the amount in (i). We also prepared the ratio of intangible asset and ICT asset investments to total investments. For firm internationalization, we use two continuous variables: export-sales ratio and the ratio of employees working at foreign subsidies to total employees.

Regarding employee characteristics of sectors, we compared four variables: the ratio of graduate from universities or graduate school to the total employees, female employees to male workers, management staff to total employees, and employees with more than 15 years experience to the total number of employees. Finally, to examine the effects of sector-level variables other than employee characteristics on labor share, we used variables on deflator of investment goods, import penetration ratio, and the Herfindahl-Hirschman index.

Figure 1 shows the trend in average labor share for the sample data. Consistent with previous empirical evidence such as Fukao & Perugini (2018), a declining trend over the current study period is clear. The labor share fluctuated around 70% at the beginning of the data period, then it declined rapidly in 2007 and has remained in the low 60% (See

Appendix 2 for additional details on the data).

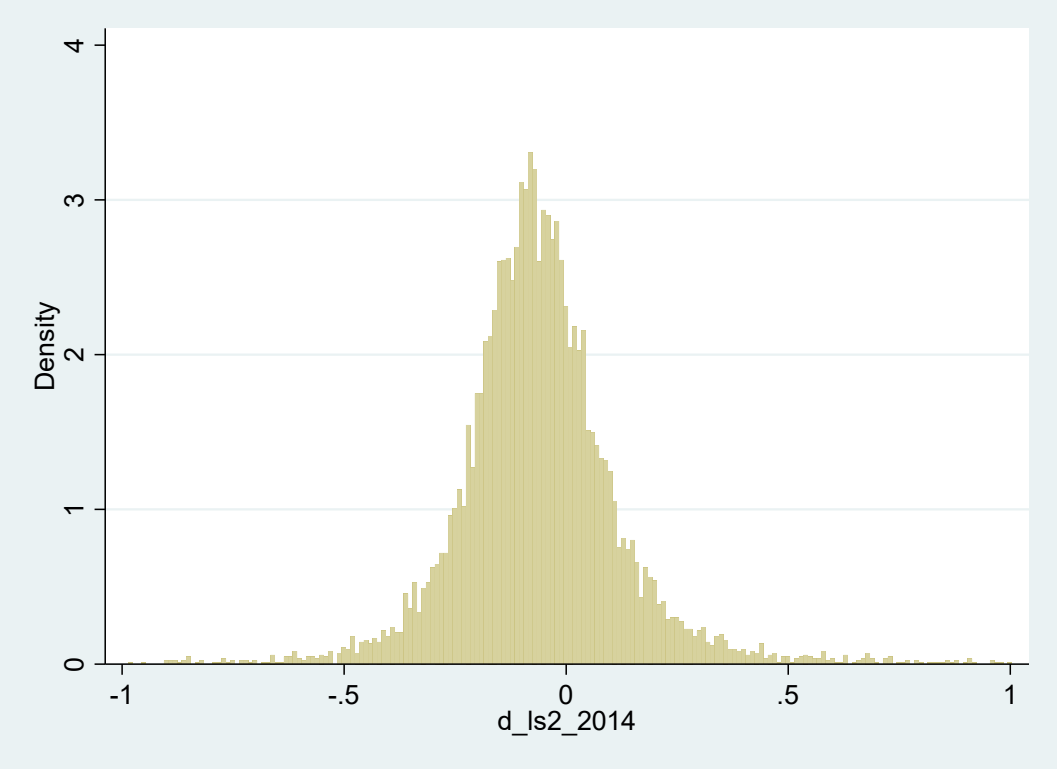
Figure 1. Average Labor Share of Japanese Manufacturing Firms, by Year



Note: Author's calculation based on the JBSA survey

To observe the decline in labor share for firms and the overall trend, Figure 2 show a plot of the changes in firms' labor share from 2004 to 2014. The data were normally distributed and 5,837 firms (69.2% of the surviving 8,440 firms from 2004 to 2014) had a decline in the labor share.

Figure 2. Distribution of change in labor share, 2004-2014



Note: Author's calculation based on the JBSA Survey

Figure 1 shows the distribution of differences in firms' labor share from 2004 to 2014, that is, $d\,LS^{ij,2014} = LS^{ij,2014} - LS^{ij,2004}$. The total number of existing firms from 2004 to 2014 is 8,440. The mean and standard deviation of $d\,LS^{ij,2014}$ are -0.0663 and 1.1165, respectively.

5.2 Estimation result

Table 2 reports the results of the estimation of equation (2). All models include sector, year, and prefecture dummies, including dummy variables on firm international activities. The estimation is implemented by a standard fixed-effect (FE) and the Arellano–Bond (AB) GMM estimation method. Columns [1] and [2] report the FE estimation with and without the following sector variables: deflator of investment goods, import penetration

ratio, and Herfindahl-Hirschman index, respectively. Columns [3] and [4] show the estimation results with and without sector variables for the two-step GMM estimations, respectively.[7] The results of the AB test for the second-order serial correlation of all GMM estimations did not reject the null hypothesis; therefore, there is no second-order serial correlation in the first-order difference of the error term.[8]

A comparison of the results based on the FE and AB GMM estimation methods shows that the signs and significance levels of the TFP, regular employees to total employees ratio, and university graduates to total employees ratio are stable. In the AB GMM estimation, we added the one-year lag of labor share to the explanatory variables. The statistically significant positive coefficient is consistent with our expectations and confirms a remarkable feature of persistence in the levels of labor share over time.

Firms with high TFP had a smaller labor share, a result that is in line with previous research. However, TFP growth, a portion of growth in output not explained by growth in inputs, seems to be neutral for factor share. The negative coefficient implies that the technological progress entails capital deepening as Karabarbounis and Neiman (2014)

[7] GMM estimation involves two methods: one-step estimation, which uses a generalized least squares method under the assumption of homoscedasticity on the product of the error term matrix and the instrumental variable matrix, and a two-step estimation without imposing homoscedasticity. The results of a two-step estimation is more general because of fewer assumptions, but it has downward bias (Arellano & Bond, 1991). Thus, in this chapter we compare the results of both methods.
Arellano and Bond (1991) also show that the results of both methods are asymptotically equal if the error term is independent and identically distributed.

[8] Because the estimation is just-identified, the Sargan test for over identification was not implemented.

indicated.

On the other hand, the coefficients of capital assets are instable. Results from the FE model indicated that the coefficient of capital to output ratio was negative, but it was positive for the AB model.[9] The coefficients of intangible asset and ICT asset investment ratios were significantly positive in the FE model, but not statistically significant in the AB model. This means that the role of capital assets, including intangible and ICT assets as a facto of labor share, are unstable and can change depending on time.

For firms' international activities, export and import had no statistically significant effect for either the FE or AB models. However, firms with FDI and foreign owned firms tended to have higher labor share in the FE model. This statistical significance disappears in the AB model. Globalization also has no stable effect on labor share.

[9] We estimated the FE model with a one-year lag of labor share, but the coefficient of capital to output ratio was negative.

Table 2. Analysis of drivers of labor share with international activities represented as dummy variables

	[1]	[2]	[3]	[4]
Estimation Method	FE	FE	AB (two step)	AB (two step)
TFP (ln)	-0.6261 ***	-0.6281 ***	-0.4943 ***	-0.4974 ***
	[-144.50]	[-145.01]	[-15.23]	[-15.27]
real K/Y (ln)	-0.0736 ***	-0.0742 ***	0.1052 ***	0.1027 ***
	[-21.90]	[-22.08]	[4.91]	[4.77]
Invest_ICT_ratio (ln)	0.02 *	0.0205 *	0.0102	0.0099
	[1.67]	[1.71]	[0.51]	[0.50]
Invest_Intangible_ratio (ln)	0.0141 ***	0.0135 ***	-0.0100	-0.0100
	[3.15]	[3.02]	[-1.56]	[-1.56]
D_EXP	0.0136 ***	0.0145 ***	0.0067	0.0069
	[3.98]	[4.24]	[0.96]	[0.97]
D_IMP	-0.0014	-0.0017	-0.0084	-0.0083
	[-0.42]	[-0.52]	[-1.02]	[-1.01]
D_FDI	0.017 ***	0.0169 ***	-0.0041	-0.0044
	[3.79]	[3.78]	[-0.35]	[-0.37]
D_Foreign	0.0234 ***	0.0231 ***	0.0031	0.0030
	[4.19]	[4.13]	[0.22]	[0.21]
Regular_employee_ratio (ln	0.0635 ***	0.0637 ***	0.0407 ***	0.0410 ***
	[12.50]	[12.56]	[4.06]	[4.06]
Femal_ratio (ln)	0.0258 **	0.0221 **	-0.0107	-0.0098
	[2.15]	[1.83]	[-0.59]	[-0.54]
Line_ratio (ln)	0.0037	0.0023	0.0108	0.0122
	[0.61]	[0.38]	[1.38]	[1.56]
Univ_ratio (ln)	0.0306 ***	0.0355 ***	0.0296 **	0.0256 **
	[3.39]	[3.93]	[2.32]	[2.00]
Experience_ratio (ln)	0.0005	0.0004	-0.0068 *	-0.0048 *
	[0.15]	[0.11]	[-1.82]	[-1.27]
Invest_deflator		-0.8860 ***		-0.6904 **
		[-4.22]		[-2.00]
Ipenn		0.0025		0.0082
		[0.83]		[1.34]
HH_index		0.037 ***		0.0091 *
		[12.46]		[1.73]
LS (t-1)			0.3967 ***	0.4028 ***
			[9.19]	[9.25]
CONST	0.229 ***	0.0251	0.3064 ***	0.3323 ***
	[5.92]	[0.59]	[2.58]	[2.64]
Sector dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Prefecture dummies	Yes	Yes	Yes	Yes
Arellano-Bond (1)			-11.59 (0.000)	-11.59 (0.000)
Arellano-Bond (2)			0.93 (0.352)	0.696 (0.339)
R-squared	0.5158	0.5169		
N	51,656	51,656	51,544	51,544

Note 1 Author's calculation

2 * denotes degree of statistical significance. ***p<.01, **p<.05, *p<.10

3 "FE" denotes Fixed-effect model. "AB" denotes Arellano Bond GMM estimation; "ln" means the variable is logarithmic; "d" means the variable is a dummy variable; Arellano-Bond (1) and (2), denotes Arellano-Bond test of first and second order serial correlation with the p-values in parentheses.

The coefficient of human capital, which is of interest to this paper, is statistically significantly positive both in FE and AB model, meaning that the accumulation of human capital in each industry raises its labor share. Regarding other variables indicating secto-level characteristics of employees, the coefficient for the female worker ratio was not statistically significant, contrary to the results of Fukao et al. (2019), The difference may stem from the calculation of the female worker ratio. The share of management staff has no statistically significant effect. The share of senior employees with more than 15-year experience also has no effect in FE model and very limited effect in AB model.

A stable effect of investment was observed for the deflator and Herfindahl-Hirschman index. However, the negative impact of the investment deflator was unexpected. Perhaps the decrease in investment goods price did not sufficiently urge firms to convert labor to capital during the estimation period when Japanese firms were facing world financial crisis or the Great East Japan Earthquake. While firms refrained from aggressive investment, they might have hired skilled personnel in preparation for ICT. In addition, import penetration had no statistically significant effect. As global value chains (GVCs) become more widespread worldwide, imports may have a stronger aspect of intermediate goods procurement than competing products for the domestic market.

The positive coefficient for the Herfindahl-Hirschman index also differs from

previous research. In general, for industries with high concentration, the firm's markup is high and the labor share is low, but the current study findings contradict existing research. It is possible that during the study period in Japan, firms with a higher markup might have hired skilled laborers at higher wages.

Table 3 indicates the estimation for equation (2) with continuous variables for a firm's international activities instead of using dummy variables. Regarding the effect of the sector-level ratio of university/graduate school graduates, the result does not differs from those in Table 2, meaning the effect of externality of human capital is robust.

Table 3. Analysis of drivers of labor share with international activities represented as continuous variables

	[5]	[6]	[7]	[8]
Estimation Method	FE	FE	AB (two step)	AB (two step)
TFP (ln)	-0.6198 ***	-0.6219 ***	-0.5028 ***	-0.5059 ***
	[-145.69]	[-146.20]	[-15.43]	[-15.46]
real K/Y_2 (ln)	-0.0682 ***	-0.0688 ***	0.0979 ***	0.0954 ***
	[-20.63]	[-20.83]	[4.64]	[4.49]
Invest_ICT_ratio (ln)	0.0202 *	0.0207 *	0.0101	0.0098
	[1.68]	[1.72]	[0.51]	[0.49]
Invest_Intangible_ratio (ln)	0.0154 ***	0.0148 ***	-0.0096	-0.0096
	[3.45]	[3.32]	[-1.49]	[-1.49]
EXP_ratio	0.0186	0.0206 *	-0.0277	-0.0269
	[1.64]	[1.81]	[-0.98]	[-0.95]
IMP_ratio	-0.0819 ***	-0.0837 ***	0.0141	0.0141
	[-4.55]	[-4.66]	[0.24]	[0.24]
FDI_ratio	-0.3248 ***	-0.3195 ***	-0.3712 **	-0.3723 **
	[-5.79]	[-5.71]	[-2.06]	[-2.07]
Foreign_ratio	0.0289	0.0409	-0.8651 ***	-0.871 ***
	[0.21]	[0.30]	[-3.54]	[-3.55]
Regular_employee_ratio (ln)	0.0632 ***	0.0635 ***	0.0412 ***	0.0415 ***
	[12.45]	[12.52]	[4.13]	[4.13]
Femal_ratio (ln)	0.0262 **	0.0226 *	-0.0109	-0.01
	[2.18]	[1.87]	[-0.60]	[-0.55]
Line_ratio (ln)	0.004	0.0026	0.0107	0.0121
	[0.66]	[0.43]	[1.37]	[1.55]
Univ_ratio (ln)	0.0307 ***	0.0356 ***	0.0297 **	0.0257 **
	[3.40]	[3.94]	[2.32]	[2.00]
Experience_ratio (ln)	0.0006	0.0004	-0.0068 *	-0.0048
	[0.18]	[0.13]	[-1.81]	[-1.26]
Invest_deflator		-0.8898 ***		-0.6915 **
		[-4.24]		[-2.00]
Ipenn		0.0026		0.0081
		[0.87]		[1.32]
HH_index		0.0369 **		0.009 *
		[12.38]		[1.71]
LS (t-1)			0.3986 ***	0.4047 ***
			[9.22]	[9.29]
CONST	0.2174 ***	1.1653 ***		
	[5.62]	[5.55]		
Sector dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Prefecture dummies	Yes	Yes	Yes	Yes
Arellano-Bond (1)			-11.60 (0.000)	-11.61 (0.000)
Arellano-Bond (2)			1.00 (0.317)	1.03(0.305)
R-squared	0.5146	0.5156		
N	51,656	51,656	51,544	51,544

Note 1 Author's calculation

2 * denotes degree of statistical significance. ***p<.01, **p<.05, *p<.10

3 "FE" denotes Fixed-effect model. "AB" denotes Arellano Bond GMM estimation; "ln" means the variable is logarithmic; "d" means the variable is a dummy variable; Arellano-Bond (1) and (2), denotes Arellano-Bond test of first and second order serial correlation with the p-values in parentheses.

6. Conclusion

This paper uses microdata on Japanese manufacturing firms, establishments, and workers to analyze the impact of human capital accumulation on the labor share in Japan.

The drivers of a firm's labor share were estimated using a fixed effect model and GMM. In the result of our estimation the direct impact of ICT and intangible asset investment within companies on the labor share was not confirmed. This may be due to the fact that such investments are sluggish in Japan.

On the other hand, human capital accumulation at the industry level was observed to have the effect of pushing up the labor share, supporting the existence of an external economy associated with human capital accumulation. If human capital is accompanied by an external economy, firms will underinvest in human capital. In fact, Japanese firms' human capital investment has remained sluggish. The recent trend of decline in human capital might cause the labor share to decline even more than it would have if no external effects existed.

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Appendix 1. Variable list

label	level	Type	Description
LS	firm	percentage	Total payroll to employees / value added
TFP	firm	continuous	Total factor productivity estimated by Olley-Pakes method
K/Y	firm	continuous	Asset - value added ratio
real K/Y	firm	percentage	Real asset - real value added ratio
Invest_Intangible_ratio	firm	percentage	Intangible asset nvestment/ asset investment
Invest_ICT_ratio	firm	percentage	ICT asset nvestment/ asset investment
D_EXP	firm	binary	Firm exporting outputs abroad (=1, 0 otherwise)
D_IMP	firm	binary	Firm importing iinputs from foreign countries (=1, 0 otherwise)
D_FDI	firm	binary	Firm having foeign subsidies (=1, otherwise 0)
D_Foreign	firm	binary	Firm fully or partially owned by foreign company (=1, otherwise 0)
EXP_ratio	firm	percentage	Exports/sales
IMP_ratio	firm	percentage	Imports/sales cost
FDI_ratio	firm	percentage	employees working at foreign subsidies/total employees
Foreign_ratio	firm	percentage	Share of stocks owned by foreign ffirms
Regular_employee_ratio	firm	percentage	Regular employees / total employees
Female_ratio	sector	continuous	female workers/ total employees
Line_ratio	sector	percentage	Line staffs / total employees
Univ_ratio	sector	percentage	University graduates / total employees
Experience_ratio	sector	percentage	employees with more than 15 year experience/ total employees
Invest_deflator	sector	continuous	Deflator of investment goods
Ipenn	sector	continuous	Import penetration ratio
HH_index	sector	continuous	Herfindahl-Hirschman index

Appendix 2. Labor share of the Japanese manufacturing sector

year	samples	mean	median	sd
2004	12,449	0.70	0.69	1.68
2005	13,234	0.67	0.68	0.48
2006	12,990	0.69	0.68	1.15
2007	12,777	0.60	0.60	0.89
2008	13,354	0.61	0.60	1.77
2009	13,390	0.63	0.63	2.01
2010	13,102	0.64	0.63	2.84
2011	13,104	0.60	0.60	1.37
2012	13,345	0.62	0.61	0.90
2013	13,202	0.63	0.61	0.78
2014	13,053	0.62	0.61	0.98
Total	144,000	0.64	0.63	1.50

人的資本の外部性と労働生産性

伊藤公二

要約

近年、無形資産の重要性が指摘されるにつれ、無形資産と不可分の人的資本の蓄積にも再び注目が集まりつつある。先進国における長期的な労働分配率の低下傾向を背景とする労働分配率に関する分析においても、無形資産、人的資本が労働分配率に及ぼす影響を考慮した分析も散見される。

ところで、人的資本に関しては当該企業への貢献のみならず、同一業種内に外部経済効果をもたらす可能性が指摘されている。本稿ではこの点を考慮して、業種における人的資本を業種内労働者に占める大卒・大学院卒の従業者の割合と定義し、業種における人的資本の蓄積（大卒・大学院卒の従業者の割合の上昇）が企業の労働分配率に及ぼす影響を分析した。

企業の労働分配率の決定要因について固定効果モデル及び一般化積率法により推計した結果、企業の無形資産投資など様々な要因を制御した上でも、業種内の人的資本の蓄積は企業の労働分配率に対して統計的に有意な正の効果を持つことが確認され、人的資本蓄積に伴う外部経済の存在を裏付ける結果となった。人的資本に外部経済が伴う場合、企業による人的資本投資は過少となるため、近年の人的資本の減少傾向は外部効果が存在しない場合と比較して労働分配率をより一層低下させたものと考えられる。