Efficiency of Japanese Corporate Investment in Human Capital and Shareholder Value

Yasushi Ishikawa, CMA and Kyoji Hasegawa, CMA

Yasushi Ishikawa, CMA
Head of Alternative Investment Fund Management Department and Joint Head of Global Multi Asset, Nikko Asset Management Co., Ltd. He joined Nomura Securities Co., Ltd. in 2000 and was assigned to the Investment Technology Research Department of the Financial Research Institute—his time with Nomura included over 11 years in the international arena, in London from 2004 and New York from 2006, where he was responsible for the development of quantitative investment strategies, mainly in the area of global equities. In March 2016, he joined Nikko Asset Management as Head of Alternative Investment Fund Management Department and was assigned to his current roles in July 2019. He graduated from the Department of Physics at the University of Tokyo in 1997, and obtained an MSc in Physics from the University of Tokyo in 1999, and PhD in Management Science from Kyoto University in 2019.

Kyoji Hasegawa, CMA
Quantitative Analyst, Investment Technology Fund Management Department, Nikko Asset Management Co., Ltd. After working for Financial Engineering Group, Inc. since 2004, he joined Nikko Asset Management in May 2005. He graduated from the International Graduate School of Social Sciences at Yokohama National University in 2004.

Abstract: Japan's struggles with issues related to its aging and shrinking population have made it important both from an economic and social perspective for the country to improve its labor productivity—which is low by international standards—by utilizing human resources efficiently. By estimating the efficiency of human capital investments of Japanese companies, we argue based on empirical analysis that higher human capital efficiency leads to higher share price performance, and that the relationship is particularly pronounced for the stocks of firms with lower labor productivity.

1. Introduction

In Japan, where the workforce is expected to decline as a result of the medium- to long-term social problems of an aging and declining population, the question of how to create value added by effectively utilizing these limited human resources is an important theme not only for individual companies but also for Japanese society overall. In particular, Japan's labor productivity (defined as GDP/number of workers) ranks 21st among the 35 OECD member countries and bottom among the seven major developed countries (G7). Some have attributed this to the deflationary economy it has experienced since the 1990s (Japan Productivity Center [2017]). While Japan's tendency for long working hours is being addressed through work style reform, it is essential for Japanese companies to create value added that exceeds increases in labor costs—in other words, to improve labor productivity through efficient investment in human capital—in order to encourage companies to hire more workers and increase wages. If this trend leads to an increase in consumption, it will raise the likelihood of a strong break from deflation. In this paper, therefore, we define human capital investment efficiency as the sensitivity of changes in labor productivity to the rate of change in the number of employees, and investigate the relationship between human capital investment efficiency and shareholder value. This research can be positioned broadly as an empirical study of the effectiveness of investments focused on the "S" component of ESG; that is, how corporate efforts to address the social issue of employment affects shareholder value.

Research on the relationship between general investments, such as capital investment, and stock returns has made particular progress in recent years. Titman et al. (2004) studied the relationship between the rate of change in capital investment and stock returns in the US market, and Cooper et al. (2008) conducted similar research that considered the asset growth rate as an investment indicator of the tangible assets of a company. Furthermore, Fama and French (2015) proposed a 5-factor model, which consists of a 3-factor model of market, size of firm, and value (book/market cap), plus

profitability (operating income/equity) and investment (total asset growth). These studies observed that companies whose investment is increasing or is at a high level have subsequently underperformed the market. It has been argued that this is because investors tend to underestimate the possibility of overinvestment by companies that are aggressively investing and expect such companies to grow faster, which can lead to the overvaluation of equity prices and subsequently cause them to underperform. Hisada (2012) and Yoshino and Saito (2012) have observed a negative relationship in the Japanese market similar to that found in the US. However, Titman et al. (2009), Watanabe et al. (2013), Fama and French (2016), and Kubota and Takehara (2018) have not observed a statistically significant relationship in Japan, and Titman et al. (2009) have argued that monitoring by affiliated main banks, a situation which is unique to Japan, may have restrained overinvestment by corporates. Although research on the relationship between investment in human capital and stock returns is limited, Belo et al. (2014) observed that stocks with a high rate of change in the number of employees subsequently underperform in the US market, which appears to be a similar result to that found by Titman et al. (2004), who focused on capital investment. Ishikawa et al. (2017) examined the relationship between investment in human capital (number of employees/sales or rate of change in the number of employees) and subsequent stock returns in the Japanese market, but observed no significant relationship.

As for studies regarding the efficiency of investments, Cohen et al. (2013) defined the sensitivity of subsequent sales growth to research and development (R&D) expenditures as investment efficiency which they called "Ability", and observed that the efficiency of R&D investment has a positive relationship with subsequent stock returns in the US, Japan, the UK, and Germany. Based on these results, they discussed the possibility that information on investment efficiency may be anomalous information that has not been fully priced into the market. Ishikawa et al. (2017) applied a similar approach to capital investment, R&D, and human capital investment to examine the relationship between investment efficiency and shareholder value (stock returns and ROE) at Japanese companies. As a result, they observed that high human capital investment efficiency has a positive effect on subsequent shareholder value, especially in labor-intensive companies with low sales per employee (i.e., low labor productivity).

Based on Ishikawa and Hasegawa (2018), which examined the potential of ESG investment from the perspective of Creating Shared Value (CSV), this paper has further advanced the study of the relationship between investment efficiency in human capital and shareholder value with a focus on improvements in labor productivity. The period of

analysis starts in 2002, when Japan's labor productivity (GDP/number of workers) lagged behind that of other major industrialized countries. The analysis targets major Japanese companies (TOPIX 500 constituents), in which it is easy to invest a certain amount of assets. In the second section of the paper, we define human capital investment efficiency in terms of its effect on the subsequent labor productivity of Japanese companies. We then examine the relationship between investment efficiency and stock returns using grouping analysis. The third section studies the impact of stock selection combined with labor productivity levels and human capital investment efficiency on shareholder value based on grouping analysis. The fourth section examines its robustness through the Fama-MacBeth regression, and we conclude in the fifth section.

2. Human capital investment efficiency and stock returns

2.1 Efficiency of Japanese corporate investment in human capital

While national labor productivity is often defined as GDP per worker, labor productivity for individual companies is defined as value added (= operating income + depreciation and amortization + labor costs)[1] divided by labor costs. The idea is to calculate the value that is added purely by the company by rebating the cost of sales activities, and then to evaluate how many times the amount of labor costs value added is equivalent to. The time-series average of the median labor productivity for the TOPIX 500 index constituents from March 2002 to February 2018 is 3.29 times. Applying the methodology of Cohen et al. (2013), here we estimate investment efficiency in human capital as the coefficient derived by time-series regression for each company to explain the change in labor productivity using the change rate in the number of employees two years previous.

$$\Delta \text{Labor Productivity}_i(t) = \alpha_{i,\text{NoE}} + \beta_{i,\text{NoE}} \times \Delta \text{NoE}_i(t-2) \,/\, \text{NoE}_i(t-3) \quad (1)$$

In equation (1), Δ denotes the change from the previous year, NoE is the number of employees, i is an individual company, and t is a fiscal year. The regression coefficients $\alpha_{i,\text{NoE}}$ and $\beta_{i,\text{NoE}}$ are estimated through a time-series regression for each company using the past five-year periods, and define $\beta_{i,\text{NoE}}$ as the investment efficiency in human capital. $\beta_{i,\text{NoE}}$ would be positive for companies that tend to see improved labor productivity after increasing employment (number of employees), while $\beta_{i,\text{NoE}}$ would be negative for companies that tend to see a deterioration in labor productivity after increasing employment.

[1] The calculation of value added and labor productivity as defined in this paper uses labor cost data that can be obtained only on a non-consolidated basis, and therefore excludes the effects of overseas subsidiaries and other factors that are reflected in consolidated accounts. Therefore, it should be noted that the true labor productivity of the company as a whole may not be captured.

If we denote labor productivity as LP, value added as VA, and labor cost as S, LP equals VA/S. Then, the change rate in LP, ΔLP/LP, can be approximately decomposed as ΔLP/LP ≈ ΔVA/VA - ΔS/S assuming that Δ denotes a relatively small change from the previous year. Hence, the variance of the rate of change in labor productivity Var (ΔLP/LP) is approximately decomposed as

$$\mathrm{Var}(\Delta \mathrm{LP}/\mathrm{LP}) \fallingdotseq \mathrm{Var}(\Delta \mathrm{VA}/\mathrm{VA}) + \mathrm{Var}(\Delta \mathrm{S}/\mathrm{S}) - 2\,\mathrm{Cov}(\Delta \mathrm{VA}/\mathrm{VA},\ \Delta \mathrm{S}/\mathrm{S}) \qquad (2)$$

In Exhibit 1, the upper panel shows the median of the time-series variance and covariance of labor productivity, value added, and labor costs in terms of annual change; the middle panel shows ratios between the medians; and the lower panel the median of ratio relative to the total variance of the rate of change in labor productivity. According to values in the middle and lower row, we can observe that the decomposition equation (2) above holds within a deviation of about 10 percent. The variance of the rate of change in value added is about five times the variance of the rate of change in labor costs, indicating that changes in labor productivity are primarily driven by changes in value added. In other words, companies with efficient human capital investment are those that, by increasing the number of employees, create value added that exceeds additional labor costs and improve labor productivity.

Exhibit 1. Decomposition of labor productivity change in major Japanese firms

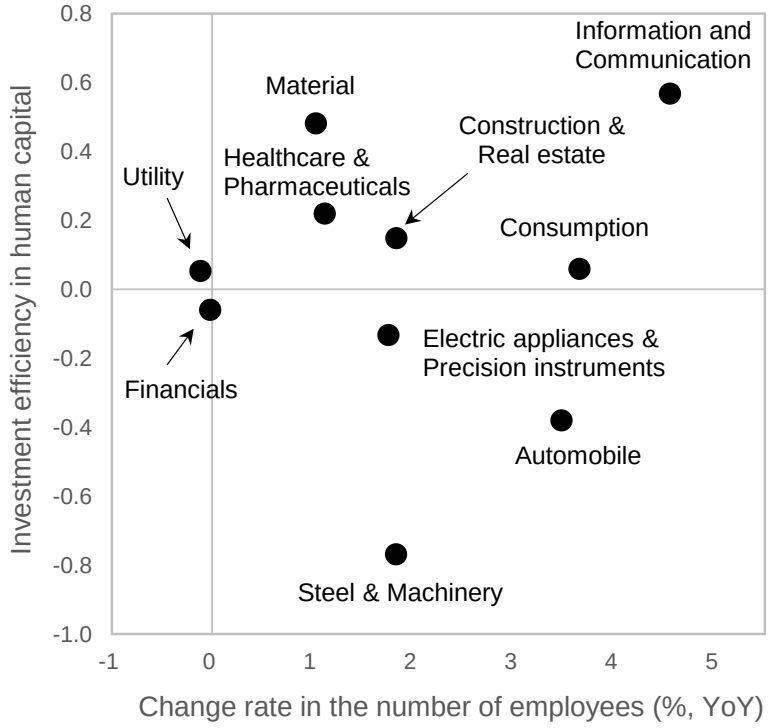
	Var of change rate in value-added (A)	Var of change rate in labor costs (B)	Cov between change rates in value-added and labor costs (C)	Var of change rate in labor productivity (D)
Median	7.34%	1.52%	1.04%	6.11%
	Var of chg rate in VA ÷ Var of chg rate in LP (A / D)	Var of chg rate in S ÷ Var of chg rate in LP (B / D)	Cov b/w chg rates in VA and S ÷ Var of chg rate in LP (C / D)	(A + B - 2 x C) / D
Median / Median	120.1%	24.8%	17.0%	110.9%
	Var of chg rate in VA ÷ Var of chg rate in LP (X)	Var of chg rate in S ÷ Var of chg rate in LP (Y)	Cov b/w chg rates in VA and S ÷ Var of chg rate in LP (Z)	X + Y - 2 x Z
Median	112.8%	35.0%	19.5%	108.8%

Note: Time-series variance and covariance based on the annual change rate in labor productivity, value-added, and labor costs in the TOPIX 500 component stocks are calculated, and the median of the values (first column), the ratio between the medians (second column), and the median of the ratio (third column) are shown. The analysis period is August 2003 to August 2018.

Median human capital investment efficiency for TOPIX 500 constituents was 0.06 on average from March 2002 to February 2018. The time-series average of the median rate of change in the number of employees (year on year) over this period is +1.36%, which is positive. Exhibit 2 shows scatter plots between human capital investment efficiency and rate of change in the number of employees by industry, which is based on the time-series average for the median within each industry (we used 10 industry categories based on the Tokyo Stock Exchange's 33 industries). The industry with the highest human capital

investment efficiency is information and communications, followed by materials and healthcare & pharmaceuticals. Conversely, the industry with the lowest human capital investment efficiency is steel & machinery, followed by automobiles and electric appliances & precision instruments. Information and communications, which represents the "new economy", appears to show high investment efficiency, while heavy industries, such as steel & machinery and automobiles, which represent the "old economy", appear to show low investment efficiency. From the perspective of improvement in labor productivity in Japan's industries as a whole, it would be efficient to have a high rate of human capital inflow into information and communications, where human capital investment efficiency is high. However, the relatively high rate of human capital inflow into industries such as steel & machinery, and automobiles, where human capital investment efficiency is relatively low, may not necessarily be efficient.

Exhibit 2. Human capital investment efficiency and change in number of employees in major Japanese firms by industry



Note: The analysis period is from April 2002 to March 2018, and the universe is the TOPIX 500 constituents. The time series average of the median price within each industry calculated on a monthly basis is shown.

2.2 Investment efficiency and stock returns

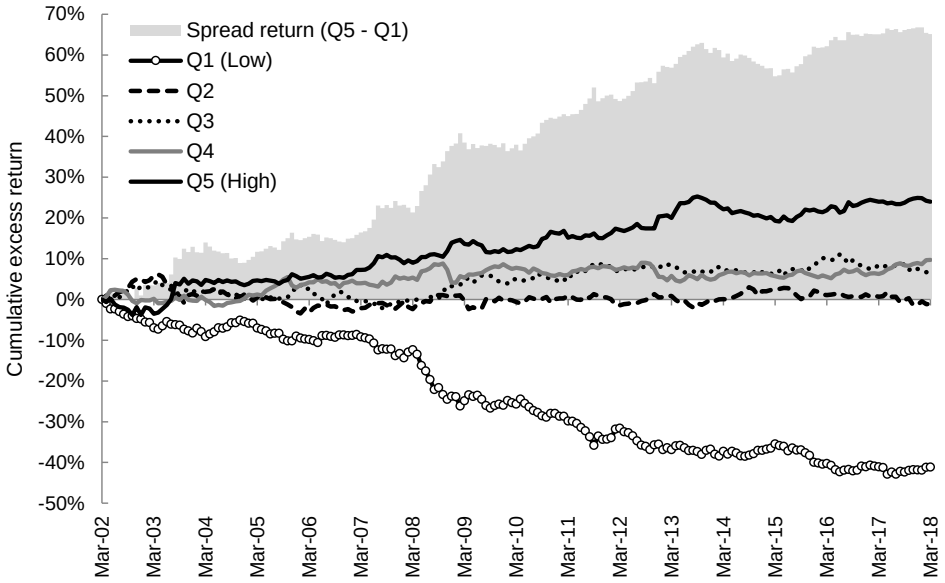
Next, we examine the relationship between human capital investment efficiency and

stock returns through grouping analysis. The period of analysis is from April 2002 to March 2018, and the universe is the TOPIX 500 constituents. Here, in order to exclude the effects of differences in human capital investment efficiency among industries which we observed in the previous section, we conducted the analysis on an industry-neutral basis. Specifically, at the end of each month, companies are divided into five quintiles based on their human capital investment efficiency levels standardized within each industry, and five equally-weighted baskets are constructed. The top panel of Exhibit 3 shows the cumulative excess returns relative to the equally-weighted universe for each basket, and the table below shows the annualized performance summary.

The fifth quintile with the highest human capital investment efficiency (Q5) significantly outperforms, and the first quintile with the lowest human capital investment efficiency (Q1) significantly underperforms. The spread between the fifth and first quintiles (Q5-Q1) also produces significant positive returns. Similar results are observed even when the same analysis is conducted without considering industry neutrality, although the statistical significance is slightly lower. The observation that higher investment efficiency leads to higher excess returns is consistent with the results of Cohen et al. (2013), which focused on R&D investment efficiency. Although the first quintile (Q1) significantly underperforms, we consider that this is due to an interaction with labor productivity, which we will discuss in the next section.

Exhibit 3. Grouping analysis by investment efficiency in human capital

Cumulative excess returns of quintiles by investment efficiency in human capital (industry neutral)



(annualized)	Q1 (Low)	Q2	Q3	Q4	Q5 (High)	Q5 - Q1 (High-Low)
Excess return	-2.57%	-0.07%	0.42%	0.61%	1.50%	4.07%
Tracking error	2.85%	2.65%	2.35%	2.39%	2.84%	4.12%
Information ratio	-0.90	-0.02	0.18	0.25	0.53	0.99
(t-value of excess return)	(-3.59)***	(-0.10)	(0.71)	(1.01)	(2.10)**	(3.94)***

Note: The analysis period is April 2002 to March 2018, and the universe is the TOPIX 500 constituents. Top chart shows cumulative excess returns of equal-weighted quintiles based on investment efficiency in human capital, relative to the equal-weighted universe (TOPIX 500). The quintiles are rebalanced monthly. The bottom table shows the performance summary where *, ** and *** indicate the significance at 10%, 5% and 1% in the t-value of excess returns.

3. Interaction effect on shareholder value from labor productivity and human capital investment efficiency

3.1 Labor productivity and stock returns

In the previous section, we defined human capital investment efficiency as the sensitivity of labor productivity to human capital investment, and observed that investment efficiency is positively related with subsequent stock returns. In this section, we examine how the level of labor productivity itself is related to subsequent stock returns, and the impact it has on the relationship between human capital investment efficiency and shareholder value.

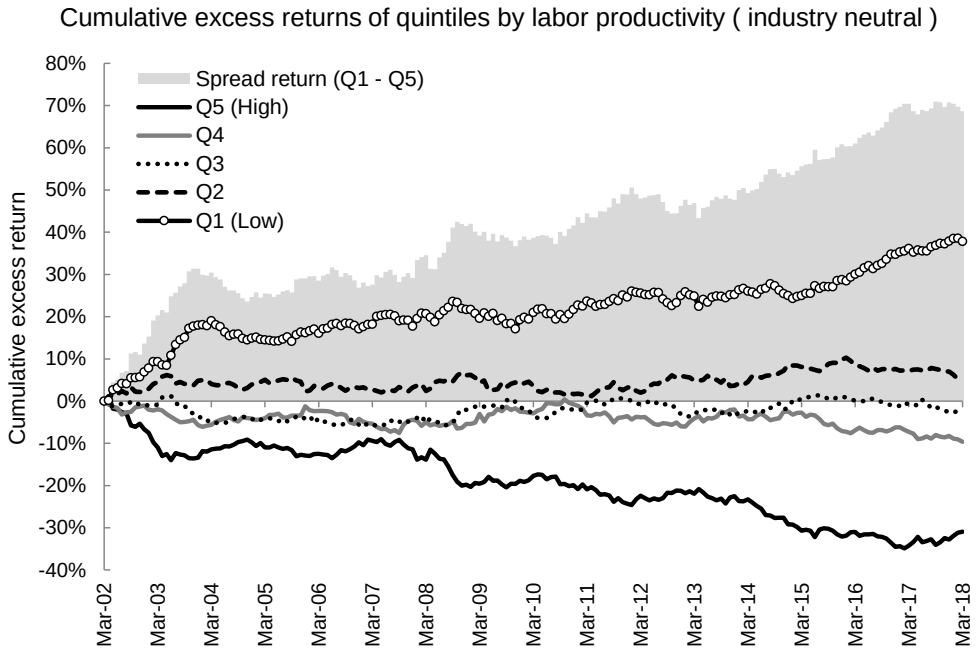
Jagannathan et al. (1998) found that, in the Japanese market as well as in the US market, stocks with higher price sensitivity to labor income growth tend to show higher subsequent returns, and that such companies have lower labor productivity (sales/labor

costs). Furthermore, Donangelo et al. (2019) observed a positive relationship between the labor distribution rate (the inverse of labor productivity) and subsequent stock returns in the US market, and argued that the higher degree of earnings sensitivity to an economic shock leads to higher expected returns for companies with high labor distribution (low labor productivity). Imrohoroglu and Tuzel (2014) studied the relationship between total factor productivity (TFP) and stock returns in the US market and observed that there is a negative relationship between TFP and subsequent stock returns. All of those prior studies suggest that stocks of companies with lower productivity subsequently show higher returns.

In this section, as in the previous section, we use the TOPIX 500 as the universe. Covering April 2002 to March 2018, we constructed five equally-weighted quantile baskets at the end of each month based on the standardized level of labor productivity within each industry. The figure in the upper part of Exhibit 4 shows cumulative excess returns of each basket over the equally-weighted universe constituents (TOPIX 500), and the table below the annualized performance summary. We see that the basket with the lowest labor productivity produces significant positive excess returns, while the basket with the highest labor productivity produces significant negative excess returns. This observation is consistent with Donangelo et al. (2019) and Imrohoroglu and Tuzel (2014), which observed that subsequent stock returns for companies with lower productivity are higher. Studies without industry neutrality also lead to similar results, however statistical significance tends to be higher under industry neutrality.

On the other hand, since lower labor productivity is equivalent to higher labor distribution, lower labor productivity can be interpreted as reflecting corporate appetite for returning profits to employees. In this case, the tendency for companies with lower labor productivity to have higher stock returns can be rephrased as a tendency for companies that are more proactive in returning profits to their employees to have higher stock returns. In the Japanese market, companies with a strong reputation for human capital utilization (Saito and Ito [2017]) and higher job satisfaction among employees (Yamada et al. [2017]) have been observed to tend to have higher stock returns, which is consistent with the observation here if higher labor distribution is associated with a stronger reputation for human capital utilization and higher employee job satisfaction.

Exhibit 4. Grouping analysis by labor productivity



(annualized)	Q1 (Low)	Q 2	Q 3	Q 4	Q5 (High)	Q1 - Q5 (Low-High)
Excess return	2.36%	0.35%	-0.10%	-0.60%	-1.93%	4.29%
Tracking error	2.99%	2.41%	2.34%	2.50%	3.02%	4.85%
Information ratio	0.79	0.15	-0.04	-0.24	-0.64	0.89
(t-value of excess return)	(3.15)***	(0.58)	(-0.09)	(-0.74)	(-2.55)**	(3.53)***

Note: The analysis period is April 2002 to March 2018, and the universe is the TOPIX 500 constituents. Top chart shows cumulative excess returns of equal-weighted quintiles based on labor productivity, relative to the equal-weighted universe (TOPIX 500). The quintiles are rebalanced monthly. The bottom table shows the performance summary where *, ** and *** indicate the significance at 10%, 5% and 1% in the t-value of excess returns.

3.2 Grouping analysis by labor productivity and investment efficiency in human capital

So far in our analysis, we have observed that investment efficiency in human capital has a positive relation with subsequent stock returns, and that labor productivity has a negative relation with subsequent stock returns. In this section, we study the effect of the combination of these two indicators on shareholder value. Specifically, at the end of each August, we divide the universe into three independent groups based on the levels of labor productivity and human capital investment efficiency (taking into account industry neutrality), construct a total of nine equally-weighted baskets, and examine their features. The analysis period is from September 2002 to August 2018. Exhibit 5 measures, among other things, the one-year forward change in ROE relative to the universe (top right table), along with the one-year excess return (top left table) for the nine baskets constructed by annual rebalancing. We find that the group with the highest

labor productivity and the lowest investment efficiency in human capital significantly underperforms, while the group with the lowest labor productivity and the highest investment efficiency in human capital significantly outperforms. This result appears consistent with the results of the grouping analysis by each indicator in Exhibits 3 and 4.

Exhibit 5. Grouping analysis independently sorted by labor productivity and investment efficiency in human capital

Annual rebalancing base under industry neutral (Sep 2002 – August 2018)

Annualized excess returns (vs. universe)		Investment efficiency in HC 1 (Low)	2	3 (High)	3 – 1 (High – Low)
Labor productivity	1 (Low)	0.61% (0.62)	1.02% (1.43)	2.20% ** (2.15)	1.58% (1.65)
	2	-0.74% (-1.18)	0.27% (0.29)	0.73% (0.96)	1.46% (1.48)
	3 (High)	-2.43% ** (-2.58)	-1.33% (-0.95)	-0.30% (-0.41)	2.14% ** (2.65)
3 – 1 (High – Low)		-3.05% * (-1.78)	-2.35% (-1.27)	-2.49% (-1.65)	

1-year forward ROE change (vs. universe)		Investment efficiency in HC 1 (Low)	2	3 (High)	3 – 1 (High – Low)
Labor productivity	1 (Low)	1.54% * (2.10)	0.85% ** (2.57)	1.73% ** (2.66)	0.18% (0.19)
	2	-1.02% ** (-2.27)	-0.14% (-0.46)	0.12% (0.46)	1.13% * (2.08)
	3 (High)	-1.37% *** (-3.71)	-0.85% * (-1.99)	-0.54% (-1.44)	0.83% * (1.79)
3 – 1 (High – Low)		-2.91% *** (-3.27)	-1.70% ** (-2.67)	-2.27% *** (-3.03)	

Investment efficiency in HC		Investment efficiency in HC 1 (Low)	2	3 (High)	3 – 1 (High – Low)
Labor productivity	1 (Low)	-19.36 *** (-5.57)	-0.24 (-0.68)	14.93 *** (16.35)	34.29 *** (9.66)
	2	-17.00 *** (-5.62)	-0.03 (-0.09)	14.25 *** (16.94)	31.25 *** (10.70)
	3 (High)	-41.77 *** (-6.87)	-0.06 (-0.14)	33.57 *** (20.78)	75.34 *** (11.55)
3 – 1 (High – Low)		-22.41 *** (-5.47)	0.18 (0.93)	18.64 *** (9.51)	

Chg of employee # (%, YoY)		Investment efficiency in HC 1 (Low)	2	3 (High)	3 – 1 (High – Low)
Labor productivity	1 (Low)	2.06 *** (3.75)	1.96 *** (3.95)	1.61 *** (3.13)	-0.45 (-1.04)
	2	2.95 *** (6.06)	4.43 *** (9.01)	2.73 *** (5.51)	-0.22 (-0.62)
	3 (High)	3.57 *** (6.00)	6.30 *** (9.84)	3.77 *** (9.53)	0.20 (0.43)
3 – 1 (High – Low)		1.51 ** (2.76)	4.34 *** (9.69)	2.16 *** (6.69)	

Note: Based on annual rebalancing at the end of August, the universe (TOPIX 500) are divided into three independent groups by labor productivity (industry-adjusted) and investment efficiency in human capital (industry-adjusted) independently, and total of nine groups are constructed. The top panels show the annualized excess return on the universe (equally weighted) over the next year, and the one-year ROE change (vs. universe) for each group. The bottom panels show the time-series average of human capital investment efficiency and change rate of the number of employees (year-on-year). The analysis period is from September 2002 to August 2018. Numbers in parentheses indicate t-values, where * , ** and *** are significant at 10%, 5% and 1%, respectively.

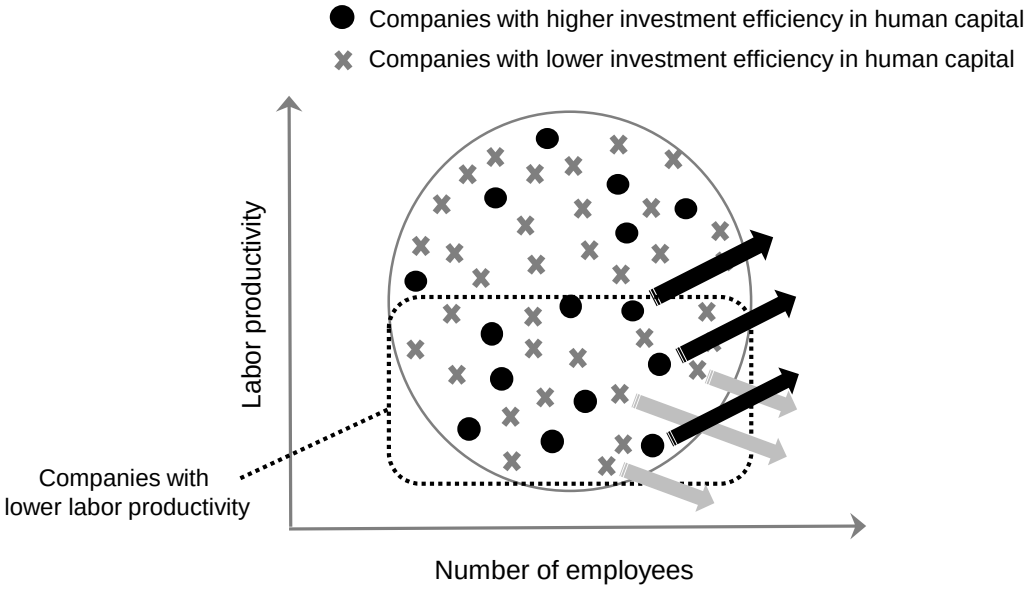
Based on the residual income model (Lee et al. [1999]), the theoretical price of a stock divided by book value per share is expressed as a form of the sum of the discounted present value of future ROE minus the cost of equity capital (equity spread). Therefore, we believe that stock price outperformance accompanied by improvement in ROE is more robust. Based on the average of one-year forward change in ROE relative to the universe for each of the baskets which are constructed by independent sort grouping (upper right table in Exhibit 5), we can see that the higher (lower) ROE of companies with higher (lower) labor productivity tends to revert to the mean and deteriorate (improve) in one year. In particular, the ROE of companies with high labor productivity and low human capital investment efficiency has deteriorated in the following year with high

significance, while companies with low labor productivity and high human capital investment efficiency have seen their ROE improve in the following year with high significance. This pattern is consistent with the pattern in excess returns, and we believe that the features in the stock returns would be relatively robust.

These observations suggest that companies with low labor productivity and high human capital investment efficiency have more room to improve their ROE and can therefore increase shareholder value by efficiently increasing the number of employees (see Exhibit 6). The bottom left table in Exhibit 5 validates this image; it shows the average of investment efficiency in human capital in each basket obtained by grouping via independent sorting, where the investment efficiencies of the groups with higher human capital investment efficiency are significantly positive, while the investment efficiencies of the groups with lower human capital investment efficiency are significantly negative. On the other hand, the lower right-hand corner of Exhibit 5 shows the average change rate in the number of employees in each basket (year on year), where the change rate in the number of employees is significantly positive for all groups, but the rate of change in the number of employees also tends to increase as labor productivity increases.

Given these results, it can be stated that companies with lower labor productivity and higher investment efficiency in human capital (positive efficiency on average) tend to increase shareholder value by increasing employee numbers efficiently. Conversely, companies with higher labor productivity and lower investment efficiency in human capital (negative efficiency on average) tend to damage shareholder value by increasing employee numbers inefficiently. In particular, the high degree of damage to shareholder value found in the latter group of companies might be due to the high pace of employee growth despite the high degree of negative investment efficiency in human capital.

Exhibit 6. Conceptual diagram of interaction between labor productivity and human capital investment efficiency



The results in the bottom row of Exhibit 5 provide implications for the phenomenon of the first quintile (Q1) with the lowest efficiency performing particularly weakly in the grouping analysis based on human capital investment efficiency (Exhibit 3). Within groups with low investment efficiency in human capital, the rate of change in the number of employees increases (lower right table in Exhibit 5) despite the fact that investment efficiency decreases as labor productivity rises (lower left table in Exhibit 5). On the other hand, within groups with high human capital investment efficiency, investment efficiency increases as labor productivity increases (lower left table in Exhibit 5) and the rate of change in the number of employees also increases (lower right table in Exhibit 5). In the end, Q1 (lowest human capital investment efficiency) and Q5 (highest human capital investment efficiency) in Exhibit 3 are likely to include many stocks with relatively high labor productivity, suggesting that if there is limited room for improvement in ROE, this will have a negative effect on subsequent stock prices. As a result, the intensifying of Q1 underperformance and the suppression of Q5 outperformance may have resulted in the asymmetric performance pattern of the quantile basket, as shown in Exhibit 3. In other words, companies with higher labor productivity tend to invest aggressively in human capital, but the efficiency of human capital investment tends to be extremely positive or negative, depending on whether the aggressive investment leads to a further improvement or deterioration in labor productivity. Especially for companies with low human capital investment efficiency,

their limited room for ROE improvement would have exposed them to additional negative impact, with the stock price seen to have significantly underperformed thereafter.

4. Robustness verification by Fama-MacBeth regression

Based on the discussion in the previous section, we define "productivity reform score" by combining investment efficiency in human capital with inversed labor productivity on a one-to-one basis after standardization. Here, labor productivity and human capital investment efficiency are standardized within each industry in the universe. In this section, we will examine the relationship between investment efficiency in human capital, labor productivity, productivity reform scores and subsequent stock returns based on the Fama-MacBeth regression (Fama and MacBeth [1973]), which takes into account the Fama-French three-factor and five-factor models (Fama and French [1992, 2015, 2016]). The analysis period is the 16 years from the end of August 2002 to the end of August 2018. Exhibit 7 shows the time-series average and the t-values of regression coefficients (annualized) based on the cross-sectional regression models which explain one-year forward stock returns by the scores at the end of each August. All productivity-related factors are standardized within industries, and, furthermore, all factors other than historical market beta (relative to TOPIX, based on 60 months) are standardized on a cross-sectional basis. Models 1-4 take only productivity-related factors as explanatory variables; Models 5-9 take Fama-French three factors (market beta, log of market capitalization, and B/P) in addition to productivity-related factors as explanatory variables; and Models 10-14 take Fama-French five factors—adding profitability (operating income/equity capital) and investment (total asset growth rate) further—as explanatory variables.

Models 1-4 show a significantly positive relationship for investment efficiency in human capital and a significantly negative relationship for labor productivity to subsequent stock returns, which is consistent with the results from the grouping analysis. Model 3, which is explained simultaneously by the two indicators, also shows a significant relationship with each, and the productivity reform score (Model 4), which combines both scores, shows a positive relationship with the highest significance among all models. When the Fama-French three factors are added to the explanatory variables in Models 5-9, the statistical significance of the negative contribution from labor productivity disappears. The disappearance of significant negative contribution from productivity by taking Fama-French three factors into account is consistent with the results in the US market by Imrohoroglu and Tuzel (2014) and Donangelo et al. (2019). On the other hand,

contributions from investment efficiency in human capital and the productivity reform score remain significantly positive, with the latter showing the highest significance in Models 5-9. Profitability and investment are added as explanatory variables in Models 10-14, but the result remains largely unchanged. The significance of labor productivity still disappears, but investment efficiency in human capital and productivity reform scores are positively related; productivity reform scores, in particular, show the highest statistical significance in Models 10-14.

Exhibit 7. Fama-MacBeth regression analysis

		Inception	Beta	Size (log of Mkt Cap)	Value (B/M)	Profitability (OP/B)	Investment (Asset Growth)	Labor Productivity	Human Capital Investment Efficiency	Productivity Reform Score	Adjusted R^2
	Model1	9.65%						-1.13% **			0.3%
		(0.87)						(-2.44)			
	Model2	9.65%							0.97% ***		0.1%
		(0.87)							(3.98)		
	Model3	9.65%						-1.10% **	0.91% ***		0.4%
		(0.87)						(-2.41)	(3.51)		
	Model4	9.65%								1.48% ***	0.3%
		(0.87)								(5.29)	
+ Fama-French 3 factors	Model5	10.62%	-0.79%	-0.76%	1.21%						6.8%
		(1.14)	(-0.27)	(-0.88)	(1.13)						
	Model6	10.58%	-0.75%	-0.66%	1.14%			-0.58%			6.9%
		(1.14)	(-0.26)	(-0.75)	(1.07)			(-1.49)			
	Model7	10.60%	-0.78%	-0.71%	1.22%				0.73% **		6.9%
		(1.13)	(-0.26)	(-0.82)	(1.14)				(2.87)		
	Model8	10.57%	-0.74%	-0.60%	1.16%			-0.56%	0.71% **		7.0%
		(1.13)	(-0.25)	(-0.69)	(1.09)			(-1.44)	(2.58)		
	Model9	10.54%	-0.69%	-0.61%	1.14%					0.95% ***	6.9%
		(1.13)	(-0.23)	(-0.70)	(1.06)					(3.38)	
+ Fama-French 5 factors	Model10	10.72%	-0.84%	-0.77%	1.07%	0.12%	-0.90%				7.9%
		(1.14)	(-0.29)	(-0.88)	(0.86)	(0.18)	(-1.68)				
	Model11	10.67%	-0.79%	-0.69%	1.07%	0.22%	-0.86%	-0.49%			7.9%
		(1.13)	(-0.28)	(-0.77)	(0.86)	(0.35)	(-1.65)	(-1.57)			
	Model12	10.70%	-0.82%	-0.72%	1.06%	0.09%	-0.87%		0.66% **		7.9%
		(1.13)	(-0.29)	(-0.83)	(0.85)	(0.13)	(-1.64)		(2.67)		
	Model13	10.65%	-0.78%	-0.64%	1.07%	0.19%	-0.83%	-0.47%	0.65% **		7.9%
		(1.13)	(-0.27)	(-0.72)	(0.86)	(0.29)	(-1.61)	(-1.51)	(2.48)		
	Model14	10.64%	-0.74%	-0.64%	1.06%	0.21%	-0.85%			0.85% ***	7.9%
		(1.13)	(-0.26)	(-0.73)	(0.85)	(0.33)	(-1.61)			(3.48)	

Note: The universe is the TOPIX 500 constituents and the period of analysis is from September 2002 to August 2018. Table shows time-series means and t-values for coefficients based on cross-sectional regressions which explain one-year forward stock returns over as of the end of August by variables including beta (vs. TOPIX 60-month historical beta), log of market capitalization, value (equity/market capitalization, B/M), profitability (operating income/equity, OP/B), investment (asset growth), labor productivity (with industry adjustments), investment efficiency in human capital (with industry adjustment), and productivity reform scores (with industry adjustment). * , ** and *** indicate that they are significant at 10%, 5% and 1%, respectively. Explanatory variables (excluding beta) are normalized to have a mean of 0 and a standard deviation of 1 in each cross-section.

5. Conclusion

This paper examined the effect of investment efficiency in human capital on shareholder value in Japan, mainly stock returns, by defining this efficiency as the sensitivity of the change in labor productivity to the prior rate of change in the number of employees. Grouping analysis showed that under industry neutrality, companies with higher efficiency in investing in human capital tended to have higher subsequent returns. Furthermore, companies with lower levels of labor productivity tended to have higher subsequent stock returns. In particular, we found that companies with low labor

productivity and high human capital investment efficiency generate significant positive excess returns accompanied by improvement in ROE, and conversely, companies with high labor productivity and low human capital investment efficiency generate significant negative excess returns accompanied by deterioration in ROE. When the Fama-MacBeth regression was used to test the robustness of the features, we observed that the negative contribution from labor productivity lost its significance when Fama-French three factors were taken into account; on the other hand, the positive contribution from investment efficiency in human capital remained significant, and the "productivity reform score", which is a composite of low labor productivity and high human capital investment efficiency, showed a positive contribution with even higher significance. The result which shows that the significance of the negative contribution from productivity disappears when size and value factors are considered is consistent with the results from the analysis of the US market by Imrohoroglu and Tuzel (2014) and Donangelo et al. (2019). The result that investment efficiency in human capital has a significantly positive relation to subsequent stock returns is consistent with the observations of Cohen et al. (2013) which focuses on the investment efficiency of R&D, discussing the possibility that the markets may not have fully priced in information regarding the efficiency of investments. Furthermore, the observation that positive contributions from efficient investment in human capital have a greater significance for companies with lower labor productivity can be said to be an encouraging result for Japanese companies, which are under pressure to improve their labor productivity by investing efficiently in a limited labor force, with Japan's labor productivity being one of the lowest among the major industrialized countries.

Finally, in this paper, we estimated the investment efficiency in human capital as the sensitivity of labor productivity change to the rate of change in the number of employees by referring to Cohen et al. (2013). According to this definition, companies that have experienced a significant decline in labor productivity as a result of reducing the number of their employees are also identified to be highly efficient in their human capital investment. It was confirmed in the 3×3 grouping analysis based on labor productivity and human capital investment efficiency independently (Exhibit 5) that for all nine groups the time-series average of the rate of change in the number of employees is significantly positive; we therefore believe that the negative rate of change in the number of employees had only a limited impact on the conclusions drawn in this paper. However, the relationship between human capital investment efficiency and shareholder value that takes into account the positive and negative rates of change in the number of employees is a theme for future research.

Acknowledgements: We would like to thank two anonymous referees, professors Yasuyuki Kato, Nobuyuki Isagawa, and Chiaki Hara of Kyoto University, and Hiroki Tsujimura and Jiro Nakano of Nikko Asset Management, as well as many others, for their valuable input in writing this paper. We would like to take this opportunity to express our deepest gratitude to all of them. The content of this article is not representative of the organizations to which the authors belong, and is based entirely on their personal views. Any errors in this paper are attributable to the authors.

References

Belo, F., Lin, X. and Bazdresch, S. 2014. "Labor Hiring, Investment, and Stock Return Predictability in the Cross Section," *Journal of Political Economy*, Vol.122, No.1, pp.129-177.

Cohen, L., Diether, K. and Malloy, C. 2013. "Misvaluing Innovation," *The Review of Financial Studies,* Vol.26, No.3, pp.635-666.

Cooper, M., Gulen, H. and Schill, M. 2008. "Asset Growth and the Cross-Section of Stock Returns," *Journal of Finance,* Vol.64, No.4, pp.1609-1651.

Donangelo, A., Gourio, F., Kehrig, M. and Palacios, M. 2019. "The Cross-Section of Labor Leverage and Equity Returns," *Journal of Financial Economics*, Vol.132, No.2, pp.497-518.

Fama, E., and French, K. 1992. "The Cross-Sectional of Expected Stock Returns," *Journal of Finance*, Vol.47, No.2, pp.427-465.

Fama, E., and French, K. 2015. "A Five-Factor Asset Pricing Model," *Journal of Financial Economics*, Vol.116, No.1, pp.1-22.

Fama, E., and French, K. 2016. "International Tests of a Five-Factor Asset Pricing Model," *Journal of Financial Economics*, Vol.123, No.3, pp.441-463.

Fama, E., and MacBeth, J. 1973. "Risk, Return, and Equilibrium: Empirical Tests," *Journal of Political Economy,* Vol.81, No.3, pp.607-636.

Hisada, S. 2012. "Verification of Asset Growth Effect in the Japanese Market," *Yokohama Journal of Social Sciences*, Vol.33, No.2, pp.118-132. (In Japanese)

Imrohoroglu, A., and Tuzel, S. 2014. "Firm Level Productivity, Risk, and Return," *Management Science*, Vol.60, No.8, pp.2073-2090.

Ishikawa, Y., Nishimura, M. and Kato, Y. 2017. "Investment Efficiency and Stock Returns in Japan," *the 25th Annual Meeting of the Nippon Finance Association*, June 2017. (In Japanese)

Ishikawa, Y. and Hasegawa, K. 2018. "ESG Investments based on CSV," *Research on ESG Investment: The Forefront of Theory and Practice* (edited by Y. Kato), Ittosha, pp.47-69. (In Japanese)

Jagannathan, R., Kubota, K., and Takehara, H. 1998. "Relationship between Labor-Income Risk and Average Return: Empirical Evidence from the Japanese Stock Market," *The Journal of Business*, Vol.71, No.3, pp.319-347.

Japan Productivity Center 2017. "International Comparison of Labor Productivity 2017," December, 2017. (In Japanese)

Kubota, K., and Takehara, H. 2018. “Does the Fama and French Five-Factor Model Work Well in Japan?” *International Review of Finance,* Vol.18, No.1, pp.137-146.

Lee, C., Myers, J., and Swaminathan, B. 1999. “What Is the Intrinsic Value of the Dow?” *Journal of Finance,* Vol.54, No.5, pp.1693-1741.

Saito, R. and Ito, A. 2017. “Human Resources Utilization and Corporate Value,” *the 25th Annual Meeting of the Nippon Finance Association*, June 2017. (In Japanese)

Titman, S., Wei, K. J., and Xie, F. 2004. “Capital Investments and Stock Returns,” *Journal of Financial and Quantitative Analysis*, Vol.39, No.4, pp.677-700.

Titman, S., Wei, K. J., and Xie, F. 2009. “Capital Investments and Stock Returns in Japan,” *International Review of Finance*, Vol.9, No.1-2, pp.111-131.

Watanabe, A., Xu, Y., and Yu, T. 2013. “The Asset Growth Effect: Insights from International Equity Markets,” *Journal of Financial Economics*, Vol.108, No.2, pp.529-563.

Yamada, T., Usui, T. and Goto, S. 2017. “Employee Satisfaction and Firm Performance,” *Security Analyst Journal*, November 2017, pp.75-86. (In Japanese)

Yoshino, T. and Saito, T. 2012. “Asset Growth and Stock Returns in Japan,” *Gendai Finance*, No. 32, pp.3-31. (In Japanese)