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ECONOMICAL EFFECT OF ON-THE-JOB TRAINING: USING KOREAN FIRM PANEL DATA

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Abstract

The study aims to investigate the economic effect of firm on-the-job training using a panel data in Korea, improving analysis data, method, and study model of a precedent study. To accomplish the object of this study, the panel analysis was applied to analyze using a Korea Investors Service (KIS), Human Capital Corporate Panel (HCCP) and Workplace Panel Survey (WPS) data. The results of this study show that positive effect firm on-the-job training on firm's productivity. Based on the results of this study, government should need to make a policy development to reinforcement investment on firm on-the-job training at the national level. And it was drawn in a conclusion to need not avoid but continuous investment on firm on-the-job training at the company level.

Keywords

Human Capital, Firm on-the-job training, Economics of Education, Panel Analysis, The effect of on-the-job training

1. Introduction

It has been known that investment in on-the-job training gives a positive economic effect to the firm (Conti, 2005; Dearden, 2006). Still, some of researches and firm executives are

doubtful on its effectiveness. (Black & Lynch, 2001; Cappelli & Neumark, 2001; Fey et al., 2001; Hatch & Dyer, 2004; Wright, 2005).

The reasons of disagreements exhibited on diverged conclusions of precedent researches about economic effect of on-the-job training can be discussed under perspectives of analyzed data, estimation methods, and applied research models. Researches examined the economic effect of on-the-job training through econometric analysis of large firm samples (Black & Lynch, 2001; Barrett & O'Connell, 2001; Fey et al., 2001; Hatch & Dyer, 2004; Zwick et al., 2005; Wright et al., 2005; Dearden et al., 2005; Conti, 2005) have used short-term panel data, mostly for two or three years'. Acquiring the characteristics of human capital, however, explanatory power of those researches upon relation and effect of investment in on-the-job training on labor productivity is weak.

Also those researches have limitations from ambiguous treatment of biased parameters, such as omitted variables, including capacity of firms which must be a highly influential factor of labor productivity, or other unobservable variables (Bartel, 2000). Plus, those researches have not considered qualitative difference of labor force of each firm, which also can play a significant role on economic yields of the firm. In other words, those econometrics researches used large quantity of samples cannot provide a good explanation of how the characteristics or attributes of labors, presumably depending on the culture of each firm, influence to the labor productivity of the firm.

In order to reflect unique details of individual firm on the researches of the investment in on-the-job training and its economic effects, many researchers have used more focused data dealing with only one or two firms (Bartel, 1995; Krueger & Rouse, 1998). Those researches have achieved relatively better controls on the characteristics of labors or firms, or other control factors affecting on the labor productivity. On the other hands, however, since those researches have strong aspect of case study, they are hard to be generalized.

On this paper, economic effects of on-the-job training is studied, using panel data of large firm samples of Korea, resolving limitations of precedent researches from analyzed data, estimation methods, and applied research models.

2. Theoretical Background

2.1 Theoretic Approach on Economic Effect of On-the-Job Training

This paper is based on the human capital theory that education and training bring improvement on productivity and hence result increment on the expected income of labor, and

the endogenous growth theory, which claims that long-run growth or sustainable growth can be achieved by intangible endogenous factors, such as technological innovations or accumulation of human capital on labors.

Classical growth theory cannot explain how the accumulation of human capitals, which are endogenously possessed by firms like technology or knowledge, influences on the improvement of labor productivity. Thus, it cannot explain how the human capital accumulated on employees through on-the-job training affects to the labor productivity improvement. According to the endogenous growth theory, technology or knowledge developed endogenously can bring internal innovation so long run or sustainable growth is possible without external technology transfer or other external forces.

As mentioned above, the important point of the endogenous growth theory is that the theory considers both of quantitative and qualitative perspective of labor. The qualitative perspective of labor means possessing distinguishable human capital that absent in other firms. Appropriate investment and educational training of a certain period of time can only secure human capital. Through investment in on-the-job training, a firm can foster knowledge and technology of employee, and moreover cultivate human resources that the firm requires. Also through the training program, the firm can improve quality of human capital, upgrading existing abilities, or establishing new capacities.

2.2. Analysis of Precedent Researches

Exploring characteristics and limitations of precedent researches done on the effects of on-the-job training through econometric analysis of large firm samples, the researches done before the year of 2000 mainly made indirect estimation about the relationship between educational training of firms and their productivity as analyzing relationship between educational training and personal income using data from individuals, since in that time, there was a lack of reliable data of investment in educational training performed in each business unit, and productivity of firms. Contrastingly, majority of researches done after the 2000 directly estimated the relationship between on-the-job training and productivity using financial information provided from national institutions illustrating firms' variables of on-the-job training and their performances, investigating effects of various types of on-the-job training to the productivity of a firm.

Panel data rather than cross-section data was more frequently used. In order to treat biased parameter problem arose from omitted variables such as capacity of each firm which is presumably a highly influential factor on the labor productivity, or other unobservable variables,

models using panel data had used for the research method. Also econometric methodologies including solving system of equations had applied to correct simultaneous bias which occurred from the possibility that labor productivity affects on the on-the-job training, while on-the-job training affects to the productivity of labor. As illustrated, various efforts to estimate causality and net effect of on-the-job training on performance of firms had been made.

Most of precedent researches, however, relied on short term panel data, records of about two or three years, to estimate the effect of on-the-job training to the labor productivity (Holzer et al., 1993; Bartel, 1994; Black & Lynch, 1997; Barrett & O'Connell, 2001; Byung-Hee Lee, Dong-Bae Kim, 2004; Zwick et al., 2005; Wright et al., 2005; Yong-Jin Noh, Won-Ho Jung, 2006). Considering characteristics of human capital, propagation of influence of on-the-job training to actual labor productivity requires certain period of time. Hence it is necessary to use data covering enough time period to verify the influence of the on-the-job training for the research.

As research methods, models using panel data had applied, in order to treat biased parameter problem arose from omitted variables such as capacity of each firm which is presumably a highly influential factor on the labor productivity, or other unobservable variables (Holzer et al., 1993; Bartel, 1994; Black & Lynch, 1997; Barrett & O'Connell, 2001). Also to correct simultaneous bias, occurred from concurrent influences exchanged between labor productivity of a firm and the on-the-job training, econometric methods such as two-stage least squares (2SLS) had applied. Many of researchers introduce educational training cost of previous year as instrumental variable for the 2SLS method (Tan & Barta. 1995; Jang-Soo Ryu, 1995; Yong-Jin Noh, Won-ho Jung, 2006). Because of the mismatch on the time period interval of data sets, however, there is a chance that the educational training cost of previous year is not the best choice for the instrumental variable for the 2SLS. As discussed on this section, precedent researches of the effects of on-the-job training on productivity partly bore some bias problems. This research examines effects of on-the-job training on productivity through econometric analysis of large firm samples, in a improved way, to resolve limitations of precedent researches.

3. Research Method

3.1. Analyzed Data

On this paper, to measure the influence of investment in on-the-job training on the improvement of labor productivity, Korea Information Service - Financial Accounting System

(KIS-FAS), which is one of the representative panel data administrated by the government is used, and based on characteristics of different types of present on-the-job training of Korea, Human Capital Corporate Panel (HCCP) and Workplace Panel Survey (WPS) are also used.

First, data of the Korea Information Service allows investigation of effect of long-term on-the-job investment on the labor productivity considering the characteristics of human capital. Thus, similar to the research of Harbison & Myers (1964), relationship and effects of long-term investment in on-the-job training and labor productivity performance can be observed from the scale of a business unit or a firm. Also resolving problems claimed from the research of Harbison & Myers (1964), relationships and effects of those two factors can be explored in a long period of time.

Second, data of Human Capital Corporate Panel (HCCP) and Workplace Panel Survey (WPS) has a disadvantage that it only covers relatively short period of time. On the other hand, based on characteristics of different types of present on-the-job training of Korea, empirical study of effects on the labor productivity brought by the investment in on-the-job training is possible from data of HCCP and WPS. Furthermore, alternative policy for the government can be established based on the empirical study.

Third, data of KIS-FAS, HCCP, and WPS are complementary to each other and so the patchwork of the data covers enough period of time that the accumulated human capital on employees can affect on the economic performance of the firms. So it is possible to find out how the long-term investment in on-the-job training affects on the economic performance of the firms. Hence the government can receive empirical proofs of national human capital development policy and most of all owners of firms can get enough information to understand the action of investment in educational training.

Workplace Panel Survey (WPS) systematically apprehends overall employment structure and demands toward labor force, and tracks administrative structure of human resource management of 2,000 panel members representing Korean business firms every year. Although human capital management paradigm of business organizations is rapidly changing after the economic crisis, there is no systematic survey of the issue. Under such circumstance, WPS provides useful information about changes of human capital management paradigm and its spectrum, allowing prediction for the future changes of the paradigm.

3.2 Estimation Model of Panel Data

Analysis of panel data resolves bias problem of parameter, which occurs from existence of omitted variables, such as capacity of each firm, presumably one of the highly influential

factors of the labor productivity, or other unobservable variables. Conventionally, omitted variables or unobservable variables on the panel data analysis are defined as C variables (Wooldrige, 2002).

On the analysis of panel data, if C variables exist (capacity of firms or et cetera), parameters can be estimated using fixed effect method or random effect method. For fixed effect method, difference of intercept terms is assumed capturing the difference of firms (Greene, 2003). This means that the value of C_i of equation (1) is not a randomly assigned value but a fixed constant for each firm representing embedded characteristics of the firm. Hence the matrix X_{it} is constructed with time variant variables, and time invariant variables are excluded from it.

$$N_{it} = X_{it}\beta + C_i + U \qquad (1)$$

(i=1, 2, . . ., n) (t=1, 2, . . ., T)

Least square dummy variable (LSDV) method is one of the classical fixed effect methods (Wooldridge, 2002). In LSDV, dummy variables as many as number of firms is defined and an assumption that C_i can be obtained as well as the regression coefficient β must be introduced. For i^{th} dummy variables, only i^{th} firm receives value '1' and the rest receives '0', and this procedure is repeated N times; so N dummy variables (dN_i) are prepared. Using prepared independent variables $d1_i$, $d2_i$, …, dN_i and X_{it}, pooled ordinary least square (POLS) method is applied about performances of firms N_{it}. Then obtained estimation of parameter $\tilde{\beta}$ from the method represents the estimation of fixed effect $\widehat{\beta_{FE}}$. On the fixed effect method, degree of freedom is limited by the number of introduced dummy variables ($d1_i$, $d2_i$, …, dN_i), hence precision of estimation is relatively lower than the random effect method which will be introduced next, if there is no endogeneity problem.

Random effect method assumes that differences between firms are randomly drawn from a certain distribution (Greene, 2003). So C_i of equation (1) is interpreted as a randomly selected value, not the value capturing characteristics embedded on each firm. C_i is treated with U_{it} and the overall value is considered as an error ($e_{it} = C_i + U_{it}$). In order to do so, C_i must be independent from other independent variables including the variables of labor productivity. Otherwise, X_{it} and e_{it} become related terms and the estimation will be biased.

For the random effect method, generalized least square (GLS) estimation is applied (Wooldridge, 2002). GLS is a good method to control serial correlation between observed

values of a single firm over a period of time[1]. To estimate the parameter using GLS, it is important to estimate the matrix Ω constructed with variance of e_{it} ($E(e_{it}^2)=\sigma_c^2+\sigma_u^2$) and their covariance ($E(e_{it}e_{is})=\sigma_c^2$). Estimation of matrix Ω is actually estimations of σ_u^2 and σ_c^2 as shown on the expression of Ω below[2].

$$\Omega=E(e_i e_i')=\begin{vmatrix} \sigma_c^2+\sigma_u^2 & \sigma_c^2 & \cdots & \sigma_c^2 \\ \sigma_c^2 & \sigma_c^2+\sigma_u^2 & \cdots & \vdots \\ \vdots & & \ddots & \sigma_c^2 \\ \sigma_c^2 & \cdots & & \sigma_c^2+\sigma_u^2 \end{vmatrix}$$

For this procedure, we subtract equation (2) which formed with mean values of each firm from the equation (1) introduced above, then C_i is eliminated and yields equation (3). Equation (3) is the error term e_{it} without C_i so residual variance of equation (3) is the estimation of σ_u^2.

$$N_{it}=X_{it}\beta+C_i+U_{it} \quad (1)$$

$$\overline{N_{it}}=\overline{X_{it}}\beta+C_i+\overline{U_i} \quad (2)$$

$$-\ (N_{it}-\overline{N_{it}})=(X_{it}-\overline{X_{it}})\beta+(U_{it}+\overline{U_i}) \quad (3)$$

Now estimation of σ_c^2 is left to finalize the estimation of matrix Ω. Since variance of e_{it} is $\sigma_c^2+\sigma_u^2$, estimated value of σ_c^2 can be earned as subtracting estimated σ_c^2 computed using POLS from estimation of σ_u^2 which obtained from equation (3). Applying GLS on matrix Ω,

[1] Let $e_{it}=C_i+U_{it}$, then such correlation occurs under assumptions of ① $C_i-iid(0,\sigma_c^2),\forall i$, ② $U_{it}-iid(0,\sigma_u^2),\forall it$, ③ $Cov(X,U)=0,\forall it$, and can be expressed as , $Cov(e_{it},e_{is})=E(e_{it},e_{is})=E[(C_i+U_{it})(C_i+U_{is})]=E(C_i^2)=\sigma_c^2\neq 0$. The expression means that the off-diagonal terms of matrix Ω are not '0'but σ_c^2, so observations of a firm at different time point are related.

[2] As shown, GLS estimation requires the matrix Ω, which is unknown at first. So matrix Ω must be estimated first and this is called feasible generalized least square (FCLS) estimation.

Estimated parameter $\hat{\beta} = (\sum_{i=1}^{N} X_i' \widehat{\Omega^{-1}} X_i)^{-1} (\sum_{i=1}^{N} X_i' \widehat{\Omega^{-1}} Y_i)$[3] of GLS using matrix Ω obtained is estimated value of random effect $\widehat{\beta_{RE}}$.

Before the application of fixed effect method or random effect method, existence of C values, or unobservable variables like capacity of firms must be proved, and applicable hypothesis test is LM(Lagrange multiplier) test of Breusch and Pagan(1980). LM test is a test of a null hypothesis that variance of C_i is zero ($H_0 : \sigma_c^2 = 0$). If the null hypothesis fails to be rejected, in other words, if variance of C_i does not exist[4], then it is appropriate to use POLS (Wooldridge, 2002). If the null hypothesis is rejected, so if the variance of C_i exists, fixed effect method or random effect method may be applicable.

After the verification of existence of variance of C variable through LM test, the next task is deciding how we should interpret the C variable - as an error or an independent variable using dummy variables. This decision actually depends on dependence of the C variable on the independent variables including the firm performance, or the existence of endogeneity, and related test is Hausman(1978) test.

Hausman test is to confirm the prerequisite of random effect method: The C variable is related with independent variables including firm performance[5]. If the null hypothesis $(H_0 : Cov(X_{it}, C_i) = 0)$ is not rejected, in other words, if X_{it} and C_i are not correlated, random effect method is allowed. If the null hypothesis is rejected, random effect method cannot be used, since correlation between independent variables and error (e_{it}) exists so estimated parameter will be biased by the endogeniety. Hausman test is to determine fitness of random effect method, and not for the fixed effect method. So if the Hausman test could not reject the

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[3] X and Y are observed values, hence estimation of Ω following procedure described above allows to estimate $\bar{\beta}$.

[5] Hausman test gives estimation according to following flow of logic: under the null hypothesis($(H_0 : Cov(X_{it}, C_i) = 0)$, LSDV(fixed effect method) and GLS(random effect method) have consistency. Estimation of GLS is more efficient and estimation of LSDV is not. In contrast, under the alternative hypothesis $(H_0 : Cov(X_{it}, C_i) \neq 0)$, estimation of LSDV has consistency while GLS's does not.

Hausman test statistics are $W \equiv (\hat{\beta}_{LSDV} - \hat{\beta}_{GLS})' V^{-1} (\hat{\beta}_{LSDV} - \hat{\beta}_{GLS}) \sim \chi^2(K-1)$ and $V = [Var(\hat{\beta}_{LSDV}) - Var(\hat{\beta}_{GLS})]$. If $W \approx 0$, we accept the null hypothesis and use random effect method but this does not mean that fixed effect method cannot be applied. If $W \gg 0$, we accept alternative hypothesis and so we cannot apply random effect method, but still the fixed effect method can be applied.

null hypothesis, both of fixed effect and random effect method can be applied.

Estimation methods used on this paper to test effect of on-the-job training on labor productivity of the firm using panel data are summarized on figure 1. First, if there is no C variable related with independent variables including variables of labor productivity are suspected, use POLS estimation method; and if it exists, apply fixed effect or random effect method. Suppose C variable is related with the variables of labor productivity and other independent variables, then application of random variable method gives biased estimation, therefore fixed effect method must be applied. If not, both of methods can be applied but the random effect method exceeds in precision of estimation.

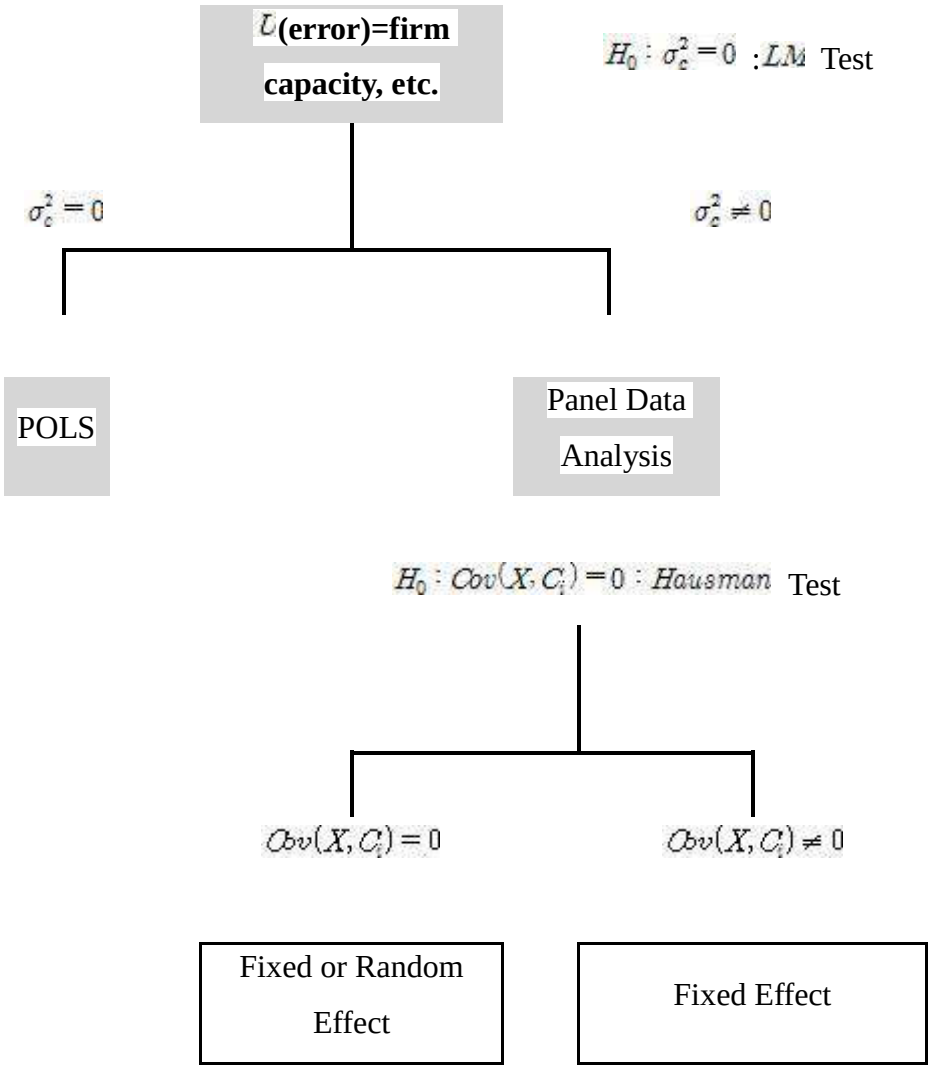

Figure 1: *Estimation Method of Panel Data*

3.3 The variable used of panel data analysis

Analysis found the investment in educational training is contributed to the increase of labor productivity. By the human capital theory, this study use a model of production function with it considerably related to the expenditure for educational training. With this, we have also made use of the log of exponential for a person's educational training as an investment variable. Also the study use some sort of the variable for companies' character, which are demonstrated to positively take an effect on labor production by the prior study: the data from Korea Investors Service, the panel data for companies with human capital, and the size of firms, the variable for the stability of employment, the particular variable in the market, labor union, character of both working organization and personnel system, constituent of human capital. Especially, how large the size of company is in Korea labor market has a considerable influence on labor productivity (Bartel, 1944). Therefore, we have improved a method to explain a model for weighing analysis with using business scale in a model of production of educational training at one time. And have controlled years in order to regulate the influence of business fluctuations able to make all firms commonly under effects.

Table 1: *The variable used for panel data analysis (KIS, HCCP, WPS)*

	KIS	HCCP	WPS
	10year: 373 firms	248 firms	418 firms
	18year: 216 firms		
LnSPP	O	O	O
LnEEP	O	O	O
LnFCP	O	O	O
LnEDU	O		
LnNOE	O	O	O
PIR		O	
PJC		O	O
LUI		O	O
TEI		O	O
INC	O		O
REA	O		
EXP			O
MAS			O
OPE			O

Note) Explanations of variables:

LnSPP = the value after taking a natural logarithm to the sales per person, LnEEP = the value after taking a natural logarithm to capital intensity per person, LnFCP = the value after taking a natural logarithm to capital intensity per person, LnEDU = the value after taking a natural logarithm to the percentage of people who completed middle school and high school out of all the people involved in economical activity, LnNOE = the value after taking a natural logarithm to the number of workers, PJC = turnover per year(month), LUI=union role limit, TEI = export weight, INC = index for incentives, REA = research and development cost , EXP = average years of service, MAS = market share, OPE = index of work organization

3.4 Analysis of data

The study shows what the result of organized technique statistic of materials for firm's panel (KIS, HCCP, WPS) is. First of all, the dependent variable used the revenue of 373 firms for 10 years and 216 firms for 18 years (natural logarithm). This variable is a form in which natural logarithm is applied to the revenue of a business for a person. The reason why it has this form is to replace weighted distribution reflecting geometrical surge in sales with regular distribution. In case that it is a panel data for 10 years, the revenue of model firms for a person is distributed from 4,390,000 won in 1988 to 5,2000,000 in 2007

Second, the dependent variable of HCCP data is the revenue of 248 firms for a person. The sales of this model business for a person from this data are from 4,650,000 won in 2005 to 5,290,000 won in 2007. And the cost of educational training for a person is from 620,000 won in 2004 to 680,000 won in 2006. This is higher than the amount of money, the ministry of labor announced with the survey of the cost of a business for labor, from 240,000 won in 2003 to 270,000 won in 2005. A cause of making this difference is that the survey of the cost of a business for labor appropriated the expense for educational training for corporations over 10 people. There is a big difference of the expense for educational expense, based on business scale (Ministry of labor, 2009). Therefore, it is almost impossible to directly compare the cost in this study. Capital intensity for a person is from 1,380,000 won in 2005 to 1,530,000 won in 2007. We can see its swell in 2005 compared to in 2007.

Third, the dependent variable of WPS data suggests both revenue of a corporation for a person and average standard deviation. The variable is a form to make this sales applied to natural logarithm. The revenue of model businesses for a person is from 3,800,000 won in 2001 to 3,540,000 won in 2003. And the expense for educational training for a person is from 270,000 won in 2001 to 280,000 won, which seems similar. One of the reasons is that according to a survey of expenditure for labor, the cost of a business for labor appropriated the expense for educational training for corporations with over 10 people is similar with the expense for those

with over 30 people. Capital intensity for a person is from 2,880,000 won in 2001 to 2,840,000 won in 2002. There is a similar aspect of the capital intensity between 2001 and 2002.

4. Study Results

4.1 The result of data form firm panel (KIS, HCCP, WPS) after compared and analyzed

Chart 2 shows the result of the analysis of Labor productivity about companies' educational training. This study is to analyze whether the investment in educational training is contributed to the increase of labor productivity. The dependent variable of production function reflecting labor productivity makes the revenue for a person applied to natural logarithm. Investment variable for educational training uses the cost of educational training for a person. And an additional variable which will be able to have an influence on labor productivity such as business scale, stability of employment, character of the market, relationship of labor union and so on is controlled.

We have also investigated how much influence on increased productivity the investment of educational training has, considering the bias of parameter resulted from omitted variables or unobservable variables, such as capability of companies, which is assumed to play an important role in labor productivity. It also searched the effect of On-the-Job training on labor productivity, applying estimation models of fixed effect and random effect considering endogeneity caused by the bias of parameter. It has been found that the investment of educational training gives the growth of productivity a positive effect with the data from Korea Investors Service, business panel (HCCP) and company panel (KIS). This predictable result is consistent with the analyzed result of prior study (Bartel, 1994; Barrett & O'Connel, 2001; Turcotte et al., 2004; Conti, 2005,; Zwick. dt al.,2005; Dearden et al., 2006).

More specifically, we have studied if the investment in a long term educational training of businesses takes an effect on swell in labor productivity as macro model with building panel data for 18 materials from 1900 to 2007 for 10 and 18-year time-bar and the data from Korea Investors Service. The result is that both data does. Furthermore, the data for 10-year time bar seem to have more positive improvement than those for 18-year time bar.

And we have investigated how much influence on labor productivity the short-term investment in educational training with the panel of companies (HCCP, WPS), based on the character of Korea companies' investment in educational training by type. The result shows that this investment increases labor productivity in accordance with the result of their relationship and effectiveness for a long time. This suggests that the type of companies' educational training

tends to focus on making workers skilled rather than get a new skill. (Korea Labor Institute, 2007).

Besides, the short-term investment in educational training can produce positive labor productivity regardless of a business or a company. However, the investment in educational training of a business whose size is relatively smaller than a company's produced much higher labor productivity. The result of this study shows that companies whose size is smaller than others tend to concentrate on basic function and skill development, which is able to achieve good results despite short period time(The Korea Chamber of Commerce ＆Industry, 2008).

4.2 The rate of change of labor productivity in the data of firm Panel (KIS, HCCP, WPS) after compared and analyzed

Chart 3 indicates the result of the analysis of the rate of change in labor productivity on the investment in educational training. Namely, the turnover for a person averagely increases by 0.040% if the cost of educational training for a person increases by 1% under the control of other explanation variable. According to the result of the data from the panel of companies for human capital, which were conducted with over 100 companies, the turnover for a person averagely increases by 0.034% if the cost of educational training for a person increases by 1% under the control of other explanation variable. And the result of the data from the panel of companies with over 30 employees shows that the turnover for a person averagely increases by 0.056% if the cost of educational training for a person increases by 1% on the same condition.

As we look into the effect of both the investment in educational training and labor productivity per an hour as a concept of electricity, the result of data from Korea Investors Service which were conducted with growing companies in South Korea shows that the turnover for a person averagely increases by 0.040% pen an hour if the cost of educational training for a person increases by 1%(3,450 won) under the control of other explanation. According to the result of the data from the panel of companies for human capital, which were conducted with over 100 corporations, the turnover for a person averagely increases by 0.034%(8,315 won) if the cost of educational training for a person increases by 1%(4,800 won) under the control of other explanation variable. And the result of the data from the panel of companies with over 30 employees shows that the turnover for a person averagely increases by 0.056%(10,114 won) if the cost of educational training for a person increases by 1%(2,600 won) on the same condition.

The labor productivity per an hour in South Korea is 20.4 dollars, which is 54% of average level in OECD (Ministry of Strategy and Finance, 2006). This means that if the labor productivity in Usa is 100, ours is 41, amount not a half of America (Jung-Ahng Newspaper,

2006) The average labor productivity of nations in OECD is 75 dollars and the labor productivity of nations in G-7 is 89 dollars. At this point, the government and company trying to consolidate their competitiveness in order to be a developed country should take measures about relatively lower labor productivity than developed countries'

The government and company should develop workers' knowledge and skill, training them to be the necessary with investment. And they also either improve their ability or develop the level of human capital's quality by making workers leran new skills because this study indicates the educational training of companies is one of ways to improve the quality of labor and to develop labor productivity.

Table 2: *The result of data for companies panel(KIS, HCCP, WPS) after compared and analyzed*

	KIS						HCCP			WPS		
	10years unit(1998-2007)			18years unit(1990-2007)								
	FE	POLS	RE	FE	POLS	RE	FE	POLS	RE	FE	POLS	RE
LnEEP	0.040 (8.49)**	0.049 (10.17)**	0.040 (8.78)**	0.051 (11.83)**	0.043 (9.37)**	0.055 (12.44)**	0.034 (2.28)**	0.108 (6.91)**	0.059 (4.75)**	0.056 (1.86) †	0.087 (3.03)**	0.087 (3.45)**
LnFCP	0.507 (32.66)**	0.782 (76.67)**	0.581 (43.82)**	0.486 (36.00)**	0.781 (85.30)**	0.515 (38.79)**	0.297 (7.73)**	0.424 (12.15)**	0.237 (6.82)**	0.238 (7.60)**	0.570 (28.65)**	0.447 (21.25)**
Adj-R2	0.650	0.676	0.447	0.756	0.796	0.587	0.316	0.548	0.377	0.583	0.592	0.424
N	3730 (373firms)	3730	3730 (373firms)	3888 (216firms)	3888	3888 (216firms)	496 (248firms)	496	496 (248firms)	836 (418 firms)	836	836 (418 firms)

Notes. 1. †:P<0.10, * : p < 0.05, ** : p< 0.01

2. Numbers in parenthesis are the value of t

3. Explanations of variables: LnEEP = the value after taking a natural logarithm to capital intensity per person,

LnFCP = the value after taking a natural logarithm to capital intensity per person,

Table 3: *The result of ratio of labor productivity on investment in educational training from the data of companies panel (KIS, HCCP, WPS)*

KIS				HCCP (more than 100 people firms)		WPS (more than 30 people firms)	
10years unit(1998-2007)		18years unit(1990-2007)					
Ln(The sales per person)	Ln(Educational training cost per person)	Ln(The sales per person)	Ln(Educational training cost per person)	Ln(The sales per person)	Ln(Educational training cost per person)	Ln(The sales per person)	Ln(Educational training cost per person)
604 (1,000,000 won)	34 (10,000 won)	362 (1,000,000 won)	48 (10,000 won)	497 (1,000,000 won)	65 (10,000 won)	367 (1,000,000 won)	26 (10,000 won)
△0.040%	△1%	△0.051%	△1%	△0.034%	△1%	△0.056%	△1%
11,889 won	3,450 won	9,085 won	4,800 won	8,315 won	6,500 won	10,114 won	2,600 won

$\%\Delta y = \beta_1 \%\Delta x$ (rate of change of y 1% change of x)

note) 1. The study results are not absolute comparison numerical value.

2. Difference of comparison standard year(KIS: 1990-2007year; HCCP: 2004year, 2006year; WPS: 2002year, 2003year).

3. The model don′t have a technical[an educational] standard difference.

4. Considering of the sales per person and educational training cost per person heavy deviation by firm

5. assumption 1) working day by year is 254days. {(365days(1 year)-104days(holiday)-7days(holiday by law court)}=254days/1 year

assumption 2) working time by year is 2032 time. {254days(working day by 1 year) X 8시간(working time by law court)}=2032

5. Conclusions and Suggestion

Conclusion from this study is like below. First, the investment in educational training contributes to increasing labor productivity. It is demonstrated that this investment takes an positive effect on swell in labor productivity with empirically analyzing from the panel data of companies (WPS), the panel data for companies of human capital (HCCP) and the data from Korea Investor Service(KIS) while considering companies' ability to play an important role in labor productivity.

Second, the companies' investment is considered to increase labor productivity. The capital intensity for a person took a positive effect on swell in labor productivity with empirically analyzing from the panel data of companies, the panel data for companies of human capital and the data from Korea Investor Service while considering companies' ability to play an important role in labor productivity.

Third, the stability variable for employment is considered to take a positive effect on surge in labor productivity. Similar with the result of Korea Labor Institute (2005), the ratio of temporary position or transfer influences negatively (-) on labor productivity. It is because this more excessive ratio than average takes an side effect on the performance of companies, factors concerning loyalty to the company, immersion in working and development labor productivity decreasing.

Fourth, it is judged that the character of working organization and personnel management takes a positive effect on labor productivity. As Zwick. et al.,(2005), Wright et al.,(2005) and Dearden et al.,(2005) pointed, it is demonstrated to do so. In particular, compensation, a variable showing the character of working organization and personnel management is revealed to have a positive influence on labor productivity because the compensation system plays a role in providing either human capital or immersion to have a new skill.

Fifth, the long-term investment in educational training developing labor productivity seems to have an important meaning in terms of lifelong education. The result of this investment can suggest various directions to develop and manage the program for lifelong education since educational training has been in charge of education from the youths to the elderly in terms of lifelong education. Therefore, it is

considered that the effectiveness of investment in educational training and labor productivity subordinately help educational training active.

Based on this study, we'd like to suggest a political and follow-up study. First, for each company to develop policy is needed by the government to enhance the investment in educational training. This study demonstrates that this investment helps swell in labor productivity with the data from considerable companies' model. Recently, domestic corporations invest in development of human capital through educational training lesser than advanced foreign corporations (the Korea Chamber of Commerce & Industry 2008). Moreover, domestic corporations investing in this area decreases more and more every year (Ministry of Labor, 2008). Accepting this tendency, the government should improve labor productivity through the policy to vitalize the development of human capital as a measure for relatively lower labor productivity than developed country.

Second, corporations are needed to constantly invest in educational training without reluctance. Some one earlier studies question about the effectiveness on educational training (Black & Lynch, 2001; Cappelli & Neumark, 2001; Wright, 2005). Moreover, the owners of corporations has some suspicion of the effect on the investment in educational training to improve labor productivity despite the result of earlier studies that there is a positive relationship between the investment in educational training and labor productivity (Fey et al., 2001; Hatch & Dyer, 2004). However, as noted in this study, the corporations investing in this training for a long time got improved labor productivity. In other words, human capital is bringing increased labor productivity. Therefore, corporations should pursue constant investment in educational training to get competition in business.

Third, the government and corporations are needed to make a policy to enhance competition after getting broad knowledge and skills through the long-term investment in human capital. After looking into the result of change in the investment in educational training, the type of educational training from domestic corporations has short-term tendency, not long-term accumulation of capital, which shows cumulative effects. Advanced foreign corporations are developing it with the plan to improve the

long-term human capital to be competitive in the rapid environmental change (Yung-Won Ki,). However, domestic corporations generally have weaker training contents than foreign corporations and without conglomerates they don't practice educational training properly, departmentalizing factors like duty, position, and function. So, the government and corporations are needed to make long-term development of human capital, which is stabilized, in the rapid environmental change.

The proposal for follow-up study is like that. First, it is needed to have efforts to simultaneously understand factors having influence on labor productivity not only for a company but also a person. This study can't explain if the character of employees for corporations gives some effects on labor productivity by analyzing some factors having influence on labor productivity. Therefore, efforts to simultaneously understand these factors not only for a company but also a person are needed. To reflect this point, it is needed to consider applying hierarchical linear model with us considering a rank of analyzed data (Sang-Jin Kang, 2005).

Second, it is needed to have efforts to grasp its effectiveness, considering specific situations on educational training of corporations. This study has positively researched the relationship between the long-term educational training and labor productivity, adding the effectiveness. Now, corporations are practicing educational training in detail with divers goals. In the near future, the specific effectiveness of educational training should be investigated through this study.

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