

"Capital-Skill" and "Size-Skill"  
Complementarity:  
The evidence from relative wage between  
managers and workers

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**Abstract**

In this paper, I study the existence of "Capital-Skill" and "Size-Skill" Complementarity within firm. I test the existence by examining the relative wage between top managers and workers below top managers within the firm. I suggest two channels through which "capital-intensity" has effects on the relative wage. First, the highly educated managers are more complementary with the physical capital than the lower educated workers. Second, the "capital-intensity" affects the relative wage by reallocating the controllable resources within firm. The increase in the "capital-intensity" shifts a labor demand from non-skilled labor to skilled labor within firm, which could increase the resource (skilled labor) under top managers' control. The estimation shows that the share of executives' compensation in the total labor cost increases with the capital-intensity of firms in the 2005 sample of U.S firms.

**JEL Classification:** D20, D30, G30, J31, J40

**Keywords:** Production and Organization, Distribution, Capital-Skill Complementarity, Size-Skill Complementarity

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# 1 Introduction

Many studies suggest that the "Capital (technology)-Skill Complementarity" theory can explain the relative wage structure (also, widening wage gap) between skilled workers and non-skilled workers well. In this paper, I test this theory by examining the relative wage between top managers and workers below top managers within the firm. It is well known that the ratio of CEO wage to the wage of production workers increased so much over the last 30 years. For instance, Murphy and Zabojnik (2004) show that the ratio increased from 25 to 90 between 1970 to 2000. Since top managers are super-highly skilled or educated, they could be more highly complementary with physical capital than other workers.

Alternatively, we can approach the relative wage between top managers and workers below top managers by combining the "Capital (technology)-Skill complementarity" with the "Size-Skill Complementarity" provided by Garicano and Rossi-Hansberg (2006). They suggest that "the Size-Ability Complementarity" exists in the hierarchies of firm because talented employees can share their ability (or knowledge) with the resource under their control. Since the impact of talented workers increases in the size of resource under their authority, more talented people hold higher position in the firm. It naturally follows that the key determinant of wage is the size of controllable assets.

In line with this notion, we can conjecture the indirect channel through which the "capital-intensity" of firm has an effect on the relative wage structure. Berman, Bound and Griliches (1994) show that the "capital-intensity" shifts a labor demand from non-skilled labor to skilled labor within industries. It could be the case that this shift of labor demand reallocates the controllable resource in the hierarchies of firm under the assumption that the skilled workers are the resource only under top managers' control. Given the total amount of labor, the resource under top managers' control (under workers below top managers) increases (decreases) by the amount of increase (decrease) in the skilled labor (unskilled labor).

In addition, I approach the wage structure among top managers within firm. Based on Garicano and Rossi-Hansberg (2006), I explore the effect of organizational change on the wage structure among executives. Rajan and Wulf (2006) show that the U.S. firms' hierarchies in the top managing part becomes flatter. Currently, the more managers report directly to the CEO and the more have the real authority by holding the officier position. From the view point of CEO, the centralization goes on because the span of the CEO's control is widening. However, the decentralization takes place from the view point of executives below the CEO due to the flattening of organization. We can hypothesize that (1) the compensation of lower ranked

executive below CEO grows faster than that of higher ranked one below CEO, and (2) the relative wage structure among executives below CEO becomes flattened.

The empirical evidences support this prediction. In the 2005 sample, the share of executives' compensation in the total labor cost increases with the capital-intensity of firms. Also, the wage growth rate of lower ranked executive in terms of wage level between 1995-2005 is higher than the wage growth rate of higher ranked executive. Finally, the relative wage between the first ranked executive and third one (and fourth one) becomes flattened over the past 10 years.

The rest of the paper is organized as follows. In section 2, I provide a simple model and empirical prediction. In section 3, I describes the data set and the section 4 shows the empirical results. I summarize concluding remarks in Section 5.

## 2 Model: Empirical prediction

### 2.1 The wage structure

Here, I drive the relative wage structure between top managers and workers below top managers. Based on Murphy and Zabojnik (2004), Garicano and Rossi-Hansberg (2006), and Gabaix and Landier (2006)<sup>1</sup>, the production of firm is defined by

$$y = \sum_i S_i(K_i, L_i)C_iT_i$$

where  $S_i(K_i, L_i)$  is the size of firm under the worker  $i$ 's control which is increasing and concave function with respect to  $K_i$  and  $L_i$ . Also,  $S_l > S_m$  when  $T_l > T_m$ .  $K_i$  and  $L_i$  denotes the physical capital and labor under the worker  $i$ 's control.  $T_i$  is the talent of worker  $i$ , and  $C_i$  is the parameter which reflects the impact of the worker  $i$  on the production of firm. I assume that there is no complementarity between each worker's talent. Then, the top managers' wage,  $W_e$ , is determined by solving

$$\max_{T_e} \sum_e S_e(K_e, L_e)C_eT_e - \sum_e W_e, \quad e = CEO \text{ or } executives \text{ below } CEO$$

$T_e$  is the talent of top managers, and  $C_e$  is the parameter which reflects the impact of the top managers' talent on the production of firm.  $L_e$  is decomposed of only the skilled labor under their control since the top managers occupy the high position

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<sup>1</sup>In this section, I only develop the simple model which shows the indirect channel through which the "capital-intensity" affects the relative wage. The simple "capital-intensity" approach is straightforward in a sense that the highly educated managers are more complementary than the workers below top managers, so the relative wage increases in the capital-intensity.

in the organization. I also assume that  $L_e = r_e L_s$ , where  $r_e$  is the proportion parameter and  $L_s$  is the total amount of skilled labor in the firm. Similarly, the wage level of each worker  $j$  below the top managers solves to

$$\max_{T_j} \sum_j S_j(K_j, L_j) C_j T_j - \sum_j W_j$$

where  $L_j = r_j L_u$ .  $L_u$  is the total amount of unskilled labor in the firm, which implies that they only control the unskilled labor. Clearly, the total amount of labor,  $L$ , is

$$L = L_u + L_s$$

Then, we can get the wage of each worker  $i$  by

$$W_i = S_i(K_i, L_i) C_i$$

The share of top managers' compensation in the total labor cost,  $S_W$ , is given by

$$\begin{aligned} S_W &= \frac{\sum_e W_e}{\sum_e W_e + \sum_j W_j} \quad (1) \\ &= \frac{\sum_e S_e(K_e, L_e) C_e}{\sum_e S_e(K_e, L_e) C_e + \sum_j S_j(K_j, L_j) C_j} \end{aligned}$$

I assume that the "capital-intensity" shifts a labor demand from non-skilled labor to skilled labor within firm. Given total amount of labor, it reallocates the skilled labor and unskilled labor. Then, when the "capital-intensity",  $k$ , increases,  $S_e(K_e, L_e)$  goes up and  $S_j(K_j, L_j)$  goes down. Mathmatically,

$$\begin{aligned} \frac{\partial \sum_e S_e(k) C_e}{\partial k} &= \sum_e \left( \frac{\partial S_e(K_e, L_e)}{\partial L_e} \right) \left( \frac{\partial L_e}{\partial k} \right) C_e \\ &= \sum_e \left( \frac{\partial S_e(K_e, r_e L_s)}{\partial L_s} \right) \left( \frac{\partial r_e L_s}{\partial k} \right) C_e > 0 \end{aligned}$$

and

$$\begin{aligned} \frac{\partial \sum_j S_j(k) C_j}{\partial k} &= \sum_j \left( \frac{\partial S_j(K_j, L_j)}{\partial L_j} \right) \left( \frac{\partial L_j}{\partial k} \right) C_j \\ &= \sum_j \left( \frac{\partial S_j(K_j, r_j L_u)}{\partial L_u} \right) \left( \frac{\partial r_j L_u}{\partial k} \right) C_j < 0 \end{aligned}$$

Now, it can be easily shown that the share of top managers' compensation in the total labor cost,  $S_W$ , increases in the "capital-intensity" of firm. Taking the derivative of  $S_W$  with respect to  $k$ ,

$$\frac{\partial S_W}{\partial k} = \frac{\frac{\partial \sum_e S_e(k)C_e}{\partial k} \sum_j S_j(k)C_j - \left( \frac{\partial \sum_j S_j(k)C_j}{\partial k} \right) \sum_e S_e(k)C_e}{\left( \sum_e S_e(k)C_e + \sum_j S_j(k)C_j \right)^2} > 0^2$$

Next, I explore the effect of firm size on the relative wage structure. Taking the derivative of  $S_W$  with respect to the total size of firm,  $S$ , we can get

$$\frac{\partial S_W}{\partial S} = \frac{\frac{\partial \sum_e S_e(k)C_e}{\partial S} \sum_j S_j(k)C_j - \left( \frac{\partial \sum_j S_j(k)C_j}{\partial S} \right) \sum_e S_e(k)C_e}{\left( \sum_e S_e(k)C_e + \sum_j S_j(k)C_j \right)^2}$$

The relative wage increases in the total size of firm if the following condition holds:

$$\frac{\frac{\partial \sum_e S_e(k)C_e}{\partial S}}{\sum_e S_e(k)C_e} > \frac{\left( \frac{\partial \sum_j S_j(k)C_j}{\partial S} \right)}{\sum_j S_j(k)C_j} \quad (2)$$

Otherwise, the relative wage decreases in the total size of firm. It implies that if the elasticity of sum of executives' wage with respect to the total firm size is larger than the elasticity of sum of workers (below top managers) wage, then the share of executives compensation in the total labor expenditure increases.

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<sup>2</sup>Alternatively, we can assume that top executives control the proportion of total amount of labor by

$$L_e = r_e(L_s + L_u)$$

Then,

$$\frac{\partial \sum_e S_e(k)C_e}{\partial k} = \sum_e \left( \frac{\partial S_e(K_e, r_e(L_s + L_u))}{\partial(L_s + L_u)} \right) \left( \frac{\partial r_e(L_s + L_u)}{\partial k} \right) C_e = 0$$

because we assume that given the total amount of labor, the change in the capital-intensity only reallocates the skilled labor and unskilled labor within firm. Additionally, we still have

$$\frac{\partial \sum_j S_j(k)C_j}{\partial k} = \sum_j \left( \frac{\partial S_j(K_j, L_j)}{\partial L_j} \right) \left( \frac{\partial L_j}{\partial k} \right) C_j < 0$$

so, we can conclude that

$$\frac{\partial S_W}{\partial k} = \frac{- \left( \frac{\partial \sum_j S_j(k)C_j}{\partial k} \right) \sum_e S_e(k)C_e}{\left( \sum_e S_e(k)C_e + \sum_j S_j(k)C_j \right)^2} > 0$$

## 2.2 The wage structure among top managers

The wage of top managers is given by

$$W_e = S_e(K_e, L_e)C_e$$

Based on Garicano and Rossi-Hansberg (2006), I assume that  $W_l > W_m$  when  $l > m$ .  $l$  and  $m$  denote the valued position in the hierarchies of top managers. The high value represents the high position in the organization. More specifically, if  $l > m$ , then  $S_l(K_l, L_l) > S_m(K_m, L_m)$ , which implies that the  $l$  positioned manager controls more amount of resource than  $m$  positioned manager. I also assume  $C_l = C_m$ , so  $W_l > W_m$ . In what follows, the growth rate of wage is

$$\frac{W_{e,T} - W_{e,0}}{W_{e,0}} = \frac{S_{e,T}(K_e, L_e)C_{e,T} - S_{e,0}(K_e, L_e)C_{e,0}}{S_{e,0}(K_e, L_e)C_{e,0}}$$

where  $W_{e,T}$  represents the wage of executive  $e$  at time  $T$ . If we assume that  $C_{e,T} = C_{e,0}$ , then

$$\begin{aligned} \frac{W_{e,T} - W_{e,0}}{W_{e,0}} &= \frac{S_{e,T}(K_e, L_e) - S_{e,0}(K_e, L_e)}{S_{e,0}(K_e, L_e)} \\ &= \frac{S_{e,T}(K_e, L_e)}{S_{e,0}(K_e, L_e)} - 1 \end{aligned} \quad (3)$$

where  $S_{e,T}$  is the size of firm under executive  $e$ 's control at time  $T$ . It can be easily seen that the main determinant of wage growth rate is the relative size under his control between the base year, 0 and  $T$ . Similarly, the relative wage among executives below the CEO at a given time is

$$\frac{W_l}{W_m} = \frac{S_l}{S_m}$$

Taking derivative the relative wage with respect to  $m$ , we can get

$$\frac{\partial \left( \frac{W_l}{W_m} \right)}{\partial m} = \frac{\partial \left( \frac{S_l}{S_m} \right)}{\partial m} < 0 \text{ and } \lim_{m \rightarrow l} \frac{W_l}{W_m} = 1$$

When the positioning gap between two executives falls ( $l - m$  get smaller), the relative wage becomes smaller. Also, the growth rate of relative wage between two

executives below CEO,  $j$  and  $h$  is defined by

$$\begin{aligned} \frac{\left(\frac{W_{2005}^j}{W_{2005}^h} - \frac{W_{1995}^j}{W_{1995}^h}\right)}{\left(\frac{W_{1995}^j}{W_{1995}^h}\right)} &= \left(\frac{W_{2005}^j}{W_{1995}^j}\right) \left(\frac{W_{1995}^h}{W_{2005}^h}\right) - 1 \\ &= \left(\frac{S_{j,2005}}{S_{j,1995}}\right) \left(\frac{S_{h,1995}}{S_{h,2005}}\right) - 1 \end{aligned} \quad (4)$$

where  $W_{2005}^j$  denotes the wage level of executive  $j$  at 2005 and  $S_{j,2005}$  is the size of firm under executive  $j$ 's control at 2005. We can easily find that the size of firm under their control is the key element of the growth rate. Suppose the executive  $j$  holds  $l$  valued position in 1995 and 2005. In a mean while, the executive  $h$  holds  $m$  valued position in 1995, but  $m + \alpha$  valued position in 2005. Then,

$$\left(\frac{S_{j,2005}}{S_{j,1995}}\right) \left(\frac{S_{h,1995}}{S_{h,2005}}\right) - 1 < 0,$$

which implies that the relative wage between two executive,  $\frac{W_{2005}^j}{W_{2005}^h}$ , gets smaller in 2005.

**Table 1 Descriptive statistics for CEO compensations and total labor related expense**

- The CEO/executive compensations include the following item: Salary, Bonus, Other Annual, Total Value of Restricted Stock Granted, Total Value of Stock Options Granted (using Black-Scholes), Long-Term Incentive Payouts, and All Other Total.
- The total labor related expense includes salary, pension, retirement, profit sharing, provision for bonus and stock options, and other employee benefits
- I rank the executives below CEO by the compensation level

	The total labor related expense(\$thousand)	The CEO compensation (\$thousand)	The compensation for 1 <sup>st</sup> ranked executives	The compensation for 2 <sup>nd</sup> ranked executives	The compensation for 3 <sup>rd</sup> ranked executives	The compensation for 4 <sup>th</sup> ranked executives
<i>Year: 1995</i>						
<i>Number of observation</i>	150	91	88	86	83	64
<i>Mean</i>	1057136	3113.471	1927.07	1396.239	1129.201	951.5917
<i>Median</i>	171032.5	1728.158	1056.228	909.7455	722.729	615.124
<i>Standard deviation</i>	3122729	3178.751	2199.139	1347.581	1179.642	869.482
<i>Year: 2005</i>						
<i>Number of observation</i>	184	184	180	177	172	150
<i>Mean</i>	2119511	6838.068	3463.281	2672.621	2267.94	2038.364
<i>Median</i>	527680	3618.068	1900.978	1463.412	1172.987	1097.412
<i>Standard deviation</i>	4394035	7978.721	5147.229	3948.03	3285.394	3014.531

### 3 Data

I collect the CEO (executives) compensation and total labor related expenditure of U.S firms in 1995 and 2005 from Compustat data base. *Table 1* shows the descriptive statistics for executive compensations, and the total labor related expenditure. I rank the executives below the CEO by the wage level. For instance, the compensation for 1st ranked executive denotes the wage level of executive who gets paid the highest except the CEO.

*Table 2* provide the statistics for the share of CEO/executive compensations in the total labor related expenditures. The "mean difference" test and "median" test suggest

**Table 2** *The total labor related expenditures and the share of CEO/executive compensations in the total labor related expenditures*

- *The share of CEO and executive compensations in the total labor related expense is the sum of CEO compensation and the compensations of top four executives (below CEO) ranked by wage level divided by the total labor related expense*
- *I provide the "mean difference" test and "median" test: \*\*, and \*\*\* denote that the mean(median) of 2005 sample is significantly higher than the mean (median) of 1995 sample at 5% and 1% level*

	<i>The share of CEO compensation in the total labor related expense</i>	<i>The share of CEO and executive compensations in the total labor related expense</i>
<i>Year: 1995</i>		
<i>Number of observation</i>	85	62
<i>Mean</i>	.0064 (0.64%)	.017 (1.7%)
<i>Median</i>	.0037 (0.37%)	.011 (1.1%)
<i>Standard deviation</i>	.006	.015
<i>Year: 2005</i>		
<i>Number of observation</i>	184	157
<i>Mean</i>	.015*** (1.5%)	.039** (3.9%)
<i>Median</i>	.0067*** (0.67%)	.019** (1.9%)
<i>Standard deviation</i>	.03	.08

that the mean (median) of 2005 sample is significantly higher than the mean (median) of 1995 sample at 5% (1%) levels. It implies that the share of CEO compensation and CEO plus top four executive compensations in the total labor related expenditures increase significantly over the past 10 years.

## 4 Empirical Result

First, I explore the determinant of the relative wage structures within the firm. Based on equation (1), the specification is given by

$$S_{W,t} = \alpha_1 S_t + \alpha_2 k_t + \varepsilon_t$$

where  $S_{W,t}$  denotes the share of executives' wage in the total labor related expenditure,  $S_t$  is the total size of firm, and  $k_t$  is the capital-intensity of firm. Here,  $\alpha_2$  captures the effect of capital-intensity on the relative wage in itself, not through the total size of firm. *Table 3* shows the outcome. In the 2005 sample, the coefficient of "capital-intensity" ( $K/Sales$ ) is positively significant, which implies that the share of executives' compensation increases in the "capital-intensity". However, the "capital-intensity" is

**Table 3** *The share of total executive compensations in the total labor related expenditure (OLS: 1995/2005 sample)*

- *Dependent variable: the share of executive compensations including CEO and top four executives below CEO in the total labor related expenditure*
- *Independent variables are the characteristics of firms*
- *K/Sale denotes the total value of property, plant and equipment divided by sale*
- *Debt/Asset represents the long term debt divided by total asset value, which reflects the degree of investment*
- *The market capitalization and sale are the natural log value*
- *The standard error is in parenthesis*
- *\*\*\* and \*\* denote the significant level at 1% and 5%*

	1995 year	1995 year	2005 year	2005 year
Market capitalization	.003**	.003**	.016***	.02***
Sale	-.01***	-.01***	-.04***	-.04***
K/Sale	-.002	-.002	.03**	.02
Debt/Asset		-.0007		.15***
Constant	.06***	.06***	.18***	.14***
R-squared	0.4737	0.4737	0.3277	0.4131
N	62	62	153	143

**Table 4 The share of CEO compensations in the total labor related expenditure (OLS: 1995/2005 sample)**

- *Dependent variable: the share of CEO compensations in the total labor related expenditure*
- *Independent variables are the characteristics of firms*
- *K/Sale denotes the total value of property, plant and equipment divided by sale*
- *The market capitalization and sale are the natural log value*
- *The standard error is in parenthesis*
- *\*\*\* and \*\* denote the significant level at 1% and 5%*

	1995 year	1995 year	2005 year	2005 year
Market capitalization	.004*** (.0008)	.004*** (.0009)	.013*** (.003)	.013*** (.003)
Sale	-.007*** (.0009)	-.007*** (.001)	-.023*** (.003)	-.023*** (.003)
K/Sale	-.002*** (.0006)	-.002*** (.0007)	.011*** (.003)	.009** (.004)
Debt/Asset		.002 (.005)		.022* (.013)
Constant	.025*** (.003)	.023*** (.004)	.072*** (.013)	.07*** (.015)
R-squared	0.4182	0.4028	.4557	0.4958
N	109	98	105	93

not related with the relative wage in the 1995 sample. When we measure the size of firm as the market capitalization<sup>3</sup>, it is positively related with the share of executives' compensations in all samples. When we, however, proxy the firm size as the total amount of sale, it is negatively related with the relative wage. From the equation (2), we can interpret that the elasticity of sum of executives' compensation with respect to the market capitalization is larger than the elasticity of sum of workers wage, but the elasticity of sum of executives' wage with respect to the amount of sale is smaller than the elasticity of sum of workers wage. I test the another variable, *Debt/Asset*, which could reflect the "capital-intensity" of firm. This variable is also positively related with the relative wage structure only in the 2005 sample. In *Table 4*, the dependent variable is the share of CEO compensation in the total labor related expenditure. The "capital-intensity" (*Debt/Asset* and *K/Sales*) has a positive effect on the relative wage structure only in the 2005 sample<sup>4</sup>. In the 1995 sample, the "capital-intensity" (*K/Sales*) is negatively related

<sup>3</sup>Based on Gabaix and Landier (2006), the market capitalization is measured by the sum of "market value of equity" and "book value of debt".

<sup>4</sup>Based on Berman, Bound and Griliches (1994), I also regress the change in top executives'

with the relative wage structure<sup>5</sup>.

Hereafter, I explore the relative wage among top managers. First, I look at the growth rate of wage between 1995 and 2005 defined by

$$\frac{W_{e,2005} - W_{e,1995}}{W_{e,1995}} = \frac{S_{e,2005}(K_e, L_e) - S_{e,1995}(K_e, L_e)}{S_{e,1995}(K_e, L_e)}$$

*Table 5* suggests that the growth rate of lower ranked (by wage level) executive's wage is higher than the growth rate of higher ranked executive. Simply, the order of the growth rate is "1st executive < 2nd < 3rd < 4th"<sup>6</sup>. From the equation (3), it implies that

$$\frac{S_{4,2005}}{S_{4,1995}} > \frac{S_{3,2005}}{S_{3,1995}} > \frac{S_{2,2005}}{S_{2,1995}} > \frac{S_{1,2005}}{S_{1,1995}}$$

This provides additional evidence of flattening organization in the hierarchies of top managers team which is shown in Rajan and Wulf (2006). The growth rate of lower executive's wage is higher than higher executive's wage due to the flattened hierarchies among top managers below the CEO. The size of firm under lower executive's control has been more widened than higher executive.

*Table 6* shows the relative wage among executives below CEO in the 1995 sample and 2005 sample. The relative wage between 4th ranked executive (in terms of

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share in the total labor related expenditure between 1995-2005 on the change in the capital-intensity between 1995-2005. The coefficient of the change in the capital-intensity is not significant in this regression.

<sup>5</sup>I could not find a good reason why only the 2005 sample supports the predicted effect of capital-intensity on the relative wage. Also, it is a puzzle why the market capitalization and total amount of sale have different effects on the relative wage structure.

<sup>6</sup>Note that the ranking of executives by wage level is not exactly matched with the valued position in the hierarchies of firm. Suppose that A division manager is 4th ranked in terms of wage level in 1995. His valued position could have gone up due to the organizational change over the past 10 years, but it is also possible that his ranking by wage level would still be 4th in 2005. The point is that the gap between his wage and wage of executives above him should get small.

**Table 5 The growth rate of CEO's and executives (below CEO)' compensation between 1995 and 2005**

	<i>The Growth rate of CEO compensation</i>	<i>The Growth rate of compensation for 1<sup>st</sup> ranked executives</i>	<i>The Growth rate of compensation for 2<sup>nd</sup> ranked executives</i>	<i>The Growth rate of compensation for 3<sup>rd</sup> ranked executives</i>	<i>The Growth rate of compensation for 4<sup>th</sup> ranked executives</i>
<i>Number of observation</i>	91	88	86	78	58
<i>Median</i>	1.79	1.3	1.32	1.49	1.61

**Table 6 The relative wage among executives below the CEO**

	<i>The relative wage between the 1<sup>st</sup> ranked and 4<sup>th</sup> ranked executive: (Wage of 1<sup>st</sup> ranked/Wage of 4<sup>th</sup> ranked)</i>	<i>Wage of 1<sup>st</sup> ranked/Wage of 3<sup>rd</sup> ranked</i>	<i>Wage of 1<sup>st</sup> ranked/Wage of 2<sup>nd</sup> ranked</i>
<i>Year: 2005</i>			
<i>Number of observation</i>	157	172	179
<i>Median</i>	1.78	1.51	1.25
<i>Year: 1995</i>			
<i>Number of observation</i>	63	83	86
<i>Median</i>	1.84	1.53	1.17
<i>The growth rate of relative wage between 1995 and 2005</i>	-0.03	-0.01	0.07

wage level) and 1st ranked executive (in terms of wage level) has decreased. Also, the relative wage between 3rd ranked executive and 1st one has decreased. Now, let me compare the growth rate of relative wage. From the equation (4), the growth rate of relative wage between 1st one and 4th one is given by

$$\frac{\left(\frac{W_{2005}^{1ST}}{W_{2005}^{4TH}} - \frac{W_{1995}^{1ST}}{W_{1995}^{4TH}}\right)}{\left(\frac{W_{1995}^{1ST}}{W_{1995}^{4TH}}\right)} = \left(\frac{S_{2005}^{1st}}{S_{1995}^{1st}}\right) \left(\frac{S_{1995}^{4th}}{S_{2005}^{4th}}\right) - 1$$

Likewise, the growth rate of relative wage between 1st one and 3rd one is

$$\frac{\left(\frac{W_{2005}^{1ST}}{W_{2005}^{3RD}} - \frac{W_{1995}^{1ST}}{W_{1995}^{3RD}}\right)}{\left(\frac{W_{1995}^{1ST}}{W_{1995}^{3RD}}\right)} = \left(\frac{S_{2005}^{1st}}{S_{1995}^{1st}}\right) \left(\frac{S_{1995}^{3rd}}{S_{2005}^{3rd}}\right) - 1$$

In *Table 6*, we can find that the growth rate of relative wage between 4th ranked executive and 1st ranked executive is lower than the relative wage between 3rd

ranked executive and 1st one. It implies that

$$\left(\frac{S_{1995}^{3rd}}{S_{2005}^{3rd}}\right) < \left(\frac{S_{1995}^{4th}}{S_{2005}^{4th}}\right)$$

The growth rate of the 4th ranked executive's control span is higher than the 3rd ranked executive, which provides evidence that the positioning gap between two executives has decreased.

## 5 Conclusion

In this paper, I test the "Capital-Skill Complementarity" by examining the relative wage between top managers and workers below top managers within the firm. Specially, I explore the indirect channel through which the "capital-intensity" affects the relative wage by reallocating the controllable resources. The increase in the "capital-intensity" shifts a labor demand from non-skilled labor to skilled labor within firm, which could increase the resource (skilled labors) under top managers' control. The current sample support this prediction. In the 2005 sample, the share of executives' compensation in the total labor cost increases with the capital-intensity of firms. Additionally, I explore the effect of organizational change on the wage structure among executives and find that (1) the compensation of lower ranked executive below CEO grows faster than that of higher ranked one below CEO between 1995 and 2005, and (2) the relative wage structure among executives below CEO becomes flattened over the past 10 years.

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