Interprovincial differences in the endowment and utilization in labor force by educational attainment in Indonesia's post-crisis economy

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ABSTRACT

We comprehensively explore the factors contributing to interregional inequalities in the labor endowment and utilization by educational attainment in the Indonesia's post-crisis economy, introducing a variable of the employment with *j* educational attainment per capita (where *j* consists of five different levels of educational attainment) and employing Cheng and Li's (2006) additive inequality decomposition method. Further, we employ Shorrocks' (1980) one-stage Theil decomposition method to measure the factors contributing to overall inequality in employment rate, which is the divergence between the employment rate in a nation and employment rates with j education attainment in province i.

We find that the industrial structures and business functions seem to vary more widely from province to province than the other characteristics, such as demographic structures and labor market efficiency, do. The interprovincial differences in labor market efficiencies tend to be greater for the highly educated groups than the less educated. This is affected by several factors: no universal social security system, province-specific compositions of formal/informal sectors, and different minimum-wage provisions across provinces. Moreover, the interprovincial inequities in employment rates with the junior secondary education attainment have the most significant influences among all education groups. The recent increase in the corresponding labor force share could make this a crucial issue for the country. Consequently, policies for improving the efficiency in the corresponding labor market must be implemented.

Keywords: Education, interprovincial allocation, Indonesia, inequality decomposition

JEL classification code: R11, R12, R58

I. Background and Objectives

Education develops skills and knowledge of labor force. It promotes economic growth in a sub-national region and its development stage determines the education level. Educational endowment in labor force and its utilization differ by sub-national region. This subject is one of major growing public concerns, especially, in the developing nations which faces an interregional resource imbalance and has experienced a rapid educational expansion.

Given its insular geography and the world's fourth largest population, its extraordinary economic, demographic, and cultural diversity, and richly endowed with natural resources, Indonesia faces uneven resource distribution across subnational regions as Java Island, which constitutes 6% of the national land area, has almost 60% of economic activities. Over the past two decades, Indonesia has experienced a massive increase and significant changes in its labor force from 77.4 million in 1990 to 116.5 million in 2010 and the labor force annually grew by 2.1%, which is significantly faster than the annual population growth rate (1.5%). The annual growth rates of the different education groups of labor force varied widely: No primary, -1.5%; Primary, 1.1%; Junior secondary, 5.6%; Senior secondary, 6.2%; and Tertiary, 9.8% (BPS various years b; BPS various years d).

Generally, the highly educated enjoys greater employment stability; however, in Indonesia, the highly educated are less employed. This is most likely because the absence of a universal social security system made it so that the less educated could not afford to remain unemployed.

Observing the existing literature, few studies thoroughly focused on the endowment and utilization in labor force across Indonesia's sub-national regions by educational attainment. We comprehensively examine this subject in the Indonesia's post-crisis economy, employing Cheng and Li's (2006) additive inequality decomposition method. Further, we employ Shorrocks' (1980) one-stage Theil decomposition method to measure the factors contributing to overall inequality in employment rate, which is the divergence between the employment rate in a nation and employment rates with j education attainment in province i.

II. Method

II.1 Cheng and Li's (2006) inequality decomposition method

Cheng and Li (2006) method shows the additive inequality decomposition analysis by using causal factors when the decomposition variable is expressed with multiplicative components. Their technique, which improved upon that of Duro and Esteban (1998), [1] presents the additive interpretive inequality decomposition in per capita income, consisting of Theil second measures in productivity and labor participation rates and their interaction terms. We use the variable of employment with *j* educational attainment per capita, which is obtained by three multiplicative components (shown by Equation (1)), we can apply Cheng and Li's (2006) method to our study.

Now, let P_i , L_i , and E_i represent the population, labor force, and employment in province *i*, respectively. Furthermore, let the nation in question have a total of *m* provinces. We divide the labor force and employment variables into *n* groups based on educational attainment; as such, L_{ij} and E_{ij} represent labor and employment with *j* educational attainment in province *i*. When the subscript *i* is omitted, the aforementioned variables represent the corresponding national values.

We introduce a variable of the employment with j educational attainment per capita in province i, denoted as $x_{ij} = E_{ij} / P_i$. This can be multiplicatively expressed as

$$x_{ij} = l_i \cdot l_{ij} \cdot e_{ij} \quad \left(i = 1 \cdots m,\ j = 1 \cdots n,\ x_{ij} > 0 \text{ for all i and j.}\right), \tag{1}$$

where $l_i = L_i / P_i$ is the labor force participation rate (LFPR) in province *i*,

$l_{ij} = L_{ij} / L_i$ is the share of labor force with *j* educational attainment in province *i*, and

$e_{ij} = E_{ij} / L_{ij}$ is the employment rate among those with *j* educational attainment in province *i*.

The first two multiplicative terms at the right hand side of Equation (1) is regarded as endowments for the entire labor force and the labor force with j educational attainment, while the third term is regarded as labor utilization/market efficiency with j educational attainment in a province. The provincial mean of the each variable in Equation (1) is expressed as μ_{x_j} , μ_l , μ_{l_j} , and μ_{e_j} , that is, $\mu_{e_j} = (1/m)\sum_{i=1}^{m} e_{ij}$.

The interprovincial inequality in employment with *j* educational attainment per capita, as measured by the Theil second measures, $T_j\left(\mu_{x_j}, x_j\right)$, are given by

$$T_j\left(\mu_{x_j}, x_j\right) = \frac{1}{m}\sum_{i=1}^{m} \ln\left(\mu_{x_j} / x_{ij}\right) \quad \left(T_j\left(\mu_{x_j}, x_j\right) \geq 0, \text{for all } j\right) \tag{2}$$

Now, substituting Equation (1) into the right hand side of Equation (2) and multiplying quotient inside the natural logarithm by $\left(\mu_l \cdot \mu_{le_j} / \mu_l \cdot \mu_{le_j}\right)$ yields

$$T_j\left(\mu_{x_j}, x_{ij}\right) = \frac{1}{m}\sum_{i=1}^{m} \ln\left(\frac{\mu_l}{l_i} \cdot \frac{\mu_{le_j}}{l_{ij} \cdot e_{ij}} \cdot \frac{\mu_{x_j}}{\mu_l \cdot \mu_{le_j}}\right) \tag{3}$$

$$= \frac{1}{m}\sum_{i=1}^{m} \ln\left(\frac{\mu_l}{l_i}\right) + \frac{1}{m}\sum_{i=1}^{m} \ln\left(\frac{\mu_{le_j}}{l_{ij} \cdot e_{ij}}\right) + \ln\left(\frac{\mu_{x_j}}{\mu_l \cdot \mu_{le_j}}\right)$$

where $\mu_{le_j} = 1/m \sum_{i=1}^{m}\left(l_{ij} \cdot e_{ij}\right)$. Similarly, multiplying the quotient inside the natural logarithm in the second equity of the right hand side of Equation (3) by $\left(\mu_{l_j} \cdot \mu_{e_j} / \mu_{l_j} \cdot \mu_{e_j}\right)$, we obtain

[1] The additive inequality decomposition terms in Duro and Esteban (1998) can take positive or negative values, although a strict Theil index maintains a non-negative value for its property. It is difficult to interpret the role of the negative values, which indicates that the inequality of the corresponding factor negatively affects the inequality (Gisbert 2001; Cheng and Li 2008).

$$T_j\left(\mu_{x_j}, x_{ij}\right) = \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_l}{l_i}\right) + \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_{l_j}}{l_{ij}}\cdot\frac{\mu_{e_j}}{e_{ij}}\cdot\frac{\mu_{le_j}}{\mu_{l_j}\cdot\mu_{e_j}}\right) + \ln\left(\frac{\mu_{x_j}}{\mu_l\cdot\mu_{le_j}}\right)$$
$$= \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_l}{l_i}\right) + \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_{l_j}}{l_{ij}}\right) + \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_{e_j}}{e_{ij}}\right) + \ln\left(\frac{\mu_{le_j}}{\mu_{l_j}\cdot\mu_{e_j}}\right) + \ln\left(\frac{\mu_{x_j}}{\mu_l\cdot\mu_{le_j}}\right) \quad (4)$$

Now, we may express the covariance of l_i and $\left(l_{ij}\cdot e_{ij}\right)$ (denoted as $\sigma_{(l_i, l_{ij}\cdot e_{ij})}$) as follows:

$$\sigma_{(l_i, l_{ij}\cdot e_{ij})} = (1/m)\sum_{i=1}^{m}(l_i - \mu_l)\left(l_{ij}\cdot e_{ij} - \mu_{le_j}\right)$$
$$= (1/m)\sum_{i=1}^{m}\left(l_i\cdot l_{ij}\cdot e_{ij} - l_i\cdot\mu_{le_j} - \mu_l\cdot l_{ij}\cdot e_{ij} + \mu_l\cdot\mu_{le_j}\right) \quad (5)$$
$$= \mu_{x_j} - \mu_l\cdot\mu_{le_j}$$

If we divide all of the terms in Equation (5) by $\left(\mu_l\cdot\mu_{le_j}\right)$, we get

$$\frac{\mu_{x_j}}{\mu_l\cdot\mu_{le_j}} = \frac{\sigma_{(l_i, l_{ij}\cdot e_j)}}{\mu_l\cdot\mu_{le_j}} + 1 \quad (6)$$

Similarly, the covariance of l_{ij} and e_{ij} (denoted as $\sigma_{(l_{ij}, e_{ij})}$) can be expressed as

$$\sigma_{(l_{ij}, e_{ij})} = (1/m)\sum_{i=1}^{m}\left(l_{ij} - \mu_{l_j}\right)\left(e_{ij} - \mu_{e_j}\right) = \mu_{le_j} - \mu_{l_j}\cdot\mu_{e_j} \quad (7)$$

Then, by dividing all of the terms in Equation (7) by $\left(\mu_{l_j}\cdot\mu_{e_j}\right)$, we obtain

$$\frac{\mu_{le_j}}{\mu_{l_j}\cdot\mu_{e_j}} = \frac{\sigma_{(l_{ij}, e_{ij})}}{\mu_{l_j}\cdot\mu_{e_j}} + 1 \quad (8)$$

Then, we may substitute Equations (6) and (8) into Equation (4) in order to finally obtain

$$T_j\left(\mu_{x_j}, x_{ij}\right) = \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_l}{l_i}\right) + \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_{l_j}}{l_{ij}}\right) + \frac{1}{m}\sum_{i=1}^{m}\ln\left(\frac{\mu_{e_j}}{e_{ij}}\right) + \ln\left(\frac{\sigma_{(l_i,\, l_{ij}\cdot e_{ij})}}{\mu_l\cdot\mu_{le_j}} + 1\right) + \ln\left(\frac{\sigma_{(l_{ij},\, e_{ij})}}{\mu_{l_j}\cdot\mu_{e_j}} + 1\right)$$
$$= T_j(\mu_l, l_i) + T_j\left(\mu_{l_j}, l_{ij}\right) + T_j\left(\mu_{e_j}, e_{ij}\right) + Cov_j\left(l_i,\ l_{ij}\cdot e_{ij}\right) + Cov_j\left(l_{ij},\ e_{ij}\right) \quad (9)$$

Equation (9) shows that the interprovincial inequality in employment with j educational attainment per capita is the sum of three inequality terms and two interactions terms. The first three terms are strict Theil second measures and take on non-negative values.[2] Each inequality is governed by different forces: The first term depends on regional demographic patterns, the level of economic development, and the existence of unemployment benefits. The second depends on regional industrial structures, business functions, and education systems. The third depends on regional shocks and labor market efficiency.

The last two interaction terms take on positive (negative) values when the component variables are positively (negatively) correlated. They are equal to zero when the component variables are totally uncorrelated. It should be noted that the last two terms never take on undefined values: as all of the mean variables on the left-hand side of Equations (6) and (8) are positive, so too are the terms within the natural logarithms.

Especially, the last interaction term indicates an interesting implication as it shows the correlation between the relative size of labor market and its employability (market efficiency) in a province. The labor market efficiency in a province is negatively associated with wage inflexibility, which is determined by several factors such as minimum wage provisions, union activity, and proportion of large firms (Armstrong and Taylor 2000). The implementation of a minimum wage will reduce wage flexibility since wages will be prevented from falling below the legal minimum even in the face of high unemployment. Strong unions can prevent wage cuts during the recessions, thereby reducing wage flexibility. Large firms

[2] The equation forms of the Theil first and second measures are the divergence between the shares of two variables, weighted by the numerator of variables inside natural logarithm (Gisbert 2001). The quotient inside the natural logarithm of first three terms in the right hand-side of Equation (9) are expressed as $(\mu_l/l_i) = \left((1/m)/\left(l_i/\sum_{i=1}^{m} l_i\right)\right)$, $\left(\mu_{l_j}/l_{ij}\right) = \left((1/m)/\left(l_{ij}/\sum_{i=1}^{m} l_{ij}\right)\right)$, and $\left(\mu_{e_j}/e_{ij}\right) = \left((1/m)/\left(e_{ij}/\sum_{i=1}^{m} e_{ij}\right)\right)$. Those are satisfied with the property of Theil second measure.

are unlikely to be on the edge of competitiveness and do not therefore monitor their wage costs very closely.

The dual economy, which separately coexists the formal and informal sectors, normally exists in the developing economies. The aforementioned determinates factors do not apply in the informal sector (Comola and de Mello 2009). Like other developing nations, most less-educated work in the informal sector in Indonesia (ADB 2010). In general, (less) developed provinces are richly endowed with highly (less) educated and with large (small) firms. Conclusively, the highly educated abundant provinces, which are more likely (unlikely) to lose wage flexibility, show lower employability. Then, it can be assumed that the last interaction term $\sigma_{(l_j, e_j)}$ takes the negative (positive) values for the higher (less) educated labor.

II. 2 Shorrocks' (1980) one-stage Theil decomposition method

The second method was derived by Shorrocks (1980), which can decompose the overall inequalities in employment rate into those between education subgroups and those between provinces within each subgroup based on the Theil second measure. As stated above, labor and employment are divided into *n* education groups, which are classified into *m* mutually exclusive and collectively exhaustive provinces in accordance with working location. The relationships can be expressed as $L = \sum_{j=1}^{n} \sum_{i=1}^{m} L_{ij}$ and $E = \sum_{j=1}^{n} \sum_{i=1}^{m} E_{ij}$. Based on the aforementioned structure, overall inequality in employment rates can be measured by the following Theil second measure: (Anand 1983; Fields 2001)

$$T(e, e_{ij}) = \sum_{j=1}^{n} \sum_{i=1}^{m} (L_{ij}/L) \ln(e/e_{ij}) \tag{10}$$

where $e = (L/E)$. Equation (10) can be additively decomposed into between-group inequality and within-group inequality as follows (Shorrocks 1980):

$$\begin{aligned} T(e, e_{ij}) &= \sum_{j=1}^{n} (L_j/L) \ln(e/e_j) + \sum_{j=1}^{n} (L_j/L) \cdot T_{w_j} \\ &= T_B + T_W \end{aligned} \tag{11}$$

where $T_{W_j} = \sum_{i=1}^{m} (L_{ij}/L_j) \ln(e_j/e_{ij})$. This term is the Theil second measure index for the within-group inequality, which is a weighted average of the between-province inequalities in employment rates for each education group.

III. Data

The data used in this study consists of annual observations of 30 contiguous Indonesian provinces' populations, labor forces, and employment figures from 2002 to 2010. The population data are from the *Population Census* (BPS various years b) and the *Intercensal Population Survey* (BPS various years c). The data on the provincial labor forces and employment are from *Labour Force Situation in Indonesia* (BPS various years d).

The present study aggregates labor and employment statistics into five groups in order to conduct a decomposition analysis: (1) no primary (no schooling or incomplete primary education); (2) primary; (3) junior secondary; (4) senior secondary and (5) tertiary education.

BPS redefined labor force and employment status twice for the last two decades. Currently, the labor force is defined as persons aged 15 and above, while before 1994, it was those aged 10 years and above. This change affected all of the provincial labor force statistics recoded from 1998 onward. In 2001, unemployment status was redefined to include those who were not working and had given up actively searching for a job, whereas previously, it had only included those who were seeking employment. However, no retroactive adjustment of past relevant data (by province and educational attainment) has been officially made thus far. Consequently, we use the data on those variables covering the years 2002 – 2010 in conducting our analysis.

It should also be noted that after the economic crisis of 1998, political reforms led to the creation of eight new provinces and that the province of East Timor gained independence. Consequently, the number of provinces changed from 27 to 34. However, only four provinces established prior to the year of 2002 has released data in 2002 and after. As of yet, no effort has been made to adjust the historical data in order account for these changes. As such, we study only 30 provinces and aggregate the data from the new and existing provinces for each year.

IV. Empirical results

IV.1 Cheng and Li's (2006) inequality decomposition method

Figures 1 through 5 present the inequality decompositions of the education groups' employment by a number of factors (which were calculated using Equation (9)).[3]

First, $T_j(\mu_l, l_{ij})$, which is mainly determined by province-specific industrial structures, business functions, and education systems, appears to be a significant factor in determining the overall inequalities $T_j(\mu_{x_j}, x_j)$. The observations are fairly uniform across the education groups. These findings show that the industrial structures and business functions seem to vary more widely from province to province than the other characteristics, such as demographic structures and labor market efficiency, do. Those values for no primary education group (ranging between 0.060 and 0.141) and tertiary education group (ranging between 0.038 and 0.092) are more uneven than those with other education group are. This may be because less educated workers are more often employed in the labor intensive agriculture sector, which has a greater presence in less developed provinces, while highly educated workers are more attracted to the value-adding manufacturing and service sectors, which are more common in developed provinces.

Second, interprovincial inequalities in labor market efficiency by education group $T_j(\mu_{ej}, e_{ij})$, which takes on small values, has very little influence on the overall inequality for each education group. However, the cross-group comparisons shown at Figure 6 provide interesting observations. The interprovincial differences in labor market efficiencies for the highly educated groups tend to be greater and more fluctuate than the less educated. This is simply because there is no universal social security system, so there is no province in which the less educated can afford to remain unemployed. Additionally, minimum-wage provisions do not apply in the informal sector, which more consist of less educated. The reverse is also true for the higher educated. In 2001, the nation decentralized the minimum wage provisions to provinces and districts and the minimum wages rapidly increased by the mid-2000s and those increases varied across provinces (Islam and Chowdhury 2010). Besides, the province-specific compositions of formal/informal sectors also affect interprovincial differences in labor market efficiencies. The more fluctuation values for the period for the higher educated group infers that the regional shocks affects the corresponding group's provincial labor market more greatly than less-educated counterparts.

Finally, the interaction terms $Cov_j(l_{ij}, e_{ij})$ take on positive (negative) values for lower (higher) education groups; though, these values are small and fluctuate cyclically. For instance, the annual arithmetic mean values for Groups 1 through 5 are 0.0029, 0.0007, -0.0003, -0.0030, and -0.0013, respectively. The values of $Cov_j(l_{ij}, e_{ij})$, which is not standardized, can range from zero to positive infinity. Thus, we employ a scaled version of covariance, correlation coefficient, which is takes on a value between 1 and – 1. The annual arithmetic mean values for Groups 1 through 5 are 0.4103, 0.1425, -0.0041, -0.1847, and -0.0548 respectively (Table 1). This observation does not support our hypothesis that the highly educated abundant provinces, which are likely to have the lower wage flexibility, show lower employability.

IV.2 One-stage Theil decomposition of the employment rate by educational attainment

Table 2 shows the results of the one-stage Theil decomposition analysis of the inequality in employment rates for three selected years. The overall inequality increased from 0.0020 in 2002 and peaked to 0.0028 in 2005, and then decreased to 0.0012 in 2010. Decomposition analysis reveals that the inequalities between the education groups' employment rates (TB) played a crucial role in determining the overall inequality. The between-group inequality (TB) increased from 0.0013 in 2002 to 0.0019 in 2005 and then decreased 0.0008 in 2010 and the corresponding contribution share increased from 67.4% in 2002 to 68.8% in 2005 and then decreased 64.8% in 2010.

Decomposition of the within-group inequality (TW) also showed the divergence and convergence process and the inequality values increased from 0.0007 in 2002 to 0.0009 in 2005 and then decreased to 0.0004 in 2010. In the contribution shares of each group's (TWj), those in the junior secondary group show the most significant values among the education group, 12.1% in 2002, 12.1% in 2005, and 11.5% in

[3] The interaction term $\text{cov}(l_i, l_{ij} \cdot e_{ij})$ are excluded from Figure 1 to 5 as those do not provide significant economic interpretations.

2010. Generally, higher interprovincial variations in the employment opportunities could lead to increased interprovincial migration. Then, if provinces with greater employment opportunities were to restrict labor immigration, interprovincial tensions would rise precipitously. Since the ongoing increase in the labor force share of junior secondary education group could make this a crucial issue for the country.

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Figures 1–5 Cheng and Li's (2006) inequality decomposition method by education attainment

Figure 1: No primary

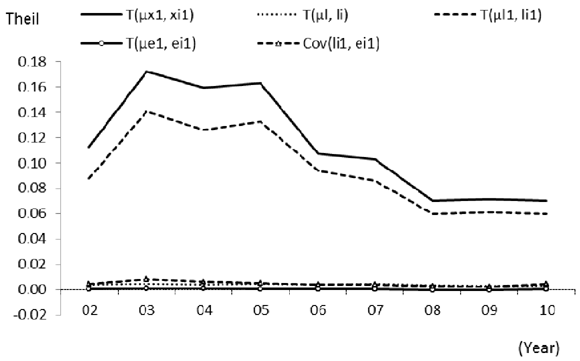

Figure 2: Primary

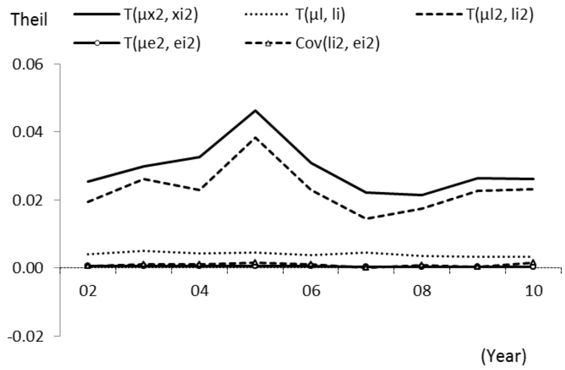

Figure 3: Junior secondary

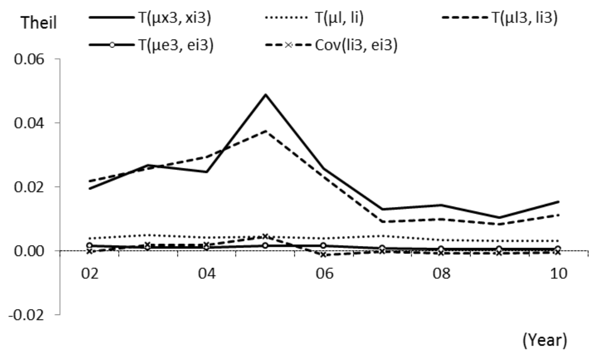

Figure 4: Senior Secondary

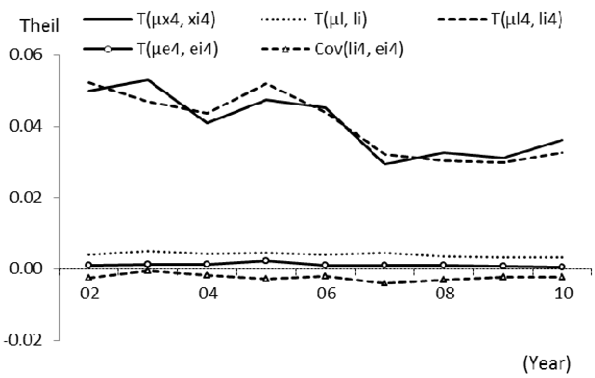

Figure 5: Tertiary

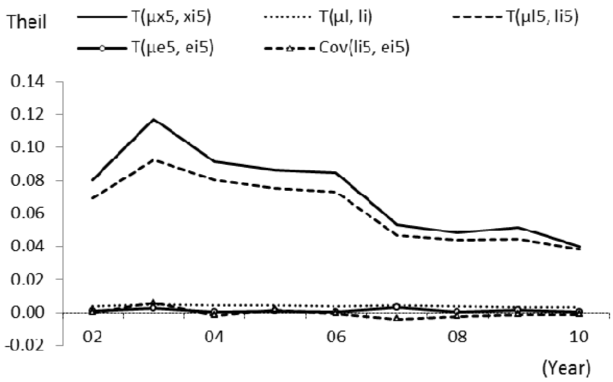

Figure 6 Interregional inequalities employment rate with j education attainment

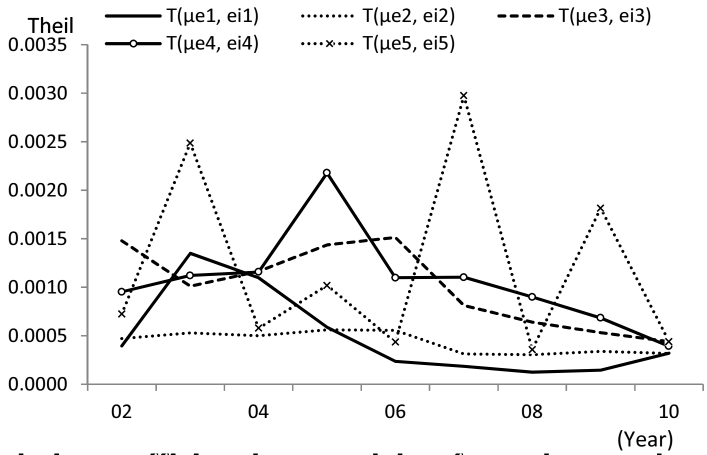

Table 1 Correlation coefficient between labor force share and employment rate with j education attainment

	Minimum		Maximum		Mean
	Value	Year	Value	Year	Value
Cor(li1, ei1)	0.2888	2004	0.5312	2007	0.4103
Cor(li2, ei2)	-0.0009	2007	0.2914	2010	0.1425
Cor(li3, ei3)	-0.1690	2008	0.2838	2005	-0.0041
Cor(li4, ei4)	-0.3092	2007	-0.0325	2003	-0.1847
Cor(li5, ei5)	-0.2355	2008	0.1700	2003	-0.0548

Table 2 One-stage Theil decomposition analysis of the inequality in employment rates

	Theil Value			% of Contribution		
	2002	2005	2010	2002	2005	2010
$T(e, e_{ij})$	0.0020	0.0028	0.0012	100.0	100.0	100.0
TB	0.0013	0.0019	0.0008	67.4	68.8	64.8
TW	0.0007	0.0009	0.0004	32.6	31.2	35.2
TW1	0.0001	0.0001	0.0001	2.8	2.5	4.8
TW2	0.0002	0.0002	0.0001	8.8	7.4	8.4
TW3	0.0002	0.0003	0.0001	12.1	12.1	11.5
TW4	0.0002	0.0002	0.0001	8.2	8.1	7.7
TW5	0.0000	0.0000	0.0000	0.7	1.1	2.7