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# The Determinants of Large and Medium Industrial Sectors Productivity Growth in Indonesia

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***Abstract***

The study aims to analyze the determinants of labor productivity growth in the large and medium industrial sub-sectors in Indonesia related to changes in economic structure that lead to the dominant role of the industrial sector in national GDP formation. The data used are combined between cross-section from 62 large and medium industrial sub-sectors, and time series, during 1990-2014, which are divided into 5 sub-periods of research. The data includes value added, number of workers, FDI, and Wages. Data sources are the Central Bureau of Statistics, Bappenas, and the Ministry of Industry of the Republic of Indonesia. The analytical method used is the panel data regression model, using secondary data. The model is analyzed by estimating the Least Square Dummy Variable (LSDV) method. The results of the study show that: (1) Changes in the share of labor as a result of the process of reallocating labor between sub-sectors have a negative effect on labor productivity growth. (2) Determinants of labor productivity growth, in addition to changes in the share of labor: those are investment variables (capital deepening), both short and long-term, and FDI does not affect labor productivity growth, while wages have a significant positive effect.



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## INTRODUCTION

The contribution of industrial sector in National GDP has reached 20.16% higher than the agricultural sector of 13.14% (Centraul Bureau of Statistics, 2017). It shows that there has been a change on Indonesia economic structure. Even though industrial sector contributed the largest share to GDP with the increase in labor share, during the year of 2000-2014 this sector was apparently stagnant even declined. The decline were 27.75% (2000) to 25.54% (2014). Even in 2017, the contribution was even lower.

Based on UNIDO reports, the competitiveness of manufacturing industry in Indonesia experienced stagnancy in the past 20 years. In 2013, Indonesia was in the 42th rank in CIP (Competitive Industry Performance). This rank showed decline when compared to year 2000, namely in the 38th position (Bappenas, 2017). This condition impacts the whole Indonesia economy performance.

Industry is actually supposed to be the machine of economic growth. This is line with what is stated by McMillan et al. (2014), and Nicholas Kaldor in 1960s in UNIDO (2013) that the increase of industry roles through more optimal utilization of resources can increase overall productivity growth. By referring to Badriah et al.'s study (2017) it is known that the change in Indonesia economy impacts to the decline of industrial sector productivity growth aggregately. To confirm the findings of their study, there is a need to conduct an in depth investigation regarding the condition happening in the industry sub-sector.The Ministry of Industry and Trade of the Republic of Indonesia (2011), categorizes industrial sectors into 5 groups, namely Resources-Based Industries, Labor Intensive Industries, Scale Intensive Industries, Differentiated Goods, and Sciences Based. According to the statistical data of Large and Small Industries, the Standard Clarification of Indonesia Business Field (KBLI) in the third revision year 1990-2014, the market share of the large and small industries values added was dominated by resources-based industries group.

Averagely, the market share of resources-based industries showed its domination with a downward trend during 1990-2014. This had an impact on the performance of the industrial sector. By looking at the aforementioned facts, it is necessary to conduct a deeper study of the determinants of industrial sector productivity growth more specifically in the Large and Medium Industry sub-sectors in Indonesia. Productivity in this study was more emphasized on labor productivity because based on publication data from APO (2014), a large gap between Asian GDP per capita and US was largely explained by the gap in labor productivity reaching more than 50 percent.

The industries involved as the objects of the study were derived from IBS sub-sectors by considering Central Bureau of Statistics (BPS) data (2015) that even though the number of IBS was less than 1% (0.69%) of the total number of industries in Indonesia, its contribution reached almost 90% both in output (88.26%) and value added (89.93%) of all industrial sectors in Indonesia. Therefore, IBS sub-sectors contributed relatively high performance on industrial performance in particular, and economy in general.

Several previous studies indicate that changes in structure leading to industrial sector can impact the performance of industrial sector growth. It is seen from the indicators of labor productivity growth. The studies are such as those that have been done by Bosworth and Collins (2008), and Chen et al. (2011), Jorgenson et al. (2011), Szirmai (2012), Marouani & Mouelhi (2015), Timmer & Szirmai (2000), Peneder (2003), and Carree (2003). However, the changes revealed by those researchers indicate different conclusions. Some researchers show that the effect of changes in structure and production factors relocation on economic performance show positively significant relationship, while other researchers indicate that the effects are absent or very small and even negative. By referring to several other empirical studies, there are several factors that impact the productivity. One of them is structural change

factor. It can be seen from the indicators of the occurrence of labor reallocation (changes in the share of labor) between the industrial sub-sectors along with the increasing role of the sector in contributing to the formation of National GDP compared to the agricultural sector.

The Solow Growth Model (Solow, 1957) shows that savings, population / labor growth, and technological advances affect the level of economic output and growth over time.

A central assumption of the Solow model pays attention to the characteristic of the production function and the development of the three inputs in the production functions (capital, labor, and knowledge) (Romer, 2012). Furthermore, Endogenous Griwth Theory (New Growth Theory) states that economy growth is resulted from factors in production process, such as by increasing investment or introducing technological changes. (Mankiw, 2007).

Paus (2004), who examined the productivity growth in Latin America shows that there is a need for openness to FDI to encourage productivity growth. However, to achieve a continuous productivity, and more extensive FDI spillover, trade liberalization and openness to FDI must be accompanied by adequate domestic technological capabilities. As Fagerberg et al. (2010) suggest that the adoption of technology through FDI is important but for the optimal results it is often constrained by the ability of domestic absorption.

Again, Kemeny (2010) explains that FDI has a positive effect on improving technology, but this effect depends on the level of development of a country and the absorption ability. Additionally, FDI has potentials to provide benefits through the diffusion of technology from the creator to the follower, but still it depends on domestic investment. It is because FDI is not an agent of the success of technology transfer without the development of good domestic capabilities,

According to the above statement, it can be said that technology becomes the central of industrialization and it can be found from FDI and domestic companies / organizations. It is proved through the study of Naude et al. (2013) that China and India experienced a structural transformation from agriculture to industry and services (industrialized) supported by a change in structure in manufacturing from labor intensive to capital intensive.

According to Harrod Domar there is a positive correlation between the level of investment and the rate of economic growth (Subandi, 2011). FDI is believed to have an important role to drive the economic development of developing countries (Masron & Abdullah, 2010).

As previously explained, the adoption of technology through FDI is important, yet to get the optimal results, it is often constrained by domestic absorption capabilities. Through technology transfer and know-how a country can quickly catch up, but in this case it does not happen automatically (Fagerberg et al., 2010).

Even though some of the statements above show the positive influence of FDI on economic growth and productivity, some studies related to this show different results. Some empirical results show that FDI can increase economic growth and productivity (Kien, 2008; Antwi et al., 2013; Melnyk et al., 2014; Siddique et al., 2017; Le & Nguyen, 2018), while the empirical results others show that the effect of FDI on productivity is unclear (Javorcik, 2004, Thiam, 2006) and even negative (Choi, 2004; Saqib et al., 2013).

Even though theoretically FDI has a positive spillover effect on the productivity of domestic companies in the host country, various empirical studies have different results. The magnitude of the spillover effect varies between technology levels, the intensity of the company's capital, the quality of skilled labor, the size of domestic companies, and various forms of FDI in the host country (Kien, 2008).

Another factor that can affect the industrialization process is wages. Wages are considered to be able to affect worker productivity. There is a positive relationship between real wages and productivity. There are two underlying arguments, namely: first, based on the efficiency wage theory. The main hypothesis of this theory is that productivity depends positively on real wages. If companies

pay higher wages, then workers mobilize more effort to avoid being fired (Storm & Naastepad, 2007).

Second, based on the macroeconomic framework, increasing real wages will cause companies to replace labor with capital. This substitution occurs because the increase in real wages will increase the marginal productivity of labor from reduce the labor (Wakeford, 2004).

Apparently, some results of the study show that there is a positive influence of wages on productivity growth, among others: Wakeford (2004), Mihaljek & Saxena (2010), Nayak & Patra (2013), and Yildirim (2015).

Based on the previous explanation, the research problem of this study is how is the influence of changes in structure, investment, FDI, and wages on labor productivity growth in the Large and Medium Industry sub-sectors in Indonesia? Therefore, this study aimed to analyze the determinants of labor productivity growth in the Large and Medium Industrial sub-sectors in Indonesia.

Theoretically, the results of this study are expected to contribute to the economic theory, especially the economic development through obtaining empirical evidence related to the determinants of industrial sector performance in Indonesia. Meanwhile, practically, the findings of this study are expected to contribute to development policy making in order to encourage the growth of industrial sector performance in Indonesia.

## RESEARCH METHODS

This study used secondary data, covering both cross-sections and times series from the Central Bureau of Statistics. Ministry of Industry and Trade, National Development Planning Agency, and some other related institutions.

There were 62 Large and Medium industrial sub-sectors in the 3-digit category of ISIC based on the classification of the 3rd revision of Standard Classification of Indonesian Business Fields (KBLI) ranged from 1990 to 2014. The data used were related to the research variables, covering independent variables and dependent variables. These variables included: value added data, the number of labors, the amount of capital, the amount of foreign direct investment (FDI), and wages.

The data usage of IBS until 2014 have been converted into equal values and groups from several revisions of KBLI. For more, the 3rd revision of KBLI was used as the foundation of conversion because the 3rd revision of KBLI was considered easier to accommodate changes in the previous and afterwards revisions.

The method of analysis used in this study was quantitative analysis through panel data regression model. This method can be done by the models of fixed effect or random effect. However, initially there should be a Hausman test. Moreover, the estimation processes were done by using EViews 9 software. The indicators used determine the performance of industrial sub-sector was the growth of labor productivity.

The labor productivity is a ratio between the amount of output produced by each labor, and used by each industrial sub-sector. In addition, to know the determinants of the industrial sub-sector productivity growth, the researchers used panel data with time series for 25 year (1990-2014) divided into 5 sub-periods.

Each consisted of 5 years data (M=5) and cross section of 62 large and medium industrial sub-sectors in 3-digit group by adding dummy variable of IBS sub-sector, and dummy variable as the results of dummy sub-sector with structural change variable which was dynamic, namely the indicators of changes in the share of industrial sub-sector labor at the beginning of sub-periods.

The addition of the IBS sub-sector dummy variable was intended to see the heterogeneity of the initial conditions of labor productivity growth in each of the industrial sub-sectors. The addition of the dummy interaction variable as a specific dummy was intended to expand the analysis in order to capture the impact of differences in the characteristics of changes in structure among industrial sub-sectors towards the growth of labor productivity. To deal with problems which might arise in relation to panel data usage, both heteroscedasticity and autocorrelation, Gujarati

and Porter (2012) and Wooldridge (2009) suggest to use Generalized Least Squares (GLS) method or Feasible Generalized Least Square (FGLS). In this study, the researchers used Ordinary Least Square (OLS) estimation method with FGLS. The regression models used are as follows:

$$ln\left(\frac{Y_{i,t}}{Y_{i,t-M}}\right) = \gamma + \theta_1 lnY_{i,t-M} + \theta_2 \left(\frac{X_{i,t} -}{X_{i,t-M}}\right) + \theta_3 X_{i,t-M} + \theta_4 lnINVT_{i,t-M} + \theta_5 \Delta lnINVT_{i,t} + \theta_6 FDI_{i,t+} \theta_7 lnW_{i,t} + \theta_m \sum_{m=2}^{62} D_i + \theta_q \sum_{q=63}^{124} (X_{i,t} - X_{i,t-M})^* D_i + (1)$$

Notes:

Ln(Yi,t)/(Yi,t-M) = Labor productivity growth

Yi,t-M = Labor productivity growth in the beginning of sub-period.

Xi,t – Xi,t-M = Industrial sub-sector labor share in the end of sub-period of study

Xi,t-M = Industrial sub-sector labor share in the beginning of sub-period of study

INVTt-M = Total investment in the beginning of sub-period, short-term capital deepening proxy

ΔINVTi,t = Changes in total investment, long-term capital deepening proxy

FDIi,t = The number of Direct Foreign Investment project unit, proxy for ease access of technology

Wi,t = Total labor recruitment per month.

(Xi,t – Xi,t-M)*Di = interaction variable between IBS sub-sector dummy and IBS sub-sector labor share in the beginning and end of sub-period

γ = Constant

θi = Estimation parameter

ε = error term

t = Years

M = Total years in one sub-period (5)

i = The large and medium industrial sub-sector in i

## RESULTS AND DISCUSSION

Model Specification Test, The Hausman Test results on the research model show the value of Chi-Sq. Further, the researchers obtained statistics value of 65.607784 with Probability 0.0000 <α (α = 0.05). It indicated that the right model to use was the Fixed Effect Model (FEM).

Multicollinearity Test, The results of Multicollinearity test using Variance Inflation Factor (VIF) value indicator showed that the centered VIF for all variables valued at <10. This meant that the research model used was free from multicollinearity.

Heteroscedasticity Test, to examine the presence or absence of heteroscedasticity symptoms in the research model, the Breusch-Pagan-Godfrey method was used. The results showed that the Obs * R-squared value were 18.338731 with the Prob value. Meanwhile, the Chi-Square (7) was 0.0103 <α (α = 0.05). These values showed a significant condition, and implied that the model contained heteroscedasticity symptoms.

Autocorrelation Test, was done by employing Breusch-Godfrey Serial Correlation LM Test method. The results showed that the Obs * R-squared value was 0.399454 with the Prob value. Meanwhile, the Chi-Square (2) was 0.8190> α (α = 0.05). Those values indicated that the condition was not significant, and meant that the model did not contain autocorrelation. Based on the classical assumptions, it was known that the model used was free from multicollinearity and autocorrelation problems. The model was estimated by using Feasible Generalized Least Square (FGLS) technique.

Through this technique, heteroscedasticity and autocorrelation problems in the model as one of the properties relatively inherent with cross section data and time series could be minimized so that it can produce estimation results that are BLUE (Gujarati and Porter, 2012; Wooldridge, 2009). The model was estimated by using ISIC 160 as the reference sub-sector in calculating the sub-sector dummy. The results are showed in Table 1.

**Table 1**. The Estimation Results of the Growth of Large and Medium Industrial Sub-sector Labor Productivity

| Dependent Variables | The Growth of Large and Medium Industrial Sub-sector Labor Productivity |
|---|---|
| Constants | -1.34118*** (-2.6319) |
| $Y_{i,t-M}$ | -0.85309*** (-15.7109) |
| $(X_{i,t} - X_{i,t-M})$ | -0.19481* (-1.67296) |
| $X_{i,t-M}$ | 0.016423 (0.7006) |
| $INVTi_{,t-1}$ | -0.01149 (-0.47048) |
| $\Delta INVT_{i,t}$ | 0.022351 (1.159658) |
| $FDI_{i,t}$ | 7.30E-05 ( 0.05221) |
| $W_{i,t}$ | 0.899174*** (13.96809) |
| Sub Sector Dummy | Ya[1)] |
| Interactions Dummy | Ya[2)] |
| $R^2$ *Adjusted* | 0.590895 |
| F-Stat | 4.459743 (0.000000) |

Source: Data Processing, 2017.

Notes: *** = significant at α = 1%, ** = significant at α = 5, * = significant at α = 10%. 1) and 2) = can be seen in Table 2 and Table 3.

Based on the data in Table 1 the Adjusted R2 value was 0.590895, meaning that 59.09% of the variation in the growth of IBS industrial sub-sector labor productivity was able to be explained by all the independent variables.

In the model, it was seen that the initial productivity variable (Yi, t-M) showed a significant negative coefficient value at α = 1%. This meant that an IBS sub-sector that had a labor productivity of 1% higher at the beginning of the sub-period, on average, will experience lower productivity growth than the other IBS sub-sectors in the same sub-period with an average of 0.85%. This shows the convergence in the average growth of labor productivity among the IBS sub-sectors in Indonesia. This condition is in line with exogenous growth theory which estimates that countries with lower initial income will grow faster than those with higher initial income, ceteris paribus, and vice versa, resulting in convergence in state revenues (Mankiw, 2007). The results of this study are in line with the results of the a study by Carree (2003) which shows the existence of inter-industrial technology convergence.

The coefficients of the two proxy variables of structural changes showed different directions. Variable changes in the share of labor at the beginning and end of the sub-period showed a significant negative value at α = 10%, while the variable of labor share in the beginning showed a not significant positive value.

The coefficient value of labor share changes variable obtained significant negative result at α = 10%, amounting to -0.19481. It implied that changes in labor share in an industrial sub-sector in a sub-period averaged of 1% would decline the growth of labor productivity in the sub-sector concerned of 0.19%. Whereas, the initial value of labor share

variable was not significant positive, meaning that the variable had no influence. These estimations are in line with the findings in the study of Timmer and Szirmai (2000), Peneder (2003), and Carree (2003) that labor reallocation has a weak or even negative impact on labor productivity growth.

The two investment variable coefficients, as proxies for capital deepening, both in the short term and in the long term, had no effect on labor productivity growth in the Large and Medium Industrial sub-sectors in Indonesia. This was due to the inability of the labor to adapt quickly to the process of capital deepening. Besides, it was also related to the characteristics of a growing industrial structure in Indonesia where 67.79% were resource-based industries and intensive labor industries. Such industries, in general, have unskilled labor.

Based on the results of a study by the Ministry of PPN / Bappenas and LPEM FEB UI (2015), economic conditions that have abundant labor, generally the capital productivity is relatively low. This result is in line with the results of the Ministry of National Development Planning/National Development Planning Agency (2010) research that the overall elasticity of manufacturing industry output on capital is relatively low (0.03), indicating that capital productivity in the manufacturing industry is relatively low. Also, Wacker, Yang, & Shev (2006) state that developed countries commonly have high capital elasticity that they have advanced manufacturing sector and give more priority on high added value products, so the need for capital for those countries is high. It is because the countries use the capital to encourage the development of production and productivity of manufacturing sectors. Meanwhile, the condition of Indonesia indicates that most of the manufacturing sectors produce Natural Resources-based and labor intensive outputs which cause Indonesia has relatively small requirement of capital.

Another way, the real impact of investment on the production and productivity of a company generally requires a relatively long period of time, and usually causes a relatively weak capital impact. It is because the conditions of each sub-sector are more specific with input needs.

The variable of the number of Direct Foreign Investment project unit, proxy for ease access of technology did not affect the productivity growth of the IBS sub-sector in Indonesia. This was because the amount of FDI in Indonesia was still limited and uneven among the industrial sub-sectors.

Besides, the problem of the real benefits of access to technology that accompanies FDI was also related to the quality of human resources as the results of the study by Paus (2004). He said that if openness to FDI is not accompanied by adequate development in the capabilities of domestic technology to be able to benefit from access to new technology from outside, it will not be able to bring sustainable productivity growth and limited FDI spillover. This is in line with Fagerberg et.al. (2010), Kemeny (2010), Franco et.al. (2011), and Naude et.al. (2013). Therefore, FDI needs to be balanced by domestic absorption capacities. FDI has the potential to provide benefits through the diffusion of technology from the creator country to the follower, but it depends on domestic investment. Because without the development of good domestic capabilities, FDI is not the agent of the success of technology transfer. The wage level variable coefficient was positive and significant at $\alpha = 1\%$ of 0.899174. It meant that if the average wage of the IBS sub-sector labor increased by 1%, it would increase the labor productivity growth of the IBS sub-sector by an average of 0.90%. In other words, a rise in wage levels could increase labor productivity growth. This is in line with the results of the research by Nayak & Patra (2013) which shows that there is a positive correlation between wages and worker performance. This is also in line with the efficiency wage theory that higher real wages increase the opportunity cost of losing jobs and encourage greater work effort. (Mankiw, 2007) The presence / absence of differences in the initial conditions of the average growth in labor productivity among the IBS sub-sectors based on the dummy cross section value is showed in Table 2.

**Table 2.** The Cross Section Dummy of the Model of Large and Medium Industrial Sub-sectors Labor Productivity Growth

| ISIC | Dummy Coefficient Values | ISIC 160 Constants | Differences |
|---|---|---|---|
| 153 | -0.74691** | -1.341181*** | -2.088091 |
| 154 | -1.202624*** | | -2.543805 |
| 155 | -0.765217** | | -2.106398 |
| 171 | -0.794962*** | | -2.136143 |
| 172 | -1.382693*** | | -2.723874 |
| 173 | -1.162291*** | | -2.503472 |
| 174 | -1.632815*** | | -2.973996 |
| 181 | -1.578912*** | | -2.920093 |
| 191 | -1.153798*** | | -2.494979 |
| 192 | -1.535516*** | | -2.876697 |
| 201 | -1.013558* | | -2.354739 |
| 202 | -1.17961*** | | -2.520791 |
| 221 | -1.030859*** | | -2.37204 |
| 222 | -0.977662*** | | -2.318843 |
| 231 | -1.045534* | | -2.386715 |
| 241 | -0.616341* | | -1.957522 |
| 242 | -0.743474* | | -2.084655 |
| 251 | -0.700175* | | -2.041356 |
| 252 | -1.131385*** | | -2.472566 |
| 261 | -1.263538*** | | -2.604719 |
| 262 | -0.915112** | | -2.256293 |
| 263 | -1.594165*** | | -2.935346 |
| 264 | -0.697429** | | -2.03861 |
| 265 | -0.984202*** | | -2.325383 |
| 266 | -1.333008*** | | -2.674189 |
| 269 | -1.396799*** | | -2.73798 |
| 271 | -0.675738** | | -2.016919 |
| 272 | -0.587917* | | -1.929098 |
| 281 | -0.819387** | | -2.160568 |
| 289 | -1.01092*** | | -2.352101 |
| 291 | -1.021482** | | -2.362663 |
| 292 | -1.027243*** | | -2.368424 |
| 311 | -0.84402*** | | -2.185201 |
| 312 | -1.121267** | | -2.462448 |
| 315 | -1.963853** | | -3.305034 |
| 321 | -0.951114*** | | -2.292295 |
| 322 | -1.089913** | | -2.431094 |
| 323 | -0.849897** | | -2.191078 |
| 331 | -1.260795*** | | -2.601976 |

| | | |
|---|---|---|
| 332 | -1.52753*** | -2.868711 |
| 333 | -1.02781* | -2.368991 |
| 342 | -1.018178** | -2.359359 |
| 351 | -1.15788*** | -2.499061 |
| 352 | -0.88371** | -2.224891 |
| 353 | -2.505206** | -3.846387 |
| 361 | -1.388654*** | -2.729835 |
| 369 | -1.271482*** | -2.612663 |

Source: Data Processing, 2017.

Notes: *** = significant at α = 1%, ** = Significant at α = 5%, * = significant at α = 10%

Based on table 2 data, it was known that there were 47 sub-sectors owned significant sub-sector dummy value, while the other 15 sub-sectors were not significant. Also, table 2 showed that all sub-sectors had negative dummy coefficient values. These meant that the average productivity growth of labor in 47 IBS sub-sectors obtained lower point when other variables were zero point (0). This happened when the value was compared to IBS sub-sectors used as a reference, namely ISIC 160 (tobacco processing industry). The tobacco processing industry belonged to resources-based industry. The average of the lowest productivity value of ISIC 353 (aircraft industry) which belongs to sciences-based industry and is high-technology were -3.85%.

Whereas, the absence of IBS sub-sector characteristics differences in influencing labor productivity growth can be seen from the interaction dummy coefficient values as specific dummy in table 3. According to the results of model estimation, there were 19 sub-sectors obtained significant specific dummy value, while the other 43 sub-sectors gained insignificant specific dummy.

It meant that labor share changes variable, in the beginning up to end of the sub-period only affected the growth of labor productivity in the 19 sub-sectors concerned. Moreover, table 3 also showed that there were 6 sub-sectors which had negative specific dummy, namely ISIC 160 (tobacco processing industry), ISIC 231 (coal goods industry), ISIC 271 (iron and steel industry), ISIC 300 (machinery and office equipment, accounting, and data processing industries), ISIC 314 (electric accumulator and battery batteries industries), ISIC 322 (communication equipment industry). The negative specific dummy on these 6 sub-sectors happened because the labor reallocation took place in those 6 sub-sectors contributed to the decline of labor productivity growth. Meanwhile, the other 13 sub-sectors gained positive specific dummy values.

Industries in the resources based industries and labor intensive industries groups commonly had relatively low productivity levels because the majority of their labor were unskilled, and had relatively lower capital requirements. Moreover, when there is an increase of labor share in those industrial groups, there will be zero or even negative marginal product of labor. Therefore, this will decline the overall productivity growth. Meanwhile, there were relatively smaller portion of industries which had potentials in contributing higher productivity level with better capital requirements, and technologies, namely 32.31% in the average, and absorbed averagely 28.82% of labor.

Besides, Indonesia industrial development especially for the industries which require more specific requirements of labor faced a problem related to job-skill mismatch. It was because the skilled labor in Indonesia industry was still low when compared to the skilled labor. Further, the growth of labor expertise was very slow, namely it only reached 0.45% during 2005-2010. This condition caused gap skills in the industrial sector in Indonesia (Iryanti, 2017). It also contributed disadvantaged effects on the company because it could reduce the productivity and growth of the company.

**Table 3.** The Specific Dummy in the Model of Large and Medium Industrial Sub-sectors Labor Productivity Growth

| ISIC | Dummy Coefficient Values | Types of Industry | Labor Share Coefficient in the end-beginning of the sub-period, ISIC 160 | Decline/ increase of Productivity Growth | Types of Industry |
|---|---|---|---|---|---|
| 160 | | Tobacco processing | -0.194809 | -0.194809 | Resources Based |
| 154 | 0.572243* | Other foods | | 0.377434 | Resources Based |
| 171 | 0.287693** | Spinning, weaving, textile final processing | | 0.092884 | Labor intensive |
| 181 | 0.459134*** | Apparel, except for furry clothes | | 0.264325 | Labor intensive |
| 202 | 0.36654** | Wooden goods, and woven goods | | 0.171731 | Resources Based |
| 221 | 1.625658*** | Publishing | | 1.430849 | Scale Intensive |
| 222 | 0.6059*** | Printing and activities related to printing | | 0.411091 | Scale Intensive |
| 231 | -104.818** | Goods made of coal | | -105.012909 | Scale Intensive |
| 241 | 1.73525*** | Industrial chemical compounds | | 1.540441 | Scale Intensive |
| 251 | 0.399038* | Rubber and goods made of rubber | | 0.204229 | Resources Based |
| 252 | 0.573017* | Plastic goods | | 0.378208 | Resources Based |
| 264 | 1.207907** | Cement, chalk and casts | | 1.013098 | Scale Intensive |
| 271 | -3.28448** | Iron and steel base metals | | -3.479288 | Scale Intensive |
| 281 | 0.862964* | Available metal goods to install for buildings, tank manufacturing, and steam generators | | 0.668155 | Labor intensive |
| 292 | 2.912073* | Machinery for special purposes | | 2.717264 | Differentiated goods |
| 300 | -28.1896** | Machinery and office equipment, accounting, and data processing | | -28.384399 | Sciences based |
| 314 | -6.42451*** | Electric accumulator and batteries | | -6.619314 | Differentiated goods |
| 322 | -4.94917** | Communication tool | | -5.143981 | Differentiated goods |
| 341 | 4.450072*** | Four-wheeled or more motorized vehicles | | 4.255263 | Differentiated goods |

The above phenomenon could possibly occur because the majority of developing industries were labor-intensive and resource-based, and also there was a limited number of capital intensive industries in which their developments were centered to capital augmenting technical development, not labor augmenting technical progress. Hence, when the reallocation of labor from the agricultural sector to the industry happens, it would effect to the decline of the growth of labor productivity. Again, according to Nehru (2013), the pattern of output growth and employment in Indonesia is not sustainable because the manufacturing sector has not yet acted as the main driver of growth.

The characteristics of IBS sub-sectors in influencing the growth of the labor productivity were explained as follows. There were 19 IBS sub-sectors that had significant specific dummy values and 6 of them had negative specific dummy values, while 13 others were positive.

When carefully observed from the industrial groups, the 6 sub-sectors which gained a negative specific dummy were ISIC 231 and ISIC 271 which belonged to the scale intensive industries group, ISIC 300 which included in the science-based industries group, ISIC 314 and ISIC 322 which were in the differentiated goods industries group and ISIC 160 in resource based industries.

According to the characteristics of the industry, the five industries which had relatively large specific dummy coefficient values (ISIC 231, 300, 314, 322, and 271) belonged to the industrial groups which demanded an increase in the economies of scale to increase the efficiency of their production processes and used better technology in the production process (including the categories of medium-tech and high-tech industries). Such industry groups not only required adequate capital support, but also better qualifications labor.

If the flow of labor entering such sub-sectors does not meet the requirements, there will be production inefficiency which further can cause smaller output growth rate than the labor growth. This condition would reduce labor productivity. Meanwhile, since ISIC 160 belonged to natural resources-based industrial group, its value will still obtain less than 1% whenever productivity reduction takes place. The results of ACDP company survey in 2016 showed that more than 50% of companies thought that workers did not have the skills needed to work in the company concerned (Malik, 2017).

The industries took place on resources-based industries and labor intensive industries commonly had relatively low productivity because they had unskilled labor and relatively low capital requirements. Therefore, when there is an increase in labor share, their marginal product of labor turns zero or even negative. As a result, it will reduce the overall productivity growth. Meanwhile,

The sub sectors with the highest positive specific dummy coefficient value was ISIC 341 (four-wheeled or more motorized vehicle industry). This industry is generally classified as a large industry with high-tech industries. Its recruited labor was obviously skillful and had special expertise as well as adequate technical capabilities in the automotive field. In large scale industries, the recruitment really pays attention to qualifications in order to minimize product failures. Thus, it can minimize the mismatch between education and the skills of the labor with the field of work. As a result, it can increase efficiency which can ultimately have an impact on increasing labor productivity.

Next, ISIC 341 belonged to the differentiated goods industries group which really needs better capital support and better labor expertise to create a more efficient production process in order to increase the competitiveness of similar products on the market. This is in line with the results of Purba and Prasetyo's study (2018) that the quality of human resources has an effect on industrial competitiveness. Furthermore, based on Table 3, the IBS sub-sectors which gained positive specific dummy were dominated by resources based industry, and labor intensive industry. Even though labor reallocation contributed positive impact to the labor productivity, however, the increase was relatively low.

Such thing can happen because in general the industries included in resources-based and labor intensive groups do not really require special skills from the labor so that there are many unskilled labor and cause the productivity low. Also, these types of industry are currently dominating industrial structure in Indonesia, namely 67.79% with the absorption of labor around 71.18% during 1990-2014 (BPS, 1990-2014).

Since the majority of industries are based on natural resources and labor intensive, therefore, to encourage the improvement in the productivity of the Large and Medium Industries in Indonesia, it is necessary to strengthen the support of better quality labor. This is in line with Rasyid's study (2015) that to support the growth of the industrial sector the government needs to improve the quality of inputs, especially the quality of labor.

## CONCLUSION

Based on the data analysis and discussion, this study draws several conclusions regarding the determinants of the growth of labor productivity in Large and Medium industrial sub-scales in Indonesia. First, the initial productivity contributes negative influence to IBS sub-sectors labor productivity growth. It indicates the productivity growth convergence among those sub-sectors. Second, labor share changes as the impact of the change in structure to industrial sector contribute to the decline of labor productivity growth. Third, wages apparently help improving the labor productivity growth in IBS sub-sectors in Indonesia.

Fourth, labor reallocation which takes place between industrial sub-sectors negatively influences the growth of labor productivity in 6 large and medium industrial sub-sectors which require higher economic scale and better technology use. The reallocation also positively impacts 13 resources-based industry and labor intensive-based industry. Meanwhile, there is no impact in other sectors.Fifth, the investment variable and its change into capital deepening proxy, in short-term and long-term, as well as FDI have no influence on labor productivity growth.

This study also gives suggestions to the development of science that the future studies are suggested to use 5 digit ISIC IBS objects or by using industrial group objects based on different industry groupings according to their characteristics so that the analysis can be more specific and in-depth. Further studies can also be carried out by adding other variables which are expected to affect the productivity growth of the Large and Medium Industries.

This study implies the need for more appropriate policy supports to encourage labor productivity growth in the industrial sub-sectors. Given that the quality of human resources is an important factor for increasing labor productivity, the policies made are supposed to have more favor of improving the quality of education through adequate budget allocations. The allocation of the education budget as much as 20% of the current state budget (APBN) should be prioritized for improving the quality of educational activities directly to students. Besides, it is necessary to align the education curriculum and skills training program based on the job market needs as a user.

Supports is needed for industrial intensive capital development which is generally able to produce higher levels of productivity; for, example through optimizing the provision of incentives for technological development by companies, strengthening support for the creation of protection of intellectual property rights by facilitating and accelerating the process of acquiring rights copyright and industrial property rights (patents, industrial designs, brands, countermeasures against fraudulent competition, integrated circuit layout design, and trade secrets). Since wage is one of the important factors that can increase the growth of labor productivity, wage policies are needed based on the detailed needs of workers by taking into account intangible revenues to meet decent living standards. Also, the policies must be accompanied by an increase in the effectiveness of labor inspection policies.

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