

# Structural Change and Labor Productivity Growth in Indonesia

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**Keywords:** Structural change; Input reallocation; Labor productivity growth.

**Abstract:** Structural changes indicate reallocation of inputs from less productive sectors to more productive sectors. Some literature indicate that the impact of structural change could become a structural bonus for productivity growth. However, the others indicate that structural changes could become a structural burden. This study aims to examine the impact of structural changes on labor productivity growth in Indonesia and the determinants of that growth. The methods used are shift-share analysis and panel data regression. The data consist of total output and sectorial labors as well as other macro data from 30 provinces of Indonesia during 2003-2014. The combination of both methods show a corresponding result that structural changes have a weak impact on labor productivity growth in Indonesia. This result implies the need for support of more relevant government policies by improving the quality of human resources, investment, infrastructure, and maintaining macroeconomic stability to get more benefits from structural changes.

## 1 INTRODUCTION

The data from the Central Bureau of Statistics (2013) shows that there are changes in Indonesian economic structure which is marked by the shifting of dominance role of economic sector in GDP formation, from agriculture sector to non-agriculture sector, both from the output side and the labor side. The interesting thing is the condition of the industrial sector. Despite the fact that the share of output dominates in the formation of GDP, throughout 2004-2013, the share shows a consistently decreasing trend from 28.37% (2004) to 25.54% (2013). It shows that the development in the industrial sector is stagnant and even tends to decline. These conditions have an impact on the performance of the Indonesian economy, which can be seen, among others, from the aggregate productivity indicators created. According to data of Asian Productivity Organization (2014), the growth of Indonesian TFP during 1970-2012 was fluctuated with a downward trend. The average per year was 0.9%. These conditions indicate that the productivity which accompanies structural changes is not sustainable. Whereas some literature reviews indicate that manufacturing is “the engine of economic growth” (McMillan et.al, 2014; Kaldor in 1960s in UNIDO, 2011; and Ocampo, 2005).

The structural changes indicate the reallocation of production inputs, from less productive sectors to more productive sectors. The process of reallocating these inputs can have a significant positive effect on productivity growth that encourages the economic growth overall (the Structural Bonus Hypothesis). Timer and Szirmai (2000) argue that the shifting of resources from the early industry to the middle and the late industries illustrates the process of technological improvement and encourages bonus for aggregate productivity growth in the manufacturing sector. This is in line with McMillan et.al (2014) that any shift in resources from low productivity activities to high productivity activities can result in structural change bonus known as “growth-enhancing structural change”. However, structural changes can also have a weak impact and even a negative impact on the growth of productivity (The Structural Burden Hypothesis). Baumol’s Hypothesis of unbalanced growth states that the difference between industries in the opportunity to increase labor productivity (at a certain level of demand) shifts the share of labor from a “progressive” industry to a “stagnant” industry. In the long-run, this condition tends to decrease the prospect of per capita income growth (Baumol, 1967).

In 2003, Penender’s empirical study of industrial structure and aggregate growth in OECD countries

during 1990-1998, with shift- share analysis and panel data regression model, showed determinants affecting per capita output and its growth, i.e. changes in economic structure, demographic, business cycle conditions, labor market rigidity, physical capital investment, and human capital development. The results showed that on average, structural change had a weak impact on the growth of aggregate labor productivity (robust structural burden).

Carree (2003) did comment on Fagerberg (2000) research on technological progress, structural change, and productivity growth using ISIC 5 industry data from 20 OECD countries, during 1972-1992, divided into 4 sub periods. The results of Carree's study showed that changes in industrial employment share did not have a significant impact on productivity growth, industrial employment share at the beginning of the period had a significant positive effect on productivity growth in highly technologically progressive industries, and initial productivity levels have a significant negative effect on productivity growth. It means that the inter-industries technology convergence has been occurred.

Concerning productivity growth, Paus (2004) studied the growth of productivity in Latin America by observing factors affecting productivity growth, i.e. technological change (short and long run), domestic technological capabilities and conducive social and economic environment influenced by macroeconomic and political stability, access to technological know-how, requisite physical infrastructure, and human capital development. Another factor that can affect productivity growth is wages. According to the efficiency-wage theory, high wages can make workers more productive (Mankiw, 2007).

Based on the phenomenon of structural changes occurring in Indonesia, which are associated with some relevant empirical study results, this research is addressed to answer how does the structural change influence the growth of labor productivity in Indonesia and what are the determinant factors of that labor productivity growth?

Previous empirical studies tend to focus on the relationship between structural change and productivity growth in the manufacturing sector of some countries, focusing on industry data, or just looking at interrelationships from shifting between economic sectors. This study, therefore, observed the relationship of structural change and productivity growth occurring in one country (Indonesia) in more depth, with research objects using sectoral data from each province to capture detailed characteristics of behavioral change in the Economy of various

provinces. Hence, it is expected to provide recommendation for development policy makers in Indonesia to get more benefits of the structural change.

## 2 METHODS

### 2.1 Data

This study used panel data of 30 provinces during 2003-2014. The data obtained from the Central Bureau of Statistics, including real GDP at constant 2000 prices; the number of sectoral and national workers; the proportion of economic sector contribution to GRDP; the proportion of workers; and the productivity of workers in various economic sectors, investment, average length of school, infrastructure, inflation rate, and wages.

### 2.2 Research Model

#### 2.2.1 Shift-Share Analysis Model

This model can show structural bonus or structural burden conditions in relation between structural change and productivity growth (Peneder, 2003). This research adopted shift-share decomposition model used by Peneder (2003), in which the factors affecting labor productivity growth were decomposed into static-shift effect, dynamic-shift effect, and within-shift effect, by the following formula:

$$Growth (LP_{\tau}) = \frac{LP_{\tau, fy} - LP_{\tau, by}}{LP_{\tau, by}} \tag{1}$$

$$= \frac{\sum_{i=1}^9 LP_{i, by} (S_{i, fy} - S_{i, by}) + \sum_{i=1}^9 (LP_{i, fy} - LP_{i, by}) (S_{i, fy} - S_{i, by}) + \sum_{i=1}^9 (LP_{i, fy} - LP_{i, by}) S_{i, by}}{LP_{\tau, by}} \tag{2}$$

Where LP = labor productivity; By = base year of study; Fy = final year of study; T = sigma, whole sector i; Si = share of sector i workforce in total employment; i = 9 economic sectors: (1) agriculture; (2) mining and quarrying; (3) industry; (4) Electricity, Gas and Water Supply; (5) Construction; (6) Trade, Hotel, Restaurant; 7) Transportation and Communication; (8) Financial, Real Estate, and Business Service; (9) Services.

The first part of equation (2) is the static-shift effect. If the static-shift effect is positive value, it indicates a structural bonus. The second part of that equation is the dynamic-shift effect. If the dynamic-

shift effect is negative value, it indicates a structural burden. The third part of that equation is the within-shift effect that shows growth of labor aggregate productivity assuming no structural shifts during the initial year.

### 2.2.2 Econometric Analysis Model

To analyze the determinant factors of productivity growth, this study adopted the model of Carree (2003) with the addition of some relevant control variables from Peneder (2003), Paus (2004), and other researchers. The study period was divided into 4 sub-periods, each consisting of 3 years ( $M = 3$ ): 2003-2005, 2006-2008, 2009-2011, and 2012-2014. The division into four sub-periods was intended to capture intra-period variations and to increase the sensitivity of changes in business cycle (Carree, 2003). Thus, the model of this study is as follows:

$$\ln \left[ \frac{Y_{i,t}}{Y_{i,t-M}} \right] = \alpha + \beta_1 \ln Y_{i,t-M} + \beta_2 (X_{i,t} - X_{i,t-M}) + \beta_3 X_{i,t-M} + \beta_4 INVT_{i,t-1} + \beta_5 \Delta INVT_{i,t} + \beta_6 HC_{i,t} + \beta_7 \ln INFST_{i,t} + \beta_8 \ln INFLS_{i,t} + \beta_9 \ln W_{i,t} + \varepsilon_{i,t} \quad (3)$$

Where  $\ln (Y_{i,t})/(Y_{i,t-M}) =$  growth in labor productivity;  $Y_{i,t-M}$  = initial labor productivity;  $X_{i,t} - X_{i,t-M}$  = changes in labor share of the industrial sector;  $X_{i,t-M}$  = initial labor share of the industrial sector;  $INVT_{t-1}$  = total investment in previous period;  $\Delta INVT$  = total investment change;  $HC$  = development of human capital, with indicator of the average number of years in education;  $INFST$  = Infrastructure, with indicator of length of provincial road;  $INFLS$  = Inflation rate;  $W$  = Wage rate;  $M$  =

number of years range in a sub-period (4);  $i = i$  (rank of) Province.

## 3 RESULTS AND DISCUSSION

### 3.1 Result of Shift-Share Analysis

The result of Shift-Share analysis of aggregate economic sector can be seen in Table 1.

Based on Table 1, the growth of labor productivity in Indonesia is influenced by static-shift effect, dynamic- shift effect, and within-shift effect. In aggregate, average labor productivity growth reached 0.8386. In line with previous research results (Peneder, 2003, Fagerberg, 2000; Timmer and Szirmai, 2000; McMillan et.al, 2014), the within- shift effect still dominates the contribution of labor productivity growth. This means, the reallocation of labor between sectors has only a weak net impact on overall productivity growth.

The total static-shift effect is positive at 0.3665. This means that sectors with high productivity levels are able to attract more labor resources, increasing the shares of the sectors in total employment. While on the other hand, dynamic-shift effect is negative at -0.1002. This means that the economic sectors with high labor productivity growth are unable to manage its shares of labor in total employment. It caused a decline in the shares of labor. This condition indicates that the share of employment shifts from a progressive economic sector to an economic sector has lower labor productivity growth.

Table 1: Decomposition of aggregate productivity growth in Indonesia, during 2003-2014 period.

| Economic Sector                      | Labor productivity growth | Static shift effect | Dynamic shift effect | Within shift effect |
|--------------------------------------|---------------------------|---------------------|----------------------|---------------------|
| Total                                | 0.8386                    | 0.3665              | -0.1002              | 0.5722              |
| agriculture                          |                           | -0.0691             | -0.0423              | 0.1583              |
| mining and quarrying                 |                           | 0.1060              | -0.0430              | -0.0732             |
| industry                             |                           | 0.0354              | 0.0094               | 0.1264              |
| Electricity, Gas and Water Supply    |                           | 0.0060              | 0.0008               | 0.0015              |
| Construction                         |                           | 0.0438              | 0.0090               | 0.0199              |
| Trade, Hotel, Restaurant             |                           | 0.0457              | 0.0192               | 0.1161              |
| Transportation and Communication     |                           | -0.0149             | -0.0388              | 0.2395              |
| Financial, Real Estate, and Business |                           |                     |                      |                     |
| Service                              |                           | 0.1328              | -0.0152              | -0.0173             |
| Services                             |                           | 0.0807              | 0.0005               | 0.0010              |

Source: Results of data processing (2017)

Based on the decomposition of the economic sectors, the value of static-shift effect is positive while the dynamic-shift effect is negative. It can be said that the structural changes in Indonesia shows the tendency of structural burden, where labor shifts from high productivity sector to low productivity sector, although initially the sector productivity level is high. Therefore, it can be said that the structural bonus is relatively weak. This is consistent with the conclusion of Peneder (2003).

### 3.2 Result of Econometric Analysis

The results of estimation model can be seen in Table 2.

Based on the data in Table 2, the independent variables in the equation model (1) only consist of

the main variables affecting the labor productivity growth, whereas in the equation model (2), the model (1) is expanded by 6 control variables. Based on Table 2, in both equation models, initial productivity variable and structural change variables, i.e. changes in labor share of the industrial sector and initial labor share of the industrial sector, consistently show significant negative values. The variable of initial labor productivity with negative value significantly indicates the existence of technological convergence in the inter-provincial industrial sector, affecting the growth of labor productivity of the industrial sector in Indonesia. The results of this study are in line with the research of Fagerberg (2000) and Carree (2003).

Table 2: Estimation results of labor productivity growth (fixed effect model).

| Dependent Variables    | Labor productivity growth of industrial sector |                            |
|------------------------|--|----------------------------|
|                        | Model 1  | Model 2                    |
| Constanta              | 4.052843**<br>(11.98322)                       | 4.456731**<br>(5.280394)   |
| $Y_{i,t-M}$            | -0.781214**<br>(-12.13188)                     | -0.854858**<br>(-18.42272) |
| $SX_{i,t} - X_{i,t-M}$ | -0.110918**<br>(-21.34025)                     | -0.132177**<br>(-39.61234) |
| $X_{i,t-M}$            | -0.078727**<br>(-11.34640)                     | -0.102929**<br>(-18.55085) |
| $INVT_{i,t-1}$         |  | 0.005037**<br>(2.653326)   |
| $\Delta INVT_{i,t}$    |  | 0.005356**<br>(2.837547)   |
| $HC_{it}$              |  | 0.135552**<br>(3.217918)   |
| $INFST_{i,t}$          |  | -0.136145*<br>(-1.669724)  |
| $INFLS_{i,t}$          |  | 0.023453**<br>(17.44209)   |
| $W_{it}$               |  | 0.000808<br>(0.040627)     |
| $R^2 Adjusted$         | 0.875960                                       | 0.963714                   |
| F-Stat                 | 27.26142                                       | 84.17206                   |

Source: Data Processing, 2017

\*\* = significant at  $\alpha = 1\%$ , \* = significant at  $\alpha = 10\%$ .

The variable of industrial labor share change is significant negative value in both models. This means, the reallocation of labor moves towards the industrial sector with lower productivity levels. The variable of initial labor share is significant negative value. This means, the reallocation of labor moves towards the industrial sector with lower productivity levels at the beginning of the period. Both variables of structural change negatively affect the labor

productivity growth of industrial sector in Indonesia. This indicates the occurrence of structural burden. The results of these estimation are in line with the research of Timmer and Szirmai (2000), Fagerberg (2000), Peneder (2003), and Caree (2003) that structural changes have a weak impact on improving labor productivity growth. The estimation results are also in line with the results of shift-share decomposition analysis, which tends to prove the

structural burden hypothesis proposed by Baumol (1967).

The variable of total investment in the previous period and the variable of total investment change are positive values significantly. These means that investment/capital deepening in short and long run term have a significant positive impact on labor productivity growth in the industrial sector. This results are in line with Peneder (2003).

The variable of average number of years in education, as a proxy of human capital, is positive significantly. That is, the workers with higher education will increase the growth of labor productivity in the industrial sector. The results of this study are in line with Fagerberg (2000), Jorgenson and Stiroh (2001), Peneder (2003), and Paus (2004).

The variable of infrastructure, with proxy of provincial road length, is negative significantly at  $\alpha = 10\%$ . This can happen because, based on existing data, road conditions in each province are different and still inadequate. This condition causes complicated congestion and distribution process, thus less supporting economic activity, among others, causing the increase of transportation/distribution cost which can reduce net result of output value. In addition, based on data from The Global Competitiveness Report 2016-2017 (The World Economic Forum, 2016), Indonesia's infrastructure performance is still relatively low. Of the 138 countries studied, Indonesia is ranked 80th for the overall infrastructure aspect, while in terms of road quality, Indonesia is ranked 75th.

The variable of inflation rate. As a proxy of macroeconomic stability, is positive significantly. This means, an increase in inflation rate will increase the labor productivity growth. This result is different from some existing studies that inflation has a negative effect on economic performance (Jaret and Selody, 1982; Clark, 1982; Hondroyannis and Papapetrou, 1997; Bitros and Heat, 2001; Tsionas, 2003a; Christopoulos and Tsionas, 2005). Nevertheless, Mankiw (2007) states that in terms of supply side, inflation reflects an increase in aggregate demand. It will encourage the company to increase its production capacity to make a profit, as shown in the dynamics of the aggregate supply curve, where there is a positive relationship between the price and the quantity of output. Indeed, to some extent, with-in the relatively low level of inflation (less than 10%), it is needed in order to encourage the supply side development.

The variable of wage is insignificant positive value. The wage rate indicator used in this study is provincial minimum wage. The insignificant impact of wage because the provincial minimum wage is made as a reference for employers to determine wages for their workers, so it is likely that many

employers who pay less than the provincial minimum wage. The International Labor Organization (2015) states that while it is the right of workers to receive remuneration equal to the minimum wage, high levels of vulnerability and informality in the labor market and limited labor inspection capacity causing one-third of workers receive wages less than the provincial mini-mum wage. According to Mankiw (2007), wage measurement should be based on total compensation covering wages in cash and intangible compensation (fringe benefit). In situations of intangible compensation, such as pension funds and health insurance being a major part of compensation, wages in cash are generally not in line with productivity.

## 4 CONCLUSIONS

The results of this study indicate that structural changes in Indonesia that lead to the increasing role of industrial sector in the formation of national output is not necessarily able to increase labor productivity in the respected sector. The structural changes that occur tend to be structural burden, which unfavourable for the growth of labor productivity of industrial sector.

The results of this study imply that structural changes occurring along with the economic growth should be supported by various other elements. They are relevant government policies as efforts to improve the quality of human capital and to provide better infrastructure through an adequate development budget allocation, maintaining the stability of the macro-economy through appropriate controlling of inflation rate Hence, it may create conducive conditions to encourage of capital accumulation through various investment activities.

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