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Abstract

This paper investigates the relationship between structural change and regional economic growth in Indonesia. We utilize several measures of structural change, i.e. structural change index, norm absolute value index, shift-share method, and effective structural change index, for 30 provinces over the period 2005-2018. We show that the structural change has occurred across provinces, even though it is slowing, towards an agricultural-services transition. By employing dynamic panel data models, this study shows that structural change is a significant determinant of growth. However, structural change matters for growth only if there is an increase in productivity, not only a movement of labor across sectors. An improvement in productivity within sectors and a movement of labors to other sectors with better productivity lead to a better economic development.

Subject Keywords: Structural Change, Regional Growth, Indonesia, Productivity

JEL Codes: L16, O40, R11

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1. Introduction

Structural change is an important determinant of economic growth. Kuznets (1973) claims that the high rate of structural change is one of six characteristics of the modern economy. Theoretically, the transmission channel linking structural change to economic growth is through productivity, where there is a cross-sectoral reallocation from low productivity economic sectors to higher productivity sectors. Traditionally, the reallocation occurs from agriculture to industry (Chenery *et al.* 1986). The increasing role of the manufacturing sector, well known as industrialization, as argued by Rodrik (2013) and later supported by Felipe *et al.* (2014), is claimed as an engine of growth and empirically creates unconditional convergence of increased labor productivity with its capacity to absorb capital and technology.[1] Lately, however, the reallocation can also occur from agriculture to services, as took place in many other developing countries (Timmer *et al.* 2015), particularly in Asia (Asian Development Bank 2013).

The definition for the term of structural change varies. Silva and Teixeira (2008) identify that there are at least nine meanings of structural change. In their literature survey, the term structure refers to the division of the economic system into a limited number of subsystems and the term structural change then refers to a change from one classification scheme to another. Krüger (2008), for instance, borrows the definition used by Erich Streissler, i.e. "*long-term changes in the composition of economic aggregates,*" while GHK (2011) defines structural change as "*a dynamic and turbulent process associated with very substantial changes of growth and contraction at the sectoral*

[1] O'Rourke and Williamson (2017) provide a comprehensive review of industrialization; while Assunção *et al.* (2015) show that the convergence depends on country-specific characteristics, such as political institutions, trade openness, and education.

and business levels which yield small, but persistent, net economic benefits over the long-term." Mostly, the concepts of structural change are related to the results of the structural change process itself. As an example, Hausmann and Klinger (2006) define structural change as a development process from a poor economy with simple products into a rich economy with more complex products. Alternatively, Laitner (2000) shows that structural change leads to a higher income through an increase in a national savings rate.

GHK (2011) documents that structural change is mainly caused by technological, societal, political, financial, and ecological transformations. Theoretically, a structural change occurs due to preference changes in demand and sector-specific productivity (Dietrich 2011). Moreover, Herrendorf *et al.* (2014) develop a multi-sector extension of the one-sector growth model accounting for many aspects of a structural change such as regional income, aggregate productivity, working hours, wages, and business cycles. In terms of policy and institutional settings, Dabla-Norris *et al.* (2013) show that structural reform policies such as the openness to trade, and human and physical capital as well as finance, can be the factors that can improve the growth-enhancing structural change.

The cost of transition, consisting of structural unemployment and social costs, on the other hand, may hamper the benefit of structural change on economic growth (GHK 2011). This may cause a country to experience a wrong-direction structural change from more productive to less productive activities such as in Africa (McMillan *et al.* 2014). Some factors can contribute to this negative flow such as the endowment of natural resources and globalization as well as policy and institutional settings. The high endowment of natural resources, in general, has a growth-reducing effect of structural change because even though the extractive sectors typically operate at very high productivity, they do not generate much employment that absorbs the surplus labor from agriculture (McMillan *et al.* 2014). The other important factors that may disrupt the structural change contribution to economic growth are the non-economic factors such as social conflict and natural disaster (Rao & Vidyattama 2017; Heger & Neumayer 2019).

Empirically, the relationship between structural change and economic growth either in a regional or at a national level is rather inconclusive. Regionally, evidence of a positive relationship has been supported, among others, for OECD countries (Dietrich 2011) and Asian economies (Vu 2017). Szirmai (2012) argues that the manufacturing sector is an important growth determinant for developing economies in Asia and Latin America, while the service sector is more important for developed economies. On the other hand, negative evidence is found for Africa and Latin America (McMillan *et al.* 2014). At an individual economy level, Padilla-Perez and Villarreal (2017), for instance, show that Mexico has experienced no positive impact of structural change due to the wrong direction of reallocation which is from high labor productivity sectors to lower or declining productivity growth ones. The recent overview of the relationship between structural change and growth is given by McMillan *et al.* (2017) who also discuss cases in India, Viet Nam, Botswana, Ghana, Nigeria, Zambia, and Brazil.

Studies at the subnational level have also been conducted although mainly on China and India. In China, for example, Jiang (2011) argues that regional growth depends on structural change for labor productivity growth as the economy evolves. In the case of India, Babu and Raj (2011) and Thind and Singh (2018) show that structural change has positively contributed to regional economic growth. The latter, however, argues that the contribution of productivity growth within individual sectors is found to be more important than the structural productivity effect of labor reallocations across different sectors.

Indonesia has similar characteristics to China and India, particularly in terms of high population and regional diversity. However, there has been no study on the impact of structural change on regional growth in Indonesia so far. The studies on general regional growth determinants have been conducted by Hill *et al.* (2008), McCulloch and Sjahrir (2008), and Vidyattama (2010). All studies, however, do not examine the structural change impact. The latter uses gross domestic product (GDP) shares of manufacture, agriculture, and services as determinants of regional growth, but these metrics are not a direct measurement of structural change. Similar to the GDP share approach, a structural change index is used by Hill *et al.* (2008), explaining the sector value added share change between agriculture, industry, and services. By using a simple scatter plot, Hill *et al.* (2008) show that there is a weak correlation between structural change and regional growth. This index, however, according to Vu (2017), is less meaningful because there is no indication if the structural change is productivity enhancing or decreasing. To fill in this gap, this study aims at measuring structural change dynamics and examining their impact on regional growth in Indonesia. This is our main contribution to a structural change and regional growth nexus.

The structure of this paper is as follows. Section 2 explains the methodology and data used to measure structural change and its relationship with regional economic growth. Next, Section 3 describes the results, including the descriptions of the pattern of structural change at national and subnational levels in Indonesia and the estimations of empirical models. Section 4 discusses the findings, and Section 5 concludes the paper.

2. Methodology and Data

2.1. Measurement of Structural Change

The measurements of structural change are usually calculated in terms of employment shares or value added shares. These measurements however only reflect quantity aspects of structural change. Krüger (2008) argues that there is an important interaction between structural change and productivity, where higher productivity as the result of innovation is essential for economic development. This study, therefore, not only defines structural change to the changes in the sectoral composition of an economy due to structural shifts from a sector to another sector but also examines if the change is beneficial in boosting economic growth.

To measure both quantity and quality aspects of structural change, this study employs four measurements of structural change. They are structural change index, norm absolute value index, shift-share method, and effective structural change index. The first two measurements reflect the quantity aspects of structural change, while the last two reflect the quality ones. The measurements are explained as follows:

a. *Structural Change (SC) index*

SC index provides a simple measure of the overall magnitude of structural change by calculating the change of value added share over the period [0, T] as follows:

$$SC = \frac{1}{2}\sum_{i=1}^{n}|VA_{iT} - VA_{i0}| \tag{1}$$

Here n denotes the number of sectors and VA_{iT} and VA_{i0} denote the value added share of sector i at time T and 0, respectively. This method provides a quick structural change measure from the total reallocation of value added but cannot explain whether the reallocation occurred to a better sector or worse. Hence, this index may fail to explain the effect of structural change on economic growth.

b. *Norm Absolute Value (NAV) index*

NAV index is similar to SC index, but uses employment share rather than value added share, and is calculated as follows:

$$NAV = \frac{1}{2}\sum_{i=1}^{n}|S_{iT} - S_{i0}| \tag{2}$$

where S_{iT} and S_{i0} denote the employment share of sector i at time T and 0, respectively. Again, this index only measures the shifting of employment, with no direct link between employment shifting and productivity, and does not make a distinction as to whether structural change experienced by a sector is productivity-enhancing or decreasing.

c. Shift-Share (SS) method

The SS method is a more common measurement of structural change. The method decomposes the sectoral contribution to overall labor productivity growth into three terms as follows:

$$\frac{\Delta P}{P_0} = \sum_{i=1}^{n} \frac{S_{i0}\Delta P_i}{P_0} + \sum_{i=1}^{n} \frac{P_{i0}\Delta S_i}{P_0} + \sum_{i=1}^{n} \frac{\Delta S_i \Delta P_i}{P_0} \tag{3}$$

where n, S_{iT} and S_{i0} are the same variables as in the NAV index. $\Delta S_i = (S_{iT} - S_{i0})$ is the change of employment share of sector i over time 0 and T, P_0 is the level of labor productivity at time 0 (i.e. the value added measured at constant prices divided by the number of workers), and ΔP_i is the change of level of labor productivity of sector i over time 0 and T.

The first term ($\sum_{i=1}^{n} \frac{S_{i0}\Delta P_i}{P_0}$), commonly known as "within effect" *(Within)*, captures the improvement productivity sourced from the same sector. The number is usually positive since labor productivity tends to increase over time. It may happen even when a sector has maintained the same amount of shares in total employment as during the base year. The second term $\left(\sum_{i=1}^{n} \frac{P_{i0}\Delta S_i}{P_0}\right)$ is commonly known as "static structural effect" (*Static*). It represents the contribution of the reallocation of employment among sectors, given the initial level of productivity. The number is positive (negative) if the employees reallocate to above (below) average productivity sectors. In other words, sectors with higher productivity attract more (less) labor resources. The third term ($\sum_{i=1}^{n} \frac{\Delta S_i \Delta P_i}{P_0}$) can be called "dynamic structural effect" (*Dynamic*), capturing the effect of both employment reallocation and productivity growth. *Dynamic* is positive if and only if there is both an increase in employment share and productivity ($\Delta S > 0$ and $\Delta P > 0$) or there is both a decrease in employment share and productivity ($\Delta S < 0$ and $\Delta P < 0$). The interaction term becomes larger (smaller) when sectors with fast productivity growth are faced with more (less) labor resources. In other words, the number is positive (negative) if workers tend to shift from productivity-declining (improving) sector to productivity-improving (declining) sectors.

Vries *et al.* (2013) argue it is important to distinguish between static and dynamic reallocation effects to understand differences in the role of structural change. This method breaks down aggregate labor productivity into the contribution of technological progress (within effect) and structural change (between effect). It also quantifies the contribution of labor reallocation to productivity growth. However, this index is rather problematic because of the assumption that productivity growth within each sector is independent of structural change.

d. *Effective Structural Change (ESC) index*

This index is proposed by Vu (2017) to combine the strengths of the NAV index and the SS method. The index is similar to NAV but only considers the sectors that positively contribute to labor productivity. Hence, Equation (2) is modified as follows:

$$ESC = \frac{1}{2}\sum_{i \in Y}|S_{iT} - S_{i0}| \;\; with\; Y = \{i\} \text{ such that } C_i > 0 \qquad (4)$$

where n, S_{iT} and S_{i0} are the same variables as in the NAV index, and Y is the set of sectors that has a positive contribution to labor productivity growth and C_i is the total contribution of sector i to the economy's total overall productivity growth. This index is believed to be better in measuring structural change since it eliminates the declining sector in which the reallocation (changes) does not contribute to the overall productivity as well as to growth.

ESC index examines the overall contribution instead of its two components (within and between effects) separately. However, it accounts only for productivity-enhancing structural change and eliminates productivity-decreasing. It cannot decompose proximate drivers of productivity growth and is relatively more complex measurement than other approaches

Most studies, such as Dietrich (2011) and Hill *et al.* (2008), use the so-called three-sector model or a tri-partite decomposition of the economic system where sectors in an economy are divided into primary, secondary, and tertiary production or agriculture, industry, and services classification. This study, however, uses a more detailed disaggregation into nine sectors (n=9). Since 2010, the number of sectors in Indonesia's GDP has changed to 17 sectors so we need to reclassify the data from 2010 to 2018 into nine sectors. See Appendix I for the detailed conversion method

2.2. *Regional Growth Model*

Silva and Teixeira (2008) classify the studies on structural change into 11 main topics, where this study focuses on the topics of convergence and growth as well as regional and urban economics.[2] However, the causal direction between structural change and growth is still unclear; it could be economic growth causes structural change, structural change causes economic growth, or both causes each other at the same time (Krüger 2008; Silva & Teixeira 2008; Dietrich 2011). This study focuses on the direction from structural change to economic growth because it is interested in regional growth determinants.

[2] The other topics are development, technical change and innovation, economic fluctuations, international trade, employment and migrations, industrial dynamics, institutions and policies, measurements and methods, and environment and sustainability.

Regional growth models have been employed by many studies such as Chen and Wu (2005) for China and Vidyarthi (2017) for India. To assess the relationship between structural change and growth, we are interested in a stable dynamic model, provided $|\alpha| < 1$, in the following model specification set laid out by Mankiw *et al.* (1992) and Barro and Sala-i-Martin (2004) for a basis of empirical analysis:

$$PRGDP_{i,t} - PRGDP_{i,t-j} = \alpha PRGDP_{i,t-j} + \delta INVT_{i,t} + \gamma Schooling_{i,t} + \beta' X_{i,t} + \eta_i + \sum D_t + \varepsilon_{i,t} \qquad (5)$$

Where $PRGDP_{i,t} - PRGDP_{i,t-j}$ denotes province i per capita regional GDP growth rate in j-year period from year *t-j* to year j and $PRGDP_{i,t-j}$ is the initial logarithm of per capita real regional GDP, representing the convergence process. $INVT_{i,t}$ and $Schooling_{i,t}$ represent physical and human resource capital, measured as the average of share provincial real gross fixed capital formation in real regional GDP and the number of average years spent by the residents of a province in the formal education, respectively. Chen and Wu (2005) and Vidyattama (2010) argue that $INVT_{i,t}$ is important to be included to measure the impact of capital as a factor of production on regional economic growth from the production factors capital formation. Meanwhile, $Schooling_{i,t}$ is included due to the vitally important role of human capital in inducing structural change (Martins 2019). A country's average years of schooling may provide information on the average skill level of the workforce through a compulsory national education level of primary school and junior high school as is the case in Indonesia (Vidyattama 2010).

The other variables are $\boldsymbol{X}_{i,t}$, which is a vector of our variable of interests as well as control variables (i.e. *SC, NAV, ESC, Within, Static*, or *Dynamic*). Meanwhile, η_i is an unobservable province effect; D_t is dummy variable for time t, and $\varepsilon_{i,t}$ is the error term that is assumed to be homoscedastic and mutually uncorrelated over time. The subscript *i* and *t* denote province and year, respectively.

Krüger (2008) argues that structural change is a long-term phenomenon. To accommodate business cycles and identify the long-term relationship between the variables of interest, we first examine five-year average growth regressions as utilized by Harris and Tzavalis (1999) and Vidyattama (2010). Three five-year average periods are used here: 2005–2009, 2010–2014 and 2015–2018.[3] The first term in Equation (5) is therefore the value of *PRGDP* in the years 2005, 2010, and 2015. Equation (5) is estimated by employing the two-steps system generalized method of moments (GMM) developed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), as also used in Vidyattama (2010).

We also use a set of other control variables for excluded instruments (Panel B Table 1), which are the length of roads (*Road*s), the importance of mining (*Mining*), government spending for capital expenses (*Government*), commercial banking loans (*Credit*) and foreign direct investments (*FDI*). These variables are also set to capture mediating factors of policies and institutional setting, natural resource endowment effect, funding supports from government and private sectors, and globalization, respectively. These variables are mainly found to be statistically significant to growth in existing studies such as in Hill *et al.* (2008), McCulloch and Sjahrir (2008), and Vidyattama (2010).

These variables are also good excluded instrument variables because they are correlated with our structural changes measurements (Asian Development Bank & Bappenas 2019; Martins 2019). The constant term is excluded because we include all-year dummies as extra exogenous instruments as suggested by Han and Kim (2014). We also follow Roodman (2009) to employ the

[3] The last period only consists of four years due to data availability.

collapsing technique and only use one lag to reduce the number of instruments used. We transform the data by taking the natural logarithm of all variables except for the structural change variables. For five-year data, we use the standard practice in the empirical studies by averaging the data.

To attend that imposing an average effect limitation makes it impossible to capture each country's idiosyncrasy (Aretis & Demetriades 1997), we adapt Andriansyah and Messinis (2014)'s approach by also using annual time-series data and employing a first-order autoregressive distributed lag (ARDL) version of Equation (5). GMM estimators are also used for annual data; however, we utilize the level GMM estimators instead of the two-steps system GMM system. This choice is based on the argument of Jenkinson and Ljungqvist (2001) and Mitze (2012) that the level GMM estimators are relatively better than the system GMM estimators for a small sample (the number of cross-sections is about 25, 35, or 50 and the number of years is about 12 or 15).

2.3. Data

In addition to the national level, this study calculated the four structural change measurements above for the 30 sub-nationals (provinces) in Indonesia. It is worth noting that some of the provinces have experienced a fragmentation, such as Riau (some areas became Riau Islands), East Kalimantan (North Kalimantan), South Sulawesi (West Sulawesi) and Papua (West

Papua).[4] The data used for the calculation is collected from CEIC which is mainly derived from *Badan Pusat Statistik* (Indonesia Statistics) covering the 2005–2018 period (Panel A Table 1).[5]

INSERT TABLE 1 ABOUT HERE

3. Results

3.1. Patterns

Indonesia's gradual structural transformation from a traditional agricultural-driven economy into a manufacturing and services-driven economy helped to boost Indonesia's income per capita and to raise the nation's status from an underdeveloped to a developing country by the late 1980s. However, the 1997–98 Asian financial crisis ended the episode of exponential growth abruptly, and Indonesia has not fully recovered from this crisis (Basri *et al.* 2016). Manufacturing was the engine of Indonesian growth before the crisis by growing 9.3%, but following the crisis, the sector never recovered to its pre-crisis rate and grew below the national average of 4.7% in 2000–2018.

Indonesia also underwent a structural transformation from a regional perspective but showed disproportionate outcomes between different regions. Judging from the pace of economic transformation and industrialization, there is a clear disproportion among regions due to a poor national logistics system (Axelsson & Palacio 2018). In terms of the regional gross domestic product (RGDP)'s contribution to the total GDP, there is also a disparity between Java and non-

[4] See Appendix II for details. We acknowledge that the conversion of provinces because of a change in administrative boundary may introduce considerable bias into parameter estimates. Griffith (1983) reports that the decision to define the boundary affects spatial distribution identification and statistical parameter estimation. Furthermore, Weir-Smith (2016) describes the issue of shifting boundaries due to two main problems: firstly, the scale problem, where different results can occur when one set of areal units is aggregated into a fewer number of larger units for analysis; and secondly, the aggregation problem, where different results can be obtained when boundaries of spatial entities are arranged in different ways.

[5] The period of 2005–2018 is selected to avoid the outlier data in the crises period as well as to consider the availibility of provincial data in CEIC.

Java. For instance, despite representing more than two-thirds of the Indonesian territory, Kalimantan, Sulawesi, Bali-Nusa Tenggara, and Maluku-Papua together only made up about 20% of the total GDP. In terms of manufacturing, Java accounted for 71.1% of total national manufacturing which amplifies the argument of highly concentrated economic activity on this small island and denotes the industrialization process did not occur on other islands.

To assess the economic transformation dynamics among regions, this study uses four measurements of structural change (SC, NAV, ESC, and SS) over four different periods (2005-2009, 2010-2014, 2015-2018, and 2005–2018). The results are presented in Table 2, with the measurements for Indonesia presented in the last line of the table.

INSERT TABLE 2 ABOUT HERE

National Patterns

Over the period 2005-2018, the progress of Indonesia's structural transformation into a services-driven one has been slowing. This can be shown by Indonesia's SC index for the period 2015-2018 of 0.017 which is much lower than the first five-year period (2005–2009) index of 0.035. On the other hand, the employment reallocation has been increasing but relatively stable for the last eight years, as shown by the NAV index for the period of 2010-2018 which is on average 0.051, higher than the index for the period 2005–2009. The reallocation mainly occurs in the four sectors, i.e. Trade, Government, Agriculture, and Transportation.[6] The first two sectors have been experiencing an increase in employment share while the others have been experiencing a decrease. The shifting of value added and employment in this period was mainly supported by the development of e-commerce and the digital economy. The different pattern of value added

[6] The details of changes in value added share by sector, employee share by sector, and productivity by sector are available in Appendix III, Appendix IV, and Appendix V, respectively.

shifting in the two periods gives the consequences to the SC index in 2015–2018 which is lower than in 2004–2009. Significant value added shifting in the Mining sector was the main culprit, while the Agriculture sector in these two periods relatively experienced the same decreasing level of value added. There is also a possibility that there is a bounce-back effect after the better agricultural comparison to manufacturing performance in the previous crisis's time.

Judging from the shift in labor, the share of agricultural labor in Indonesia has decreased by 15.2% over the period 2005–2018, or roughly, a 1% decrease every year. Overall, there has been a shift in employment from the agricultural sector to services, especially in Trade and Government. On the other hand, sectors with high productivity, such as Manufacturing, Construction, and Financial Services on average only shown a slight increase in employment.

The employment shifting to the Government sector may be the result of the implementation of a decentralization policy (Law No. 32/2004) that has encouraged regional expansion, particularly in the sub-provincial level. Over the period 2004–2009 the number of regencies/cities increased by 13.0%, districts grew by 26.0%, and villages grew by 10.2%. The fragmentation of administrative entities at the sub-national level has been mirrored by a boom in the number of public-service jobs, at around 17.5 public servants per 1000 population (Vujanovic 2017). Moreover, Mahi (2016) finds that over 2 million public servants or almost two-thirds of the central government workforce were transferred to the regions. This is reflected in the labor shifting from the Agriculture to the Government sector during the 2004–2009 period.

The structural changes in the terms of value-added and employment reallocation are followed by an increase in productivity as presented by the positive total value of SS (*Within* + *Static* + *Dynamic*). This increasing productivity, however, has been slowing, shown by the value of the 2015–2018 period which is lower than that of the 2005–2014 period.[7] Two sectors that have experienced the largest increase in productivity are Trade and Manufacturing. It is interesting, however, to notice that the highest productivity occurred from 2010 to 2014 due to the commodity boom benefiting Indonesia as a large producer of some commodity-based products, i.e. crude palm oil, coal, and minerals. The increase in productivity at the national level mostly happens in the same sectors and due to the reallocation of employment among sectors as shown by positive values of *Within* and *Static*, respectively. Meanwhile, the slowing productivity is caused by the negative dynamic structural effect. This indicates that workers tend to shift from productivity-improving sectors to productivity-declining sectors. These findings are similar to Martins (2019)'s suggesting that within-sector productivity improvements are more important than labor reallocations in 169 countries throughout 1991–2013. The sectors experiencing both an increase in labor share and an increase in productivity are Manufacture, Construction, Trade, and Government.

The slowing productivity is confirmed by decreasing the ESC index over the period of study, showing that reallocating of employment occurs more to the sectors that have not increased in productivity. Over the period 2005–2009, only six sectors were having a positive value of *C*, i.e. Agriculture, Manufacture, Utilities, Construction, Trade, and Transport, while in the period 2015–2018 the number of sectors has been reduced to five, i.e. Agriculture, Construction, Transport, Finance, and Government.

Regional Patterns

Figure 2 illustrates the distribution of regional structural change in Indonesia. Panel A and Panel B map the effective structural change index and shift-share method (real labor productivity)

[7] The total value of SS for the period 2015–2018 is 0.080, while that for the period 2005–2014 is 0.1101.

across provinces over the period 2005–5018, respectively. Almost all major provinces in Java Islands only grew in the range of the national average. While the provinces with the fastest growth and highest structural change index are mostly small provinces such as North Maluku, Maluku, Gorontalo, and Central Kalimantan.

INSERT FIGURE 1 ABOUT HERE

Regionally, it is clear that the provinces in Sulawesi Island relatively have higher structural change measurements than those in Java Island,[8] in particular in terms of NAV and ESC. This means that reallocation of employment to more productive sectors is happening more in Sulawesi Island than in Java Island.

The pattern of double-digit decline in agricultural labor share occurred in all provinces, except DKI Jakarta and Bangka Belitung. As expected, the share of agricultural labor has been very low in DKI Jakarta, while the share of Agriculture has increased in Bangka Belitung probably due to a significant decrease in employment in the mining sector. Share of manufacturing employment has shown only a slight improvement of 2.0% from 2005 to 2018, where only two provinces (Maluku and North Sulawesi) rose more than 5%. In the case of Maluku, its share of manufacturing employment was very low in 2005 at about 3.2% and fluctuated during the next 14 years, ending up with 8.5% in 2018. The violent conflict in Maluku seems to play an important role where there was a significant drop in Maluku's manufacturing employment from 446,310 people in 2004 to 409,137 people in 2005 (Rao & Vidyattama 2017). The share of the manufacturing sector in Riau, DKI Jakarta, Bali, West Nusa Tenggara, and East Kalimantan has been decreased.

[8] Sulawesi Island, also known as Celebes, consists of five provinces: North Sulawesi, Central Sulawesi, South Sulawesi, South East Sulawesi, and Gorontalo. Meanwhile, Java Island consists of six provinces: DKI Jakarta, West Java, Central Java, East Java, DI Yogyakarta, and Banten.

The slight increase in manufacturing amidst a significant decrease in the agricultural sector indicates fewer manufacturing jobs created relative to services jobs during the period.

In terms of SC index, the largest structural change occurred in Papua and Aceh over the period 2005–2018. While in the period 2005–2009, Aceh experienced the fastest change before it was replaced by West Nusa Tenggara in the next two five-year periods. In Java, the slowing downtrend also occurred in the period 2005–2014, in particular in Central Java and East Java. Meanwhile in terms of the NAV index, over the period of study, the largest index belonged to Central Kalimantan while the lowest one belonged to DKI Jakarta. It seems the labor structure in the capital city has been stable and concentrated in the sectors of Trade and Government. Meanwhile, in the period 2010–2018, the largest change has occurred in Sulawesi Island, in particular in central and southeast parts.

In terms of SS, the productivity at the national level has been increased during 2010–2014 where all provinces have a positive value of labor productivity. However, three provinces experienced decreasing productivity, i.e. Riau, Papua, and Aceh. The decrease in Aceh might be due to the tsunami, while in Papua and West Nusa Tenggara due to the declining production of mining companies. The impact of the large aid for reconstruction in this province may explain the fast structural changes in Aceh during 2005–2009 and the decreasing productivity during 2010–2014 when the program ended period (Heger & Neumayer 2019).

The higher productivity in Indonesia may be caused by the higher productivity in the same sector (*Within*) and the higher share of labor in the same sector (*Static*), not caused by the movement of labor to more productive sectors. The only province that experienced the movement of labor to more productive sectors is Central Sulawesi, shown by a positive dynamic structural effect. In terms of the within effect, the largest improvement in productivity was experienced by

Riau in the period 2005–2018, while Aceh and East Kalimantan experienced a consistent decline in the same sector productivity in the four different periods of study. We can also see even though the variation of within effect is relatively small at the national level, the variation across provinces is relatively high in particular for Papua.

In terms of static structural change, while most provinces have a positive value, showing their labor share is expanding, a decreasing trend has occurred in Riau and West Nusa Tenggara. Southeast Sulawesi, North Maluku, and Lampung exhibit their labor share expand much faster than other provinces. Interestingly, the contribution of dynamic structural effect has been negative for all provinces, meaning that workers have shifted from productivity growing sectors to productivity-declining sectors, or at least to a sector with no improvement in productivity growth.

Interestingly, the pattern in NAV index is different to that in ESC index because in general, the number of productive sectors is unchanged (six sectors) even though the cluster of sectors differed from Mining, Utilities, Construction, Trade, Finance, and Government in 2005–2009 to Mining, Manufacture, Utilities, Trade, Transport, and Finance in 2015–2018. Structural change occurring in Maluku is more effective than other provinces shown by the higher ESC values and an increase in the number of sectors experiencing higher productivity. The provinces experiencing slower effectivity of the structural change are Aceh, Riau, and Jambi.

3.2. Descriptive Statistics

Table 3 and Table 4 present descriptive statistics for the variables of interest. Table 3 summaries the main economic data of Indonesia divided into 30 provinces. Various indicators show that the characteristics of economic data vary across regions in Indonesia. GDP from the poorest province is Rp 18 million per capita, lagging very far behind the richest province with Rp 248 million per capita.

In terms of growth, the average growth per capita also varies from 0.3% to 8.8%. Most provinces experienced an inline trend with the national average, which increased in the 2010–2014 period but declined in the 2015–2018 period. The commodity boom in the era of 2010–2014 plays an important factor here not only for natural resources-rich provinces but also by other regions that do not rely on natural resources.

INSERT TABLE 4 ABOUT HERE

INSERT TABLE 5 ABOUT HERE

Table 5 shows the strength of the relationship among variables. Mostly there is a weak negative correlation between structural change measures and *PRGDP*, except for *Static*. In terms of cross-section dependence in macro panel data, Pesaran CD cross-sectional independent tests show that there is an interlinkage among provinces that may arise from globally common shocks as the result of local spillover effects between provinces.

Figure 3 is set as an early indication of the relationship between GDP per capita growth and the NAV index. There may be a positive relationship between regional growth and the NAV index, which is similar to Hill *et al.* (2008) that also shows a weak relationship between structural change and regional growth. These figures demand an explanation if the structural change matters for regional economic growth. The next sub-section explains the formal examination of the relationships.

INSERT FIGURE 2 ABOUT HERE

3.3. The Five-Year Average Data

Table 5 presents the estimates of the traditional growth model using five-year average data. Model 1 to Model 4 presents the estimates for *SC*, *NAV*, *ESC*, and *SS*, respectively. We find that the coefficient estimate of *SC* is statistically insignificant, while other structural change measures are statistically significant. A higher SC index does not significantly lead to a higher regional GDP per capita growth, possibly due to the index only measuring the change of value added share. Interestingly, the impacts of *NAV* and *ESC* on growth are negative, while the impacts of *Within*, *Static*, and *Dynamic* are positive. This means that the movement of labor across sectors may hamper economic growth if the movement does lead to higher productivity. This is confirmed by the two measures of the shift-share method, i.e. *Within* and *Static*, that are statistically important to determining growth because they are linked to productivity growth.

Model 4 shows that within-sector productivity improvement is more important than static and dynamic structural effects for the case of Indonesia as in India (Thind & Singh 2018) and as in the world (Martins 2019). The coefficient of *Static* is insignificant, even though positive. This means that in Indonesia reallocating employees to above-average productivity sectors is not enough to boost economic growth. A higher movement of employees across sectors is needed more attention because it statistically leads to a higher growth.

3.4. The Annual Data

In estimating the dynamic model using annual data, we firstly employ two panel unit root tests: the Im-Pesaran-Shin (IPS W-t-bar) test (Im *et al.* 2003) and the Pesaran's simple panel unit root test in the presence of the cross-section dependence (CADF Z-t-bar) test (Pesaran 2007). Next, we examine the possibility of a long-run relationship and employ the Westerlund error-correction-based panel cointegration tests (Westerlund 2007). The test results generally show that (1) all variables contain a unit root except for structural change and government expenditure variables, and (2) there is no cointegration between regional economic growth and structural change measures.[9] To be consistent with the interpretation of change, we estimate GMM by using first differences of all examined variables.

Table 6 presents the estimates of the dynamic growth model using annual data. Two specification tests, i.e. the AR(2) test in first differences and the Hansen (1982) test concerning the joint validity of the instruments, suggest that our models are acceptable. The results of annual data are similar to those of five-year average data, affirming the conclusion that *SC*, *NAV*, and *ESC* have a negative relationship with growth where *SS* has a positive relationship with growth.

Model 4 in Table 6 displays a contrasting result with Model 4 in Table 5. For annual data, it seems that dynamic structural effects have more impact on growth than static structural effects and within-sector productivity improvement. This may due because the movement of labor occurs gradually. Again, the results, in general, show that structural change matters for growth only if there is an increase in productivity, not just the movement of labor across sectors.

4. Discussions

Recent studies from Hill *et al.* (2008) and Axelsson and Palacio (2018) have examined the pattern of structural change from Indonesia's subnational perspective. These studies take a long historical data from 1975–2004 and 1968–2010, respectively. Our study inadvertently provides a further discussion of the pattern of structural changes in the period 2005–2018 but with more complete structural change measurements.

In terms of classification of regions based on the progress of structural changes, Hill *et al.* (2008) identify that provinces experiencing the fastest structural change have no similar

[9] The results of the panel unit root tests and of the panel cointegration tests are available upon request.

characteristics; for example, East Kalimantan and Riau are the resource-rich regions, West Java and Central Java are industry-dominant regions, and Bali is a tourism-dominant region. Meanwhile, Axelsson and Palacio (2018) in general classify provinces into three groups, namely Java and Kalimantan as the sustained growth regions, Sumatra and Sulawesi as the stagnant regions, and the Eastern Indonesia as the continuous shrinking regions. Judging from the productivity growth measured by the SS method (Figure 2 Panel B) and the similarity of regional characteristics, our study prefers to classify the provinces into three major groups: outperformer regions, underperformer regions, and median regions.

The outperformer regions such as provinces in Sulawesi (except Gorontalo), Central Java, and East Java are characterized by their productivity that grows far above the national average, mainly driven by the growth of new industries. For example, in Sulawesi, there have been new industrial estates developed in recent years for agro- and metal-processing industries. Central Java and East Java also benefited from new investments such as the garment and electronics industries. The underperformer regions, covers the provinces of Aceh, Riau, Bangka Belitung, East Kalimantan, Maluku, and Papua. The productivity growth in this group is far below the national average. Most of the underperforming regions are commodity-driven regions that have experienced a downward trend of production in the last 14 years, such as Riau and East Kalimantan. The last group, the median regions include provinces in Sumatra (other than Aceh, Riau, and Bangka Belitung), provinces in Java (other than Central Java and East Java), provinces in Kalimantan (except East Kalimantan), Gorontalo, North Maluku, Bali, and Nusa Tenggara regions. Productivity in the median group grows at the range of the national average. Even though they are in the same range, the pattern of structural change in these regions varies greatly. Some regions have relatively mature industries, such as West Java, but others have not yet undergone the process of industrialization, such as East Nusa Tenggara and North Maluku.

An interesting question in this grouping is that if the resource cycle drives regional development in a province, why has the province underperformed? McMillan *et al.* (2014) argue this may be caused by the nature of the extractive sectors that do not require much employment. Meanwhile, the large gaps of share employment and value added in agriculture lead to a surplus of labor that has been unable to be absorbed by other more productive sectors (Axelsson & Palacio 2018). Moreover, resource-rich regions such as East Kalimantan and Riau have experienced a decline in the share of the manufacturing sector, indirectly implying that the sector seems still to act as an engine of growth through higher productivity (Felipe *et al.* 2014). Hill *et al.* (2008) also show that there has been a rapid shift out of agriculture on most provinces in Indonesia, while the development of industrialization was only seen in seven provinces, shown by the manufacturing share above 20% in 2004, where two of them are resources-rich regions (Riau and East Kalimantan).

How about Sulawesi that is a resource-rich region but is a stronger performer? Sulawesi is, surprisingly, the region with the fastest structural change patterns, as indicated by the relatively high NAV and ESC indexes in all five provinces. This is supported by changes in sector shares that are favorable and are above the national average. The decline in the share of the agricultural sector in the five provinces of Sulawesi reached an average of 21% (compared to 15.2% at the national level) followed by an increase in the manufacturing sector, an average of 3.5% (national only 2%). In terms of GDRP and GDRP per capita growth, all five provinces in Sulawesi were consistently able to outperform the national growth.

Eastern regions, such as Maluku and Papua, show a high NAV index, indicating a more rapid structural change compared to their provinces. However, the speed of structural change in this region needs to be interpreted with great caution, given the low level of productivity and small economic share of the provinces to the national economy. On the other hand, the Java region shows a relatively lower value of all structural change indicators. The high indicator of structural change in the eastern region coupled with the slower pace in Java might show a sign of economic convergence in Indonesia.

In terms of the relationship between structural change and economic growth, this study has confirmed that there is a positive relationship between structural change and regional economic growth, in particular the shift-share method indicators. This is in line with the theory that there is a link between economic growth and structural change through productivity. Empirically this finding is also similar to India (Babu & Raj 2011; Thind & Singh 2018) and China (Jiang 2011). On the other hand, although the dynamic structural effect has a positive impact on growth, this indicator for Indonesia was always in the negative zone during the 2005–2018 period. This indicates that the reallocation of labor that occurred on average does not shift to growth-improving sectors. The fact that the largest reallocation occurred from the agriculture sector to the services sector, particularly Trade and Government (which includes social and community services) confirms this. Those two destination sectors have lower productivity levels compared to the manufacturing and construction sector. The phenomena of agriculture-services transition are commonly happening in developing countries as discussed by Chenery *et al.* (1986). The decentralization and proliferation of a district may be the main reason behind the failure of reallocation of labor to more productive sectors due to diminishing marginal return in the government sector.

The finding also shows that the long-term impact of structural change on growth is higher than the short-term effect of structural change. This is shown by the elasticities of within effect and dynamic effect in the five-year average data that are higher than that of in the annual data, confirming the argument of Krüger (2008) that structural change is a long-term phenomenon.

This study also confirms the Dietrich (2011)'s findings showing the impact of structural change in terms of value added on growth is higher than in terms of employment.

With this varied productivity performance, policies to support the structural change among regions need to be customized based on the character of each region. We have to learn from the case of Mexico where the wrong direction of reallocation, meant structural change had no impact on growth (Padilla-Perez & Villarreal 2017). Asian Development Bank and Bappenas (2019) show that primary gross enrolment ratio, foreign direct investment, manufacturing exports, economic complexity index, high technology export, and current account openness, are, among others, the important factors determining productivity growth. There is also a need to examine further the factors that determine productivity for each region.

5. Conclusions

This paper has examined the dynamics of structural change and investigated the relationship between structural change and regional economic growth in Indonesia. By calculating four measures of structural change, namely structural change index, norm absolute value index, shift-share method, and effective structural change index, this study finds that structural change has occurred across 30 provinces over the period 2005–2018 toward an agricultural-services transition. The progress of structural change is relatively slowing, towards a new economic structure. The provinces in Sulawesi outperformed other regions.

By utilizing five-year average data and annual data and employing dynamic panel data models with GMM estimators, this study empirically confirms that productivity is an important factor that links structural change to economic growth. In particular, the shift-share method shows that for annual data dynamic structural effects have more impact on growth than static structural effects and within-sector productivity improvement. Even though the role of manufacturing needs to be improved as the engine of growth, industrialization policies must be based on the characteristics of each province. Structural change matters for growth only if there is an increase in productivity, not just the movement of labor across sectors. Growth can happen if there is an improvement in productivity within sectors as well as by shifting to other sectors with better productivity. Policies to support the structural change among provinces however need to be customized based on the characteristics of each province. There is a need to examine the factors that determine productivity for each province.

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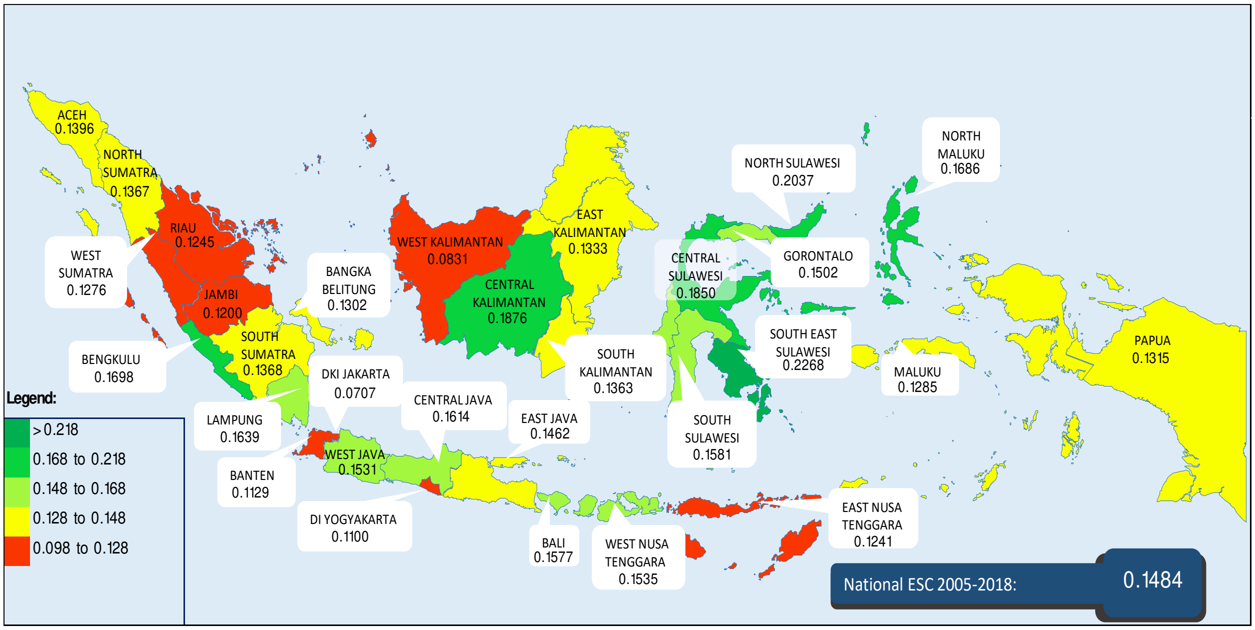
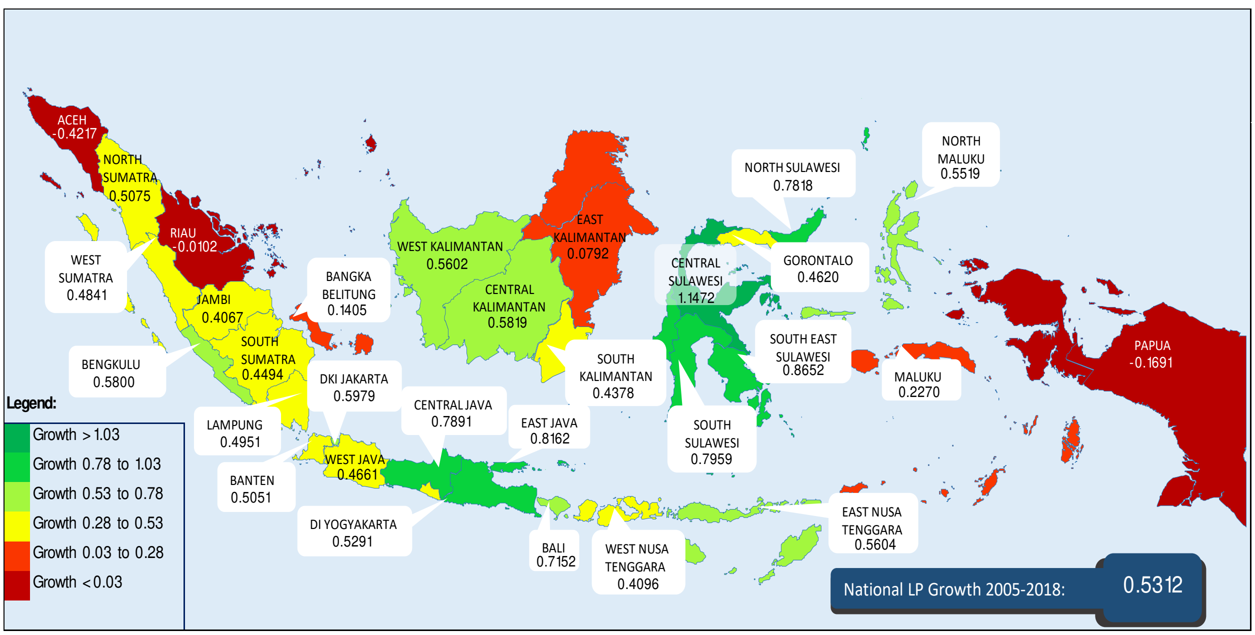


Panel A: Effective Structural Change Index 2005-2018

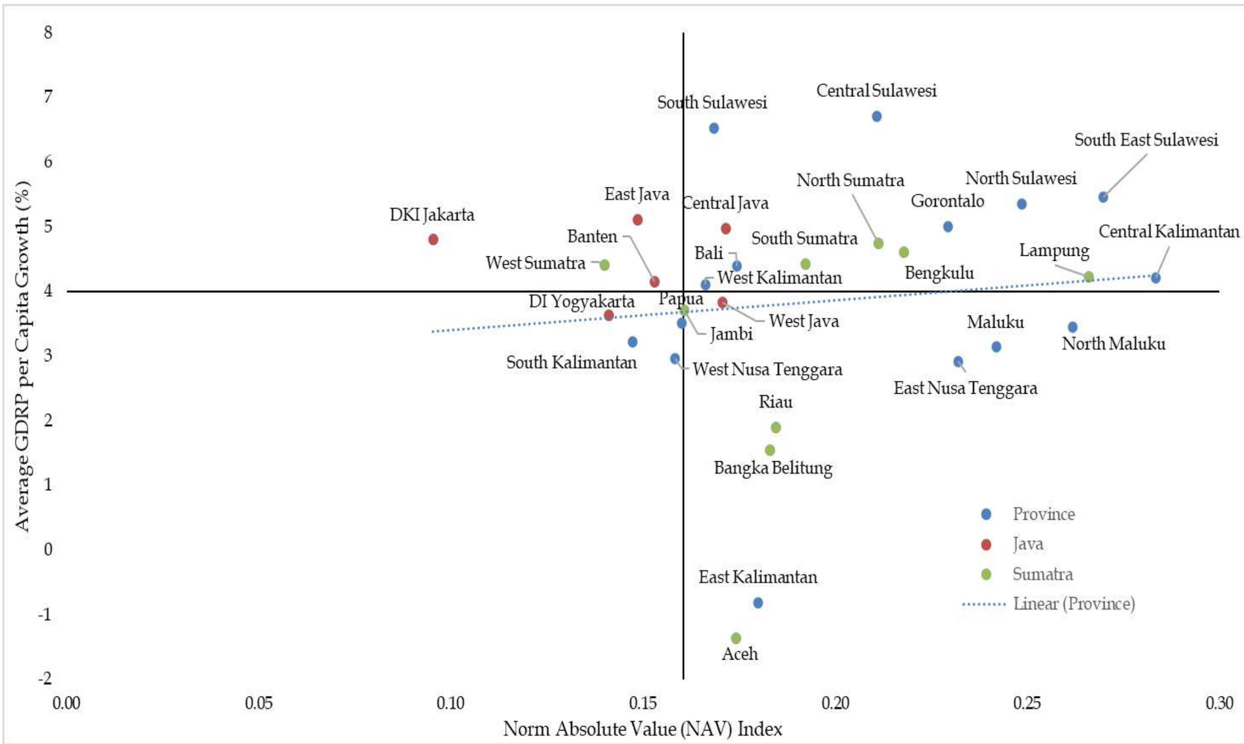
The index based on employment share change for the sectors that recorded positive productivity growth in 2005-2018



Panel B: Shift-Share Method (Real Labor Productivity 2005-2018)

The index is similar to the overall labor productivity growth from 2005 to 2018

Figure 1. Map of Effective Structural Change and Shift Share Method, 2005-2018



Panel A: GDP Per Capita Growth and NAV Index

Figure 2. Scatter Plot Structural Change (NAV) and GDP per Capita Growth

Table 1
List of variables and their definitions

Variable	Definition	Unit	Source
A. Structural Change Variables			
GDRP	Regional GDP per capita (at constant prices)	Rp million	Indonesia Statistics
S	Employment share by sector in the economy	-	National labor force survey (SAKERNAS)
P	Labor productivity (regional GDP by sector per employment)	Rp million	Own Calculation
SC	See Equation (1)		Own Calculation
NAV	See Equation (2)	-	Own Calculation
Within	See Equation (3)	-	Own Calculation
Static	See Equation (3)	-	Own Calculation
Dynamic	See Equation (3)	-	Own Calculation
ESC	See Equation (4)	-	Own Calculation
B. Control Variables			
Schooling	The number of average years spent by the residents (aged 25 years and over) in formal education. BPS used a new methodology in calculating the variable after 2010. Hence, we do backcast for the data before 2010 using the splicing method by applying the growth rate of data before 2010 (the previous method) to the 2010 data.	Year	Indonesia Statistics
INVT	Representing the stock of physical capital which calculated by dividing the regional real gross fixed capital formation (addition of fixed assets during a given period) and regional GDP in constant price	-	Indonesia Statistics
Roads	Representing roads per capita which measured by dividing the length of road in provincial level by its population	Km/person	Indonesia Statistics
Mining	Mining sector share over total regional GDP (in nominal prices)	-	Indonesia Statistics
Government	The ratio between the realization of the local government budget for capital spending and total regional GDP (in nominal prices)	-	Indonesia Statistics
Credit	The ratio of commercial and rural banks loans outstanding by project location of provinces to its regional GDP (in nominal prices)	-	Indonesia Statistics
FDI	The ratio of foreign direct investment realization in provincial level to its regional GDP (in nominal prices)	-	Indonesia Investment Coordinating Board

Table 2
Structural Change Measurements, 2005-2018

Provinces	SC				NAV				ESC			
	2005-2018	2005-2009	2010-2014	2015-2018	2005-2018	2005-2009	2010-2014	2015-2018	2005-2018	2005-2009	2010-2014	2015-2018
Aceh	0.310	0.188	0.062	0.034	0.174	0.079	0.023	0.067	0.140	0.042	0.018	0.033
North Sumatra	0.131	0.034	0.039	0.014	0.211	0.101	0.046	0.067	0.137	0.052	0.040	0.034
West Sumatra	0.097	0.026	0.028	0.033	0.140	0.048	0.071	0.066	0.128	0.026	0.062	0.033
Riau	0.178	0.054	0.058	0.042	0.185	0.105	0.052	0.044	0.124	0.077	0.026	0.022
Jambi	0.065	0.025	0.031	0.022	0.161	0.079	0.062	0.061	0.120	0.045	0.038	0.030
South Sumatra	0.142	0.078	0.039	0.052	0.192	0.071	0.051	0.084	0.137	0.049	0.046	0.059
Bengkulu	0.148	0.027	0.023	0.031	0.218	0.096	0.074	0.080	0.170	0.056	0.052	0.044
Lampung	0.141	0.062	0.029	0.024	0.266	0.154	0.082	0.064	0.164	0.078	0.061	0.032
Bangka Belitung	0.150	0.062	0.065	0.044	0.183	0.109	0.048	0.064	0.130	0.054	0.035	0.032
DKI Jakarta	0.099	0.030	0.019	0.019	0.095	0.043	0.043	0.045	0.071	0.025	0.026	0.023
West Java	0.109	0.052	0.030	0.015	0.171	0.038	0.055	0.049	0.153	0.025	0.040	0.024
Central Java	0.095	0.014	0.025	0.021	0.172	0.050	0.051	0.056	0.161	0.038	0.042	0.043
East Java	0.114	0.031	0.013	0.020	0.149	0.041	0.053	0.061	0.146	0.039	0.040	0.047
DI Yogyakarta	0.089	0.025	0.026	0.013	0.141	0.051	0.054	0.071	0.110	0.023	0.039	0.036
Banten	0.263	0.025	0.058	0.031	0.153	0.078	0.070	0.035	0.113	0.073	0.058	0.031
Bali	0.126	0.032	0.043	0.021	0.174	0.035	0.089	0.047	0.158	0.033	0.071	0.030
West Nusa Tenggara	0.224	0.030	0.179	0.086	0.158	0.051	0.071	0.077	0.153	0.039	0.062	0.056
East Nusa Tenggara	0.175	0.026	0.024	0.020	0.232	0.108	0.051	0.073	0.124	0.054	0.047	0.041
West Kalimantan	0.165	0.023	0.045	0.018	0.166	0.059	0.042	0.070	0.083	0.029	0.032	0.042
Central Kalimantan	0.205	0.075	0.028	0.036	0.283	0.092	0.051	0.080	0.188	0.046	0.048	0.046
South Kalimantan	0.117	0.036	0.030	0.028	0.147	0.082	0.038	0.051	0.136	0.042	0.029	0.032
East Kalimantan	0.142	0.059	0.050	0.035	0.180	0.055	0.036	0.045	0.133	0.031	0.021	0.020
North Sulawesi	0.055	0.040	0.037	0.014	0.249	0.113	0.069	0.073	0.204	0.075	0.043	0.042
Central Sulawesi	0.235	0.051	0.056	0.061	0.211	0.059	0.106	0.062	0.185	0.032	0.071	0.040
South Sulawesi	0.103	0.050	0.028	0.025	0.168	0.051	0.071	0.066	0.158	0.030	0.045	0.053
South East Sulawesi	0.233	0.077	0.043	0.010	0.270	0.100	0.075	0.107	0.227	0.074	0.060	0.054
Gorontalo	0.184	0.044	0.016	0.036	0.229	0.108	0.043	0.052	0.150	0.054	0.034	0.029
Maluku	0.240	0.035	0.036	0.011	0.242	0.059	0.062	0.100	0.129	0.005	0.053	0.063
North Maluku	0.270	0.025	0.052	0.044	0.262	0.132	0.058	0.047	0.169	0.074	0.046	0.044
Papua	0.353	0.160	0.113	0.017	0.160	0.074	0.079	0.069	0.132	0.048	0.051	0.040
Indonesia	**0.095**	**0.035**	**0.028**	**0.017**	**0.160**	**0.049**	**0.051**	**0.052**	**0.148**	**0.036**	**0.045**	**0.030**

Table 2 Structural Change Measurements, 2005-2018 (Continued)

Provinces	SS											
	Within				Static				Dynamic			
	2005-2018	2005-2009	2010-2014	2015-2018	2005-2018	2005-2009	2010-2014	2015-2018	2005-2018	2005-2009	2010-2014	2015-2018
Aceh	-0.480	-0.533	-0.013	-0.024	1.798	1.098	0.078	0.064	-1.740	-0.987	-0.038	-0.036
North Sumatra	0.382	-0.017	0.236	0.014	0.629	0.338	0.113	0.054	-0.503	-0.254	-0.029	-0.038
West Sumatra	0.469	0.058	0.169	0.044	0.156	0.058	0.062	0.032	-0.141	-0.036	-0.042	-0.020
Riau	1.047	1.002	0.052	0.000	-0.309	-0.302	0.037	-0.028	-0.748	-0.684	-0.042	-0.008
Jambi	0.321	0.211	0.191	-0.080	0.186	-0.028	0.137	0.171	-0.100	-0.059	-0.029	-0.061
South Sumatra	0.019	-0.042	0.055	0.022	0.957	0.290	0.128	0.125	-0.527	-0.144	-0.021	-0.051
Bengkulu	0.370	0.029	0.109	0.074	0.558	0.217	0.116	0.053	-0.349	-0.081	-0.026	-0.037
Lampung	0.302	-0.011	0.254	0.039	2.450	2.355	0.095	0.019	-2.257	-2.246	-0.067	-0.016
Bangka Belitung	0.141	0.041	0.115	-0.027	0.148	0.017	0.130	0.063	-0.148	-0.041	-0.042	-0.025
DKI Jakarta	0.493	0.040	0.199	0.235	0.133	0.043	0.115	-0.006	-0.028	-0.016	-0.022	-0.036
West Java	0.400	0.073	0.106	0.063	0.175	0.015	0.031	0.014	-0.109	-0.006	-0.020	-0.013
Central Java	0.629	0.202	0.135	0.082	0.219	0.026	0.056	0.039	-0.059	-0.008	-0.019	-0.009
East Java	0.635	0.149	0.165	0.042	0.195	0.000	0.084	0.086	-0.014	-0.006	-0.015	-0.017
DI Yogyakarta	0.322	-0.010	0.052	0.005	0.245	0.111	0.095	0.085	-0.038	-0.028	-0.031	-0.042
Banten	0.337	0.219	0.155	0.051	0.281	0.060	0.092	0.033	-0.113	-0.002	-0.032	-0.018
Bali	0.661	0.158	0.245	0.131	0.224	0.047	0.046	0.007	-0.170	-0.014	-0.046	-0.024
West Nusa Tenggara	0.671	0.538	0.120	-0.004	-0.051	-0.127	-0.038	0.028	-0.210	-0.286	-0.016	-0.026
East Nusa Tenggara	0.057	-0.177	0.094	0.039	1.240	0.576	0.124	0.050	-0.737	-0.298	-0.048	-0.020
West Kalimantan	0.361	0.104	0.173	-0.011	0.820	0.156	0.047	0.180	-0.621	-0.158	-0.048	-0.062
Central Kalimantan	0.277	0.084	0.210	0.037	0.680	0.275	0.000	0.117	-0.375	-0.199	-0.055	-0.035
South Kalimantan	0.263	0.028	0.174	0.044	0.267	0.080	0.015	0.058	-0.092	-0.036	-0.021	-0.022
East Kalimantan	-0.071	-0.067	-0.094	-0.047	0.463	0.074	0.175	0.006	-0.312	-0.074	-0.038	-0.020
North Sulawesi	0.680	0.091	0.153	0.067	0.369	0.167	0.108	0.053	-0.267	-0.073	-0.036	-0.029
Central Sulawesi	0.820	0.189	0.277	0.111	0.321	0.092	0.072	0.072	0.006	-0.035	-0.102	-0.039
South Sulawesi	0.612	0.038	0.208	0.118	0.331	0.122	0.087	0.043	-0.147	-0.066	-0.040	-0.020
South East Sulawesi	0.395	-0.059	0.249	0.050	2.427	2.359	0.136	0.080	-1.956	-2.117	-0.028	-0.052
Gorontalo	0.566	0.008	0.199	0.107	0.189	0.116	0.057	-0.009	-0.293	-0.080	-0.042	-0.021
Maluku	0.045	-0.118	0.186	0.070	0.651	0.178	0.111	0.131	-0.470	-0.125	-0.051	-0.092
North Maluku	0.114	-0.121	0.105	0.102	2.254	1.294	0.060	0.051	-1.816	-1.048	-0.009	-0.002
Papua	-0.483	-0.497	-0.124	0.035	0.705	1.319	0.175	0.162	-0.391	-0.928	-0.049	-0.069
Indonesia	**0.367**	**0.081**	**0.121**	**0.042**	**0.225**	**0.027**	**0.081**	**0.046**	**-0.064**	**-0.004**	**-0.019**	**-0.008**

Table 3

Selected Statistics of 30 Provinces and Indonesia

	Province	Average GDRP Growth				Average GDRP/Capita Growth				Level in 2018 (in Million)		
		2005 -18	2005 -09	2010 -14	2015 -18	2005 -18	2005 -09	2010 -14	2015 -18	GDP Per Capita (Rp)	Labor Prod (Rp)	Popu- lation
1	Aceh	0.3	-4.3	2.8	2.8	-1.4	-5.0	0.4	1.0	24.01	57.55	5,281.3
2	North Sumatra	5.8	6.0	6.2	5.1	4.8	4.8	5.4	3.9	35.57	76.21	14,415.4
3	West Sumatra	5.8	5.9	6.1	5.3	4.4	4.3	4.8	4.1	30.47	68.04	5,382.1
4	Riau	4.1	5.0	4.6	2.5	0.3	0.0	1.0	0.0	73.26	171.82	8,951.4
5	Jambi	6.2	6.4	7.3	4.5	3.7	4.3	3.8	2.8	40.05	83.07	3,570.3
6	South Sumatra	5.4	5.0	5.8	5.3	4.4	5.5	3.8	3.9	35.67	75.32	8,370.3
7	Bengkulu	5.8	5.9	6.3	5.1	4.6	6.0	4.1	3.5	22.50	45.85	1,963.3
8	Lampung	5.4	5.1	5.9	5.2	4.2	4.1	4.5	4.1	27.74	57.19	8,370.5
9	Bangka Belitung	4.7	4.1	5.6	4.3	1.6	0.4	2.2	2.1	35.76	74.44	1,459.9
10	DKI Jakarta	6.1	5.9	6.3	6.0	4.8	4.9	4.5	5.0	165.86	367.31	10,467.6
11	West Java	5.8	5.7	6.1	5.4	3.8	3.6	4.0	4.0	29.16	68.32	48,683.7
12	Central Java	5.4	5.4	5.4	5.3	5.0	5.3	5.0	4.6	27.29	54.58	34,490.8
13	East Java	5.9	5.8	6.3	5.5	5.1	4.8	5.6	4.9	39.59	76.47	39,500.9
14	DI Yogyakarta	5.0	4.4	5.2	5.4	3.6	2.4	4.4	4.2	25.78	46.27	3,802.9
15	Banten	7.1	9.0	6.4	5.6	4.2	6.2	2.7	3.5	34.19	81.37	12,689.7
16	Bali	6.4	6.5	6.6	6.1	4.4	4.8	3.6	4.9	35.91	61.89	4,292.2
17	West Nusa Tenggara	4.2	4.9	2.2	5.8	3.0	4.0	0.8	4.5	18.02	41.93	5,013.7
18	East Nusa Tenggara	5.0	4.6	5.4	5.1	2.9	1.9	3.6	3.4	12.28	27.34	5,371.5
19	West Kalimantan	5.3	5.0	5.6	5.1	4.1	4.9	3.8	3.5	26.11	55.64	5,001.7
20	Central Kalimantan	6.4	5.9	6.8	6.4	4.2	5.0	3.5	4.2	35.56	72.71	2,660.2
21	South Kalimantan	5.4	5.6	5.7	4.7	3.2	3.3	3.3	3.0	30.63	63.37	4,182.7
22	East Kalimantan	3.1	3.0	4.4	1.5	0.0	-0.8	1.5	-0.9	119.73	161.48	4,365.2
23	North Sulawesi	6.7	7.2	6.6	6.2	5.4	5.8	5.1	5.1	33.92	76.94	2,484.4
24	Central Sulawesi	8.8	8.2	8.5	9.7	6.7	6.6	5.7	8.0	34.42	71.39	3,010.4
25	South Sulawesi	7.4	6.7	8.2	7.2	6.1	5.8	6.5	6.0	33.61	77.47	10,127.6
26	South East Sulawesi	7.8	7.6	8.9	6.6	5.5	5.9	5.8	4.5	33.29	73.15	2,653.7
27	Gorontalo	7.2	7.5	7.6	6.5	5.0	5.1	5.0	4.9	22.54	48.10	1,185.5
28	Maluku	5.8	5.2	6.4	5.7	3.1	3.6	2.0	4.0	16.61	42.09	1,773.8
29	North Maluku	6.8	6.8	6.7	6.9	3.5	2.4	3.5	4.8	20.32	48.58	1,232.6
30	Papua	6.1	8.5	3.4	6.4	1.7	4.2	-3.0	4.4	51.69	100.32	4,260.0
	Indonesia	5.5	5.6	5.8	5.0	4.0	4.2	4.0	3.8	39.47	84.89	264,161.6
	Min	0.3	-4.3	2.2	1.5	-1.4	-5.0	-3.0	-0.9	12.3	27.3	1,185.5
	Max	8.8	9.0	8.9	9.7	6.7	6.6	6.5	8.0	165.9	367.3	48,683.7
	Mean	5.7	5.6	6.0	5.4	3.7	3.8	3.6	3.9	39.1	80.9	8,833.8
	STDEV	1.5	2.3	1.5	1.5	1.8	2.5	2.0	1.7	30.9	62.0	11,533.7

Table 4
Descriptive statistics

Statistic	*PRGDP*	*SC*	*NAV*	*ESC*	*Within*	*Static*	*Dynamic*
Correlation (No. observations = 420)							
PRGDP	1.000						
SC	-0.080	1.000					
NAV	-0.031	-0.019	1.000				
ESC	-0.040	-0.025	0.929	1.000			
Within	-0.036	-0.010	0.082	0.199	1.000		
Static	0.009	0.045	0.239	0.185	-0.444	1.000	
Dynamic	-0.021	-0.073	-0.338	0.296	-0.056	-0.842	1.000
Pesaran CD Cross-sectional Independence test							
Average coefficient	0.780	0.692	0.343	0.282	0.184	0.122	0.498
CD-statistic	60.84	54.01	26.74	21.99	14.32	9.52	38.87

Note: The null hypothesis is there is cross-section independence. All CD-statistic is significant at 1 percent level

Table 5
Two-step system GMM estimates regressions of the relationship between structural change and regional growth, 5-year average data

Variables	Model 1	Model 2	Model 3	Model 4
$PRGDP_{i,0}$	-0.126**	-0.116***	-0.128***	-0.044*
	(0.047)	(0.028)	(0.041)	(0.025)
$SC_{i,t}$	0.624			
	(0.763)			
$NAV_{i,t}$		-2.744***		
		(0.928)		
$ESC_{i,t}$			-5.317**	
			(2.082)	
$Within_{i,t}$				3.531***
				(0.448)
$Static_{i,t}$				2.360
				(1.417)
$Dynamic_{i,t}$				2.774**
				(1.169)
$INVT_{i,t}$	-0.026	-0.059***	-0.046**	-0.059**
	(0.023)	(0.017)	(0.018)	(0.026)
$Schooling_{i,t}$	0.240**	0.264***	0.298***	0.045
	(0.090)	(0.051)	(0.076)	(0.034)
Time Dummies	YES	YES	YES	YES
Observations	90	90	90	90
Number of instruments	15	15	15	19
AR(1)	0.048	0.072	0.048	0.080
Hansen test	0.206	0.929	0.722	0.460

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent levels, respectively. Standard errors are in parentheses. The standard errors are robust to heteroscedasticity and autocorrelation with Windmeijer correction. The covariance matrix estimate is based on a small sample correction. The number of instruments used is reduced both by using only one lag (i.e. lag 1) and collapsing the instrument matrix. The instrument variable set is one-period lag exogenous variables.

Table 6
One-step level GMM estimates regressions of the inter-relationship between the structural change and PRGDP growth, selective sample, annual data

Variables	Model			
	Model 1	*Model 2*	*Model 3*	*Model 4*
$\Delta PRGDP_{i,t-1}$	0.883***	0.558***	0.534***	0.389
	(0.128)	(0.130)	(0.145)	(0.371)
$\Delta SC_{i,t-1}$	-0.280**			
	(0.117)			
$\Delta NAV_{i,t-1}$		-0.330***		
		(0.094)		
$\Delta ESC_{i,t-1}$			-0.444*	
			(0.242)	
$\Delta Within_{i,t-1}$				0.157*
				(0.090)
$\Delta Static_{i,t-1}$				0.236
				(0.142)
$\Delta Dynamic_{i,t-1}$				0.290**
				(0.140)
$\Delta INVT_{i,t-1}$	0.014	-0.028	-0.029	0.007
	(0.044)	(0.031)	(0.030)	(0.044)
$\Delta School_{i,t-1}$	-0.415	-0.057	0.039	-1.076
	(0.467)	(0.476)	(0.528)	(0.733)
$\Delta SCi_{,t}$	-0.074			
	(0.184)			
$\Delta NAV_{i,t}$		-0.374**		
		(0.162)		
$\Delta ESC_{i,t}$			-0.939***	
			(0.331)	
$\Delta Within_{i,}$				-0.095
				(0.132)
$\Delta Static_{i,t}$				-0.078
				(0.179)
$\Delta Dynamic_{i,t}$				0.098
				(0.184)
$\Delta INVT_{i,t}$	0.018	-0.009	-0.002	-0.081
	(0.045)	(0.034)	(0.034)	(0.050)
$\Delta School_{i,t}$	0.511	1.512***	1.459***	2.968**
	(0.565)	(0.451)	(0.441)	(1.290)
Time Dummies	YES	YES	YES	YES
Observations	309	309	309	309
Number of instruments	20	20	20	22
AR(2)	0.085	0.303	0.532	0.496
Hansen test	0.028	0.148	0.116	0.309

Notes: ***, **, and * indicate p<0.01, p<0.05, and p<0.1 respectively. Robust standard errors with Windmeijer correction are in parentheses. Covariance estimates are based on a small sample correction. The number of instruments used is reduced by using only one lag (i.e. lag 1) and collapsing the instrument matrix to a one-period lag of each exogenous variable.

Appendix I
Conversion 17 Sectors into 9 Sectors, Based on the System of National Account 2008

17 SECTORS	9 SECTORS	Code
Agriculture, Forestry, and Fisheries	Agriculture	AGRI
Mining and Quarrying	Mining and quarrying	MINE
Manufacturing	Manufacturing	MANU
Electricity and Gas Supply	Electricity, gas, and water	UTIL
Water Supply, Sewerage, Waste and Recycling Mgt		
Construction	Construction	CONS
Wholesale and Retail Trade	Trade, hotel, and restaurant	TRAD
Accommodation and Food Beverages Activity		
Transportation and Storage	Transportation and communication	TRAN
Information and Communication		
Financial and Insurance Activity	Financial services	FINA
Real Estate		
Business Services		
Public Admin, Defense, and Social Security	Services	GOVE
Education Services		
Human Health and Social Work Activity		
Other Services		

Appendix II
Conversion 34 Provinces to 30 Provinces for Data Analysis

No	List of Provinces		Notes
	Current	Combined Provinces	
1	Aceh	Aceh	
2	North Sumatra	North Sumatra	
3	West Sumatra	West Sumatra	
4	Riau Riau Island	Riau	Riau Island established on 25 Oktober 2002, but initial economic data start available in 2006.
5	Jambi	Jambi	
6	South Sumatra	South Sumatra	
7	Bengkulu	Bengkulu	
8	Lampung	Lampung	
9	Bangka Belitung	Bangka Belitung	
10	DKI Jakarta	DKI Jakarta	
11	West Java	West Java	
12	Central Java	Central Java	
13	East Java	East Java	
14	DI Yogyakarta	DI Yogyakarta	
15	Banten	Banten	
16	Bali	Bali	
17	West Nusa Tenggara	West Nusa Tenggara	
18	East Nusa Tenggara	East Nusa Tenggara	
19	West Kalimantan	West Kalimantan	
20	Central Kalimantan	Central Kalimantan	
21	South Kalimantan	South Kalimantan	
22	East Kalimantan North Kalimantan	East Kalimantan	North Kalimantan established on 25 October 2012
23	North Sulawesi	North Sulawesi	
24	Central Sulawesi	Central Sulawesi	
25	South Sulawesi West Sulawesi	South Sulawesi	West Sulawesi established on 25 October 2004, but initial economic data start available in 2006
26	South East Sulawesi	South East Sulawesi	
27	Gorontalo	Gorontalo	
28	Maluku	Maluku	
29	North Maluku	North Maluku	
30	Papua West Papua	Papua	West Papua established on 21 November 2001, but initial economic data start available in 2006

Appendix III
Change in Value-Added Share by Sector (in percentage points), 2005-2018

	Province	Total	AGRI	MINE	MANU	UTIL	CONS	TRAD	TRAN	FINA	GOVE	SERV
1	Aceh	31.0	3.0	-18.1	-12.8	0.0	6.2	5.0	4.3	5.3	7.1	21.8
2	North Sumatra	13.1	-3.1	0.1	-5.4	-1.0	8.1	1.8	-1.4	3.1	-2.2	1.4
3	West Sumatra	9.7	-2.4	0.9	-2.3	-1.3	4.1	-0.8	4.3	0.4	-2.9	1.0
4	Riau	17.8	0.6	-16.4	6.9	0.2	5.1	3.6	1.0	0.9	1.0	6.5
5	Jambi	6.5	0.7	2.1	-2.0	-0.8	2.7	-2.3	-0.2	1.1	-1.2	-2.6
6	South Sumatra	14.2	-2.8	-8.3	-2.4	-0.3	6.8	3.6	1.4	2.5	-0.4	7.1
7	Bengkulu	14.8	-11.6	0.2	2.1	-0.2	2.2	-3.0	2.4	4.5	3.4	7.3
8	Lampung	14.1	-7.0	0.8	6.6	-0.5	4.6	-2.0	2.3	-1.5	-3.0	-4.1
9	Bangka Belitung	15.0	-0.2	-12.4	-1.7	-0.6	4.6	0.9	2.7	2.8	4.1	10.5
10	DKI Jakarta	9.9	0.0	-0.2	-2.8	-0.7	1.6	1.5	3.3	-6.1	3.5	2.2
11	West Java	10.9	-3.3	-1.7	-2.3	-2.2	5.5	-1.4	3.2	1.2	1.0	4.0
12	Central Java	9.5	-5.1	1.6	0.8	-1.0	5.0	-3.3	0.7	1.5	-0.1	-1.3
13	East Java	11.4	-5.3	2.3	-0.3	-1.5	6.1	-3.2	2.4	0.6	-1.2	-1.3
14	DI Yogyakarta	8.9	-6.0	-0.3	-1.2	-1.1	1.5	-0.4	3.6	1.9	1.8	7.0
15	Banten	26.3	-2.7	0.6	-18.5	-2.7	7.9	-2.3	6.0	8.5	3.3	15.5
16	Bali	12.6	-6.5	0.3	-2.6	-1.4	5.4	2.4	2.9	1.7	-2.0	4.9
17	West Nusa Tenggara	22.4	0.8	-22.2	0.7	-0.2	3.8	5.3	1.8	3.4	6.7	17.1
18	East Nusa Tenggara	17.5	-12.3	-0.3	-0.5	-0.3	3.3	-4.1	5.7	3.5	5.0	10.1
19	West Kalimantan	16.5	-6.8	4.2	-2.9	-0.4	4.2	-6.3	2.0	1.9	4.1	1.7
20	Central Kalimantan	20.5	-14.7	6.4	6.4	-0.5	4.7	-5.1	-0.2	0.8	2.1	-2.3
21	South Kalimantan	11.7	-8.2	-0.6	1.2	0.0	1.6	-2.9	2.1	2.4	4.5	6.0
22	East Kalimantan	14.2	2.5	-1.4	-12.5	0.1	3.1	3.1	2.6	1.1	2.2	8.9
23	North Sulawesi	5.5	1.7	0.5	0.7	-0.8	-3.5	-1.0	0.8	1.8	-0.2	1.4
24	Central Sulawesi	23.5	-17.8	11.3	5.1	-0.6	6.2	-2.8	0.9	-0.2	-2.2	-4.2
25	South Sulawesi	10.3	-5.9	-2.5	-0.9	0.0	2.6	3.5	3.1	1.8	-0.3	8.1
26	South East Sulawesi	23.3	-18.4	16.4	0.3	-0.8	6.7	-1.0	-1.0	-0.7	-1.3	-4.0
27	Gorontalo	18.4	10.6	0.2	-3.1	-0.7	4.8	2.3	0.5	-4.3	-10.4	-11.9
28	Maluku	24.0	-12.4	1.7	0.8	-0.3	6.4	-10.5	-0.7	0.0	15.0	3.8
29	North Maluku	27.0	-15.6	6.1	-6.3	-0.5	4.7	-4.6	1.7	0.3	14.1	11.5
30	Papua	35.3	0.2	-39.9	6.2	0.0	7.2	3.6	3.7	3.0	6.7	17.0
	Indonesia	**9.5**	**-2.8**	**-4.9**	**-1.9**	**-0.1**	**1.6**	**2.1**	**3.6**	**1.2**	**0.9**	**7.7**

Note: Total Change in value-added refer to total magnitude change in value-added share by sector correcting for double counting (known as Structural Change Index). AGRI = Agriculture, MINE = Mining and & Quarrying, MANU = Manufacturing, UTIL = Utilities which includes Electricity, Gas and Water, CONS = Construction, TRAD = Trade, Hotel and Restaurant, TRAN = Transportation and Communication, FINA = Finance and Business Services, GOVE = Government, Social and Other Services, SERV = Combination of TRAD, TRAN, FINA, and GOVE (detail of sector definition in Appendix I)

Appendix IV
Change in Employment Share by Sector (in percentage points), 2005-2018

	Province	Total	AGRI	MINE	MANU	UTIL	CONS	TRAD	TRAN	FINA	GOVE	SERV
1	Aceh	17.4	-15.8	0.6	4.7	0.3	2.0	3.0	-1.6	1.3	5.6	8.2
2	North Sumatra	21.1	-20.2	0.6	3.3	0.3	0.3	9.3	-0.9	1.4	5.9	15.6
3	West Sumatra	14.0	-12.7	1.0	0.5	0.4	2.3	8.7	-1.2	1.1	-0.1	8.5
4	Riau	18.5	-9.9	-6.8	-1.6	0.5	-1.5	10.1	-1.5	1.4	3.6	13.6
5	Jambi	16.1	-14.3	0.3	1.2	0.2	2.2	5.5	-1.8	1.2	5.6	10.5
6	South Sumatra	19.2	-19.0	1.0	3.0	-0.2	0.6	6.5	1.0	1.2	5.9	14.7
7	Bengkulu	21.8	-20.9	1.0	4.1	0.8	2.4	7.4	-0.9	1.3	4.7	12.7
8	Lampung	26.6	-26.6	0.6	2.4	0.2	1.8	13.2	0.9	0.9	6.6	21.6
9	Bangka Belitung	18.3	2.8	-15.8	2.1	0.1	-1.1	7.3	-1.4	1.2	4.9	11.9
10	DKI Jakarta	9.5	0.1	0.4	-5.6	0.6	0.0	-3.9	4.0	3.8	0.6	4.5
11	West Java	17.1	-13.4	-0.1	3.1	0.7	1.8	5.4	-3.6	2.8	3.4	8.0
12	Central Java	17.2	-16.5	0.0	3.9	0.4	3.2	5.2	-0.7	1.7	2.8	9.1
13	East Java	14.9	-13.5	-0.1	2.7	0.5	2.4	5.3	-1.3	1.2	2.7	7.9
14	DI Yogyakarta	14.1	-14.0	0.4	3.3	0.3	-0.1	4.2	1.0	2.3	2.7	10.2
15	Banten	15.3	-13.4	0.0	2.7	0.7	3.0	2.5	-1.9	4.3	2.1	6.9
16	Bali	17.4	-13.4	-0.5	-1.9	0.4	-1.1	11.0	-0.5	3.0	3.1	16.6
17	West Nusa Tenggara	15.8	-10.3	-2.4	-1.0	1.0	2.3	7.5	-2.1	0.8	4.3	10.5
18	East Nusa Tenggara	23.2	-23.1	-0.1	1.6	0.4	3.1	6.6	2.1	1.2	8.2	18.1
19	West Kalimantan	16.6	-14.6	-0.4	1.3	0.3	3.7	4.6	-1.7	1.8	4.9	9.6
20	Central Kalimantan	28.3	-27.6	4.9	1.1	0.4	3.2	8.1	-0.8	1.2	9.4	18.0
21	South Kalimantan	14.7	-14.6	1.0	0.0	0.5	-0.1	5.8	0.1	1.7	5.7	13.2
22	East Kalimantan	18.0	-12.8	4.6	-1.5	0.2	-1.8	5.9	-1.9	3.2	4.0	11.2
23	North Sulawesi	24.9	-23.2	1.8	5.0	0.4	2.1	7.9	-1.7	1.8	5.9	13.9
24	Central Sulawesi	21.1	-20.2	0.8	3.6	0.6	3.6	3.1	-0.9	1.0	8.4	11.7
25	South Sulawesi	16.8	-14.9	0.4	2.4	0.3	2.2	6.8	-2.0	1.3	3.5	9.6
26	South East Sulawesi	27.0	-26.7	2.4	2.9	0.5	4.5	8.9	-0.3	1.2	6.6	16.4
27	Gorontalo	22.9	-21.0	1.3	3.6	0.2	2.8	7.1	-1.9	1.2	6.8	13.2
28	Maluku	24.2	-24.2	1.3	5.3	0.5	3.1	4.7	1.5	1.1	6.8	14.1
29	North Maluku	26.2	-26.2	2.4	3.4	0.4	1.5	4.3	1.8	1.4	11.1	18.6
30	Papua	16.0	-16.0	0.4	1.1	0.2	1.7	5.1	0.4	0.3	6.8	12.6
	Indonesia	16.0	-15.2	0.1	2.0	0.4	1.8	5.7	-0.9	1.9	4.0	10.7

Note: Total Change in employment refers to total magnitude change in employment share by sector correcting for double counting (known as Norm of Absolute Values). AGRI = Agriculture, MINE = Mining and & Quarrying, MANU = Manufacturing, UTIL = Utilities which includes Electricity, Gas and Water, CONS = Construction, TRAD = Trade, Hotel and Restaurant, TRAN = Transportation and Communication, FINA = Finance and Business Services, GOVE = Government, Social and Other Services, SERV = Combination of TRAD, TRAN, FINA, and GOVE (detail of sector definition in Appendix I).

Appendix V
Change in Productivity by Sector (in percentage points), 2005-2018

	Province	Total	AGRI	MINE	MANU	UTIL	CONS	TRAD	TRAN	FINA	GOVE	SERV
1	Aceh	-42.2	0.9	-45.4	-9.5	0.1	3.1	2.3	1.5	1.5	3.5	8.7
2	North Sumatra	50.8	9.9	1.0	4.8	0.1	8.2	11.4	5.7	5.8	4.0	26.9
3	West Sumatra	48.4	5.5	1.3	2.5	0.1	6.3	8.7	14.9	2.5	6.7	32.8
4	Riau	-1.0	-0.1	-17.1	5.7	0.2	4.6	3.2	0.9	0.8	0.9	5.7
5	Jambi	40.7	11.2	6.6	2.5	0.1	5.0	6.2	3.2	3.5	2.6	15.4
6	South Sumatra	44.9	4.9	4.1	7.7	0.1	7.9	7.4	4.6	4.0	4.3	20.3
7	Bengkulu	58.0	9.4	1.9	3.8	0.2	3.1	12.5	7.8	6.7	12.6	39.6
8	Lampung	49.5	6.3	-0.6	11.7	0.2	5.6	7.8	9.1	5.1	4.3	26.2
9	Bangka Belitung	14.1	4.1	-6.8	-0.7	0.0	4.2	3.9	2.6	2.0	4.7	13.2
10	DKI Jakarta	59.8	0.0	-0.1	4.1	0.2	6.6	11.7	16.1	13.7	7.5	49.0
11	West Java	46.6	-0.3	-1.6	17.7	0.0	6.2	10.4	7.3	2.6	4.3	24.6
12	Central Java	78.9	5.1	2.0	27.1	0.1	8.9	14.3	8.8	4.4	8.2	35.7
13	East Java	81.6	3.4	4.9	22.4	0.0	7.1	22.8	10.2	5.0	5.9	43.8
14	DI Yogyakarta	52.9	0.3	0.2	3.8	0.1	7.4	10.9	11.1	7.0	12.2	41.2
15	Banten	50.5	1.1	0.1	12.2	-0.2	6.4	9.0	8.6	9.8	3.5	30.9
16	Bali	71.5	4.4	0.4	4.2	0.3	8.4	23.7	11.9	6.2	12.0	53.8
17	West Nusa Tenggara	41.0	9.1	-9.1	2.3	0.1	7.4	11.7	6.3	5.6	7.5	31.2
18	East Nusa Tenggara	56.0	7.5	0.7	0.6	0.1	5.9	8.6	10.2	5.4	17.2	41.3
19	West Kalimantan	56.0	10.5	4.1	4.7	0.1	8.3	7.1	9.2	5.5	6.5	28.4
20	Central Kalimantan	58.2	2.6	14.3	7.1	0.1	6.2	9.3	5.5	4.8	8.3	27.9
21	South Kalimantan	43.8	3.7	10.0	2.2	0.3	3.9	6.9	6.0	3.9	6.9	23.7
22	East Kalimantan	7.9	3.1	1.8	-11.0	0.1	3.7	3.6	3.0	1.2	2.5	10.4
23	North Sulawesi	78.2	8.3	4.3	7.1	0.0	11.7	14.5	13.7	7.1	11.5	46.7
24	Central Sulawesi	114.7	17.7	27.5	20.4	0.1	14.0	8.5	9.4	4.5	12.7	35.0
25	South Sulawesi	79.6	11.8	1.5	9.3	0.2	11.9	16.1	11.0	7.4	10.4	45.0
26	South East Sulawesi	86.5	9.4	22.5	6.0	0.2	14.3	13.9	7.7	4.2	8.4	34.1
27	Gorontalo	46.2	13.5	0.5	0.7	0.1	6.6	8.4	5.3	3.8	7.4	24.8
28	Maluku	22.7	0.2	-0.3	1.3	0.0	4.0	5.3	3.3	1.5	7.6	17.6
29	North Maluku	55.2	6.0	0.0	5.1	0.1	5.6	15.0	7.8	3.0	12.4	38.3
30	Papua	-16.9	-0.6	-42.7	5.5	0.0	6.3	3.0	3.2	2.6	5.8	14.6
	Indonesia	**52.8**	**3.7**	**-0.6**	**10.7**	**0.1**	**7.1**	**11.4**	**8.6**	**5.8**	**6.0**	**31.8**

Note: AGRI = Agriculture, MINE = Mining and & Quarrying, MANU = Manufacturing, UTIL = Utilities which includes Electricity, Gas and Water, CONS = Construction, TRAD = Trade, Hotel and Restaurant, TRAN = Transportation and Communication, FINA = Finance and Business Services, GOVE = Government, Social and Other Services, SERV = Combination of TRAD, TRAN, FINA, and GOVE (detail of sector definition in Appendix I).