ECONOMIC DETERMINANTS OF CHANGES IN LABOR PARTICIPATION IN THE INDONESIAN AGRICULTURAL SECTOR BEFORE AND DURING COVID-19

Alla Asmara,[1*] Agung Satria Permana,[1] and Mohammad Iqbal Irfany[2]

[1] Department of Economics, Faculty of Economics and Management,
IPB University, Bogor 16680, Indonesia
[2] Department of Islamic Economics, Faculty of Economics and Management,
IPB University, Bogor 16680, Indonesia
[*]Corresponding author: allasmara@apps.ipb.ac.id

ABSTRACT

Indonesia has been experiencing structural changes with the decline in the agricultural sector's share of gross domestic product (GDP) and the agricultural labor's percentage every year. However, Indonesia's agricultural sector is still the largest labor-absorbing sector, contributing 29.76% of the total labor in 2020. Sectoral changes in output affect the demand for labor between sectors. This study sought to analyze the economic determinants of changes in labor participation in Indonesia agricultural sector before and during Covid-19 employing panel data analysis with data from 34 provinces in Indonesia from 2015 - 2020. The gross regional domestic product in the non-agricultural sector, the average length of schooling, the percentage of households accessing the internet and the difference in wages have a negative effect on the share of the agricultural labor. On the other hand, the area of agricultural land, the share of foreign investment in the non-agricultural sector and the COVID-19 dummy impacted positively on the percentage of the agricultural labor. This research suggests the widest possible access for Indonesian people to education, especially for agricultural workers to increase productivity and reduce the income gap with the industrial sector. Investment should be directed more at increasing labor absorption which is increasingly balanced between economic sectors.

Key words: agriculture, panel data, structural transformation

INTRODUCTION

Economic development is often characterized by a transformation of the economic structure, characterized by a decrease in the share of agricultural gross domestic product (GDP) and the percentage of labor in the agricultural sector in a country. Indonesia is starting to experience changes in the economy's structure, with a decreasing share of GDP from the agricultural sector and the percentage of the agricultural labor every year. The dominance of the agricultural sector decreases as economic development progresses, and the proportion of GDP and labor moves to the industrial sector and then to the service sector (Surhayadi et al. 2017).

Initially, the role of the agricultural sector was concurrent; that is, it had a significant value. However, there will be a divergence when agriculture dominates the economy (Isbah and Iyan 2016). Based on World Bank data, the agricultural contribution to Indonesia's GDP was 19.66% in 1991, but 1n 2020 decreased to only 13.70%. The agricultural sector's contribution was inferior to the industrial sector, 38.30%, and the service sector, 44.40%. This decline was due to the GDP growth rate in the agricultural sector, which was smaller than the national GDP growth rate and was lower than the non-

agricultural sector (Widyawati 2017). Changes in output between industries will cause the demand for labor between sectors to experience changes. Sectors that experience higher output growth will increase the demand for work. This increase in demand can be met either by absorbing new workers or by labor mobility (Permata et al. 2010). In addition, the limited factors of production that occur due to sectoral participation have resulted in unequal wages, where the agricultural sector has lower wages and lower capital intensity than the non-agricultural sector (Carrera and Raurich 2018).

Structural transformation is a shift in economic structure from the traditional sector with low productivity towards the economy sector with high productivity (Szirmai et al. 2012). Generally, the structural transformation is dominated by the shift from the agricultural sector to the industrial sector (Christiaensen et al. 2021). The large number of industrial sectors that emerged in the agricultural base areas caused labor migration from the agricultural sector to the non-agricultural sector. This is because, in an economic downturn, the informal and industrial sectors provide more guarantees for survival (Simanjuntak 2003). The structural transformation process can be successful if followed by changes in the economic structure of the labor. However, the structural transformation process in Indonesia has yet to be followed by changes in the structure of the labor, considering that the agricultural sector is still the largest labor-absorbing sector in Indonesia, although it is no longer the most significant contributor to GDP.

The historical economic development experience in developed countries requires structural changes (Martins 2019). The slow rate of change for labor will increase significantly the agricultural labor sector, causing a burden on the agricultural sector by decreasing productivity and income inequality between agricultural sector and non-agricultural sector workers (Kariyasa 2006). Besides, the large number of labor mobilization from the agricultural to the non-agricultural sector will exacerbate the development of the agricultural sector due to a lack of labor, so agricultural production costs become increasingly expensive (Tulangow et al. 2017; Sumanto 2009).

In Indonesia, excess labor in the agricultural sector has yet to be fully absorbed, especially in the industrial sector. It can be seen from the ratio between the percentage of labor and the percentage of GDP between sectors. The ratio of the agricultural sector in Indonesia has a value greater than 1, which means the share of agricultural sector labor exceeds its contribution to GDP (Table 1). The share of GDP in the agricultural sector decreased from 15.68% (2000) to 13.70% (2020). A decline also occurred in the share of the agricultural sector labor from 45.28% (2000) to 29.76% (2020). Meanwhile, the share of GDP in the non-agricultural sector (industry and services) increased from 75.34% (2000) to 82.66% (2020) and the share of the non-agricultural sector labor increased from 54.72% (2000) to 71.50% (2020).

Table 1. The ratio of percentage of labor to percentage of GDP.

Year	Agriculture			Industry			Services		
	% Labor	% GDP	Ratio	% Labor	% GDP	Ratio	% Labor	% GDP	Ratio
2000	45.28	15.68	**2.89**	17.44	41.97	**0.42**	37.28	33.37	**1.12**
2005	44.00	13.13	**3.35**	18.76	46.54	**0.40**	37.24	40.33	**0.92**
2010	39.13	13.93	**2.81**	18.65	42.78	**0.44**	42.22	40.67	**1.04**
2015	33.04	13.49	**2.45**	22.04	40.05	**0.55**	44.92	43.31	**1.04**
2020	29.76	13.70	**2.17**	22.36	38.26	**0.58**	49.14	44.40	**1.11**

Source: World Bank (2021)

The changes in the percentage of labor in the agricultural, industrial, and service sectors are believed to be attributed to higher incomes in the industrial and service sectors, leading to a transformation of labor from the agricultural sector to the industrial and service sectors. However, there are other factors that may contribute to this phenomenon, such as an increase in the number of

workers in the industrial and service sectors due to the influx of new labor or a decrease in agricultural labor due to the aging of farmers. Labor movement, if done correctly, is important to ensure economic growth and its viability (Kurniawati 2023). The decline in the contribution of the agricultural sector does not mean that the sector is losing its role in the Indonesian economy. The agricultural sector still have an important role by being the supporting sector for the Indonesian economy, especially during a crisis, as can be seen from agricultural sector contribution which increased in every crisis such as during the 1998 crisis, the 2008 crisis and the 2020 crisis due to the Covid-19. The Coordinating Ministry for Economic Affairs of the Republic of Indonesia (2021) stated that the agricultural sector was able to achieve positive growth of 2.19% during the Covid-19.

Analyzing the movement of agricultural labor in Indonesia, Raiyan and Putri (2021) concluded that there is a causality relationship between economic growth and the movement of labor from the agricultural sector to the non-agricultural sector. An increase in economic growth will be accompanied by an increase in the shift of labor from the agricultural sector to the non-agricultural sector. Raiyan and Putri (2021) captured the shift of agricultural to non-agricultural labor, using national level data with a two-stage least squares method. However, labor movement between sectors needs to pay attention to regional diversity, because Indonesia is an archipelagic country with more than 30 provinces. Variations in levels of economic growth, differences in wage levels, availability of agricultural land in each region and other factors need to be taken into consideration in analyzing the movement of labor from the agricultural to non-agricultural sectors. The current COVID-19 pandemic has also caused economic shocks which have an impact on labor absorption, so it is important for this research to analyze how COVID-19 affects labor participation in the agricultural sector. Therefore, this research analyzes the current conditions of employment in the agricultural sector by considering variations that occur between regions, using regional data at the provincial level and using panel regression.

In Indonesia, there was an unsustainable decline in the agricultural sector because it was not accompanied by increased productivity, which caused agricultural sector workers to receive low wages (Manning and Purnagunawan 2016). The problem of equal distribution of labor absorption between sectors is a formidable challenge for the government, given the limited ability of the non-agricultural sector to absorb labor. Many studies have examined structural changes at the national level (Bilenko 2022; Dartanto et al. 2017; Maris 2019; Pratomo and Manning 2022; Raiyan and Putri 2021). Still, only a few studies have looked at structural changes from the labor side and at the provincial level (Badriah et al. 2017; Pranoto et al. 2020; Putra et al. 2023). Likewise, the impact of the Covid-19 shock on labor participation in the agricultural sector was not widely studied. The disruption due to the COVID-19 pandemic in Southeast Asia has a negative impact on the labor in the agricultural sector (Gregorio and Ancog 2020). Moreover, around 3.5% of the sample in the agricultural labor lost their job (Putra et al. 2023) About 6 to 8% agricultural workers were unable to work due to the COVID-19 pandemic in US (Pena 2023). The present study sought to fill the gap in previous research in terms of structural changes in agriculture labor participation at regional level. Hence, this study aimed to analyze the factors that affected changes in labor participation in the agricultural sector before and during Covid-19.

DATA AND METHODS

Data. This study used secondary data from several government agencies, such as the Central Bureau of Statistics (BPS), the Ministry of Agriculture, and the Investment Coordinating Board (BKPM). The data used is panel data from 34 provinces in Indonesia from 2015 to 2020. This period selected based on availability of data at the provincial level and also because this period covers before and during Covid-19, in accordance with the research objectives. The labor in agricultural sector shows a declining pattern, meanwhile the labor in industrial and service sectors shows an increasing pattern over time (Table 1). This show the transformation has been the same pattern for two decades.

Methods. Panel regression was used to analyze the factors affecting labor participation changes in the agricultural sector. The use of panel data is based on differences in the resources endowment owned, policies, and objectives of local governments that can affect the speed of labor transformation between regions. In addition, the number of observations in panel data is more significant, and the parameter estimation results are more accurate because these are viewed from two dimensions (individual and time).

Variable and model specification. The theory of structural change is one of the four main streams in classical economic development. The structural change theory focuses on underdeveloped countries still in subsistence agriculture economies to transform their economies into more modern ones that are urban-oriented and rely on various manufacturing and service industries (Todaro and Smith 2011). The measurement of structural transformation is generally assessed through three indicators: the share of value-added, the share of employment, and the share of final consumption expenditure. The share of employment is calculated based on the number of workers or hours worked by sector. In the context of structural transformation, Herrendorf's work emphasizes the shift in employment patterns from primary sectors (e.g., agriculture) to secondary sectors (e.g., manufacturing) and tertiary sectors (e.g., services). As GDP per capita increases, the share of service occupation employment increases in both sectors, indicating a shift in the economy's structure (Herrendorf et al. 2014).

The theory of structural change posits that development is a process of growth and change that can be identified and has similar characteristics in all countries. However, the speed and pattern of development among countries may vary due to domestic and international factors. Economists who support the structural change stream include W. Arthur Lewis (Lewis 1954), known for the theoretical model called "two-sector surplus labor," which was later developed by Fei-Ranis. Based on the Fei-Ranis economic growth model, which depicts the dynamics of labor transfer based on the influence of economic variables, the shift of labor from the agricultural sector to the industrial sector reflects the influence of labor wages, investment rates, and production levels (Ranis and Fei 1961). Based on that theory, Table 2 shows the descriptions of variables expected to influence agricultural sector labor.

Table 2. Description on impact on labor participation

Variable	Description on Impact on Labor Participation
Non-agricultural sector's GDP	The GDP of the non-agricultural sector represents the income generated by activities outside of agriculture. It reflects the total productivity generated within the non-agricultural sector for one year. Increasing income from non-agricultural tends to reduce labor participation in the agricultural sector (Agwu et al. 2014).
Wage difference	The wage disparity between workers in the agricultural sector and non-agricultural sector. Alvarez (2020) found wage disparity caused by disparities in worker characteristics such as age and education. The increasing inequality of wage tends to sectoral shifts in labor market (Odland and Ellis 2015).
Share of domestic investment	The share of investment originating from domestic. Typical investments in capital lead to an increase in domestic labor for modern manufacturing demand (Aghion et al. 2022).
Share of foreign investment	The share of investment originating from foreign countries. Foreign Direct Investment (FDI) by companies from advanced industrial nations in the manufacturing sectors of industrializing nations can lead to changes in labor demand for modern manufacturing (Baldwin 1995).
Agricultural land area	The extent of land used for agriculture represents the level of productivity and profitability in agricultural sector. The larger agricultural land area, the more attractive for individuals to engage in agricultural sector (Agwu et al. 2014).

Variable	Description on Impact on Labor Participation
Years of schooling	The duration of schooling represents the level of education attained. Agwu et al. (2014) said that an extended duration of schooling tends to decrease labor participation in the agricultural sector, as higher education levels can lead individuals to seek non-agricultural jobs with better remuneration. Additionally, the centralized location of educational institutions in urban areas, promoting urbanization, decreases interest in working in the agricultural sector.
Internet access	The number of households with internet access. Internet access can amplify the impact of labor transformation by providing information about job opportunities that offer higher wage levels.
Covid-19 Pandemic	The COVID-19 pandemic has restricted daily activities, including imposing significant constraints on production activities worldwide. Gregorio and Ancog (2020) state that disruption due to the COVID-19 pandemic had a negative impact on the agricultural labor sector. COVID-19 pandemic reduced 3.11% of the volume of agricultural production in Southeast Asia and poses the risks of unemployment, widespread reduction in living standards, and agricultural sector labor. Moreover, around 3.5% of the sample in the agricultural labor lost their job (Putra et al. 2023).

Based on the theories discussed above and supported by previous research, the hypotheses for variables expected to influence the share of the labor in the agricultural sector are as follows:

1. The variable of the non-agricultural sector's GDP share (GRDP), wage different (WGAP), share of domestic investment (PMDN), share of foreign investment (PMA), average years of schooling (RLS), internet access (INT), and Covid-19 pandemic variable are hypothesized to impact labor's participation in the agricultural sector negatively.
2. The agricultural land area (LAND) is hypothesized to positively impact labor's participation in the agricultural sector.

The variables used in the panel regression analysis are the share of labor in the agricultural sector in percent (LAGR) as the dependent variable. The independent variables consist of the share of GRDP in the non-agricultural sector according to constant prices in percent (GRDP), the difference between wages in the agricultural and non-agricultural sectors in percent (WGAP), average years of schooling in years (RLS), households were accessing the internet in percent (INT), share of foreign investment in the non-agricultural sector in percent (PMA), share of domestic investment in the non-agricultural sector in percent (PMDN), Variable natural logarithm of agricultural land area (lnLAND), Covid-19 dummy (Dcovid) to see the impact of Covid-19 which is worth 0 (zero) before the Covid-19 pandemic and is worth 1 (one) during the Covid-19 pandemic.

$$LAGR_{it} = \alpha + \beta_1 GRDP_{it} + \beta_2 WGAP_{it} + \beta_3 PMA_{it} + \beta_4 PMDN_{it} + \beta_5 lnLAND_{it} + \beta_6 RLS_{it} + \beta_7 INT_{it} + \beta_8 Dcovid_{it} + \varepsilon_{it}$$

where:
$LAGR_{it}$: Share of labor in the agricultural sector in province i year t (percent)
$GRDP_{it}$: GRDP share of non-agricultural sector, based on constant prices (in 2010 prices) province i year t (percent)
$WGAP_{it}$: The difference between the wages of the agricultural sector and the non-agricultural sector of province i year t (percent)
PMA_{it} : Share of foreign investment (PMA) share in the non-agricultural sector in province i year t (percent)
$PMDN_{it}$: Share of domestic investment (PMDN) in the non-agricultural sector of province i year t (percent)

$lnLAND_{it}$: Natural logarithm of the agricultural land area of province i year t
RLS_{it} : Average length of school in province i year t (years)
INT_{it} : Households accessing the internet in province i year t (percent)
$Dcovid_{it}$: Before the Covid-19 pandemic = 0; during the Covid-19 pandemic = 1
α : Intercept
$\beta_1 - \beta_8$: Coefficient of an independent variable
ε_{it} : *Error term*
i : Province
t : Year

The variation in values for each variable reflects the variation between time and between provinces (Table 3). The average value for the labor share in the agricultural sector is 35.26%, with a minimum value of 0.33%, a maximum value of 73.93% and a standard deviation of 13.95%. This shows that in some provinces in Indonesia, agriculture is still the main sector with a large share labor. In some other provinces, agriculture is no longer the main sector with a low labor share. The existence of variations over time and between provinces is also reflected in other research variables (Table 3).

Table 3. Summary statistics of research variables.

Variable	Description	Mean	Std Dev	Min	Max
$LAGR_{it}$	Share of labor in the agricultural sector in province i year t (percent)	35.30	13.99	0.33	73.93
$GRDP_{it}$	GRDP share of non-agricultural sector based on constant prices (in 2010 prices) province i year t (percent)	80.76	9.17	60.19	99.92
$WGAP_{it}$	The difference between the wages of the agricultural sector and the non-agricultural sector of province i year t (percent)	39.56	40.56	-42.12	321.15
PMA_{it}	Share of foreign investment (PMA) share in the non-agricultural sector in province i year t (percent)	86.79	18.56	10.82	100.00
$PMDN_{it}$	Share of domestic investment (PMDN) in the non-agricultural sector of province i year t (percent)	81.14	24.87	3.56	100.00
$LnLAND_{it}$	Natural logarithm of the agricultural land area of province i year t	13.43	1.34	7.12	14.94
RLS_{it}	Average length of school in province i year t (years)	8.33	0.96	5.99	11.13
INT_{it}	Households accessing the internet in province i year t (percent)	57.95	17.12	16.28	93.33

Three types of models can be used for estimating panel data regression; Fixed Effect Model (FEM), Pooled Least Square (PLS), and Random Effect Model (REM). Testing the hypothesis on three tests was carried out to choose best model using: Chow test, Hausman test, and LM test. The Chow test is used to choose between PLS or FEM models. Then, the Hausman test is used to choose between FEM or REM models. The LM test is used to choose between REM or PLS models. Since obtaining the best model, a test is conducted to detect whether or not there is a violation of the Gauss-Markov assumption due to time-related disturbances, cross-sectional disturbances, or disturbances from both. Assumption tests include Normality, Heteroscedasticity, Autocorrelation, and Multicollinearity (Gujarati 2004).

RESULTS AND DISCUSSION

Changes in agricultural labor participation. The transformation of the economic structure is a process that naturally needs to be passed for economic progress. However, risk needs to be avoided in the transformation process, which can widen the income gap if the transformation is not balanced (Daryanto et al. 2015). Simon Kuznets suggested that inequality will worsen in the early stages of economic transformation; only at later stages will it improve (Todaro and Smith 2011). Estimation from Dartanto et al. (2017) supports the idea of increasing inequality in Indonesia leads by structural transformation. Furthermore, structural change causes more income inequality if it is accompanied by labor mobility frictions (Makarski and Tyrowicz 2023).

Figure 1 shows that the trend of labor absorption conditions between sectors is not much different from the agricultural sector's contribution to GDP, which experienced a decline in the percentage. The workers rate in the agricultural sector in 2000 was 45.28% which decreased to 28.50% in 2019 but increased again in 2020 to 29.76%. It showed that the agricultural sector is a support sector experiencing economic shocks. Significant increase occurred in the service and industrial sector. Although there is an increase of workers in the industrial sector, their contribution is still below the agricultural sector.
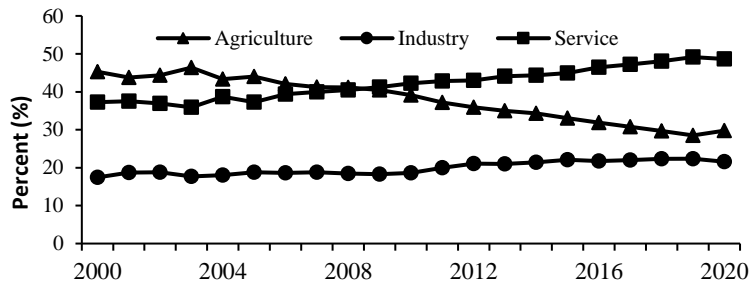

Figure. 1. Trends in the percentage of workers among sectors in Indonesia 2000-2020 (World Bank 2021)

Figure 2 shows that the trend of number workers in the agricultural sector from 2000 to 2020 fluctuated although, generally, it decreased. In 2000, the number of workers in the agricultural sector reached 40.67 million people, and it decreased to 38.22 million people in 2020. Different things happened in the industrial and service sectors, which experienced increased workers in the same period. There was an increase of 12.04 million workers in the industrial sector while there was an increase of 29.03 million workers in the service sector. However, there was a decline in the labor in the industrial sector due to a reduction in production capacity due to Covid-19 in 2020.
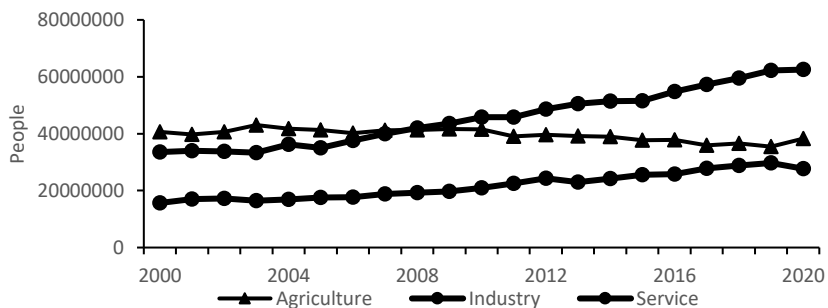

Figure. 2. Trends in the number of workers among sector in Indonesia 2000-2020 (Central Bureau of Statistics 2021a).

The share of labor in the agricultural sector in almost all provinces decreased in 2020 compared to 2015 (Fig. 3). Only three provinces experienced an increase, West Java with an increase of 0.44%; Jakarta with a rise of 0.16%; and Bali with an increase of 0.11%. Papua was the province with the highest share of labor in the agricultural sector with a contribution of 73.93% in 2015. However, it decreased to 66.91% in 2020. Jakarta province had the lowest labor share, contributing only 0.58%. The decrease in the share of labor can impact the agricultural sector and the Indonesian economy because it will reduce the burden on the agricultural sector to absorb labor.
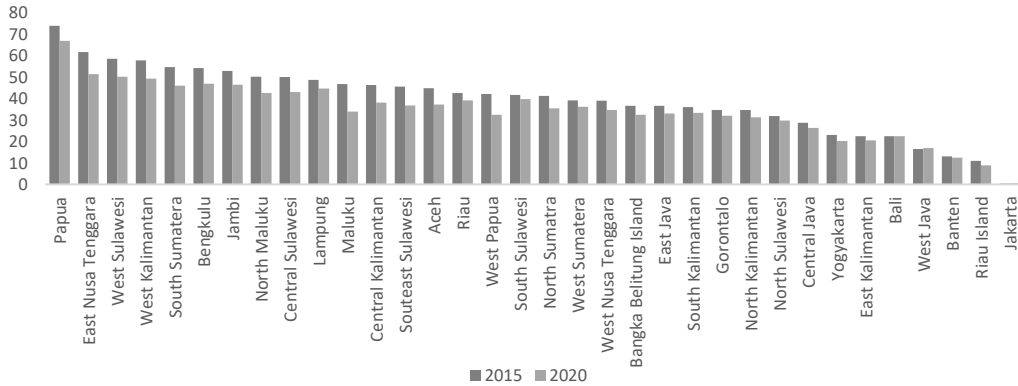
Figure 3. Share of agricultural sector labor by province 2015-2020 (Central Bureau of Statistics 2021a)

Best model. Panel data regression analysis was employed to determine what factors caused a decrease in the number of workers in the agricultural sector. This study used the Random Effect Model as the best model based on the three tests (Table 4).

Table 4. Best Model Test Results

Type of Test	Probability Value	Conclusion
Chow Test	0.0000	Reject H_0 ; Best Model: FEM
Hausman Test	0.7652	Accept H_0 ; Best Model: REM
LM Test	0.0000	Reject H_0 ; Best Model: REM

The classical assumption test was carried out to obtain the BLUE (Best Linear Unbiased Estimator) model. The tests included: Normality, Heteroscedasticity, Autocorrelation, and Multicollinearity. The results of the Jarque-Bera test indicated that the residual value produced is normally distributed. The results of the Breusch-Pagan test obtained a probability value smaller than the 5% significance level, indicating that the variance in the model used was not constant. This problem was solved using the White Heteroscedasticity-Consistent (HC) standard error technique. The Durbin-Watson (DW) test results obtained a probability value more than the 5% significance level, indicating that the model used does not have a serial correlation between residuals (Table 5).

Table 5. Classic Assumption Test Results

Type of Test	Probability Value
Normality.Test (Jarque-Bera)	0.1094
Heteroscedasticity.Test (Breusch-Pagan)	0.0000
Autocorrelation Test (Durbin-Watson)	0.2642

A multicollinearity test was conducted to determine a high correlation between two or more variables. Multicollinearity investigated by the variance inflation factor (VIF) value. The results of the VIF value show that no variable has a VIF value greater than 10, indicating that the model used does not have a multicollinearity problem (Table 6).

Table 6. VIF value between variables

Variable	GRDP	WGAP	PMA	PMDN	LnLAND	RLS	INT	Dcovid
VIF	1.1437	1.1277	1.0480	1.1462	1.1909	4.1678	4.1928	1.5941

Interpretation of estimation results. The estimation results in Table 7 show that F-statistical probability value was 0.00, which indicates one or more independent variables have a significant effect on the share of agricultural labor. The coefficient of determination (R^2) obtained a value of 0.63, which means that the independent variable in the model can explain the dependent variable by 62.92%. The t-test was conducted to determine the significance of the independent variables that affect the dependent variable individually. The significance levels are generally 1%, 5%, and 10%. T-test results showed that $GRDP_{it}$, $WGAP_{it}$, PMA_{it}, $LnLAND_{it}$, RLS_{it}, INT_{it}, Dcovid significantly affected the variable share of agricultural labor. The $PMDN_{it}$ is the only variable that does not have a significant impact on agricultural labor.

Table 7. Panel data regression model estimation results.

Dependent variable: LAGR		
Independent variable	**Coefficient**	**Probability value**
(intercept)	70.3835	0.0000
GRDPit	-0.5327	0.0000
WGAPit	-0.0183	0.0010
PMAit	0.0370	0.0077
PMDNit	-0.0204	0.1804
LnLANDit	3.0106	0.0000
RLSit	-3.1680	0.0121
INTit	-0.1287	0.0000
Dcovidit	3.0255	0.0000

R-Squared: 0.6292
Adj. R-Squared: 0.6139
Chisq: 308.865 on 8 DF, p-value: < 2.22e-16

GRDP in the agricultural and non-agricultural sector. The share of GRDP in the non-agricultural sector (GRDPit) is a proxy for structural transformation in this study. The estimation results showed that a one-percentage-point increase in the share of non-agricultural GRDP caused a decrease of 0.53 percentage points in the share of labor in the agricultural sector (Table 7). These results are consistent with the findings of Pranoto et al. (2020), that the GRDP of the agricultural sector will increase the absorption of labor in the agricultural sector. In another way, the increase in the GRDP of the non-agricultural sector will increase the absorption of labor in the non-agricultural sector, thereby reducing the share of labor in the agricultural sector.

The changes in GRDP in the agriculture sector show that most provinces have experienced a decline in the share of GRDP in the agricultural sector (Fig 4, Panel a). Central Sulawesi had the most significant decline in the share of GRDP in the agricultural sector by 9.71%, while West Sulawesi had the highest share of GRDP in the agricultural sector by 39.70% from 2015 to 2020. Meanwhile, GRDP in the non-agricultural sector shows that most provinces experienced an increase in the share of GRDP in the non-agricultural sector (Figure 4, Panel b). There are 20 provinces whose non-agricultural GRDP has increased. The highest increase in the share of GRDP in the non-agricultural sector occurred in Central Sulawesi with an increase of 9.71% and Jakarta is the province with the highest non-agricultural sector GRDP share, reaching 99.92%. In Indonesia, economic centers that focus on industry and the service sector only grow on the island of Java, so the labor mobility flow becomes unstoppable (Pratiwi et al. 2019).
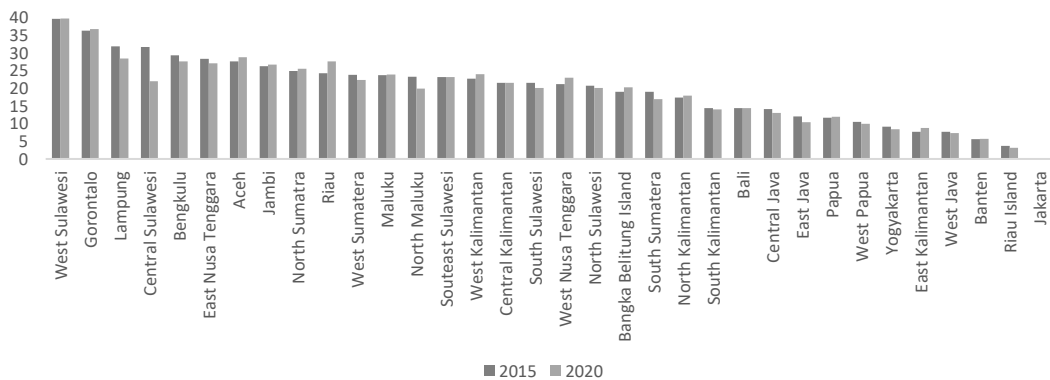
(a) Agricultural Sector
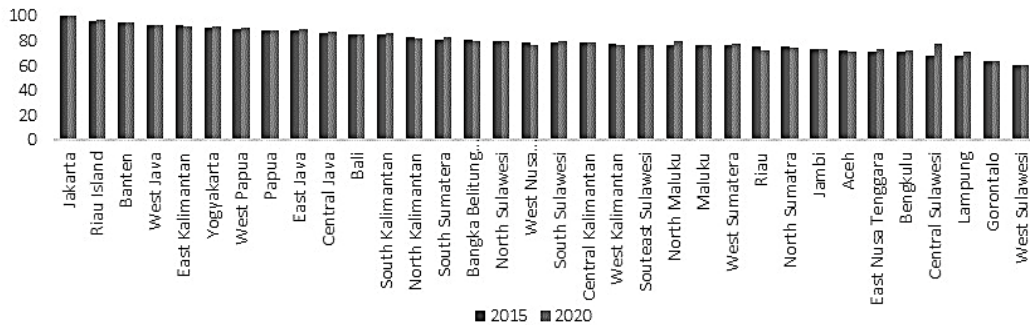
(b) Non-Agricultural Sector

Figure 4. Share of GRDP in the agricultural and non-agricultural sector by province 2015-2020 (Central Bureau of Statistics 2021b).

Differences in wage levels in the agricultural and non-agricultural sectors. The estimation results showed that the difference wage (WGAPit) had a negative effect on the share of labor in the agricultural sector at a significance level of 1% (Table 7). A one percentage point increase in the wage gap (non-agricultural wages minus agricultural wages) leads to a 0.018% decrease in the agricultural labor share (ceteris paribus). This confirms the wage pull effect, where higher wages in non-agricultural sectors incentivize individuals to leave agriculture for better-paying opportunities (Massey et al. 1993). These results are consistent with findings that confirm that wage differences affect work shifts, and workers with low wages, which are characteristic of the agricultural sector, have a more significant opportunity to change jobs (Permata et al. 2010).

Figure 5 shows that the agricultural sector has lower average wage level than the non-agricultural sector in all provinces. The highest average wage in the non-agricultural sector is in the Riau Islands province at Rp. 4.51 million, while, the highest average wage in the agricultural sector is in the Jakarta province at Rp. 3.12 million. Only five provinces have wages in the agricultural sector above the average in 2020. The agricultural sector is identically known as a sector with a non-formal work system that tends not to have a stable income, causing workers to be reluctant to work in the agricultural sector (Dartanto et al. 2019).
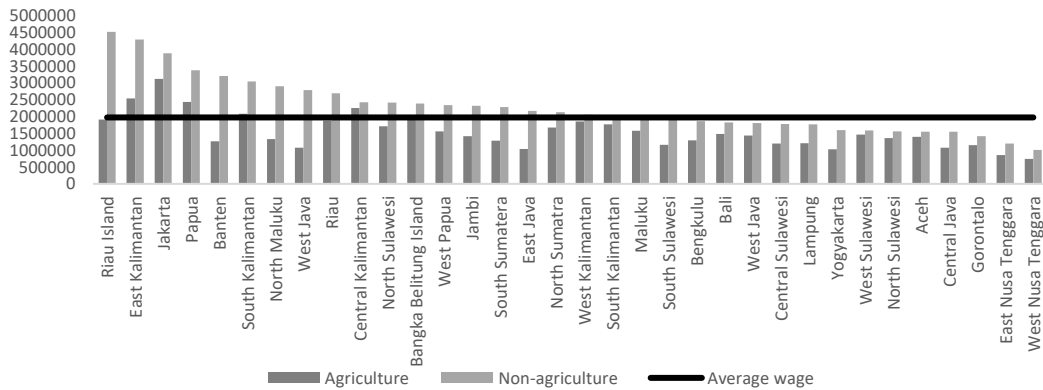
Figure 5. Average wages of the agricultural and non-agricultural sectors by province in 2015-2020 (Central Bureau of Statistics 2021a).

Investment in the non-agricultural sector. The share of FDI in the non-agricultural sector (PMAit) had a positive effect on the share of labor in the agricultural sector at a significance level of 1% (Table 7). A one percentage point increase in FDI in the non-agricultural sector led to a 0.037% increase in the agricultural labor share (ceteris paribus). These are consistent with earlier studies that showed an increase in FDI in the industrial sector and decreased labor in the industrial sector (Handayani 2015). This result also strengthens Todaro and Smith's critique of Lewis's structural transformation theory, which assumes that the transfer of labor in the modern sector is proportional to the level of capital accumulation in the modern sector. Meanwhile, the share of domestic investment in the non-agricultural sector (PMDNit) has a probability value of 0.18, which is greater than the 5% significance level. This indicates that there is no significant effect from the share of domestic investment in the non-agricultural sector on the share of labor in the agricultural sector. Earlier studies showed that the domestic investment in the industrial sector did not significantly increase the labor in the industrial sector (Kuswan 2017). The unequal distribution of domestic investment between regions is likely the reason why domestic investment does not have a significant effect on the decline in the share of labor in the agricultural sector.

The development of FDI in the non-agricultural sector in 2015 compared to 2020 tended to vary (Fig. 6). Seventeen provinces experienced a decline: West Java, Banten, East Java, North Sumatra, Kalimantan, Papua, East Kalimantan, Bali, NTB, South Kalimantan, Lampung, Central Kalimantan, North Kalimantan, Bangka Belitung Islands, Jambi, Yogyakarta, and West Papua. The most significant increase was obtained by North Maluku Province of US$ 2.21 million compared to 2015, while East Kalimantan Province experienced the most significant decline from US$ 1.95 million in 2015 to US$ 0.31 million in 2020.
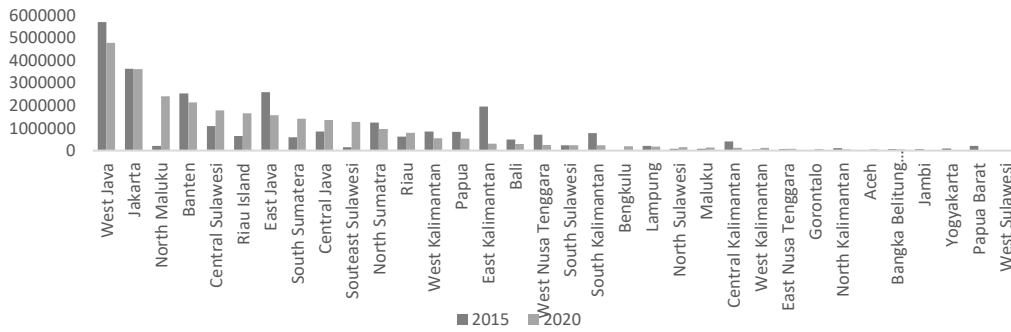
Figure 6. Non-agricultural sector FDI by province in 2015-2020 (Capital Investment Coordinating Board 2022)

Viewed from the domestic investment (PMDN) in the non-agricultural sector, most provinces experienced an increase (Fig. 7). Only three provinces experienced a decline, namely: Jambi, North Sulawesi, and West Sulawesi. Java Island was the leading destination for non-agricultural PMDN in Indonesia, as seen from the five provinces, with the largest PMDN being the province on the island of Java. This is in contrast to conditions in Papua Island and Maluku Island which only obtained PMDN of 4.5 million rupiah from the non-agricultural sector in 2020 or only 0.09% PMDN from West Java province. It differed from the FDI in the non-agricultural sector, where North Maluku province is in the top five provinces with the most significant FDI.
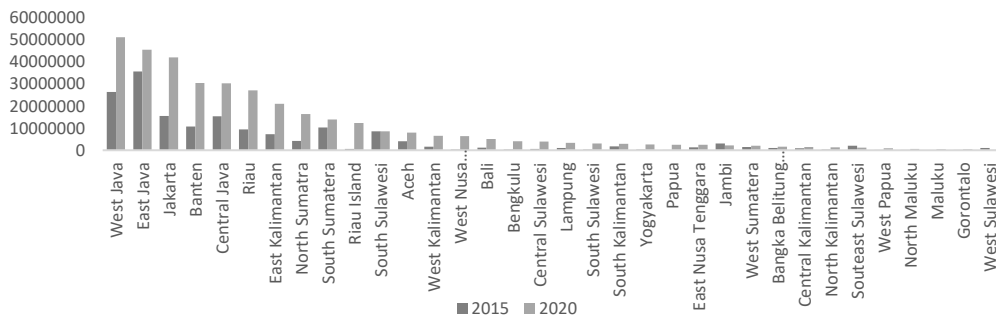

Figure 7. Domestic investment in the non-agricultural sector by province in 2015-2020 (Capital Investment Coordinating Board 2022)

Agricultural land. The agricultural land area (LnLANDit) had a positive effect on the share of labor in the agricultural sector, at a significance level of 1% (Table 7). A one percentage point increase in agricultural land area in a province led to a 3.01% increase in the agricultural labor share. These results is intuitive, as larger land areas naturally require more labor for cultivation and agricultural activities. These results are consistent with the findings of Pranoto et al. (2020), where increasing the area of agricultural land increased the ability of the agricultural sector to absorb more labor. Land is an essential factor for the agricultural sector. With the fixed land area condition and continued population growth, agricultural land per capita area is getting narrower. It impacts farmers who do not have large enough land, can no longer depend on the agricultural sector, and must look for other jobs outside it (Marzuki et al. 2010).

In traditional, labor-intensive agricultural practices, a larger area of land may require more labor for activities such as planting, harvesting, and tending to crops. The greater land area used for agricultural purpose led to higher labor absorption in areas where traditional farming methods are

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prevalent. The region with the largest agricultural land was Central Kalimantan in 2015, but this decreased in 2020 (Fig. 8). The decline in agricultural land is not limited to Central Kalimantan but is a phenomenon that occured in most provinces in Indonesia.
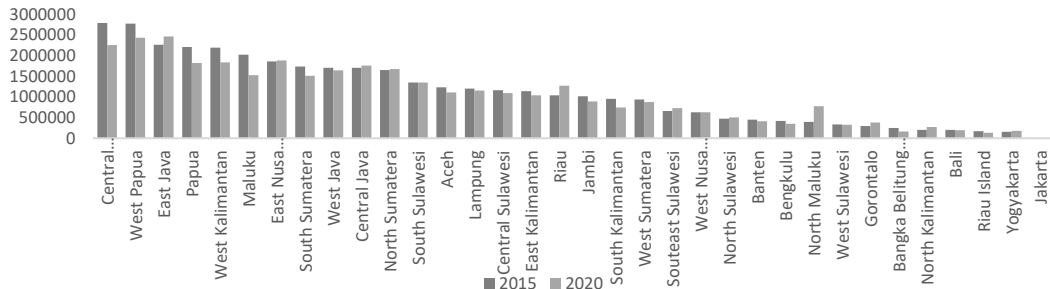

Figure 8. Agricultural land area of province (Ministry of Agriculture 2020).

Length of schooling. The average length of schooling (RLSit) had a negative effect on the share of labor in the agricultural sector at the 5% significance level (Table 7). If there is an increase in the average length of schooling of 1 year it led to a decrease of 3.17 percentage points in agricultural labor share. This result is consistent with the study by Saleh (2015), which confirmed that the higher level of education resulted in more people who are active in the non-agricultural sector. This sector is characterized by the use of a highly skilled labor to increase their bargaining power to work in the non-agricultural sector. A low level of education will limit the professions that can be entered to or occupations that do not require high skills, such as workers in the agricultural and informal sectors (Daryanto et al. 2015). Advance education is one way to improve workers' skills to increase their bargaining power to work in the non-agricultural sector.

The average length of schooling increased in all provinces (Fig. 9). Jakarta is the province with the highest average length of schooling, reaching 11.1 years in 2020. Meanwhile, Papua is the province with the lowest average, only 6.7 years. There are 14 provinces whose average length of schooling is below the national average. Difficulty in access to education and inequality in the distribution of the number and quality of teachers, especially in remote areas, are obstacles in the world of education in Indonesia (Kuswan 2017).
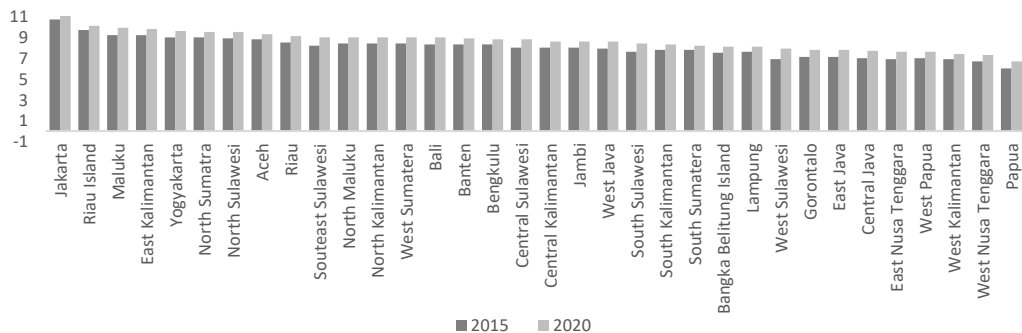

Figure 9. Years of average length of schooling in Indonesia (Central Bureau of Statistics 2023a).

Internet access. The percentage of households that access the internet (INTit) had a negative effect on the share of labor in the agricultural sector at the 1% significance level (Table 7). A one percentage point increase in households with internet access leads to a decrease of 0.13 percentage points in

agricultural labor share (ceteris paribus). This finding suggested that internet access exposes individuals to opportunities beyond agriculture, potentially leading them to seek non-agricultural employment. This aligned with studies on determinants of rural workforce decisions (Ramadhan 2020). Increasing internet access would make flow of information and knowledge more accessible (Cong 2021).

Internet access is key to improving productivity because the internet can play a role in the efficient use of fertilizers and pesticides as well as accelerate the adoption of the technologies such as new crop varieties, irrigation, and harvesting technologies (Kaila and Tarp 2019). However, when connected to labor participation, good internet access actually has a negative impact because it provides more options for income generation (Bridgewater 2021). The percentage of households that can access the internet has increased in all provinces (Fig. 10). Jakarta has the highest percentage, reaching 93% and Papua has the lowest percentage, only 35% in 2020.
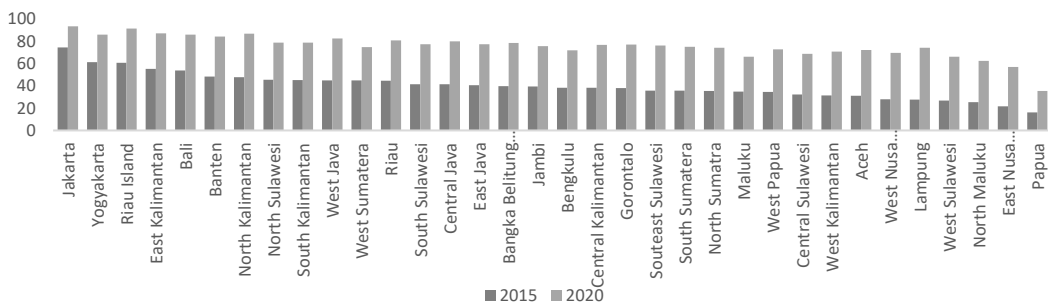

Figure 10. Percentage of households accessing the internet in Indonesia by province (Central Bureau of Statistics 2023b)

COVID-19 pandemic. The COVID-19 pandemic dummy variable has a positive effect on the share of the agricultural sector labor at the 1% significance level (Table 7). The Covid-19 pandemic led to a substantial increase of 3.03 percentage points in the share of labor in agriculture (ceteris paribus). This finding might be explained by disruptions in non-agricultural sectors due to lockdowns and economic slowdown, causing individuals to return to or remain in agriculture for subsistence or temporary employment. The agricultural sector became one of the resilience sectors during the COVID-19 pandemic when other sectors experienced contractions. The results of the BPS survey of 34,559 business actors related to the impact of COVID-19 showed that 35.56% of companies chose to reduce the number of employees working due to the COVID-19 pandemic.

CONCLUSION AND RECOMMENDATIONS

The decline in the labor share of the agricultural sector can be attributed to factors such as the increasing prominence of non-agricultural sectors in the economy, disparities in wages between agricultural and non-agricultural sectors, levels of education among the population, and improved accessibility to the internet. Conversely, the increase in the labor share in the agricultural sector was influenced by foreign direct investment (FDI) in non-agricultural sectors, the extent of agricultural land holdings, and the impact of external events like the COVID-19 pandemic.

This research also suggests that the government needs to provide the broadest possible access to the Indonesian people to formal education, considering that the level of education is the main factor in the transformation of labor. The Indonesian government also should focus on developing education that enhances the quality of agricultural labor, aiming to improve productivity and reduce income disparity with the industrial sector. Investment entering Indonesia needs to be more directed at

increasing capital accumulation which is also capable of encouraging an increase in labor absorption that is increasingly balanced between economic sectors.

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REFERENCES CITED

Aghion, P., C. Antonin, S. Bunel and X. Jaravel. 2022. Modern manufacturing capital, labor demand, and product market dynamics: Evidence from France. CEP Working Papers, Centre for Economic Performance, London School of Economcs. Hal Id- l-03943312.

Agwu, N.M., E.E. Nwankwo and C.I. Anyanwu. 2014. Determinants of agricultural labor participation among youths in Abia State, Nigeria. International Journal of Food and Agricultural Economics (IJFAEC). 2: 157-164.

Alvarez, J.A. 2020. The agricultural wage gap: Evidence from Brazilian micro-data. American Economic Journal: Macroeconomics. 12: 153–173.

Badriah, L. S., A. Alisjahbana, K. Wibowo and F. Hadiyanto. 2017. Structural change and labor productivity growth in Indonesia. In Proceedings of the 2nd International Conference on Economic Education and Entrepreneurship (ICEEE 2017) (pp. 397-402).

Baldwin, R.E. 1995. The effects of trade and foreign direct investment on employment and relative wages. OECD Economic Studies. 23: 7-54.

Bilenko, Y. 2022. Labor productivity in the agriculture, structural shifts and economic growth in the Central and Eastern European countries. Agricultural and Resource Economics: International Scientific E-Journal. 8: 5-32.

Bridgewater, S.E. 2021. Estimating the impact of high-speed internet on teen and young adult labor force participation. M.Sc. Thesis, Montana State University, Bozeman, Montana, USA.

Capital Investment Coordinating Board. 2022. Development of investment realization by location in 2015-2020 [internet]. Available from: https://nswi.bkpm.go.id/data_statistik.

Carrera, J.A. and X. Raurich. 2018. Labor participation, structural change, and economic growth. Journal of Macroeconomics. 56: 292-310.

Central Bureau of Statistics. 2021a. Situation of Workers in Indonesia August 2020. Jakarta (ID): BPS.

Central Bureau of Statistics. 2021b. Gross Regional Domestic Product of Provinces in Indonesia According to Business Field (2015-2019). Jakarta (ID): BPS.

Central Bureau of Statistics. 2023a. Average Length of School (years). Jakarta (ID): BPS.

Central Bureau of Statistics. 2023b. Percentage of Households Who Have Accessed the Internet in the Last 3 Months According to Province and Regional Classification. Jakarta (ID): BPS.

Christiaensen, L., Z. Rutledge and J.E. Taylor. 2021. The future of work in agrifood. Food Policy. 99: 101963.

Cong, B.T. 2021. The impact of metropolises characteristics on provincial economic structure transformation: evidence from Vietnam. Cogent Economics and Finance. 9: 1-16.

Dartanto, T., A. Halimatussadiah, J.F. Rezki, R. Nurhasana, C.H. Siregar, H. Bintara, Usman, W. Pramono, N.K. Sholihah, E.Z.W. Yuan and R. Soeharno. 2019. Why do informal sector workers not pay the premium regularly? Evidence from the national health insurance system in Indonesia. Applied Health Economics and Health Policy. 18: 81-96.

Dartanto, T., E.Z.W. Yuan and Y. Sofiyandi. 2017. Two decades of structural transformation and dynamics of income equality in Indonesia. ADBI Working Paper Series. No. 783: 1-20. Asian Development Bank Institute, Tokyo, Japan.

Daryanto, A., I. Fahmi, N.A. Achsani, A. Asmara, M. Yuwono, Y.H. Asnawi and Suhendi. 2015. ST2013 Thematic Analysis of Indonesian Farming and Smallholder Structural Transformation Sub-sectors. Central Bureau of Statistics, Jakarta, Indonesia. 121 p.

Gregorio, G.B. and R.C. Ancog. 2020. Assessing the impact of the COVID-19 pandemic on agricultural production in Southeast Asia: Toward transformative change in agricultural food systems. Asian Journal of Agriculture and Development. 17: 1-13.

Gujarati, D.N. 2004. Basic Econometrics. 4th Edition. The McGraw-Hill Inc. USA.

Handayani, F. 2015. The role of industrial investment to industrial sector labor absorption in Indonesia (in Indonesian, English summary). Jurnal Ilmu Ekonomi. 5: 18-27.

Herrendorf, B., R. Rogerson and Á. Valentinyi. 2014. Growth and structural transformation. Handbook of Economic Growth. 2: 855-941.

Isbah, U. and R.Y. Iyan. 2016. Analysis of the role of the agricultural sector in the economy and employment in Riau Province. Jurnal Sosial Ekonomi Pembangunan. 7: 45-54.

Kaila, H. and F. Tarp. 2019. Can the internet improve agricultural production? Evidence from Viet Nam. Agricultural Economics. 50: 675-691.

Kariyasa, K. 2006. Changes in the economic structure and employment opportunities as well as the quality of human resources in Indonesia (in Indonesian, English Summary). SOCA: Jurnal Sosial Ekonomi Pertanian. 6: 439-469.

Kurniawati, T.P., I. Mafruhah and T.R. Putro. 2023. Determinants of labor participation with spatial approach System Literature Review (SLR) method in Boyolali City, Indonesia. Randwick International of Social Science Journal. 4: 580-593.

Kuswan, S. 2017. The effect of structural transformation on labor absorption against industrial sector in Indonesia 2010-2015 (in Indonesian, English Summary). M.Sc. Thesis, IPB University. Bogor, Indonesia, pp 1-37.

Lewis, W.A. 1954. Economic development with unlimited supplies of labor. The Manchester School. 22: 139-191.

Makarski, K. and J. Tyrowicz. 2023. Preference for redistribution during structural change with labor mobility frictions. European Journal of Political Economy. 77: 102316.

Manning, C. and R. Purnagunawan. 2016. Has Indonesia passed the Lewis turning point and does it matter. ISEAS Publishing.

Maris, M. 2019. Structural and productivity shift of industries in Slovakia and Czech Republic: A comparative study. Journal of International Studies. 12(1): 313-323.

Martins, P.M.G. 2019. Structural change: pace, patterns and determinants. Review of Development Economics. 23: 1-32.

Marzuki. A., U. Bustaman, and S. Hartini. 2010. Changes in economic structure and employment opportunities. Central Bureau of Statistics, Jakarta Indonesia. 118 p.

Massey, D. S., J. Arango, G. Hugo, A. Kouaouci, A. Pellegrino and J. E. Taylor. 1993. Theories of international migration: a review and appraisal. Population and Development Review. 19(3): 431–466.

Ministry of Agriculture. 2020. Agricultural Land Data Statistics for 2015-2019. Jakarta (ID).

Odland, J. and M. Ellis. 2015. Changes in the inequality of earnings for young men in metropolitan labor markets, 1979–1989: the effects of declining wages and sectoral shifts within an efficiency wage framework. Economic Geography. 77: 148-179.

Pena, A. 2023. Labor Impacts of COVID-19 in US Agriculture: Evidence from the current population survey. Journal of Labor Research. 3:1-12.

Permata, M., A. Prasmuko, and Yanfitri. 2010. The labor shifting in Indonesian labor market. Buletin Ekonomi Moneter dan Perbankan. 12(3): 251-288.

Pranoto, J., A.P. Utomo, and M.F. Muin. 2020. Performance labor in agriculture sector in Java Island using panel data 2007-2014. AGROLAND The Agricultural Sciences Journal. 7: 1-8.

Pratiwi, E., K. Ashar, and W. Syafitri. 2019. Intersectoral labor participation in Indonesia. Business and Management Research. 144: 102-106

Pratomo, D. S. and C. Manning. 2022. Structural change and formal sector employment growth in Indonesia. Journal of Southeast Asian Economies. 39(1): 1-20.

Putra, R.A.A., K. Ovsiannikov and K. Kotani. 2023. COVID-19-associated income loss and job loss: evidence from Indonesia. Journal of Asian Economics. 87: 101631.

Raiyan, N. and N.D.K. Putri. 2021. Determinants of the shifting labor in agricultural sector to non-agricultural sectors evidence in Indonesia, pp. 439-448 In Proc. Seminar Nasional Official Statistics, Jakarta, Indonesia.

Ramadhan, G.I. 2020. Determinants of rural labor decisions to work in the agricultural and non-agricultural sectors (study of rural households in Indonesia). Jurnal Ilmiah Mahasiswa FEB Universitas Brawijaya. 9(2): 62-85.

Ranis. G. and J.C.H. Fei. 1961. A theory of economic development. The American Economic Review. 51(4): 533–565.

Saleh, R.D. 2015. The influence of economic growth and structural transformation on job opportunities in Indonesia. Cita Ekonomika. 9: 170-179.

Simanjuntak, P.J. 2003. Introduction to human resource economics. Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia, Indonesia. 138 p.

Sumanto, A. 2009. Identification of socio-economic factors of labor migration (the case of housewives working from the agricultural sector to the non-agricultural sector). Jurnal Ekonomi dan Studi Pembangunan. 1(2): 74-80.

Surhayadi, A., J. Marshan and V.T. Indrio. 2017. Structural transformation and the release of labor from agriculture. Asian Development Bank. 1-17.

Szirmai, A., N. Wim and H. Nobuya. 2012. Structural change, poverty reduction and industrial policy in The Brics. Vienna. United Nations Industrial Development Organization (UNIDO).

The Coordinating Ministry for Economic Affairs of the Republic of Indonesia. 2021. The impact of the Covid-19 pandemic on employment in Indonesia. Study Report: 21-25.

Todaro M.P and S.C. Smith. 2011. Economic Development. 11th ed. Pearson Education, Harlow, UK. pp 140-148.

Tulangow. N.N., N.F.L. Warney, and J.F.J. Timban. 2017. Labor migration from the agricultural sector to non-agriculture in Tatelu Village Dimembe District (in Indonesian, English summary). Jurnal Agri-SosioEkonomi Unsrat. 13(3A): 191-202.

Widyawati, R. 2017. Linkages analysis of agricultural sector and effect on the economy in Indonesia (Input-Output Analysis). Jurnal Economia. 13(1): 14-27.

World Bank. 2021. Employment in agriculture, industry, and service (% of total employment). Retrieved from https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS.