AGROLAND: The Agricultural Sciences Journal
Vol. 7, No. 1 June (2020), 1- 8
P-ISSN : 2407- 7585 & E-ISSN : 2407- 7593, Published by Tadulako University

Original Research **Open Access**

PERFORMANCE LABOR IN AGRICULTURE SECTOR IN JAVA ISLAND USING PANEL DATA 2007-2014

Joko Pranoto[1)], Agung Priyo Utomo[2)], Muhamad Fathul Muin[3)]

[1)] BPS-Statistics Mempawah, West Kalimantan, Indonesia
[2)] Polytechnic of Statistics-STIS, Jakarta, Indonesia
[3)] BPS-Statistics Papua, Papua, Indonesia

Correspondence author's: Joko Pranoto
Email : joko.pranoto@bps.go.id

Submit: 10 March 2020, Revised: 17 Marcht 2020, Accepted: 1 June 2020

ABSTRACT

The highest decrease in the number of food crop workers occurred in Java, as many as 2,87 million people in 2007-2014. The age of food crop agriculture workers in Java is dominated by workers aged over 45 years (64,95%). If there is no addition of new workers, then the food crop labor will be increasingly dominated by old age groups which will make it difficult for the agricultural sector to carry out its mandate to improve and maintain sustainable food security. The purpose of this study is to describe the condition of the food crop agriculture subsector from the aspect of labor absorption in Java for the period 2007-2014 and analyze the effect of the regional GDP of food crops subsector, real wages, education, and land area to the absorption power of agricultural food crops subsector on labor in Java. Central Java Province is a province with the largest decrease in the number of agricultural food crop subsector workers compared to the other four provinces on Java island. From the results of the estimation, the fixed-effect model with cross-section SUR is chosen as the best model. The results show that the variable of regional GDP, real wage, and size of land area has a significant and positive effect on the labor absorption of agricultural food crops subsector, while education has a significant and negative effect. Overall this model able to explain variations of this phenomenon by 89,32%. Meanwhile, another 10,68% is explained by other variables not included in the model.

Keywords: Employment, Food Crop, Primary Sector.

DOI: https://doi.org/10.22487/agroland.v6i1.3

INTRODUCTION

Agricultural development is a dynamic process that in the long term will have a change in the socio-economic structure (Gilles & Dalecki, 1988). The changes can be in the form of sectoral shifts of employment, institutions, and values that exist in society (Sinuraya & Saptana, 2010). According to modernization theory, a country undergoing a process of structural transformation is characterized by the development of secondary sectors

and the decline of primary sectors (Marjanović, 2015).

Currently viewed from the workforce structure,it is still dominated by the agricultural sector at around 34% in 2014. However, the food crops subsector as one of the largest absorbs the agricultural workforce has decreased to 2,87 million workers as long the 2007-2014 period. The main reason is the lower average income than the industrial and service sectors (Ministry of Agriculture, 2015).

The decline in the number of agricultural food workers will have an impact on national food security in the future (Omotesho et al, 2014). If there is no addition of new workers, the workforce will be dominated by the old age group. This condition needs to be considered because of the old age workforce more difficult to know well the agricultural technology (Guo, Wen, & Zhu, 2015).

Many factors can increase labor absorption in the agricultural sector. According to several theories and related research, they arethe gross domestic product (Mardalena*et al* 2019), wage level (Putri & Sudarsono, 2019), agricultural land area (Fauzul Halim ZI, 2015), and education level (Hindun, 2019).

The Lewis Theory of Development explains the structural transformation in developing countries which excess supply of labor during the 1960s (Gollin, 2014). This model explains the process of shifting labor from the traditional sector to the modern sector caused by wage differentials and output growth. On the other hand, high wages are seen as burdens for employers because it will reduce the profit proportion for the company (Luca & Luca, 2018). It made the demand of labor quantity will decrease when the wages increase (Jardim & Inwegen, 2019).

Regarding the broad aspects of agricultural land, Metzemakers & Louw(2005) says that land size has an important role as a primary factor for production. The wide of the land will affect the high demand for labor. Therefore, theconsequences of the less agricultural land make the number of workers which are accommodated lessen.

As for the aspects of education, the hopes for more educated people to get a job with a better income in the modern sector (Roser & Ortiz-Ospina, 2020). This conclusionalso supported by the research conducted by Isidore et al. (2018)showed that who are educated tend to leave the agricultural sector. While ideally, increasing the level of education of a farmer will increase agricultural productivity (Weir, 1999)and profitability which in turn will create agricultural employment for others(Jayne, Yeboah, & Henry, 2017).So it can be seen that the demand for education is indirect demand to obtain the high-income employment opportunities in the modern sector (Ishchenko-Padukova et al 2017).

Based on the explanation, the decrease in employment of food crops subsector is an issue that needs fo further investigation. Knowing the effect of the variables on the absorption of the labor can determine the exact policy.

Therefore, the objectives of this study are as follows:

1. Describe the condition of the food crops subsector, seen from the aspect of employment in the provinces of Java inperiod2007-2014
2. Analyze the variables that affect the absorption of the food crop subsector labor in the provinces of Java in 2007-2014.

RESEARCH METHODS

The Scope of Research

The scope of this study is five provinces in Java: West Java, Central Java, East Java, Special Region of Yogyakarta, and Banten. The data used from 2007 to 2014, covering five variables obtained from the BPS-Statistics Indonesia, namely:

1. Percentage of the agricultural workforce in the food crop subsector.
2. Contribution of regional GDP in the food crops subsector.
3. The highest percentage of education

completed (high school and above) in the food crops workforce.
4. Average wages/real income of the food crops subsector.
5. The large agricultural land area.

Method of Collecting Data

The data used in this study are secondary data sourced from BPS-Statistics Indonesia in the form of SAKERNAS raw data and the publication of the Indonesian Labor Force and Statistics. The type of data used is panel data with the provincial level in Java.

Analysis Method

The inference analysis used to determine the magnitude of the influence of independent variables on the labor absorption of the food crop subsector is panel data regression analysis. The number of cross-section data (N) in were 5 provinces (i = 1,2,3,4,5) and time-series data (T) were 8 years (t = 2007, 2008, 2009, .., 2014). The type of panel data used in this study is the balanced panel, which is the year used for each province so that the total observations in this study were 40 observations.

The stages of the analysis are as follows:

1. Modelling the three estimation models, namely pooled effect, fixed effect, and randomeffect models.
2. Conducting tests or checking classic assumptions.
3. Test the significance of the model with criteria that include overall test, partial test, and coefficient of determination.
4. Interpreting the chosen model concerning the proposed theory.

RESULTS AND DISCUSSION

Selection of the Best Model

Determination of the best panel data regression model is done with several stages of testing. The selection was made among three estimation models, namely the pooled effect, fixed effect, and random effect tested using the Chow Test, Hausman Test, and the Breusch-Pagan LM Test.

The first is modelling for pooled and fixedeffect models. To be able to choose between the two models, the significance test that must be done is to use the Chow Test with the pooled null hypothesis model better than the fixed effect model. Based on the test results in Table 1., the calculated F counted value is 4,1903 or a probability of 0,0079. This value is greater than the critical value of 2,6787 or a probability smaller than 0,05, so the decision is to reject the null hypothesis. This shows that by using a 5% significance level, there is at least one unequal interception from the five provinces studied. Therefore, of the two models, the fixed effects model is better than the pooled model.

Table 1. The Result of Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4,1902	(4,31)	0,0079
Cross-section Chi-square	17,2889	4	0,0017

The next test is to determine the best model between fixed effect and random effect models. To find the best model between them, the test used is the Hausman Test with the null random effect model better than the fixed effect model. Based on the test results showed in Table 2., the calculated chi-square value generated is 16,7611 or probability in the amount of 0,0022. This value is greater than the critical value of 9,4877 or a probability smaller than 0,05, and the resulting decision is to reject the null hypothesis. This shows that by using a 5% significance level, the fixed effect model is better than the randomeffect model. Thus, from the two tests that have been carried out, it can be concluded that of the three models formed, the fixed effect model is the best model chosen in this study. The Breusch-Pagan test was not carried out

because the chosen model was the fixed effect model.

Table 2. The Result of Hausman Test

Test Summary	Chi-Sq. Stat.	d.f.	Prob.
Cross-section random	16,761076	4	0,0022

Testing for Assumptions of Residual Covariance Variance Structures

From the chosen model (fixed effect model), it is necessary to choose an estimator to see the nature of the residual variance-covariance structure. This test is carried out using the Lagrange Multiplier Test (LM) with a homoscedastic variance-covariance structure determined as the null hypothesis. Based on the test results, the value of the LM test statistical calculation results is 19,01522. With a test statistic value greater than the chi-square critical area of 9,4877, the resulting decision is to reject the null hypothesis. Thus, with a significance level of 5%, it can be concluded that the structure of residual variance-covariance is heteroscedastic.

The final step is to choose the estimator of the structure of heteroscedasticity and see whether there is a cross-sectional correlation. This selection uses the λ_{LM} test statistic in the absence of a correlation between the provincial residuals, which is set as the null hypothesis. Based on the test results, the value of the results of the calculation of the test statistic λ_{LM} is 33,1632. With a test statistic value greater than the chi-square critical area of 18,3070, the resulting decision is to reject the null hypothesis. This shows that with a significance level of 5%, the residual variance-covariance structure of the selected fixed effects model is heteroscedastic, and there is a cross-sectional correlation or correlation between provincial residuals in Java. The results of this test form the basis for determining the type of weigher. The weigher that should be used is SUR cross-section.

Classical Assumption Testing

To construct the best-fitted model, we need to test the normality assumption criteria. The normality assumption test uses Jarque-Berra test statistics with the selected model normal distribution residuals determined as the null hypothesis. Based on the test results, the calculated chi-square value generated is 2,127384 or a probability of 0,345179. With a calculated chi-square value greater than the critical value of 5,9915 or a probability value greater than the significance level of 0,05, the resulting decision is to accept (not reject) the null hypothesis. Thus, it can be concluded that residuals follow a normal distribution or normality assumptions are met.

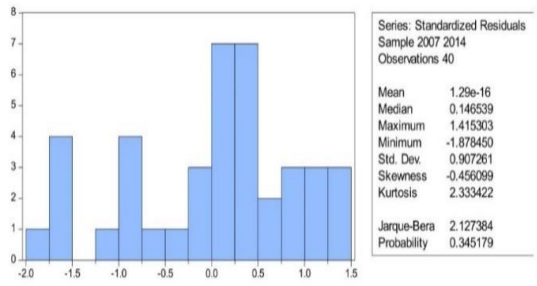

Figure 1.Normality test

The non-multicollinearity assumption of the chosen model has also been fulfilled. Based on the results of data processing outputs, all correlation values between independent variables are smaller than 0,8. Thus, it can be concluded that there is no linear relationship (non-multicollinearity) between the independent variables used.

Furthermore, the homoscedasticity assumption has been overcome by cross-section SUR weighing. That is because the weigher is able to overcome the problem of heteroscedasticity. Thus, the assumption of homoscedasticity has also been fulfilled. The non-autocorrelation assumption was not tested in this study. That is because the SUR model has accommodated the problem of heteroscedasticity and autocorrelation (Greene, 2003).

Table 3. The Correlation between Independent Variables

Variable	Reg. GDP	Wage	Land Area	Education
Reg. GDP	1,000	-0,306	0,213	0,315
Wage		1,000	-0,174	-0,101
Land Area			1,000	-0,252
Education				1,000

Table 4. The Result of Final Equation Model

Method: Panel EGLS (Cross-section weights)				
Var.	**Coef.**	**SE**	**t-stat**	**Prob.**
C	-58,195	15,723	-3,700	0,000
RGDP	0,784	0,246	3,188	0,002
WAGE	5,04E-06	2,70E-06	1,868	0,036
LAND	5,47E-05	1,21E-05	-3,701	0,000
EDUCATION	-0,456	0,181	-2,516	0,009
Weighted Statistics				
R-squared	0,915	Mean dep. var		2,267
Adjusted R-squared	0,893	S.D. Mean dep. Var		8,589
S.E. of regression	1,018	Sum squared resid		32,102
F-statistic	41,805	Durbin-Watson stat		1,896
Prob(F-statistic)	0,000			

Table 5. The Individual Effect

No.	Province	Individual Effect
1.	West Java	-27,16052
2.	Central Java	-24,79862
3.	Special Region of Yogyakarta	62,04585
4.	East Java	-51,95678
5.	Banten	41,87007

Test for Meaning and Model Interpretation

After going through several stages of testing, the best estimation model selected in this study is the fixed effect model with cross-section SUR. Through this model, independent variables can be identified that have a significant effect on the absorption of the agricultural food crop workers in Java for the period 2007-2014. The formed regression equation is as follows:

$$\widehat{\text{Work Force}}_{it} = (-58{,}19545 + \hat{u}_i) + 0{,}784164\ \text{Regional GDP}_{it} + 5{,}04 \times 10^{-6}\text{Wage}_{it} + 5{,}47 \times 10^{-6}\text{Land Size}_{it} - 0{,}456246\text{Education}_{it}$$

Simultaneously, the overall test results with Fisher's test statistics show the resulting Fcount value is 41,8048 which is greater than the critical value or F-statistic Probability of 0,0000 which is smaller than the significance level of 0,05. The results of these tests provide a decision to reject the null hypothesis. Thus, it can be

concluded that with a significance level of 5%, there is at least one independent variable that has a significant effect on the absorptive capacity of agricultural food crops in Java. These results are reinforced by the R-square value formed in this model which is equal to 0,8932. This shows that the independent variable is able to explain variations in the absorption capacity of agricultural food crops by 89,32%. Meanwhile, another 10,68% is explained by other variables not included in the model.

However, if viewed partially by using t-test statistics, the model shows that by using a significance level of 5%, the four independent variables studied have a significant effect on the absorption power of agricultural food crops. Of the four variables, the three variables of the regional GDP contribution of food crop agriculture, real wages and land showed a positive effect, while education had a negative effect on the absorption of the food crop agricultural workforce.

The regression result shows that the variable contribution of GRDP of food crops has a positive and significant effect on the absorption of agricultural labor with a regression coefficient of 0,7842. This value indicates that each increase of 1% of the contribution of GRDP of food crops will cause the absorption of agricultural labor in food crops to increase by 0,7842% when the other independent variables are in a fixed condition (assuming ceteris paribus). This shows that the hypothesis proposed in this study is acceptable and in accordance with Lewis's theory. This finding also supported by previous research that the economic growth in the primary sector will positively impact the absorption of labor (Daud, 2017).

For the next, the regression result shows that land variables have a positive and significant effect on the absorption of agricultural labor with a regression coefficient of $5{,}47x10^{-5}$. This value indicates that every 1.000 hectare increase in agricultural land will cause the absorption of agricultural labor in food crops to increase by 0,047 (assuming ceteris paribus). In other words, an increase in the variable of agricultural land will lead to an increase in the absorption power. This shows that the hypothesis proposed in this research is acceptable and in accordance with research conducted by Sumanto(2009). This finding is also consistent with research conducted by Agwuet et al.(2014) that expanding agricultural land area is likely to increase labor participation in the agricultural sector. The extent of agricultural land is often associated with the amount of output (Ellyani, 2016) and income level (Hassan, 2015) so that it can be an attraction to work in the agricultural sector. From the results obtained by agricultural land is the most influential on the absorption of agricultural labor in food crops.

Furthermore, the regression result shows that the real wage variable has a positive and significant effect on the absorption of agricultural labor with a regression coefficient of $5{,}04x10^{-6}$. This value indicates that every increase of 100 thousand of the real wages will cause the absorption of labor in food crops subsector to increase by 0,504% (assuming ceteris paribus). The low wage/income received is one of the factor that Java farmers out of the food crop subsector. This low wage is due to the surplus of labor without sufficient demand. According to Sukirno (2006), the higher of the wages make workers are more willing to offer their services.

Meanwhile, the last result of regression shows that the educational variable has a negative and significant effect on the absorption of agricultural labor with a regression coefficient of -0,4562. This value indicates that each increase of 1% of the percentage of farmers with a minimum education of high school will cause the absorption of agricultural labor in food crops to decrease by 0,4562% when the other independent variables are in a fixed condition (assuming ceteris paribus). This is consistent with Todaro and Smith (2015)which stated that a high level of

education will increase the opportunity to find high-income jobs in the modern sector and other benefits. In other words, the increasing number of agricultural workers in food crops with a minimum of high school graduates will reduce the absorption of labor in the food crop agriculture sector. This shows that the hypothesis proposed in this study can be accepted. That was according to Sandi (2013) because many workers with a minimum education graduated from high school who switched to other sectors such as industry and trade, so this sector lacked the next generation or the younger generation. Some reasons why the agricultural sector is currently experiencing a decrease in the interest of the labor force to engage in the agricultural sector, especially in the younger age (productive age) generation, aside from the stretching of other sectors such as industry and trade which is growing rapidly, it is also due to erratic weather anomalies.

CONCLUSION

Based on the results and discussion in the previous chapter, there are conclusions that are obtained in this research, namely:

1. The absorption of labor in the food crops subsector in the provinces of Java tends to decrease during the study period. Central Java is a province with the highest decrease in the number of food crop subsector workers due to the low of the average wage. Banten is a province with the lowest decrease in the number of food crop subsector workers because the average level of land tenure wages in Banten Province is higher than in other provinces on Java.
2. The four variables studied have a significant effect on the absorption of food crops subsector worker. From the four variables, the contribution of regional GDP of food crops, land area, and real wages has a positive effect on the absorption, while education has a negative effect.

REFERENCES

Agwu, N. M., et al. Determinant of Agricultural Labour Participation Among Youths in Abia State, Nigeria. International Journal of Food and Agricultural Economics. 2014 *2*(1), 157-164. doi:10.22004/ag.econ.163717

Daud, N. The Effect of Sector Economic Growth on the Performance of Employment and Welfare of People. International Journal of Business and Management. 2017 12(9), 194-203. doi:10.5539/ijbm.v12n9p194

Ellyani, et al. The Affecting Factors of Maiz Farming Production in Rarampadende Village West Dolo District. Agroland: The Agriculture Science Journal. 2016 3(1), 71-80.

Halim, F., et al. Faktor-Faktor yang Mempengaruhi Penyerapan Tenaga Kerja Usaha Tani Sawah di Provinsi Aceh. *Jurnal Magister Ilmu Ekonomi.* 2015 *3*(1), 27-36.

Gilles, J. L., & Dalecki, M. Ural Well-being and Agricultural Change in Two Farming Regions. Rural Sociology. 1988 *53*(1), 40-55.

Gollin, D.. The Lewis Model: A 60-Year Retrospective. The Journal of Economic Perspectives. 2014 28(3), 71-88.

Greene, W. H. Econometric Analysis (5th ed.). New Jersey: Prentice Hall. 2003

Guo, G., et al. The Impact of Aging Agricultural Labor Population on Farmland Output: From the Perspective of Farmer Preferences. Mathematical Problems in Engineering, . 2015 1-7. doi:10.1155/2015/730618

Hassan, T. A. Economic Analysis of Factors Affecting the Farmer Income Under Traditional Farming System in South Darfur State – Sudan. Journal of Agricultural Science and Engineering, 2015 1(3), 114-119.

Hindun. Pendidikan, Pendapatan Nasional, dan Penyerapan Tenaga Kerja di Indonesia. Jurnal Pendidikan Ekonomi, Manajemen

dan Keuangan. 2019 3(1), 15-22. doi:10.26740/jpeka.v3n1.p15-22

Ishchenko-Padukova, O., et al. Economy of Education: National and Global Aspects. Journal of International Studies. 2017 10(4), 246-258. doi:10.14254/2071-8330.2017/10-4/19

Isidore, M. M., et al. Education and Agricultural Productivity in Democratic Republic of Congo: The Case of South-Kivu Province. International Journal of Elementary Education. 2018 7(1), 7-12. doi:10.11648/j.ijeedu.20180701.12

Jardim, E., & Inwegen, E. v. Payroll, Revenue, and Labor Demand Effects of the Minimum Wage. Upjohn Institute Working Paper, 2019. 1-59.

Jayne, T., et al. The Future of Work in African Agriculture: Trends and Drivers of Change. ILO Working Paper No. 25, 2017. 1-32.

Luca, D. L., & Luca, M. Survival of the Fittest: The Impact of the Minimum Wage on Firm Exit. Working Paper 17-088, 2018. 1-42.

Mardalena, M., et al. How Leading Economic Sectors Stimulate Economic Growth, Income and Labor Absorption? Input - Output Approach. International Journal of Economics and Financial Issues. 2019 9(1), 234-244. doi:10.32479/ijefi.6406

Marjanović, V. Stuctural Changes and Stuctural Transformation in a Modern Development Economy. Economic Themes. 2015 53(1), 63-82. doi:10.1515/ethemes-2015-0005

Metzemakers, P., & Louw, E. Land as a Production Factor. 45th Congress of the European Regional Science Association in Amsterdam. Amsterdam: Delft University of Technology, 2005. 2-21p.

Ministry of Agriculture. Rencana Strategis Kementerian Pertanian Tahun 2015-2019. Jakarta: Ministry of Agriculture, 2015.

Omotesho, K. F., et al. Assessment of Hired Labour Use and Food Security among Rural Farming Households in Kwara State, Nigeria. Journal of Agricultural Sciences. 2014 59(3), 353-361. doi:10.2298/JAS1403353O

Putri, N., & Sudarsono, H. The Analysis of Factors that Affect Labor Absorption in Natural Rubber Plantation. Ekuilibrium: Jurnal Ilmiah Bidang Ekonomi. 2019 14(2), 120-135. doi:10.24269/ekuilibrium.v14i2.1610

Roser, M., & Ortiz-Ospina, E. Global Education. Our World In Data.org. Retrieved from https://ourworldindata.org/global-education, 2020.

Sandi, D. R. Pengaruh Tingkat Pendidikan Terhadap Penyerapan Tenaga Kerja pada Usaha Sektor Pertanian di Kabupaten Jombang. Jombang: Sekolah Tinggi Keguruan dan Ilmu Pendidikan, 2013.

Sinuraya, J. F., & Saptana. Migrasi Tenaga Kerja Perdesaan dan Pola Pemanfaatannya. SOCA (Socio-Economic of Agriculture and Agribusiness). 2010 7(3), 1-24.

Sukirno, S. Pengantar Teori Makroekonomi. Jakarta: PT Raja Grafindo Persada, 2006.

Sumanto, A. Identifikasi Faktor-faktor Sosial-Ekonomi Migrasi Tenaga Kerja (Kasus Ibu Rumah Tangga yang Bekerja dari Sektor Pertanian ke Sektor Non Pertanian. JESP: Jurnal Ekonomi & Studi Pembangunan. 2009 1(2), 1-7.

Todaro, M., & Smith, S. Economic Development (12th ed.). Boston: Pearson, 2015.

Weir, S. The Effects of Education on Farmer Productivity in Rural Ethiopia. CSAE Working Paper Series 1999-07, 1999.