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A longitudinal study of agriculture households in Indonesia: The effect of land and labor mobility on welfare and poverty dynamics

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ABSTRACT

The conventional wisdom of Arthur Lewis’s dual sector model says that households in the agricultural (traditional) sector who can move out to a non-agricultural (modern) sector will become better off. We then scrutinize the last three waves of the Indonesia Family Life Survey (IFLS) to analyze the existence of the dual theorem. Our study uses Difference in Difference (DiD) regressions and ordered logit regressions to confirm that moving out of agriculture sectors has significantly increased the welfare of poor agricultural households, especially in the period of 2000–2007, but this is not the case of 2007–2014. Movement out of agricultural sectors decreases the probability of being always poor by 13.5 percentage points. However, when the economy transforms into a more advanced economy, simply moving out of agriculture does not guarantee that farmers, especially landless farmers, will become better off. Welfare improvement requires a shifting to formal non-agricultural sectors, but unfortunately farmers might not be readily equipped with the skills required in formal sectors. Our study also obviously confirms that farmland is an important asset for agricultural households. Agricultural households experiencing a decrease of agricultural land also decreased their expenditure per capita by IDR 36,833 in 2000 and IDR 68,683 in 2007. These findings suggest that, currently, moving out of agriculture is not the solution to improve the well-being of farmers. Keeping farmland ownership, raising investment in human capital, and the modernization of agriculture should be the main concerns in agricultural development.

1. Introduction

Agriculture sectors continue to be a fundamental instrument for sustainable development and poverty reduction in the 21st century. Agriculture contributes to development as an economic activity, as a livelihood, and as a provider of environment services; however, agriculture sectors alone will not be enough to massively reduce poverty (World Bank, 2007). Three pathways out of rural poverty include smallholder farming activities, off-farm labor activities, and migration out of agriculture. The way agriculture works for development varies across countries depending on the role of agriculture as engines of growth in the country: whether they are agriculture-based countries, transforming countries, or urbanized countries (McCaig & Pavcnik, 2013; World Bank, 2007).

As a transforming country, Indonesia’s decline in its value added agriculture share to GDP occurred faster than the decline in its agriculture employment share to total employment (Byerlee, de Janvry, & Sadoulet, 2009). Statistics Indonesia reported that agriculture sectors absorbed 40% of total employment in the past decade. While it has steadily decreased over the years, employment in the agriculture sectors in 2017 still accounted for 31.86% of all employment in Indonesia, making agriculture a vital sector to ensure livelihoods. Agriculture also plays another important role due to the interdependence between the agricultural sector and the industrial sector that might vary and change over time (Ahluwalia, 1986; Rangarajan, 1982). Indonesia’s 2005 Input-Output Table reported that there is a strong linkage between the two sectors, meaning that the agricultural sector is still important for the development and transformation of the economy. Moreover, Statistics Indonesia (BPS) (2020) recently reported that during the pandemic of Covid-19, Indonesia’s economic growth in the second quarter of 2020 (y-on-y) contracted by -5.32%, while the agriculture sector still experienced growth of 2.19%, an indication of the agriculture sector resilience. These facts highlight the importance of agriculture from the macro side of the economy.

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The micro side tells a different story with regards to the agricultural sector. In 2019, 49.38% of the households that are considered poor (based on the Statistics Indonesia poverty line) come from the primary sector, with the poverty rate of households in the agricultural sector being 14.35%, higher than any other sector. Over the years, neither the incomes nor the expenditures of agricultural households have increased significantly. Another measure of agricultural welfare is the farmers’ terms of trade, which shows the ratio between the price received by farmers and the price paid by farmers and can be used to gauge the purchasing power of farmers. The farmers’ terms of trade has continuously decreased since 2012, meaning that the purchasing power of farmers has persistently declined. This supports the claim that the welfare of agricultural households has worsened over the years, raising the question that despite their crucial role to the economy, why do agricultural households remain the most impoverished.

Reducing poverty requires more efforts to develop the agricultural sector. The pathways out of rural poverty in transforming countries like Indonesia include shifting to high-value agriculture, decentralizing nonfarm economic activities in rural areas, and providing assistance to help move people out of agriculture (World Bank, 2007). Ravallion and Chen (2007), Christiaensen and Demery (2007), and Cervantes-Godoy and Dewbre (2010) have said that the development of income in the agricultural sector has the most potent effect on decreasing poverty. Moreover, no country can sustain a rapid transition out of poverty without raising productivity in its agricultural sector (Timmer & Akkus, 2008). In the case of Indonesia, during 1993–2000 most of the rural agricultural poor people who escaped poverty did so without moving to urban areas. Changes in agricultural prices, wages and productivity played a critical role in making it possible for them to move out of poverty (McCulloch, Timmer, & Weisbrod, 2007).

Any discussion about agriculture and welfare must refer to the Arthur Lewis’s unlimited labor supply model or dual sector theorem (1954) which says that the development of agriculture should be done by moving agricultural workers (traditional sector) to non-agricultural sectors (modern sector). This is due to the modern sector having higher marginal productivity of labor, while the agricultural sector experiences zero marginal productivity of labor. Higher marginal productivity means that farmers who move to the modern sector will receive higher wages and will be guaranteed to be better off. Two implications of the dual sector theorem are labor mobility and a change in land ownership. When a farmer leaves agriculture, their land ownership will be affected as farmland will be sold to buy smaller high productive agricultural land or non-agricultural assets (capital) that give higher returns (Ding et al., 2009; Li & Li, 2017). In short, when a farmer leaves agriculture not only do they change their occupation, but their asset portfolio is also affected, and their welfare should increase.

In Indonesia, the trend of farmers leaving agriculture has been observed both from Statistics Indonesia’s and the panel data of Indonesia Family Life Survey’s (IFLS) data (see Fig. 1). The share of workers in agriculture has continually decreased while the share of non-agricultural workers has increased. This movement of labor into the non-agricultural sector corroborates the Lewis dual sector theorem.

From an asset-portfolio perspective, based on the 2014 IFLS, agriculture land represents 61% of the total business assets (farm and nonfarm business) held by agricultural households. From a business
perspective, farmland continues to be the main asset for generating income in agricultural households. However, ownership of farmland has constantly decreased since the year 2000 among both agricultural and non-agricultural households (see Fig. 2). This decrease in farmland may be due to farmland reinvested into non-agricultural sectors or to land transformation for industrialization needs, or the land may have been inherited by and divided between children living in different households. Thus, ownership of land per household has decreased, also in accordance with the Lewis dual sector theorem. However, while labor and farmland trends in Indonesia follow the theorem, this does not guarantee that farmers’ welfare improves together with movement out of agriculture.

Given of the importance of agriculture issues for development in Indonesia, it is striking that empirical studies are relatively scare and there is few variation in data and methodologies between existing studies (Alisjahbana & Manning, 2006; McCulloch et al., 2007; Timmer & Akkus, 2008; Yamauchi, 2014). Thus, given the Arthur Lewis theorem, we aim at evaluating how labor mobility and change of farmland ownership will impact the welfare of agricultural households and the incidence of poverty using the last three waves of the IFLS dataset and by applying the quasi-experiment impact evaluation approach. This study measures welfare using expenditure per capita, and defines poverty as those whose expenditure per capita are below the $3.2 PPP per person per day. We intentionally uses the $3.2 poverty line as it is the international standard poverty line for lower-middle income countries, such as Indonesia. ¹ We did not apply the official Statistics Indonesia (BPS) poverty line due to different natures of the consumption dataset in the IFLS and the BPS dataset that can create a biased measurement of poverty (see (Dartanto, Moeis, & Otsubo, 2020) for the detailed discussion).

There are two main contributions of this study to the literature in the economics of agriculture, as the majority of the world’s poor earn their living from agriculture; therefore, understanding the economics of agriculture reveals much about the economics of being poor (Schultz, 1979). First, our study contributes a causal inference analysis using quasi experiment approach which can show clear impacts of labor mobility on agricultural household welfare. This study expands the study Alisjahbana & Manning (2006) that only infer association of agriculture with poverty. Second, this study provides empirical evidence on the existence of Lewis’ theorem in Indonesia of how the structural changes have affected the household welfare of agricultural sector. Our results show that moving out of agriculture sectors has significantly increased the welfare of poor agricultural households in the early 2000s, but is not the case in the late 2000s. During more recent times, simply moving out of agriculture will not guarantee the improvement of farmers’ welfare, particularly if farmers are landless. Therefore, we believe that this study

¹ In 2020 Indonesia is classified as upper middle income countries; however, during the period of 2000–2014, Indonesia was classified as lower middle income countries.
will promote awareness among policy makers about the need for a comprehensive approach to improve agricultural welfare.

The report proceeds as follows: the next section provides a theoretical framework of how labor mobility and farmland holding affect farmers' welfare; section 3 presents the methodological framework for the Difference in Difference (DiD) and the ordered logit models and the datasets used; section 4 analyses the findings and relationship(s) between labor mobility, farmland holding, and farmers' welfare; the concluding section of the paper summarizes the key findings and discusses policy implications.

2. Literature review: Labor mobility, landownership and agricultural household welfare

There are many literatures regarding factors that affect welfare mobility in agricultural sector. The Lewis (1954) dual sector economy model explains the relationship between the agricultural sector with the industrial sector, remarking upon the asymmetry or dualism between the two sectors. Agriculture uses land and labor in production, with farmland considered to be constant in the theorem. In contrast, industry uses capital and labor in production. Hence, capital accumulation only happens in industry, and the two sectors are related through the input of labor. In the beginning, the agricultural sector experiences zero marginal product of labor, meaning that the last unit of additional labor does not contribute anything to agricultural output. This implies that there are some forms of labor that can be moved to the industrial sector without sacrificing any agricultural output. This growth process will continue until the marginal product of labor in the agricultural sector is not zero any longer. This process will create growth in the economy, especially in the industrial sector.

Lewis’ dual sector model can be expanded by adding another relationship between the two sectors that has not been much explored. This has to do with the farmland and capital input used in each sector (agriculture and industry), as there exists a possibility that farmland is reinvested/reallocated into non-agricultural sectors/industrial sectors (Sarap, 1995) or used for industrialization needs (Tuyen and Huong, 2013). Farmland loss due to industrialization causes expansion and industrial development that creates urban areas, industrial zones, and improved local infrastructure. This form of industrialization will quicken the process of labor movement out of agriculture. However, not all farmers benefit from this, as farmers with low education end up jobless or in the informal sector (Nguyen et al., 2005; Tran et al., 2013).

There have also been several studies of labor mobility and its influence on welfare. On one side, Nguyen et al. (2005) in Vietnam found that as a result of industrialization which transformed farmland into non-agricultural uses, farmers experienced difficulties in finding employment due to their low education. Even if they were able to find jobs, these farmers could only work in the informal sector. Cook (1999) also believes that moving out of agriculture has high risks due to the uncertainty of getting a job that would be more beneficial than being a farmer. However, Johnson (1988) advocated that Chinese farmers should move out of the agricultural sector, as they would receive higher income and would reduce inequality. Alisjahbana and Manning (2006), using panel data in Indonesia, determined that workers who work in the agricultural sector tend to be poorer than workers in other sectors.

There have been many empirical studies done on the impact of
farmland size on income of the agricultural household. In Indonesia, Yamauchi (2014) showed that an increase in landholding would increase farmers’ incomes, a result similar to that found in other countries such as Poland (Csaki and Lerman, 2002) and Thailand (Rigg, 1988). Keswell and Carter (2014) found a more complex process, showing that when a farmer buys farmland, their welfare does not automatically increase. Rather, it first decreases income before gradually increasing it significantly, in some cases, by up to 150% of their initial income. This is because the farmer requires time to grow accustomed to the cultivation techniques needed for bigger plots of farmland they cultivate, but will eventually come to understand the techniques needed. This shows the importance of time frame for analysis.

While there have been many studies on landholding and land reform impacts, research on the impact of farmland loss/sales on welfare have been limited. There remains inconclusive evidence on the impact of farmland loss/sales on welfare. Sen (1966), Newell et al. (1997), Deininger and Jin (2003), and Deininger et al. (2009) showed that, as a consequence of selling land, the farmers’ incomes would increase due to the factor equalization of labor, allowing for more efficient cultivation of farmland. However, Nguyen et al. (2005) found that income worsened for farmers who had lost land due to industrialization as farmers with low education end up jobless or in the informal sector. Other results by Tuyen and Huong (2013) and Tran et al. (2013) show that farmland loss does not significantly decrease income or expenditure per capita. This is because they are short-run effects and have not incorporated the long-run effects of farmland loss. With such conflicting results, we aim to find some clarity through conducting in-depth research on the effects of labor mobility and farmland loss on welfare and poverty dynamics in Indonesia.

Other factors contributing to agriculture welfare include education. Formal education increases productivity of farmers due to better knowledge technical and allocative efficiency, non-formal education gives farmers on-hands training and helps improve farming skills, while informal education keeps farmers up-to-date with latest innovations and share experiences among farmers (Oduro-ofori et al., 2014; O’Donoghue & Heanue, 2018). There is also indication that the skills between farmers are heterogenous; thus, productivity is higher for certain farmers (Bryan & Morten, 2019). Education also improved the likelihood of farmers to adapt technology and access markets which improves productivity and income (Awotide, Karimov, & Diagne, 2016). Education also increases the chance of farmers to work in formal employment (Leavy & Hossain, 2014).

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When using the term “labor mobility”, the writer refers to Sectoral labor mobility (whether the individual moves to a different job sector which may involve or not involve spatial labor.

3 We do not fully accommodate the heterogeneity among farmers in the model as it is quite difficult to be applied. However, we have tried to control with variables such as location origin (Java/Non-Java and Urban/Rural) explained in Bryan & Morten (2019) to minimize these heterogeneities.
Table 2
DID Estimation Results of 2000–2007.

| VARIABLES | All Sample Agriculture HH | Agriculture HH of Informal Sector | Landless Agriculture HH | Landless Agriculture HH in Informal Sector | Agriculture HH with Land ownership |
|-----------|---------------------------|---------------------------------|-------------------------|-------------------------------------------|----------------------------------|
| Year (1 = 2007; 0 = 2000) | −1.203*** (0.087) | −1.287*** (0.092) | −1.344*** (0.168) | −1.444*** (0.215) | −1.362*** (0.129) |
| Move Out of Agriculture (1 = Moving Out of Agriculture; 0 = others) | −0.527*** (0.111) | −0.384** (0.189) | −0.20 (0.44) | −0.189 (0.04) | 0.067 |
| Moving to Formal Sector (1 = Moving to Formal Sector; 0 = others) | −0.012 (0.209) | 0.18 (0.055) | 0.633 (0.445) | −0.113 (0.099) | −0.226*** (0.141) |
| Farmland Decrease (1 = Farmland decrease; 0 = others) | −0.039*** (0.012) | −0.019 (0.014) | −0.012*** (0.014) | −0.012*** (0.014) | −0.041** (0.021) |
| Ownership of Farming Land per Capita (Log) | 0.001 (0.002) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) | −0.002 (0.002) |
| Years of Schooling of HH Head (in Years) | 0.009 (0.011) | 0.013 (0.023) | 0.010 (0.007) | 0.008 (0.007) | 0.009 (0.007) |
| Age of HH Head (in Years) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) |
| Location (1 = urban; 0 = other) | −0.329*** (0.107) | 0.348*** (0.128) | 0.031 (0.051) | 0.228 (0.065) | 0.388*** (0.081) |
| Province (1 = Java; 0 = Non-Java) | 0.044 (0.083) | 0.079 (0.092) | 0.031 (0.012) | 0.213 (0.019) | 0.125 (0.098) |
| Electricity in Household (1 = Has Electricity; 0 = Doesn’t Have Electricity) | −0.514*** (0.120) | −0.483*** (0.130) | 0.043 (0.035) | 0.080 (0.059) | 0.022 (0.053) |
| Farm Business Assets per Capita (Rupiah) | −0.007*** (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Off-Farm Secondary Job (1 = Has Off-Farm Job; 0 = Doesn’t) | −0.123 (0.109) | −0.028 (0.030) | 0.059* (0.119) | 0.204 (0.033) | 0.077** (0.033) |
| Constant | 2.291*** (0.168) | 2.072*** (0.192) | 1.652*** (0.214) | 1.175*** (0.184) | 1.122*** (0.218) |
| Observations | 5,258 | 4,026 | 1,902 | 964 | 3,356 |
| R-squared | 0.122 | 0.123 | 0.124 | 0.135 | 0.134 |
| Number of hh_id | 2,629 | 2,629 | 2,013 | 951 | 482 |

Note: *** p < 0.01, ** p < 0.05, * p < 0.1; Standard errors in parentheses Source: Authors’ estimation

Agricultural physical assets also play an important role in improving welfare (Israr & Khan, 2010). Agricultural assets can be used to increase productivity which increases harvest (Yamauchi, 2014; Winters et al., 2020). Accumulation of physical assets also help agricultural households access financial institutions which may reduce poverty (Chigungha, Svotwa, Govere, & Chikazze, 2020). Access to infrastructure increases productivity and income for farmers. For example, electricity access increases the access of agricultural information for small-scale farmers through television, mobile phones, etc. (Abdul-Salam & Phimister, 2017; Ahuwalia, 1986).

Off-farm work has also contributed to better welfare of agriculture households as a means for diversification of income (Ellis & Freeman, 2004; World Bank, 2020). Off-farm jobs help as additional income or as an alternative source of income between periods of harvest and if crop loss happens. Off-farm jobs play a crucial role in providing the means to overcome food poverty for poor households (Zereyesus, Embaye, Tisboe, & Amanor-Boadu, 2017).

3. Data and methodology

The study utilizes the last three waves (2000, 2007 and 2014) of the Indonesia Family Life Survey (IFLS) to measure the impacts of moving out of agriculture as well as the decrease in farmland on agricultural household welfare. The first IFLS sample frame in 1993 stratified the population into 13 major provinces covering roughly 83% of the population. The IFLS dataset contains uniquely detailed information on household demographics, economic characteristics, consumption behaviour, health status and access to community facilities and social safety nets (Frankenberg & Karoly, 1995; Frankenberg & Thomas, 2000). Unlike many longitudinal household surveys in developing countries, the attrition rate of the IFLS between the baseline survey and the second follow-up survey is low at only 5% (Thomas et al., 2012), while the attrition of IFLS between the baseline survey and the fifth wave of IFLS 2014 is only 16.33% (Dartanto et al., 2020). Although the IFLS was conducted in 1993, 1997, 2000, 2007 and 2014, this paper does not utilize all five waves of the IFLS, due to the unavailability of data on farmland size in the 1993 and 1997 surveys. Farmland size was only added to the survey in the year 2000. Thus, our analysis spans the years 2000 through 2014, and the sample is further limited to agricultural households, defined as households in which the head of household works in the agricultural sector.

We employ mainly two econometric models. The first model is a quasi-experiment approach, where the Difference-in-Differences (DiD) technique is used to estimate impacts of movement out of agriculture and decreases in farmland on the welfare of agricultural households. The welfare of agricultural households is measured through two indicators: households’ poverty statuses which are determined using a poverty line of $3.2 PPP (Purchasing Power Parity) per person per day (see Dartanto et al., 2020) for the detailed calculation), and households’ expenditures per capita per month. The second model is an ordered logit model to estimate the relationship of moving out of agriculture and decreases in farmland on poverty dynamics. Poverty dynamics are measured through the spell approach of poverty incidence (Baulch & Hodginton, 2000; Dartanto et al., 2020; Yaqub, 2000). This study then divides the analyses into three periods, 2000 – 2007 (short-run), 2007 – 2014 (short-run), and 2000 – 2014 (long-run), so that it is possible to conduct robustness checks of estimation and compare the impacts between different time horizons.
The DiD method is an impact evaluation method that emphasizes the comparison between treatment and control groups before and after interventions. If the outcome of the treatment groups improves/decreases faster than the control groups after the intervention (controlling for other factors), the treatment is considered to be effective towards the outcome. We mainly use three treatments: movement out of agriculture, movement to the formal sector, and decrease in land ownership.

We mainly use three treatments: movement out of agriculture, movement to the formal sector, and decrease in land ownership.

| VARIABLES | (1) All Sample Agriculture | (2) Agriculture HH of informal Sector | (3) Landless of Agriculture HH in Informal Sector | (4) Landless of Agriculture HH in Formal Sector | (5) Agriculture HH with Land Ownership |
|-----------------|---------------------|---------------------------------|--------------------------------------|--------------------------------------|--------------------------|
| Year (1 = 2014; 0 = 2007) | −1.590*** 0.359*** | −1.573*** 0.379*** | −2.015*** 0.394*** | −1.885*** 0.425*** | −1.410*** 0.453*** |
| Move Out of Agriculture (1 – 2007) | (0.115) (0.021) | (0.106) (0.019) | (0.196) (0.032) | (0.188) (0.033) | (0.165) (0.030) |
| Farmland Decrease (1 – 2007) | −0.185 0.002 | −0.181 0.010 | −0.181 0.010 | −0.181 0.010 | −0.181 0.010 |
| Moving to Formal Sector (1 – 2007) | −0.380* 0.062 | −0.008 0.010 | | | |
| Ownership of Farming Land per Capita (Log) | −0.003 0.010** | −0.012 0.012** | | | |
| Years of Schooling of HH Head (in Years) | −0.051*** −0.012** | −0.041*** −0.015** | −0.103*** −0.017* | −0.097*** −0.012 | −0.022 −0.007 |
| Age of HH Head (in Years) | −0.003 0.001 | −0.005 0.001 | −0.003 −0.004 | −0.008 −0.006* | −0.005 0.003 |
| Location (1 = urban; 0 = other) | | | | | |
| Province (1 = Java; 0 = Non-Java) | 0.265*** −0.408* 0.297*** −0.416 | 0.051 −0.392* | | | |
| Electricity in Household (1 = Has Electricity; 0 = Doesn’t Have Electricity) | −0.967*** 0.146*** | −0.979*** 0.150*** | −1.169*** 0.188*** | −1.213*** 0.197*** | −0.822*** 0.119*** |
| Farm Business Assets per Capita (Rupiah) | −0.000*** 0.000** | −0.000*** 0.000* | −0.000*** 0.000* | −0.000*** 0.000* | |
| Off-Farm Secondary Job (1 = Has Off-Farm Job; 0 = Doesn’t Have Off-Farm Job) | −0.044 −0.019 | −0.082 −0.017 | 0.190 −0.014 | 0.136 −0.006 | 0.241* −0.017 |
| Observations | 5,184 | 5,184 | 4,602 | 4,602 | 2,086 |
| Regressed | 2.752 | 2.752 | 2.301 | 2.301 | 1.043 |

Note: *** p < 0.01, ** p < 0.05, * p < 0.1; Standard errors in parentheses
Source: Authors’ estimation

The econometric models are as follows (Khandker, Koolwal, & Samad, 2009):

\[ Poverty_{3,2} = \theta_1 Year_n + \theta_2 Treatment_i + \theta_3 Treatment_i \times Year_n + \sum_{j=1}^{J} \beta_j SocioDemo_j + \sum_{m=1}^{M} \gamma_m Econoic_m + \epsilon_n \]  
\[ (1) \]

\[ ExpPerCapita_{it} = \beta_1 Year_{it} + \beta_2 Treatment_i + \beta_3 Treatment_i \times Year_{it} + \sum_{j=1}^{J} \beta_j SocioDemo_j + \sum_{l=1}^{L} \beta_l Regional_i + \sum_{n=1}^{N} \gamma_n Economic_n + \epsilon_{it} \]  
\[ (2) \]

Where, Poverty 3.2 is a binary variable, 1 = poor under the poverty line of $3.2/capita/day and 0 = non-poor; ExpPerCapita is log expenditure per month per capita; Year is a binary variable, 1 = the post treatment year (2007 & 2014) and 0 = the baseline year or pre-treatment (2000 & 2007); Treatment is a binary variable of treatment (1 = Treatment; 0 = No-Treatment), with treatments being movement out of agriculture, movement to the formal sector and decrease in land per capita (see notes of Table 1). All pre-treatment (the initial year) of samples is 0; therefore, the typical DiD regression omits the treatment variable as it the same as the treatment and year interaction variable (Treatment \times Year) due to collinearity. SocioDemo is a set of socio-demographic variables including years of schooling, age of household head, land ownership per capita; Regional is a set of location variables including rural–urban location and provincial dummy; Economic is a set of economic variables including access to electricity, farm business assets, and off farm secondary jobs; i denotes an agricultural household with i = 1,2,3, ..., n; and t denotes the years of 2000, 2007, 2014. The poverty regression (Eq. (1)) is estimated using the random effect Logit Regression due to the poverty status being a binary variable, while the expenditure per capita regression (Eq. (2)) uses the fixed effect regression. The descriptive statistics of variables for the estimations of impact evaluation are shown in Table A1, B1 & C1.

The IFLS panel data enables a clear division between the control and intervention groups which allows us to explore whether households experiencing the treatment during the relevant periods also experienced an increase or decrease in their welfare. Therefore, this strengthens the
confirm that the parallel assumption of landowner subsample holds (Khandker et al., 2009), and Figs 3a, 3b and 3c show the parallel trend.

The econometric models of ordered logit regression are as follows:

\[
PovDynamic = \theta_1 \text{LandDec} + \theta_2 \text{LaborMob} + \theta_3 \text{FormalLabMob} + \sum_{j=1}^{J} \theta_{j\text{SocioDemo}} + \sum_{i=1}^{I} \theta_{i\text{Regional}} + \sum_{m=1}^{M} \theta_{m\text{Economic}} + \epsilon_i
\]

Where \( PovDynamic \) is the household’s experience of being in poverty. This study uses the spell approach to categorize households into three (four) ordered groups based on how many times households experienced poverty. The dependent variable of poverty experience can be represented as \( 0 = \) never poor; \( 1 = \) poor once; \( 2 = \) poor twice; \( 3 = \) poor three times or chronically poor. In the period of 2000–2007 and 2007–2014, the maximum of poverty experiences is twice, while in the period of 2000–2007, the maximum of poverty experiences is three times. \( \text{LandDec} \) is the decrease in land ownership; \( \text{LabMob} \) is labor mobility out of agriculture; \( \text{FormalLabMob} \) is movement out of agriculture to non-agriculture formal sector. Again, \( i \) represents the household observation—\( i = 1, 2, 3, \ldots, n \). The descriptive statistics of variables for the estimations of poverty dynamics are shown in Tables A2, B2 & C2.

We estimate four ordered logit models using the whole sample of

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**Table 4**

| VARIABLES | (1) All Sample Agriculture HH Poor,3,2 Inpce | (2) Agriculture HH ofinformal Sector Poor,3,2 Inpce | (3) Landless of Agriculture HH Poor,3,2 Inpce | (4) Landless of Agriculture HH in Informal Sector Poor,3,2 Inpce | (5) Agriculture HH withLand ownership Poor,3,2 Inpce |
|-----------|---------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|
| Year (1 – 2014; 0 – 2000) | \(-2.783***\), 1.589*** | \(-2.680***\), 1.604*** | \(-3.222***\), 1.555*** | \(-3.091***\), 1.614*** | \(-2.554***\), 1.714*** |
| | (0.168) | (0.024) | (0.173) | (0.024) | (0.318) | (0.039) | (0.395) | (0.064) | (0.225) | (0.035) |
| Move Out of Agriculture (1 – Moving Out of Agriculture; 0 – others) | -0.196 0.070** | -0.426* 0.129** | (0.140) | (0.031) | (0.244) | (0.052) |
| Moving to Formal Sector (1 – Moving to Formal Sector; 0 – others) | -0.399 0.141*** | -0.234 0.088 | (0.249) | (0.053) | (0.505) | (0.113) |
| Farmland Decrease (1 – Farmland decrease; 0 – others) | -0.021 0.021*** | -0.010 0.020*** | (0.015) | (0.005) | (0.017) | (0.005) |
| Ownership of Farming Land per Capita (Log) | -0.085** 0.001 | -0.064*** -0.002 | (0.014) | (0.004) | (0.015) | (0.005) |
| Years of Schooling of HH Head (in Years) | 0.001 0.000 | 0.000 | (0.002) | (0.001) | (0.002) | (0.001) |
| Age of HH Head (in Years) | 0.147 0.034 | 0.161 0.031 | (0.126) | (0.039) | (0.152) | (0.044) |
| Location (1 – urban; 0 – other) | -0.109 -0.266 | -0.060 -0.517 | -0.446** -0.113 * | (0.101) | (0.316) | (0.112) | (0.320) | (0.188) | (0.462) | (0.263) | (0.496) | (0.121) | (0.411) |
| Province (1 – Java; 0 – Non-Java) | -0.247 0.090** | -0.225 0.104** | -0.090 0.110 | (0.151) | (0.038) | (0.164) | (0.043) | (0.288) | (0.064) | (0.364) | (0.088) | (0.177) | (0.048) |
| Electricity in Household (1 – Has Electricity; 0 – Doesn’t Have Electricity) | -0.000 0.000*** | -0.000 0.000*** | -0.000 0.000*** | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Off-Farm Secondary Job (1 – Has Off-Farm Job; 0 – Doesn’t Have Farm Off-Job) | -0.117 0.040 | -0.126 0.027 | 0.045 -0.012 | (0.121) | (0.029) | (0.132) | (0.032) | (0.238) | (0.053) | (0.303) | (0.064) | (0.140) | (0.035) |
| Number of hh,لد | 2.115 2.115 | 1.631 1.631 | 735 735 | 369 369 | 1,380 1,380 |

Note: *** p < 0.01, ** p < 0.05, * p < 0.1; Standard errors in parentheses

Source: Authors’ estimation

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The exploratory variables are divided into two main groups: the initial variables and change variables.

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5 Due to the subsample of farmland decrease not fulfilling the parallel trend assumption based on pure trends (without control variables), we check whether the parallel trend assumption is fulfilled after controlling for the factors used in our regression model. Thus, we reestimated the model and used the predicted outcome of the model as the dependent variable for our parallel trend assumption graph.

6 The independent variables are drawn from only the initial period in order to avoid/minimize problems of endogeneity with poverty spell. This approach could not resolve all endogeneity problems, because unobserved heterogeneity could not be completely identified. We therefore need to be cautious in interpreting causal effects from the results.
agricultural households, subsample of landless households, subsample of households in Java and subsample of households Outside of Java. The estimation of poverty dynamics using landless farmers are validated whether the assumption of the Lewis model that labor mobility improves welfare flows empirically in the case of Indonesia.

4. Results and discussion

4.1. The impact of land and labor mobility in the welfare of agriculture households

Tables 2-4 show the results from the impact evaluation on poverty and real expenditure per capita. Based on all regressions, we find that the year variable which represents the trend of the dependent variable shows improvement in both indicators (less probability of being poor and increased expenditure per capita). This is line with the macroeconomic developments where the Indonesian economy continuously improved after the Asian Financial Crisis. Between 2000 and 2014, GDP per capita increased from USD 780 to USD 3,492. The year trend may show the continuously increasing productivity of the agriculture sectors (Dartanto, Zheng, Yuan, & Sofiyandi, 2018). The share of agriculture sectors of GDP did not change much from 15.68% (2000) to 13.72% (2007) and to 13.34% (2014), while the share of employment in agriculture changed from 45.31% (2000), to 41.38% (2007) and to 34.28% (2014). Thus, as productivity increases, the welfare of agricultural households will consequently increase.
Thus, the Arthur Lewis theorem holds true in the past but fails to explain poverty and a long term persistent effect on the welfare of landless households. However, Tables 2–4 could not confirm a robust and consistent finding to support the dual sector theorem of Arthur Lewis. Thus, the Arthur Lewis theorem holds true in the past but fails to explain current trends.

One possible explanation to this finding is Indonesia’s structural transformation: the economy experienced immature transformation, jumping from agriculture to services, while industrialization faltered (Dartarto et al., 2018). The macroeconomic data shows that different patterns were prevalent during the period of 2000–2007 and 2007–2014. In 2000–2007, the productivity of industrial sectors decreased while the productivity of the services sector increased. This was reversed in 2007–2014, when the productivity of industrial sectors increased and the productivity of the services sector sharply declined. Moreover, during 2007–2014, the employment share of the services sector grew faster than the GDP share of the sector, indicating a decrease in productivity during the period.

In the earlier years of 2000–2007, agriculture’s productivity was relatively low compared to other sectors such as industry and services. Therefore, the movement out of poverty improved the welfare of agricultural households. However, along the years, the productivity of agriculture sectors recovered slightly due to labor movements out of agriculture to other sectors; however, the productivity in other sectors (industry and services) stagnated. Consequently, in 2007–2014, labor mobility represented movement from low productivity agriculture to other sectors; however, the productivity in other sectors recovered slightly due to labor movements out of agriculture sectors.

Table 6

| VARIABLES | 2000–2007 | 2000–2007 | 2000–2007 | 2000–2007 | 2000–2007 | 2000–2007 | 2000–2007 | 2000–2007 |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Ordered Logit Poverty $3.2 | Marginal Effects | Never Poor (0) | Always Poor (2) | Never Poor (0) | Always Poor (2) | Never Poor (0) | Always Poor (2) | Never Poor (0) | Always Poor (2) |
| Labor Status Change in 2000–2007 (1 = Moving Out of Agriculture; 0 = Stays in Agriculture) | -0.413*** (0.141) | 0.060*** (0.020) | -0.095*** (0.032) | -0.389** (0.187) | 0.050** (0.024) | -0.042** (0.020) |
| Labor Status Change in 2007–2014 (1 = Moving Out of Agriculture; 0 = Stays in Agriculture) | -0.175 (0.160) | 0.040 (0.032) | -0.021 (0.017) | 0.070 (0.195) | -0.009 (0.025) | 0.008 (0.021) |
| Moving Out to Formal Sector in 2000–2007 (1 = Moving Out from Agriculture to Non-Agr Formal; 0 = Other) | -0.052 (0.232) | 0.008 (0.034) | -0.012 (0.053) | 0.151 (0.271) | -0.019 (0.035) | 0.016 (0.029) |
| Moving Out to Formal Sector in 2007–2014 (1 = Moving Out from Agriculture to Non-Agr Formal; 0 = Other) | -0.262 (0.186) | 0.061 (0.043) | -0.031 (0.022) | -0.749*** (0.283) | 0.094*** (0.036) | -0.080*** (0.031) |

Note: Standard Error in parentheses; * p < 0.10 **p < 0.05 *** p < 0.01; HH = household.
Source: Authors’ estimation.

Between 2000 and 2007, movement out of agriculture significantly decreases the probability of being poor for both the landless sample and the whole sample of agricultural households as the Lewis theorem predicted. However, surprisingly, movement out of agriculture between 2007 and 2014 did not significantly affect poverty status or expenditures. This indicates that while initially (during the period of 2000–2007) moving out agriculture did improve welfare conditions in the short-run, it does not ensure welfare improvement welfare in the more recent period of 2007–2014. Table 2 shows an interesting finding in which the short-term, labor mobility is very beneficial for the poor but not as beneficial for the non-poor. Table 2 confirms that moving out of agriculture (both in all sample and landless HH) significantly reduces the probability of being poor but will not significantly affect the increase in per capita expenditure. Meanwhile, in the long run, moving out of agriculture significantly lowers the probability of being poor and increases real expenditure per capita. Moving out of agriculture for landless households had an immediate effect on movement out of poverty and a long term persistent effect on the welfare of landless households. However, Tables 2–4 could not confirm a robust and consistent finding to support the dual sector theorem of Arthur Lewis. Thus, the Arthur Lewis theorem holds true in the past but fails to explain current trends.
also low productivity services, which does not improve welfare significantly. Long-run patterns support the short-run trends by indicating that most households were able to reap the benefits of labor mobility largely from the initial years. As the productivity of industry and services continue to stagnate, the impacts of labor mobility on welfare may become questionable.

We also analyze the welfare impacts of movements into the formal sector. Workers are considered within the formal sector if their job statuses fall within the categories of doing business with permanent workers, government employee, or private employee. Movement into the formal sector includes movements into the formal agricultural sector or the formal non-agricultural sector. However, around 70% of household sample move to non-agriculture formal sector. Table 2 shows that between 2000 and 2007, movement into formal sector did not significantly affect poverty nor welfare, while in 2007–2014, movement into the formal sector reduced the probability of being poor in all initially informal households (Table 3). In the long run, moving into the formal sector only significantly improved real expenditure per capita, with no significant effect towards lifting households out of poverty (Table 4). There is no persistent effect of movement to formal sector on poverty and household welfare.

DiD estimations in Tables 2–4 confirm that land ownership is clearly important for the welfare of agricultural households. When agricultural households decrease their land, their log expenditure per capita will significantly decrease by 0.226 in the period of 2000–2007 and by 0.200 in the period of 2007–2014. These numbers are equivalent to a per capita expenditure per month reduction of IDR 36,833 in 2000 and IDR 68,683 in 2007. Farmland is an important asset for agricultural households to grow their harvest, and last farmland results in lower output produced by farmers, thus decreasing consumption. Equally interesting is the finding that the decrease in farmland did not affect the probability of landowner agricultural households being poor, but only reduced their expenditure per capita. This may be due to landowners not selling their entire ownership, therefore preventing them from falling into poverty. Our findings are similar to the findings of Nguyen et al. (2005), but contradict to Tuyen and Huong (2013) and Tran et al. (2013) showing that farmland loss does not significantly decrease income or expenditure per capita.

Control variables also give insight on how agricultural households may improve their welfare. Education levels show that agricultural households with higher education levels have a lower chance of being poor, highlighting the importance of education. Education for farmers may improve productivity through better knowledge and skills regarding agricultural processing and techniques. Our results support findings in other countries such as O’Donoghue & Heanue (2018), Oduro-ofori et al. (2014) and Awothide et al., (2016). Electrical access and farmland asset ownership also significantly increases expenditure per capita and lowers the probability of being poor. These also follow the findings of Abdul-Salam & Phimister (2017) and Winters et al. (2009). This shows that infrastructure access and modernization of agriculture are key to improving the productivity of agricultural households.

4.2. The role of land and labor mobility in poverty Dynamics

We complement the Difference in Difference (DiD) estimations with the ordered logit models, which estimates the determinants of poverty
dynamics. These estimates confirm whether land ownership and labor mobility have long term persistent effects on poverty and how frequently households fall into poverty. Table 5 shows the estimates for the whole sample of agricultural households, while Table 6 shows the estimates based on the sample of landless households. We also estimate the poverty dynamics of households with locations in Java and Non-Java (Table 7). All estimation results are quite robust and consistent. Robustness checks are also conducted through estimating the models using a different poverty threshold by changing the poverty line from $3.2$ PPP to $1.9$ PPP (see Table A4).

The first variable of interest is the log of initial farmland per capita (see Table 5). The coefficient is negative in all periods, but are significant only during 2000–2007 and 2000–2014. A one percent increase in initial farmland per capita will decrease the probability of the household being continuously poor by 1.2 percentage points. Farmland ownership is highly associated with a low poverty incidence (Burgess, 2001; Deininger et al., 2009). Conversely, a decrease in land ownership will increase poverty incidence. Table 5 confirms that agricultural households who experienced a decrease in the land ownership tend to be chronically poor: the probability of being chronically poor increases by 2.4 percentage point. This finding is similar to the case of Vietnam, where a decrease of land ownership also increases the probability of being continuously poor (Tran et al., 2013). However, this condition is only observed in the period of 2000–2007 and in the period of 2000–2014. In the period of 2007–2014, both the initial ownership of land and the decrease of land ownership are consistently insignificant in influencing the probability of agricultural households being poor. Hence, our estimations demonstrate a thought-provoking result in which the role of farmland for agricultural households were an important determinant of agricultural welfare in the past, but may be less crucial in recent conditions.

In the context of labor mobility, the coefficient of the moving-out-of-agriculture variable is negative in 2000 $–$ 2007 (short run) and 2000–2014 (long run) which is consistent with earlier results. The

| Table A1 | Descriptive Statistics of Impact Evaluation of Period 2000–2007. |
|----------|---------------------------------------------------------------|
| Variable | Obs. | Mean | Std. Dev. | Min | Max |
| $3.2$ PPP Poverty Status (1 = Poor; 0 = Non-Poor) | 5,258 | 0.58 | 0.49 | 0 | 1 |
| Real Expenditure (Ln) | 5,258 | 11.98 | 0.64 | 8.97 | 15.11 |
| Move Out of Agriculture (1 = Moving Out of Agriculture; 0 = others) | 5,258 | 0.16 | 0.37 | 0 | 1 |
| Formal Sector (1 = Formal Sector; 0 = Informal Sector) | 5,258 | 0.18 | 0.39 | 0 | 1 |
| Farmland Decrease (1 = Farmland decrease; 0 = others) | 5,258 | 0.20 | 0.40 | 0 | 1 |
| Ownership of Farming Land per Capita (Log) | 5,258 | 4.23 | 3.67 | 0 | 15.42 |
| Years of Schooling of HH Head (in Years) | 5,258 | 4.54 | 3.77 | 0 | 18 |
| Age of HH Head (in Years) | 5,258 | 49.97 | 23.37 | 15 | 99 |
| Location (1 = urban; 0 = other) | 5,258 | 0.18 | 0.38 | 0 | 1 |
| Province (1 = Java; 0 = Non-Java) | 5,258 | 0.50 | 0.50 | 0 | 1 |
| Electricity in Household (1 = Has Electricity; 0 = Doesn’t Have Electricity) | 5,258 | 0.86 | 0.34 | 0 | 1 |
| Farm Business Assets per Capita (Rupiah) | 5,258 | 7,679,478 | 26,200,000 | 0 | 601,000,000 |
| Off-Farm Secondary Job (1 = Has Off-Farm Job; 0 = Doesn’t Have Farm Off-Job) | 5,258 | 0.13 | 0.34 | 0 | 1 |

Source: Authors’ calculation based on Indonesia Family Life Survey.

| Table B1 | Descriptive Statistics of Impact Evaluation of Period 2007–2014. |
|----------|---------------------------------------------------------------|
| Variable | Obs. | Mean | Std. Dev. | Min | Max |
| $3.2$ PPP Poverty Status (1 = Poor; 0 = Non-Poor) | 5,184 | 0.33 | 0.47 | 0 | 1 |
| Real Expenditure (Ln) | 5,184 | 12.86 | 0.62 | 10.81 | 16.24 |
| Move Out of Agriculture (1 = Moving Out of Agriculture; 0 = others) | 5,184 | 0.24 | 0.43 | 0 | 1 |
| Formal Sector (1 = Formal Sector; 0 = Informal Sector) | 5,184 | 0.15 | 0.36 | 0 | 1 |
| Farmland Decrease (1 = Farmland decrease; 0 = others) | 5,184 | 0.16 | 0.37 | 0 | 1 |
| Ownership of Farming Land per Capita (Log) | 5,184 | 4.06 | 3.58 | 0 | 15.14 |
| Years of Schooling of HH Head (in Years) | 5,184 | 5.41 | 3.84 | 0 | 18 |
| Age of HH Head (in Years) | 5,184 | 47.61 | 13.72 | 17 | 93 |
| Location (1 = urban; 0 = other) | 5,184 | 0.21 | 0.41 | 0 | 1 |
| Province (1 = Java; 0 = Non-Java) | 5,184 | 0.46 | 0.50 | 0 | 1 |
| Electricity in Household (1 = Has Electricity; 0 = Doesn’t Have Electricity) | 5,184 | 0.95 | 0.22 | 0 | 1 |
| Farm Business Assets per Capita (Rupiah) | 5,184 | 16,900,000 | 44,700,000 | 0 | 1,000,000,000 |
| Off-Farm Secondary Job (1 = Has Off-Farm Job; 0 = Doesn’t Have Farm Off-Job) | 5,184 | 0.18 | 0.39 | 0 | 1 |

Source: Authors’ calculation based on Indonesia Family Life Survey.
probability of being poor decreases by 13.5 percentage points (short run) and 7.2 percentage points (long run) when agricultural households move out of agriculture sectors. Estimation results in Table 6 using only run) and 7.2 percentage points (long run) when agricultural households continually being poor. This phenomenon can again be explained by the progress of structural transformation in Indonesia (Dartanto et al., 2018), where the stagnation of productivity in non-agriculture sectors during 2007–2014 produced no welfare improvement from movement out of agriculture.

Although movement out of agriculture is insignificant during the period of 2007–2014, the estimation results in Tables 5 and 6 show that the type of movement out of agriculture which significantly improves welfare is the movement out from the agricultural sector into the formal non-agricultural sector. This is because the formal sector provides a larger and more stable income (Dartanto, Moeis, & Otsubo, 2020; Dartanto & Nurkholis, 2013). The probability of being always poor will decrease by 3.3 percentage points when agricultural households move out into formal non-agriculture sectors (Table 5). This presents a challenge to Arthur Lewis’s theorem that guarantees better welfare for agricultural households who move out into non-agricultural sectors. In Indonesia, evidence shows that movement out of agriculture did at one point make farmers better-off (i.e., in 2000–2007), but currently (i.e., in 2007–2014) fails to present any welfare improvements. These findings suggest that improving the welfare of agricultural households, especially landless agricultural households, requires not only a shift out of the agricultural sector to other sectors, but also necessitates that the shift be from the agricultural sector to formal non-agricultural sectors.

There are some control variables that should be noted. First, higher initial education levels reduce the probability of being chronically poor and show significance that is supported by Dartanto & Nurkholis, 2013; Tran et al., 2013. The importance of education for agricultural household is thus further emphasized: greater human capital promotes higher productivity. Initially having off-farm secondary jobs significantly reduces the probability of being continuously poor (except during 2007–2014). This follows the Ellis & Freeman (2004)’s finding in Africa and the Zereyesus et al. (2017)’s findings in Northern Ghana. World Bank (2020) also states that economic diversification is a typical pathway for economic prosperity. This diversification, while not always possessing high productivity, helps farmers have additional income and may mildly mitigate risks in their main agricultural occupation. Another variable of interest is the farm business asset variable. Farm business assets also have favorable impacts on poverty dynamics by reducing the probability of being poor, and is significant in all periods of analysis.

Table C1
Descriptive Statistics of Impact Evaluation of Period 2000–2014.

| Variable                                           | Obs  | Mean  | Std. Dev. | Min  | Max  |
|----------------------------------------------------|------|-------|-----------|------|------|
| $3.2$ PPP Poverty Status (1 – Poor; 0 – Non-Poor)  | 4,230| 0.46  | 0.50      | 0    | 1    |
| Real Expenditure (Ln)                              | 4,230| 12.66 | 1.03      | 9.55 | 16.65|
| Move Out of Agriculture (1 – Moving Out of Agriculture; 0 – others) | 4,230| 0.25  | 0.43      | 0    | 1    |
| Formal Sector (1 – Formal Sector; 0 – Informal Sector) | 4,230| 0.21  | 0.40      | 0    | 1    |
| Farm Land Decrease (1 – Farm land decrease; 0 – others) | 4,230| 0.19  | 0.40      | 0    | 1    |
| Ownership of Farming Land per Capita (Log)        | 4,230| 4.34  | 3.64      | 0    | 14.38|
| Years of Schooling of HH Head (in Years)           | 4,230| 4.88  | 3.89      | 0    | 18   |
| Age of HH Head (in Years)                          | 4,230| 49.83 | 24.86     | 17   | 99   |
| Location (1 – urban; 0 – other)                    | 4,230| 0.20  | 0.40      | 0    | 1    |
| Province (1 – Java; 0 – Non-Java)                  | 4,230| 0.48  | 0.50      | 0    | 1    |
| Electricity in Household (1 – Has Electricity; 0 – Doesn’t Have Electricity) | 4,230| 0.89  | 0.32      | 0    | 1    |
| Farm Business Assets per Capita (Rupiah)           | 4,230| 16,700,000 | 49,800,000 | 0    | 1,000,000,000 |
| Off-Farm Secondary Job (1 – Has Off-Farm Job; 0 – Doesn’t Have Farm Off-Job) | 4,230| 0.18  | 0.38      | 0    | 1    |

Source: Authors’ calculation based on Indonesia Family Life Survey.

Table A2
Descriptive Statistics of Poverty Dynamics of Period 2000 – 2007.

| Variable                                           | Obs  | Mean  | Std. Dev. | Min  | Max  |
|----------------------------------------------------|------|-------|-----------|------|------|
| $3.2$ PPP Poverty Dynamics                        | 2,629| 1.16  | 0.75      | 0    | 2    |
| $1.9$ PPP Poverty Dynamics                        | 2,629| 0.51  | 0.65      | 0    | 2    |
| Initial Ownership of Farming Land per Capita (Log) | 2,629| 4.50  | 3.72      | 0    | 15   |
| Farm Land Decrease (1 – Farm land decrease; 0 – others) | 2,629| 0.40  | 0.49      | 0    | 1    |
| Move Out of Agriculture (1 – Moving Out of Agriculture; 0 – others) | 2,629| 0.32  | 0.47      | 0    | 1    |
| Move Out to Formal Non-Agriculture (1 – Moving Out to Formal Non-Agriculture; 0 – others) | 2,629| 0.08  | 0.27      | 0    | 1    |
| Initial Years of Schooling of HH Head (in Years)   | 2,629| 4.41  | 3.68      | 0    | 17   |
| Years of Schooling of HH Head Increases (1 – Increase; 0 – Others) | 2,629| 0.25  | 0.43      | 0    | 1    |
| Initial Age of HH Head (in Years)                  | 2,629| 48.29 | 29.85     | 17   | 99   |
| Initial Location (1 – urban; 0 – other)            | 2,629| 0.15  | 0.36      | 0    | 1    |
| Initial Province (1 – Java; 0 – Non-Java)          | 2,629| 0.50  | 0.50      | 0    | 1    |
| Initial Access to Electricity in Household (1 – Has Electricity; 0 – Doesn’t Have Electricity) | 2,629| 0.80  | 0.40      | 0    | 1    |
| Average Farm Business Assets per Capita (Million Rupiah) | 2,629| 7.68  | 20.60     | 0    | 331  |
| Initial Off-Farm Secondary Job (1 – Has Off-Farm Job; 0 – Doesn’t Have Farm Off-Job) | 2,629| 0.15  | 0.36      | 0    | 1    |

Source: Authors’ calculation based on Indonesia Family Life Survey.
This result follows Tuyen and Huong (2013), as assets will improve the productivity of households. Thus, the modernization of agriculture is important for agricultural development.

We also sought an additional analysis by breaking down the samples into those households that were initially from the Java region and those initially from a Non-Java region to see if there regional differences exist in the behavior of the two samples (Table 7). From the poverty incidence model, the variable of initial farmland shows a negative sign for Non-Java households, which means that if initial farmland increases in Non-Java, then the probability of being continuously poor decreases. The positive sign for farmland dynamics in Non-Java regions indicates that when farmland decreases, the probability of being continuously poor will increase. The two variables for farmland show that while farmland issues are more prominent in Non-Java regions.

With regards to labor mobility, even when broken down into Java and Non-Java regions, most of the results are consistent with those of the aggregate sample. Labor mobility of agriculture decreases the probability of being continuously poor only in initial years, and only specific sectoral movements will reduce the probability of being continuously poor in later years. Controls such as initial education levels are also consistently significant in reducing the probability of being continuously poor. Off-farm secondary jobs decrease the probability of being continuously poor in 2000–2007 and in the long-run, corroborating the aggregate sample results. Average farm business assets significantly affect poverty incidence in both Java and Non-Java regions.

After obtaining the results from the quantitative data, we also sought to compare the results with the real situation of farmers. Our interviews found that farmland is indeed an important asset for agricultural households as it gives farmers the ability to self-produce and to create income for other uses that will increase the household’s welfare. We also found that moving out of agriculture currently is not necessarily a better option for farmers. Most farmers who moved to urban areas were unable to find steady jobs and worked in informal/low-income jobs. Eventually those farmers would return to their village and cultivate back to their old farmland.

5. Concluding remarks

Most economists believe Arthur Lewis’ dual theorem of that moving out of the agricultural sector to a non-agricultural sector will result in farmers being better off due to higher productivity in the non-agricultural sectors. Yet, the dual theorem might not always hold because it is dependent upon the time period, the stage of development, and the structural transformation of an economy. In earlier stages of development, when the economy is dominated by the agricultural

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7 We went to Tanjungkarang Village, which is located at Cigalontang Sub-District, Tasikmalaya District, West Java. We interviewed 4 farmers: Kang Karna, Kang Cepi, Kang Oja, and Teh Siti.
sector, labor mobility from the agricultural sector to other sectors will
increase the welfare of agricultural households, but when the economy
is relatively advanced, this mobility does not guarantee an increase in
the welfare of agricultural households.

In the case of Indonesia, we observed that both the number of agri-
cultural workers and average farmland ownership have continually
decreased during the past decade, which is in line with Lewis’ theorem.
Our study using Difference in Differences (DiD) regressions and ordered
logit regressions confirm that moving out of agriculture has significantly
increased the welfare of poor agricultural households especially in the
early 2000s. Labor mobility is very beneficial for the poor but less
beneficial for the non-poor as it significantly reduces the probability of
being poor but will not significantly affect per capita expenditure.

Moreover, moving out of agriculture is particularly important for
landless households, as labor mobility has an immediate effect on their
movement out of poverty and has a long-term persistent effect on their
welfare.

This condition, however, was true only in the early of 2000s, but
faded towards the end of the decade. When the Indonesian economy
transformed into a more advanced economy, simply moving out of
agriculture no longer guaranteed that farmers would become better off.

| VARIABLES | 2000-2007 Ord. Logit Marginal Effects | 2000-2007 Ord. Logit Marginal Effects | 2000-2007 Ord. Logit Marginal Effects | 2000-2007 Ord. Logit Marginal Effects | 2000-2007 Ord. Logit Marginal Effects |
|-----------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|           | Poverty $1.9                     | Never Poor (0)                    | Always Poor (2)                  | Poverty $1.9                     | Never Poor (0)                    |
| Initial Ownership of Farming Land per Capita (Log) | -0.040*** (0.019) | 0.009*** (0.004) | -0.003*** (0.001) | 0.046* (0.026) | -0.006* (0.003) | 0.001* (0.000) | -0.045** (0.019) | 0.010** (0.004) | -0.004** (0.002) |
| Change in Ownership of Farming land in 2000–2007 (1 = decrease in land; 0 = other) | 0.209* (0.113) | -0.046* (0.026) | 0.015* (0.009) | (0.124) | (0.028) | (0.010) |
| Labor Status Change in 2000–2007 (1 = Moving Out of Agriculture; 0 = Stays in Agriculture) | -0.119 (0.159) | 0.015 (0.020) | -0.001 (0.002) | 0.068 (0.104) | -0.016 (0.024) | 0.006 (0.008) |
| Moving Out to Formal Sector in 2000–2007, (1 = Moving Out from Agriculture to Non-Agric Formal; 0 = Other) | -0.210* (0.124) | -0.048* (0.028) | 0.017* (0.010) | -0.235** (0.124) | 0.053** (0.028) | -0.019** (0.010) |

Note: Standard Error in parentheses; * p < 0.10 **p < 0.05 ***p < 0.01; HH = household.
Source: Authors’ estimation.
of farmers and by the fact that most farmers who leave agriculture move into the informal sector. From a regional perspective, also it is also seen that this mobility is most effective in Non-Java regions (and even then, only in the earlier part of the decade).

Additionally, our study also obviously confirms that farmland is an important asset for agricultural households. Farmland should not be rashly sold or transformed for non-agricultural uses as the dual sector ownership decreases, agricultural households lose their main livelihoods, thus becoming prone to poverty and declines in welfare. This puts landless farmers in more dire straits. These farmers must either rent land or work in someone else’s farmland. The only source of income for these landless farmers is from their wages, which often fluctuates and therefore exacerbates their proneness to poverty and declines in welfare.

Our study suggests that policies must be centered on improving the productivity of farmers through vocational agricultural education and the modernization of agriculture. This research has shown that agricultural households with high education and high agricultural business assets are less prone to poverty and have higher welfare. The investment of human capital through education and of physical capital through the modernization of agriculture should increase the agricultural household’s productivity. Hence, these two policies should become the main concerns of agricultural development.

Author contributions

FRM and TD conceived the idea for the study. TD designed the outline and methodology of the study, while FRM conducted the literature review and estimated all econometric models. JPM constructed the initial draft of the study. MI provided feedback on the study design and reviewed the first draft of the paper. TD, FRM, and MI prepared the revision process of the manuscript. All authors reviewed the draft manuscript and provided input to the preparation of and approval for the final version of the report.

Declaration of Competing Interest

Faizal Rahmanto Moeis, Teguh Dartanto, Jossy Pranata Moeis and Mohamad Ikhsan declared no conflicts of interest that are directly relevant to the content of this article.

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