Transformation of labor participation on off-farm diversification: insights from rural households in Indonesia

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Abstract. This study analyses the rural transformation and the determinants of off-farm work diversification in Indonesia. Based on employment growth, the study explores the transformation of the labour sector to off-farm work as an alternative income source in mitigating the decreasing carrying capacity of the agricultural sector. Using a panel data set from rural households in Central Sulawesi, the study applied a random logit model to account for the determinants of off-farm participation and economic mobility over time. The results show that crop failure is a key driver of off-farm work diversification which is further compounded by several factors including asset holdings, the age and education level of the household head by 51.1%, 21.77%, 1.59% and 18.59% respectively. These results confirm that “these push” factors are motivating the rural household on off-farm labour allocation, which indicate the implications of economic transformation through the diversification of income sources and labour allocation away from agriculture subsystems in rural areas in Indonesia.

1. Introduction
Off-farm employment has been found to rapidly grow economic activities in recent decades, contributing significantly to both employment and rural income growth [1]. Off-farm employment is a process of constructing different portfolio activities and the social support capabilities of rural families in improving living standards. These diversified sources of income are called off-farm income and are defined as all economic activities outside of producing primary agricultural commodities [1]. Conceptually, it is a shift in wages from farming to off-farm and off-farm self-employment [2].

Indonesia is a country that has experienced a structural transformation as it has shifted away from a dependence on the agricultural sector to industry, a shift that began following the Asian Crisis in the late 1990s. This transformation has driven the Indonesian economy towards higher value-added activities that have led to a structural change in the labour force. The share of the labour force in agriculture has fallen sharply since the 1980s, while the share of labour in the industrial and service sectors has risen significantly over time [3]. Industry labour force peaked around 20% since the mid-1990s, while the labour force in services has grown and overtaken the agricultural sector in 2008. The changes in the labour force have implications for the structure of Indonesia’s economy. As shown in Figure 2, the share of agriculture to total GDP has declined significantly since the 1960s from above 50% to 13.72% in 2012. On the other hand, the share of the industry sector to total GDP, including the share of manufacturing and services, rose sharply and continued to do so into 2012.

Moreover, the off-farm work in Indonesia increased during the years 1993 – 2015 [3]. Labour productivity growth over GDP growth from the manufacturing sector, increased from 0.22%, in the period 1993 – 2006, to 0.50%, in the period 2007-2015, creating about 1.2 million informal jobs and 5.6
million formal jobs between 1993 and 2015. This condition continues as reported by the Central Bureau of Statistic [4], in 2019 the industrial sector contributed 19.63% of GDP in Indonesia which was the largest contributor to GDP, followed by the trade and construction sectors which contributed 12.99%, 11.26% respectively. Meanwhile the agricultural sector is in the fourth position, contributing 11.19% to the total GDP in Indonesia.

These statistics indicate substantial growth in the labour supply outside of the agricultural sector in Indonesia. This growth has changed the economic conditions that led to poverty alleviation in the country. However, this leads to the questions: What factors influence the household decision to engage in the off-farm sector? Using panel data from rural villages in Indonesia, the study addresses this question to determine the driving factors on off-farm diversification and the economic mobility of rural households in Indonesia.

2. Materials and methods

2.1. Materials

The research study uses three waves of panel data for the period 2001 – 2006 and re-interviewed in 2013 based on a sample of households across 13 villages in Central Sulawesi, Indonesia. Of the 294 households that were interviewed, the sample data restricted to the 255 households who could be interviewed in all of the years and carried out 765 observations for the panel data. These households are smallholder farmers who live in the rural areas and engaged in agricultural activities in the vicinity of the Lore Lindu National Park Central Sulawesi, Indonesia.

The Lore Lindu National Park is a protected area of forest in Indonesia located in Central Sulawesi province. Like other provinces in Indonesia, the main staple food in the area is rice, while cash cropping is concentrated in cocoa, coconut, palm oil, clove and coffee. In the early 1990's the main cash crop in the area was coffee; however, rural households switched to cocoa production due to the decrease in world coffee prices at the time [5]. This then makes the area one of the largest chocolate producers in Indonesia.

2.2. Methods

The empirical analysis and the econometric methods used to identify the factors that influence household off-farm engagement over time. Off-farm diversification is measured through the allocation of labour; hence, we build a framework of the household decision making process in diversifying labour supply to off-farm work, based on the classifications of human capital, variable location, initial household wealth, financial assets and the risk indicators. The estimation model of household participation is given as follows:

\[ L_{it} = \beta_0 + \beta X_{it} + \alpha_i + \varepsilon_{it}, t = 1,2,...,T \]  

(1)

Where \( L_{it} \) is a binary labour supply variable taking the value 1 if a household \( i \) offers off-farm labour in period \( t \) and 0 otherwise. \( \beta \) are the parameters to be estimated, \( X_{it} \) represents ‘observable variables’ that may change across \( t \) but not \( i \), variables that change across \( i \) but not \( t \), and variables that change across \( i \) and \( t \). \( \alpha_i \) stands for unobserved individual heterogeneity, which is considered constant over time and \( \varepsilon_{it} \) represent the idiosyncratic errors that change across \( t \) and \( i \). In this regard, it defines labour supply to be off-farm work (\( L_{it} \)) as a function of household size and composition (the age, gender and education level of the household head), location variables (the availability of electricity and distance to a main road), initial household wealth (durable assets), financial assets (access to credit) and risk indicators (crop failure), which are identified as the determinants of off-farm diversification.

A random logit model employed to account for the determinants of off-farm work participation. The logit random effects model is a model based on the assumption that time-invariant household characteristics are not correlated with the explanatory variable [2,6], and thus the time-invariant effect can be observed consistently. In applying a random effects estimator, control for time-invariant characteristics; including the household-specific and time-varying so-called Chamberlain-Mundlak adjustment [6]. While Sisay [2] used robustness checks and re-estimates the model using linear random
effects. Moreover, the logit random-effects model gives results in terms of marginal effects; hence, binary choice models can be interpreted as the percentage change of an independent variable over the probability of off-farm participation [2]. Based on this consideration, the logit random-effects model applied to capture the determinants of household diversification between a participant and non-participant to engage in the off-farm sector.

3. Results and discussion

3.1 Characteristics of the rural household

Table 1 details the descriptive statistics of the characteristic household used for the analysis. The dependent variable is household participation in the off-farm activity and the respective income effect. Off-farm participation is a binary variable for the decision in labour allocation to off-farm activities, with 1 indicating that a household engages in off-farm employment and 0 otherwise. In the outcome equation, the dependent variable is total income, which is the total amount of earnings from a household's economic activity stemming from both farming and off-farm employment in real local currency (IDR). The independent variables are human capital measured by household characteristics, such as household size and the age, sex and education level of the household head, while location variables, which include initial household wealth, financial assets and risk indicators, are measured accordingly by distance to road, asset value, access to credit and crop failure.

| Variables                        | Mean   | Obs  | Definition                                                      |
|----------------------------------|--------|------|----------------------------------------------------------------|
| **Dependent**                    |        |      |                                                                 |
| • Off-farm participation         | 0.39   | 304  | 1 = if the household participates in off-farm employment, 0 = otherwise |
| • Total income                   | 1,489,266 | 765 | Household income from agricultural and non-agricultural activities (IDR) |
| **Independent**                  |        |      |                                                                 |
| Household head’s age             | 48.81  | 765  | Household’s head age (year)                                     |
| Sex                              | 0.95   | 765  | 1 = male, 0 = female                                           |
| Household’s size                 | 5.84   | 765  | No of household members                                        |
| Schooling                        | 4.02   | 765  | Formal education of household’s head (year)                     |
| Distance to road                 | 42.95  | 765  | Time travel to the road (minutes)                               |
| Asset value                      | 4,857,049 | 765 | Natural log total value of HH’s asset holding (IDR)              |
| Area own                         | 187.50 | 765  | Agriculturally suitable land (are)                              |
| Access to credit                 | 746,350| 765  | Natural log total value credit from formal and informal institution (IDR) |
| Crop failure                     | 0.25   | 765  | 1 = if the household report crop failure, 0 = otherwise         |

Note: Local lands unit are measured in acres (1 acres = 100 m² = 0.01ha). Standard deviation is in parentheses.

The data shows that 304 households (39.74 per cent) have diversified income from off-farm sources. Household characteristics demonstrate that 95 per cent of the households are male-headed with an average age of 48 years. On average, the household head has a level of education below the secondary school level (on average 4.02 years) with an average household size of 5.84 members. These household
characteristics use to capture the opportunity to be involved in off-farm activities. Age indicates experience and a lifestyle effect, whereby experience initially increases with age and the probability to generate income from off-farm activities, though the effect will gradually decline after a maximum age point [2,7]. Moreover, sex uses to capture the gender effect on the decision-making process, to determine if there is a difference in wages between male or female-headed households. On the other hand, education level used to control for the effect of illiterate family members on labour allocation to off-farm employment. A higher level of education can encourage a household to enter the off-farm labour market due to an increase in the accessibility of information and the ability to build better networking within the community. Education increases a household's bargaining position and the probability of participating in the labour market, which in turn increases total household income. While household size is associated with the number of participants in the labour market, which is assumed to have a positive effect on off-farm activities and income. The number of family members can be translated as household labour supply, where a larger size indicates more labour-power and more hands available for off-farm earnings.

Household wealth is measured by the ability to hold assets and the amount of land owned. It is assumed that wealthier households tend to have more assets, such as equipment, household goods and valuables. In this study, a wealth indicator constructed based on asset value calculated by their current value. It includes the amount of land owned as a proxy for household wealth. Given the important role of agriculture, land-holding becomes the most important asset in ensuring continuous food production through the generation of income and direction production of food for consumption. Hence, the area owned might influence a household's decision in allocating labour supply to farming or non-farming activities. It found the total asset value of the households to be around IDR 4,857,049 with an average land-holding of 187.50 acres. The amounts of assets and land area-held reflect the wealth condition of a household, which could motivate off-farm participation.

Distance to the main road is used to measure the effectiveness of the location variable on the decision to participate in off-farm work. Most of the sample households are in rural areas, requiring approximately 42.95 minutes of travel time to reach the main road. The distance and travel time to a place of work will influence the amount of earnings, particularly for a worker in rural areas and thus determine the probability of participation due to the marginal cost that would be incurred [2]. Furthermore, the research highlights the effects of financial assets and risk indicators through access to credit and crop failure as 'push' factors that cause a household to diversify into off-farm activities. Crop failure was reported by 25 per cent of the households due to climate and production shocks. While financial assets, measured by the access to the credit market, both from formal and informal financial resources and accounted for an average of IDR 746,350 per capita. These variables assume that household participation is based on the assumption that credit and crop failures have a positive correlation on diversifying the sources of income for survival reasons. It examines if off-farm activities are used as a strategy for credit loan responsibility, as well as a way to mitigate crop failure, which pushes households to take up off-farm employment.

### 3.2 Factor determinants of household participation in off-farm employment

The factors that influence household participation in off-farm work examined using a logit random-effects model. The findings indicate the important role of human capital as the main source for entering the off-farm labour market. A positive effect found for age and education level of the household head on a household's decision to participate in off-farm employment.

As shown in Table 2, a household head being of productive age (15 – 65 years old) and having a greater level of education, which can be an asset in terms of labour-power, can increase a household's probability of engaging in non-farming activities by 1.59% and 13.13% (Table 2). Education plays an important role in income diversification and helps a household to more easily adjust to entering the off-farm labour market [8]. This implies that a literate household head and being of working age improves the capability of a household to process and apply information passed on to them as well as the ability to adopt new technology and diversify income by entering the labour market. Thus, more-educated
households are more active and entrepreneurial, and more likely to have better opportunities and be active in generating income from both farming and non-farming activities [9].

### Table 2. Determinants of off-farm employment.

| Variables                      | Logit estimation model |
|-------------------------------|------------------------|
|                               | Coefficient  | SE  | Coefficient  |
| Household head’s age (year)   | 0.0159*       | 0.0095 | 0.094    |
| Sex (1 = male, 0=female)      | 0.1329        | 0.6221 | 0.831    |
| Household’s size              | 0.0622        | 0.0449 | 0.166    |
| Schooling                     | 0.1313***     | 0.0504 | 0.009    |
| Distance to road              | -0.0017       | 0.0012 | 0.145    |
| Asset value ( IDR)            | 0.2177***     | 0.0594 | 0.000    |
| Area own (acres)              | -0.0016**     | 0.0006 | 0.012    |
| Access to credit ( IDR)       | 0.0155        | 0.0201 | 0.442    |
| Crop failure                  | 0.5110**      | 0.2531 | 0.043    |
| Constant                      | -5.7100       | 1.1831 | 0.000    |
| Observation                   | 765           |       | 0.000    |

Note: Author’s calculation from the survey data using Logit model for the household participation. Local lands unit are measured in acres (1 acres =100 m²= 0.01ha). Test statistic ***, ** and * indicate the significance of the estimated coefficient at 1%, 5% and 10%, level respectively.

Having explained the motivation for off-farm diversification, crop failure and asset holding show that diversification is driven by accumulative ‘push’ and ‘pull’ factors. However, the ‘push’ factor seems to dominate and drives off-farm participation given that 51.10 per cent of the decision is affected by crop failure. This indicates that off-farm employment is a risk minimization strategy for production and income losses. It found out that the diversification of income sources tends to be an option for households to mitigate the risk of weather and agricultural shocks through off-farm employment. On the other hand, households holding more assets—the wealthy—are less likely (21.77%) to be ‘pulled’ into off-farm work (Table 2).

Interestingly, total land-holding has a trade-off effect in a household's decision in whether to allocate labour intensively to off-farm activities or to farm activities that could be used to increase high earning activities. Our results indicate a negative correlation, where holding more land saw households allocate more labour to farming activities. It reduced the probability of household engagement in off-farm work by 0.16 per cent. These results are in agreement with Birthal et al. [10], who confirm that off-farm income is more important for households at the lower end of the land distribution than for those with larger holdings. Thus, farm size could be a determining factor, acting as a barrier for households with large cultivation areas, in engaging in non-farming employment.

### 4. Conclusions

The research shows factor determining and economic mobility situation of the rural household in engaging off-farm work. It found out, that in the research area household's off-farm diversification is linked with crop failure and income-related factors in asset holding, which increasing off-farm participation by 51.10 and 21.77 per cent, respectively. In addition, increases in the age and education level of the household tend to influence the household's decision in off-farm engagement by 1.59 and 18.59 per cent, respectively. These results confirm that 'push' factors presented by crop failure and income-related factors in asset holding had driving the rural household on shifted away to the off-farm labour allocation, which is undertaken as a risk minimization strategy for production and income losses in the research area. These findings indicate the implications of economic transformation in significant
scale, which is occurring through the diversification of income sources and labour allocation away from agriculture subsystems in rural Indonesia.

References
[1] Haggblade S, Hazell P and Reardon T 2010 The rural non-farm economy: prospects for growth and poverty reduction World Dev. 38 1429–41
[2] Sisay W 2010 Participation into off-farm activities in rural Ethiopia: who earns more? 59
[3] Group W B 2016 Economic transformation and employment: Policy input for an Indonesia jobs strategy
[4] Central Bureau of Statistic 2020 Statistics Official News (Jakarta: Central Bureau of Statistics, Indonesia)
[5] Klasen S, Priebe J and Rudolf R 2013 Cash crop choice and income dynamics in rural areas: Evidence for post-crisis Indonesia Agric. Econ. 44 349–64
[6] Himanshu, Lanjouw P, Murgai R and Stern N 2013 Nonfarm diversification, poverty, economic mobility, and income inequality: a case study in village India Agric. Econ. 44 461–73
[7] Seng K 2015 The effects of nonfarm activities on farm households’ food consumption in rural Cambodia Dev. Stud. Res. 2 77–89
[8] Akaakohol M A and Aye G C 2014 Diversification and farm household welfare in Makurdi, Benue state, Nigeria Dev. Stud. Res. 1 168–75
[9] Rao E J O and Qaim M 2011 Supermarkets, farm household income, and poverty: insights from Kenya World Dev. 39 784–96
[10] Birthal P S, Negi D S, Jha A K and Singh D 2014 Income sources of farm households in India: determinants, distributional consequences and policy implications Agric. Econ. Res. Rev. 27 37