Income diversification of rural households in Central Sulawesi, Indonesia checked

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Abstract

This paper examines two aspects of income diversification: diversification as a shift away from agricultural activities and as an increasing mix of income activities. Agricultural activities are the most important source of income for rural households in the vicinity of the Lore Lindu National Park in Indonesia. They contribute 68% to total household income with the remaining 32% originating from non-agricultural activities. Considering the wealth status shows that the better-off households derive 40% of their income from non-agricultural activities whereas it accounts for only 10% of the poorest households' income. Using a Tobit model to evaluate the determinants of non¬farm income diversification shows that the socio-economic status and the access to formal financial markets both have a positive impact. As a measure of the overall diversity of income we apply the Shannon equitability index, which increases with the number of income source and their evenness. The access to social capital and the occurrence of crop failures both have a positive impact on the Shannon equitability index, whereas the socio-economic status and the distance to roads have a negative influence.

Keywords: income diversification, rural households, Shannon index, Tobit model, Indonesia

1. Introduction

Đa dạng hóa thu nhập của các hộ gia đình nông thôn ở Trung Sulawesi, Indonesia

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Tóm tắt

Bài viết này đi vào phân tích hai khía cạnh của đa dạng hóa thu nhập: đa dạng hóa dưới dạng dịch chuyển ra khỏi các hoạt động nông nghiệp và dưới dạng tăng mức độ kết hợp các hoạt động thu nhập. Các hoạt động nông nghiệp là nguồn thu nhập quan trọng nhất của các hộ gia đình nông thôn ở vùng lân cận Công Viên quốc gia (vườn quốc gia) Lore Lindu ở Indonesia. Chúng đóng góp 68% vào tổng thu nhập của hộ gia đình và 32% còn lại thu từ các hoạt động phi nông nghiệp. Xét tình trạng giàu có ta thấy các hộ gia đình khá giả có 40% thu nhập từ các hoạt động phi nông nghiệp trong khi nó chỉ chiếm 10% thu nhập của các hộ gia đình nghèo nhất. Sử dụng mô hình Tobit để đánh giá các yếu tố quyết định sự đa dạng hóa thu nhập phi nông nghiệp ta thấy tình trạng kinh tế-xã hội và tiếp cận các thị trường tài chính chính thức đều có tác động tích cực. Với tư cách là một thước đo tính đa dạng thu nhập tổng thể chúng ta áp dụng chỉ số công bằng Shannon, một đại lượng tăng theo nguồn thu nhập và sự ngang bằng của chúng. Việc tiếp cận nguồn vốn xã hội và sự xuất hiện mất mùa đều có tác động tích cực đến chỉ số công bằng Shannon, trong khi tình trạng kinh tế xã hội và khoảng cách đến đường giao thông có ảnh hưởng tiêu cực.

Từ khóa: đa dạng hóa thu nhập, hộ gia đình nông thôn, chỉ số Shannon, mô hình Tobit, Indonesia

The Lore Lindu National Park (LLNP) in Central Sulawesi, Indonesia, hosts some of the worlds most unique plant and animal species, but logging and agricultural activities threaten its integrity. Therefore, alternative income sources outside the agricultural sector, which are able to reduce the pressure on the National Park, are needed.

In this study we describe the income activities of rural households and examine the determinants of non-farm diversification. But this considers only one aspect of diversification: the shift from agricultural to non-agricultural activities. In addition, we also look at diversification as an increase in the mix of income activities. Specifically, the following research questions will be addressed: (1) Which are the income activities of rural households? (2) How much of the income originates from sources not related to agriculture? (3) Do poor differ from better-off households in their income activities?

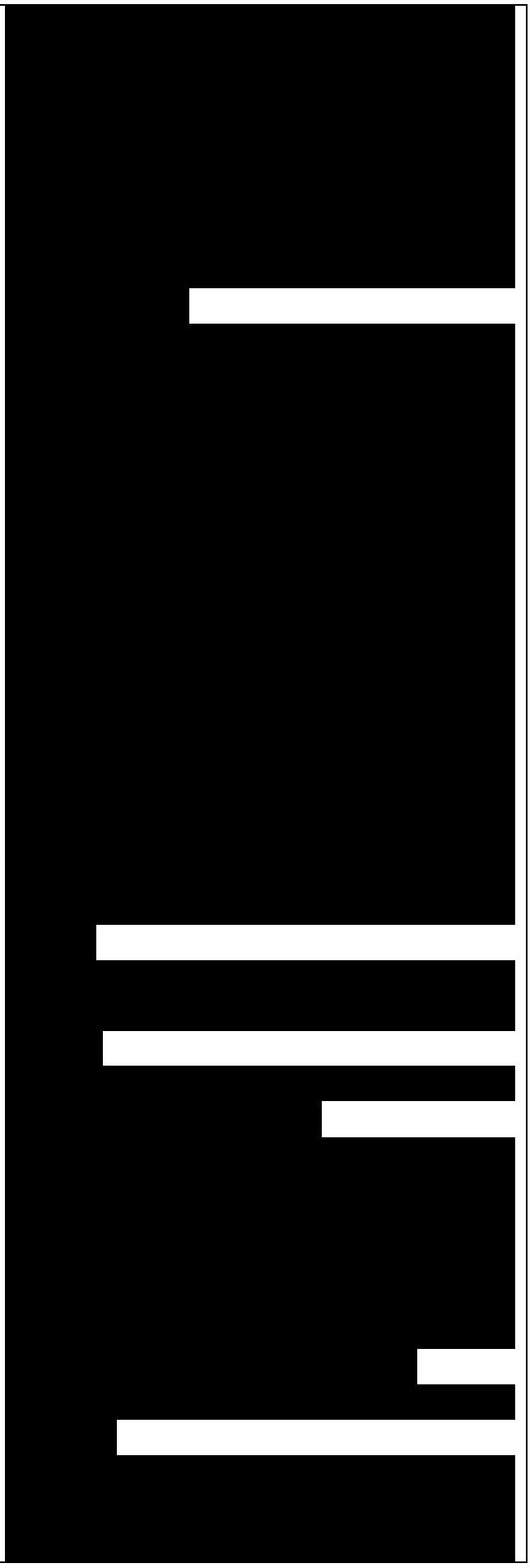
(4)Which factors influence the access to income sources outside agriculture?

(5) Which factors influence overall diversification?

Data was collected through standardized, formal questionnaires from 293 randomly selected households living in twelve villages in the vicinity of the LLNP (for more details on the sampling and data collection see ZELLER et al., 2002a).

2. Factors influencing diversification

A review of empirical studies concerning the share of rural non-farm income shows its importance for rural



households. On average they contribute to 29% of the total income of rural households in South Asia (REARDON et al., 1998).

Why do households diversify their activities and increase their income from activities outside agriculture? Households diversify because returns to their assets endowed in agricultural production decrease in relation to the returns from using them in activities outside agriculture. This implies that the ability to diversify highly depends on the access to the different types of assets, like for example physical, human, and social capital. It also explains why not all households have the same opportunities to participate in non-farm activities. There is a strong link between non-farm income share and total household income. Poorer households tend to have less access to non¬farm activities than better-off households (see REARDON et al., 1998).

In the econometric model we will explore this relationship by including a poverty index as a medium-term welfare indicator. To generate the index, a method developed by ZELLER et al. (2002b) was used which employs principal component analysis to select and eventually aggregate various indicators of poverty into a (0, 1) normally distributed poverty index. Unlike the commonly used absolute measures of poverty such as a monetary poverty line, this method takes also into account other dimensions of poverty, such as education, food consumption and the condition of the dwelling.

Details of this method, including sampling and questionnaire design, are reported in HENRY et al. (2001). The poverty index increases with wealth and was estimated for each of the sample households (ABU SHABAN, 2001). It is computed from three asset-related indicators, four dwelling indicators, and two consumption indicators. Thus, the index can also be seen as a proxy for the endowment with physical capital not related to agricultural activities. To account for the influence of physical capital related to agriculture, the area of land owned is also included as an explanatory variable in the regression models.

Better-off households do not only own more productive assets, they also have a better access to markets, especially to financial markets. Limited access to credit can either 'push poor households into wage-labor activities to earn cash (REARDON et al., 1998) or it restricts their ability to invest in non-agricultural activities even more. Poor households are not able to adjust their capital stock to the different needs in activities outside agriculture. As a proxy measuring the access to formal credit institutions we use a dummy variable, which is ‘one’ when the household received a formal credit in the last five years and ‘zero’ otherwise. As formal loans are mostly invested in small enterprises outside the agricultural sector it is expected that diversification out of agriculture is positively associated with the access to credit.

Studies by DE JANVRY et al. (1991) and KINSLEY et al. (1998) indicate

that income diversification is not only positively correlated with wealth but also with an increased ability to cope with shocks, or in other words, diversification reduces livelihood vulnerability. Diversification is a way rural households insure themselves against the occurrence of such shocks. Therefore, we included a variable in the model measuring the number of harvests failed in the last ten years.

This self-insurance can also be seen as a negative function of the availability of social insurance, provided for example, by the community or family. The better the access to social networks and institutions, the less likely a household needs to apply self¬insurance systems as the diversification of income portfolios. In contrast, social capital can also foster the ability to participate in many different income activities. To test whether the density of a social network has any influence on the degree of diversification we include a social capital index, which was calculated as in GROOTAERT (1999). The head of the household and its spouse were asked to evaluate on a scale from zero ("not very active") to two ("very active") how active they are in the decision making process of the three most important organizations they are members of. The average response was rescaled from zero to 100 and the number of memberships was added to form the social capital index.

BARRETT, REARDON and WEBB (2001) point out that better education is one of the most important determinants of non-farm earnings in almost all of the papers in a special issue of "Food

Policy" on income diversification. In this study we include the years in school of the head of the household as a proxy for education.

Studies by LANJOUW et al. (2001) in Tanzania and SMITH et al. (2001) in Uganda show that a better physical access to markets increases non-farm earnings. Thus, we include the distance from the homestead to the next tarmac road in our econometric models. Nevertheless, it is difficult to distinguish the effect of the distance to roads from other spatially fixed effects. To control for these effects we include location dummies, which are equivalent to the four districts in our research area. Besides these variables, we also control for demographic and cultural characteristics. Dummy variables measure the influence of ethnicity and gender on diversification.

3. Classification of income sources

In the literature there has been a wide range of different systems in classifying sources of income. Terms like off-farm and non-farm income are used at first glance in a synonymous way, but with slightly different definitions. ELLIS (2000) for example defines off-farm income as income originating from wage labor on other farms whereas BARRETT, REARDON and WEBB (2001) refer to off-farm income as all activities away from the farmers' own property. We follow the classification proposed by BARRETT, REARDON and WEBB (2001) according to sectors (agriculture and non¬agriculture) and functions (wage and self-employment). The third

criteria used, spatial classification, was not distinguished here because there is not a single household in the sample where income from migrated household members is relevant. All income derived is therefore classified as local. Figure 1 illustrates the concept and the classification of the different income sources.

Figure 1. Classification of activities

Function	Sector	
	Agriculture	Non-agriculture
Self-employment	• Crop income • Livestock income • Forest products, fishing	• Enterprise profits • Rents
Wage employment	• Agricultural wage labor income	• Non-agricultural wage labor income

Source: adapted from BARRETT, REARDON and WEBB (2001)

The Shannon equitability index used as a measure of overall diversity was calculated by using six different income sources. In the basic classification with four different sources, the component agricultural income from self-employment was differentiated into crop and livestock income as well as income from fishing and forest products (see figure 1).

4. Income and activities

On average, households in the research area earned a total income of around 5.9 million Indonesian Rupiahs (IDR) originating from a wide variety of activities with agriculture being the most important source (see table 1). Agricultural activities contribute 68%

to total household income with the remaining 32% coming from non¬farm activities. The most important income source is crop production, which accounts for about 45% of the income, followed by income from enterprises and rents (17%), and non-agricultural wage labor (15%) (the latter two are non-farm income sources). However, participation of the households in the latter activities is only around 18% and 21%, respectively. In contrast, 94% take part in cropping activities. But income from enterprises and rents and from non-agricultural wage labor is a much more important income source for participating households. It makes up 53% and 40% of the total income of these households. It is also striking that their total household income is on average more than three-quarters higher than those of all the households.

Non-farm income accounts for almost one-third of the total household income over all groups. This relationship can be differentiated according to wealth groups. Table 2 shows incomes and activities differentiated by poverty terciles: poorest (poverty group 1), poor (poverty group 2), and less-poor households (poverty group 3).

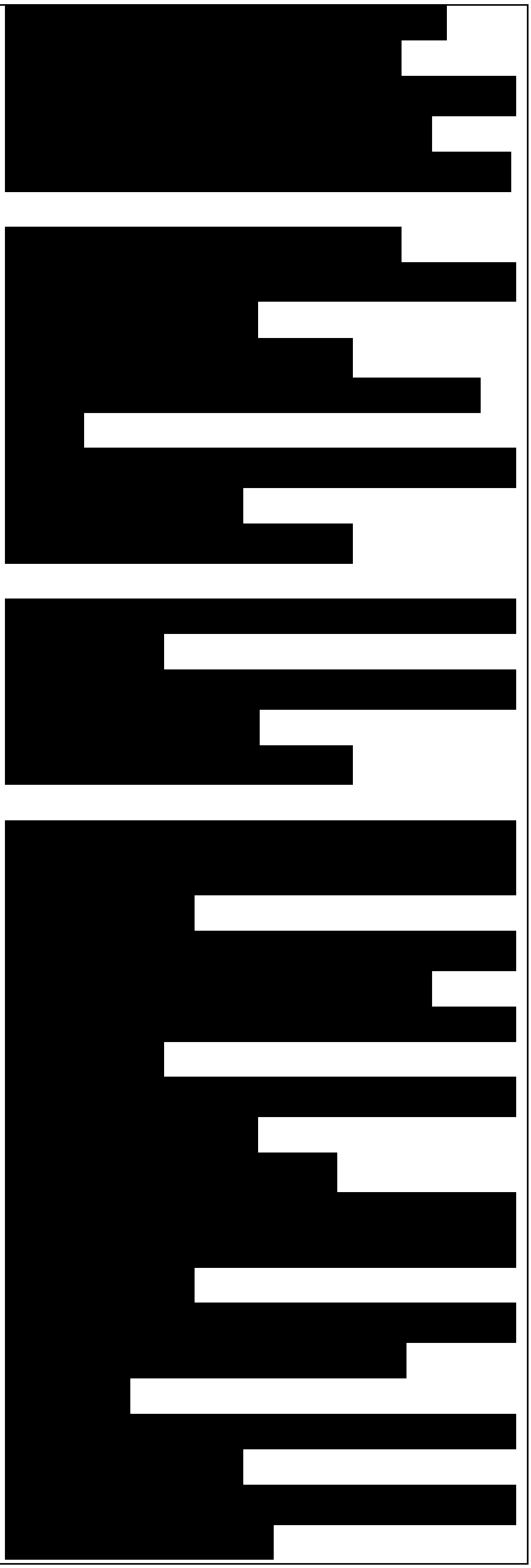
The average income of poverty group 3 is more than three times higher than the one in poverty group one. Own account agricultural activities are the most important income source for all socio-economic groups, but for the poorest households (poverty group 1), it contributes almost three-quarters to their total household income. For the other groups it accounts for only 54% and 57%, respectively. The same applies also for agricultural wage labor income. It is most important for the

poorest households and less important for the poor and less-poor households.
For income derived from outside the agricultural sector it is the other way round. Less- poor households generate 25% of their total household income from self-employment outside agriculture, whereas it accounts only for 3% of the income of the poorest households. The same applies to the participation in this activity. In case of non- agricultural wage income, the picture is not as clear, as it plays an important role especially for poverty group two. This might be explained by the different types of non-agricultural wage labor activities, which is a mix of unskilled jobs, like working in construction, and skilled jobs, like for example working as teacher.
An important activity for the poorest households is the selling of forest products: 30% of the poorest participate in this activity, thus generating 22% of their total household income. For the poor households it accounts for 7% only and for the non-poor this income source is not relevant any more.

Table 1. Income and activities

	Total	in %
Total household income		
• Mean household income (1,000 IDR)	5,899	100
Agricultural income - Self-employed		
• Mean income for all households (1,000 IDR)	3,521	60
• Number of households participating	278	96
• Mean agricultural income of households participating (1,000 IDR)	3,666	62

• Mean total income of households participating (1,000 IDR)	5,918	100
Crop income		
• Mean income for all households (1,000 IDR)	2,626	45
• Number of households participating	272	94
Livestock income		
• Mean income for all households (1,000 IDR)	477	8
• Number of households participating	183	65
Income from fishing and forest products		
• Mean income for all households (1,000 IDR)	418	7
• Number of households participating	55	19
Agricultural income - Wage labor		
• Mean income for all households (1,000 IDR)	514	9
• Number of households participating	132	46
• Mean agricultural wage labor income of households participating (1,000 IDR)	1,131	21
• Mean total income of households participating (1,000 IDR)	5,401	92
Non-agricultural income - Self-employed		
• Mean income for all households (1,000 IDR)	991	17
• Number of households participating	51	18
• Mean average self-employment income of households participating (1,000 IDR)	5,649	53
• Mean total income of households participating (1,000 IDR)	10,646	180
Non-agricultural income - Wage labor		
• Mean income for all households		

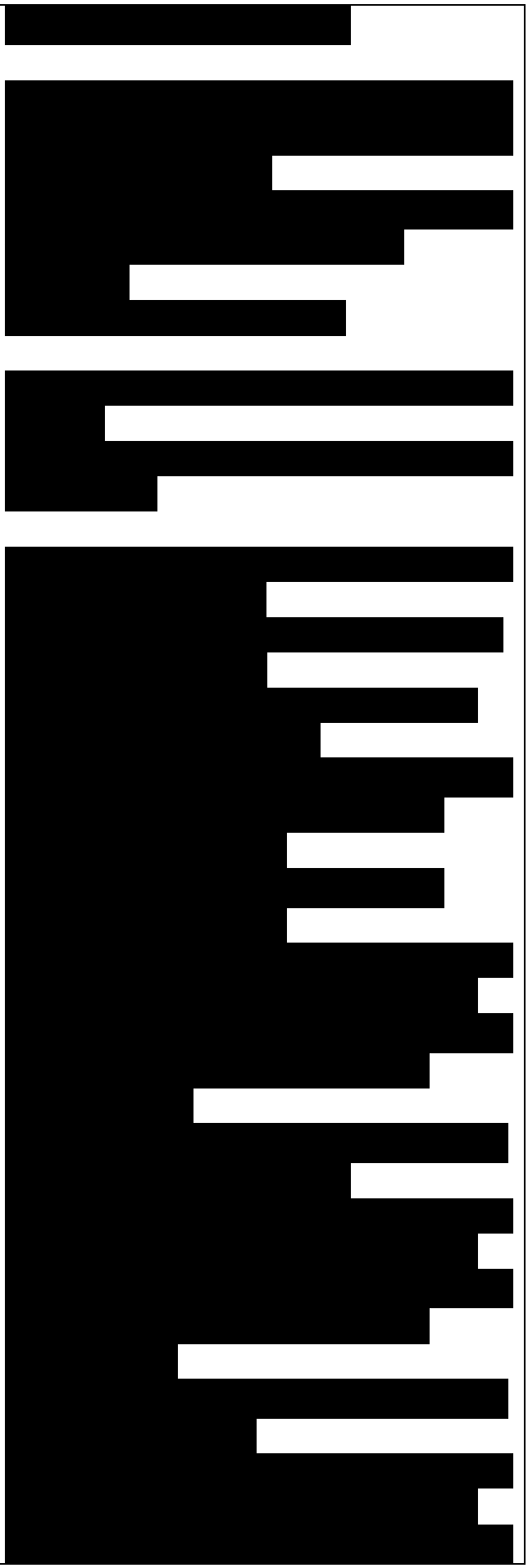


(1,000 IDR) 868 15
• Number of households participating 60 21
• Mean non-farm wage labor income of households participating (1,000 IDR) 4,168 40
• Mean total income of households participating (1,000 IDR) 10,536 179
Note: number of households = 290

Source: Storma project A4 household survey

Table 2. Income and participation by poverty group

	Poverty group 1		Poverty group 2		Poverty group 3	
	Total	%	Total	%	Total	%
Total household income						
• Mean household income (1,000 IDR)	3,606	100	3,790	100	11,134	100
• Number of households	102	100	102	100	86	100
Agricultural income - Self-employed						
• Mean household income (1,000 IDR)	2,643	73	2,044	54	6,319	57
• Number of households participating	98	96	98	96	82	95
Agricultural income - Wage labor						
• Mean household income (1,000 IDR)	590	16	501	13	440	4
• Number of households participating	48	47	58	57	26	30
Non-farm income - Self-employed						



• Mean household income (1,000 IDR) 116 3 393 10 2,744 25
• Number of households participating 7 7 22 22 22 26

Non-farm income - Wage labor

• Mean household income (1,000 IDR) 251 7 849 22 1,623 15
• Number of households participating 10 10 27 26 23 27

Source: Storma project A4 household survey

5. Measuring income diversity

To quantify the degree of non-farm diversification, we use the share of non- agricultural income in total household income. As a measure of the overall diversity of income we apply the Shannon equitability index. It is derived from the Shannon index (H), which is usually used to assess the diversity of species (MAGURRAN, 1988). Adapting it for our purposes leads to:

s

(I) Hincome = -X l(inCsharei) ‘)n(incsharei)]

i=1

where s is the number of income sources and incsharei the share of income from activity i in total household income. The Shannon index Hincome takes into account both, the number of income sources and their evenness. It is calculated for every household and increases continuously with higher diversity. Based on this index H, the Shannon equitability index

E is calculated as:
H

where the denominator is the maximal possible Shannon index. E ranges from zero to 100 and states the percentage share of the actual income diversification in relation to the maximal possible diversity of income.

6. Determinants of diversification

Using econometric modeling we investigate the influence of different factors on diversification (see section 2). First, we look for factors influencing diversification out of the agricultural sector. This is measured by the share of non-agricultural income, both from self-employment and wage labor, in total household income. In a second model we investigate the factors influencing the overall mix of the income measured by the Shannon equitability index introduced in section 5. In both regressions we use the same set of explanatory variables, whose descriptive statistics is shown in table 3.

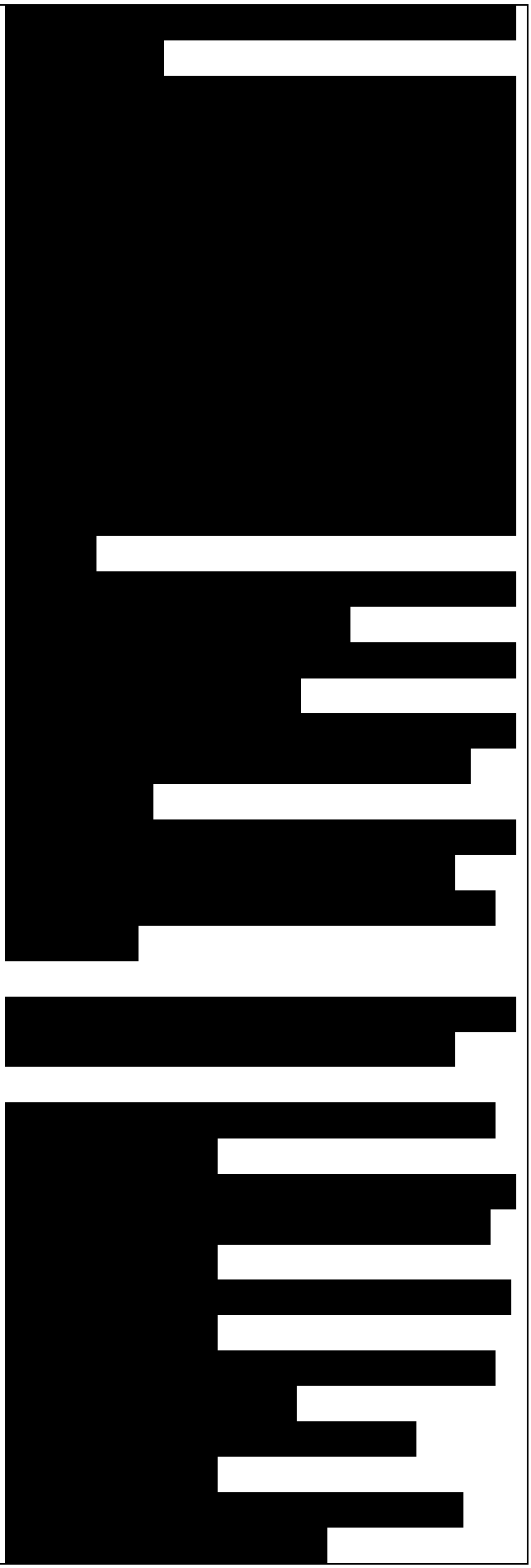
Both dependent variables are continuous variables but with a limited range between zero and 100 and zero and 0.71, respectively (see table 3). Moreover, in both cases there is a large share of observations with zero values meaning that households do not participate in non-farm activities and that they derive their income from one source only. Therefore, we apply Tobit models, which have been originally developed for censored data, but which are also used for corner solution models (WOOLDRIDGE, 2002). DE JANVRY and SADOULET (2001) and

WOLDENHANNA and OSKAM (2001) for example use Tobit models in similar settings.

In the first regression on the share of non-agricultural income in total household income the poverty index has a highly significant positive influence (see table 4) indicating that wealth increases the diversification out of the agricultural sector. Also the access to formal financial markets has a significant positive impact on the share of non-agricultural income. Households that received a formal loan in the last five years have diversified their income more out of the agricultural sector.

Table 3. Descriptive statistics of the variables used in the regression models

	Unit	Min	Max	Mean	StD
Share of income not from agriculture	%	0	100	19.97	33.00
Shannon equitability index based on 6 categories	%	0	0.71	0.29	0.20
Poverty index	metric	-1.84	3.48	0	1.00
Female headed household (1=yes)	dummy	0	1	0.04	0.20
Number of crops failed	metric	0	5	0.56	0.78
Ethnicity of head of household (1=non-indigenous)	dummy	0	1	0.20	0.40
Distance house-road	hours	0	13	0.90	2.67
Years in school of head of household	years	0	12	6.84	3.31
Dependency ratio	metric	0	5	0.71	0.62
Social capital index	metric	0			



	1,600	205.12	259.18	
Household received formal loan in last 5 years (1=yes)	dummy	0	1	0.15 0.35
Total area of land owned	0.01 ha	0	1,138	190.50 193.84
Kecamatan dummy for Lore Utara	dummy	0	1	0.27 0.45
Kecamatan dummy for Palolo	dummy	0	1	0.15 0.36
Kecamatan dummy for Sigi Biromaru	dummy	0	1	0.31 0.47

Source: Storma project A4 household survey

Considering the overall degree of diversification, the socio-economic status has again a highly significant but negative influence (see table 4). Whereas wealth increases the share of income from outside the agricultural sector it has a negative influence on the Shannon equitability index. The income of poor households tend to originate from more sources and to be more evenly distributed between these sources. Social capital also has a significant and positive influence on diversification. Social networks seem to enable household members to extend their participation to new activities.

The occurrence of shocks related to cropping activities within the last ten years is positively influencing the overall diversification. This supports the hypothesis of diversification as an ex-post reaction on the occurrence of shocks. The distance of the dwelling from the next tarmac road has a negative influence on diversification. Households living far away from a tarmac road tend to have a lower

number of income sources and their distribution is more uneven. In remote areas there are no income possibilities outside self-employment within agriculture.

7. Conclusions

Agricultural self-employment activities are the most important source of income for rural households in the vicinity of the LLNP accounting for 60% of the total household income. Nevertheless, also activities outside the agricultural sector play an important role. Self-employment and wage labor from non-agricultural sources contribute one- third to the income. But not all households participate in the same degree in these activities. Differentiating the income sources by poverty groups shows that less-poor households derive 40% of their income from activities outside agriculture whereas it accounts only for 10% of the income of the poorest households. This result is also confirmed by the econometric analysis. The poverty index has a highly significant positive influence on the income share derived from outside agriculture suggesting that better-off households diversify more out of the agricultural sector than poorer households. REARDON et al. (1998) call this the "inter-household paradox": the poorest households, while having the greatest need for non-agricultural income, are also the most constrained. Agricultural policies or projects aiming to reduce poverty by promoting these activities have to consider this. Poorer households, because of their lower endowment with physical capital not related to agriculture, have fewer opportunities to participate and derive income from

non-agricultural sources. Therefore, potential non-farm activities have to be carefully evaluated whether they suit the assets owned by poor households. Otherwise, they will not be able to participate and it will not be possible to reduce poverty by promoting non-agricultural activities. Another key determinant we observed is the access to formal credit institutions which has a significant positive impact on the share of non-agricultural income. Households that received a formal loan in the last five years have diversified their income more out of the agricultural sector. Credit enables households to change their physical capital stock within a short time to take advantage of income opportunities outside agriculture. The basic constraint in deriving income from non-agricultural sources is the stock in physical capital and the ability to borrow money. In contrast, our study also showed that poor households are already involved in a number of different activities. Using the Shannon equitability index to measure the degree of income diversity shows that poor households tend to have more income sources and a more evenly distribution of the income between these sources. Agricultural policies and projects can take advantage of this by increasing the returns from activities in which particularly poor households are already involved.	[redacted] [redacted] [redacted] Các chính sách và dự án nông nghiệp có thể tận dụng điều này bằng cách tăng lợi nhuận từ các hoạt động mà các hộ gia đình đặc biệt nghèo đã tham gia.