Effects of oil palm expansion and other related land-use changes on the livelihoods of rural households in Indonesia

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D7

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To my husband, Peter,
for your support, love and for teaching me
to never let a fall in the road to be the end
of the journey.

And to my son, Sergio,
for giving me the chance to experience
the kind of love that anyone
would die for.

Summary

The demand for agricultural land is globally increasing due to population growth and dietary diversification. As the availability of agricultural land is limited, much of the cropland expansion is occurring at the expense of tropical forests.

During the past few decades, oil palm has become one of the most rapidly expanding agricultural crops in the world, especially in Southeast Asia. In Indonesia, the land area grown with oil palm grew by almost 50% over the last 10 years. While some of the new oil palm plantations were established on recently deforested land, oil palm has also replaced other agricultural crops such as rubber. About 60% of the oil palm land in Indonesia is managed by large-scale public or private companies; the rest is cultivated by smallholder farmers. The rapid expansion of oil palm in Southeast Asia has given rise to various environmental and social concerns. While implications of such land-use change for the environment and for local farm households were already examined in previous research, possible effects on the livelihoods of rural non-farm households and on rural inequality are not yet well understood.

This dissertation addresses this gap in the literature by analyzing the role of different types of agricultural and non-agricultural employment income for non-farm households. In addition it examines the effects of oil palm and rubber on income inequality among rural households in rural Jambi, one of the hotspot regions of Indonesia's recent oil palm boom. These aspects are analyzed in two separate papers, which are embedded into broader introduction and conclusion chapters.

The first paper shows that employment in rubber and employment in oil palm are important livelihood components for non-farm households. Employment in oil palm is more lucrative than employment in rubber and is positively associated with total household income. Regression models show that whether or not a household works in oil palm is largely determined by factors related to migration background, ethnicity, and the size of the village area grown with this crop.

Oil palm and rubber are the most important agricultural crops in Jambi, cultivated by large companies as well as smallholder farmers. The data show that employment in both crops accounts for 70% of total household income on average. Poorer households depend much more on employment in rubber, whereas for richer households employment in oil palm is of larger importance.

For many autochthonous households of the Melayu ethnicity, working in rubber as sharecroppers has a long family tradition. Hence, autochthonous households are less likely to be involved in oil palm employment than migrant households who do not have a tradition of working in rubber. However, due to higher wages and longer working hours, employment in oil palm is more lucrative than employment in rubber.

Apart from working in oil palm, the expansion of the oil palm area at the village level also contributes to significant increases in income from self-employed activities. This can be explained by oil palm developments being associated with general infrastructure improvements and growth in the local village economy, leading to a boost in demand for locally produced goods and services.

The second paper shows that oil palm does not seem to have significant effects on overall rural inequality. While oil palm cultivation contributes to increasing inequality among farmers, it tends to decrease income inequality among non-farm households through labor-market and employment effects. In other words, via employment opportunities, oil palm is contributing positively to the welfare of the poorest segments of the rural population.

Proceeding further with the results of the second paper, rubber income is found to be inequality-reducing; suggesting that further growth of rubber income would lead to decreasing inequality. However, as more expansion of oil palm is expected to happen in forest areas, fallow land, and even in existing rubber land, an increase in the oil palm area may possibly be accompanied by a decrease in the rubber area and therefore rising overall inequality.

Further, the data show an unequal distribution of income among rural households over the survey period. On average, farm households are significantly richer than non-farm households. This is also reflected in a lower poverty rate among farm households. Non-farm households might be characterized by a lower level of income inequality, but they still belong to the poorest segments of the rural population in Jambi.

As a concluding remark, this study suggests that further expansion of the oil palm area will likely benefit farm and non-farm households economically through gains in farming and employment income. These benefits should not be ignored when designing policies towards sustainable land use. Moreover, a better understanding of the possible ramifications of land-use change for these households is of particular relevance for development policies. Besides, these findings add to the understanding of the role of oil palm expansion for rural inequality,

which might help in designing policies towards maximizing the economic and social benefits of land-use change, while minimizing its negative externalities.

It should be stressed that this study only analyzes partial aspects of the palm oil sector in Indonesia, leaving environmental issues and also other social challenges, such as conflict over land, largely unaddressed. These other issues are important but beyond the scope of this dissertation. Nevertheless, the research provides new insights into areas that have not been well addressed in the literature so far.

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Thank you very much for all your encouragement!

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Abbreviations

AE	Adult equivalent
BPS	Statistical Office Indonesia
CPO	Crude palm oil
CRC	Collaborative Research Center
DJP	Direktorat Jenderal Perkebunan (The Directorate General of Taxes)
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Statistics Division of the Food and Agriculture Organization of the United Nations
IDR	Indonesian Rupiah
KKPA	Kredit Koperasi Primer Anggota
MVP	Multivariate probit model
NES	Nucleus Estate and Smallholder scheme
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary least squares
PODES	Village Potential Statistics Survey Indonesia
RT	Rukun Tetangga
RSPO	The Roundtable on Sustainable Palm Oil
SAKERNAS	National Labor Force Survey Indonesia
USDA	United States Department of Agriculture

CHAPTER 1: General introduction

1.1 Background

Land is the foundation of agricultural economics and a vital input for food production and habitation (Wu, 2008). As the demand for agricultural products is comprehensively increasing, land use is becoming an activity of global concern (Gibbs et al., 2010; Godfray et al., 2010; Davis et al., 2014). The need to assure food, fuel and dwelling to more than seven billion people is the major driver of cropland expansion across the developing world (Foley et al., 2005; Gibbs et al., 2010). Thus, facing such growing population, access to agricultural land is limited and most of the world is looking toward what is left of arable land in order to meet the increasing agricultural demands (Mattsson et al., 2000; Alexandratos, 1999 and 2006; Foley et al., 2005; Green et al., 2005; Gibbs et al., 2010). Therefore, most of the cropland expansion is occurring in forest-rich tropical countries (Foley et al., 2005; Gibbs et al., 2010). Indeed, across the tropics between 1980 and 2000, more than 55% of the agricultural land (croplands and pastures) were established by clearing intact rainforests (Gibbs et al., 2010). In the near future, this rapid land-use change is expected to continue spreading at the frontier of remaining forests (Tilman et al., 2001; Gibbs et al., 2010; Lambin and Meyfroidt, 2011). Such land-use change may be required to satisfy human needs, but on the other hand it presents a serious threat to ecosystems and biodiversity worldwide (Tilman et al., 2001; Foley et al., 2005).

Taking into consideration the recent widespread agricultural expansion, where rainforests are transformed into croplands and plantations, oil palm (*Elaeis guineensis*) is a typical case that reflects these land-use changes best. During the past few decades, oil palm has become one of the world's most rapidly expanding crops, especially in Southeast Asia (Euler et al., 2016; FAO, 2017). Since 1961, the global area under oil palm cultivation increased from 3.6 million ha to around 21 million ha in 2016, while the world's production of crude palm oil (CPO) boosted from 1.5 million to almost 57 million tons in 2014 (FAOSTAT, 2017). This rapid expansion is primarily affiliated to the crop's low production costs, high yield potential and land use efficiency (Yussof and Hansen, 2007; Sheil et al., 2009, World Bank, 2011). Besides, the continuing growing demand for both vegetable oils and biofuels, is affecting significantly the oil palm production, making palm oil the most profitable and traded vegetable oil in the world (Sayer et al., 2012; Cramb and McCarthy, 2016; World Bank, 2017; USDA, 2017).

Oil palm is commercially grown in more than 43 countries and accounts for nearly one-tenth of the world's permanent crop land (Koh and Wilcowe, 2008; Sheil et al., 2009; FAO, 2015). Oil palm needs humid equatorial conditions to bloom and Southeast Asia provides the ideal environment for growing it (Sheil et al., 2009). Currently, Indonesia and Malaysia produce the bulk of the world's palm oil, with a combined world market share of 85% (FAO, 2017). In Indonesia, the land area grown with oil palm grew by almost 50% over the last 10 years; since 2009, Indonesia is the world's largest producer of oil palm (FAOSTAT, 2017). This boom in Indonesia's palm oil production is attributable to abundant land, cheap labor, and the typical humid tropical climate (Sheil et al., 2009). In addition to that, oil palm plantations employ workers for the entire year, which makes it a very attractive crop, especially for public companies and smallholder farmers (Sheil et al., 2009). Oil palm plantations in Indonesia directly employ 7.5 million people, making this sector an important source of income for rural populations (Sung, 2016; Petrenko et al., 2016). With appropriate management and investment, oil palm can provide substantial income for producing companies and countries (Sheil et al., 2009). Thus, the palm oil sector can serve as an important vehicle for socio-economic development in rural areas.

Oil palm was first introduced in Indonesia at larger scale in the late 1980s through the government's transmigration program, where families from Java voluntarily relocated to Sumatra, Kalimantan and Papua (Gatto et.al, 2015). Through this program, the Indonesian government used oil palm as a major tool for economic improvement in rural areas (Potter and Lee, 1998; Elmhirst, 1999; Zen et al., 2005; Rist et al., 2011). Arriving transmigrant families were allocated a piece of land with full ownership rights and were supported in the cultivation of specific agricultural crops (Elmhirst, 1999; Murdiyarso et al., 2002; Gatto et al., 2017). In the beginning of the program, transmigrants were allocated rice fields, which soon were switched to rubber. From the late-1980s, the Indonesian government changed the focus and transmigrants were supported in the cultivation of oil palm, usually on land adjacent to large oil palm plantations. These large plantations were managed by public or private companies to which the transmigrant families delivered their harvest under contract arrangements (Gatto et al., 2015). Such arrangements were done through the "Nucleus Estate and Smallholder" (NES) schemes, which are government-sponsored contracts between palm oil companies and smallholder farmers (Larson, 1996; Feintrenie and Levang, 2009; McCarthy and Cramb, 2009; Cramb and McCarthy, 2016). Under these contracts, farmers received subsidized loans and technical support. In addition, they were able to entrust or sell their plots directly to the company and in return receive compensation for loss of land (Rist et

al., 2011). The NES schemes marked the beginning of smallholder farmers' involvement in the palm oil sector in Sumatra. Since the late-1990s, smallholders have also started to adopt oil palm independently without company contracts (Euler et al., 2016).
Nowadays, around 40%of the oil palm land in Indonesia is cultivated by smallholder farmers, the rest is managed by large-scale public or private companies (Gatto et al., 2015; Euler et al. 2016).
It is broadly held that oil palm plantations play a significant role in Indonesian's agricultural sector and as such they contribute to the improvement of rural households' livelihoods and development of rural areas. Eventually, recent studies found that small-farm households in Indonesia profit significantly from oil palm cultivation in terms of income gains and improvements in living standards (Krishna et al., 2017; Euler et al., 2017).

Given the remarkable trends of oil palm expansion in Indonesia, it is expected that such development of the sector will be followed by more farming, employment opportunities, and thus income generation for rural households.

1.2 Problem statement and research novelty

The expansion of oil palm has generated much controversy and debates for its effects on the forest-rich tropical countries (Koh and Wilcove, 2007; Stone, 2007; Sheil et al., 2009). It is thoroughly recognized that oil palm is associated with loss of environmental goods and social concerns. Oil palm is often held rensponsible for deforestation, loss of biodiversity, land property conflicts, and social inequality (Fargione et al., 2008; Fitzherbert et al., 2008; McCarthy and Cramb, 2009; McCarthy 2010; Wicke et al., 2011; Cramb and Curry 2012; Obidzinski et al., 2013; Dewi et al., 2013; Margono et al., 2014; Clough et al., 2016; Drescher et al., 2016; Tsujino et.al., 2016; Austin et al., 2017; McCarthy and Obidzinski, 2017; Prabowo et al., 2017).

At the same time, the rapid expansion of oil palm has contributed essentially to rural economic development (Feintrenie et al., 2010; Rist et al., 2010; Lee et al., 2014; Castiblanco et al., 2015; McCarthy and Zen, 2016; Gatto et al., 2017; Purnomo et al., 2018). Recent empirical evidence has shown that oil palm is a profitable crop for small-farm households in terms of high returns to land, labor, income gains and improvements of living standards (Euler et al. 2017; Krishna et al. 2017). However, these studies focus on the impacts of oil

palm and how its growth affects smallholder farmers. Moreover, as the welfare gains from oil palm might be unequally distributed, previous research suggested that the oil palm expansion has contributed to rising inequality among farming households (Cramb and McCarthy, 2016; Euler et al., 2017; Gatto et al., 2017). However, in order to make any land-use decision associated with oil palm expansion, it is insufficient to look at profits and incomes of farm households only. There are also non-farm households in rural areas that may be affected through local labor markets. Non-farm households often belong to the poorest segments of rural populations and typically derive a sizeable part of their income from working as agricultural laborers (von Braun and Gatzweiler, 2014).

To the best of our knowledge, no previous study has analyzed the role of oil palm and other agricultural crops on the income of non-farm households in Indonesia or elsewhere. This study contributes to the literature by analyzing the role of different types of agricultural and non-agricultural employment incomes for non-farm households, with a particular emphasis on the income from employment in oil palm and alternative crops (especially rubber). It also highlights the effects of oil palm and rubber on income inequality among rural households. Data for this study were collected in rural Jambi, one of the hotspot regions of Indonesia's recent oil palm boom.

It should be stressed that this study only analyzes partial aspects of the palm oil sector in Indonesia, leaving environmental issues and also other social challenges, such as conflict over land, largely unaddressed. These other issues are important but beyond the scope of this dissertation. Nevertheless, the research provides new insights into areas that have not been well addressed in the literature so far.

1.3 Research objectives and approach

This dissertation includes two research papers, which contribute to the literature in different ways. Both papers are based on a survey of non-farm households in Jambi Province, Sumatra, Indonesia, conducted in 2015. The questionnaire, which is included in the General Appendix, captured details of the different income sources and economic activities of all household members for a period of 12 months. For employment in rubber and oil palm we also asked for details of the labor arrangements, such as type of employer (company or individual farm), type of contract (casual, permanent, sharecropping), wage rates, and

possible seasonality. Moreover, other demographic, social, and institutional details (e.g. household migration history, ethnicity, educational background, and market access) were also captured in the survey. Apart from non-farm household data, in the second paper, farm household data are also used. The farm household data were collected through a parallel survey conducted by a different team of researchers also in 2015. The farm household data helped in enriching the analysis and creating a broader picture of the role of oil palm and rubber on income inequality among all rural households. Additionally, we collected village-level data, such as land use at the village level and institutional history, through consulting village and sub-village heads.

The first paper examines the non-farm households living in Jambi province and the role of employment in oil palm and rubber for their livelihoods. It represents the novelty of this study as one of the first papers that shed light on how a group of less well studied stakeholders have also benefited from the development of rubber and oil palm in Indonesia. Specifically, the first paper analyzes the structure and determinants of non-farm household income, particularly focusing on the role of oil palm and rubber employment activities. Further, using regression models, we analyze the factors influencing household's decision to participate in oil palm, rubber and other employed or self-employed activities. Finally, we investigate whether the employment in oil palm or rubber influences the magnitude of household income. We disaggregate the employment activities into oil palm employment, rubber employment, other agricultural employment, non-farm employment, and self-employment and use different econometrics approaches.

The second paper analyzes how oil palm and rubber contribute to poverty and income inequality among farm and non-farm households in Jambi. First, we look at the differences between farm and non-farm households in terms of socio-demographic charachteristics. In addition, we examine the structure of farm and non-farm household incomes as well as their poverty situation. Second, we examine the distribution of rural household income and how poverty rates differ between groups and between different types of villages. Village are grouped into transmigrant and autochthnous villages as well as oil palm-based, rubber-based and mixed villages. This division is made based on the share of crop land to total village land. Finally, we analyze income inequality among rural households and how individual income sources contribute to overall inequality, with a particular focus on oil palm and rubber. We employ a Gini decomposition method, which allows the decomposition of the

overall Gini coefficient into different components. We test the hypothesis that incomes from oil palm and rubber contribute differentially to farm and non-farm household income inequality.

1.4 Dissertation outline

The rest of this dissertation is organized as follows: Chapter 2 presents the first paper, analyzing the role of different types of agricultural and non-agricultural employment income for non-farm households in rural Jambi, one of the hotspot regions of Indonesia's recent oil palm boom. This paper builds its findings on cross-sectional data. Chapter 3 features the second paper, which explores the effects of oil palm and rubber on income inequality among rural households based on farm and non-farm household data. Chapter 4 summarizes the major findings, draws conclusions and discusses policy implications. Details about the study area and the sampling procedure for data collection are included in the two papers themselves. The English version of the non-farm household questionnaire conducted in 2015 is included in the General Appendix.

CHAPTER 2: Land-use change and livelihoods of non-farm households: the role of income from employment in oil palm and rubber in rural Indonesia[1]

Abstract: Many tropical regions are experiencing massive land-use change that is often characterized by an expansion of oil palm at the expense of forests and more traditional forms of agricultural cropping. While implications of such land-use change for the environment and for local farm households were examined in previous research, possible effects on the livelihoods of non-farm households are not yet well understood. This study analyzes the role of different types of agricultural and non-agricultural employment income for non-farm households in rural Jambi, one of the hotspot regions of Indonesia's recent oil palm boom. Data from a survey show that employment in rubber and oil palm are important livelihood components for non-farm households. Employment in oil palm is more lucrative than employment in rubber, so involvement in the oil palm sector as a laborer is positively associated with total household income. Regression models show that whether or not a household works in oil palm is largely determined by factors related to migration background, ethnicity, and the size of the village area grown with this crop. These results suggest that further expansion of the oil palm area will likely benefit non-farm households through gains in employment income. As non-farm households belong to the poorest segments of the rural population, these benefits should not be ignored when designing policies towards sustainable land use. Possible negative environmental and social externalities of further oil palm expansion are also discussed.

Keywords: Rural labor markets; sharecropping; poverty; income inequality; deforestation

[1] This paper is published as In Press in the journal "Land Use Policy". It is co-authored by Vijesh V. Krishna, Zulkifli Alamsyah and Matin Qaim. Jonida Bou Dib is the first author and carried out data collection, data analysis, interpretation, and writing of the first draft of the paper. The co-authors commented at all stages of the research.

2.1 Introduction

During the past few decades, oil palm has become one of the most rapidly expanding agricultural crops, especially in Southeast Asia (Euler et al., 2016; FAO, 2017). Indonesia and Malaysia are the biggest producers of palm oil, with a combined world market share of 85% (FAO, 2017). In Indonesia, the land area grown with oil palm grew by almost 50% over the last 10 years. While some of the new oil palm plantations were established on recently deforested land, oil palm has also replaced other agricultural crops such as rubber (Krishna et al., 2017a). About 60% of the oil palm land in Indonesia is managed by large-scale public or private companies, the rest is cultivated by smallholder farmers (Gatto et al., 2015; Euler et al. 2016).

The rapid expansion of oil palm in Southeast Asia has given rise to various environmental and social concerns. Oil palm is often held rensponsible for tropical deforestation, loss of biodiversity, increases in greenhouse gas emmisions, land property conflicts, and social inequality (Fargione et al., 2008; Fitzherbert et al., 2008; McCarthy and Cramb, 2009; McCarthy 2010; Wicke et al., 2011; Cramb and Curry 2012; Obidzinski et al., 2013; Dewi et al., 2013; Margono et al., 2014; Tsujino et.al., 2016; Austin et al., 2017; McCarthy and Obidzinski, 2017). On the other hand, research also shows that oil palm can contribute to rural economic growth and development (Feintrenie et al., 2010; Rist et al., 2010; Lee et al., 2014; Castiblanco et al., 2015; Gatto et al., 2017). Recent studies found that small-farm households in Indonesia profit significantly from oil palm cultivation in terms of income gains and improvements in living standards (Krishna et al., 2017b; Euler et al., 2017).

However, in order to assesss the role of oil palm, or of land-use change more generally, for rural livelihoods it is insufficient to look at profits and incomes of farmers alone. There are also non-farm households in rural areas that may be affected through various channels, including changing conditions in local labor markets. Non-farm households often belong to the poorest segments of rural populations and typically derive a sizeable part of their income from working as agricultural laborers (von Braun and Gatzweiler, 2014). Land-use change may alter employment opportunities and incomes for these labor-supplying households (McCarthy, 2010; Li, 2011; McCarthy and Obidzinksi, 2017). To the best of our knowledge, no previous study has analyzed the role of oil palm and other agricultural crops for the income of non-farm households in Indonesia or elsewhere. Here, we address this research gap with data from a survey of non-farm households that we conducted in Jambi Province on the Island of Sumatra. Jambi has been one of the hotspots of the recent oil palm boom in

Indonesia (Clough et al., 2016). Based on our data, including several hundred observations from 26 randomly selected villages, non-farm households account for approximately 60% of all households in rural Jambi.[2] This means that a meaningful assessment of rural livelihoods is not possible without considering non-farm households.

We analyze the magnitude and structure of non-farm household income with a particular focus on the role of employment in oil palm and rubber farms and plantations. Oil palm and rubber are by far the two most important crops in Jambi in terms of the land area cultivated (Gatto et al., 2015; Euler et al., 2016). Using regression models, we also analyze factors that influence a household's decision whether or not to work in oil palm, rubber, and other employed or self-employed activities. Finally, we examine whether employment in oil palm or rubber affects the magnitude of household income after controling for other factors. As household employment decisions are endogenous, income differences cannot be interpreted as net effects of oil palm expansion. Nevertheless, insights into the relationships between land use, employment, and income of non-farm households can broaden the understanding of the socioeconomic trends associated with land-use change and possible sustainability trade-offs.

2.2 Background

2.2.1 Land-use change in Jambi

Jambi Province is located along the eastern coast of central Sumatra and was originally covered with tropical rainforest. Significant deforestation already started in Jambi more than 100 years ago to extract timber and grow rubber. For many decades, rubber was the most common cash crop in the region grown by companies and local smallholder farmers. While some oil palm was also grown in Jambi during the first half of the twentieth century, more formal development and growth of the palm oil sector only started during the 1970s (Gatto et al., 2017). Initially, oil palm was only cultivated on large plantations. Since the 1980s, smallholder farmers also started to get involved (Euler et al., 2016).

[2] We define non-farm households as households that earn less than 50% of their income from own farming enterprises. Our survey includes 432 non-farm households. To estimate the proportion of non-farm households in rural Jambi, we also used data from 300 farm households living in the same 26 villages (Drescher et al., 2016; Euler et al., 2017b).

The area planted with oil palm continued to grow during the last few decades, largely due to the rapid increase in the global demand for vegetable oil. Between 1990 and 2014, the oil palm area in Jambi almost quadrupled (Fig. 1). However, the rubber area in Jambi also increased, as there was still sufficient forestland that could be converted to agricultural use. Remote sensing data suggest that – between 1990 and 2010 alone – the forest area in Jambi decreased by more than one million hectares (Margono et al. 2012; Clough et al., 2016). Recent research showed that many of the new oil palm plantations were established in degraded (heavily logged) forests and shrub lands (Obidzinski et al., 2012; Gatto et al., 2015). It was estimated that around 8% of the new oil palm plantations in Jambi were established through direct clearing of intact forests (Gibbs et al., 2010; Margono et al., 2014).

To some extent, new oil palm plantations were also established on land previously cultivated with rubber, especially extensive rubber plots that are sometimes also referred to as 'jungle rubber' (Gatto et al., 2015, Drescher et al., 2016). The conversion of intensively-managed rubber into oil palm plantations was rare, as long as jungle rubber, forest, or shrub lands were still available. Fig. 1 shows that the rubber area in Jambi also increased between 1990 and 2010. Only more recently, the rubber area started to decline. With increasing land scarcity, more-intensively cultivated rubber is now also sometimes converted to oil palm. Since 2012, oil palm has been the most widely grown crop in Jambi (Fig. 1). Further land-use change can be expected in the future. If recent trends persist, oil palm will continue to grow at the expense of rubber. Against this background, it is important to understand what role these two crops play for the employment and income of local non-farm households.

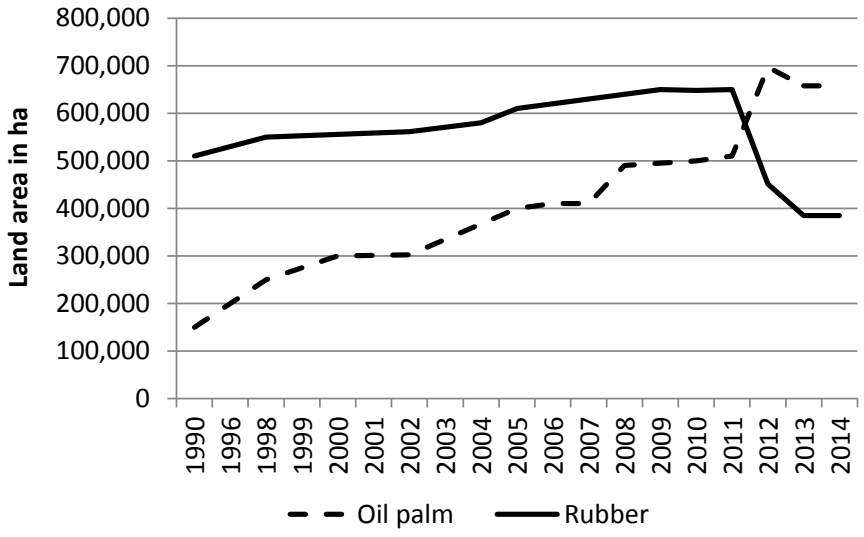

Figure 1. Oil palm and rubber cultivation in Jambi Province between 1990 and 2014.
Source: Own presentation based on official government statistics (BPS, 2017).

2.2.2 Institutional context

The autochthonous population in Jambi belongs to the Melayu ethnicity, but the proportion of people with other ethnicities has been growing due to significant in-migration. Since the early-1980s, the Government of Indonesia encouraged and supported such migration as part of its transmigration program (Fearnside, 1997). The transmigration program involved the voluntary relocation of famiies from densely populated Java to the so-called 'outer islands' Sumatra, Kalimantan, and Papua. Arriving families from Java were settled in newly established communities, the so-called transmigration villages. In these villages, transmigrant families were allocated a piece of land with full ownership rights and were supported in the cultivation of specific agricultural crops (Elmhirst, 1999; Murdiyarso et al., 2002; Gatto et al., 2017). In the early days of the program, transmigrant families were supported in the cultivation of rice, but soon the government's focus switched to rubber. From the late-1980s onward, new transmigrants were supported in the cultivation of oil palm, usually on land adjacent to large oil palm plantations. These large plantations were managed by public or private companies to which the transmigrant families delivered their harvest under contract (Gatto et al., 2015).

The government-sponsored contracts between palm oil companies and smallholder farmers in Indonesia are typically referred to as 'nucleus estate and smallholder' (NES) schemes (Larson, 1996; Feintrenie and Levang, 2009; McCarthy and Cramb, 2009; Cramb and McCarthy, 2016).[3] Under these contracts, farmers received subsidized loans and technical support. In addition, the government supported the construction of infrastructure (roads, schools etc.) in transmigrant villages. A recent study showed that communities with NES contracts experienced faster economic development than communities without such contracts (Gatto et al. 2017).

The NES schemes marked the beginning of smallholder farmers' involvement in the palm oil sector in Sumatra. Since the late-1990s, smallholders have also started to adopt oil palm independently without company contracts (Euler et al., 2016). Nowadays, not only transmigrants but also autochthonous Melayu farmers cultivate oil palm, but for many of the Melayu families rubber remains the major crop (Krishna et al., 2017b). As rubber trees can

[3] In later phases, government support for these NES schemes was phased out and the contracts between palm oil companies and smallholders became known as *Koperasi Kredit Primer untuk Anggota* (KKPA) schemes (McCarthy, 2010).

be productive for several decades, autochthonous Melayu families often have a cultural attachment to rubber, which is not the case for migrants from other parts of Indonesia.

In this study, we do not focus on farm households, but on non-farm households that generate most of their income from being employed or from own non-farm businesses. Non-farm households can be autochthonous people or migrants. In addition to the transmigrant families, there are many other households that migrated to Jambi from Java, from other parts of Sumatra, or also from other islands without government support. To differentiate from the transmigrants, these other migrants are sometimes referred to as 'spontaneous migrants' (Gatto et al., 2015). However, many of the spontaneous migrants settled in transmigrant villages, thus benefiting indirectly from the local economic development spurred by the NES contracts.

2.2.3 Types of agricultural labor contracts

Rubber and oil palm cultivation in Jambi is hardly mechanized, so a lot of manual labor is required for planting, fertilizing, weeding, spraying, harvesting, and other operations. Overall, rubber is more labor-intensive, while oil palm is more capital-intensive (Feintrenie et al., 2010; Lee et al., 2014). Hired labor is employed on large-scale plantations as well as on smallholder farms (Li, 2011; Obidzinski et al., 2012). Companies with rubber or oil palm plantations usually hire casual laborers without formal contracts for land clearing, but use permanent (or longer-term) contracts for most other operations (McCarthy and Cramb, 2009; McCarthy, 2010; Li, 2011; Sinaga, 2013; Li, 2015).

On smallholder farms, the employment arrangements differ more markedly between the two crops. For oil palm, farms typically hire casual laborers, especially for harvesting (Pye et al., 2012; Li, 2015). Casual laborers in oil palm are mostly male, due to the physical strength required. Many of the casual laborers work for the same oil palm farmer for longer periods of time, yet mostly without a formal contract (Li, 2011). Rubber farmers, on the other hand, primarily employ laborers through sharecropping arrangements, involving both male and female laborers (Li, 2015; Krishna et al., 2017b). Sharecropping in rubber means that the laborers do all the work on a rubber plot, but instead of a fixed wage they receive an agreed-upon share of the farmer's sales revenues. Sharecropping is typically a longer-term arrangement between the farmer and a labor household, but the contracts are informal and can be adjusted from time to time. According to our own survey data, depending on labor

supply and demand in a particular location, the age of the rubber trees on a farm, and other factors, sharecropping laborers typically receive a share of 50-70% of the rubber sales revenues. In principle, sharecropping arrangements also exist in oil palm, but these are rarely observed in Jambi.

2.2.4 Role of agriculture in local labor markets

Employment in the agricultural sector is an important source of income for rural non-farm households in Jambi, as we will show below using our household survey data. However, also from a broader economic perspective, agriculture remains a very important source of employment. Much of the employment in the agricultural sector is casual, so that macro-level statistics may underestimate this sector's role in local labor markets. To get a realistic assessment, the Indonesian Statistical Office carries out National Labor Force Surveys (SAKERNAS) every year using representative household samples. Building on SAKERNAS data for Jambi Province, Fig. 2 (panel A) shows that agriculture is by far the most important sector for the employment of casual laborers. While the sectors' relative role declined somewhat in recent years, in 2015 agriculture still employed around 60% of the casual laborers in Jambi. However, mean wages in the agricultural sector are much lower than in other sectors (Fig. 2, panel B). The main reason is that the agricultural sector primarily employs unskilled laborers (Krishna et al., 2017b). This underlines that agriculture is a particularly important source of employment for low-income households with relatively low levels of formal education (von Braun and Gatzweiler, 2014).

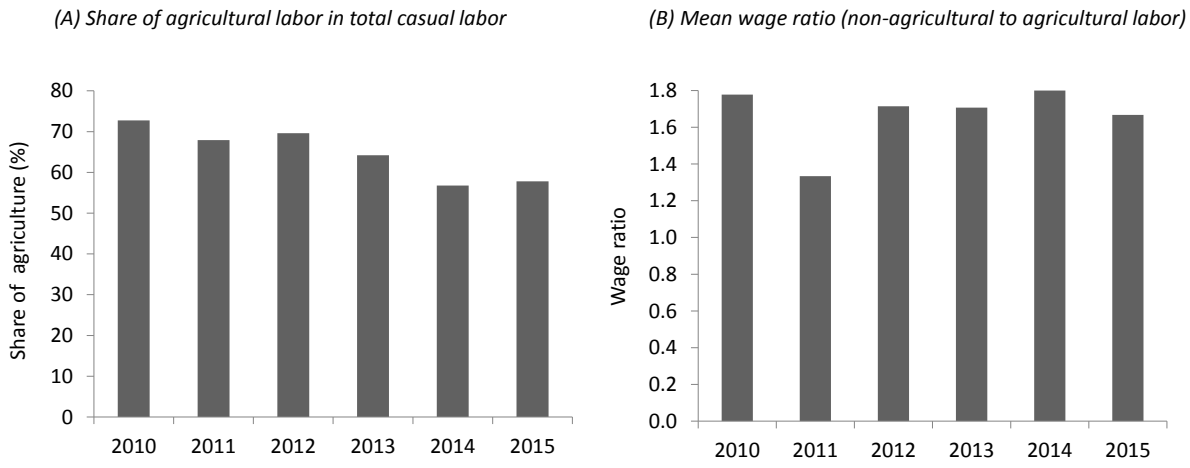

Figure 2. Role of the agricultural sector in labor markets in Jambi Province (2010-2015).
Source: Own presentation based on data from SAKERNAS (2010-2015).

2.3 Household survey

We carried out a survey of non-farm households in rural areas of Jambi Province in 2015. Non-farm households are defined as households for which own agricultural production accounts for less than 50% of total income. This does not necessarily mean that non-farm households are not involved in own agricultural production at all. Some of these households cultivate small fields of own land, but most of their income is derived from employed activities and/or self-employed non-farm businesses, such transport, trade, or handicrafts.

Non-farm households are not a homogenous group. Many of them are spontaneous migrants who moved to Jambi during the last 20-30 years in order to benefit from the booming rubber and palm oil sectors (Pye et al., 2012; Gatto et al., 2015). There are also a few transmigrants that obtained land as part of the transmigration program but sold some or all of their land later on due to various reasons, or descendants of transmigrants moving out of their parents' house and starting their own household with little or no land (Li, 2011). Finally, there is also a significant share of autochthonous households with little or no own land, often because they sold their land or lost it due to insecure property rights (McCarthy, 2010; Li, 2015; Krishna et al., 2017a). Further details about the socioeconomic characteristics of non-farm households are provided below. According to our survey data, non-farm households account for around 60% of all households in rural Jambi. Better understanding the livelihoods of non-farm households is important, because they often belong to the poorest population segments in the local village settings (von Braun and Gatzweiler, 2014; Gatto et al., 2017).

We used a multi-stage sampling procedure to select households for inclusion in the survey. First, we purposively selected four regencies in Jambi, namely Muaro Jambi, Batanghari, Sarolangun, and Tebo, representing the province's lowland areas where much of Jambi's oil palm land is located and where significant land-use change occurred in recent decades (Fig. 3). Second, we used lists of rural villages in these four regencies from the Village Potential Survey (PODES) to randomly select 26 villages. Third, in each village we randomly selected four sub-villages (so-called 'Rukun Tetangga' or RTs), because at the sub-village level it was much easier to obtain complete household lists and differentiate between farm and non-farm households with the help of the sub-village head. Fourth, in each sub-village, depending on the village size between 3 and 6 non-farm households were randomly selected, leading to 12-24 household observations per village. The total sample includes 432 households.

The survey was implemented between August and November 2015. Data were collected through face-to-face interviews using a structured questionnaire.[4] The interviews were conducted with the household head in Bahasa Indonesia by a team of six enumerators from Jambi University, who were intensively trained and supervised by the researchers. The questionnaire captured details of the different income sources and economic activities of all household members for a period of 12 months. For employment in rubber and oil palm we also asked for details of the labor arrangements, such as type of employer (company or individual farm), type of contract (casual, permanent, sharecropping), wage rates, and possible seasonality. Other demographic, social, and institutional details – such as household migration history, ethnicity, educational background, and market access – were also captured in the survey. Selected variables related to land use at the village level and village history (e.g., whether the village was established as part of the transmigration program) were collected through additionally consulting village and sub-village heads. Sample descriptive statistics are provided in the next section.

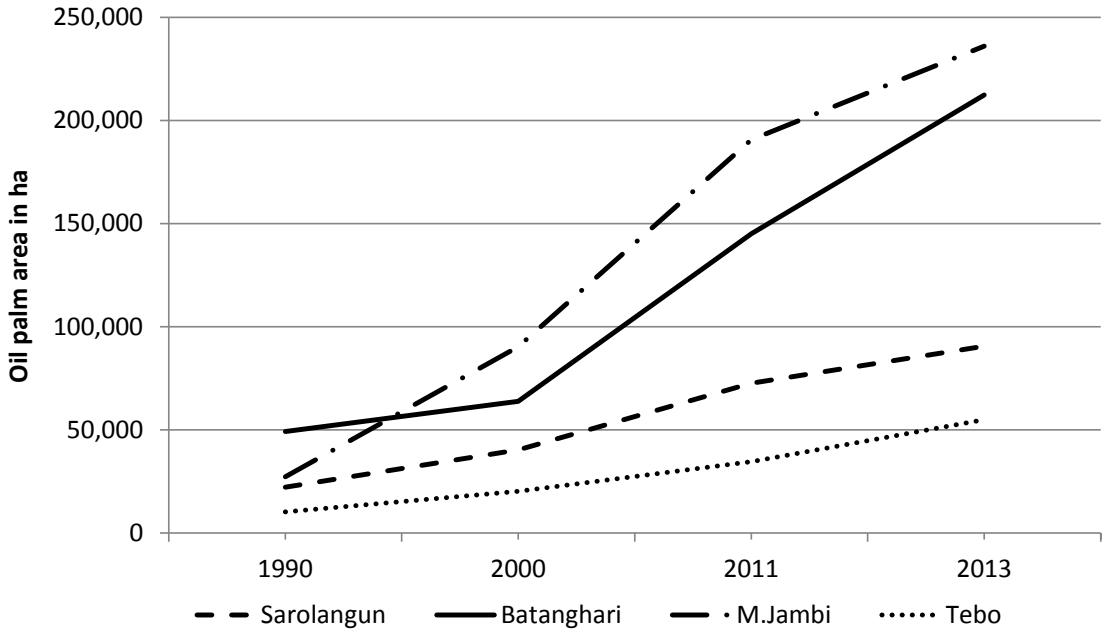

Figure 3. Development of oil palm area in four regencies of Jambi Province (1990-2013).
Source: Own presentation based on official government statistics (BPS, 2017).

[4] A copy of the questionnaire is provided in the General Appendix. Participation in the survey was voluntary, informed consent was obtained from all respondents. International ethical guidelines were followed. Institutional review board approval was not required, as the study was not associated with any health or financial risks for study participants.

2.4 Descriptive statistics

2.4.1 Socioeconomic characteristics of non-farm households

Table 1 shows descriptive statistics for the non-farm households surveyed in rural Jambi. The average sample household has close to four members. Almost all households are headed by men. About two-thirds have a migration background, and 80% of those with migration background came as spontaneous migrants outside of the government-sponsored transmigration program. Close to 60% of all households in the sample belong to the Javanese ethnicity, the rest belongs to the Melayu (26%), Sundanese, Batak, and other ethnicities. In terms of economic indicators, the average annual household income in the sample is 28.3 million Indonesian Rupiah (IDR) (about 2,100 US dollars), including all income sources. This is only about half of the average income of farm households in rural Jambi (Krishna et al., 2017b). In other words, non-farm households are significantly poorer than farm households on average.

Table 1 shows that 38% of the non-farm households in our sample work in oil palm, meaning that one or more of the household members worked in somebody else's oil palm farm or company plantations during the last 12 months. Most of this work in oil palm is through casual labor arrangements. Sixty-eight percent of the households work in rubber, mostly as sharecroppers. Agricultural employment in other crops is relatively rare in the study region (only 5% of the sample households). Thirteen percent of the households have one or more members with employment in non-agricultural sectors, and 17% pursue self-employed non-farm activities. Non-agricultural employment includes jobs in construction, manufacturing, education, and other services, while self-employed activities include trading of agricultural commodities, shop-keeping, handicrafts etc.[5] As can also be seen from Table 1, the average household in the sample has 0.6 ha of own land. Around 21% are involved in small-scale oil palm cultivation themselves.

[5] The numbers of who works in what type of employment in Table 1 do not add up to 100%, because most households have more than one source of income.

Table 1. Sample descriptive statistics

Variable name	Variable description	Mean	Std Dev
Socioeconomic characteristics			
Household size	Number of household members	3.896	1.269
Age	Age of household head (years)	41.810	10.62
Male	=1 if household head is male, 0 otherwise	0.984	0.126
Education	Years of education of household head	6.421	3.480
Migrant	=1 if household has migration background, 0 otherwise	0.674	0.469
Land owned	Total land owned in ha	0.640	1.068
Oil palm cultivation	=1 if household cultivates oil palm on own farm, 0 otherwise	0.206	0.405
Credit	=1 if household has access to credit, 0 otherwise	0.461	0.499
Melayu	=1 if household belongs to Melayu ethnicity	0.259	0.439
Javanese	=1 if household belongs to Javanese ethnicity	0.592	0.491
Other ethnicity	=1 if household belongs to Sundanese, Batak, or other ethnicity	0.171	0.377
Assets ownership	Asset index (based on principal components analysis)[a]	2.380	1.032
Total income	Total annual household income (‘000 Indonesian Rupiah)	28,250	50,243
Employment			
Oil palm employment	=1 if household works in oil palm, 0 otherwise	0.377	0.485
Rubber employment	=1 if household works in rubber, 0 otherwise	0.682	0.465
Other agric. Employment	=1 if household works in other crops., 0 otherwise	0.051	0.220
Non-farm employment	=1 if household works in non-farm sectors, 0 otherwise	0.129	0.336
Self-employment	=1 if household is self-employed, 0 otherwise	0.167	0.373
Employment arrangements			
Company	=1 if household works in palm oil or rubber company, 0 otherwise	0.268	0.443
Oil palm casual	=1 if household is casual laborer in oil palm, 0 otherwise	0.363	0.481
Oil palm permanent	=1 if household is permanent laborer in oil palm, 0 otherwise	0.007	0.083
Oil palm sharecropping	=1 if household is sharecropper in oil palm, 0 otherwise	0.005	0.068
Rubber casual	=1 if household is casual laborer in rubber, 0 otherwise	0.074	0.262
Rubber sharecropping	=1 if household is sharecropper in rubber, 0 otherwise	0.643	0.479
Oil palm history	=1 if previous generation was working in oil palm, 0 otherwise	0.065	0.246
Rubber history	=1 if previous generation was working in rubber, 0 otherwise	0.049	0.215
Village characteristics			
Autochthonous	=1 if autochthonous village, 0 otherwise	0.527	0.499
Transmigrant oil palm village	=1 if transmigrant oil palm village, 0 otherwise	0.250	0.433
Transmigrant rubber village	=1 if transmigrant rubber village, 0 otherwise	0.222	0.416
Share of oil palm in village	Share of oil palm land area in total village land	0.235	0.267
Share of rubber in village	Share of rubber land area in total village land	0.468	0.335

Note: The number of observations is N=432. [a] The asset index was calculated following Viyas and Kumaranayake (2006), using data on household ownership of the following assets: tractors, trucks, cars, motorbikes, fridges, air conditioners, television, satellite dishes, and washing machines. Larger index values indicate relatively more assets owned.

Fig. 4 shows the average wage rates received by households employed in oil palm and rubber (panel A). Wage rates are higher in oil palm employment, although some differences are observed according to major village land-use types.[6] Households employed in oil palm also work more hours per month than households employed in rubber (Fig. 4, panel B).[7] Higher wage rates per hour and longer hours worked, lead to higher average incomes for households employed in oil palm, as compared to households employed in rubber.

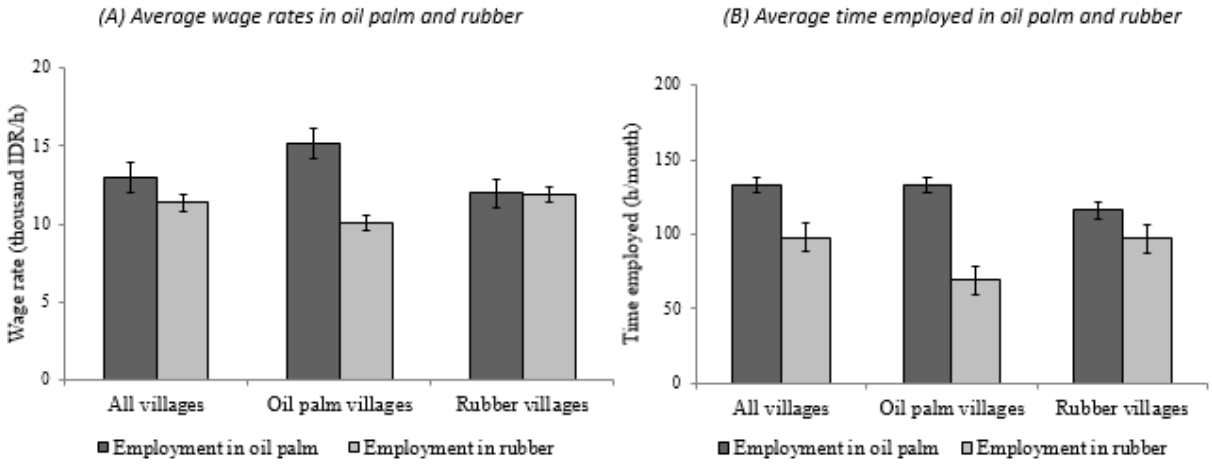

Figure 4. Average wage rates and hours employed in oil palm and rubber.
Notes: Calculations based on own survey data. Mean values are shown with error bars. For each column in the graphs, only households that were actually employed in oil palm/rubber were considered. The total number of villages included is 26, of which 11 were classified as oil palm villages (oil palm area in the village >50%), and 15 as rubber villages (rubber area in the village >50%).

[6] While sharecroppers do not work on a fixed-wage basis, we calculated the shadow wage rate for each sharecropping household based on the number of hours worked and the share of the revenues received.
[7] Rubber is more labor-intensive than oil palm when considering the number of hours required for the cultivation of one hectare (Euler et al., 2017). The numbers in Fig. 4 do not reflect the labor requirements per hectare, but count the number of hours that members of non-farm households worked as employed laborers in a particular crop.

2.4.2 Structure of income of non-farm households

Fig. 5 shows how different income sources contribute to total household income. Employment in rubber and oil palm accounts for 70% of total income, underlining the importance of these two crops for non-farm households' livelihoods. On average, rubber has a higher income share (44%) than oil palm (26%)[8]. However, this pattern changes across income terciles, as Fig. 5 also shows. With rising overall income, the share of income from employment in rubber decreases. For the poorest households (first tercile), employment in rubber accounts for over 60% of total income, for the richest households (third tercile) it only accounts for 24%. On the other hand, the importance of oil palm increases with overall income. The contribution of self-employment and other income sources to total income is also higher in relatively richer households. These simple comparisons do not allow causal inferences. Nevertheless, the results in Fig. 5 underline that the share of income from rubber employment is negatively associated with total household income, whereas the association between the share of income from oil palm and total household income is positive. This is consistent with field observations during the survey: households with employment in oil palm tend to live in better houses and are more likely to have access to electricity and tapped water than households with employment in rubber.

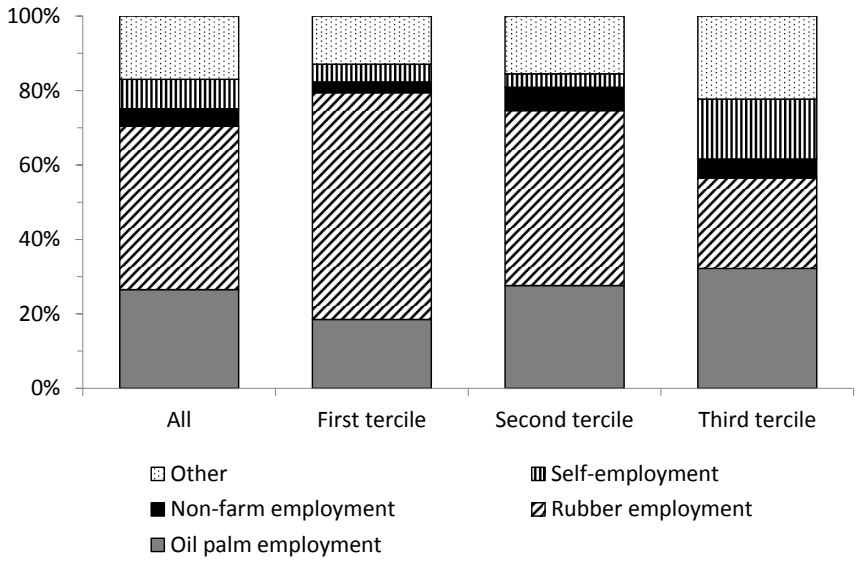

Figure 5. Structure of total household income by income tercile

[8] Note that these are average income shares calculated over all households in the sample (N=432). When only considering households that are employed in rubber and not in oil palm (N=232), the rubber income share is 74%. When only considering households that are employed in oil palm and not in rubber (N=120), the oil palm income share is 82%. The remaining households (N=80) work in both crops or in none of these crops. Households only employed in rubber are significantly poorer (annual mean income of 21.5 million IDR) than households only employed in oil palm (annual mean income of 31.1 million IDR).

2.5 Determinants of participation in different types of employment

2.5.1 Modeling approach

The previous section has shown that households with employment in rubber tend to be poorer than households with employment in oil palm. Against this background it is interesting and important to understand what factors influence household employment decisions. Households can be involved in more than one type of employment. This can be accounted for in a multivariate probit (MVP) model with dummies for participation in different types of activities as dependent variables. In an MVP model, the different equations are estimated simultaneously, thus allowing for non-zero correlation between the various employment activities (Greene, 2014).

We consider five different types of employment, namely oil palm employment, rubber employment, other agricultural employment, non-farm employment, and self-employment. Accordingly, the MVP model is specified as follows:

$$Y_{Mij} = \beta' X_{Mij} + \varepsilon_{Mij} \qquad M = 1, \dots 5$$

where Y_{Mij} is a dummy variable indicating whether or not household *i* in village *j* participates in activity *M*, X_{Mij} is a vector of household- and village-level explanatory variables, β_M is a vector of parameters to be estimated, and ε_{Mij} is a normally distributed random error term. We expect that household characteristics – such as age, education levels, asset ownership, and ethnicity – will play a role for employment decisions. In addition, village characteristics – such as the share of rubber and oil palm land in the village and whether or not the village was established as part of the transmigration program – may have an effect on local employment opportunities.

2.5.2 Estimation results

Estimation results from the MVP model are shown in Table 2 (the correlation matrix for the residuals from the different equations is shown in Table A1 in the Appendix). For interpretation, we primarily focus on the determinants of employment in oil palm (column 1) and rubber (column 2). Javanese households with a migration background are significantly more likely to be employed in oil palm than local households from the Melayu ethnicity.[9] Melayu households are more likely to be employed in rubber. These patterns are related to the history of land use in Jambi Province. As explained, rubber was the dominant cash crop in Jambi during the twentieth century. This means that autochthonous rural families have a long tradition of working in rubber. And this tradition seems to be perpetuated, not least through the observed sharecropping arrangements. As mentioned, sharecropping arrangements tend to be longer-term relationships between rubber farmers and labor households. Sometimes, these arrangements are even transferred from parents to children. Indeed, having previous-generation family members who worked in rubber significantly increases the probability of own employment in rubber, while decreasing the probability of being employed in oil palm (Table 2).

Most migrants who came from outside of Jambi do not have such a family tradition of working in rubber. A few of the early migrants, who arrived in Jambi before the oil palm boom started, found employment in rubber. But most of the migrants who came to Jambi since the early-1990s started working in oil palm. In fact, the growing palm oil sector and its demand for labor was an important reason for many households from outside the region to migrate to Jambi.

The size of the land owned by households reduces the probability of being employed in oil palm on other farms or plantations. This is plausible, because households with a larger land size typically spend more time working on their own farm. However, after controlling for land size, own cultivation of oil palm tends to increase the probability of oil palm employment, which may be explained by the experience gained with this crop.

Looking at the village-level variables in the lower part of Table 2 shows that living in a transmigrant oil palm village (i.e., where transmigrant families were supported in oil palm cultivation) increases the probability of being employed in oil palm, while decreasing the

[9] The variables migrant and Javanese are positively correlated, but not all migrants are of Javanese ethnicity. Some of the migrants also came to Jambi from other parts of Sumatra, or from different islands.

probability of being employed in rubber. Similarly, the share of oil palm in total village land increases the probability of employment in oil palm, while decreasing the probability of employment in rubber. These results are unsurprising, as they reflect local patterns of labor demand and employment opportunities.

Table 2. Determinants of participations in different employment activities

	(1) Oil palm employment	(2) Rubber employment	(3) Other agric. employment	(4) Non-farm employment	(5) Self-employment
Household level					
Household size	0.038	0.028	0.193**	0.036	-0.032
	(0.063)	(0.069)	(0.082)	(0.064)	(0.063)
Age	-0.041***	0.026**	0.019	0.014*	0.0122
	(0.009)	(0.010)	(0.012)	(0.008)	(0.008)
Education	0.017	-0.051*	0.019	0.034	0.034
	(0.024)	(0.026)	(0.036)	(0.027)	(0.025)
Migrant	0.405**	-0.435**	0.037	0.011	0.113
	(0.191)	(0.222)	(0.284)	(0.199)	(0.187)
Asset ownership	0.032	-0.126	-0.071	0.0288	0.301***
	(0.083)	(0.097)	(0.125)	(0.085)	(0.202)
Land owned	-0.142*	-0.072	0.013	-0.177*	0.348***
	(0.079)	(0.075)	(0.127)	(0.101)	(0.085)
Oil palm cultivation	0.769***	-0.042	-0.393	-0.321	0.204***
	(0.205)	(0.212)	(0.382)	(0.244)	(0.074)
Credit access	-0.188	-0.010	0.213	-0.0172	0.212
	(0.161)	(0.188)	(0.250)	(0.165)	(0.161)
Javanese [a]	0.809***	-0.867***	0.616*	-0.134	0.457*
	(0.231)	(0.253)	(0.322)	(0.240)	(0.241)
Other ethnicity [a]	-0.016	-0.507**	-0.320	0.123	0.017
	(0.219)	(0.241)	(0.426)	(0.211)	(0.209)
Oil palm history	6.136	-1.478***	-4.255	-0.125	-0.389
	(215.8)	(0.412)	(538.6)	(0.337)	(0.315)
Rubber history	-0.748***	2.238***	0.058	0.429**	-0.224
	(0.220)	(0.431)	(0.293)	(0.202)	(0.216)
Village level					
Transmigrant oil palm village [b]	0.849***	-0.771***	0.930	0.615	-0.144
	(0.206)	(0.216)	(0.620)	(0.393)	(0.379)
Transmigrant rubber village [b]	-0.153	4.797	-0.122	-0.058	0.418*
	(0.223)	(99.11)	(0.359)	(0.232)	(0.222)
Share of oil palm in village	1.903***	-3.639***	-2.352**	-0.197	0.964*
	(0.489)	(0.581)	(1.025)	(0.565)	(0.503)
Share of rubber in village	-0.367	1.021***	0.326	0.451	-0.0007
	(0.287)	(0.304)	(0.408)	(0.338)	(0.308)
Constant	0.002	0.092	-2.645**	-2.475***	-3.123***
	(0.884)	(0.884)	(1.047)	(0.910)	(0.862)

Notes: Coefficient estimates from a multivariate probit model are shown with robust standard errors in parentheses; N = 432; log likelihood = -484.35; Chi-squared=70.35; * significant at 10% level; ** significant at 5% level; *** significant at 1% level. [a] Reference group is Melayu. [b] Reference group is autochthonous village.

Interestingly, the share of oil palm in total village land also increases the probability of being involved in self-employed activities (column 5 of Table 2). Previous research in Jambi showed that oil palm cultivation leads to significant income gains in farming households (Euler et al., 2017; Krishna et al., 2017b). Such income gains can boost local demand for

goods and services offered by small non-farm businesses, thus improving opportunities for self-employed activities. Other factors that are positively associated with self-employment include ownership of land and other assets, as well as own oil palm cultivation. Finally, households of Javanese ethnicity are more likely to be involved in self-employed activities than Melayu households.

2.6 Correlates of household income

2.6.1 Factors influencing total household income

The descriptive analysis above suggested that employment in oil palm is positively associated with total household income. We now examine this relationship further with regression models, controlling for possible confounding factors. In particular, we regress total household income on oil palm employment and other covariates that may also influence income. One way to measure oil palm employment could be to simply take the employment dummy variable that was also used in the previous section. However, while many households work either in oil palm or in rubber, a few households also derive income from employment in both crops. Typically, households with employment income from both oil palm and rubber primarily concentrate on one of these crops and only receive a small share from the other. To avoid ambiguity, we therefore use two dummy variables, one for households that work only in oil palm and the second for households that work in both oil palm and rubber. The reference group comprises households that only work in rubber.[10] To allow for non-linear effects and facilitate interpretation in percentage terms, the dependent variable – total household income – is expressed in logarithmic form.

Three versions of this income model are shown in Table 3 with different covariates included. Column (1) only includes the two oil palm employment dummy variables without any other covariates. The coefficient for 'employment in oil palm only' is positive and highly significant. On average, households that are employed only in oil palm have 32% higher total incomes than households that are only employed in rubber. The dummy variable for employment in both crops has a coefficient that is positive but not statistically significant.

[10] These dummy variables only refer to oil palm and rubber employment. Employed only in oil palm or only in rubber simply means that these households are not employed in the other crop; it does not mean that these households could not also be employed or self-employed in other sectors.

Table 3. Factors influencing total household income

	(1) Total income (log)	(2) Total income (log)	(3) Total income (log)
Household level			
Employment in oil palm only [a]	0.318***	0.331***	0.231**
	(0.075)	(0.085)	(0.095)
Employment in oil palm and rubber [a]	0.013	0.072	0.045
	(0.118)	(0.120)	(0.119)
Household size		0.063*	0.064*
		(0.029)	(0.028)
Age		0.006*	0.006
		(0.004)	(0.004)
Education		0.029**	0.032**
		(0.011)	(0.011)
Land owned		0.261***	0.243***
		(0.033)	(0.033)
Javanese [b]		0.067	0.026
		(0.089)	(0.099)
Other ethnicity [b]		0.142	0.131
		(0.111)	(0.094)
Village level			
Transmigrant oil palm village [c]			0.059
			(0.159)
Transmigrant rubber village [c]			-0.189*
			(0.101)
Share of oil palm in village			0.471**
			(0.229)
Share of rubber in village			0.278***
			(0.134)
Constant	9.707***	8.865***	8.639***
	(0.046)	(0.230)	(0.243)
R-squared	0.037	0.195	0.237

Notes: Coefficient estimates from ordinary least squares regressions are shown with robust standard errors in parentheses; N = 432. The three models in columns (1), (2), and (3) differ only in terms of the covariates included, as shown in each column. * significant at 10% level; ** significant at 5% level; *** significant at 1% level. [a] Reference group is households only employed in rubber. [b] Reference group is Melayu. [c] Reference group is autochthonous village.

Since employment in oil palm is influenced by a number of socioeconomic factors, it is important to control for these factors, which is done in columns (2) and (3) of Table 3. In column (2), we only include household-level variables. Unsurprisingly, larger households and those with more own land and better educated household heads have higher total incomes. However, even after controlling for these factors, the effect of oil palm employment remains significant and in the same magnitude as in column (1).

In column (3) of Table 3, we additionally include village-level variables. A higher share of oil palm and also a higher share of rubber in total village land both have positive and significant effects on total household income. This is plausible, because these two cash crops

provide more employment for non-farm households than local food crops such as rice or cassava. However, the effect of oil palm is larger than that of rubber: in a hypothetical village where all the land was cultivated with oil palm (share of oil palm in village land equal to 1), non-farm households would have 47% higher incomes than in a village without any oil palm cultivation. For rubber, the corresponding effect would be 28%.[11] To some extent, these differences can be explained through the wages that are higher in oil palm than in rubber (see above). However, as mentioned, the expansion of oil palm is also associated with infrastructure improvements and overall economic growth at the village level, which can contribute to income gains for non-farm households also through various other channels.

In the model in column (3) of Table 3, the coefficient of employment in oil palm remains positive and significant, but it is somewhat smaller than the coefficients in columns (1) and (2). This comparison further supports the finding that oil palm contributes to income gains among non-farm households through various channels.

2.6.2 Factors influencing income from oil palm and rubber employment

In addition to understanding the effects of oil palm and rubber employment on total household income, it is also interesting to identify and compare factors that influence the level of employment income from these two crops. Such analysis is undertaken in this subsection. In particular, in separate models we regress income from oil palm employment and income from rubber employment on a set of explanatory variables. Households not employed in one of these crops have zero income for the respective model. We use a Tobit estimator to account for this left-censoring of the dependent variables. Estimation results are shown in Table 4.

Columns (1) and (3) of Table 4 show the models for income from oil palm and rubber employment with household-level and village-level explanatory variables included. The estimates in column (1) suggest that education has a significantly positive effect on income from oil palm employment. Every additional year of schooling increases income from oil palm employment by 443 thousand IDR. Interesting to see is that the same effect is not observed in rubber. In other words, for employment in rubber better education does not

[11] The negative and significant income effect in transmigrant rubber villages is probably related to the relatively old age of the rubber trees and thus lower crop productivity in these villages. The rubber plantations in these villages were mostly planted in the early-1980s.

necessarily seem to pay off.[12] We also see differences in the effects of age. While for rubber employment age does not seem to play a significant role, the income from oil palm decreases with rising age. This is probably related to the physical strength required for the manual operations in the oil palm crop, especially harvesting.

Table 4. Factors influencing income from oil palm and rubber employment

	(1) Income from oil palm employm.	(2) Income from oil palm employm.	(3) Income from rubber employm.	(4) Income from rubber employm.
Household level				
Household size	-355.76	-244.35	601	421.4
	(1,058)	(391.62)	(461.59)	(428.9)
Age	-98.41**	-98.54*	126	87.1
	(56.42)	(52.87)	(71.97)	(69.78)
Education	443.49**	194.3	-5.05	79.17
	(168.8)	(155.5)	(145.1)	(202.6)
Migrant	3,481**	2,485**	-901	484.2
	(1,138)	(1,047)	(1,115)	(1,096)
Land owned	-164.44	-302.2	-306.4	-92.87
	(829.6)	(741.6)	(472.4)	(380)
Javanese [a]	3,809**	2,445**	-4,825***	-3,635***
	(1,798)	(1,652)	(1,238)	(1,196)
Other ethnicity [a]	1,754.6	2,128	-587.8	-267.3
	(1,591)	(1529)	(1,674)	(1,541)
Village level				
Transmigrant oil palm village [b]	5,381**	6,647***	-2,359	-6,131***
	(5,464)	(1,698)	(1,971)	(1,077)
Transmigrant rubber village [b]	-5,858***	-3,142***	-1,619	-4,371**
	(1,115)	(929.7)	(1,473)	(1,497)
Share of oil palm in village	22,916***		-8,977***	
	(4,098)		(2,522)	
Share of rubber in village	-3,549*		3,463*	
	(2,114)		(2152)	
Employment contract				
Company employment		10,941***		1,338
		(1,629)		(1,033)
Permanent contract [c]		7,430*		
		(4,748)		
Sharecropping contract [c]		26,629		10,117***
		(19,476)		(1,015)
Constant	4,520	2,892	4,446	-999.3***
	(3,496)	(3260)	(4,823)	(3,868)
Pseudo R-squared	0.289	0.338	0.168	0.271

Notes: Coefficient estimates from Tobit regressions are shown with robust standard errors in parentheses; N = 432. In all models, income is measured in '000 Indonesian Rupiah. The two models in columns (1) and (2) have income from oil palm employment as dependent variable, whereas the two models in columns (3) and (4) have income from rubber employment as dependent variable. Otherwise, the four models differ only in terms of the covariates included, as shown in each column. * significant at 10% level; ** significant at 5% level; *** significant at 1% level. [a] Reference group is Melayu. [b] Reference group is autochthonous village. [c] Reference group is casual labor arrangement.

[12] We saw in Table 2 that households with better education are less likely to be employed in rubber.

In terms of the village-level variables, the share of oil palm in the village significantly increases the income from oil palm employment while decreasing the income from rubber employment (Table 4). For the share of rubber in the village, the signs of the coefficients are reversed. This as such is unsurprising. Noteworthy, however, is that the positive effect of the share of oil palm in column (1) is much larger than the negative effect in column (3). In other words, the expansion of oil palm at the village level leads to gains in employment income from that crop that are larger than the losses in employment income from rubber.[13]

In the models in columns (2) and (4) of Table 4 we additionally include variables characterizing the types of employment contracts that households have in oil palm and rubber. As these contract-related variables are closely correlated with village-level factors, we had to exclude some of the village variables to avoid problems of multicollinearity. The results in column (2) suggest for oil palm that being employed on a company plantation leads to higher income than being employed on an individual farm. Wage rates paid by companies are not necessarily higher than those paid by individual farmers, but company contracts are usually associated with lower fluctuations in terms of working hours. A significant company effect is not observed for rubber in column (4), even though it should be stressed that employment on rubber company plantations is relatively rare in our sample.

Having a permanent employment contract in oil palm is associated with higher income than working under casual labor arrangements (column 2 of Table 4). To some extent, this is also related to differences in terms of working hours. However, people with a permanent contract are often also employed for tasks where more skills are required, so that average wage rates are also higher than for casual laborers. Permanent employment contracts hardly exist in rubber, which is why this variable was not included in column (4). But for rubber we see that sharecropping contracts lead to much higher employment incomes than casual labor arrangements. This is also why sharecropping arrangements are popular among non-farm households in Jambi, especially for Melayu households in autochthonous villages where employment opportunities outside of the rubber sector were relatively rare in the past.

[13] Note that this comparison of income gains and losses holds true on average. Individual households may suffer from income losses if they lose employment in rubber without finding new employment in oil palm. This may potentially happen because the worker requirements in both crops are not identical.

2.7 Discussion

The data from rural Jambi have shown that employment in rubber and oil palm is an important livelihood component for non-farm households, accounting for 70% of total household income on average. Poorer households depend much more on employment in rubber, whereas for richer households employment in oil palm is of larger importance. The role of self-employed non-farm businesses – such as transport, trade, or handicrafts – also increases with total household income.

Regression models were used to analyze the determinants of household participation in different types of employment. Major factors explaining whether non-farm households work in oil palm or rubber are related to migration background and ethnicity. Migrant households from Java and other islands were found to be much more likely to work in oil palm than autochthonous Melayu households who have a stronger tradition of working in rubber. At the same time, employment in oil palm was found to be associated with significantly higher household incomes, also after controlling for other factors. This means that migrant non-farm households are significantly richer than autochthonous non-farm households on average.

The results also showed that opportunities to work in oil palm increase significantly with the share of total village land cultivated with oil palm. While this result is not surprising, it suggests that further expansion of the oil palm area will likely benefit non-farm households through higher employment incomes. Non-farm households that heavily depend on working in rubber may suffer from such land-use change through lower incomes from rubber employment. But our regression results suggest that such income losses will likely be overcompensated by the gains that arise through newly emerging employment opportunities. Apart from working in oil palm, the expansion of the oil palm area at the village level also contributes to significant increases in income from self-employed activities. This can be explained by oil palm developments being associated with general infrastructure improvements and growth in the local village economy, leading to a boost in demand for locally produced goods and services.

To be sure, we did not explicitly analyze the impacts of land-use change, as this would require panel data with several rounds of observations over time. Our analysis only used cross-section data. We also acknowledge that household employment decisions are endogenous and may be influenced by unobserved factors that we could not properly control for in the analysis. Similarly, the share of the oil palm and rubber area in a village is not a

random variable and may also be influenced by unobserved factors. Against this background, the estimated coefficients should not be over-interpreted in terms of causal effects. Nevertheless, even when only interpreting in terms of associations, the results clearly show that oil palm cultivation is positively associated with the income of non-farm households in rural Jambi. This allows the cautious conclusion that further land-use change towards oil palm will likely benefit rural non-farm households economically. Given that non-farm households typically belong to the poorest population segments in rural Indonesia, the economic gains from employment in oil palm can contribute to poverty reduction.

However, our finding of economic gains for non-farm households does not imply that all households in rural Jambi would benefit from oil palm expansion to the same extent. Previous research suggested that the oil palm expansion has contributed to rising inequality among farming households due to various reasons (Cramb and McCarthy, 2016; Gatto et al, 2017). Euler et al. (2017) showed that the absolute income gains from oil palm adoption are positively correlated with initial income levels. Similarly, Krishna et al. (2017b) showed that farmers with access to capital and additional land benefit more from oil palm adoption than capital- and land-constrained farmers. Some farmers without sufficient access to capital sold their land, thus losing the basis for own agricultural production (McCarthy, 2010).

Our results suggest that oil palm expansion may exacerbate inequality also among non-farm households, possibly further intensifying ethnic and geographical divides. Due to different cultural traditions, Melayu households are much less involved in oil palm employment than Javanese or other migrant households. Similarly, non-farm households in autochthonous villages with a smaller share of oil palm land have fewer opportunities to benefit from the economic boom in the palm oil sector. Even though not explicitly analyzed here, rising intra-village inequality is in line with other recent empirical studies (McCarthy, 2010; Euler et al., 2016; Gatto et al., 2017).

Beyond rising inequality, the oil palm boom in Indonesia is associated with other social and environmental externalities. The biodiversity loss and climate change effects induced by tropical deforestation are well documented (Fitzherbert et al., 2012; Clough et al., 2016; Drescher et al., 2016). These are global problems that need to be managed. However, deforestation and oil palm expansion cause local environmental problems too, thus directly reducing the quality of life of households living in affected areas. Forest fires, which are often used deliberately to clear forestland for agricultural production, contribute to serious air pollution and haze (Obidzinski et al., 2012). In sloped terrain, deforestation can lead to soil

erosion and landslides. Also when no deforestation is involved, switching from rubber to oil palm can reduce environmental quality, as oil palm is typically cultivated with higher input intensities (Kubitza et al., 2018). Higher quantities of chemical fertilizers and pesticides can negatively affect wildlife and fresh water resources (Dudgeon et al., 2006; Obidzinski et al., 2012). Such negative externalities need to be considered in a broader analysis of the effects of oil palm expansion.

2.8 Conclusion

Indonesia and other regions in the tropics are experiencing massive land-use change that is often characterized by an expansion of the area cultivated with oil palm at the expense of forests and more traditional forms of agricultural land use (Wicke et al., 2011; Margono et al., 2012; Obidzinski et al., 2013). The implications of such land-use change for the environment and for local farm households have been examined in previous research (Fargione et al., 2008; Fitzherbert et al., 2008; McCarthy and Cramb, 2009; Wicke et al., 2011; Margono et al., 2014; Euler et al., 2017; Krishna et al., 2017b; McCarthy and Obidzinski, 2017). However, land-use change may also affect non-farm households through labor markets and other possible spillovers. Economic effects of land-use change on non-farm households were hardly analyzed in previous research. In this study, we have contributed to the literature by analyzing the role of different types of agricultural and non-agricultural employment income for non-farm households in rural Jambi, one of the hotspot regions of Indonesia's recent oil palm boom (Clough et al., 2016). Non-farm households often belong to the poorest population segments in rural areas, so that better understanding the possible ramifications of land-use change for these households is of particular relevance for development policy.

Oil palm and rubber are the most important agricultural crops in Jambi, cultivated by large companies as well as smallholder farmers. Our data revealed that employment in both crops is an important livelihood component for non-farm households, accounting for 70% of total household incomes. Employment in oil palm is more lucrative than employment in rubber, so involvement in the oil palm sector as a laborer is positively associated with total household income. Regression models showed that whether or not a household works in oil palm is largely determined by factors related to migration background, ethnicity, and the size of the village area grown with this crop. These results suggest that further expansion of the oil palm area will likely benefit non-farm households through gains in employment income. These economic gains could contribute to poverty reduction. At the same time, further oil palm expansion may contribute to rising inequality and also causes environmental problems at global and local scales. Policies towards more sustainable land use require the consideration of economic, social, and environmental dimensions.

2.9 Appendix

Table A1. Correlation matrix from the multivariate probit model

	Oil palm employment	Rubber employment	Other agricultural employment	Non-farm employment
Rubber employment	-0.152***			
	(0.195)			
Other agricultural employment	-0.308*	0.241		
	(0.172)	(0.164)		
Non-farm employment	0.029	0.110	-0.288	1
	(0.119)	(0.127)	(0.129)	
Self-employment	-0.129	-0.241*	-0.312**	-0.331***
	(0.112)	(0.144)	(0.149)	(0.126)

Notes: Correlation coefficients of the residuals in the different equations are shown with standard errors in parentheses; N = 432. The likelihood ratio test of equal correlation coefficients is rejected ($p < 0.01$). * significant at 10% level; ** significant at 5% level; *** significant at 1% level.

CHAPTER 3: Land-use changes and income inequality in rural Indonesia[14]

Abstract. Many regions in Southeast Asia are experiencing massive land-use change. While areas covered with tropical forests and traditional agricultural crops, such as rubber, are shrinking, oil palm plantations are rapidly gaining ground. Recent studies have analyzed environmental effects of this land-use change. Relatively little is known about the socioeconomic implications. A few studies have examined economic effects of oil palm cultivation for particular groups of households, such as farmers, but broader effects for different types of rural households are not yet well understood. We address this research gap with data from farm and non-farm households in rural Jambi, one of the hotspots of Indonesia's recent oil palm boom. On average, farm households have significantly higher incomes than non-farm households that often work as agricultural laborers on rubber and oil palm plantations. Both farm and non-farm households are better off in villages with a large share of the land under oil palm than in villages where relatively more rubber and other crops are grown. Oil palm does not seem to have significant effects on overall rural inequality. While oil palm cultivation contributes to increasing inequality among farmers, it tends to decrease income inequality among non-farm households through labor-market and employment effects.

Keywords: Oil palm; rubber; deforestation; rural households; income inequality; Indonesia

[14] This paper is co-authored by Zulkifli Alamsyah and Matin Qaim. Jonida Bou Dib is the first author and carried out data collection among the non-farm households, data analysis, interpretation, and writing of the first draft of the paper. The co-authors commented at all stages of the research.

3.1 Introduction

Many regions in Southeast Asia have recently experienced considerable land-use change. Land areas covered with tropical forest and traditional agricultural crops, such as rubber, have been shrinking. At the same time, oil palm plantations were expanded rapidly. The expansion of the oil palm area was instigated by rising global demand for vegetable oils and biofuels. Palm oil is now the most traded vegetable oil in the world; there is no other crop that yields higher quantities of edible oil per unit of land (Sayer et al., 2012; Cramb and McCarthy, 2016; World Bank, 2017; USDA, 2017). Indonesia is the world's leader in palm oil production with an estimated global market share of 55% (FAO, 2017; USDA, 2017).

These land-use changes have far-reaching environmental and socioeconomic consequences. Deforestation and the expansion of oil palm plantations were found to be associated with biodiversity loss, increased greenhouse gas emissions, land conflicts, displacement of forest-dependent tribes, and other social concerns (Naylor et al., 2007; Fitzherbert et al., 2008; McCarthy 2010; Wicke et al., 2011; Cramb and Curry 2012; Obidzinski et al., 2013; Margono et al., 2014; Abood et al., 2015; Susanti and Maryudi 2016; Tsujino et.al., 2016; Kunz et al., 2017; Prabowo et al., 2017; Purnomo et al., 2017; Purnomo et al., 2018). On the other hand, oil palm cultivation has contributed to rural income growth and economic development (Feintrenie et al., 2010; Rist et al., 2010; Lee et al., 2014; Castiblanco et al., 2015; Gatto et al., 2017; Purnomo et al., 2018). While many of the oil palm plantations were established by large public and private sector companies, approximately 40% of the oil palm area in Indonesia is managed by smallholder farmers (Euler et al., 2016).

Several recent studies with household-level data from Indonesia have shown that smallholder farmers can benefit significantly from cultivating oil palm, in terms of income gains and improved living standards (Euler et al., 2017; Krishna et al., 2017b). However, not all farmers are able to cultivate oil palm, because the crop is capital-intensive and local farm households are often credit-constrained (Kubitza et al., 2018). Even among those farmers who managed to establish oil palm plantations, the benefits are heterogeneous, because of unequal access to inputs, technical know-how, and other factors of production (Krishna et al., 2017b). Hence, oil palm expansion may contribute to rising inequality among farmers (McCarthy, 2010), even though effects on income distribution have not been analyzed explicitly. In addition to farmers, landless rural households may also be affected through land-use change. A recent study with data from Sumatra, Indonesia, showed that own farming activities are the main source of income for less than half of all rural households; for

most of the rest working on other farms and company plantations as laborers is the major source of household income (Bou Dib et al., 2018). In how far the expansion of cash crops in general, and of oil palm in particular, affects the incomes of non-farm households and rural income distribution more broadly is not yet sufficiently understood. This is a relevant research gap, because landless households often belong to the poorest of the poor in rural areas. The present study makes an attempt to contribute in this direction.

In particular, we use representative data from rural areas of Sumatra, covering both farm and non-farm households, to analyze and compare income levels, income structures, and sources of inequality with a particular focus on oil palm and rubber. The data were collected in 2015 in 26 randomly selected villages in Jambi Province. Observed regional differences in agricultural land-use types are used to compare mean levels of income, poverty, and inequality between villages with smaller and larger proportions of oil palm land. The rest of this article proceeds as follows. The next section provides some background on oil palm expansion and the situation of poverty and income inequality in Indonesia. The data and statistical approaches are explained in section 3, while the empirical results are presented and discussed in section 4. Section 5 concludes.

3.2 Background

3.2.1 Oil palm expansion in Indonesia

Palm oil is a very important ingredient for a number of foods and cosmetic products, and is considered the cheapest source of vegetable oil in international markets (Miyake et al., 2012). This has resulted in the rapid expansion of oil palm plantations in tropical areas of Southeast Asia. Since 2009, Indonesia has been the largest producer of palm oil worldwide (Fig. 6).

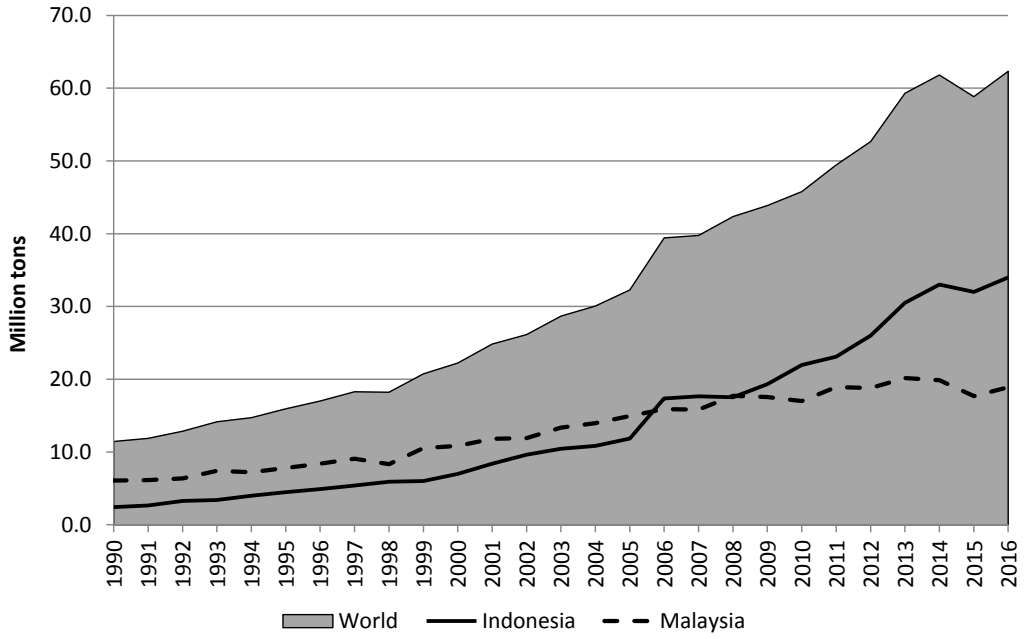

Figure 6. Palm oil production between 1990 and 2016
Sources: Own presentation based on data from FAO (2017), USDA (2017), and DJP (2017).

In addition to the rising demand from international markets, the growth of the palm oil industry in Indonesia and the involvement of smallholder farmers were also spurred by the Indonesian government's transmigration program in the 1980s and early-1990s (Gatto et al., 2017). The transmigration program involved the voluntary resettling of households from densely-populated Java to less-densely populated islands, such as Sumatra. Families participating in this program settled in newly-established transmigrant villages, where they were allocated 2-3 ha of land and supported in the cultivation of agricultural crops through the provision of subsidized credits, inputs, and technical advice (McCarthy 2010). In the early 1980s, transmigrant families were primarily supported in the cultivation of rubber. Since the mid-1980s, the government's focus had switched to oil palm (Krishna et al., 2017b).

In the late-1980s, almost all smallholder farmers cultivating oil palm were transmigrant families that produced the crop under government-sponsored contract with public or private companies. Since the mid-1990s, more and more autochthonous farmers had also started to cultivate oil palm, delivering their produce to nearby company mills, mostly without any contracts (Euler et al., 2016). Today, transmigrant and autochthonous families produce oil palm mostly without contracts. Most of the initial contracts expired, and – without the government-subsidized credits – most farmers find it more attractive to cultivate oil palm independently (Gatto et al., 2017). Fig. 7 shows the development of the oil palm area in Indonesia since 1990. In 2016, around 40% of the total oil palm area was managed by smallholder farmers.

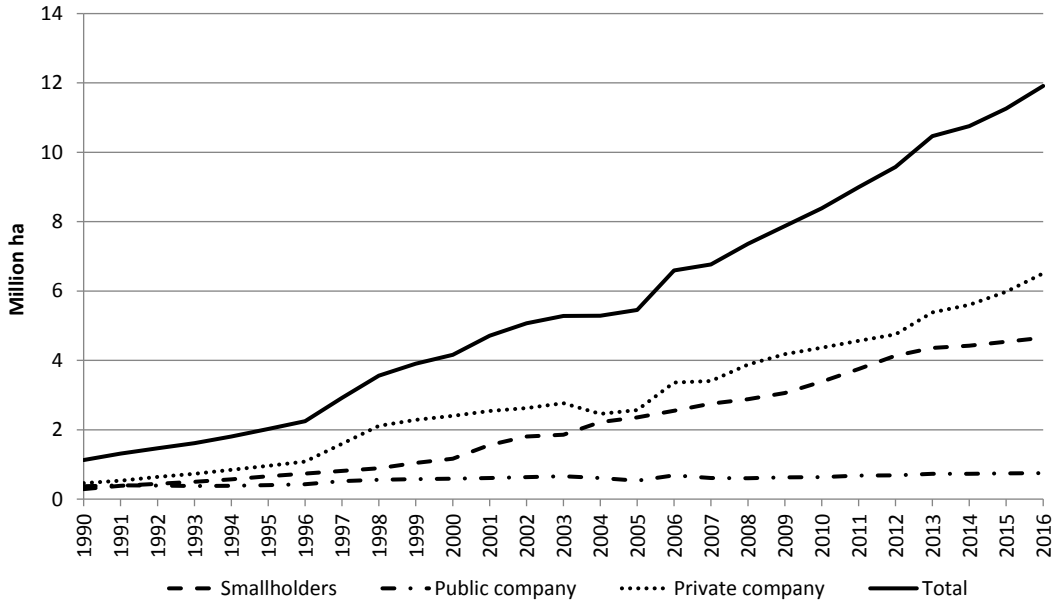

Figure 7. Oil palm area in Indonesia by farming category (1990-2016)
Sources: Own presentation based on data from DJP (2017) and BPS (2017).

3.2.2 Land-use change in Jambi

This study focuses on Jambi Province on Sumatra Island, one of the hotspot regions of the recent oil palm boom in Indonesia (Drescher et al., 2016; Clough et al., 2016). Historically, Jambi was covered by tropical rainforest, but significant deforestation already occurred during the first half of the twentieth century, instigated by the rising international demand for timber and natural rubber. Rubber has been cultivated in Jambi for more than 100 years and has been the dominant cash crop in the region until recently (Gatto et al., 2015). Rubber in Jambi is primarily grown by autochthonous farm families and to a lesser extent by public and private companies. When the oil palm boom started in the 1980s, new oil palm plantations

were mostly established on degraded (logged) forestland. Between 1990 and 2016, the area planted with oil palm in Jambi almost quadrupled (Fig. 8). During the same period, the forest area decreased by more than one million hectares (Margono et al. 2012; Clough et al., 2016).

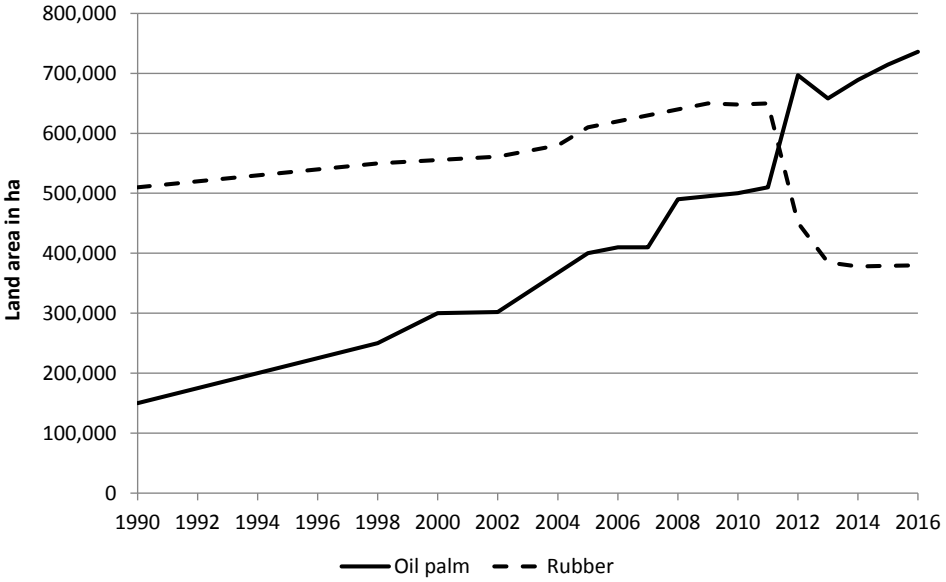

Figure 8. Oil palm and rubber area in Jambi Province, Indonesia (1990-2016)
Sources: Own presentation based on data from BPS (2017) and DJP (2017).

Interesting to see in Fig. 8 is that the rubber area in Jambi also increased until recently. For autochthonous farm households, rubber remains the dominant crop. Rubber is less capital-intensive than oil palm, and rubber trees can remain productive for many decades (Feintrenie et al, 2010; Lee et al, 2014). Hence, switching from rubber to oil palm was not often observed as long as additional land was still available. Only more recently, with declining rubber prices and increasing land scarcity, oil palm is gradually replacing rubber plantations (Euler et al., 2017).

3.2.3 Poverty and income inequality in Indonesia

Poverty in Indonesia has fallen rapidly during the last 15 years, from around 20% in the early 2000s to 11% in 2016 (World Bank, 2017). Most of this decline in poverty is attributable to economic growth, including growth in the agricultural sector. Even though people living below the poverty line benefited from this growth, inequality increased, with the Gini coefficient rising from 0.34 in 2002 to 0.40 in 2016 (World Bank, 2017). In Jambi Province, the poverty rate is somewhat below the national average; it was reported at 8% in 2016 (BPS, 2017). Similarly, inequality in Jambi is lower than in the rest of Indonesia, even though it

also increased over time. Between 2002 and 2016, the Gini coefficient for Jambi Province rose from 0.27 to 0.35 (BPS, 2017). Since agriculture is one of the most important economic sectors in Jambi, the question as to how the observed land-use changes may have contributed to the trends in poverty and inequality is of particular interest. This is analyzed in the following sections.

3.3 Material and methods

3.3.1 Household survey

Data for this study were collected through a structured household survey carried out in 2015 in rural areas of Jambi Province, Sumatra, Indonesia. Villages and households for inclusion in the survey were randomly selected using a multi-stage sampling framework. First, four regencies in Jambi (Sarolangun, Batanghari, Muaro Jambi, and Tebo) were purposively selected. These four regencies represent land-use patterns and land-use changes in the province's lowland areas very well (BPS, 2017). Second, 26 villages were randomly selected in these four regencies using village lists from the government's official Village Potential Survey (PODES). Third, in each of the 26 villages, 20-40 households were randomly selected with the exact numbers adjusted to village size. In total, our data set includes data from 841 households and can be considered representative for the lowland areas of Jambi, where most of the rubber and oil palm plantations are located.

Face-to-face interviews were conducted by a team of local enumerators, who were selected, trained, and supervised by the researchers. The interviews were carried out in Bahasa Indonesia using structured questionnaires. Detailed data were collected on household demographic structures and all economic activities pursued by the household or individual household members, including farm and off-farm activities. We also captured details of employment contracts and other institutional and socioeconomic characteristics. All income-related data were collected for a recall period of 12 months. In addition to the household-level data, information about land-use patterns at the village level and a few other village characteristics were obtained from village officials.

3.3.2 Statistical methods

The main objective is to analyze income levels and income sources for different types of households, which can help to assess how land use and land-use change affect income inequality. Total annual household income is calculated as the sum of farm income and off-farm income earned by all household members over a period of 12 months. Farm income includes income derived from the cultivation of rubber, oil palm, and any other agricultural crops, as well as livetsock enterprises. Off-farm income includes employment on rubber and oil palm plantations owned by other farms and companies, other agricultural and non-agricultural employment, self-employed activities (own non-farm businesses), and other income sources, such as transfers or renting out land. Annual incomes are expressed in Indonesian Rupiahs (IDR) per adult equivalent (AE) for better comparability across households of different size. Households are classified as poor if the annual income per AE remains below the official 2015 poverty line for rural Jambi of 3.96 million IDR (BPS, 2017).

To account for different livelihood strategies of households, we subdivide the total sample into two subsamples depending on the relative contribution of different income sources to total household income. Farm households are defined as households that obtain more than 50% of their total income from own farming activities. Non-farm households are defined as households where off-farm income accounts for more than 50%. For both subsamples, we analyze the importance of oil palm and rubber as sources of farming and employment income. Furthermore, we compare mean income and poverty levels between farm and non-farm household and test whether observed differences are statistically significant.

We also subdivide the total sample by different types of villages. One classification differentiates between households living in transmigrant and autochthonous villages, depending on whether or not the village was newly established as part of the government's transmigration program. Note that not all households living in transmigrant villages participated in the transmigration program themselves. Spontaenous migration is also common in Jambi, often instigated by the economic opportunities arising from the oil palm boom. Spontaneous migrants are found both in transmigrant and autochthonous villages.

A second village classification differentiates by major land-use types: (i) oil palm-based villages are those where more than 50% of the land within the village boundaries is cultivated with oil plam; (ii) rubber-based villages are those where more than 50% of the land is

cultivated with rubber; (iii) mixed villages are those where neither of these two crops accounts for more than 50% of the land within the village boundaries. In mixed villages, food crops such as rice, cassava, and vegetables still play a more important role. Comparing mean income and poverty levels between these types of villages provides some indication of how agricultural land use and land-use change affect the livelihoods of farm and non-farm households.

Income inequality is analyzed with the Gini coefficient. Sources of inequality are examined with a Gini decomposition analysis (Shorrocks, 1983). As mentioned, total income *Y* consists of income from *k* different sources, such as farm income from own oil palm cultivation, farm income from own rubber cultivation, off-farm income from working on oil palm plantations etc. Hence, total income *Y* for each household and also for the sample as a whole can be written as:

$$Y = \sum_{k=1}^{k} y_k. \quad (1)$$

The Gini coefficient of total income (G) can then be expressed as:

$$G = \sum_{k=1}^{k} S_k G_k R_k, \quad (2)$$

where S_k is the share of income source *k* in total income, G_k is the Gini coefficient of income from source *k*, and R_k is the correlation coefficient between income from source *k* and total income *Y*. $G_k R_k$ is known as the pseudo-Gini coefficient of income source *k* (Shorrocks, 1983). The contribution of income source *k* to total income inequality is given as $S_k G_k R_k / G$, while the relative concentration coefficient of income source *k* in total income inequality is expressed as:

$$g_k = G_k R_k / G. \quad (3)$$

Income sources that have a relative concentration coefficient greater than one contribute to increasing total inequality, while those with a relative concentration coefficient less than one contribute to decreasing total inequality. The source elasticity of inequality is expressed as $(S_k G_k R_k / G) - S_k$ and indicates the percentage effect of a one percent change in income from source *k* on the overall Gini coefficient. For instance, a positive sign for the elasticity of farm income from own oil palm cultivation would suggest that income inequality among farm households would rise through further expansion of the oil palm land.

We conduct the decomposition analysis for the whole sample, as well as separately for farm and non-farm households. Interesting to see is whether further oil palm expansion would have the same effect on income inequality among farm and non-farm households. Furthermore, we differentiate by village types, in order to better understand how land use at the village level is associated with inequality.

3.4 Results

3.4.1 General characteristics of rural households

Table 5 shows descriptive statistics for general household characteristics, for the sample as a whole, as well as separately for the subsamples of farm and non-farm households (see Table A2 in the Appendix for variable definitions). Of the total sample, 64% are classified as non-farm households, meaning that more than 50% of their income is derived from off-farm activities. These are not necessarily landless households, many of them have small pieces of land that they cultivate to generate some farm income. But the fact that less than half of all households has own farming as the main income source clearly underlines the importance of labor markets for people's livelihoods in rural Jambi.

Around 48% of the sample households live in transmigrant villages, the other 52% live in autochthonous villages, with some variation observed between farm and non-farm households. Two-thirds of all households have a migration background, meaning that they themselves or their parents moved to the village as transmigrants or spontaneous migrants. The migration background does not differ significantly between farm and non-farm households. The lower part of Table 5 also shows the breakdown of the sample by dominant village land-use types. Close to 70% of all households live in rubber-based villages, meaning that rubber plantations account for more than 50% of the land within the village boundaries. In most of these villages, some oil palm is also cultivated, but rubber remains the dominant crop. Around 18% of the households live in villages where oil palm is the dominant crop, and 13% live in mixed villages, where food crops still play a more important role.

Table 5. General sample characteristics

Variable name	Total sample (N=841)	Farm households (N=301)	Non-farm households (N=540)
Socio-economic variables			
Household size (adult equivalents)	2.89	2.98	2.84
	(1.08)	(1.11)	(1.06)
Age (years)	44.98	48.00***	43.3
	(11.59)	(12.05)	(11.00)
Education (years of schooling)	6.62	6.53	6.70
	(3.60)	(3.57)	(3.62)
Migrant (dummy)	0.67	0.69	0.66
	(0.47)	(0.46)	(0.48)
Village characteristics			
Transmigrant village (dummy)	0.48	0.56**	0.44
	(0.50)	(0.50)	(0.50)
Autochthonous village (dummy)	0.52	0.44**	0.57
	(0.50)	(0.49)	(0.50)
Oil palm-based village (dummy)	0.18	0.20	0.17
	(0.38)	(0.40)	(0.37)
Rubber-based village (dummy)	0.69	0.71	0.70
	(0.46)	(0.46)	(0.46)
Mixed village (dummy)	0.13	0.09**	0.15
	(0.33)	(0.30)	(0.37)

Notes: Mean values are shown with standard deviations in parentheses. ** Difference between farm and non-farm households significant at 5% level. *** Difference between farm and non-farm households significant at 1% level.

3.4.2 Role of different income sources

Table 6 shows mean income levels for all sample households, as well as separately for farm and non-farm households (see Table A2 in the Appendix for variable definitions). The total mean income is in a magnitude of 15.5 million IDR (1167 US dollars) per AE and year. This is much higher than the official poverty line of 3.96 million IDR for rural Jambi. However, mean income levels mask the underlying distribution, which has a considerable spread. Fourteen percent of all households fall below the poverty line, which is more than the poverty rate of 8% indicated in official statistics (BPS, 2017). But the official poverty rate refers to Jambi Province as a whole, whereas our sample is restricted to rural areas. In rural areas, poverty is often more prevalent than in urban areas (World Bank, 2017). Striking to see is the difference in mean income levels between farm and non-farm households. Non-farm households have significantly lower incomes than farm households and are much more likely to be poor.

Table 6. Level and composition of rural household incomes

Income source	Total sample (N=841)	Farm households (N=301)	Non-farm households (N=540)
Farm income (‘000 IDR/AE)	6,706.96	15,625.01***	1,735.98
	(18,551.29)	(28,493.21)	(3,911.07)
Oil palm	2,303.51	5,259.77***	655.67
	(9,826.83)	(15,518.73)	(2,974.79)
Rubber	3,998.84	8,478.47***	944.46
	(15,126.77)	(24,116.74)	(2,601.31)
Other farming.	394.32	857.78***	135.99
	(2,582.52)	(3,963.86)	(1,209.06)
Off-farm income (‘000 IDR/AE)	8,801.16	3,659.65***	11,667.07
	(16,642.54)	(7,145.94)	(19,499.62)
Agricultural wages	4,213.44	1,373.10***	5,796.66
	(5,349.91)	(3,553.49)	(5,528.14)
Oil palm	1,798.89	473.75***	2,537.54
	(4,427.48)	(2,342.55)	(5,095.88)
Rubber	2,180.45	757.72***	2,973.48
	(3,719.67)	(2,733.81)	(3,955.03)
Other agriculture	234.09	141.63	285.64
	(1,483.30)	(816.65)	(1,746.48)
Non-agricultural wages	1,495.78	542.75**	2,027.01
	(8,868.20)	(1,865.75)	(10,946.98)
Self-employment	2,742.67	1,476.79**	3,448.29
	(13,692.97)	(6,197.72)	(16,414.34)
Other off-farm income	221.22	77.99**	301.06
	(1,462.43)	(288.25)	(1,808.04)
Total income (‘000 IDR/AE)	15,508.12	19,284.66***	13,403.05
	(24,926.40)	(30,464.38)	(20,960.43)
Below poverty line (dummy)	0.14	0.08***	0.17
	(0.35)	(0.27)	(0.38)

Notes: Mean values are shown with standard deviations in parentheses. AE, adult equivalent. IDR, Indonesian Rupiah (official exchange rate in 2015: 1 US dollar =13,280 IDR). ** Difference between farm and non-farm households significant at 5% level. *** Difference between farm and non-farm households significant at 1% level.

Concerning the income sources, by definition farm income plays a much more important role for farm households than for non-farm households. Most of the farm income is derived from rubber and oil palm cultivation, other crop and livestock activities only play a minor role. Interesting to see is that rubber is a more important source of farm income than oil palm on average, even though this composition may change with further expansion of the oil palm land. For non-farm households, agricultural wages are the most important source of income, accounting for more than 40% of total income. Hence, land-use change can have important economic effects also for non-farm households. Most of the agricultural wages stem from employment in rubber and oil palm, with both crops contributing in similar magnitudes.

Much of the rubber employment is through sharecropping arrangements, where tenant households receive an agreed-upon share of the rubber output rather than a fixed wage. We used locally observed output shares and rubber prices to value the labor income derived from sharecropping arrangements. For oil palm, sharecropping is less often observed. Employment in oil palm is mostly through casual labor arrangements. Only larger oil palm farms and companies sometimes employ laborers on a longer-term basis.

3.4.3 Income differences by village type

Table 7 shows mean income and poverty levels differentiated by village type. Total household incomes are somewhat higher in transmigrant than in autochthonous villages. In both types of villages, farm households have significantly higher mean incomes and are less affected by poverty than non-farm households.

Table 7. Household income and poverty rates by village type

Village type	Total income ('000 IDR/AE)			Below poverty line (dummy)		
	All households	Farm households	Non-farm households	All households	Farm households	Non- farm households
Transmigrant	16,094.55 (27,923.97)	19,588.16** (34,158.22)	13,567.27 (22,096.90)	0.14 (0.35)	0.07*** (0.28)	0.14 (0.39)
Autochthonous	14,963.38 (21,794.58)	18,890.80** (24,992.48)	13,276.52 (20,076.90)	0.13 (0.34)	0.08** (0.28)	0.16 (0.37)
Oil palm-based	20,842.75 (29,817.13)	24,333.97 (25,719.13)	18,489.12 (32,215.49)	0.08 (0.27)	0.03* (0.18)	0.11 (0.32)
Rubber-based	15,056.37 (25,116.27)	19,050.54*** (33,010.94)	12,763.22 (18,845.19)	0.14 (0.35)	0.08*** (0.27)	0.18 (0.39)
Mixed	10,591.09 (12,070.52)	10,245.64 (12,976.41)	10,712.00 (11,820.74)	0.19 (0.40)	0.18 (0.39)	0.20 (0.40)

Notes: Mean values are shown with standard deviations in parentheses. The total number of villages in the sample is 26. First classification: 12 transmigrant and 14 autochthonous villages. Second classification: 9 oil palm-based, 13 rubber-based, and 4 mixed villages. AE, adult equivalent. IDR, Indonesian Rupiah (official exchange rate in 2015: 1 US dollar =13,280 IDR).
* Difference between farm and non-farm households significant at 10% level. ** Difference between farm and non-farm households significant at 5% level. *** Difference between farm and non-farm households significant at 1% level.

Bigger differences between village types are observed when using the classification by dominant land-use type. The lowest income levels and the highest poverty rates are observed in mixed villages, where food crop cultivation dominates and plantations cash crops play a less important role. In mixed villages, farm and non-farm households are equally poor. Mean income levels are higher in oil palm and rubber-based villages, suggesting that the cultivation of these plantation crops contributes to economic development. However, significant

differences are also observed between the plantation-based villages. Mean household incomes in oil palm-based villages are 38% higher than in rubber-based villages, and poverty rates are significantly lower.

These results suggest that oil palm cultivation benefits farm and non-farm households alike. To be sure, this comparison of mean income levels in different types of villages is not a rigorous impact assessment of the economic effects of oil palm cultivation. The oil palm area in a village is endogenous and correlated with a number of other characteristics that may influence household incomes through various channels. The comparisons in Table 7 do not control for such confounding factors. However, studies with historical data from Jambi suggest that the villages with a high proportion of oil palm land today are particularly those where oil palm cultivation started early on, already back in the late-1980s and the early-1990s (Euler et al., 2016). And these early-adopting oil palm villages were often poorer in those days than the villages where oil palm adoption started later (Gatto et al., 2017). The reason is that the richer villages in the early-1990s were villages with highly-productive rubber plantations, where the economic need to adopt a new plantation crop was not particularly pronounced. Against this background, the hypothesis that oil palm contributed to accelerated income growth for farm and non-farm households seems justified. For farm households, the main mechanism is through higher farm incomes from own oil palm cultivation. For non-farm households, the larger oil palm area at the village level means better and more lucrative employment opportunities.

3.4.4 Income inequality

Table 8 presents the Gini decomposition analysis for our rural household sample. The total Gini coefficient is 0.48, which is higher than what is reported for Jambi in official statistics (BPS, 2017). But again, the official statistics include rural and urban areas, whereas our sample includes rural households only. Farm income accounts for 44% of total household income, but is responsible for 53% of total inequality. This means that – holding other income sources constant – an increase in farm income would lead to rising inequality. The source elasticity of 0.11 shown in the last column of Table 8 suggests that a 1% increase in farm income would increase the Gini coefficient by 0.11%, or a 10% increase in farm income would increase the Gini coefficient by 1.1%. This effect is mainly driven by farm income from oil palm cultivation, whereas the source elasticity for farm income from rubber is small

and statistically insignificant. In other words, farm income from oil palm cultivation contributes significantly to income inequality in rural Jambi.

Table 8. Gini decomposition by income source

Income source	Income share (S_k)	Gini coefficient (G_k)	Correlation with total income distribution (R_k)	Percentage contribution to total inequality ($S_kG_kR_k/G$)	Source elasticity of total inequality ($S_kG_kR_k/G$)-S_k
Farm income	0.44	0.79	0.81	53.26	0.11*** (0.03)
Oil palm	0.15	0.99	0.80	23.05	0.08***(0.02)
Rubber	0.27	0.84	0.70	26.03	0.02 (0.03)
Other farming	0.03	1.29	0.52	4.18	0.02* (0.01)
Off-farm income	0.57	0.58	0.74	46.74	-0.11*** (0.03)
Agricultural wages	0.28	0.62	0.24	8.00	-0.20*** (0.01)
Oil palm	0.12	0.90	0.32	6.30	-0.05*** (0.01)
Rubber	0.14	0.75	0.03	0.60	-0.14*** (0.01)
Other agriculture	0.02	0.10	0.35	1.10	-0.01* (0.01)
Non-agric. wages	0.10	0.92	0.64	11.13	0.02 (0.02)
Self-employment	0.19	0.93	0.84	26.81	0.09*** (0.01)
Other off-farm	0.02	0.92	0.24	0.80	-0.01*** (0.01)
Total		0.48			

Notes: All households are included (N=841). For the source elasticities, bootstrapped standard errors are shown in parentheses. * Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

However, as already discussed, oil palm cultivation does not only affect farm income, but also off-farm income through labor-market effects. Table 8 shows that off-farm income as a whole, and agricultural wage income in particular, is inequality-decreasing. Agricultural wage income consists primarily of income from employment in rubber and oil palm, and both types of employment contribute significantly to reduced total inequality.

So far, we have differentiated between farm and off-farm income, whereby oil palm and rubber played a role in both income categories. We now use an alternative income classification, where we calculate total oil palm income as the sum of the earnings derived from oil palm farming and oil palm employment. In the same way, total rubber income is calculated as the sum of the earnings from rubber farming and rubber employment. This alternative income classification helps to assess how rubber and oil palm contribute to income inequality more broadly through farming and employment channels combined. Results of the Gini decomposition analysis with this alternative income classification are shown in Table 9.

Oil palm income accounts for 27% of total household income and is responsible for 29% of total inequality. The source elasticity of total inequality is positive but small and statistically insignificant. Hence, there is no strong evidence that further growth of oil palm income would lead to a rise in overall inequality. It seems that the inequality-increasing effect of oil palm through the farm-income channel is offset by the inequality-decreasing effect through the employment channel. The employment channel benefits non-farm households in particular, and these are generally poorer than farm households. For rubber income, the source elasticity in Table 9 is negative and statistically significant, meaning that further growth of rubber income would lead to decreasing inequality.

Table 9. Gini decomposition with alternative income classification

Income source	Income share (S_k)	Gini coefficient (G_k)	Correlation with total income distribution (R_k)	Percentage contribution to total inequality ($S_kG_kR_k/G$)	Source elasticity of total inequality ($S_kG_kR_k/G$)-S_k
Oil palm (combined)	0.27	0.86	0.67	29.35	0.03 (0.02)
Rubber (combined)	0.41	0.63	0.58	26.63	-0.13*** (0.04)
Other agriculture (combined)	0.05	1.14	0.50	5.28	0.01 (0.01)
Non-agricultural wages	0.10	0.92	0.65	11.13	0.02 (0.02)
Self-employment	0.19	0.94	0.84	26.81	0.09*** (0.02)
Other	0.02	0.91	0.24	0.80	-0.01*** (0.01)
Total		0.48			

Notes: All households are included (N=841). For the source elasticities, bootstrapped standard errors are shown in parentheses. *** Significant at 1% level.

We continue with this alternative income classification that combines farm and employment effects of oil palm and rubber but now look at the two subsamples of farm and non-farm households separately. The Gini decomposition analysis for both subsamples is shown in Table 6. For farm households (upper part of Table 10), growth in oil palm income increases inequality to a significant extent, whereas for non-farm households (lower part of Table 10), growth in oil palm income reduces inequality. Growth in rubber income reduces inequality among both types of households. These findings confirm the earlier results discussed above.

Interesting to observe is that income from self-employment increases inequality, and especially so among non-farm households (Table 10). Self-employment includes various business activities, such as transport, trade, processing, and small-scale manufacturing. Relatively richer households find it easier to exploit such business opportunities, often due to their better physical, human, and social capital endowments.

Table 10. Gini decomposition by type of households

Income source	Income share (S_k)	Gini coefficient (G_k)	Correlation with total income distribution (R_k)	Percentage contribution to total inequality ($S_kG_kR_k/G$)	Source elasticity of total inequality ($S_kG_kR_k/G$)-S_k
			Farm households (N=301)		
Oil palm (combined)	0.30	0.90	0.80	40.13	0.10** (0.04)
Rubber (combined)	0.54	0.60	0.70	42.20	-0.12** (0.05)
Other agriculture (combined)	0.05	1.03	0.46	4.63	- 0.01 (0.01)
Non-agricultural wages	0.03	0.93	0.52	2.53	-0.01 (0.00)
Self-employment	0.08	0.94	0.80	10.74	0.03** (0.01)
Other	0.01	0.89	-0.19	-0.13	-0.01*** (0.00)
			Non-farm households (N=540)		
Oil palm (combined)	0.24	0.80	0.53	20.53	-0.03* (0.02)
Rubber (combined)	0.29	0.61	0.32	11.60	-0.18*** (0.02)
Other agriculture (combined)	0.03	1.26	0.43	3.51	0.01 (0.01)
Non-agricultural wages	0.15	0.90	0.71	19.81	0.05 (0.04)
Self-employment	0.26	0.93	0.87	42.64	0.17*** (0.04)
Other	0.02	0.90	0.34	1.41	-0.01 (0.01)

Notes: For the source elasticities, bootstrapped standard errors are shown in parentheses. * Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

We also carried out the Gini decomposition analysis by village type, differentiating between transmigrant and autochthonous villages and between villages with different dominant land-use types. These additional analyses are shown in Tables A3 and A4 in the Appendix. In all types of villages, oil palm contributes to increasing inequality through the farm-income channel and to decreasing inequality through the off-farm employment channel. Significant associations between the Gini coefficients and the village types are not observed (Table 11).

Table 11. Gini coefficients by household and village types

Type of village	All households	Farm households	Non-farm households
Transmigrant	0.50	0.51	0.49
Autochthonous	0.49	0.50	0.48
Oil palm	0.49	0.50	0.47
Rubber	0.50	0.52	0.49
Mixed	0.45	0.52	0.47

3.5 Conclusion

Many regions in Southeast Asia are experiencing massive land-use change. While areas covered with tropical forests and traditional agricultural crops, such as rubber, are shrinking, oil palm plantations are rapidly gaining ground. Several studies have analyzed environmental effects of such land-use changes, but relatively little is known about the broader socioeconomic implications. A few recent studies have examined economic effects of oil palm cultivation for farm households in Indonesia. But a focus on farm households is insufficient, given that rural non-farm households may also be affected by land-use change. In this study, we have addressed this research gap with data from farm and non-farm households in rural Jambi, one of the hotspots of Indonesia's recent oil palm boom. We have used the data to analyze and compare income levels, income structures, and sources of inequality with a particular focus on oil palm and rubber.

The data have shown that 64% of the rural households in Jambi derive more than half of their total income from off-farm economic activities. The most important sources of income for these non-farm households are employment in oil palm and rubber plantations. These plantations either belong to local farm households or to large public and private companies. On average, non-farm households in rural Jambi are significantly poorer than farm households. We also found significant differences in mean income levels between villages with different dominant land-use types. The lowest incomes and the highest poverty rates are observed in villages where much of the area is cultivated with food crops. Villages where more rubber is cultivated are significantly richer. The highest mean income levels and the lowest poverty rates are observed in villages where oil palm is the dominant land use type. These comparisons suggest that oil palm contributes to economic development and poverty reduction. Farm households benefit from oil palm cultivation in terms of higher farm profits, whereas non-farm households benefit from oil palm through new lucrative employment opportunities.

The role of different income sources for income inequality was analyzed through Gini decomposition analysis. Oil palm cultivation contributes to higher income inequality among farm households. This was also suggested in other recent studies with farm-household data from Indonesia (Euler et al., 2017; Krishna et al., 2017b). These earlier studies showed that farmers with better access to land and financial capital find it easier to adopt oil palm and benefit more than farmers who are more land- and capital-constrained. However, an explicit analysis of the effects of oil palm on income inequality has not been carried out previously.

While income inequality among farmers has increased through the expansion of oil palm, total rural inequality has not. The reason is the positive effect of oil palm through the employment channel, which benefits non-farm households, reduces inequality, and thus offsets the inequality-increasing effect through the farm-income channel.

It should be noted that the Gini decomposition analysis and the estimated source elasticities of income inequality are static tools that examine the effect of an increase in one source of income while holding other sources constant. This was realistic in the past, because the expansion of oil palm often occurred in degraded forest areas or fallow land. However, in future, oil palm may be expanded more on existing rubber land, so that an increase in the oil palm area may possibly be accompanied by a decrease in the rubber area and therefore also in rubber income. Since rubber income was found to be inequality-reducing, it is possible that further oil palm expansion would be associated with rising overall inequality. This should be monitored to avoid undesirable social outcomes. Rising inequality can possibly be prevented through specific policies, such as credit programs targeted at capital-constrained households. If properly designed, credit programs may not only benefit farmers, but also non-farm households through stimulating self-employed non-farm business activities.

In closing, we should stress that the persistent oil palm expansion is associated with environmental problems. While these were not the focus of this study, policies towards sustainable land use certainly need to consider economic, social, and environmental aspects.

3.6 Appendix

Table A2. Variable definitions

Variable name	Variable descriptions
Household size	Number of household members expressed in adult equivalents
Age	Average age of adult household members (years)
Education	Years of schooling of household head (years)
Migrant	1 if household has migrant background, 0 otherwise
Transmigrant village	1 if village was newly established as part of the government's transmigration program, 0 otherwise
Autochthonous village	1 if traditional village, 0 otherwise
Oil palm-based village	1 if oil palm accounts for >50% of land within village boundaries, 0 otherwise
Rubber-based village	1 if rubber accounts for >50% of land within village boundaries, 0 otherwise
Mixed village	1 if no single crop accounts for >50% of land within village boundaries, 0 otherwise
Total income	Total annual household income in IDR per adult equivalent
Farm income	Annual income from own farming in IDR per adult equivalent
Oil palm	Annual income from own oil palm farming in IDR per adult equivalent
Rubber	Annual income from own rubber farming in IDR per adult equivalent
Other farming	Annual income from other own farming activities in IDR per adult equivalent
Off-farm income	Annual off-farm income in IDR per adult equivalent
Agricultural wages	Annual income from agricultural employment in IDR per adult equivalent
Oil palm	Annual income from oil palm employment in IDR per adult equivalent
Rubber	Annual income from rubber employment in IDR per adult equivalent
Other agriculture	Annual income from other agricultural employment in IDR per adult equivalent
Non-agricultural wages	Annual income from non-farm employment in IDR per adult equivalent
Self-employment	Annual income from self-employed activities in IDR per adult equivalent
Other	Other off-farm income (transfers etc.) in IDR per adult equivalent
Below poverty line	1 if total income is below official poverty line for rural Jambi, 0 otherwise

Table A3. Gini decomposition in transmigrant and autochthonous villages

Income source	Income share (S_k)	Gini coefficient (G_k)	Correlation with total income distribution (R_k)	Percentage contribution to total inequality ($S_kG_kR_k/G$)	Source elasticity of total inequality ($S_kG_kR_k/G$)
			Transmigrant villages (N=405)		
Farm income	0.50	0.77	0.84	59.30	0.11*** (0.04)
Oil palm	0.19	0.94	0.80	25.21	0.08*** (0.03)
Rubber	0.27	0.85	0.66	28.09	0.02 (0.05)
Other farming	0.05	1.16	0.67	6.00	0.01 (0.01)
Off-farm income	0.51	0.61	0.71	40.70	-0.11*** (0.04)
Agricultural wages	0.24	0.67	0.23	6.22	-0.18*** (0.02)
Oil palm	0.12	0.86	0.37	6.52	-0.05*** (0.01)
Rubber	0.12	0.81	-0.14	-2.02	-0.13*** (0.02)
Other agriculture	0.02	0.99	0.21	0.16	-0.01* (0.01)
Non-agric. wages	0.08	0.90	0.57	7.30	-0.01 (0.01)
Self-employment	0.18	0.94	0.85	27.29	0.09*** (0.04)
Other	0.01	0.90	0.20	0.21	-0.01*** (0.01)
			Autochthonous villages (N=436)		
Farm income	0.40	0.79	0.78	49.50	0.12*** (0.04)
Oil palm	0.10	1.08	0.81	17.66	0.08*** (0.03)
Rubber	0.28	0.81	0.66	31.84	0.04 (0.03)
Other farming	0.02	1.589	0.36	2.00	0.01 (0.01)
Off-farm income	0.62	0.55	0.78	50.50	-0.12*** (0.04)
Agricultural wages	0.33	0.57	0.29	10.01	-0.23*** (0.02)
Oil palm	0.13	0.86	0.29	6.40	-0.06*** (0.02)
Rubber	0.17	0.71	0.11	1.20	-0.16*** (0.01)
Other agriculture	0.03	0.96	0.42	2.41	-0.01 (0.01)
Non-agric. wages	0.12	0.93	0.69	15.02	0.04 (0.04)
Self-employment	0.17	0.93	0.84	24.71	0.05*** (0.03)
Other	0.03	0.92	0.32	0.86	-0.01 (0.01)

Notes: All households are included (N=841). For the source elasticities, bootstrapped standard errors are shown in parentheses. * Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

Table A4. Gini decomposition in oil palm-based, rubber-based, and mixed villages

Income source	Income share (S_k)	Gini coefficient (G_k)	Correlation with total income distribution (R_k)	Percentage contribution to total inequality ($S_kG_kR_k/G$)	Source elasticity of total inequality ($S_kG_kR_k/G$)
			Oil palm-based villages (N=185)		
Farm income	0.44	0.80	0.82	51.64	0.08 (0.06)
Oil palm	0.36	0.85	0.84	47.10	0.12** (0.05)
Rubber	0.08	0.87	0.28	3.30	-0.05*** (0.02)
Other farming	0.02	1.42	0.40	1.24	-0.01 (0.01)
Off-farm income	0.57	0.64	0.74	49.36	-0.08 (0.06)
Agricultural wages	0.24	0.72	0.15	5.29	-0.19*** (0.02)
Oil palm	0.21	0.73	0.26	7.11	-0.15*** (0.02)
Rubber	0.03	1.64	-0.29	-1.62	-0.06*** (0.01)
Other agriculture	0.01	1.00	-0.43	-0.20	-0.01 (0.01)
Non-agric. wages	0.05	0.90	0.50	3.70	-0.01 (0.01)
Self-employment	0.26	0.93	0.86	40.06	0.14** (0.05)
Other	0.02	0.92	0.15	0.31	-0.01* (0.01)
			Rubber-based villages (N=548)		
Farm income	0.46	0.78	0.82	56.40	0.11*** (0.03)
Oil palm	0.09	1.09	0.80	15.70	0.06** (0.02)
Rubber	0.35	0.80	0.73	37.60	0.05 (0.03)
Other farming	0.02	1.40	0.58	3.10	0.01* (0.01)
Off-farm income	0.56	0.58	0.73	45.60	-0.11*** (0.03)
Agricultural wages	0.28	0.60	0.26	8.51	-0.12*** (0.01)
Oil palm	0.09	0.90	0.34	5.06	-0.04*** (0.01)
Rubber	0.18	0.70	0.10	2.32	-0.16*** (0.02)
Other agriculture	0.02	0.98	0.45	1.13	-0.01* (0.01)
Non-agric. wages	0.11	0.93	0.70	13.57	0.03 (0.02)
Self-employment	0.14	0.94	0.83	22.80	0.08*** (0.03)
Other	0.02	0.91	0.25	0.72	-0.01** (0.01)
			Mixed villages (N=108)		
Farm income	0.30	0.91	0.76	43.80	0.15* (0.07)
Oil palm	0.07	1.03	0.40	5.30	-0.01 (0.02)
Rubber	0.15	1.26	0.66	24.53	0.11 (0.08)
Other farming	0.10	1.02	0.73	13.97	0.08 (0.05)
Off-farm income	0.72	0.48	0.80	56.20	-0.15* (0.07)
Agricultural wages	0.36	0.61	0.24	11.29	-0.26*** (0.05)
Oil palm	0.14	0.84	0.16	3.70	-0.10*** (0.03)
Rubber	0.18	0.74	0.10	2.53	-0.17*** (0.03)
Other agriculture	0.05	0.97	0.47	5.06	-0.01 (0.02)
Non-agric. wages	0.15	0.89	0.60	17.66	0.06 (0.04)
Self-employment	0.17	0.90	0.79	27.10	0.10** (0.03)
Other	0.01	0.84	0.07	0.15	-0.02** (0.01)

Notes: All households are included (N=841). For the source elasticities, bootstrapped standard errors are shown in parentheses. * Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

CHAPTER 4: General conclusion

4.1 Main findings

In the face of a growing population, access to agricultural land is restricted. While the demand for food, feed and fuel is globally increasing, the agricultural land needed for production, is gradually decreasing. Consequently, most of the agricultural expansion is occurring at the expense of forest-rich tropical countries.

Oil palm (*Elaeis guineensis*), is a typical case that reflects the recent widespread agricultural expansion best. Indonesia is the largest producer of oil palm in the world. Recently, Indonesia has experienced a massive oil palm expansion at the expense of forests, which has provoked much controversy concerning the negative effects on environment and social structures. While acknowledging that the effects of such land-use practices on the environment and farm households have been thoroughly studied in previous research, the issue of socioeconomic effects of oil palm and other land-use practices on non-farm households in Indonesia did not receive the same attention in the existing literature.

This dissertation contributes to the literature in different ways. We have analyzed the role of different agricultural and non-agricultural employment income for non-farm households in Indonesia. Unlike most previous studies, this research builds its results on non-farm household data. It is noteworthy to better understand the possible consequences of land-use change for these households particularly when building development policies. In addition, we have broadly examined the role of oil palm and rubber on income inequality of rural households.

Our results show that around 60% of the rural households in Jambi derive more than half of their total income from off-farm activities. While employment in oil palm and rubber plantations constitutes the main source of their income, employment in oil palm is shown to be more profitable and strongly associated with total household income. Indeed, results indicate that poorer households depends more on rubber, whereas for richer households involvement in oil palm is their priority. Migration background and ethnicity are found to directly affect the employment preferences. For instance, Melayu households have a strong tradition of working in rubber as they see it the most important crop in the region. On the other hand, migrant households are very attracted to getting involved in oil palm. This

explains why the autochthonous population is poorer than migrant households in Jambi Province. The second paper explicitly shows that non-farm households in rural Jambi are significantly poorer than farm households. In addition, big differences in income levels between villages with different land-use types are observed. Our findings indicate that rural households living in transmigrant and oil palm-based villages have higher levels of income and are characterized by lower poverty rate. These results suggest that oil palm can serve as an important tool for economic development and poverty reduction.

Actually, the findings bring to mind that further expansion of the oil palm area will likely benefit non-farm households through gains in employment income. Thus, it will contribute to poverty reduction, but may – at the same time – also contribute to rising inequality. The second paper shows that oil palm contributes to increasing inequality among farm households, even though it helps to reduce income inequality among non-farm households through labor market and employment effects. This is in line with other recent empirical studies, which concluded that richer farmers benefit more from oil palm cultivation than poorer ones. In other words, farmers with better access to land and capital find it easier to adopt and profit more from oil palm than farmers who are land and capital-constrained. Nevertheless, oil palm does not seem to significantly affect total rural inequality, because the inequality-decreasing effect through the employment channels seems to outweigh the inequality-increasing effect through the farming channel.

Our results further indicate that opportunities to work in oil palm and rubber are strongly associated with the share of total village land cultivated with oil palm and rubber. Anyhow, we acknowledge that the share of the oil palm and rubber area in a village is not a random variable, which can lead to endogeneity bias. Hence, the estimated effects should not be over-interpreted in a causal sense.

Besides, rubber income is found to be inequality-reducing, suggesting that further growth of rubber income would lead to decreasing inequality. However, as more expansion of oil palm is expected to happen in forest areas, fallow land, and even in existing rubber land, an increase in the oil palm area may possibly be accompanied by a decrease in the rubber area and therefore rising overall inequality.

From the outset of the conclusion, while this study contributes empirical evidence of the economic role of oil palm and rubber on rural communities, it is important to note that oil palm expansion is also associated with adverse social and environmental outcomes. Negative externalities should be monitored and specific policies that promote environmentally and socially sustainable oil palm development need to be issued and applied.

4.2 Policy recommendations

"To oil palm or not to oil palm?" This is a question that has been hotly debated recently, provoking a huge amount of controversy worldwide. While, it probably needs to be acknowledged that future oil palm expansion will occur, more sustainable oil palm cultivation scenarios need to be developed and implemented. These scenarios should try to maximize the benefits of oil palm cultivation for the local population, while minimizing the negative social and environmental impacts. This dissertation contributes knowledge on the economic and some of the social dimensions of oil palm cultivation, while a deeper consideration of environmental effects is beyond the scope of this particular study. Nevertheless, combined with other existing and emerging knowledge, some recommendations towards sustainable oil palm may be derived.

Environmental sustainability of oil palm expansion can possibly be achieved by implementing standards for sustainable oil palm production and by encouraging companies and smallholders to adopt better agronomic practices. One noteworthy case of such policy is the Roundtable on Sustainable Palm Oil (RSPO)[15], which through voluntary certification plays an important role in promoting further oil palm development through smallholders (Rist et al., 2010; Krishna et al., 2017b). The involvement in such certification schemes can help in increasing social and environmental sustainability in rural areas in Indonesia. Besides, it will lend a hand to farm households to improve their agronomic practices in oil palm cultivation, increase their yields, and thus their income (Brandi et al., 2015; Krishna et al., 2017b). Still, RSPO might broaden and boost income inequality within rural communities, as one primary condition of RSPO certification is that smallholders need to have a legal ownership title for

[15] The Roundtable for Sustainable Palm Oil is established in 2004 by Malaysian and Indonesian companies. Through certification schemes, it aims to promote a sustainable oil palm production and to ensure that oil palm contributes to a better world (Sheil et al., 2009). Currently, the RSPO has more than 3400 members including producers, processors, traders, consumer goods manufacturers, retailers, banks and investors, as well as Non-Governmental Organizations (RSPO, 2018).

their land. One strategy to decrease such inequality is by facilitating the participation conditions of poor farmers in contracting schemes with oil palm companies and the government. This scenario might assist them in acquiring formal land titles for their property. A more beneficial approach is to reduce the regulations for obtaining land titles for smallholders. This will give an advantage to cultivate in their own land and thus, participate in certification schemes which will help in improving their living standards, decrease inequality and deforestation.

Another promising pathway in ensuring socio-economic sustainability in oil palm cultivation is by easing the accessibility of oil palm to rural smallholders. This can be done through credit programs targeting the land and financial capital-constrained households. If properly designed and promoted, credit programs may not only benefit farmers, but also non-farm households through stimulating self-employed off-farm business activities.

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General Appendix

CRC 990: "Determinants of land use change and impact on household welfare among smallholder farmers"

University of Göttingen – University of Jambi – IPB

Non-farm household survey questionnaire (2015)

1. Household identification

1. Village (name):				
2. Dusun (name or number):				
3. RT (number):				
4. Household code (given by supervisor):				
5. Full name of respondent:				
6. Full name of head of households (*only if he or she is **not** the respondent*):				
7. GPS co-ordinates of the household:		……S;……E;……Alt		
8. Mobile phone numbers:		Primary : …….. Secondary: ……		
9. Distance from the household's dwelling to the nearest market/trading center (km)				
10. Time usually taken to reach the nearest market/trading center (minutes) by motorbike				
11. How much is the distance in km from the village to the district capital?				
12. Time usually taken to reach the district capital by motorbike?			Public transportation	
			Other (Specify)……	
13. In last 12 months, does any member of the household*	a. Cultivate any crops?	Yes / No		
	b. Involve in trading of agricultural outputs	Yes / No		
	c. Provide labor for agriculture	Yes / No		
	d. Involve in livestock rearing	Yes / No		
	e. Involve in any other agricultural activity?	Yes / No; *if yes, specify*……		
14. Interviewer (name):				
15. Supervisor (name):				
16. Date of interview		…./…../2015	Enumerator's signature:	
17. Date questionnaire was checked by supervisor:		…./…../2015	Supervisor's signature:	

* If the answer is "no" for all questions from b-e, contact your supervisor.

2. General farm data

2.1 Cropping activities

a. What kind of crops are you currently growing **on your farm?**

	Owned area under cultivation (ha)		For how much of this land (ha) in 2015, you have	
	In 2012	In 2015	Systematic certificate	Sporadic certificate
1. Oil palm (total)				
a. Oil palm (independent)				
b. Oil palm (under contract)				
2. Plantation and jungle rubber (total)				
a. Plantation and jungle rubber (independent)				
b. Plantation and jungle rubber (under contract)				
3. Other plantation crops 1: _____				
4. Other plantation crops 2: _____				
5. Other plantation crops 3: _____				
6. Homestead and kitchen garden				
7. Vegetable crops				
8. Rice				
9. Other annual crop 1: _____				
10. Other annual crop 2: _____				
11. Fallow land (no cultivation in last 12 months)				

2.2 Land ownership and management

1a. In the last 12 months, did you **own** any land, which is cultivated by some other household *(Sharecropping as landlord)* or you rented out?	Yes/No	If yes, under output sharing?.....Yes/No
		Size of land under output sharing:…… ha
		If no, rent you received for renting out: .....Rp'000/ha/year Size of land under other arrangements:…… ha
1b. In the last 12 months, did you **own** any land, which is cultivated by a company?	Yes/No	If yes:
		Size of such land: …… ha
		Rent you got for renting out: Rp:…… '000/ha/year.
2. In the last 12 months, did you cultivate any land together with another farmer or group of farmers or co-operative society? *(Collective farming)*	Yes/No	If yes:
		Total land under this arrangement:…… ha
		How much of the land you own is under this arrangement? …… ha
		No. of farmers in the group: ……
3a. In the last 12 months, did you cultivate in any land, owned by others? *(Sharecropping as laborer)*	Yes/No	If yes:
		Under output sharing: Yes/No If yes, share of harvest received as wage:……..%
		Size of land under output sharing:…… ha Size of land under other arrangements:…… ha
3b. In **2012**, did you cultivate in any land, owned by others? *(Sharecropping as laborer)*	Yes/No	If yes:
		Under output sharing: Yes/No If yes, share of harvest received as wage:……..%
		Size of land under output sharing:…… ha Size of land under other arrangements:…… ha

2.3. Information and institutional context of smallholder plantation (*Complete the columns irrespective of whether the farmer cultivates this crop*)

	Oil palm (if no, go to next column)	**Rubber** (if no, go to next table)
1. Have you or any of the household members ever associated with the crop as a trader, laborer?	Yes/ No	Yes/ No
a. If yes, how or in what context?	Trader / Laborer / Both	Trader / Laborer / Both
If involved as a trader:		
b. In which year did you/ household member start associating with the crop as a trader?		
c. In which year did you/ household member stop associating with the crop as a trader? (*Put NA if still working as trader)*		
If involved as a laborer:		
d. Were you/household member associated as a laborer in a sharecropping or a wage arrangement?	Sharecropping / Wage / Both	Sharecropping / Wage / Both
If involved as a wage laborer:		
e. In which year did you/household member start associating with the crop as a wage laborer?		
f. In which year did you/household member stop associating with the crop as a wage laborer? (*Put NA if still working as laborer)*		
If involved as a sharecropping laborer:		
g. Who from your household members was previously involved as a sharecropping laborer in the past? (Code A)		
h. In which year did that person start associating with the crop as a laborer?		
i. How much was the percentage share of output obtained in that year?		
j. In which year did you start associating with the crop as a laborer?		
k. In which year did you/household member stop associating with the crop as a laborer? (*Put NA if still working as laborer)*		

Code A: father or mother=1; brother/sister = 2; grandparents=3; other relative=4; none=5

3. **Cost of cultivation of all crops cultivated during the last 12 months** (including the homestead and kitchen garden)

Please finish filling a column before starting the next crop.

Crop name		Perennials					Annuals				Home-stead and kitchen garden
		Oil palm	Rubber (plantation + jungle)	Other 1	Other 2	Other 3	Crop 1	Crop 2	Crop 3	Cro p 4	
1. Name of the main crop (if an annual crop is cultivated in more than one seasons, consider it as an additional crop)											
2. Which household members are more involved in crop management, like selecting varieties, choosing fertilizers etc. (Male = 1; Female = 2; Both equally = 3.)											
3. Total area under cultivation under this crop (ha)											
4. Area under production (ha)											
5. Area under share-cropping (ha)											
6. Do you intercrop plot? *(If no, go to question 13)*		Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes/ No	Yes /No	
7. If yes, number of intercrops (report types of crops in homestead and kitchen farm)											
8. Area under intercropping (ha)											
9. Names of major intercrops (different plants/trees in case of homestead farming)	1										
	2										
	3										
10. **Intercrop 1**											
a. Number of harvests during last 12 months											
b. Quantity (kg) produced during last 12 months											
c. Quantity (kg) marketed											
d. Avg. price received during last 12 months (‘000 Rp/kg)											
11. **Intercrop 2**											
a. Number of harvests during last 12 months											
b. Quantity (kg) produced during last 12 months											
c. Quantity (kg) marketed											
d. Avg. price received during last 12 months (‘000 Rp/kg)											
12. **Intercrop 3**											
a. Number of harvests during last 12 months											
b. Quantity (kg) produced during last 12 months											
c. Quantity (kg) marketed											

d. Avg. price received during last 12 months (‘000 Rp/kg)											

13. Main Crop											
a. Number of harvests during last 12 months											
b. Quantity (kg) produced during last 12 months											
c. Quantity (kg) marketed											
d. Avg. price received during last 12 months (‘000 Rp/kg)											
14. **Quantity of inputs** applied for the crop plots (quantity/season for annuals or quantity/year for perennials) for **all main and inter-crops** in last 12 months*											
a. Seeds/Seedlings (‘000 Rp spent by household)											
b. Manures (‘000 Rp spent by household)											
c. Chemical fertilizers (‘000 Rp spent by household)											
d. Pesticides (‘000 Rp spent by household)											
e. Herbicides (‘000 Rp spent by household)											
f. Hired male and female labor on daily basis (‘000 Rp spent by household)											
g. Hired male and female labor on sharecropping basis — Share farmer is receiving (%)											
g. Hired male and female labor on sharecropping basis — Share laborers are receiving (%)											
h. Hired animal/machine labor (‘000 Rp. spent by household)											

*** <u>Remember that we are not asking for the total cost of inputs/labor used for the crop, but the actual amount spent by the household for the crop. In case of sharecropping, these two values may differ.</u>**

4. **Forest dependent activities:** *Include all the timber and non-timber products your household collects or used to collect in the last 12 months.*

- Have you or any of your household member been involved in any forest activity in the last 12 months?.....Yes/*No If No, please go to section 5.*
- How far away is the closest forest from your household (walking minutes, put NF if there is no forest within walking distance)? .....

1. Forest product collected (name)	2. How often do you collect it or do it? (Once in --- Days)	3. How many members of **your HH** are involved in collection/ activity? (number)	4. How many **other** households are involved in this activity? (number)	5. Quantity obtained during last 12 months year (in QU)		6. Quantity sold during last 12 months (in QU)		7. Average price obtained (Rp/Unit) during last 12 months	8. Share of revenue (%) for your household if more than 1 households are involved
				a. Quantity	b. Unit	a. Quantity	b. Unit		
Timber									
Honey									
Firewood									
Hunting birds									
Other hunting									
Other:									

5. Livestock production

a. Animals possessed and produced by the household during the last 12 months

		Cow/ Buffalo/ Bull/bullock	Goat/ Sheep	Poultry
1. Did you own any of these livestock in last 12 months? (*If no, go to next column or section*)		Yes/No	Yes/No	Yes/No
2. Which household members are more involved in livestock management (1 = Male, 2 = Female; 3 = Both equally)				
3. How many heads do you own at this point of time? (number)				
4. If you sell all of them today, how much money you would receive? (million Rp)				
5. If sold in last 12 months	a. Number of animals sold			
	b. Amount obtained in total from sale(s) (million Rp)			
6. Animals you consumed as meat in last 12 months?	a. Number of animals/birds			
	b. Total quantity (kg) of meat consumed			
	c. Market price of meat ('000 Rp/kg)			
7. How many animals did you given to someone as gift in last 12 months? (number)				
8. How many died or were lost during the last 12 months? (number)				
9. If purchased in last 12 months	a. Number of animals purchased			
	b. Total amount spent for purchasing (million Rp)			
10. How many were born on your farm during the last 12 months? (number)				
11. How many animals did you receive as gift during the last 12 months? (number)				
12. *The main product*				
a. Name the main product				
b. Quantity (Unit) produced during last 12 months				
c. Quantity (Unit) marketed				
d. Avg. price received during last 12 months ('000 Rp/Unit)				
e. Unit (Used for Questions b. c. d.)				
13. *The byproduct*				
a. Name the byproduct				
b. Quantity (Unit) produced during last 12 months				
c. Quantity (Unit) marketed				
d. Avg. price received during last 12 months ('000 Rp/Unit)				
e. Unit (Used for Questions b. c. d.)				
14. Total feed cost during last 12 months ('000 Rp spent by the household)				

b. Fish culture

1. Have you involved in fish culture in the last 12 months? (*If no, go to next section*)	Yes/No		
2. Which household members are more involved in fish culture (1 = Male, 2 = Female; 3 = Both equally)			
3. Number of households involved in fish cultivation (if done jointly with others)?			
4. Number of ponds under cultivation			
5. Total size of all fish ponds under cultivation (m^2)			
	Fish type 1	Fish type 2	Fish type 3
6. Name of major fish types being grown			
7. How often did you harvest during the last 12 months?			
8. What is the average quantity of fish obtained per harvest (kg)?			
9. Did you sell fish?	Yes/No	Yes/No	Yes/No
10. Amount of fish sold during last 12 months (kg)?			
11. If sold, average price obtained (Rp/kg)?			
12. How much did you spend on fish feed during the last 12 months ('000 Rp)?			
13. How much did you spend on non-feed materials during the last 12 months ('000 Rp)?			
14. How much did you pay for hired labour during last 12 months ('000 Rp)?			

c. Fishing during the last 12 months

1. Apart from fish pond cultivation, do you or any of your HH members go fishing?	Yes/No (*if no, go to next section*)
2. How many of your HH members go for fishing? (number)	
3. Are female household members involved in fishing?	Yes/No
4. How often do you or your HH members go fishing? (once in …..days)	
5. How much time do you spend on average when you go fishing (hours/day)?	
6. What is the quantity of fish you obtain in an average month? (kg)	
7. What is the quantity of fish you sell in an average month? (kg)	
8. How much money did you receive from fishing in an average month? ('000 Rp)	

6. Credit and Savings
(**Credit**)

6.1. Formal credit institutions

a. Have you taken **credit** during the last 12 months from a bank, farmer group or cooperative?..... (Yes/No)
b. If yes, type of the institute …… (Code: Bank = 1; farmer group = 2; farmer cooperative = 3)
c. If **credit** is taken from a bank in last 12 months from a bank/ farmer group/ cooperative/ Other formal groups:

		1. Bank	2.Cooperative	3. Farmer group	4. Others
1. Amount taken ('000 Rp)					
2. In which of the household members' name the credit was taken	a. Relationship with HoH (Code A)				
	b. Gender (Code B)				
3. Date of obtaining credit (DD/MM/YY)					
4. If interest rate, Rate of interest (% annual) *(If fixed payments, go to questions 5)*					
5. If fixed,	a. Amount per time ('000 Rp)				
	b. Number of times per year				
6. Repayment period (months)					
7. % of credit used for consumption					
8. % of credit used for farming					
9. If used for farming, a. % used for annual crops					
b. % used for perennial crops					
c. % used for other agricultural activities…….(Specify)					
10. Did you have to submit your land title/certificate to get the credit?		Yes / No	Yes / No	Yes / No	Yes / No
11. Did you have to submit your house title/certificate to get the credit?		Yes / No	Yes / No	Yes / No	Yes / No

Code A: household head or wife = 1; son or daughter=2; father or mother=3; grandchild=4; mother or father in law=5; son or daughter in law=6; brother/sister = 7; other relative=8; non-relative=9.
Code B: Male = 1; Female = 2.

6.2. Informal credit sources

a. Have you taken **credit** during the last 12 months from other households/ input dealer? …….. (Yes/ No)

b. If yes, type of the institute …… (Code: Other household = 1; Input dealer = 2)

c. If **credit** is taken in last 12 months from other households:

		Other household (major credit sources)			
		HH 1	HH 2	HH 3	HH 4
1. Which of the household member took the initiative to obtain credit?	a. Relationship with HoH (Code A)				
	b. Gender (Code B)				
2. Total amount taken in last 12 months ('000 Rp)					
3. If interest rate: Rate of interest (% annual; put 0 if it is interest free)					
4. If fixed:	a. Amount per times ('000 Rp)				
	b. Amount per time per year				
5. Mutually agreed repayment period (months; NA if not fixed)					
6. His/her farm size (ha; 0 if non-farmer)					
7. Shortest distance between your farm and his/her (km; NA if not a farmer)					
8. Is she/he your relative or friend?		Yes / No	Yes / No	Yes / No	Yes / No
9. Does she/he belong to your village?		Yes / No	Yes / No	Yes / No	Yes / No
10. Does she/he belong to your dusun?		Yes / No	Yes / No	Yes / No	Yes / No
11. What is the distance between your houses (km)					
12. Do you both belong to same ethnic community?		Yes/ No	Yes /No	Yes / No	Yes / No
13. Did he/she borrow money <u>from you</u> in past 12 months?		Yes / No	Yes / No	Yes / No	Yes / No
14. % of credit used for consumption					
15. % of credit used for farming					
16. If used for farming,					
a. % used for perennial crops					
b. % used for annual crops					
c. % used for other agricultural activities……(Specify)					
17. Did you have to submit your land title/certificate to get the credit?		Yes / No	Yes / No	Yes / No	Yes / No

Code A: household head or wife = 1; son or daughter=2; father or mother=3; grandchild=4; mother or father in law=5; son or daughter in law=6; brother/sister = 7; other relative=8; non-relative=9.
Code B: Male = 1; Female = 2; Joint = 3.

6.3 Savings

		1. Bank	2.Cooperative	3. Chit fund	4. Other: (……)
1. Do you have an account or are a member of this institution?		Yes/No *(If no, go to next column)*	Yes/No *(If no, go to next column)*	Yes/No *(If no, go to next column)*	Yes/No *(If no, go to next table)*
2. Annual amount of savings (‘000 Rp)	At present				
	In 2012				
Interest payment of savings					
3. If interest rate:	Rate of interest (% annual)				
4. If fixed amount:	Amount per time (‘000 Rp)				
	Number of times per year				

7. Non-farm Household characteristics

7.1 History of household

a. Did the household migrate from somewhere to this village? ……. (Yes/No) *If No, go to the next section 7.2*

If yes, details of starting of farming and/or activity employment for **migrant** households

	Head of the household
1. When did you migrate to the village? (Year)	
2. When did the household migrate to the village? (Year)	
3. Did the household migrate as a part of transmigrant program?	Yes/No
4. Who was the head of the household at the time of migration? (Code A)	
5. If you were **not** the head of household at time of migration, age of the household head at that time (Years)	
6. The place from where the household migrated to this village? (Code B)	
7. What was the major source of income for the household before migration? (Code C)	
8. What was your household size before migration? (number of household members)	
9. How many of **your household members**…. (number)	
a. Came to this village in your group of migration?	
b. Arrived in this village after you came? (exclude the members born here)	
10. How many **other households** …(number)	
a. Came to this village in your group of migration?	
b. Were already living in this village when you arrived?	
c. Arrived in this village after you came?	
d. Came to this village as migrants (in total)?	
e. Are there in this village now?	
11. Did you have any precise labor contract before you came?	Yes / No
12. What was the reason to migrate? (Code D) *Multiple answers are allowed*	

Code A: current HH head = 1, father/mother of current HH head=2; grandparent of current HH head=3; brother/sister of current HH head=4; other (specify) = 5
Code B: Other part of Jambi = 1; Java = 2; North Sumatra = 3; South Sumatra = 4; Kalimantan = 5; Sulawesi = 6; others (specify) = 7
Code C: crops =1; fisheries and livestock = 2; wage labor = 3; small business = 4; others (specify) = 5
Code D: to find a job =1; for a better life =2; to work in oil palm plantations =3; to work in rubber plantations=4; family members immigrated before =5; others (Specify) =6.

7.2 Asset baseline

a. When was the household established? …….. (Year)

	Number of items owned	
	In 1990 or time of household establishment (if established after 1990)?	At this point of time
Television		
Satellite Dish		
Motorbike		
Car		
Jeep/Truck		
4-wheel tractor		
Fridge		
Air conditioner (AC)		
Washing machine		

7.3 Asset accumulation

- Number of cellphones owned by the household in the present: ……..

	Number of items owned in last 25 years or from HH establishment.	Year of ownership /purchase	If was registered, under whose name?	
			Relationship with HoH (Code A)[16]	Gender (1 = male; 2 = female)
Television (colour)				
Satellite Dish				
Motorbike				
Car				
Jeep/Truck				
4-wheel tractor				
Fridge				
Air conditioner (AC)				
Washing machine				

Code A: not registered=0; household head or wife = 1; son or daughter=2; father or mother=3; grandchild=4; mother or father in law=5; son or daughter in law=6; brother/sister = 7; other relative=8; non-relative=9.

[16] **Code A**: not registered=0; household head or wife = 1; son or daughter=2; father or mother=3; grandchild=4; mother or father in law=5; son or daughter in law=6; brother/sister = 7; other relative=8; non-relative=9.

7.4 Housing

- Did you purchase any house in the last 25 years?.....Yes/No
- If yes, in which year?.....

What was the number of bed rooms in 1990 or at the time of household establishment?		
Number of bed-rooms in main house now		
Year and number of room extension	Year of extension	Number of added rooms
What was the main water source for drinking for this household in 1990 or at the time of household establishment? (Code A)		
What is the main water source for drinking for this household now? (Code A)		
If changed, year and type of change	Year	Type of change (X → Y)
		→
		→
What was the main floor material of the living room in 1990 or at the time of household establishment? (Code B)		
Main floor material (of main room) now (Code B)		
If changed, year and type of change	Year	Type of change (X → Y) (Code A)
		→
		→
What was the wall material of the living room in 1990 or at the time of household establishment (Code C)		
Wall material now (Code C)		
If changed, year and type of change	Year	Type of change (X → Y) (Code B)
		→
		→

Code A: Pipe Water inside the house=1, Pipe Water outside the house=2; Well=2, Spring Water=3, Other (specify)=4

Code B: Tiles=1, Parquet=2, Cement=3, Wood=4, Earth=5, Other (specify) =6.

Code C: Un-plastered brick=1; Brick covered with cement=2; Brick with ceramics=3; Low quality wood=4; High quality wood (e.g. ornamentation)=5; Other (specify) =6.

7.5 Household member details

a. Details of household members. Total members in the household staying in the house:..…… (number) during the last 12 months.

1. HH member (Name)	2. Relationship with HoH	3. Member ID	4.Age (years)	5. Sex (m/f)	6.Marital status (married =1, unmarried =0)	7. Education (number of years in school and college)	8. Last graduation (Code A)	9. Main Occupations (Code B)		Involved in financial management of household (yes = 1, no = 0)
								a. Primary	b. Secondary	
Respondent		1								
Head of household*		2								
		3								
		4								
		5								
		6								
		7								
		8								
		9								
		10								
		11								
		12								
		13								
		14								
		15								

* Do not fill this row if respondent is head of the household. Use more rows if household size is more than 15.

Code A: never attended=1; attended but not completed=2; completed SD (primary) =3; completed SMP (Middle) =4; completed SMA (High School) =5; D3 or S1 (Associates Degree or University level first stage) =6; student at present = 7.

Code B: own farm activities=1; wage/salaried labor in agriculture=2; wage/salaried labor in other sectors=3; still attending school=4; household activities=5; other (specify) =6.

b. Religion of HoH: Muslim / Christian / Hindu/ Buddhist/ Others (specify: ……).

c. Ethnic group (specify): ……

b. Residency status of household members

	Used to live in the village whole life? (Code A)	If no, answer the following questions	
		Year of migration to the village	From where moved to the village (Code B)
Head of the household (HoH)			
Parents of the HoH			
Spouse of the HoH			
Parents of the spouse			

Code A: Yes=0; No=1; Never=2.

Code B: outside village in Jambi = 1; outside Jambi, but in Sumatra = 2; outside Sumatra, but in Indonesia = 3; Outside Indonesia = 4

8. Off-farm household income sources

8.1 Wage and contract labor

- Have any of your household members been working as a daily laborer (daily / weekly / monthly payment of money) or as permanent laborer (fixed payment for specific jobs) **during the last 12 months**? …… (Yes/No). *If No, please go to the next section 8.2.* DO NOT INCLUDE SHARECROPPING LABOUR.
- If worked as laborer during the last 12 months, provide details. Use different tables for different members and different activities.

a. **Member ID** (from Table 7.5a): ……

		In rubber farm	In oil palm farm	In oil palm estates	In other crop fields	Non-farm 1	Non-farm 2
Name of crop or activity							
Since when are you working in this employment? (year)							
Did any of your family members been working in the same crop activity before you?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
How many months per year are you working in this job?	Dry season (May-November)						
	Rainy season (Dec-April)						
How many days per month are you working in this job on average?	Dry season (May-November)						
	Rainy season (Dec-April)						
How many hours per day are you working in this job on average?	Dry season (May-November)						
	Rainy season (Dec-April)						
Have you lost any work days in last 12 months due to illness?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
• If yes, the number of days' work lost							
What type of work do you generally do? (Code A)							
Is there any written contract between the employer and you?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Where is your work location? (*Village or City name*)							
How far in km from home is the location of work?							
How long is the trip from home to the location of work? (*Minute*)							
What kind of transportation do you use to go and come back to/from the job location? (Code B)							
How regularly is the payment given? (Code C)							
Average amount earned/received during a month worked ('000 Rp/month)	Dry season (May-November)						
	Rainy season (Dec-April)						

Code A: land clearing for planting =1; seedling transportation=2; planting=3; manure application=4; fertilizer application=5; pesticide application=6; irrigation=7; harvesting=8; processing=9; transportation to market=10; security=11; other (specify)=12.
Code B: Public transportation=1; Shared transportation=2; Private transportation=3; Without using a transportation=4.
Code C: Daily=1; Weekly=2; Monthly=3; Other (specify)=4.

b. **Member ID** (from Table 7.5a): ……

		In rubber farm	In oil palm farm	In oil palm estates	In other crop fields	Non-farm 1	Non-farm 2
Name of crop or activity							
Since when are you working in this employment? (year)							
Did any of your family members been working in the same crop activity before you?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
How many months per year are you working in this job?	Dry season (May-November)						
	Rainy season (Dec-April)						
How many days per month are you working in this job on average?	Dry season (May-November)						
	Rainy season (Dec-April)						
How many hours per day are you working in this job on average?	Dry season (May-November)						
	Rainy season (Dec-April)						
Have you lost any work days in last 12 months due to illness?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
• If yes, the number of days' work lost							
What type of work do you generally do? (Code A)							
Is there any written contract between the employer and you?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Where is your work location? (*Village or City name*)							
How far in km from home is the location of work?							
How long is the trip from home to the location of work? (*Minute*)							
What kind of transportation do you use to go and come back to/from the job location? (Code B)							
How regularly is the payment given? (Code C)							
Average amount earned/received during a month worked ('000 Rp/month)	Dry season (May-November)						
	Rainy season (Dec-April)						

Code A: land clearing for planting =1; seedling transportation=2; planting=3; manure application=4; fertilizer application=5; pesticide application=6; irrigation=7; harvesting=8; processing=9; transportation to market=10; security=11; other (specify)=12.
Code B: Public transportation=1; Shared transportation=2; Private transportation=3; Without using a transportation=4.
Code C: Daily=1; Weekly=2; Monthly=3; Other (specify)=4.

c. **Member ID** (from Table 7.5a): ……

		In rubber farm	In oil palm farm	In oil palm estates	In other crop fields	Non-farm 1	Non-farm 2
Name of crop or activity							
Since when are you working in this employment? (year)							
Did any of your family members been working in the same crop activity before you?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
How many months per year are you working in this job?	Dry season (May-November)						
	Rainy season (Dec-April)						
How many days per month are you working in this job on average?	Dry season (May-November)						
	Rainy season (Dec-April)						
How many hours per day are you working in this job on average?	Dry season (May-November)						
	Rainy season (Dec-April)						
Have you lost any work days in last 12 months due to illness?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
• If yes, the number of days' work lost							
What type of work do you generally do? (Code A)							
Is there any written contract between the employer and you?		Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Where is your work location? (*Village or City name*)							
How far in km from home is the location of work?							
How long is the trip from home to the location of work? (*Minute*)							
What kind of transportation do you use to go and come back to/from the job location? (Code B)							
How regularly is the payment given? (Code C)							
Average amount earned/received during a month worked ('000 Rp/month)	Dry season (May-November)						
	Rainy season (Dec-April)						

Code A: land clearing for planting =1; seedling transportation=2; planting=3; manure application=4; fertilizer application=5; pesticide application=6; irrigation=7; harvesting=8; processing=9; transportation to market=10; security=11; other (specify)=12.
Code B: Public transportation=1; Shared transportation=2; Private transportation=3; Without using a transportation=4.
Code C: Daily=1; Weekly=2; Monthly=3; Other (specify)=4.

8.2 Sharecropping arrangement

- Have any of your household members been involved in sharecropping arrangements during the last 12 months? ..... (Yes/No). *If No, please go to section 8.3*
- If worked as sharecropping laborer during the last 12 months, provide details. Use different tables for different members.

a. **Member ID** (from Table 7.5a): ……

		Landlord 1	Landlord 2	Landlord 3
Crop (Code A)				
Year of starting the sharecropping arrangement				
Total land under this arrangement (ha)				
Is the landlord a close relative of you?		Yes/No	Yes/No	Yes/No
Does the landlord belong to your ethnicity?		Yes/No	Yes/No	Yes/No
Distance between your and landlord households (*km*)				
What is the age of the landlord? (*years*)				
What is the level of education of the farmer? (*number of years in school*)				
Area the landlord is cultivating (*ha*)				
Does the landlord have land title for the plot you are working?		Yes/No/ No idea	Yes/No/ No idea	Yes/No/ No idea
Are other laborers from different households involved in sharecropping the plot with you?		Yes/No	Yes/No	Yes/No
• If yes, number of laborers involved				
Did you sign a written agreement with the landlord?		Yes/No	Yes/No	Yes/No
If yes, did the village head witnessed this contract?		Yes/No	Yes/No	Yes/No
Average amount earned from this arrangement? (‘000 Rp/month)	Dry season (May-November)			
	Rainy Season (Dec-April)			
How many days do you work per month?				
How many hours do you work per day?				
How much was and is the percentage share of output obtained as wage?	Now			
	In 2012			
	When contract started			
If there is any change over time in the percentage share of output obtained as wage, the reason (Code B)				

Code A: Oil palm=1; Rubber=2; Other =3 (Specify)
Code B: decrease of the rubber price =1; plantation (the trees) getting older=2; recent land scarcity in the village=3; other factors (Specify)=4

b. **Member ID** (from Table 7.5a): ……

		Landlord 1	Landlord 2	Landlord 3
Crop (Code A)				
Year of starting the sharecropping arrangement				
Total land under this arrangement (ha)				
Is the landlord a close relative of you?		Yes/No	Yes/No	Yes/No
Does the landlord belong to your ethnicity?		Yes/No	Yes/No	Yes/No
Distance between your and landlord households (*km*)				
What is the age of the landlord? (*years*)				
What is the level of education of the farmer? (*number of years in school*)				
Area the landlord is cultivating (*ha*)				
Does the landlord have land title for the plot you are working?		Yes/No/ No idea	Yes/No/ No idea	Yes/No/ No idea
Are other laborers from different households involved in sharecropping the plot with you?		Yes/No	Yes/No	Yes/No
• If yes, number of laborers involved				
Did you sign a written agreement with the landlord?		Yes/No	Yes/No	Yes/No
If yes, did the village head witnessed this contract?		Yes/No	Yes/No	Yes/No
Average amount earned from this arrangement? (‘000 Rp/month)	Dry season (May-November)			
	Rainy Season (Dec-April)			
How many days do you work per month?				
How many hours do you work per day?				
How much was and is the percentage share of output obtained as wage?	Now			
	In 2012			
	When contract started			
If there is any change over time in the percentage share of output obtained as wage, the reason (Code B)				

Code A: Oil palm=1; Rubber=2; Other =3 (Specify)

Code B: decrease of the rubber price =1; plantation (the trees) getting older=2; recent land scarcity in the village=3; other factors(Specify)=4

8.3 Trading activities on agricultural commodities

- Did any of your household members gain any income from trading activities during the last 12 months? ..... (Yes/No) (*If no, go next table*)

Trading activities

		Oil palm	Rubber	Other crops (……)
When did you start trading? (year)				
How many months per year are you working in this job?	Dry season (May-November)			
	Rainy season (Dec-April)			
How many days per month are you working in this job on average?	Dry season (May-November)			
	Rainy season (Dec-April)			
How many hours per day are you working in this job on average?	Dry season (May-November)			
	Rainy season (Dec-April)			
Number of farmers you are doing business with during last 12 months?				
% crop output that you sell to	Other traders			
	Mill or company			
	Others			
Average income being generated from this activity in 2015 (‘000 Rp/month)?	Dry season (May-November)			
	Rainy season (Dec-April)			
How many kilometres do you travel to collect the crops per day on average? (km)				
In the last 12 months, is there any change in your income level due to the decrease of the rubber market price?			Yes/No	
If yes, how much did your monthly income decrease? (%)				

8.4 Own business activities

a. How many household members gain any income from any type of own-business activities during the last 12 months? ……. *If No, please go to 8.5*

Type of enterprise or business (Code)			1 Business	2 Business	3 Business
What kind of business are you running? (Code A)					
Which household members are involved? (*State member IDs*)					
Household member who is mainly responsible for the business (ID from 7.5a)					
When was the business started? (year)					
Are there non-household members involved in the business?			Yes/No	Yes/No	Yes/No
If yes, how many people are involved?	Male				
	Female				
If yes, how much do you pay per month for the people together? (‘000 Rp/month)					
Total number of months worked by household members in business during last year? (IDs from Table 7.5a and details be given)	Member 1	ID: ……..			
	Member 2	ID: ……..			
	Member 3	ID: ……..			
Total hours worked by members on average month in business? (IDs from Table 7.5a and details be given)	Member 1	ID: ……..			
	Member 2	ID: ……..			
	Member 3	ID: ……..			
Number of months the business was running last.	Dry season (May-November)				
	Rainy season (Dec-April)				
Total amount earned from business per month on average? (‘000 Rp).	Dry season (May-November)				
	Rainy season (Dec-April)				

Code A: shop=1; restaurant (food) =2; hotel (stay) =3; chauffeur/driver =4; carpenter=5; construction worker=6; other (specify) = 7.

8.5 Public transfers

a. Have any of your household members benefited from some kind of public/NGO transfer program (given money in daily/weekly/ monthly basis) during the last 12 months? ……. (Yes/ No). *If No, go to section 8.6*

Member Ids (from 7.5a)	Type of program (Code A)	Who is providing the program? (Code B)	What kind of benefits do you receive? (Code C)	Estimated amount received during last 12 months (‘000 Rp.)

Code A: pensions=1; education subsidies=2; health care benefits=3; poverty reduction program=4; others (specify) = 5.
Code B: local government=1; federal government=2; NGO=3; other (specify) =4.
Code C: cash=1; clothes=2; food=3; agricultural inputs =4; others (specify) =5.

8.6 Private transfers and remittances

a. Did your household sent any money to anybody (e.g. a family member, **not** included in 7.5a) staying **outside** the household during the last 12 months? ……. (Yes/No).
b. Did anybody (e.g. a family member, relative or friend) staying **outside** the household sent money to your household during the last 12 months? ……. (Yes/No).
   - *If yes to any of the above questions:*

1. If money is sent outside			2. If money is received from outside			3.Region where the sender or receiver resides (Code B)
Receiver´s relation with your household head (Code A)	Estimated amount sent during last 12 months (‘000 Rp.)	Main reasons for remittance (Code C)	Sender´s relation to your household head (Code A)	Estimated amount received during last 12 months (‘000 Rp.)	Main reasons for remittance (Code C)	

Code A: Son or daughter=1; father or mother=2; grandchild=3; mother or father in law=4; son or daughter in law=5; other relative=6; non-relative=7.
Code B: outside village in Jambi = 1; outside Jambi, but in Sumatra = 2; outside Sumatra, but in Indonesia = 3; Outside Indonesia = 4.
Code C: emergency spending=1; financing education=2; support livelihood=3, other (specify) =4

9. Membership in the village-level organizations in last 12 months

Household member ID (see Table 7.5a)	Name of organization	Year of joining	Position in organization (other than being member)	How many households in the village participate?	Describe functions of the organization(Code A) *Multiple answers are allowed*

Code A: Religious meetings=1, To save jointly=2; Share experience=3; Collective sales and purchases of farm outputs and inputs; Plan village related events=4; give out credit=5, other (specify) =6.

10. Decision-making and Perceptions

10.1 Household decision-making

Who is primarily responsible for the following consumption expenditure items and tasks?

Consumption and task items	Example	Persons responsible (Put √ mark)		
		Male members	Female members	Both male and female members equally
1. Purchase of food items	Rice, vegetables, meat etc.			
2. Paying the bills	Telephone, electricity, gas etc.			
3. Selecting clothing and footwear	Cloths, tailoring, footwear etc.			
4. Paying for recreation and membership	Movies			
5. Spending on education of children (*if applicable*)	School fees, books etc.			
6. Travel and transport	Taxy, public bus etc.			
7. Purchase and sale of durable goods	Purchasing television			
8. Purchasing and sale of land and houses	Including involving in sharecropping			
9. Representing the household in the public	Talking to officials, participating in the discussions and group meetings etc.			

Thank you for participating in the survey!

We will continue the consumption survey with <u>the housewife</u> on household consumption.

Household Survey Questionnaire C 07
Non-farm households
(Consumption; 2015)

1. Household identification

1. Village (name):				
2. Dusun (name or number):				
3. RT (number):				
4. Household code (given by supervisor):				
5. Name of respondent:				
6. Sex of respondent:	Male / Female			
7. Are you responsible for the purchase of	Food	Non-food materials	Services	
	Fully/Partly/No	Fully/Partly/No	Fully/Partly/No	
8. Name of head of household:				
9. Respondent's relationship with head of household (code):				
10. Number of persons regularly consuming food from your house in last 7 days:				
11. Interviewer (name):				
12. Supervisor (name):				
13. Date of interview	……../……../2015	Enumerator's signature:		
14. Date questionnaire was checked by supervisor:	……../……../2015	Supervisor's signature:		

Code: 1: Wife/Husband; 2: Daughter/Son; 3: Mother/Father; 4: Sister/Brother; 5: Niece/Nephew; 6: Others (specify)

2. **Household consumption**: In the following questions, we want to ask about all items consumed in your household, regardless of which person consumed it.

2.1. *Weekly consumption*: Has your household consumed following goods during the past 7 days? Please exclude from your answer any purchases for processing or resale in a household enterprise.

Item consumed	Quantity consumed in last week (units)	Unit (number, liter, kg, bag, pieces, etc.)		Market price, if purchased (Rp./unit)
		Name	How much kg or litre (approx..) one unit is?	
1) Rice (whole)				
2) Rice flour				
3) Wheat (whole)				
4) Wheat flour				
5) Maize				
6) Long bean				
7) Other cereals				
8) Other rice				
9) Cassava				
10) Flour of cassava				
11) Potato				

Item consumed	Quantity consumed in last week (units)	Unit (number, liter, kg, bag, pieces, etc.)		Market price, if purchased (Rp./unit)
		Name	How much kg or litre (approx..) one unit is?	
12) Sweet potato				
13) Gaplek				
14) Taro				
15) Sago				
16) Fish (fresh)				
17) Fish (dry)				
18) Seafood				
19) Beef				
20) Chicken				
21) Duck				
22) Mutton				
23) Buffalo				
24) Goat				
25) Lamb				
26) Sheep				
27) Entrails				
28) Liver				
29) Spleen				
30) Dried jerky meat				
31) Eggs of chicken				
32) Eggs of goose				
33) Eggs of quail				
34) Fresh Milk				
35) Milk powder				
36) Condensed milk				
37) Spinach				
38) Kangkung air				
39) Water spinach and Cassava leaves				
40) Cucumber				
41) Carrots				
42) Sprout				
43) String bean				
44) Garlic				
45) Chili				
46) Tomato				
47) Onion				
48) Bitter gourd				
49) Eggplant				
50) Cabbage				
51) Beans				
52) Peanut				
53) Soybeans				
54) Cashew				
55) Tofu				
56) Tempe				
57) Tauco				
58) Oncom				
59) Orange				
60) Mango				
61) Apple				
62) Durian				
63) Rambutan				
64) Duku				
65) Pineapple				

Item consumed	Quantity consumed in last week (units)	Unit (number, liter, kg, bag, pieces, etc.)		Market price, if purchased (Rp./unit)
		Name	How much kg or litre (approx..) one unit is?	
66) Watermelon				
67) Banana				
68) Papaya				
69) Jack fruit				
70) Avocado				
71) Guava				
72) Grapes				
73) Snake fruit				
74) Dragon fruit				
75) Coconut (whole)				
76) Coconut milk				
77) Other fresh fruits				
78) Dry fruits				
79) Honey				
80) Coconut oil				
81) Palm oil				
82) Soybean oil				
83) Other cooking oil				
84) Butter				
85) Sugar				
86) Brown sugar				
87) Tea				
88) Coffee				
89) Syrup				
90) Salt				
91) Candlenut fruit				
92) Coriander				
93) Pepper				
94) Shrimp paste				
95) Soy sauce				
96) Taste enhancer				
97) Ginger				
98) Crackers				
99) Melinjo crackers				
100) Noodles				
101) Rice noodles				
102) Macaroni noodles				
103) Bread				
104) Biscuits				
105) Cakes				
106) Porridge				
107) Meatballs				
108) Iced syrup				
109) Assorted vegetable with peanut sauce				
110) Snacks				
111) Readymade soups				
112) Canned food				
113) Mie instan				
114) Nasigoreng Nasikuning				
115) Nasi Bungkus				
116) Fried bananas				
117) Baby food				
118) Bottled water				
119) Cola, soda etc.				

Item consumed	Quantity consumed in last week (units)	Unit (number, liter, kg, bag, pieces, etc.)		Market price, if purchased (Rp./unit)
		Name	How much kg or litre (approx..) one unit is?	
120) Fresh fruit juices				
121) Lemonade				
122) Clove cigarettes				
123) Tobacco cigarettes				
124) Cigars				
125) Tobacco				
126) Betel leaves				
127) Betel nut and others				

Outside house food consumption	No. of times in last week	No. people/time	Cost (Rp/person/ time)
128) Breakfast			
129) Lunch			
130) Dinner			
131) Tea/Coffee/Snacks			

2.2. *Monthly and annual consumption*: Has your household bought or received gifts of during the past 30 days/ 12 months? Please exclude from your answer any purchases for processing or resale in a household enterprise.

Item	Monthly expenditure (Rp./month)	Yearly expenditure (Rp. /year)
132) Rent of house if rented		
133) Rent, estimated if house is owned		
134) Electricity bill		
135) Telephone bill (fixed phone line)		
136) Gas bill (kitchen)		
137) Kerosene bill		
138) Water bill		
139) Firewood		
140) House maintenance and renovation		
141) Personal care items (soap, shampoo, toothpaste, etc.)		
142) Personal services (haircuts, shaving, etc.)		
143) Cosmetics		
144) Tailoring expenses		
145) Laundry		
146) Newspaper and magazines		
147) Membership fees		
148) Toys		
149) Making of ID card/ drivers license		
150) Telephone card (mobile phone)		
151) Postal goods		
152) Recreation		
153) Entertainment (e.g., movies, drama)		
154) Travel		
155) Ornaments		
156) Registration fee		
157) SPP		
158) POMG/BP3 /entrance- / re-registration fee		
159) Boy scout		
160) Handcraft		

Item	Monthly expenditure (Rp./month)	Yearly expenditure (Rp. /year)
161) Courses		
162) Hospital		
163) Community health center		
164) Doctor´s practice		
165) Traditional healer		
166) Medicine		
167) Footwear (men, women and children)		
168) Clothing (men, women and children)		
169) Household tools		
170) Hand tools		
171) Kitchen tools		
172) Tele vision		
173) Dish TV		
174) Other entertainment facilities		
175) Sports equipment		
176) Jewelry		
177) Vehicles		
178) Umbrellas		
179) Wristwatch		
180) Camera		
181) Install telephone		
182) Install electricity		
183) Electronic equipment		
184) Taxes (House and building tax, TV fee, motor vehicle tax)		
185) Insurance (accident, health insurance)		
186) Celebration 1 (name:_____)		
187) Celebration 2 (name:_____)		
188) Celebration 3 (name:_____)		
Did you make expenses in last year for any other item?		Yes/ No
If yes (name and expense)		

2.3 Consumption of energy (fuel, light & household appliances) during the last 30 days ended on ……

Item	Unit (name)	Quantity consumed in last one month (units)	Market price (Rp. /unit) if purchased
189) Dung cake			
190) Coal, Charcoal, Briquettes, coke			
191) LPG [excl. conveyance]			
192) 3 kg (subsidized)			
193) 15 kg (non subsidized)			
194) Battery			
195) Accu/ aki (car battery)			
196) Generator			
197) Petrol (Generator)			
198) Diesel (Generator)			
199) Lubricants oil (Generator)			
200) Oil for generator maintenance (minyak rem, kanvas, etc)			
201) Other fuel			
202) Other consumption (Matches, Candle, air freshener, Mosquito repellent etc)			

2.4 Public transport expenditures during the last *30* days ended on ……

Item	Total expenditure in last month (Rp)
203) Public bus/tram fare	
204) Public minibus (angkot) fare	
205) Air fare	
206) Public motorcycle (ojek)	
207) Taxi, auto-rickshaw fare	
208) Rental car	
209) Other public conveyance expense (such as porter charges, horse cart fare, etc)	

2.5 Private transport expenditures during the last 30 days ended on ……

Item	Fuel cost in last month (Rp)	Other expenditures in last month (lubricants, other fuel for vehicle, oil for maintenance, etc) in Rp.
210) Private car		
211) Private minibus		
212) Private bus		
213) Private motorcycle		
214) Other private transport (please mention)		

3. Decision making and time allocation

3.1 Who is primarily responsible for the following consumption expenditure items and tasks? *(Ask only if the respondent in section 1-3 is different from section 4)*

Consumption and task items	*Examples*	Persons involved (Put √ mark or NA if not applicable)		
		Male members	Female members	Both male and female members equally
Purchase of food items	*Rice, vegetables, meat etc.*			
Paying the bills	*Telephone, electricity, gas etc.*			
Selecting clothing and footwear	*Cloths, tailoring, footwear etc.*			
Paying for recreation and membership	*Movies*			
Spending on education of children (*if applicable*)	*School fees, books etc.*			
Travel and transport	*Taxy, public bus etc.*			
Purchase and sale of durable goods	*Purchasing television*			
Purchasing and sale of land and houses	*Including involving in sharecropping*			
Representing the household in the public	*Talking to govt. officials, participating in the discussions and group meetings etc.*			

3.2 Details of activities of male household head and his wife (if married)

	Time and hours spent every day	
	Male household head	Wife of male household head
Usual time of waking up in the morning (O' clock)	……. am	……. am
Usual time of going to bed for sleeping in night (O' clock)	……. pm	……. pm
Hours working in the field (crops and livestock)	…… hours	…… hours
Hours working outside own-farm (working as a laborer)	…… hours	…… hours
Hours managing household activities (cooking, shopping, taking care of children etc.)	…… hours	…… hours
Hours of sleep during day time	…… hours	…… hours
Hours chatting with friends and relatives	…… hours	…… hours
Hours for religious activities	…… hours	…… hours
Hours involved in activities to relax (e.g., watching TV, listening to music, reading etc.)	…… hours	…… hours
Other activities:……	…… hours	…… hours

Thank you very much!

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EDUCATION

PhD Candidate at the Chair of International Food Economics and Rural Development, October 2014-May 2018
Georg-August University
Goettingen, Germany

Master of Science, Business Economics and Management, June 2011
Mediterranean Agronomic Institute of Chania (MAICh)
Crete, Greece

Post Graduate Program, Business Economics and Management, June 2010
Mediterranean Agronomic Institute of Chania (MAICh)
Crete, Greece

Bachelor Diploma, Agribusiness and Farm Management, May 2009
The Agricultural University of Tirana - Faculty of Economy and Agribusiness
Tirana, Albania

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RESEARCH INTERESTS

Agricultural economics, rural development, labor market, land-use changes and inequality measures

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ACADEMIC & LEADERSHIP AWARDS

Master program Scholarship CIHEAM (The International Center for Advanced Mediterranean Agronomic Studies in Paris, France), 2009-2011, MAICh Crete, Greece

Nominated for the Best CIHEAM Thesis 2011, Paris, France (Won 3rd place)

PhD Program Scholarship from DAAD (Deutscher Akademischer Austausch Dienst, October 2014

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SKILLS

Languages: Proficient in Albanian, English, and Italian. Working knowledge of German, Arabic, Spanish and Indonesian.
Computers: Microsoft Word, Excel, Power Point, SPSS, STATA

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TEACHING EXPERIENCE

Lecturer–Faculty of Economy and Agribusiness, Agricultural University Of Tirana

Macroeconomics, November 2011 – December 2013

Main responsibilities: Developing, conducting and managing teaching program.

Teaching lessons in auditorium, discussing cases and solving exercises to help undergraduate students develop their knowledge about the macroeconomic concepts such as: the aggregate demand and

supply model, the macroeconomic equilibrium, the monetary and fiscal policies, the unemployment and inflation as well as the labor market and international trade.
Helping students in their course projects, writing and grading exams for required course for students.

Lecturer-Faculty of Agriculture, Agricultural University of Tirana

Introduction to Economics, November 2011 – December 2013

Main responsibilities: Developing and conducting teaching program.

Teaching lessons in auditorium, discussing cases and solving exercises to help undergraduate students develop their knowledge about the economic concepts such as: demand and supply model, the market equilibrium, the market structure, the production function, the tax effect on prices and income.
Helping students in their course projects, writing and grading exams for required course for students.

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OTHER WORK EXPERIENCE

Conference organizer and hospitality manager, October 2010 – June 2011
MAICH – Mediterranean Agronomic Institute of Chania (Conference Center), Greece
Main responsibilities: Managing and preparing the necessary materials for the participants at the conference.
Organizing the reception for each participant.

Transfers and Payment Specialist, November 2008– 2009
Credins Bank, Albania
Main responsibilities: Conducting financial operations such as: Money Gram, E-Banking, Money Transfers, Banking Correspondence, statistical records.

Free Lancer, January 2007 – April 2008
SIFE – Student in Free Enterprise, Tirana, Albania
Main responsibilities: Project realization, coordination and presentation for "The Agricultural University of Tirana".

▪▪▪▪▪

ACTIVITIES & INVOLVEMENT

Mediterranean Agronomic Institute of Chania, Greece
Vice President of the Student Council.

▪▪▪▪▪

PUBLICATIONS

Lekocaj, J., Lekocaj, J., 2012. The role of Microcredit: Analysis of Financial Sustainability of the Pro Credit Bank in Albania. The Economy and Agribusiness Publishing, N.4, January-June. Agricultural University of Tirana.
Bou Dib, J., Shore, E., Nikolla, M., 2013. Evaluating the performance of Albanian Savings and Credit (ASC) Union. European Journal of Sustainable Development, Special Issue, V2 (4), Rome, Italy.
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SCIENTIFIC CONFERENCES AND SYMPOSIUMS

EEFS Conference on "Global Imbalances, Financial Institutions, and Reforms in the Post-crisis Era", Athens, Greece. 03 – 06 June 2010

Paper presentation: Consumer Price Index. Does the Price Collection Frequency Mater? Some Monte Carlo Results.

IV International Scientific Conference on "The Production Efficiency and Competitiveness in Agribusiness", Tirana, Albania. June 2012

Poster Presentation

ICSD 2013 International Conference on Sustainable Development, Tirana, Albania. 19-20 April 2013

Paper presentation: Evaluating the Performance of Albanian Savings and Credit Union.

1st International Conference Biotechnology in Agriculture, Agricultural University of Tirana, Albania. 22 - 23 April 2014

Paper presentation: Analyzing the efficiency of agricultural crop production by using mathematical models.

ICSD 2014 International Conference on Sustainable Development, Rome, Italy. 26 -27 Sept. 2014

Paper presentation: Cooperative microfinance in Agriculture:

Analyzing the outreach and financial sustainability of Albanian Savings and Credit Union.

158th EAAE Seminar on "Euro-Mediterranean Cooperation in Sustainable Agriculture and Food Security: Policies, Sustainability, Marketing and Trade" Chania, Greece. 08-09 Sept. 2016

Paper presentation: Oil palm, wage labor and rural economic development in Indonesia.

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JOURNAL REVIEWER

Review of Financial Economics

Journal of Food and Beverage Manufacturing and Business Models (IJFBMBM)

International Journal of Entrepreneurship

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MEMBERSHIP IN SCIENTIFIC SOCIETIES

Agricultural Economics Society (AES), United Kingdom

European Association of Agricultural Economics (EAAE), The Netherlands