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Economic Research Informing
Tobacco Control Policy



The Economics of Tobacco Farming in Indonesia: Results from Two Waves of a Farm-Level Survey

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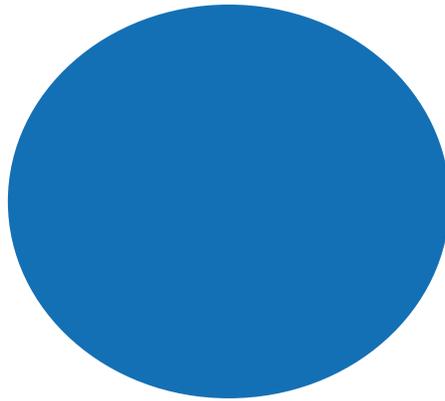
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EXECUTIVE SUMMARY

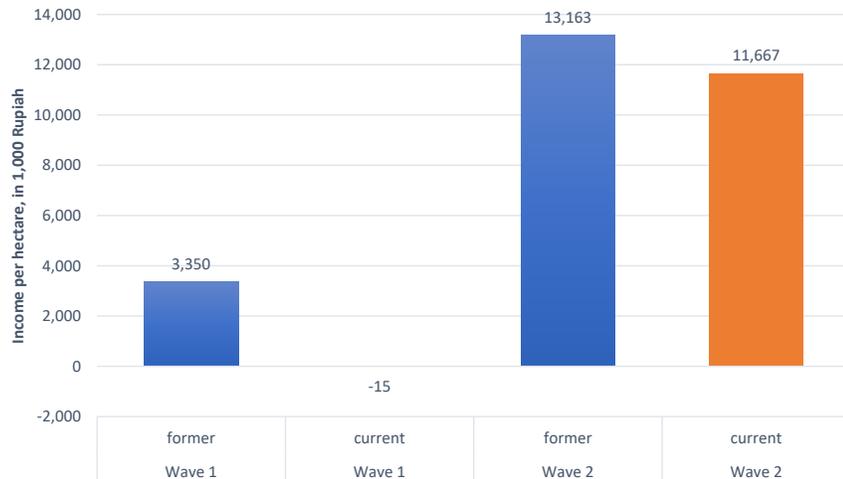


Tobacco farming has become an important agricultural commodity in some regions of Indonesia. To date, however, we know little about the economic livelihoods of tobacco farmers and the viability of this crop in relation to other alternatives. Despite this lack of knowledge, the tobacco industry promotes the notion that tobacco farming leads to prosperity. Moreover, the industry uses this argument to undermine tobacco control efforts and particularly to oppose increases in tobacco excise taxes. To address this critical need for evidence on the economic livelihoods of tobacco farmers, this research tracks the same representative group of current and former tobacco farming households over two years. Data were collected using a household survey and focus group discussions with farmers and other stakeholders, in combination with a comprehensive review of official documents and statistics. In brief, the research results strongly suggest that contrary to the tobacco industry's loud narrative, tobacco farmers would be economically better off to grow other crops or pursue other off-farm economic livelihoods, or both.

The results of the two waves of the survey must be interpreted in relation to the general seasonal and other variations in the broader context of agricultural production. The survey waves in the study coincided with an overall bad year (wave 1) and an overall good year for farming (wave 2) in Indonesia, which provides significant nuance into their economic lives. As shown in Figure ES 1, we learn that nearly all crops perform well and generate income in a very favorable growing season. Such dynamics lead many farmers to believe that tobacco is a reliably high economic performer. But this is only half the story, because it fails to capture that other crops are also high performers in good years. Moreover, non-tobacco crops performed significantly better than tobacco in wave 1, a poorer year overall for farming. In this study, one good tobacco growing year (wave 2) did not make up for the previous challenging year (wave 1). The estimates of median per hectare income across the two waves suggest that non-tobacco farmers were doing better overall due to the more consistent performance of other crops even in poor farming years.

FIGURE ES 1

Median per hectare income of 660 current and former tobacco farmers



Note: Total household income is defined as agricultural sales plus wage income, non-farming income, and other income minus input costs, rent, costs of hired labor, and household labor costs. The second wave incomes are adjusted for inflation

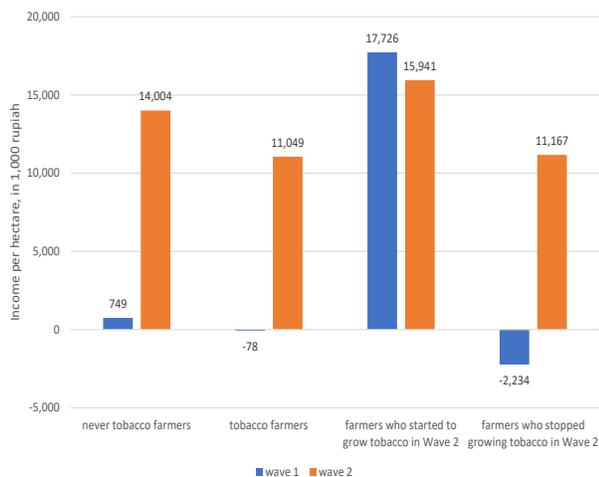
Results from Figure ES 2 on the next page help to further illustrate this dynamic. We observe that the median incomes of the farmers who did not grow tobacco (A) as well as the farmers who grew tobacco (B) in both seasons grew markedly from 2016 to 2017. The main reasons for this were higher yields and prices, with the former a result mostly of favorable rainfall. In (C), we observe that farmers who shifted to tobacco were as well off as when they were growing non-tobacco crops. Lastly, in (D), we observe that farmers who shifted away from tobacco farming had a higher income.



ALMOST ALL FARMERS GROW OTHER (NON-TOBACCO) CROPS IN THE WET SEASON



FIGURE ES 2
Median per hectare income by farming status across two waves



Note: Total household income is defined as agricultural sales plus wage income, non-farming income, and other income minus input costs, rent, costs of hired labor, and household labor costs. The second wave incomes are adjusted for inflation.

The main findings of this report include:

- Over the study period, 2016 represented a bad year overall for farming whereas 2017 represented a good year. In the bad year, non-tobacco farmers made a modest median per hectare income of nearly Rp3,350,000 while tobacco farmers' median per hectare income was nearly zero. The difference in per hectare income in the bad year was statistically significant. In contrast, in the stronger growing year, median non-tobacco income rose to above Rp13,000,000 while tobacco farmers' median income was above Rp11,000,000, though the difference was not statistically significant. Thus, over the two years combined, the median non-tobacco farmer fared significantly better than their tobacco-growing neighbors.

- Tobacco yields are particularly dependent on rainfall, which is unpredictable. Most tobacco farmers experienced losses in a season with higher-than-average rainfall but generated profits in a season with average rainfall.
- Prices are highly dependent on leaf buyers who have enormous control over the market.

- About 57.23 percent of tobacco farmers in the wave 2 study live in poverty, significantly higher than the national average of 9.66 percent in 2018. Roughly 20 percent of tobacco farmers relied on government social protection programs. Broadly, farmers would have been better off economically to grow non-tobacco crops or pursue off-farm economic activities. This finding was mostly consistent across regions, type of tobacco grown, and whether the farmer was on contract to grow tobacco.

- Some tobacco farmers considered switching because of low prices—partially owing to unfair grading—and unfavorable weather. After experiencing losses farming tobacco, farmers who switched to non-tobacco crops typically gained in profits.

- Consistent with research in other countries, per hectare input costs for growing tobacco in Indonesia are typically much higher when compared with most other crops. In wave 2, the median per hectare input costs for growing tobacco was above Rp5,700,000, significantly higher than the median per hectare input costs for growing other crops of Rp921,000.

- Tobacco farmers also bore higher per hectare costs for hired labor than non-tobacco farmers.

- The opportunity costs of tobacco are high—on average, growing tobacco requires twice the household labor hours of non-tobacco crops. These are lost opportunities for farmers to pursue other economic activities.

- Further, the median former tobacco farmer generated Rp53,083 of sales per hour spent by its members, significantly higher than the median tobacco farmer who generated Rp31,993 of sales per hour spent by its members. These two types of households were of similar average size.

- Because most former tobacco farmers spent far fewer hours in their fields, many engaged in other economically productive activities and were developing more robust and diversified economic activities than their peers who continued to grow tobacco.

- Such varied lives not only grow income but also mitigate farmers' economic risk.

- Most tobacco farmers grossly overestimate their return on investment. Specifically, farmers tend to greatly underestimate the costs of tobacco cultivation.

- In both survey waves, relative to former tobacco farmers, farmers who grow tobacco were significantly more likely to exhibit the symptoms of green tobacco sickness, which is a dangerous form of acute nicotine poisoning.

- Tobacco farmers use child labor—hired and household—to cultivate tobacco, considerably more so than non-tobacco crops. Moreover, children are missing school to work in the tobacco fields, which has long term detrimental effects on their development, and likely ultimately on incomes. Farmers report needing child labor because growing tobacco does not typically pay enough to hire legal, adult workers.



Unfair Contracts **Price Gouging** **Unfair Grading**
Too Much Rain **Green Tobacco Sickness**
Exhaustion
Generating Cash To Pay Bills
Overwork
Persistent Debt
Child Labor **Unscrupulous Middlemen**
Low Prices **Lost Economic Opportunity**



Farmer illustration: courtesy of tobaccoatlas.org

RECOMMENDATIONS

1 To assist farmers to shift to sustainable crops that will generate more stable incomes for farmers, national and local governments should **identify viable alternative crops**. Governments can conduct local assessments by analyzing soil conditions, weather patterns, existing supply chains, market availability in neighboring areas, and general demand for the crops. Importantly, governments can learn from the experiences of former tobacco farmers who have successfully made this transition.

2. Governments must then **provide or reallocate the existing agricultural extension services to promote non-tobacco crops tailor made to local contexts**. Such services may include technical aspects of growing a variety of non-tobacco crops depending on local conditions, weather prediction for annual crop planning, general farm management, identification of markets for expansions, and business skills training. From these services, farmers will also be able to identify better what is a good livelihood and make better economic decisions.

3. Governments should **link farmers to competitive agri-industries to establish mutual partnerships for non-tobacco crops growing**. Such connections will provide access to readily available markets, which was cited as one of the top reasons that tobacco farmers stayed with that crop.

4. Governments should train farmers to **establish corporations or community enterprises**—including taking advantage of village funds or dana desa—that would allow farmers to process their non-tobacco crops. This strategy creates value added that would improve farmers' livelihoods.

5. Governments should **provide incentives—both financial and non-financial—and credit schemes** to the growing of non-tobacco crops. The survey shows that farmers had limited capital and that growing non-tobacco crops generates consistent earnings. For example, the government announced in early 2020 that they will expand the community micro credit program (kredit usaha rakyat or KUR) to farmers. The government can impose a condition that receipt of KUR is conditional on growing non-tobacco crops. Another alternative is to allocate some portion of the Revenue Sharing Fund of Tobacco Products Excise (Dana Bagi Hasil Cukai Hasil Tembakau) not only to improve input quality of tobacco farming but also non-tobacco farming.

6. To increase off-farm opportunities, governments should **improve transportation infrastructure** that make it easier for the villagers to travel to economic and industrial centers. Physical distance or inadequate infrastructure may restrict mobility of farmers' household members to find off-farm opportunities elsewhere.

7. Government should **improve provision of infrastructure that supports development of market centers** in the village where much of the off-farm activities typically emerge. For many farmers, livelihood based on agriculture activities alone may be insufficient or expose them to too much risk. There will be many more rural off-farm opportunities where there is a vibrant market.

8. Government should continue to **promote policies that improve quality in education and health** through existing government program such as the Smart Indonesian Card (Kartu Indonesia Pintar) and Healthy Indonesian Card (Kartu Indonesia Sehat) programs. When farmers' households are endowed with higher human capital, and more remunerative off-farm opportunities are available, the opportunity cost of remaining in tobacco farming becomes very high.

9. Where feasible and appropriate, governments could **incentivize farmers to switch** by providing subsidies based on crop portfolios.

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INTRODUCTION

Tobacco use continues to place an unsustainable economic burden on health systems and society in general (Goodchild, Nargis, and D'Espaignet 2018). This economic cost is secondary to the massive loss of life and burden placed on families (Drope, Schluger, et al. 2018). Tobacco control has emerged as a global movement that has led to significant declines in consumption in many countries. However, the burden of consumption is shifting to many low- and middle-income countries that have historically avoided high rates of tobacco use. Often these countries are the same ones scaling up tobacco production enticed by the prospect of growth in the export-led growth and the emerging domestic market. However, research is beginning to demonstrate that the narrative of economic prosperity associated with tobacco production is illusory both at the level of benefits to tobacco farmers, and the inevitable societal costs of tobacco consumption if the domestic market for consumption grows (Magati et al. 2016; Makoka et al. 2017; Magati et al. 2019; Goma et al. 2017). Despite this evidence, the tobacco industry continues to provide a narrative that justifies the importance of tobacco products in an economy.

One of the central arguments against any tobacco control policy is the purported adverse effects that the policy would have on the livelihood of workers in the tobacco sector, particularly tobacco farmers (Otañez, Mamudu, and Glantz 2009; Lencucha, Drope, and Labonte 2016). This simplified narrative is often compelling to agribusiness and development sectors within government (Lencucha et al. 2018). However, there are at least two flaws in this argument. First, the demand for tobacco control is determined by the global market. Domestic tobacco control policy is unlikely to significantly affect production in the short term (Goma et al. 2017; Sahadewo et al. 2018). However, an important qualification for this scenario is that as the global movement towards reducing tobacco consumption gains momentum, tobacco production will no longer represent a sustainable economic strategy for countries. This point is now widely recognized, even by the most tobacco-dependent economies. Second, and most importantly, studies consistently demonstrate that tobacco farmers generate small profits and even losses in several settings (Drope, Schluger, et al. 2018; Goma et al. 2017; Magati et al. 2016; Chavez et al. 2016; Makoka et al. 2017).

The economic contribution of the tobacco farming sector in Indonesia is relatively small. The Indonesian Ministry of Agriculture estimated that tobacco farming contributed about 0.03% of total Indonesian gross domestic product (Rachmat 2010). The Directorate General of Estate Crops estimated that tobacco farmers produced 156,024 tons of raw tobacco leaf, a fairly typical production at least in the past decade. Most of the domestically grown tobacco leaf was used domestically. Indonesia also became a net importer of tobacco leaf in the past two decades to fulfill demands of the domestic cigarette industry. For example, in 2016, Indonesia imported 81,502 ton of tobacco leaf from the global market while

it exported 28,005 ton (Directorate General of Estate Crops 2017). It is important to note that the share of Indonesian tobacco exports and imports in the global market is relatively small. It is estimated that Indonesian tobacco exports accounted for 1.6 percent of global export, while Indonesian tobacco imports accounted for 5.3 percent of global imports (OECD, 2019). These statistics suggest that Indonesia is a small player entrenched in global supply and value chains of tobacco leaf.

Tobacco farming activities in Indonesia are concentrated in specific regions. In 2016, tobacco productions were concentrated in East Java (33.33 percent), West Nusa Tenggara (31.24 percent), and Central Java (22.03 percent). It is not surprising that tobacco farmers were also concentrated in these regions. The share of tobacco farmers was 50.76 percent in East Java, 28.04 percent in Central Java 28.04 percent, and 9.11 percent in West Nusa Tenggara (Directorate General of Estate Crops 2017). Despite its concentration, the share of tobacco farmers to total farmers in the agricultural sector was relatively small at 1.6 percent. Furthermore, the employment contribution of the tobacco farming sector to the overall economy was only 0.7 percent (Sahadewo et al. 2018).

This report follows up on an earlier closely related study, presenting findings from the second wave of the Tobacco Farmer Survey (TFS) to better understand the factors that affect tobacco farming. We do so by enumerating a randomly selected subset of the households from the first wave of the TFS. We designed a sampling protocol so that our second-wave sample remains a nationally representative sample of tobacco farmers. The second wave TFS involves 660 tobacco farmers in several major tobacco-growing districts in East and Central Java provinces.

The findings on the livelihoods of tobacco farmers in Indonesia are consistent with the global findings. Findings from an initial phase of this research were derived from a nationally representative household-level economic survey of tobacco farmers in Indonesia (Drope, Li, et al. 2018). This research was the first—if not the only—rigorous examination of the livelihoods of tobacco farmers in Indonesia. The study was part of a larger research agenda that analyzed tobacco sector employment, particularly tobacco farmers, clove farmers, and kretek rollers (Sahadewo et al. 2018; Araujo et al. 2018; Nargis et al. 2018; Marquez et al. 2018). One of the key findings from the first phase of this study was that tobacco farming is not a profitable economic endeavor for many tobacco farmers, and it entails high opportunity costs for the household because of the enormous demands on household labor. A follow-up study using the survey data from both TFS waves finds that tobacco farming has negative effects on earnings (Sahadewo et al. 2019).

Analysis of the second wave of data indicates that former and current tobacco farmers generally did much better in this second time period. Former tobacco farmers generated higher income from all of their economic endeavors such as non-tobacco crops, non-farm enterprise, and paid labor. Current tobacco farmers also did better as tobacco farming and non-tobacco farming income were higher in the second wave of the TFS. The higher tobacco farming income in the second wave of the TFS was driven by higher leaf production and higher prices, and ultimately, increased sales. The main explanation for the desirable tobacco farming outcomes in the second wave is the weather. The average rainfall in the year of the second wave of TFS was relatively close to the long-term average. In comparison, the average rainfall in the year of the first wave of TFS was significantly higher than the long-term average. The relatively dry conditions of the pre-harvest period led to better tobacco farming productivity and leaf quality (Syahid Muttaqin et al. 2019) because tobacco plants fare better under such weather conditions.

Despite better outcomes in the second wave of the TFS, tobacco farmers still relied quite heavily on agricultural income. In contrast, a larger share of former tobacco farmers relied more on enterprise and other sources of income. Tobacco farmers were spending significantly more for agricultural inputs—such as fertilizers, pesticides, firewood, and rental of equipment—for their tobacco crops than for their non-tobacco crops. The difference in inputs for tobacco and non-tobacco farming during the dry season persisted across the two TFS waves. We also find that tobacco households allocated far more household labor than non-tobacco farmers. This implies that tobacco farming households had high opportunity costs: tobacco farming households could have spent their time for other and more profitable economic endeavors, which is a dynamic to which we return below.

Whereas tobacco farming is clearly an important economic activity, it is valuable to note that in both time periods, most tobacco farmers were still deriving a relatively small share of total income from tobacco growing. The results from the two TFS waves do strongly suggest that tobacco farming outcome is highly dependent on an unpredictable external factor: weather. Tobacco farmers basically made a gamble in the beginning of the tobacco growing season. The return at the end of the growing season is dependent on the quality of the leaf, which itself is dependent on the uncertain weather conditions. Price is obviously another notable variable, but the over-supply of leaf globally most years appears to generate a relatively consistent situation of low prices, though this appears to be somewhat less true for particularly high quality leaf.

The structure of the report is as follows: Section 2 discusses the research methods including sampling, survey instruments, sample selection, and data analysis. Section 3 presents and analyzes sociodemographic characteristics of both former and current tobacco farmers in Waves 1 and 2. Section 4 discusses the economics of tobacco farming including contracts, costs, production, prices, and profits in both Wave 1 and 2. Section 4 also discusses other crop growing and reasons why farmers continue to grow tobacco. Section 5 discusses the incidence of child labor in tobacco farming. Section 6 discusses asset accumulation and food security. We state our conclusions in Section 7

SECTION 2

METHODS

2.1 SAMPLING AND SURVEY INSTRUMENTS

Wave 2 of the TFS, conducted in 2017, was designed as a follow up survey of a subset of the households included in Wave 1. The Wave 1 TFS implemented in 2016 was a nationally representative survey collecting information from a sample of 1,350 current and former tobacco farmer households in seven districts in three top tobacco-producing provinces in Indonesia: East Java, Central Java, and West Nusa Tenggara. These seven districts, Magelang and Temanggung in Central Java Province, Lumajang, Jember, and Bojonegoro in East Java Province, and Lombok Tengah and Lombok Timur in West Nusa Tenggara were responsible for 84 percent of tobacco production in 2015. Within each selected village (18 in total), 20 current and five former tobacco farming households were randomly selected (a ratio of 4:1), except in Lumajang, where the ratio of current and former tobacco farming households was 1:1 because of difficulties finding farmers. (see Drope et al 2018 for a complete description of the Wave 1 survey design).

Due to budget constraints, but with the overall goal of generating results largely representative of most of Indonesia's tobacco farmers, the Wave 2 TFS revisited the study villages in the five districts that are in the Central and East Java. In each study village, 15 out of 25 Wave 1 households were randomly selected for a total sample of 660 farmer households. The selection was conducted with an aim to maintain the ratio of 4:1 between Wave 1 current and former tobacco farmers, except in Lumajang where the ratio was 1:1, to ensure representativeness of the Wave 1 sample¹. A strict rule was in place to replace the target households with the households from the 10 remaining households when a household could not be re-interviewed for various reasons.² In total, only eight households were replaced (i.e. brand new households in Wave 2).

Note that the ratio used in the selection was based on the ratio of farmer status at baseline. The ratio allows for an examination of those farmers who switched between waves, Wave 1 current tobacco farmers who became former tobacco farmers in Wave 2, and former tobacco farmers in Wave 1 who became current tobacco farmers in Wave 1.

■ [Table 1 Survey respondents, by province, district, and sub-district.](#)

Table 1
Survey respondents, by province, district, and sub-district

Province	Municipality	Village	Wave 1	Wave 2
East Java	Bojonegoro	Kepoh Baru	75	45
		Ngasem	75	45
		Ngraho	75	45
		Tambakrejo	75	45
	Jember	Balung	75	45
		Kalisat	75	45
		Pakusari	75	45
		Puger	75	45
	Lumajang	Pasirian	75	55
		Tempeh	75	65
Central Java	Magelang	Kaliangkrik	75	45
		Windusari	75	45
	Temanggung	Bulu	75	45
		Parakan	75	45
West Nusa Tenggara	Lombok Tengah	Janapria	75	-
		Praya Timur	75	-
	Lombok Timur	Sakra Barat	75	-
		Sakra Timur	75	-
Total			1,350	660

The Wave 1 survey instrument was developed based on similar surveys in other countries and expanded with significant data collection elements from the World Bank Living Standards Measurement Study (LSMS). The questionnaire was divided into 26 sections and included the following major topics: household characteristics; livelihood, income and assets; land ownership and crop production; tobacco production generally; tobacco production under contracts (where applicable); tobacco marketing; farmer debt and credit; household food security; and the future of tobacco production and health. As discussed in Drope et al (2018), this survey instrument was influenced by recent survey-based research on the political economy of tobacco farming in Sub-Saharan Africa and the Philippines (Briones, 2015; Chavez et al., 2016; Goma et al., 2015; Magati et al., 2016; Makoka et al., 2016; Makoka et al., 2016) and the LSMS surveys implemented in many countries.

The aims of Wave 2 study are to investigate the dynamics of farming among current and former tobacco farmers including production, costs, prices, profits, and other crop growing. Therefore, we use the same set of instruments used in the Wave 1 with some relevant modifications. These modifications include questions to better capture symptoms of illness, labor used to apply pesticide/herbicide, hired labor paid in-kind, loan repayment, and finally, a set of questions on nearest economic centers to provide a measure of market access and off-farm opportunities.

2.2 SAMPLE SELECTION

We revisited a subset of first-wave households in East and Central Java for the second-wave TFS. These households were randomly chosen from the first-wave roster. Our analysis used the first and second-wave TFS data in two ways. First, we include only households observed in both the first and second wave of the TFS. This sample selection method allows us to compare outcomes of the same set of households across time periods. Second, we can use all observations in the first and second-wave TFS data for the data analyses. For comparability, we have excluded West Nusa Tenggara from the first-wave sample because these households were not revisited in the second wave of the TFS. Note that both alternatives would produce an unbiased estimate of the population. The first-wave households are representative of the tobacco-farming population without West Nusa Tenggara and that the second-wave households are randomly selected from the first-wave roster.

The first alternative allows us to avoid bias due to composition effects because we are analyzing the same set of households across the two waves. However, the first alternative underutilizes the rich information available in the dataset. The second alternative utilizes available information in the data. Thus, an inquiry that needs to be addressed is whether households revisited in the second wave are different in characteristics than households that were not revisited. We answered this inquiry by conducting a balance check. In particular, we investigated whether the likelihood of being revisited in the second wave of the TFS is correlated with observable characteristics in Wave 1 such as socioeconomic characteristics, farming choice, and farming outcomes.

We expect that observable characteristics are not correlated with being revisited in the second wave given the strict random sampling protocol. This would support the use of all observations from the two survey rounds in the statistical analysis. However, if being revisited in the second wave is correlated with observable characteristics, we would obtain a selection bias when comparing farmers' outcomes across waves. In such case, the first method of sample selection would be preferable.

We report the marginal effects from logistics regressions in Table A1 in the appendix. We find that the likelihood of being revisited in the second wave of the TFS is not correlated with other observable characteristics. The findings show that first-wave households that were revisited for the second wave of the TFS are on average similar in characteristics to those that were not revisited. Given these findings, we use all observations from the first and second-wave surveys for data analyses, excluding those from West Nusa Tenggara. We also conduct data analyses

using a subset of households who were observed in both survey waves, and we report the analyses in an online appendix. The online appendix is available at www.cancer.org/ehpr or queried directly to the authors.

2.3 FOCUS GROUP DISCUSSIONS

As in Wave 1, in Wave 2 we also implemented a series of focus group discussions (FGDs, $n=5$) with current and former tobacco farmers ($n=34$). The aims of the FGDs were to complement the survey data by eliciting contextual information not captured by the quantitative survey and by clarifying issues that weren't sufficiently explained by the survey.

The villages were selected using purposive sampling, choosing major tobacco-growing communities from the same sub-districts where we conducted the quantitative survey. A total of five FGDs were conducted between February and March 2019 in three of the districts that were part of the study. In the district of Temanggung, an FGD was conducted with five former tobacco farmers in the village of Wonoroto, subdistrict of Windusari. In a separate session, we conducted an in-depth interview with the head of the local farmers' group. In the district of Lumajang, two FGDs were conducted: the first one with a group of eight current tobacco farmers in the village of Bades, in the subdistrict of Pasirian, and the second one with a group of five former tobacco farmers in the village of Pandanwangi, in the subdistrict of Tempeh. In Bojonegoro we also conducted two FGDs, one with eight current tobacco farmers in the village of Woro in subdistrict Kepohbaru, and the second one with eight former farmers in the village of Setren, subdistrict Ngasem.

The participants were selected by the survey team supervisor that was responsible in the study area from a list suggested by village leaders and farmers. The team supervisor verified the eligibility of the participants. To be eligible, the participant must be a current tobacco farmer or former tobacco farmer and cannot be a village official. The FGDs were led by experienced facilitators with a background in qualitative research and were conducted in Indonesian language and local dialect (Javanese/East Javanese). The facilitators aimed to encourage different perspectives and avoid dominance of particular individuals.

In the discussions, the participants were asked to reflect on and discuss the following topics: their general experience in tobacco farming, the pricing of tobacco leaf, the costs of inputs, the labor demands of farming, the broader feasibility and profitability of tobacco farming, and other important issues identified by the farmers. Current tobacco farmers were also asked to discuss the importance of tobacco farming relative to other economic activities, and whether they have they considered shifting to other crops and leaving tobacco farming. Former tobacco farmers were asked to reflect on their previous experience in tobacco farming, the reasons they left tobacco and whether they consider moving back into tobacco farming.

The FGDs were fully recorded, transcribed verbatim, and translated into English. Analysis of the FGDs made full use of the transcripts as well as other notes from the FGDs including seating arrangement, participation level of each participant, including their interest and engagement in the conversations.

2.4 DATA ANALYSES

We use descriptive and multivariate regression analyses in the report. The objective of the descriptive analyses is to analyze farmers' socio-demographics, economic livelihoods, and employment. The objective of the multivariate regression analysis is to uncover correlations, associations, and even potential causal relationships between/among key variables of interest such as decision to enter tobacco-growing contract and household income. Specifically, we aim to identify factors associated with decision to enter tobacco-growing contract, the effects of tobacco farming on income, and factors associated farmers' willingness to switch to non-tobacco crops.

SECTION 3

FARMERS' CHARACTERISTICS

3.1 SOCIO-DEMOGRAPHIC PROFILE

The majority of tobacco farmers are middle-aged men with an elementary school education. We report characteristics of former and current tobacco farmers in both TFS waves in Table 2. Most of the heads of tobacco-farming households – 97.3 percent were male; slightly more than two thirds – 68.9 percent – of the heads of tobacco-farming households were between 36 and 60 years old, with an average age of 51 years old. This finding shows that an average tobacco farmer is significantly older than an average person in Indonesia (28.5 years). The percentage of divorced farmers is also lower than the national average of 1.26 percent in 2018. Approximately three-quarters of tobacco farmers reported completing elementary school (“SD” in the Table 2) or less, which is quite typical in the Indonesian agricultural sector. We found that 84.2% of tobacco farmers relied on the agricultural sector, while only three-quarters of former tobacco farmers relied on the agricultural sector. The share of former tobacco farmers who relied on income from the non-agricultural sector was 22.3 percent, while the share of current tobacco farmers who relied on this sector was just 12.7 percent.

Table 2 Characteristics of Former and Current Tobacco Farming Household Head.

Table 2
Characteristics of Former and Current Tobacco Farming Household Head

	Wave 1			Wave 2		
	Current	Former	Total	Current	Former	Total
Gender, in %						
Female	2.89	2.75	2.86	2.73	7.43	3.79
Male	97.11	97.25	97.14	97.3	92.6	96.2
Age (Years), in %						
21-35	11.07	11.37	11.14	8.59	8.11	8.48
36-60	72.08	69.80	71.52	68.95	68.24	68.79
>60	16.86	18.82	17.33	22.5	23.7	22.7
Marital Status, in %						
Never married	1.01	1.96	1.24	0.20	0.68	0.30
Married	93.84	94.12	93.90	94.34	93.92	94.24
Divorced/ separated	1.13	0.39	0.95	0.68	1.35	0.76
Widowed	4.03	3.53	3.90	4.88	4.05	4.70
Education, in %						
No school	-	-	-	-	-	-
Some SD	39.37	32.16	37.62	43.55	35.81	41.82
SD	39.50	38.43	39.24	33.59	36.49	34.24
Some SMP	2.77	2.75	2.76	4.10	2.70	3.79
SMP	10.06	16.08	11.52	8.98	14.19	10.15
Some SMA	1.01	0.78	0.95	1.95	2.03	1.97
SMA	4.40	5.10	4.57	4.49	4.05	4.39
Some SMK	0.38	-	0.29	0.59	0.68	0.61
SMK	2.01	2.35	2.10	1.37	2.03	1.52
D1/D2/D3	-	-	-	-	-	-
Some College	-	0.39	0.10	0.39	-	0.30
College	0.50	1.96	0.86	0.98	2.03	1.21
Main Activity, in %						
Agricultural work	83.90	71.37	80.86	84.18	75.68	82.27
Non-agricultural work	13.58	22.35	15.71	12.70	22.30	14.85
Home duties	0.13	0.78	0.29	0.59	1.35	0.76
Retired/aged	1.26	1.57	1.33	1.37	0.68	1.21
Unemployed (looking for work)	0.25	1.57	0.57	0.39	-	0.30
No work	0.88	2.35	1.24	0.78	-	0.61
Observations	795	255	1,050	512	148	660

Note: The sample from the first wave excludes households from West Nusa Tenggara

Individuals in both tobacco and non-tobacco-farming households rely on farming activities as the main source of livelihood, as illustrated in Table 3. The majority of individuals participated in farming activities within the last 12 months, which is quite typical in the agricultural sector. About 70% of individuals in the tobacco-farming households had worked on the household’s farm in the past seven days as the survey was conducted during the harvest period. Many individuals in both tobacco and non-tobacco-farming households did not receive direct wage payment for this work, but rather any income accrued to the household head and it is not clear what happened to the income thereafter. However, the share of non-tobacco farmers involved in non-agricultural business enterprise in the past seven days was higher than the share of tobacco farmers.

Table 3 Main source of livelihood by self-report: total household members.

Table 3
Main source of livelihood by self-report: total household members

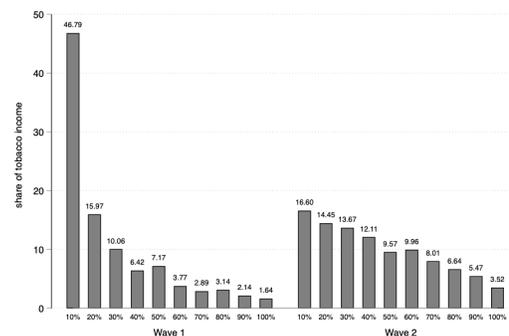
	Current Farmer		Former Farmer	
	N	Proportion (%)	N	Proportion (%)
In the last 7 days				
Received payment in agricultural or non-agricultural activities	1,864	35.41	514	42.61
Business (fisheries, livestock)	1,864	27.90	514	33.27
Helped without paid in any kind	1,864	37.88	514	43.00
Worked on this household’s farm	1,864	70.49	514	63.62
In the last 12 months				
Participated in tobacco farming	1,314	97.41	327	-
Participated in non-tobacco farming activities	1,314	91.32	327	96.64

Note: We use the sample from the second wave of the survey.

For the majority of tobacco farmers, tobacco income represents a small share of total household income despite dedicating most of their time to tobacco farming. In Figure 1, we depict the proportion of tobacco income to total household income. In the first wave, about 85% of tobacco farmers were deriving less than half of their income from tobacco growing. One explanation for this result, which will be further explored in this report, is that tobacco farming is generally not a profitable endeavor. We note that the share of tobacco farmers who were deriving less than half of their income from tobacco growing decreased to about 64% in the second wave of the TFS. The main reason for this result is that tobacco farming was more profitable in the second wave of the TFS. Despite this shift, the majority of tobacco farmers were still deriving a relatively small share of total income from tobacco growing.

FIG 1 Proportion of tobacco income to total household income.

Figure 1
Proportion of tobacco income to total household income



Note: The sample from the first wave excludes households from West Nusa Tenggara

Generally, tobacco farmers relied more heavily on agricultural income while a larger share of former tobacco farmers relied more on enterprise and other income. In Table 4, we show the percentage of farmers who drew income from various main sources. About 99% of tobacco farmers reported receiving agricultural income. Only 59% of tobacco farmers reported receiving enterprise income, while about 71% of former tobacco farmers reported receiving enterprise income. This result suggests that former tobacco households were more likely to have other economic endeavors that they can rely on.

Table 4 Percentage of farmers receiving income from main sources.

Table 4
Percentage of farmers receiving income from main sources

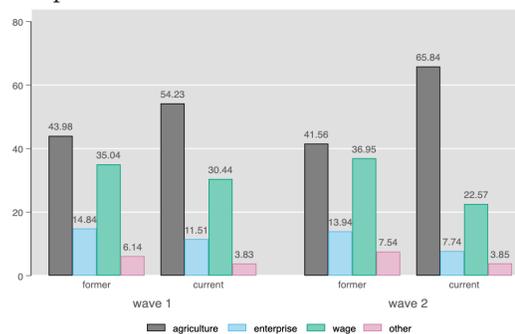
Wave	current	agriculture	enterprise	wage	Other
1	former	81.18	63.53	67.45	75.67
1	current	95.60	59.75	65.28	76.61
2	former	86.49	70.95	74.32	84.46
2	current	99.41	58.98	72.27	72.07

Note: The sample from the first wave excludes households from West Nusa Tenggara

We depict the proportion of different income sources to total household income in Figure 2. While almost all farmers received income from agriculture, the share of agriculture income was only 65.84 percent for current tobacco farmers and 41.56 percent for former tobacco farmers. It is important to note that proportion of household income from enterprise and wage income was higher among former farmers than current farmers. For example, 36.95 percent of former farmers' household income was derived from wage income, while it was only 22.57% among current farmers.

Figure 2 Proportion of different income sources to total HH income.

Figure 2
Proportion of different income sources to total HH income



Note: The sample in the first wave exclude households in West Nusa Tenggara.

We use the survey results to analyze tobacco and former tobacco revenue and income. We define household revenue as the sum of tobacco farming sales, non-tobacco farming sales, enterprise sales, wage, and other revenue. Household revenue does not incorporate farming or other business costs. On the other hand, we incorporate costs incurred for farming and business activities in the calculation of household total income. We follow established literature that calculate household income by incorporating household labor costs (Chavez et al. 2016; Goma et al. 2017; Makoka et al. 2017). Specifically, total household income is the sum of tobacco farming profit, which is revenue minus farming costs; non-tobacco farming profit; household enterprise profit; wage income; and other income minus rent and household labor costs.

An important component in the calculation of household total income is the estimation of household labor costs. We apply a method to calculate household labor costs used in a recent study that analyzes the first wave of the TFS in Indonesia (Drope, Li, et al. 2018). The method used in this study was developed based on established methodologies in the literature (Chavez et al. 2016; Goma et al. 2017; Makoka et al. 2017). Household labor cost is defined as total opportunity costs of household labor. We obtain labor costs by multiplying regional agricultural minimum hourly wages by the number of household labor hours reported.

Table 5
Average income from different sources, in 1,000 Indonesian rupiah

	Wave 1 ¹		Wave 2	
	former	current	former	current
Non-tobacco crops (perceived) profit, wet season ²	1,548	2,388	2,162	3,759
Non-tobacco crops income, dry season ³	-956	-682	862	501
Tobacco income ⁴	-	-5,470	-	5,384
Enterprise income	654	435	1,601	799
Other income	641	406	1,017	754
Wage income	6,289	5,728	7,339	6,494
Total HH income^{5,6}	7,408	79	12,191	14,359

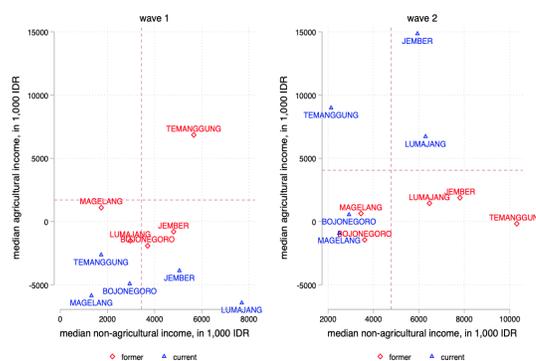
Notes: The sample in the first wave excludes households from West Nusa Tenggara. Non-tobacco crops profit is defined as crop sales minus inputs and costs of hired labor.² Non-tobacco crops income is defined as crop sales minus inputs, costs of hired labor, and household labor costs.³ Tobacco income is defined as tobacco sales minus inputs, costs of hired labor, and household labor costs.⁴ For each wave and for each group of farmers, we drop observations with total household income lower than the 5th and higher than the 95th percentiles. Total household income is defined as agricultural sales plus wage income, non-farming income, and other income minus input costs, rent, costs of hired labor, and household labor costs. The second wave incomes are adjusted for inflation.⁶

Former and current tobacco farmers generally did much better in the second wave of the TFS than in the first wave. We show average income of farmers from different sources in Table 5 (shown above). On average, current tobacco farming household's income was Rp14.359 million in the second wave of the TFS, which is significantly larger than current tobacco farming household's income in the first wave. In the second wave of the TFS, both tobacco and non-tobacco farming generated positive income, even after taking into account household labor costs.

Former tobacco farmers also were better off in the second wave of the TFS than in the first wave of the TFS. Their average income was Rp12.191 million in the second wave, almost Rp5 million more than their average income in the first wave. On average, former tobacco farmers generated higher income from other economic endeavors—such as non-tobacco farming, enterprise, and paid labor—although the difference in mean is statistically significant only for the enterprise income.

The results above suggest that former tobacco farmers experienced a greater economic stability across the two survey waves. These farmers experienced less income fluctuation across time. On the other hand, current tobacco farmers experienced a relatively large income variation over time. The large variation is largely driven by tobacco income.

Figure 3
Median agricultural by non-agricultural income – by region



Notes: The sample in the first wave excludes households from West Nusa Tenggara

Agricultural and non-agricultural incomes were generally better in the second wave of the TFS. As shown in Figure 3 (shown above), median agricultural and median non-agricultural incomes were higher in the second wave of the TFS. Consistent with the results in Table 5, agricultural incomes of current tobacco farmers were indeed higher in the second wave of the TFS. It should be noted that farmers in the districts of Temanggung, Lumajang, and Jember experienced above-median agricultural and non-agricultural incomes in the second wave of the TFS.

3.2 POVERTY

The poverty rate among tobacco farmers was lower in the second wave of the TFS than in the first wave of the TFS. However, the poverty rate among tobacco farmers was still higher than the nationwide incidence of poverty of 5.70 percent in 2017. We present results from an analysis of poverty rates in Table 6a and 6b. For example, using the per-capita revenue, the poverty rate among tobacco farmers was about 27.92 percent in the second wave of the TFS. If we use a more realistic measure of household income, the poverty rate among tobacco farmers nearly doubles to 56.86 percent. Although tobacco farmers gained relatively large tobacco revenues in the second wave of the TFS, they also incurred larger direct and indirect expenses when cultivating tobacco. The poverty rate among former farmers was also quite high in comparison to the national rate, but the poverty rate among this group of farmers was relatively stable across time, which might suggest more stable income for these farming households.

Table 6a. Poverty Status of Current and Former Tobacco Farmers

Poverty status	Poverty at \$1.90 a day per person, PPP 2011		Poverty at national poverty line IDR330,776 a month per person	
	Current	Former	Current	Former
Wave 1 ¹				
Headcount ratio measured by per capita revenue	42.77	43.14	48.80	48.23
Headcount ratio measured by per capita income	77.74	54.12	80.00	56.86
Wave 2				
Headcount ratio measured by per capita revenue	27.92	43.92	35.54	49.32
Headcount ratio measured by per capita income	57.23	55.41	61.52	60.13
Poverty line (million rupiah)	3.3		4	

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

Table 6b. Per-capita household revenue and income, in 1,000 Indonesian Rupiah

	Wave 1 ¹		Wave 2	
	Current	Former	Current	Former
Annual mean per-capita revenue	5,368	5,666	8,364	5,934
Annual median per-capita revenue	4,162	4,356	5,735	4,095
Annual mean per-capita income	-179	2,026	3,627	2,985
Annual median per-capita income	-317	934	2,112	1,802

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. For the calculations of a variable's mean, we drop observations below the 5th percentile and above the 95th percentile for each group of farmers in each wave. The second wave incomes are adjusted for inflation.

Given the high poverty rate, a non-negligible share of tobacco farmers used social assistance in various forms not surprisingly. We present the results from analysis of the social assistance among tobacco and former tobacco farmers in Table 7. In general, a larger share of tobacco and former tobacco farmers obtained assistance in various forms in the second wave of the TFS. Moreover, the share of tobacco and former tobacco farmers who received more than one form of social assistance increased in the second wave of the TFS. This could also have been driven by a better service delivery or government expansion of these social assistance programs. The survey results do not permit more inference on this issue.

Table 7 Participation in Social Security Card (KPS) or Family Welfare Card (KKS).

Table 7 Participation in Social Security Card (KPS) or Family Welfare Card (KKS)

Indicators	Wave 1 ¹		Wave 2	
	Current	Former	Current	Former
Percentage of HH with KPS/KKS	20.38	17.25	22.27	20.95
Benefit 1: Percentage of HH who received cash assistance/transfer in the last year				
With KPS/KKS	1.76	1.57	9.18	6.76
Without KPS/KKS	1.38	1.18	3.52	3.38
Benefit 2: Percentage of HH who received rice for the poor (Raskin) in the last year				
With KPS/KKS	0.63	1.57	1.95	0
Without KPS/KKS	68.43	66.27	58.01	63.51
Benefit 3: Percentage of HH who received assistance for health payment in the last year				
With KPS/KKS	0.38	0.39	0.20	0.68
Without KPS/KKS	2.52	3.92	10.55	11.49
Benefit 4: Percentage of HH who received cash assistance for poor student in the last year				
With KPS/KKS	2.52	2.75	3.12	2.03
Without KPS/KKS	9.69	7.06	9.96	11.49
Overall percentage of households who received assistance from KPS/KKS or other sources in the last year				
One benefit	49.81	47.84	36.13	40.54
Two benefits	15.35	17.25	15.43	14.86
Three benefits	6.79	4.31	8.40	8.11
Four benefits	1.38	1.18	4.69	4.73
Five benefits	0.25	0.39	1.56	1.35
Total	76.23	76.86	69.92	70.95

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara

The percentage of tobacco farmers who received government health benefits, particularly KIS, was higher than the percentage of former tobacco farmers. We present the results from analysis of enrollment in and receipt of government health benefits in Table 8. In general, the percentage of tobacco and former tobacco farmers who obtained KIS increased in the second wave of the TFS. It is important to note that it is likely both the service delivery and the coverage of KIS has been improved in the second wave of the TFS. The share of tobacco households that used KIS was 34.38 percent, while the share of former tobacco households was only 22.77 percent.

Table 8 Current and former tobacco farmers using KIS/BPJS-PBI.

Table 8

Current and former tobacco farmers using KIS/BPJS-PBI

Indicators	Wave 1 ¹		Wave 2	
	Current	Former	Current	Former
Percentage of HH who have KIS/BPJS-PBI				
KIS	22.77	17.65	34.38	31.76
BPJS-PBI	7.17	7.45	3.12	5.41
Both KIS and BPJS-KIS	0.75	0.39	0.78	0.68
None	69.31	74.51	61.72	62.16
Percentage of HH who used KIS in the last one year				
19.25	32.61	35.00	22.92	
Percentage of HH with voluntary BPJS (BPJS Sukarela/JKN)				
Plus KIS	0.38	0.39	0.78	0.68
Plus BPJS-PBI	0.38	-	0	0
Plus both KIS and BPJS-PBI	0.13	-	0	0
Only voluntary BPJS	4.15	7.84	4.88	5.41
None	94.97	91.76	94.34	93.92
Percentage of HH who have voluntary BPJS and used it in last one year				
40.00	23.81	13	55.56	
Average number of HH members who own:				
KIS	3.20	3.09	3.00	2.88
BPJS-PBI	2.44	2.85	3.60	2.67
Voluntary BPJS	2.33	2.43	2.31	2.22

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

3.3 LAND USE

Variations in the size of total land for tobacco, non-tobacco cultivation, and owned by current tobacco and former tobacco farmers were considerable. We present the analysis of land ownership and land use in Table 9. We ask in the survey land ownership and cultivation in the last 12 months. Therefore, the statistics below include land cultivated in both wet and dry season. In general, farmers in East Java owned and cultivated larger land sizes than farmers in Central Java. For example, in the second wave of the TFS, median farmer in Bojonegoro cultivated 0.28 hectare of tobacco crop and 1.21 hectares of non-tobacco crops. On the other hand, the median farmer in Magelang cultivated only 0.13 hectare of tobacco crop and 0.38 hectares of non-tobacco crops. We also take note that in general, total land owned, under cultivation, and tobacco cultivation increased in the second wave of the TFS.

Table 9. Median total land owned (hectares), under cultivation and tobacco cultivation by region, current and former tobacco farmers.

Table 9

Median total land owned (hectares), under cultivation and tobacco cultivation by region, current and former tobacco farmers

Wave 1 ¹	Current			Former	
	Tobacco	Cultivated	Owned	Cultivated	Owned
Bojonegoro	0.16	0.60	0.25	0.52	0.25
Jember	0.20	0.53	0.13	0.18	0.19
Lumajang	0.23	0.54	0.19	0.60	0.20
Magelang	0.06	0.20	0.10	0.08	0.05
Temanggung	0.35	0.78	0.30	0.01	0.18
Wave 2	Tobacco	Cultivated	Owned	Cultivated	Owned
Bojonegoro	0.28	1.21	0.40	0.98	0.30
Jember	0.30	1.05	0.25	0.12	0.11
Lumajang	0.17	0.48	0.11	0.50	0.25
Magelang	0.13	0.38	0.18	0.34	0.18
Temanggung	0.25	0.63	0.39	0.14	0.19

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

Variations in the size of land dedicated for tobacco farming across time periods can be explained by crop rotation practice. In the FGD, current tobacco farmers mentioned that they rested the land for a year after the land was used for tobacco farming. They used the land for other crops particularly paddy. Participants suggested that the yield would not be as expected if they do not practice crop rotation.

“switch” the usage of land. If we plant tobacco on this land in 2016, we plant tobacco on the other land in 2017. Each land should have rest for at least one year or one season”

(Current tobacco farmer, FGD in Lumajang)

acco, and then chilli or rice, and then rice again or corn for the second planting season. The cycle tobacco farming is around around six to 10 months. After tobacco season ended, we plant rice or chilli or corn and then tobacco all over again. I usually plant on the different piece of land.”

(Current tobacco farmer, FGD in Lumajang)

Most farmers owned their land and a non-negligible share of farmers rented parcels of land for their farming endeavor. Table 10 presents legal entitlement of land to both tobacco and former tobacco farmers. We use parcel as the main unit of analysis as farmers might have owned more than one parcel of land. The most common legal entitlement to land is ownership (70.8%) followed by rental (18.7%). We note that the share of tobacco farmers who owned land and the share of former tobacco farmers are quite similar.

Table 10 Legal entitlement to land – current and former tobacco farmers, by parcel.

Table 10
Legal entitlement to land –
current and former tobacco
farmers, by parcel

Ownership	Wave 1 ¹			Wave 2		
	Current	Former	Total	Current	Former	Total
Granted by local leader	0.65	0.60	0.64	0.36	0.99	0.47
Owned	65.04	73.56	66.75	71.23	68.98	70.83
Rented	22.26	15.51	20.91	18.79	18.48	18.74
Tenant (no rent)	11.30	9.94	11.03	3.08	5.61	3.54
Other	0.75	0.40	0.68	6.53	5.94	6.42
Total	2,008	503	2,511	1,394	303	1,697

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

SECTION 4

THE ECONOMICS OF TOBACCO GROWING

4.1 CHARACTERISTICS OF TOBACCO FARMING: CONTRACTS, PRODUCTION, AND PRICES

Tobacco farmers in Indonesia grow several different kinds of tobacco leaf. Virginia leaf is still the most common type grown by tobacco farmers in Indonesia, representing about 70% of the total grown. We present the main types of tobacco leaf farming enterprise by regions in Table 11. Virginia leaf is preferred by tobacco farmers because they believe that it will earn generally higher prices relative to Burley or Oriental leaves. Farmers also plant a handful of other tobacco type such as Gobel, Gober, Pelus, Soker Jumbo, and Tembakau 68, all of which are domestic tobacco leaves.

Table 11 Type of tobacco farming enterprise by region .

Table 11
Type of tobacco farming enterprise by region

District	Wave 1 ¹			Wave 2			
	Virginia	Burley	Oriental	Virginia	Burley	Oriental	Other
Bojonegoro	316	0	72	431	0	34	36
Jember	483	18	1	557	27	2	8
Lumajang	62	96	0	35	91	0	62
Magelang	154	0	0	11	0	8	163
Temanggung	313	0	0	183	0	4	86
Total	1,326	114	73	1,217	118	48	355

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

In all regions, most tobacco farmers were independent farmers (84%) and the remaining farmers had a formal or informal contract of some form with tobacco leaf buyers. We present the analysis on the distribution of contract and independent tobacco farmers by region in Table 12. In Indonesia, it is not uncommon for farmers to have a formal or informal contract with crop buyers or middlemen. These buyers often provide farmers with physical inputs or even cash credits. Farmers do need to pay up-front for these services. However, farmers must sell their harvest to these buyers, and the costs of these services will be deducted from crop sales.

Table 12. Distribution of contract and independent tobacco farmers by region.

Table 12
Distribution of contract and independent tobacco farmers by region

District	Wave 1 ¹					Wave 2				
	Contract	%	Ind.	%	Total	Contract	%	Ind.	%	Total
Bojonegoro	51	36.69	189	28.81	240	26	30.95	107	25.00	133
Jember	31	22.30	209	31.86	240	20	23.81	118	27.57	138
Lumajang	49	35.25	26	3.96	75	31	36.90	52	12.15	83
Magelang	1	0.72	119	18.14	120	1	1.19	79	18.46	80
Temanggung	7	5.04	113	17.23	120	6	7.14	72	16.82	78
Total	139	100	656	100	795	84	100	428	100	512

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

We analyze farming characteristics and outcomes that are correlated with decisions to enter into a contract with a leaf buyer using logistic regression. The dependent variable is a binary variable that is equal to 1 if tobacco farmers entered into a contract and 0 otherwise. We draw from existing literature that examines tobacco contract farming to obtain a set of independent variables (Chavez et al. 2016; Goma et al. 2017; Makoka et al. 2017). The independent variables include household demographics, household farming choices, household economic outcomes, district fixed effects, and a time fixed effect. We report average marginal effects of the logistic regressions for Wave 1, Wave 2, and both Wave 1 and 2 in Table 13.

We find that more experienced farmers are associated with a lower likelihood of entering tobacco-growing contracts. We also find that farmers with higher profit per area are also associated with a lower likelihood of entering tobacco-growing contracts. This result may suggest that tobacco farmers with contracts experienced lower profit, perhaps due to lower tobacco prices and/or sales. We also find that farmers with a larger land size and farmers with a higher share of land dedicated to tobacco farming are associated with a higher likelihood of entering into a contract. before the survey and the PAR (0.14) provides the total out-of-pocket health expenditure for outpatient care attributable to secondhand smoke exposure at BDT 0.6 billion..

Table 13 Logistic Regression of the decision to enter into a tobacco-growing contract: average marginal effects.

Variables	A: Wave 1	B: Wave 2	C: Wave 1 & 2
HH total asset, in log	0.00522 (0.00453)	-0.00416 (0.00551)	-0.000444 (0.00503)
HH labor hours, log	0.0167 (0.0150)	-0.0236* (0.0130)	-0.00553 (0.0103)
Head of HH age	0.0145 (0.0110)	-0.0111 (0.00929)	0.00713 (0.00759)
Head of HH age, squared	-0.000130 (0.000111)	0.000127 (0.0000929)	-0.0000556 (0.0000768)
HH size	-0.00264 (0.00960)	0.00381 (0.0114)	0.000952 (0.00759)
HH years of schooling	0.00822** (0.00374)	0.00329 (0.00510)	0.00649** (0.00303)
HH farming experience	-0.00648*** (0.00117)	-0.00838*** (0.00145)	-0.00700*** (0.000930)
HH profit per area in million, PPP	-0.303 (0.341)	0.00117*** (0.000298)	0.000986*** (0.000241)
Agricultural wage, log	-0.0000662 (0.000962)	-0.00190 (0.00138)	-0.000554 (0.000823)
Non-agricultural wage, log	-0.00124 (0.000964)	-0.000139 (0.00160)	-0.00136 (0.000854)
Farming sales, log	0.00386** (0.00167)	0.000748 (0.00308)	0.00269* (0.00151)
Non-farming sales, log	0.000209 (0.000823)	-0.00322*** (0.00113)	-0.000757 (0.000677)
Total cultivated land, in log	0.0195*** (0.00612)	0.0690*** (0.0135)	0.0290** (0.00589)
Land share, tobacco	0.00157*** (0.000520)	0.00193** (0.000748)	0.00156*** (0.000426)
1 if owned at least one parcel	0.0735*** (0.0269)	0.113** (0.0505)	0.0765*** (0.0237)
1 if seriously consider switching	-0.0109 (0.0576)	0.162** (0.0699)	0.0445 (0.0465)
1 if Temanggung	0.151 (0.111)	0.184 (0.125)	0.167** (0.0840)
1 if Lumajang	0.521*** (0.103)	0.517*** (0.120)	0.521*** (0.0774)
1 if Jember	0.229** (0.103)	0.248** (0.122)	0.238*** (0.0783)
1 if Bojonegoro	0.328*** (0.0998)	0.273** (0.121)	0.318*** (0.0761)
1 if Wave 2			0.000888 (0.0216)
Observations	795	437	1232

Note: *The sample in the first wave excludes households from West Nusa Tenggara. The signs *, **, and *** indicate significance at 10, 5, and 1%, respectively. The omitted district is Magelang. Robust standard errors are in parentheses.

Table 13

Logistic Regression of the decision to enter into a tobacco-growing contract: average marginal effects

Tobacco volume of leaf sold, prices, and sales varied across regions, but they increased quite significantly in the second wave of the TFS. We report median tobacco volume of leaf sold, prices, and sales by region in Table 14. The median volume of tobacco leaf sold in the second wave of the TFS is double the volume sold in the first wave of the survey. The median tobacco price increased in general by about 20 percent, but the magnitudes of the increase vary by region. For example, the tobacco price in Jember and Temanggung almost doubled. The combination of higher volumes of tobacco leaf sold and prices resulted in higher revenues for farmers. Median sales increased from Rp1.075 million to Rp1.923 million or about 78 percent. Higher sales owing to higher production and higher prices are the main explanations of the higher income of tobacco households in the second wave of the TFS.

■ Table 14 Median tobacco volume of leaf sold, prices, and sales by region.

Table 14

Median tobacco volume of leaf sold, prices, and sales by region

Region	Volume sold (kg)		Price per kg (IDR)		Sales (1,000 IDR)	
	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
Bojonegoro	179	455	6,000	6,730	400	673
Jember	200	550	15,000	31,730	1,535	4,183
Lumajang	240	298	25,000	28,846	2,337	4,038
Magelang	290	340	3,000	4,615	700	600
Temanggung	270	280	35,000	67,307	1,590	2,826
Total	204	400	20,000	24,038	1,075	1,923

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The prices and sales in second wave are adjusted for inflation.

The volume of tobacco leaf sold and prices also varied by tobacco leaf type. We report results from analyses of volume of tobacco leaf sold, prices, and income by leaf type in Table 15. Across all leaf types, median volume of tobacco leaf sold in the second wave of the TFS is double or more the production in the first wave of the TFS. The highest increase in volume of leaf sold was occurred among farmers who grew burley (230 percent). Owing to an increase in volume of leaf sold alone, sales of burley leaf in the second wave of the TFS were higher by 200%. The highest increase in price accrued to farmers who grew Virginia leaf as increases in price reached 50%. Notably, the median tobacco prices across leaf types are quite similar in the second wave of the TFS.

■ Table 15 Median volume of tobacco leaf sold, price, and income by leaf type.

Table 15

Median volume of tobacco leaf sold, price, and income by leaf type

Type	Volume sold (kg)		Price per kg (USD PPP)		Sales (USD PPP)	
	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
Virginia	233	499	16,000	24,038	1,000	1,923
Burley	210	695	25,000	25,000	1,807	5,488
Oriental	120	260	25,000	25,961	2,000	4,230
Total	200	400	20,000	24,038	1,075	1,923

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The prices and sales in the second wave are adjusted for inflation.

Tobacco price varied not only by leaf type but also by grade. We report median tobacco prices by grade and by leaf type from the first and second wave of the TFS in Table 16. In the second wave of the TFS, the highest tobacco price was grade D oriental leaf (Rp40,865/kg) and the lowest tobacco price was grade C Virginia leaf (Rp19,230/kg). Tobacco price by leaf and grade increased in general with grade A burley as a notable exception. We note that tobacco farmers do not have control over prices or much (if any) power to negotiate leaf quality because prices are typically determined by the middleman buyers (Drope, Li, et al. 2018).

We also note that the issue of grading is wildly complicated and difficult both for those grading to explain and for farmers to understand. Neither party in the FGDs was able to provide a reasonable explanation of this process. The inconsistency of grading and lack of a rational explanation of how it is implemented suggest that this process is used as a strategy by the buyers to extract more favorable terms of sale (i.e., lower prices overall) from the sellers (i.e., the smallholder farmers). The monopsony or oligopsony of this market strongly privilege the buyer's position.

Table 16 Median tobacco price by grade and leaf type.

"Even though we protested, there would not be any resolutions. If we brought the tobacco back home, there was no one else to buy. There is only one buyer here. If it is corn, the price is cheap, we can bring it back home and sell it in other place. But, we can't do that with the tobacco because there is only one place to sell it."

(Former tobacco farmer, FGD in Lumajang)

Table 16
Median tobacco price by grade and leaf type

Grade	Virginia		Burley		Oriental	
	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
A	18,000	25,961	32,500	27,884	23,000	28,846
B	15,000	22,115	25,000	29,615	28,000	36,057
C	10,000	19,230	20,500	20,192	23,000	25,961
D	20,000	28,846	18,000	-	27,000	40,865
Total	16,000	24,038	25,000	25,000	25,000	25,961

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The prices and sales in the second wave are adjusted for inflation.

*Note also that farmers reported growing local tobacco leaf varieties in addition to the three in this table, but generally at a volume too low for meaningful reporting.

Table 17
Deviation of rainfall from long-term average (in mm), 1988-2017

Year/District	Jember and Lumajang	Bojonegoro	Temanggung and Magelang
1988	27.50	-28.36	9.64
1989	74.94	3.72	34.24
1990	7.54	-36.40	-14.46
1991	-29.58	-54.30	-50.62
1992	61.68	-0.80	37.62
1993	-11.42	-42.74	-11.44
1994	-32.96	-53.76	-31.98
1995	-8.46	-27.22	-2.28
1996	-11.54	-32.04	-11.90
1997	-4.10	-38.56	-22.88
1998	36.26	4.82	35.10
1999	23.88	-24.48	16.50
2000	60.62	-4.40	12.52
2001	59.48	-2.08	17.54
2002	-23.66	-54.26	-25.80
2003	-17.56	-44.36	-13.40
2004	-30.18	-45.54	-7.00
2005	89.78	-8.20	20.40
2006	-25.68	-45.78	-6.98
2007	-0.78	-32.98	0.76
2008	30.68	-29.50	8.70
2009	-0.94	-31.82	1.32
2010	150.88	39.50	64.22
2011	-22.52	-43.56	-9.68
2012	12.40	-34.04	-10.34
2013	20.00	-8.08	31.32
2014	13.10	-13.92	2.12
2015	-25.84	-51.72	-27.62
2016	120.54	68.26	61.60
2017	31.94	-30.60	19.94
Average	19.20	-23.44	4.24

Source: Calculated from NOAA data (www.noaa.gov).

One of the main explanations of this finding is the relatively desirable weather conditions. Tobacco quality is quite dependent on dryer conditions particularly during pre-harvest period (Syahid Muttaqin et al. 2019). The dry conditions can be proxied by the average rainfall in a given area in a given year. In the year of the first TFS wave, the average rainfall was significantly higher than the long-term average. For example, in Jember and Lumajang, the average deviation of rainfall was 120.54mm in 2016. In Bojonegoro, the average deviation of rainfall was 68.26 mm in the same year. In contrast, the average rainfall in the year of the second wave of the TFS was relatively close to the long-term average. In Bojonegoro, the average rainfall was even lower than the long-term average by 30.60mm.

Table 17 Deviation of rainfall from long-term average (in mm), 1988-2017.

Most tobacco farmers sold their tobacco to individual middlemen, and only a small share of farmers sold their tobacco directly to a cigarette company. Table 18 presents the types of tobacco leaf buyers by region. Tobacco farmers relied quite heavily on middlemen to buy their tobacco. For example, in the district of Bojonegoro, about 80% of tobacco farmers sold their tobacco to individual middlemen, while only about 10% of tobacco farmers in Bojonegoro sold their tobacco to a cigarette company or a company warehouse. This pattern also holds in other tobacco-growing regions. Tobacco farmers relied on middlemen because middlemen provide needed services such as access to credit and physical inputs for tobacco farming.

■ Table 18 Type of tobacco leaf buyers by region.

Table 18
Type of tobacco leaf buyers by region

Wave 1 ¹	Individual Middlemen/collector	Other Farmers	Contract Representative	Company Collector	Cigarette Company Warehouse	Cigarette Company	Other	Total
Bojonegoro	309	13	5	25	36	-	-	388
Jember	389	15	1	30	58	7	2	502
Lumajang	10	2	17	76	39	14	-	158
Magelang	118	11	-	3	21	1	-	154
Temanggung	217	21	17	5	32	21	-	313
Wave 2	Individual Middlemen/collector	Other Farmers	Contract Representative	Company Collector	Cigarette Company Warehouse	Cigarette Company	Other	Total
Bojonegoro	399	43	-	3	53	2	-	501
Jember	479	14	27	15	59	-	-	594
Lumajang	45	19	3	113	-	2	6	188
Magelang	154	23	-	-	3	-	2	182
Temanggung	234	13	4	10	6	6	-	273

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

4.2. COSTS OF TOBACCO FARMING

Tobacco farming is input (non-labor)-intensive, requiring significant amounts of fertilizers, pesticides, firewood, and rental of equipment. In Table 19, we present the shares of farmers who used different input items for tobacco farming and the average cost for each item. In general, average costs borne by tobacco farmers for each item did not significantly change across the two waves, with an exception for the increase of costs for firewood (curing of Virginia leaf requires significant amounts of firewood).

Almost all tobacco farmers used inorganic (mineral/commercial) fertilizers for tobacco farming and about half used both inorganic and organic fertilizers. The result of the FGD suggest that farmers mainly used subsidized fertilizers such as ponska, urea, ZA, and SP36. In the second wave of the TFS, they spent about Rp2.2 millions for fertilizers for tobacco farming in the dry season. Accounting for the size of the land for tobacco farming, current tobacco farmers spent about Rp507.47/m² for non-organic fertilizer and Rp588.95/m² for organic fertilizer. Tobacco farmers also spent a considerable amount for firewood and rental of equipment or livestock for ploughing the land.

■ Table 19 Main inputs for tobacco farming and average cost (current dry season).

Table 19
Main inputs for tobacco farming and average cost (current dry season)

Input	Wave 1 ¹		Wave 2	
	Proportion of Farmers Who Used the Item (%)	Average costs (1,000 IDR)	Proportion of Farmers Who Used the Item (%)	Average costs (USD PPP)
Fertilizer, non-organic	97.99	1,000	97.85	1,009
Fertilizer	45.91	1,408	49.22	1,209
Pesticides (chemicals)	80.00	274	90.04	218
Gasoline for clove farming equipment	38.49	307	22.85	337
Oil	13.58	256	15.23	61
Firewood/fuel wood	4.65	556	8.59	930
Bamboo, bamboo sticks, rice hay, descuke-ride	46.79	-	54.10	.
Knapsack Sprayer	82.01	-	92.38	.
Drums	22.77	-	30.66	.
Sprinkler	68.30	-	78.91	.
Rental of equipment/livestock	37.74	609	43.95	546
Transportation (to market)	47.67	-	78.52	222
Water pump	22.01	-	25.78	.
Mattock, sickle	99.62	-	99.41	.
Others	10.44	682	12.30	1,208

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave of the survey are adjusted for inflation.

It is important to note that input costs borne by tobacco farmers for tobacco farming were significantly larger than input costs for non-tobacco farming. We present tobacco farmers' inputs for non-tobacco crops in Table 19. On average, tobacco farmers spent Rp939,000 of non-organic and organic fertilizers for non-tobacco farming, less than half of the total costs of fertilizers for tobacco farming. However, after taking into account the size of land for non-tobacco crops, current tobacco farmers are spending almost the same amount of fertilizer in the dry season. Current tobacco farmers spent Rp706.35/m² of non-organic fertilizer and Rp639.03/m² of fertilizer for non-tobacco crops in the dry season.

In the wet season, tobacco farmers exclusively plant non-tobacco crops. During this season, fertilizers costs for non-tobacco farming in the wet season was about Rp2.2 million, about the same costs for tobacco farming. However, the costs of fertilizer per-squared meter of land were relatively lower for non-tobacco farming in the wet season. Current tobacco farmers spent Rp368.16/m² of non-organic fertilizer and Rp298.89/m² for non-tobacco farming in the wet season. The per-squared-meter differences in fertilizer costs for tobacco farming and non-tobacco farming in the wet season were statistically significant. Additionally, tobacco farmers spent more on tobacco farming for pesticides, firewood, transportation to market, and other costs. The per-squared-meter difference in overall non-labor costs for tobacco farming and non-tobacco farming was statistically significant (diff. Rp236.58/m², p-value<0.05).

Table 20 Tobacco farmers' inputs for cultivating nontobacco /8520crops.

Table 20
Tobacco farmers' inputs for cultivating nontobacco crops

Wave 1 ¹	Dry season		Wet season	
	Proportion of Farmers Who Used the Item (%)	Average costs (1,000 IDR)	Proportion of Farmers Who Used the Item (%)	Average costs (1,000 IDR)
Fertilizer non-organic	89.94	435	98.13	875
Fertilizer	41.87	276	61.28	642
Pesticides (chemicals)	60.54	216	83.44	391
Gasoline for clove farming equipment	31.02	159	35.65	326
Oil	8.13	45	10.15	78
Firewood/fuel wood	0.30	.	0.80	147
Bamboo, bamboo sticks, rice hay, descuke-ride	11.45	.	15.35	.
Knapsack Sprayer	63.55	.	85.71	.
Drums	19.28	.	14.55	.
Sprinkler	52.71	.	26.57	.
Rental of equipment/livestock	31.93	384	50.87	540
Transportation (to market)	32.83	.	40.99	.
Water pump	21.99	.	16.96	.
Mattock, sickle	97.29	.	99.47	.
Others	3.92	719	6.68	996
Wave 2	Proportion of Farmers Who Used the Item (%)	Average costs (USD PPP)	Proportion of Farmers Who Used the Item (%)	Average costs (USD PPP)
Fertilizer non-organic	89.78	533	96.52	1,427
Fertilizer	50.00	406	56.15	722
Pesticides (chemicals)	71.53	196	89.34	323
Gasoline for clove farming equipment	14.96	173	12.09	151
Oil	8.76	41	4.51	51
Firewood/fuel wood	0.00	.	0.41	144
Bamboo, bamboo sticks, rice hay, descuke-ride	16.42	.	20.70	.
Knapsack Sprayer	74.82	.	90.57	.
Drums	21.17	.	13.32	.
Sprinkler	56.93	.	31.56	.
Rental of equipment/livestock	36.50	381	50.41	660
Transportation (to market)	68.25	122	72.75	150
Water pump	22.99	.	14.55	.
Mattock, sickle	95.99	.	98.57	.
Others	8.76	305	10.04	547

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave of the survey are adjusted for inflation.

Former tobacco farmers used fertilizers less (per unit of land) in the second wave of the TFS, and significantly less than the fertilizers used by tobacco farmers. We present results from analysis of former tobacco farmers' input costs in Table 21. In the dry season, former tobacco farmers spent about Rp800,000 for fertilizers, significantly less than Rp2,2 million spent on fertilizers by tobacco farmers. Taking into account the size of the land, former tobacco farmers spent Rp546.93/m² of non-organic fertilizer and Rp289.92/m² if organic fertilizer. The per-squared-meter differences in fertilizers costs between current and former farmers in the dry season were statistically significant. About the same share of former tobacco farmers rent equipment or livestock but they spent less on rentals than tobacco farmers.

Table 21 Former tobacco farmers' main inputs for cultivating nontobacco crops.

Table 21
Former tobacco
farmers' main inputs
for cultivating
nontobacco crops

Wave 1 ¹	Dry season		Wet season	
	Proportion of Farmers Who Used the Item (%)	Average costs (1,000 IDR)	Proportion of Farmers Who Used the Item (%)	Average costs (1,000 IDR)
Fertilizer, non-organic	91.79	915	97.07	930
Fertilizer	53.62	1,120	54.63	705
Pesticides (chemicals)	71.98	634	83.90	411
Gasoline for clove farming equipment	42.51	226	41.46	219
Oil	14.01	62	18.05	70
Firewood/fuel wood	0.48	100	0	.
Bamboo, bamboo sticks, rice hay, descuke-ride	16.43	.	11.22	.
Knapsack Sprayer	76.81	.	87.32	.
Drums	16.43	.	15.61	.
Sprinkler	48.31	.	32.20	.
Rental of equipment/livestock	45.41	524	69.27	618
Transportation (to market)	51.21	.	51.71	.
Water pump	14.98	.	19.02	.
Mattock, sickle	98.55	.	99.02	.
Others	9.18	1,029	5.85	917
Wave 2	Proportion of Farmers Who Used the Item (%)	Average costs (USD PPP)	Proportion of Farmers Who Used the Item (%)	Average costs (USD PPP)
Fertilizer, non-organic	96.00	604	98.45	832
Fertilizer	56.00	195	56.59	314
Pesticides (chemicals)	72.00	194	82.95	213
Gasoline for clove farming equipment	20.00	386	17.05	313
Oil	10.40	37	9.30	43
Firewood/fuel wood	0.80	.	.	.
Bamboo, bamboo sticks, rice hay, descuke-ride	20.00	.	13.18	.
Knapsack Sprayer	75.20	.	85.27	.
Drums	28.80	.	20.93	.
Sprinkler	55.20	364	32.56	513
Rental of equipment/livestock	41.60	122	54.26	128
Transportation (to market)	67.20	.	69.77	.
Water pump	26.40	.	20.16	.
Mattock, sickle	97.60	.	98.45	.
Others	7.20	502	6.98	425

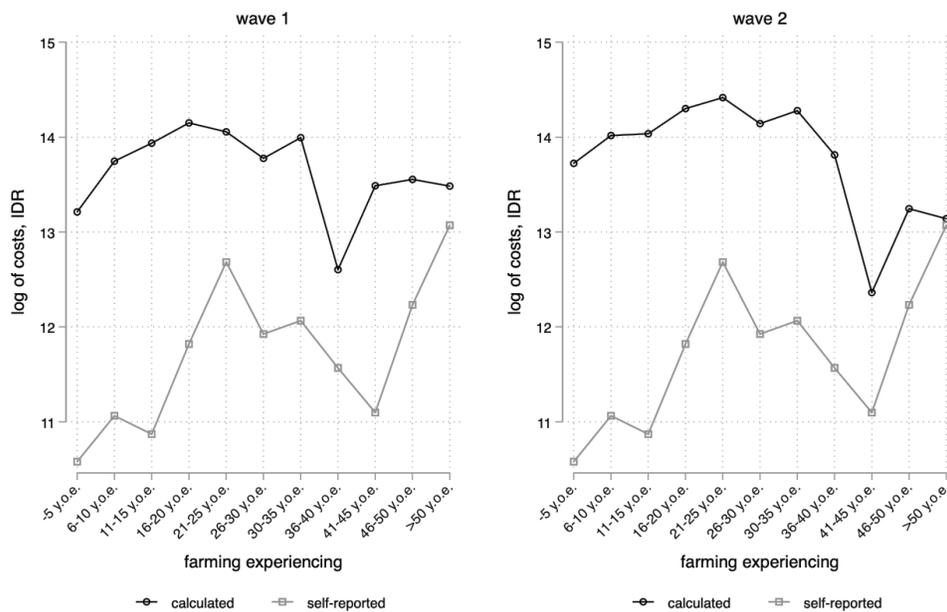
Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave of the survey are adjusted for inflation.

Actual and perceived input costs of farming differ quite significantly among less experienced tobacco farmers. In Figure 4, we depict learning curve of costs estimation among tobacco farmers. We group farmers based on their years of farming experiences in bins of 5 years. In general, farmers' self-reported costs are significantly less than actual costs particularly among less-experienced farmers. The discrepancies between perceived and actual costs were actually lower among more experienced

farmers. The pattern of learning curve for both actual and perceived costs are quite consistent across the two survey waves. This result shows that farmers—particularly those with less experience—made the decision to farm tobacco with significant underestimation of actual costs. the current 6% per capita GDP growth rate.

FIG 4 Learning curve of cost estimation for tobacco farmers

Figure 4
Learning curve of cost estimation for tobacco farmers

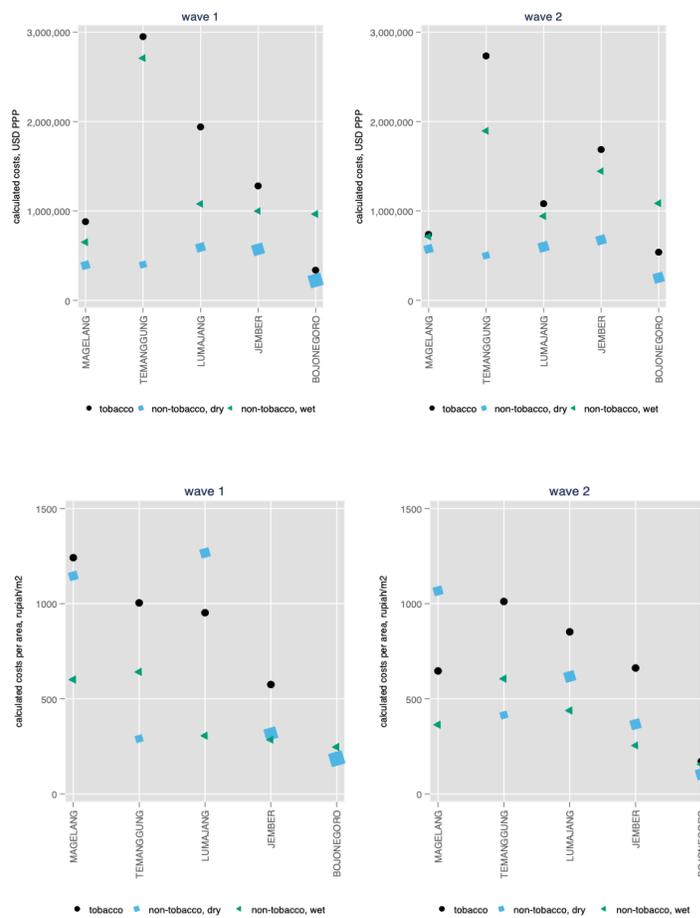


Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave of the survey are adjusted for inflation.

Current tobacco farmers were spending significantly more for agricultural inputs for their tobacco crops than for their non-tobacco crops, as presented in the first row of Figure 5. We also depict input costs per area in the second row of Figure 5. We also find that current tobacco farmers are spending relatively more inputs for their tobacco crops, except in Magelang.

FIG 5. Median input costs for tobacco farmers by region, all seasons.

Figure 5.
Median input costs for tobacco farmers by region, all seasons

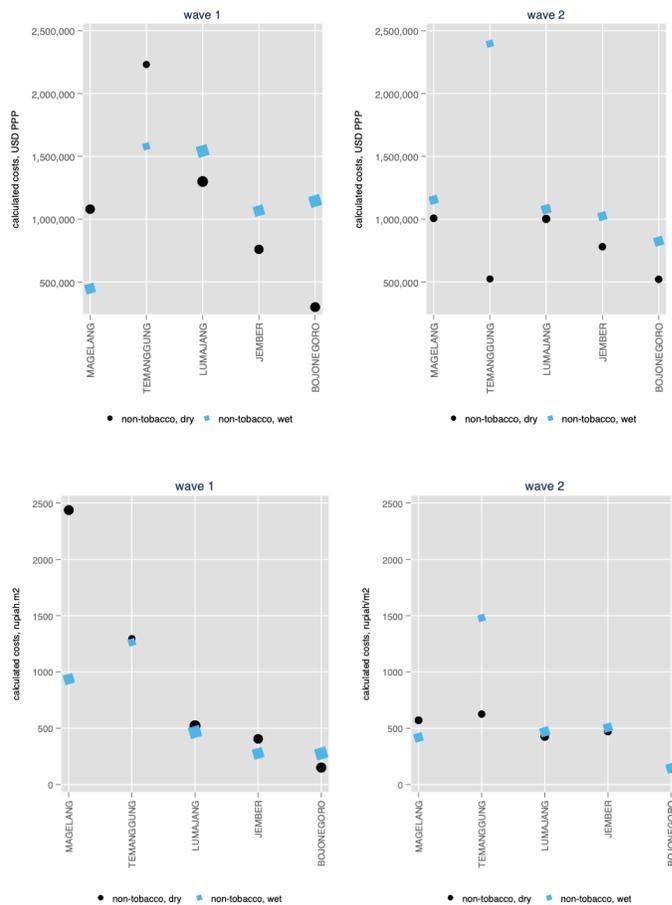


Note: *The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave of the survey are adjusted for inflation.

Note that the difference in inputs for tobacco and non-tobacco farming during the dry season persisted across the two survey waves. Median input costs also varied quite considerably across regions. For example, median tobacco farmers in the district of Temanggung were consistently spending more for inputs than median tobacco farmers in other regions. In Wave 2 of the TFS, median tobacco farmers in Temanggung spent Rp2.734 million for tobacco inputs, while farmers in Jember, Lumajang, and Magelang only spent Rp1.686, Rp1.081, Rp0.737 million, respectively. The result also implies that expenditures for agricultural inputs in the dry season were significantly higher than in the wet season.

■ FIG 6. Median input costs for former tobacco farmers by region, all seasons

Figure 6.
Median input costs for former tobacco farmers by region, all seasons



Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave of the survey are adjusted for inflation.

Former tobacco farmers' input costs also varied across regions, but the costs—particularly in the dry season—were significantly lower than the costs borne by tobacco farmers. For example, former tobacco farmers in Temanggung spent Rp0.524 million in the dry season, while the tobacco farmers spent Rp2.734 million.

Tobacco farming is also highly labour intensive. Members of tobacco farming households significantly spent more hours working in the field than members of non-tobacco households. As shown in Table 22, males age 21-35 years in tobacco households spent 270 hours for tobacco farming, while the counterparts in non-tobacco households spent 112 hours for farming. Middle-aged male in tobacco households spent 300 hours for tobacco farming, while middle-aged male in non-tobacco households spent 225 hours. The difference in hours worked was even starker among females. Middle-aged females in tobacco households spent 225 hours (median) for tobacco farming, while their median non-tobacco counterparts spent only 80 hours in the field.

■ **Table 22 Median hours worked by farming household members by gender, age, and tobacco/nontobacco crops (tobacco/dry season).**

Table 22

Median hours worked by farming household members by gender, age, and tobacco/nontobacco crops (tobacco/dry season)

Wave 1 ¹	Current: tobacco		Current: nontobacco		Former: non-tobacco	
	Male	Female	Male	Female	Male	Female
<15	35	39	3.5	8	-	-
15-20	120	92	100	30	30	3.5
21-35	540	288	180	120	220	78
36-60	640	450	276	144	418	170
>60	612	450	240	60	383	225
All	600	360	240	120	360	145
Wave 2	Current: tobacco		Current: nontobacco		Former: non-tobacco	
	Male	Female	Male	Female	Male	Female
<15	24.5	15	28	9	6.5	12
15-20	48	48	30	8	20	28
21-35	270	120	80	35.5	112	58
36-60	300	225	143	72	225	80
>60	360	192	106	54	172	120
All	240	160	75	60	116	60

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

Tobacco-growing households also hired non-household workers to assist with tobacco farming particularly for land preparation, field tending, and harvest. We present the analysis for days spent for tobacco farming by non-household members in Table 23. We present analysis for days not hours because non-household workers are usually hired by the day. Tobacco households hired adult males and females to help with different tasks such as nursery, land preparation, field tending, harvest, post-harvest, and marketing. For example, tobacco households hired adult males for about 6 days and adult females for 15 days for land preparation. The result also show that children were also hired, particularly for post-harvest tasks.

■ **Table 23 Hired labor for tobacco farming by gender, adult & child – days.**

Table 23

Hired labor for tobacco farming by gender, adult & child – days

Worker Type	Adult		Child	Adult		Child
	Male	Female		Male	Female	
Wave	1 ¹	1 ¹	1 ¹	2	2	2
Nursery	5.71	5.10	-	8.32	5.26	-
Land preparation	7.56	6.39	-	6.21	15.18	-
Field tending	14.00	13.69	-	9.82	7.27	-
Harvest	10.27	12.05	-	7.04	7.85	-
Post-harvest	9.66	9.95	1.60	8.34	7.84	2.40
Marketing	2.21	1.33	-	3.52	4.33	-

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

The results so far show that tobacco households used far more labor than non-tobacco farmers. Moreover, members of tobacco households are rarely paid for their labor. These results suggest that members bear opportunity costs because they could have spent their time for other more profitable economic endeavors.

For example, members of tobacco households could have worked on other tobacco farms or worked as day laborers. We report labor costs for hired and household labor in both tobacco and former tobacco households in Table 24.

Table 24 Median household and hired labor costs (1,000 IDR) for current and former tobacco farmers, by region (dry/tobacco season only).

Table 24

Median household and hired labor costs (1,000 IDR) for current and former tobacco farmers, by region (dry/tobacco season only)

	Current: tobacco						Current: nontobacco					
	Hired			Household			Hired			Household		
Wave	1 ¹	1 ²	2	1 ¹	1 ²	2	1 ¹	1 ²	2	1 ¹	1 ²	2
Bojonegoro	800	520	673	4,042	4,042	2,019	300	300	298	2,516	2,515	660
Jember	1,970	1,848	1,901	4,851	5,390	1,683	700	750	596	1,078	1,078	349
Lumajang	1,797	1,735	2,004	6,468	6,738	1,594	665	580	836	2,425	3,099	418
Magelang	1,779	2,000	1,384	5,146	5,956	1,669	4,295	8,400	4,153	2,431	2,431	628
Temanggung	4,060	2,340	2,500	6,554	6,807	3,491	700	712	745	4,538	4,254	1,889
Total	1,770	1,560	1,466	4,923	5,390	1,963	555	570	586	2,156	2,425	621
Former: nontobacco												
	Hired			Household								
Wave	1 ¹	1 ²	2	1 ¹	1 ²	2						
Bojonegoro	600	700	375	2,066	2,785	967						
Jember	1,925	1,550	692	2,785	3,396	621						
Lumajang	990	990	1,240	4,042	3,485	967						
Magelang	1,200	1,200	1,442	3,160	2,755	794						
Temanggung	2,870	2,727	937	3,606	7,658	1,246						
Total	1,012	1,000	769	3,234	3,234	855						

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara. The costs in the second wave are adjusted for inflation

The costs for hired and household labor are significantly higher among tobacco than among non-tobacco farmers. As shown in Table 24, the differences in costs spent for hired and household labor were quite consistent across the two survey periods. For example, in Wave 2 of the TFS, median tobacco households spent Rp1.466 million for hired labor and household labor was valued at Rp1.963 million.

On the other hand, median former non-tobacco households spent only Rp0.769 million for hired labor while household labour was valued at Rp0.855 million. There are also variations in household labor costs among tobacco farmers across regions. For example, median farmers in Temanggung had Rp3.491 million in household labor costs, while median farmers in Lumajang had Rp1.669 million.

4.3. PROFITS

Economic profits from tobacco and non-tobacco farming were higher in the second wave of the survey for both tobacco and former tobacco farmers. In the first wave of the TFS, the median tobacco farmer lost Rp25.423 million. However, the median tobacco farmer generated profits of about Rp6.279 million in the second wave. In the previous section, we explored several factors that help to explain the significant increase in profits. First, tobacco production was significantly higher in the second wave of the TFS. Second, prices of tobacco were also higher for each type and grade.

Although tobacco farmers made profits in the second wave of the TFS— which tobacco farmers in the FGDs generally considered a strong year for tobacco farming — the profits were lower than losses during the bad year. The median former tobacco farmer experienced a loss in both waves of the TFS, but the loss was less in the second wave of the TFS.

■ **Table 25 Tobacco (dry) season — median profits per hectare (1,000 rupiah) — former and current tobacco farmers**

■ **Table 25 A. Tobacco (dry) season — average profits per hectare (1,000 rupiah) — former and current tobacco farmers .**

Table 25

Tobacco (dry) season — median profits per hectare (1,000 rupiah) — former and current tobacco farmers

Wave 1 ¹	Tobacco farming		Non-tobacco farming	
	Real	Perceived	Real	Perceived
Current	-25,423	-679	-8,767	5,284
Former	.	.	-7,824	3,515
Wave 2	Tobacco farming		Non-tobacco farming	
	Real	Perceived	Real	Perceived
Current	6,279	16,533	967	5,291
Former	.	.	-577	4,841

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara. Real tobacco profit is tobacco sales minus tobacco farming non-household labor input costs and tobacco farming household labor costs, while perceived tobacco profit is tobacco sales less tobacco farming input costs. Per-hectare profit is profit divided by total cultivated land for tobacco farming in the dry season. Profits in the second wave are adjusted for inflation.

Table 25a.

Tobacco (dry) season — average profits per hectare (1,000 rupiah) — former and current tobacco farmers

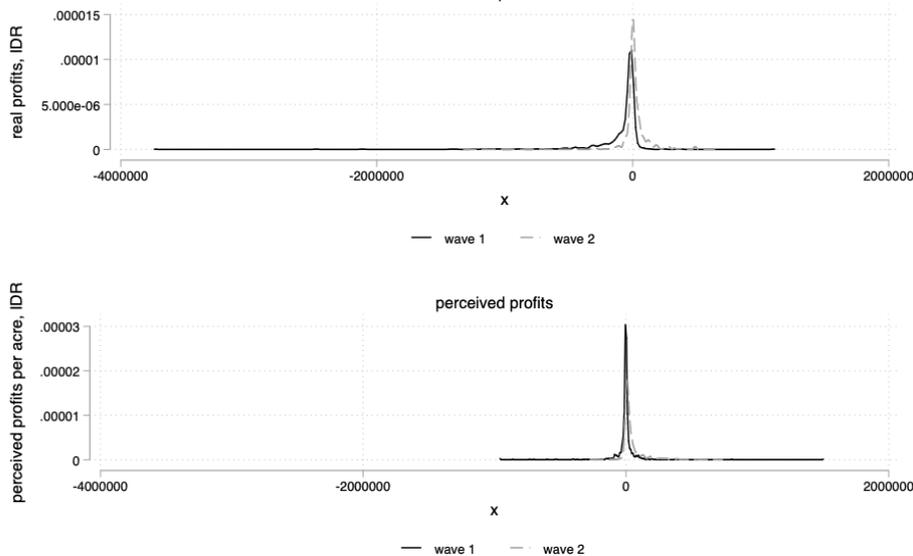
Wave 1 ¹	Tobacco farming		Non-tobacco farming	
	Real	Perceived	Real	Perceived
Current	-25,832	-500	-11,428	26,199
Former	.	.	5,526	26,919
Wave 2	Tobacco farming		Non-tobacco farming	
	Real	Perceived	Real	Perceived
Current	22,632	42,298	27	18,288
Former	.	.	7,107	13,559

Note: ¹The sample in the first wave exclude households in West Nusa Tenggara. Real tobacco profit is tobacco sales minus tobacco farming non-household labor input costs and tobacco farming household labor costs, while perceived tobacco profit is tobacco sales less tobacco farming non-household labor input costs. Per-hectare profit is profit divided by total cultivated land for tobacco farming in the dry season. Profits in the second wave are adjusted for inflation. For the calculation of statistics in each row of current tobacco farmers, we eliminate observations with real tobacco income below the first percentile and above the 99th percentile. For the calculation of statistics in each row of former tobacco farmers, we eliminate observations with real non-tobacco income below the first percentile and above the 99th percentile.

The difference in the distributions of real profits between the first and second wave was quite stark. We present distributions of real and perceived profits for the first and second waves of the TFS in Figure 7. In the first wave of the TFS, there were many tobacco farmers who had significant losses. In the second wave, the number of farmers who had significant losses decreased. It is quite interesting to observe that the second-wave distribution of the perceived profits is tighter. This suggests that tobacco farmers were more confident of making profits in the second wave of the TFS

FIG 7. Distribution of profit per hectare of tobacco farming (IDR).

Figure 7
Distribution of profit per hectare of tobacco farming (IDR)



Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. Real tobacco profit is tobacco sales minus tobacco farming non-household labor input costs and tobacco farming household labor costs, while perceived tobacco profit is tobacco sales less tobacco farming non-labor input costs. Real non-tobacco profit is non-tobacco sales minus non-tobacco farming input costs and non-tobacco farming household labor costs, while perceived tobacco profit is non-tobacco sales less non-tobacco farming input costs. Per-hectare profit is profit divided by total cultivated land for tobacco farming in the dry season. Profits in the second wave are adjusted for inflation.

Median real profits from tobacco and non-tobacco farming varied across regions and were higher in the second wave of the TFS. As shown in Table 26, the median real profit among tobacco farmers in Jember was Rp31.224 million. On the other hand, the median farmer in Bojonegoro made little profit, and the median farmer in Magelang experienced a loss of Rp8.866 million. Non-tobacco farmers in Jember and Lumajang

also made relatively large profits in the second wave of the TFS. Conversely, non-tobacco farmers in Magelang and Temanggung experienced losses. We note a negative association between real profits and labor costs, particularly household labor costs.

■ **Table 26. Median profit (1,000 IDR) per hectare for current tobacco farmers by region (tobacco/dry season).**

Table 26

Median profit (1,000 IDR) per hectare for current tobacco farmers by region (tobacco/dry season) farmers

	Tobacco: real profit			Tobacco: Perceived profit		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-22,792	-20,893	460	-472	-410	8,321
Jember	-22,749	-22,544	31,224	-467	-500	43,178
Lumajang	-25,371	-23,065	20,114	1,250	3,220	31,051
Magelang	-72,608	-73,388	-8,866	-2,976	-5,000	18,789
Temanggung	-22,425	-21,956	7,476	-679	-658	4,642
Total	-25,423	-23,636	6,279	-679	-520	16,533
	Non-tobacco: real profit			Non-tobacco: perceived profit		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-8,092	-11,338	97	6,000	6,151	3,507
Jember	-4,743	-5,554	6,055	2,920	1,333	11,007
Lumajang	-7,337	-17,544	5,511	5,660	9,729	6,573
Magelang	-43,247	-21,419	-8,559	11,944	1,900	2,311
Temanggung	-28,492	-21,222	-3,136	6,403	6,827	9,651
Total	-8,767	-11,164	967	5,284	4,985	5,291

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. Real tobacco profit is tobacco sales minus tobacco farming non-household labor input costs and tobacco farming household labor costs, while perceived tobacco profit is tobacco sales less tobacco farming non-household labor input costs. Real non-tobacco profit is non-tobacco sales minus non-tobacco farming input costs and non-tobacco farming household labor costs, perceived non-tobacco profit is non-tobacco sales less non-tobacco farming input costs. Per-hectare tobacco profit is profit divided by total cultivated land for tobacco farming in the dry season. Per-hectare non-tobacco profit is profit divided by total cultivated land for non-tobacco farming in the dry season. Profits in the second wave are adjusted for inflation.

Contract farmers generally fared better in profitability compared with independent farmers in the second wave of the TFS. As shown in Table 27, median contract and independent tobacco farmers made profits with few exceptions. For example, contract farmers in Lumajang and Jember obtained profits of Rp13.710 and Rp14.116 million, respectively. Independent farmers in Jember and Lumajang also obtained sizeable profits of Rp28.990 and Rp17.005 million, respectively.

Table 27 Median profits per hectare (1,000 IDR) — independent and contract tobacco farmers, by region (tobacco/dry season)

Table 27

Median profits per hectare (1,000 IDR) — independent and contract tobacco farmers, by region (tobacco/dry season)

	Contract: real profit (tobacco + non-tobacco)			Contract: Perceived profit (tobacco + non-tobacco)		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-12,611	-11,699	8,813	4,953	4,460	13,207
Jember	-11,841	-10,862	14,116	-3,636	-4,393	17,771
Lumajang	-23,879	-23,831	13,710	995	2,759	20,816
Magelang	-73,388	-73,388	-23,308	56,277	56,277	713
Temanggung	-25,241	-16,831	13,072	-19,764	-4,675	16,867
Total	-16,847	-14,251	10,258	896	1,830	17,030
	Independent: real profit (tobacco + non-tobacco)			Independent: perceived profit (tobacco + non-tobacco)		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-20,875	-20,875	-280	1,125	1,160	6,145
Jember	-21,927	-24,285	28,990	1,405	2,982	36,854
Lumajang	-21,928	-19,860	17,005	7,966	9,801	33,597
Magelang	-75,555	-77,166	-6,645	-2,105	-3,007	6,300
Temanggung	-21,956	-21,612	6,056	20	99	18,637
Total	-24,817	-24,419	4,522	211	809	14,718

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara. Real profit is real tobacco plus real non-tobacco farming profits, while perceived profit is perceived tobacco and non-tobacco farming profits. Per-hectare profit is profit divided by total cultivated land for tobacco and non-tobacco farming in the dry season. Profits in the second wave are adjusted for inflation.

We also calculate median profits per kilogram of tobacco for another measure of profitability because many tobacco farmers cultivated small plots of land. Thus, because so many farmers cultivate considerably less than a hectare, median profits per hectare may not be a meaningful metric. In addition, we also calculated median profits per kilogram of non-tobacco crops for comparability. We present the results of profit analyses by region in Table 28.

Consistent with the finding using median profit per hectare, tobacco farmers made higher profits in the second wave of the TFS except farmers in Magelang. For example, the median tobacco farmer in Jember earned Rp15.578 thousand per kilogram, while the median tobacco farmer in Lumajang earned Rp9.548 thousand per kilogram. Except for Magelang and Temanggung, the median tobacco farmers also made profits per kilogram of non-tobacco crops.

Table 28 Current tobacco farmer median profits per kilogram (IDR rupiah) by region .

Table 28

Current tobacco farmer median profits per kilogram (IDR rupiah) by region

	Tobacco: real profit			Tobacco: Perceived profit		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-18,742	-18,691	239	593	352	2,568
Jember	-23,378	-25,730	15,758	1,199	3,026	21,438
Lumajang	-23,940	-25,007	9,548	2,681	4,552	16,753
Magelang	-11,342	-10,990	-2,511	-284	-334	1,011
Temanggung	-10,545	-11,381	1,694	69	253	7,065
Total	-17,921	-19,235	2,139	343	483	8,857
	Non-tobacco: real profit			Non-tobacco: Perceived profit		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-9,449	-11,554	31	2,733	2,670	2,419
Jember	-2,257	-2,277	199	655	661	785
Lumajang	-2,703	-2,751	481	763	782	600
Magelang	-4,682	-7,698	-1,487	666	468	480
Temanggung	-15,087	-8,532	-1,070	4,000	1,618	3,012
Total	-5,354	-6,364	70	1,220	1,077	1,364

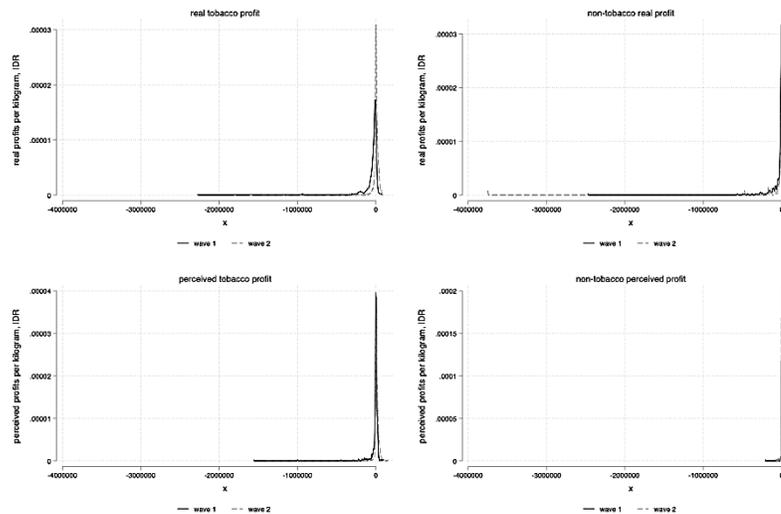
Note: ¹The sample in the first wave exclude households in West Nusa Tenggara. Per-kilogram tobacco profit is profit divided by total tobacco yield, while per-kilogram non-tobacco profit is profit divided by total non-tobacco yield. Profits in the second wave are adjusted for inflation.

The variations in perceived and real profits per kilogram for current tobacco farmers were quite wide. We depict the distribution of real and perceived profits per kilogram for tobacco and non-tobacco crops in both survey waves in Figure 8. We can observe that real profits were distributed with a relatively high variation.

FIG 8. Distribution of profits per kilogram for current tobacco farmers

Figure 8

Distribution of profits per kilogram for current tobacco farmers



Note: The sample is restricted to households who were observed in both survey waves. Per-kilogram tobacco profit is profit divided by total tobacco yield, while per-kilogram non-tobacco profit is profit divided by total non-tobacco yield. Profits in the second wave are adjusted for inflation.

Realized profits of former tobacco farmers were higher in the second wave of the TFS. We present results from the analysis of realized and perceived profits by regions in Table 29. It should be noted that prices by weight of non-tobacco crops vary tremendously because variations in the types of non-tobacco crops planted across farmers. For example, some farmers planted and harvested garlic which has little moisture, while other farmers and planted tomatoes, which are heavy with water.

In all regions except Temanggung, median profits per kilogram were significantly higher. For example, median profit per kilogram in Lumajang increased from a loss of Rp 1,363 to a profit of Rp 170¹.

Table 29. Former tobacco farmer median profits per kilogram (IDR) by Region (tobacco/dry season)

Table 29

Former tobacco farmer median profits per kilogram (IDR) by Region (tobacco/dry season)

	Non-tobacco: real profit			Non-tobacco: Perceived profit		
	Wave 1 ¹	Wave 1 ²	Wave 2	Wave 1 ¹	Wave 1 ²	Wave 2
Bojonegoro	-7,932	-6,573	-1,497	1,651	1,812	894
Jember	-724	-141	2	665	915	999
Lumajang	-1,363	-1,999	170	341	329	947
Magelang	-1,751	-4,718	151	2,532	1,468	2,342
Temanggung	707	-829	-1,128	3,790	3,480	1,252
Total	-1,991	-2,180	-351	852	915	998

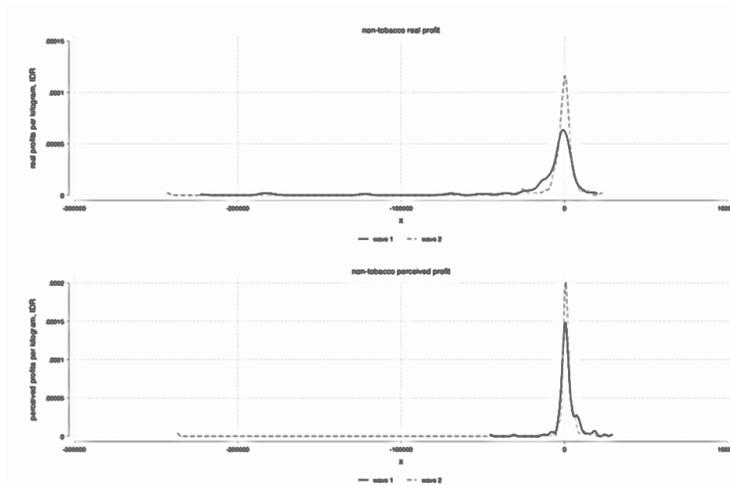
Note: ¹The sample in the first wave excludes households in West Nusa Tenggara. ²The sample is restricted to households who were observed in both survey waves. Per-kilogram non-tobacco profit is profit divided by total non-tobacco yield. Profits in the second wave are adjusted for inflation.

The distribution of realized profits per kilogram for former tobacco farmers is relatively similar to the distribution of realized profits per kilogram for current tobacco farmers. In Figure 9, we present the distribution of real and perceived profits per kilogram for former tobacco farmers. In the second wave of the TFS, we find a tighter distribution of realized and perceived profits around 0.

FIG 9. Distribution of profits per kilogram for former tobacco farmers

Figure 9

Distribution of profits per kilogram for former tobacco farmers tobacco farmers



Note: ¹The sample in the first wave excludes households in West Nusa Tenggara. Per-kilogram non-tobacco profit is profit divided by total non-tobacco yield. Profits in the second wave are adjusted for inflation.

We analyze factors that predict farmers' income using multivariate regression model. We use the regression specification in Sahadewo et al. (2019)

$$income_{it} = \beta_0 + \beta_1 tobacco_{it} + \gamma X_{it} + \gamma_s + a_i + u_{it}, \quad (1)$$

where i indicates household, s indicates district, t indicates time, $income$ indicates total household income per acre of farming land and $tobacco$ indicates the share of a household's land for tobacco farming. The vector X includes household characteristics such as log of total cultivation area, log of labor hours, log of assets, log of agriculture wage, log of non-agriculture wage, an indicator of whether farmers enter a contract, and demographics. The district dummies, γ , capture unobserved district characteristics that may be correlated with income. We also include time fixed effects in regression using both waves of the TFS. We report the result of the estimation in Table 30.

We find that a larger land allocation for tobacco is negatively associated with lower farmers' income. The estimated effect is larger in the first wave of the TFS, which is consistent with our descriptive findings. We also find that total cultivated land and household labor hours are also negatively correlated with farmer's income. One of the main explanations is that larger land size requires more agricultural and labor inputs, and the marginal costs of an additional unit of land exceeds its marginal revenue.

Lastly, we find that non-agricultural wage is positively correlated with farmers' income. Households who allocated time for more profitable non-agricultural economic endeavors can obtain higher income. The results suggest strongly that farmers can rely on other alternative livelihoods.

Table 30 Predicting farmers' income.

Table 30

Predicting farmers' income

	A:OLS, Wave 1	B:OLS, Wave 2	C: OLS, all	D: RE, all	E:FE, all
Share of land for tobacco, %	-116.0*** (43.47)	-95.24* (51.16)	-99.99*** (35.40)	-98.78*** (35.25)	-35.45 (60.29)
HH total asset, in log	541.0*** (190.9)	384.4*** (143.9)	404.7*** (125.5)	405.7*** (124.6)	500.6** (198.3)
total cultivated land, in log	-578.2 (646.5)	-5829.6*** (1180.2)	-2584.8*** (597.3)	-2590.6*** (594.1)	-2825.3*** (715.6)
agricultural wage, log	-179.9** (78.53)	-10.25 (70.86)	-100.3* (52.30)	-100.7* (52.08)	-95.14 (76.40)
non-agricultural wage, log	264.0*** (70.19)	157.3** (73.40)	225.4*** (51.46)	225.9*** (51.29)	250.8*** (82.80)
HH labor hours, log	-976.5** (489.3)	-384.3 (398.1)	-758.8** (337.9)	-759.0** (339.9)	-755.7 (479.2)
head of HH age	64.35 (79.88)	-153.8 (97.19)	-39.56 (67.89)	-39.96 (67.83)	-129.9 (213.4)
HH size	504.9 (633.5)	1148.7 (728.3)	740.7 (517.0)	740.2 (519.2)	845.6 (4027.2)
HH years of schooling	477.9** (234.8)	-265.0 (324.8)	96.80 (206.0)	92.96 (206.3)	-632.3 (569.9)
1 if contract farmer	-1893.8 (2058.8)	-449.2 (2418.7)	-1434.6 (1713.8)	-1438.7 (1701.5)	-1573.0 (2708.1)
1 if Temanggung	1333.2 (3384.2)	8063.3** (3709.3)	4459.6 (2823.0)	4454.5 (2825.0)	
1 if Lumajang	2782.6 (3623.4)	6184.4* (3474.3)	4493.0 (2833.2)	4515.7 (2833.2)	
1 if Jember	482.2 (3499.4)	9020.5*** (3318.8)	4346.8* (2539.5)	4363.0* (2538.9)	
1 if Bojonegoro	-634.5 (3055.4)	133.2 (2643.7)	-1495.8 (2261.5)	-1475.6 (2262.4)	
Observations	561	561	1122	1122	1122
Adj. R-sq	0.0806	0.196	0.127	-	0.114
F-stats	4.232	5.338	7.528	-	6.638
Controls	Y	Y	Y	Y	Y
Time F.E.	-	-	Y	Y	Y
Robust S.E.	Robust	Robust	Cluster-Rob.	Cluster-Rob.	Cluster-Rob.

Note: The signs *, **, and *** indicate significance at 10, 5, and 1%, respectively. We conduct a robust Hausman test to test the null hypothesis that the difference in FE and RE coefficients are not systematic. We apply the cluster-robust bootstrap procedure and 200 bootstrap repetitions in the calculation of the robust Hausman test. The Chi-squared test statistics for the robust Hausman test is 6.34 with a p-value of 0.8981.

4.4. CREDIT AND DEBT

A large proportion of tobacco farmers reported that they needed loans for tobacco farming, particularly for purchase of inputs and for land rental. We report the results from analysis of reasons for needing loans in Table 31. About 36 percent of tobacco farmers reported that they needed loans either for inputs (29 percent) or land rental (7 percent). A non-negligible share of tobacco farmers also needed loans for non-tobacco farming. In contrast, only about 23 percent of former tobacco farmers that needed loans for non-tobacco farming. Notably, we find that a reasonable proportion of former tobacco farmers (17 percent) needed loans for investing in business, more than the share of tobacco farmers who needed loans for investing in business. Reasonable explanations include that tobacco households' resources are spent for tobacco farming endeavors and/or tobacco farmers do not have time for other economic endeavors and therefore have less need for that investment capital.

Table 31 Reasons reported for needing loans

Table 31

Reasons farmers reported for needing loans

	Current Wave 1		Current Wave 2		Former Wave 1		Former Wave 2	
	N	Percent	N	Percent	N	Percent	N	Percent
Inputs for tobacco farming	230	35.99	137	29.59	10	6.45	3	2.75
Land for tobacco farming	31	4.85	33	7.13	3	1.94	8	7.34
Inputs for farming other crops	115	18.00	59	12.74	37	23.87	22	20.18
Land for farming other crops	12	1.88	6	1.3	4	2.58	3	2.75
Schooling	37	5.79	29	6.26	10	6.45	8	7.34
Purchasing house	7	1.10	11	2.38	5	3.23	1	0.92
Purchasing vehicle	7	1.10	9	1.94	3	1.94	3	2.75
Investing in business	33	5.16	31	6.7	22	14.19	19	17.43
Special occasions	27	4.23	27	5.83	14	9.03	12	11.01
Meeting daily needs	108	16.90	80	17.28	39	25.16	20	18.35
Health expenses	20	3.13	12	2.59	7	4.52	4	3.67
Other	12	1.88	29	6.26	1	0.65	6	5.5
Total	639	100	463	100	155	100	109	100

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

4.5. OTHER CROP GROWING

Both tobacco and former tobacco farmers grew a wide variety of non-tobacco crops during the dry and wet seasons. We analyze the types of non-tobacco crops grown to be sold by tobacco and former tobacco farmers and present the results in Table 32. We can observe that crop choices exhibit seasonal pattern. In the dry season, current and tobacco farmers dedicated a significant share of their land for corn, chili, and other vegetables. For example, on average, former tobacco farmers dedicated 39.01 percent of their lands for corn and 23.63 percent of their lands for chili. Crop choices differ in the wet season. While both current and former farmers still dedicated non-negligible shares of their lands for corn and chili, almost half of their lands was dedicated for paddy (rice). On average, former tobacco farmers dedicated 45.45 percent of their lands for paddy farming, while current tobacco farmers dedicated 40.43 percent of their lands for the same crop.

Table 32 Proportion of a crop grown to sell.

Table 32

Proportion of a crop grown to sell

Wave 1 ¹	Dry Season		Wet Season	
	Current	Former	Current	Former
Cassava	5.45	3.67	2.46	3.7
Potato	0.64	0.82		
Ground nut	1.92	1.63	0.86	1.85
Cashew or other nuts	7.05	4.08	6.89	5.09
Soybean	1.6	2.04	1.23	0.46
Corn	31.09	29.39	15.62	12.96
Chili	37.5	22.45	17.47	10.65
Shallot	1.6	0.41	2.95	0.46
Banana	4.17	0.41		
Green vegetables	4.49	7.76	0.12	
Other vegetables	0.32	8.57	5.9	4.17
Clove	3.53	13.88	3.2	5.09
Paddy	0.64	4.9	43.17	53.7
Other fruits	5.45	3.67	0.12	1.85
Wave 2	Dry Season		Wet Season	
	Current	Former	Current	Former
Cassava	2.77	3.85	1.49	2.60
Potato	0.00	0.00	0.00	0.00
Ground nut	2.15	2.20	1.65	1.30
Cashew or other nuts	7.08	2.75	3.63	6.49
Soybean	0.92	1.10	0.33	0.00
Corn	28.00	39.01	15.02	21.43
Chili	33.54	23.63	18.81	8.44
Shallot	0.62	1.10	2.31	0.65
Coconut	0.31	0.00	0.17	0.00
Banana	0.31	1.10	0.17	0.00
Green vegetables	4.92	3.30	4.79	0.00
Other vegetables	11.08	9.34	10.23	3.90
Clove	0.00	0.00	0.17	0.00
Paddy	6.77	9.89	40.43	45.45
Other fruits	1.54	2.75	0.83	1.30

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

The Former tobacco farmers had more variety of non-tobacco crops in their farming portfolio, but former tobacco farmers particularly did better in terms of sales than tobacco farmers in corn, chili, and other vegetables. We compare extra sales from each non-tobacco crops between former and current tobacco farmers and present the comparison in Table 33. A positive sign indicates that former tobacco farmers had higher sales than current tobacco farmers, and a negative sign would be the opposite. There is variety in average extra sales of non-tobacco crops across regions. Former tobacco farmers in all regions obtained higher sales from chili in both survey waves. In Magelang and Temanggung, former tobacco farmers can generate higher sales by about Rp16.7 and Rp11.25 millions, respectively, in the wet season. In Magelang, Lumajang, and Jember, former tobacco farmers also saw higher sales from corn. In Lumajang, former farmers generated significantly higher sales from other fruits both in the dry and wet seasons. In one of the FGDs, we asked former farmers income from non-tobacco crops relative to income from tobacco. One of the respondents mentioned:

“The income from watermelon is much higher than from tobacco. Watermelon is more than 50 %. It is because tobacco can be harvested in 5 months, while watermelon can be harvested only in 55 days.”

(Former tobacco farmer, FGD in Lumajang)

Another respondent mentioned that after papaya plants are cultivated they bear fruit for several years or more with little maintenance:

“Papaya is better than tobacco. Papaya can be harvested up to 3 years, while tobacco is only once in 5 months.”

(Former tobacco farmer, FGD in Lumajang)

“It is better papaya than tobacco because papaya can be planted for 3 years and the treatment is easier.”

(Former tobacco farmer, FGD in Lumajang)

We also note that current tobacco farmers generated higher sales in rice, both in the dry and wet season. This result suggests that rice is another cash crop that current tobacco farmers rely on.

Table 33

Average extra sales (IDR) generated by former tobacco farmers (compared with current farmers)

Dry season	Magelang	Temanggung	Lumajang	Jember	Bojonegoro
1.cassava	-20,000	-25,000	-600,000	2,715,000	-621,500
3.ground nut		-1,000,000	990,000	105,000	-81,250
4.cashew nut or other nut		-880,000	-2,250,000		335,000
5.soybean				-4,805,000	-800,000
6.corn	1,426,250	700,000	1,030,000	-700,000	-210,000
7.chili	2,150,000	11,207,500	925,000	400,000	-65,000
8.shallot	3,710,000	-2,984,000	-600,000		
10.banana	-100,000			600,000	45,000
11.green vegetables	5,875,000	-150,000	-2,000,000	-560,000	-222,500
12.other vegetables	1,906,250	-530,000	-1,780,000	5,368,000	140,000
13.clove					
14.rice		500,000	-2,945,500	-10,325,000	
15.other fruits		225,000	4,512,500		-5,000,000
Wet season	Magelang	Temanggung	Lumajang	Jember	Bojonegoro
1.cassava	380,000	-240,000	-1,500,000		431,250
3.ground nut	-272,500	-3,080,000	-4,700,000		-935,000
4.cashew nut or other nut	-150,000	-270,000	-3,000,000		-18,000
5.soybean					-1,650,000
6.corn	317,500	-900,000	1,225,000	528,750	-1,315,000
7.chili	16,700,000	11,250,000	3,000,000	2,800,000	
8.shallot	-1,950,000	-4,160,000	-900,000		-45,000,000
10.banana	-100,000				
11.green vegetables	1,935,000	-21,000	-500,000	-1,040,000	80,000
12.other vegetables	3,110,000	-1,000,000	1,800,000	-147,000	-175,000
13.clove		-3,000,000			
14.rice		-4,000,000	-2,487,500	-5,036,750	-1,750,000
15.other fruits		-45,000	75,000,000	-150,000	

Note: *The sample in the first wave excludes households from West Nusa Tenggara.

Most tobacco farmers in both waves indicated a desire to shift away from tobacco farming. The most common reasons included low price and unpredictable weather. We present the reasons given by tobacco farmers who seriously considering shifting from tobacco in Table 34. In Wave 2, almost half of tobacco farmers considered switching because they received low prices for their tobacco. It is notable that a significant share of tobacco households complained about low prices in the second wave of the TFS during which prices were actually higher than the first.

Table 34 Reasons given by tobacco farmers for switching from tobacco.

"Because of the price. The grading system of tobacco has been very poor. The price fell down. Because the good quality tobacco was considered as not good quality."

(Former tobacco farmer, FGD in Lumajang)

A significant share of farmers considered shifting away from tobacco owing to bad or unpredictable weather, particularly high rainfall during tobacco season. Despite the dry season during the second wave of the TFS being not "wet," many tobacco farmers still considered shifting owing to bad or unpredictable weather. In one of the FGDs, we asked participants whether they planted more or less tobacco in 2016. Participants answered:

Another participant said:

"it was raining a lot at the time so we just planted rice, chilly, green beans, cucumber, and eggplant."

(Current tobacco farmer, FGD in Lumajang)

Another interesting case on why farmers switched from tobacco farming is the combination of unfair grading and monopsony (a single buyer in the marketplace). In one of the FGDs, former farmers mentioned that only some of the tobacco passed the grading process and the rest were considered poor. The former farmers mentioned that there is only one buyer in the area so tobacco with poor grade cannot be sold.

*"...We brought 20 packs, but only 10 [of the highest graded] of them passed...
They said that the rest was poor."*

(Former tobacco farmer, FGD in Lumajang)

"Even though we protested [about the grading], there would not be any resolutions. If we brought the tobacco back home, there was no one else to buy."

(Former tobacco farmer, FGD in Lumajang)

Table 34

Reasons given by tobacco farmers for switching from tobacco

	Wave 1 ¹		Wave 2	
	N	percent	N	percent
Low price	70	27.45	64	46.38
Unfair grading	5	1.96	10	7.25
Inability to sell crop	25	9.80	24	17.39
More attractive alternatives	28	10.98	27	19.57
Effect on land	22	8.63	2	1.45
Relationship with contracting company	2	0.78	5	3.62
Extension services	-	-	-	-
Other	128	50.20	75	54.35

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

We also used logistic regression to examine farmers' willingness to shift away from tobacco. Several variables, including a higher share of land dedicated for tobacco farming, are associated with a lower likelihood of willingness to switch to alternative crops. We analyze factors that predict current tobacco farmers' willingness to switch to alternative crops. We use the following specification:

$$P(\text{willing}_{it}) = \beta_0 + \beta_1 \text{tobacco}_{it} + \gamma X_{it} + \gamma_5 + a_i + u_{it}, \quad (2)$$

where **tobacco** indicates the share of a household's land for tobacco farming. As in specification (1), the vector **X** includes household characteristics such as log of total cultivation area, log of labor hours, log of assets, log of agriculture wage, log of non-agriculture wage, an indicator of whether farmers enter a contract, demographics, district dummies, and time dummies. We report the average marginal effects in Table 35.

We find that farming households with higher assets are associated with a higher likelihood of stating their willingness to shift to alternative crops. Farmers with higher assets may have greater flexibility in choosing crops to plant. We also find that farmers who dedicated a larger share of land for tobacco farming are associated with a lower willingness to switch to alternative crops. The statistically significant finding is primarily driven by Wave 1 data. We also find that farmers who owned at least one parcel of land are associated with lower willingness to switch. One explanation for this finding is that farmers with a large share of land for tobacco farming may have invested heavily for tobacco farming.

Table 35 Logistic regression analysis of willingness to shift to alternative crops: average marginal effects.

Table 35

Logistic regression analysis of willingness to shift to alternative crops: average marginal effects

	A: Wave 1	B: Wave 2	C: Waves 1 & 2
HH total asset, in log	0.00413 (0.00363)	0.00956 (0.00957)	0.00503* (0.00298)
HH labor hours, log	-0.0125 (0.0152)	0.00506 (0.0140)	0.00111 (0.00987)
Head of HH age	-0.00746 (0.00489)	0.0143 (0.0110)	-0.000397 (0.00504)
Head of HH age, squared	0.0000721 (0.0000471)	-0.000140 (0.000103)	0.00000348 (0.0000489)
HH size	0.00735 (0.00863)	0.00952 (0.0106)	0.00814 (0.00671)
HH years of schooling	0.00293 (0.00364)	0.00613 (0.00511)	0.00432 (0.00298)
HH farming experience	0.00127 (0.00102)	0.00188 (0.00139)	0.00132 (0.000850)
HH profit per area, PPP	1.12e-08 (0.000000477)	-0.000000116 (0.000000753)	0.000000118 (0.000000362)
Agricultural wage, log	-0.000630 (0.000900)	0.000292 (0.00139)	-0.000386 (0.000749)
Non-agricultural wage, log	0.00138 (0.00103)	0.00122 (0.00150)	0.00137 (0.000860)
Farming sales, log	-0.000730 (0.00192)	-0.000662 (0.00232)	-0.000193 (0.00147)
Non-farming sales, log	0.000621 (0.000785)	0.000239 (0.00107)	0.000477 (0.000645)
Total cultivated land, in log	-0.00427 (0.00784)	-0.0136 (0.0214)	-0.00746 (0.00781)
Land share, tobacco	-0.00160*** (0.000470)	-0.000660 (0.000696)	-0.00132*** (0.000396)
1 if contract	0.0403 (0.0312)	-0.0726 (0.0532)	0.00475 (0.0261)
1 if owned at least one parcel	-0.0471* (0.0253)	-0.0447 (0.0414)	-0.0487** (0.0220)
1 if Temanggung	0.0118 (0.0510)	0.0570 (0.0488)	0.0378 (0.0351)
1 if Lumajang	0.0434 (0.0527)	0.00343 (0.0659)	0.0224 (0.0413)
1 if Jember	0.0756* (0.0455)	-0.0203 (0.0580)	0.0348 (0.0348)
1 if Bojonegoro	0.0530 (0.0445)	-0.0436 (0.0553)	0.0179 (0.0329)
1 if Wave 2			0.0142 (0.0209)
Observations	770	428	1198
Time F.E.	Y	Y	Y
Standard Errors	Robust	Robust	Robust

Note: The signs *, **, and *** indicate significance at 10, 5, and 1%, respectively. Robust standard errors are in parentheses.

4.6. WHY FARMERS CONTINUE TO GROW TOBACCO

The logical corollary to the variables that shape farmers' willingness to shift away from tobacco is farmers' motivations to continue cultivating it. The results suggest that the main factors that induce farmers to continue growing tobacco are: perceived profitability of tobacco farming, being accustomed to growing tobacco, relatively suitable weather, and existence of markets to sell their product. In the TFS, we asked farmers to respond "yes" or "no" to factors that have been identified in the literature as reasons to grow tobacco (Chavez et al. 2016; Goma et al. 2017; Magati et al. 2016; Makoka et al. 2017; Drope, Li, et al. 2018; Appau, Drope, Witoelar, et al. 2019; Appau, Drope, Goma, et al. 2019). Note that farmers may identify several factors that affect their decisions to keep growing tobacco. We present the results of the analysis in Table 36. In general, perceived profitability of tobacco farming is the main reason to keep growing tobacco and the responses were quite consistent across survey waves. The existence of market for harvested tobacco was consistently being mentioned as another main factor. However, in wave 2, a higher share of farmers noted that suitable weather was one of the important factors for growing tobacco. In an in-depth interview with a head of farmer group, we asked the respondent's main considerations for growing tobacco. The respondent answered:

"First, I consider the weather. And the second, is the capital"

(Head of farmer group, in-depth interview in Magelang)

When asked whether price is one of the main considerations and the respondent answered: .

"No. The price depends on the season actually. Good weather will result in good tobacco, thus good price."

(Head of farmer group, in-depth interview in Magelang)

This finding is likely best explained by the dry season with relatively low rainfall, which was highly suitable for tobacco farming. The second-wave response to weather is quite different from the first-wave response because the farmers faced a relatively "wet" dry season. Contrary to expectation, demand-side factors such as influence by tobacco companies or incentives for tobacco farmers were not considered as important factors that affected decisions to continue growing tobacco.

■ **Table 36** Current tobacco farmers' stated reasons for growing tobacco.

Table 36
Current tobacco farmers'
stated reasons for growing
tobacco

Reasons	Wave 1 ¹	Wave 2
It was a highly lucrative enterprise	73.08	77.73
I am used to growing tobacco	28.43	74.02
Weather	26.04	65.43
Existence of ready market	46.54	60.74
Availability of land	39.87	59.18
It was the only viable cash crop	56.73	33.98
Influenced by other tobacco producers or companies	3.14	3.13
Good incentives from the tobacco companies	1.01	2.93
To repay outstanding debts to the tobacco companies	1.01	0.78

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

SECTION 5

CHILD LABOR IN
TOBACCO FARMING

Across most LMICs with large tobacco growing sectors, there is evidence of children working in tobacco fields. As we did in first wave of the TFS, we continue to find evidence of child labor in tobacco farming in the second wave of the TFS. Moreover, it is still more common to observe child labor in tobacco farming than in non-tobacco farming. In Table 37, we report the total number cases where children—both hired and household member—helped in tasks related to tobacco and non-tobacco cultivation. We find that child involvement in tobacco farming activities decreased in the second wave of the TFS, but child involvement in post-harvest activities increased. Consistent with the first wave findings, there were cases of children working during school hours in tobacco and non-tobacco farming. However, the number cases of children working during school hours for tobacco farming was higher than for children working for non-tobacco farming.

We note that the number of cases of child labor—in both tobacco and non-tobacco farming—in the second wave is lower than the numbers in the first-wave report. This is driven by the high incidence of child labor in West Nusa Tenggara, which we omitted in the analysis of the second wave of the TFS.

Table 37 Child agricultural labor

Table 37

Child agricultural labor cases

Household Labor	Tobacco		Non-tobacco	
	Wave 1	Wave 2	Wave 1	Wave 2
Nursery	4	2	0	1
Preparation	2	1	0	0
Tending	4	5	0	5
Harvest	2	3	2	6
Post-harvest	8	13	0	10
Selling and marketing	0	0	1	1
Working during school hours	4	6	1	1
	Tobacco		Non-tobacco	
Hired	Wave 1	Wave 2	Wave 1	Wave 2
Nursery	0	0	0	0
Preparation	0	0	0	0
Tending	0	0	0	0
Harvest	0	0	0	0
Post-harvest	12	35	0	0
Selling and marketing	0	0	0	0

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

SECTION 6

WELL-BEING

6.1. ASSEST ACCUMLATION

Former farmers have significantly higher assets than current tobacco farmers, consistent with findings in the first wave report. It is important to analyze assets of farming households because assets may reflect household income and general well-being. We report the proportion of farmers having a particular asset, and the median value of different assets in Table 38. The most common assets that farmers have are vehicles and mobile phones—both important in supporting their farming activities—and the most valuable assets are vehicles and large livestock. We note that the median value of vehicles owned by former tobacco farmers was more than twice the median value of vehicles owned by current tobacco farmers.

Table 38 Household and agricultural assets — former vs current tobacco farmers (percentage and current value)

Table 38

Household and agricultural assets — former vs current tobacco farmers (percentage and current value)

	Current				Former			
	Wave 1	Current value	Wave 2	Current value	Wave 1	Current value	Wave 2	Current value
	ownership		ownership		ownership		ownership	
TV	91.70	300,000	91.41	300,000	93.33	300,000	89.19	300,000
DVD/VCD player/home theater/radio	43.14	100,000	39.65	75,000	38.43	100,000	38.51	100,000
Satelite Disc	6.54	300,000	7.42	450,000	10.98	325,000	12.84	400,000
Electric oven/microwave	2.14	100,000	2.15	50,000	1.57	75,000	2.03	25,000
Refrigerator	31.19	575,000	33.01	600,000	40.00	500,000	40.54	550,000
LPG tank - 3kg or more	84.91	100,000	87.70	100,000	89.02	100,000	87.84	100,000
Washing machine	5.28	600,000	6.84	600,000	5.49	650,000	5.41	600,000
AC	1.26	100,000	0.39	275,000	0.78	510,000	2.03	50,000
Telephone	0.00	-	0.00	-	0.39	50,000	0.00	-
Handphone	76.73	150,000	83.40	300,000	78.82	100,000	79.73	200,000
Computer	7.92	1,500,000	9.18	1,500,000	9.02	2,000,000	9.46	1,500,000
Tablet	6.67	400,000	8.20	362,500	8.24	400,000	8.78	300,000
Video camera/camera	1.51	500,000	2.15	600,000	1.57	525,000	0.68	500,000
Water heater	0.50	550,000	0.59	700,000	0.39	100,000	0.00	-
Electric pump	35.60	100,000	35.74	150,000	30.20	100,000	38.51	150,000
Generator	2.39	800,000	2.15	1,000,000	4.71	750,000	4.05	900,000
Vehicle	8.05	30,000,000	9.18	32,000,000	8.24	60,000,000	5.41	85,000,000
Motorcycle	89.94	5,000,000	92.19	6,000,000	89.41	6,000,000	89.86	7,000,000
	Current				Former			
	Wave 1		Wave 2		Wave 1		Wave 2	
Livestocks	ownership	Current tvalue	ownership	Current value	ownership	Current value	ownership	Current value
Large stocks: cow, buffalo, horse	27.92	15,000,000	31.45	17,000,000	30.98	20,000,000	45.95	18,500,000
Small stocks: Goat, sheep, pigs	31.07	2,000,000	26.37	2,000,000	23.53	2,000,000	20.95	2,000,000
Poultry: Chicken, ducks, geese, quail	43.77	200,000	48.24	250,000	34.51	200,000	55.41	250,000
	Current				Former			
	Wave 1		Wave 2		Wave 1		Wave 2	
Agricultural and Farming Goods	ownership	Current value	ownership	Current value	ownership	Current value	ownership	Current value
Wagon	6.54	200,000	8.79	200,000	2.35	200,000	6.76	100,000
Plough	1.01	150,000	1.37	7,000,000	2.35	1,100,000	1.35	2,005,000
Tractor	7.17	8,000,000	7.42	8,000,000	5.10	9,000,000	9.46	8,500,000
Water pump	19.62	1,000,000	22.27	800,000	16.08	700,000	23.65	700,000
Chopper machine	10.82	1,500,000	14.26	1,500,000	4.71	800,000	4.05	750,000
Sprayer	0.00	-	80.66	150,000	0.00	-	67.57	100,000
Hoe	0.00	-	99.61	50,000	0.00	-	98.65	30,000
Sickle	0.00	-	98.44	20,000	0.00	-	97.97	20,000
Other, V1	52.45	50,000	11.52	50,000	51.76	50,000	8.78	20,000
Other, V2	42.77	20,000	1.76	15,000	43.14	20,000	2.03	5,000

Note: The sample is restricted to households who were observed in both survey waves. Current values of assets in the second wave are adjusted for inflation.

6.2. FOOD SECURITY

The share of former farmers who grew their own food was lower in the second wave survey (68.23 percent) than in the first wave (75.68 percent), while the share of tobacco farmers was relatively consistent across time. We report farming household food security in Table 39 by looking at food self-sufficiency and longevity of food supply. We find that the share of former farmers who had more than 12 months of food supply was higher (39.3 percent) than the share of current tobacco farmers (33.6 percent). We also find that the average longevity of food supply is slightly higher among former tobacco farmers (7.28 months) than among current tobacco farmers (7.02 months), though these differences were not statistically significant.

■ [Table 39 Household and agricultural assets — former vs current tobacco farmers \(percentage and current value\).](#)

Table 39

Staple food production by month

	Current		Former	
	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
HH produce their own food, %	72.58	73.83	68.23	75.68
Longevity of food supply in months, average	7.73	7.02	7.40	7.29
Months of food supply, month				
	=<1	3.3	7.9	5.2
	2	3.9	4.5	3.5
	3	10.8	14.6	14.9
	4	15.1	10.8	12.6
	5	3.9	6.3	9.2
	6	9.2	7.7	9.8
	7	3.1	4.2	0.6
	8	6.4	4.5	3.5
	9	1.9	1.6	0.6
	10	2.4	3.2	2.9
	11	0.9	0.8	0.0
	>=12	38.9	33.6	37.4

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

Farmers rely on the market to purchase food if they do not grow their own. We present the analysis of ways nonfood-growing farmers acquire food in Table 40. We find that all farmers—both current and former tobacco farmers—buy their food staples in the market. There is a small share of tobacco and non-tobacco farmers that rely on the rice for the poor program. The statistics are quite consistent across periods.

■ [Table 40 How nonfood-growing farmers acquire food \(percentage\).](#)

Table 40

How nonfood-growing farmers acquire food (percentage)

Manner of getting staple food	Current		Former	
	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
Buy	93.58	91.99	93.33	91.22
Get for free from rice for the poor program	2.39	2.54	3.53	2.7
Work for food	0.38	0.59	0.39	0.68
Beg	0.63	0.59	1.18	-
Others	3.02	4.3	1.57	5.41
Total observations, N	795	512	255	148

Notes: ¹The sample in the first wave excludes households from West Nusa Tenggara.

Most tobacco farmers reported that they did not have sufficient food to feed their households. We present the perceptions of food security in Table 41. In general, the share of farmers who reported always lacking sufficient food decreased in the second wave. However, the share of farmers who reported usually lacking sufficient food increased in the second wave. Taken together, the majority of farmers had difficulty providing sufficient food for their family. An interesting finding is the increase in the share of Magelang and Temanggung farmers who considered switching was higher in the second wave of the TFS. This could be driven by the fact that tobacco farmers in Magelang experienced losses even during a relatively “good” year for tobacco farming.

Table 41 Perceived level of food security of current tobacco farmers.

Table 41

Perceived level of food security of current tobacco farmers

	Magelang		Temanggung		Lumajang		Jember		Bojonegoro	
	Wave 1 ¹	Wave 2								
Rice is the main staple food, %	51.7	41.2	88.3	88.5	100.0	100.0	100.0	100.0	100.0	100.0
Produce own food, %	50.0	65.0	28.3	26.9	89.3	84.3	80.0	76.8	93.3	97.0
Level of food security (mode)	3	3	3	3	3	3	3	3	3	3
Always has sufficient food, %	1.67	5	2.50	10.26	-	-	2.08	2.17	2.50	
Usually has sufficient food, %	10.03	10	9.17	7.69	4	1.20	5.83	7.97	5.42	4.51
Usually lacks sufficient food, %	61.67	76.25	55.83	65.38	58.67	63.86	51.67	58.7	51.25	62.41
Always lacks sufficient food, %	25.83	8.75	32.50	16.67	37.33	34.94	40.42	31.16	40.83	33.08
Number of income source, average	0.96	1.21	0.94	1.10	0.76	0.71	0.62	0.78	1.04	1.01
Serious switching, %	0.83	13.75	2.50	8.97	1.33	2.41	5.00	2.90	4.17	3.01

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara.

The incidence of sickness in the last 30 days among male tobacco farmers aged 21 and above was higher than among their non-tobacco farmers counterpart. We present the share of current and former tobacco farmers who reported sick in the last 30 days in Table 42. We find that the share of respondents who reported sickness in the last 30 days was consistently higher in the second wave of the survey. However, in the second wave of the survey, the share of male tobacco farmers aged 21 and above who reported being sick was higher than their non-tobacco farmer counterparts. An explanation for this finding is that tobacco farmers are exposed to the dangers of green tobacco sickness, which is a form of acute nicotine poisoning (Arcury et al. 2003; Da Mota E Silva et al. 2018).

Table 42 Reported sickness in last 30 days by gender and age

Age group	Current, Male		Current, Female	
	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
<15	23.82	49.3	22.48	46.3
15-20	13.24	33.3	18.46	38.2
21-35	14.72	35.4	13.59	39.0
36-60	26.17	49.3	26.75	50.5
>60	33.53	59.0	37.50	64.3
	Former, Male		Former, Female	
Age group	Wave 1 ¹	Wave 2	Wave 1 ¹	Wave 2
<15	31.25	57.6	17.92	41.0
15-20	15.79	31.6	0.00	30.0
21-35	14.81	32.6	19.33	38.7
36-60	21.43	35.1	27.17	52.1
>60	39.29	56.8	34.15	65.2

Note: ¹The sample in the first wave excludes households from West Nusa Tenggara

The incidence of individuals reporting the main symptoms of green tobacco sickness increased quite significantly in the second wave of the survey. We present the number and share of individuals reporting 1-4 main symptoms in Table 43. In general, the incidence of reporting 1-4 main symptoms was significantly higher in the second wave of the survey. Older tobacco farmers, particularly female, have a higher incidence. For example, in the second wave of the survey, 42.98% of female tobacco farmers aged older than 60 years reported 1-4 main symptoms. In contrast, 32.45% of their male age-counterparts reported 1-4 main symptoms.

Table 43 Individuals reporting 1–4 main symptoms* of green tobacco sickness.

Table 43

Individuals reporting 1–4 main symptoms* of green tobacco sickness

Male	Wave 1	%	Wave 2	%
<21	41	6.55	73	20.54
21-35	29	7.89	53	22.55
36-60	84	10.55	133	27.03
>60	30	13.97	60	32.45
Female	Wave 1	%	Wave 2	%
<21	36	6.11	57	15.98
21-35	40	8.42	74	25.96
36-60	102	13.05	168	32.50
>60	19	11.80	52	42.98

Notes: Symptoms of GTS include weakness, headache, nausea, vomiting, dizziness, abdominal cramps, difficulty, abnormal temperature, pallor, diarrhoea, chills, fluctuations in blood pressure or heart rate, perspiration and salivation.

Given the rich data, we can estimate individual and household-level factors that are correlated with having green tobacco sickness. The dependent variable is a binary variable that is equal to 1 if an individual has at least a symptom of green tobacco sickness and 0 otherwise. The independent variables include an indicator of tobacco farming household, hours spent in tobacco farming activities (logged), costs of pesticides (logged), whether an individual is tasked with applying pesticides, age group, an indicator of gender, an indicator for marriage, and schooling. We also include district dummies to accommodate district-specific unobservable factors and a time fixed effect. We present the average marginal effects derived from logistic regressions in Table 44.

The results of the regression analyses show that individuals in current tobacco farming households are associated with a higher likelihood of having a green tobacco sickness. It is interesting to observe that among those in tobacco farming households, individuals with longer hours in the field are associated with less

likelihood of green tobacco sickness. A likely explanation here is the issue of selection. Individuals without any physical symptom were healthier and were spending more time in the field.

The regression analyses also confirm findings from the descriptive analysis presented in Table 43. First, there is no significant gender difference in the incidence of green tobacco sickness. Second, older individuals, particularly those aged 36 or above, are associated with higher likelihoods of green tobacco sickness. One of the main explanations is that older individuals spent more time in the field for tobacco farming. For example, individuals in the 36-60 age group spent 538 hours while individuals in the 21-35 age group spent 411 hours. Lastly, the incidence of green tobacco sickness is higher in the second wave of the survey.

Table 44 Table Logistic regression of green tobacco sickness determinants: average marginal effects

Table 44

Logistic regression of green tobacco sickness determinants: average marginal effects

	A: Wave 1	B: Wave 2	C: Waves 1 & 2
1 if current farmer	0.313** (0.158)	0.410* (0.239)	0.311** (0.133)
Hour tobacco farming, in log	-0.0199* (0.0103)	-0.0321* (0.0166)	-0.0215** (0.00889)
Costs of pesticides, in log	-0.000436 (0.00149)	0.00644 (0.00396)	0.00163 (0.00167)
Task applying persticide	- -	0.0607 (0.0481)	0.0318 (0.0284)
1 if female	0.0149 (0.0199)	0.0630 (0.0397)	0.0238 (0.0180)
21-35 years	0.0172 (0.0644)	0.104 (0.0877)	0.0691 (0.0425)
36-60 years	0.0584 (0.0622)	0.123 (0.0902)	0.102** (0.0424)
60 years	0.0374 (0.0633)	0.186* (0.101)	0.108** (0.0464)
1 if married	-0.0382 (0.0293)	0.0810 (0.0542)	0.00778 (0.0305)
Years of schooling	-0.00767** (0.00322)	-0.0102 (0.00638)	-0.00917*** (0.00317)
1 if Temanggung	0.0610 (0.0416)	0.0374 (0.0709)	0.0532 (0.0380)
1 if Lumajang	-0.0371 (0.0317)	-0.0827 (0.0684)	-0.0553* (0.0332)
1 if Jember	-0.0431 (0.0287)	-0.0291 (0.0674)	-0.0382 (0.0307)
1 if Bojonegoro	-0.00136 (0.0297)	-0.154** (0.0602)	-0.0549* (0.0289)
1 if Wave 2 TFS			0.149*** (0.0256)
Observations	1215	694	1909

Note: *The sample in the first wave excludes households from West Nusa Tenggara. The signs *, **, and *** indicate significance at 10, 5, and 1%, respectively. The omitted district is Magelang and the omitted age group is below 21. Cluster robust standard errors at the household level are in parentheses.

7. CONCLUSION

The results of the Wave 2 TFS provide comprehensive insights on the dynamics of tobacco farmers' livelihoods in Indonesia. This survey complements the Wave 1 TFS and allows us to establish a two-wave dataset of current and former tobacco farmers. The two-wave dataset allows us to identify the dynamics of current and former tobacco farmers' livelihoods across time periods. Moreover, this survey allows us to better understand why many current tobacco farmers continue to farm tobacco and why some current tobacco farmers wanted to switch away from tobacco farming.

First, the evidence suggests that former and current tobacco farmers generally did much better in the second time period. Former tobacco farmers generated higher income from all of their economic endeavors such as non-tobacco crops, non-farm enterprises, and paid labor. Current tobacco farmers also did better as tobacco farming and non-tobacco farming income were higher in the second time period.

Second, the higher tobacco farming income in the second wave of the TFS was largely driven by higher leaf production and higher prices. The two-wave data indicates that leaf production doubled in the second time period, and that prices were higher by 78.00 percent on average. Higher leaf production and prices ultimately led to increased sales. The main explanation for the better tobacco farming outcomes in the second time period is the desirable weather. The average rainfall in the year of the second wave of TFS was relatively close to the long-term average. In comparison, the average rainfall in the year of the first wave of TFS was significantly higher than the long-term average. The relatively dry conditions of the pre-harvest period led to better tobacco farming productivity and leaf quality (Syahid Muttaqin et al. 2019) because tobacco plants fare better under such weather conditions.

Third, tobacco farmers still relied quite heavily on agricultural income despite better outcomes in the second wave of the TFS. The share of agriculture income in a typical current tobacco farming household was about 65.84 percent. On the other hand, the share of agricultural income in a typical former tobacco farming household was 41.56 percent. More importantly, former tobacco farmers have a better diversification of income. A larger share of former tobacco farmers relied more on enterprise income and paid labor.

Fourth, tobacco farmers were still spending significantly more for agricultural inputs—such as fertilizers, pesticides, firewood, and rental of equipment—for their tobacco crops than for their non-tobacco crops. The difference in inputs for tobacco and non-tobacco farming during the dry season persisted across the two TFS waves.

Fifth, we find that tobacco households allocated far more household labor than non-tobacco farmers. This implies that tobacco farming households had high opportunity costs: tobacco farming households could have spent their time for other and more profitable economic endeavors, which is a dynamic to which we return below.

The results from the two TFS waves do strongly suggest that tobacco farming outcome is highly dependent on an unpredictable external factor: weather. Tobacco farmers basically made a gamble in the beginning of the tobacco growing season. The return at the end of the growing season is dependent on the quality of the leaf, which itself is dependent on the uncertain weather conditions. Price is obviously another notable variable, but the over-supply of leaf globally most years appears to generate a relatively consistent situation of low prices.

The evidence suggests that former tobacco farmers generated more consistent earnings across periods by planting other crops. The important inquiry is, what are strategies that policy makers can develop? First, national and local governments can identify viable alternative crops by analyzing the soil conditions, weather patterns, existing supply chain, market availability in neighboring areas, and general demand of the crops. Second, governments must then provide agricultural extension services to promote non-tobacco crops tailor made to local contexts. Such service may include technical aspects of growing variety of non-tobacco crops depending on local conditions, weather prediction for annual crop planning, and general farm management.

Third, governments could link farmers to competitive agri-industries to establish mutual partnerships on non-tobacco crops growing. Such link-up will provide farmers with accesses to readily available markets, which was cited as one of the top reasons why tobacco farmers continued to farm tobacco. Governments can also train farmers to establish corporations or community enterprises that would allow farmers to process their non-tobacco crops. This strategy creates value added which would improve farmers' livelihoods.

Fourth, governments can tie incentives—both financial and non-financial—and credit programs to the growing of non-tobacco crops. The survey shows that farmers had limited capital and that the growing of non-tobacco crops generated consistent earnings. Governments could incentivize farmers to switch away from tobacco crops by providing credit plans tied to non-tobacco crops. Governments could also create incentive for farmers to switch by providing subsidized inputs dependent on crop portfolio.

BIBLIOGRAPHY

- Appau, Adriana, Jeffrey Drope, Fastone Goma, Peter Magati, Ronald Labonte, Donald Makoka, Richard Zulu, Qing Li, and Raphael Lencucha. 2019. "Explaining Why Farmers Grow Tobacco: Evidence From Malawi, Kenya, and Zambia." *Nicotine & Tobacco Research*. <https://doi.org/10.1093/ntr/ntz173>.
- Appau, Adriana, Jeffrey Drope, Firman Witoelar, Raphael Lencucha, and Jenina Joy Chavez. 2019. "Why Do Farmers Grow Tobacco? A Qualitative Exploration of Farmers Perspectives in Indonesia and Philippines." *International Journal of Environmental Research and Public Health* 16 (13). <https://doi.org/10.3390/ijerph16132330>.
- Araujo, Edson Correia, Pandu Harimurti, Gumilang Aryo Sahadewo, Nigar Nargis, Jeffrey Drope, Patricio V. Marquez, Jaffar Al Rikabi, Paul Isenman, Anne-Marie Perucic, and Frederico Gil Sander. 2018. "The Economics of Tobacco Taxation and Employment in Indonesia : Policy Implications Technical Brief." Washington D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/219251526070564098/policy-implications-technical-brief>.
- Arcury, Thomas A, Sara A Quandt, John S Preisser, John T Bernert, Deborah Norton, and Joanna Wang. 2003. "High Levels of Transdermal Nicotine Exposure Produce Green Tobacco Sickness in Latino Farmworkers." *Nicotine & Tobacco Research* 5 (3): 315–21. <https://doi.org/10.1080/1462220031000094132>.
- Chavez, Jenina Joy, Jeffrey Drope, Qing Li, and Madeiline Joy Aloria. 2016. "The Economics of Tobacco Farming in the Philippines." Quezon City. <http://aer.ph/industrialpolicy/wp-content/uploads/2016/09/REPORT-The-Economics-of-Tobacco-Farming-in-the-Philippines-LAYOUT.pdf>.
- Directorate General of Estate Crops. 2017. "Tree Crop Estate Statistics of Indonesia: Tobacco, 2016-2018." Jakarta. <http://ditjenbun.pertanian.go.id>.
- Drope, Jeffrey, Qing Li, Edson Correia Araujo, Pandu Harimurti, Gumilang Aryo Sahadewo, Nigar Nargis, Josefina Durazo, Firman Witoelar, and Bondan Suprptilah Sikoki. 2018. "The Economics of Tobacco Farming in Indonesia." Washington, D.C. <http://documents.worldbank.org/curated/en/161981507529328872/The-economics-of-tobacco-farming-in-Indonesia>.
- Drope, Jeffrey, Neil Schluger, Zachary Cahn, Jacqui Drope, Stephen Hamill, Farhad Islami, Alex Liber, Nigar Nargis, and Michal Stoklosa. 2018. "The Tobacco Atlas, 6th Edition." Atlanta.
- Goma, Fastone, Jeffrey Drope, Mr Richard Zulu, Ms Qing Li, Grieve Chelwa, Ronald Labonté, and Mr Johnny Banda. 2017. "The Economics of Tobacco Farming in Zambia." Lusaka. <https://www.cancer.org/content/dam/cancer-org/research/economic-and-healthy-policy/economics-tobacco-farming-zambia-2017.pdf>.
- Goodchild, Mark, Nigar Nargis, and Edouard Tursan D'Espaignet. 2018. "Global Economic Cost of Smoking-Attributable Diseases." *Tobacco Control* 27 (1): 58–64. <https://doi.org/10.1136/tobaccocontrol-2016-053305>
- Lencucha, Raphael, Jeffrey Drope, and Ronald Labonte. 2016. "Rhetoric and the Law, or the Law of Rhetoric: How Countries Oppose Novel Tobacco Control Measures at the World Trade Organization." *Social Science and Medicine* 164: 100–107. <https://doi.org/10.1016/j.socscimed.2016.07.026>.

- Lencucha, Raphael, Srikanth K. Reddy, Ronald Labonte, Jeffrey Drope, Peter Magati, Fastone Goma, Richard Zulu, and Donald Makoka. 2018. "Global Tobacco Control and Economic Norms: An Analysis of Normative Commitments in Kenya, Malawi and Zambia." *Health Policy and Planning* 33 (3): 420–28. <https://doi.org/10.1093/heapol/czy005>.
- Magati, Peter, Raphael Lencucha, Qing Li, Jeffrey Drope, Ronald Labonte, Adriana Boakyewaa Appau, Donald Makoka, Fastone Goma, and Richard Zulu. 2019. "Costs, Contracts and the Narrative of Prosperity: An Economic Analysis of Smallholder Tobacco Farming Livelihoods in Kenya." *Tobacco Control* 28 (3): 268–73. <https://doi.org/10.1136/tobaccocontrol-2017-054213>.
- Magati, Peter, Qing Li, Jeffrey Drope, Raphael Lencucha, and Ronald Labonté. 2016. "The Economics of Tobacco Farming in Kenya." Nairobi. <https://www.cancer.org/content/dam/cancer-org/research/economic-and-healthy-policy/economics-of-tobacco-farming-in-kenya-full-report.pdf>.
- Makoka, Donald, Jeffrey Drope, Adriana Appau, Ronald Labonte, Qing Li, Fastone Goma, Richard Zulu, Peter Magati, and Raphael Lencucha. 2017. "Costs, Revenues and Profits: An Economic Analysis of Smallholder Tobacco Farmer Livelihoods in Malawi." *Tobacco Control* 26 (6): 634–40. <https://doi.org/10.1136/tobaccocontrol-2016-053022>.
- Marquez, Patricio V., Jeffrey Drope, Qing Li, Pandu Harimurti, Edson Correia Araujo, Gumilang Aryo Sahadewo, Nigar Nargis, Josefina Durazo, Firman Witoelar, and Bondan Supraptillah Sikoki. 2018. "The Economics of Clove Farming in Indonesia." Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/166181507538499946/The-economics-of-clove-farming-in-Indonesia>.
- Mota E Silva, Marcelo Soares Da, Maria Da Glória Da Costa Carvalho, Josino Costa Moreira, Emiliano De Oliveira Barreto, Karol Fireman De Farias, Cristiane Araújo Nascimento, Francisca Maria Nunes Da Silva, et al. 2018. "Green Tobacco Sickness among Brazilian Farm Workers and Genetic Polymorphisms." *BMC Research Notes* 11 (1): 1–5. <https://doi.org/10.1186/s13104-018-3135-x>.
- Nargis, Nigar, Gumilang Aryo Sahadewo, Edson Correia Araujo, Pandu Harimurti, Jeffrey Drope, Qing Li, Josefina Durazo, Firman Witoelar Kartaadipoetra, and Bondan Supraptillah Sikoki. 2018. "The Economics of Kretek Rolling in Indonesia." Washington, D.C. <http://documents.worldbank.org/curated/en/644791507704057981/The-economics-of-Kretek-rolling-in-Indonesia>.
- Otañez, Martin G., Hadii M. Mamudu, and Stanton A. Glantz. 2009. "Tobacco Companies' Use of Developing Countries' Economic Reliance on Tobacco to Lobby against Global Tobacco Control: The Case of Malawi." *American Journal of Public Health* 99 (10): 1759–71. <https://doi.org/10.2105/AJPH.2008.146217>.
- Rachmat, Muchjidin. 2010. "Development of National Tobacco Economy: Developed Country Policy and Lesson Learned for Indonesia." *Analisis Kebijakan Pertanian* 8 (1): 67. <https://doi.org/10.21082/akp.v8n1.2010.67-83>.
- Sahadewo, Gumilang Aryo, Jeffrey Drope, Qing Li, Nigar Nargis, and Firman Witoelar Kartaadipoetra. 2019. "The Effects of Tobacco Farming on Farmers' Income."
- Sahadewo, Gumilang Aryo, Roberto Magno Iglesias, Edson Correia Araujo, Nigar Nargis, Pandu Harimurti, Jeffrey Drope, Qing Li, Josefina Durazo, Firman Witoelar, and Bondan Supraptillah Sikoki. 2018. "The Economics of Tobacco Taxation and Employment in Indonesia : Health Population and Nutrition Global Practice." Washington D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/919961507699751298/health-population-and-nutrition-global-practice>.

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