Nonfarm Enterprises in Rural Ethiopia: Improving Livelihoods by Generating Income and Smoothing Consumption?

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Abstract

In developing countries highly dependent on agriculture, non-farm enterprises (NFEs) are often lauded as income diversification opportunities, helping to smooth income in the farming off-seasons. Using data from the first wave of the Ethiopia Socioeconomic Survey (ESS), a nationally representative survey of rural and small town Ethiopia, we explore the role NFEs play in seasonal income generation, consumption smoothing, and risk mitigation. We find that NFEs are in fact pro-cyclical with agriculture, with the most productive months of NFE operation coinciding with the harvest season and crop sales. This pro-cyclicality appears to be driven by demand-side factors, where increases in community income through crop sales generate higher demand for NFE goods and services. We also find no evidence that households operating NFEs are better able to ward off incidence or duration of food insecurity in the face of shocks, suggesting NFEs do not insure temporally vulnerable households against risks.

Keywords: Ethiopia, LSMS, non-farm enterprises, income diversification
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1. Introduction

Accounting for an estimated 35-50% of rural household earnings in the developing world and an average of 34% of rural earnings across Africa (Haggblade *et al.*, 2010), the rural nonfarm sector matters for development. Nonfarm enterprises (NFEs), in particular, have been hailed as an instrument of rural growth (Davis *et al.*, 2010; Prahalad, 2005). Studies throughout sub-Saharan Africa also show that NFE operation is positively correlated with household welfare, though the direction of causality is still unclear (Fox & Sohnesen, 2012). The growth-wielding potential of NFEs have made them an integral component of the development research agenda in recent years.[7]

In Ethiopia, studies show that participation in NFEs has risen from 23% in 1998 to 34% in 2006 (Loening *et al.* 2008).[8] Growth in the nonfarm sector coincides with recent positive economic developments in the country, which has seen rapid economic expansion in recent years. Annual per capita GDP growth rates ranged from 4.0% to 9.8% over the past ten years (African Development Bank Group, 2014), and the country's poverty headcount ratio has fallen from 45.5% in 1995 to 29.6% in 2011 (World Bank, 2014). The question exists as to what role nonfarm enterprises might have played in bringing about this progress. Moreover, the Ethiopian government has included developing the micro and small enterprise sector as an objective of its Growth and Transformation Plan (MoFED, 2010).

1.1. NFEs, seasonality, and risk mitigation

One claim made in the literature about NFEs, which we explore in this paper in the context of Ethiopia, suggests they may represent an income smoothing opportunity (Loening *et al.*, 2008). This claim is driven by the potential of NFEs to provide diversified income sources when agricultural earnings are

[7]See numerous studies conducted over the past two decades on NFEs in west Africa using IRD-DIAL's innovative 1-2-3 surveys.
[8]NFEs are defined as any income generating business a household operates which does not involve the primary production of crops or livestock. Included in this definition of NFEs are activities that add value to primary production, such as the processing of agricultural by-products.

low, thereby mitigating income risk (Davis et al., 2010). Agricultural production is highly seasonal, creating substantial income fluctuations throughout the year. Although households engaged in agriculture can generate sizeable income streams to support consumption during the harvest season when yields are high, these income streams diminish as agricultural activity declines. This often leaves households vulnerable to food insecurity during the lean season. NFEs are hypothesized to provide an opportunity for households to smooth consumption, insofar as returns from nonfarm activity are uncorrelated or negatively correlated with the returns to agricultural production (Haggblade *et al.*, 2010). This would enable households to draw upon alternative income sources outside of the agricultural season to sustain their consumption levels. By generating household income during the agricultural off-season, NFE ownership may also create a buffer for households to rely on in the face of negative shocks, thus reducing vulnerability.

NFEs may also provide further means of risk diversification in the face of aggregate shocks to agricultural production, such as drought. Aggregate shocks weaken the alleviating role of informal mutual assistance networks, and in the absence of well-functioning insurance markets, nonfarm enterprises may act as insurance mechanisms for households. Thus, when agricultural income falls short, households can channel their capital and labor into NFEs and utilize this alternative method of income generation to replace lost agricultural income in part or in full. The risk-mitigating opportunities that NFEs may provide are also linked to the issue of food security; they may reduce a household's within-year variability of the capacity to purchase or produce food. Therefore, food security can be improved if households have access to alternative income sources in the face of low agricultural earnings or agricultural shocks (Owusu *et al.*, 2010; Ali and Peerlings, 2012; Barrett *et al.*, 2001).

Alternatively, since agricultural production still represents the largest rural economic activity in developing countries, the rural nonfarm sector may display strong dependency links to the agricultural economy (Haggblade *et al.*, 1989; Reardon *et al.*, 1994). Therefore, just as the growth of the nonfarm sector may depend on the growth of agricultural productivity, the income generating, and thus consumption smoothing, potential of NFEs may depend on the timing of and profits generated by agricultural production. Strong links with the agricultural economy may cause streams from nonfarm enterprise operation to be highly cyclical and correlated with agriculture (Haggblade *et al.,* 2010), making them an insufficient means by which to smooth consumption.

Furthermore, if NFE income is strongly dependent on agricultural activity, NFEs may not provide an effective means of risk mitigation in the face of aggregate shocks to agriculture. There are two reasons for this, one being a supply-side problem and the other being a demand-side problem. First, in the absence of efficient credit markets, if agricultural income is insufficient, households may not have the capital necessary to invest in starting or growing an NFE (Reardon *et al.*, 1994). Second, operating an NFE in an agricultural economy may be heavily dependent on the demand for nonfarm products and services, which is generated by earnings from agricultural production (Rijkers *et al.*, 2008). Therefore, the effectiveness of using NFEs as insurance against risks remains uncertain and context-dependent. For example, if starting an NFE is highly dependent on an initial injection of agriculture income, or vice versa, then one could argue that operating a farm and an NFE are not necessarily diversifying; a threat to one activity is also a threat to the other.

1.2 NFEs in Ethiopia

There is some evidence from Ethiopia suggesting households might use NFEs to complement farming income during the agricultural off seasons. Loening *et al.* (2008) find NFE activity to be seasonal but countercyclical with agriculture, providing an alternative source of household income during times of low agricultural activity. However, the magnitude of additional income provided is called into question by the authors, who point to the small size as well as low productivity of NFEs. Conversely, risk diversification effects of NFEs are found to be low by Rijkers and S*ö*derbom (2013) using the same RICS-Amhara data as Ali and Peerlings (2012), matched with precipitation-based measures of risk. They show that the likelihood of operating an NFE and the returns to NFE operation are highly correlated with agricultural productivity shocks, thus providing only limited opportunities to smooth income across agricultural fluctuations. They infer that a good harvest is favorable to NFE activity through increasing local demand, but that NFE operation is not effective in mitigating weather risk. They also find that *ex-ante*, there is no strong link between vulnerability to shocks and NFE ownership.

Overall, the existing theoretical literature on the nonfarm sector, as well as the empirical findings on NFEs in Ethiopia display mixed findings on the role that they play in mitigating risk and smoothing consumption. In addition, evidence has been collected largely based on data with incomplete coverage of Ethiopia as a whole. Past research on NFEs and the nonfarm sector in Ethiopia has focused on Amhara (Ali and Peerlings, 2012; Rijkers and Söderbom, 2013) or Tigray (Woldenhanna and Oskam, 2001), or on a sample that otherwise covers less of the entire rural population (Loening *et al.*, 2008; Bezu *et al.*, 2012). The wider coverage of the survey data we use allows us to make very careful inferences about the situation of NFEs in rural Ethiopia. Moreover, since we use survey data from 2011-2012, our analysis reflects recent information on NFEs in rural Ethiopia, which carries great relevance for current policy.

Therefore, the aim of our analysis is to update and expand insight into the role of NFEs in Ethiopia. Using nationally representative data we are able to provide a clearer and more comprehensive picture of nonfarm enterprises in rural Ethiopia and the households that operate them. The analysis of NFEs presented hereafter broadly yields two main findings. Firstly, nonfarm enterprises are largely pro-cyclical with agriculture; the highest months of NFE activity coincide with the harvest season and the sale of crops. Further analysis suggests this dependency is driven by both supply and demand side links to agricultural income; though evidence implies demand-driven factors may more fully explain this pro-cyclicality. Secondly, we find income from NFEs does not temporally complement agricultural income or help households to generate steady streams of income throughout the year. We

find no evidence that households operating NFEs are better off in the face of shocks or food insecurity, reinforcing the notion that NFEs do not significantly contribute to risk mitigation or consumption smoothing.
The remainder of this report is structured as follows. Section 2 outlines the data used in this study. Section 3 presents descriptive statistics on NFEs, their temporal operation, and supply vs. demand driven seasonality. Section 4 presents results on the risk-mitigating potential of NFEs. Finally, section 5 concludes.

2. Data

This paper uses data from the first wave of the Ethiopian Socioeconomic Survey (ESS1), which is part of an ongoing collaborative project between the Central Statistics Agency of Ethiopia (CSA) and the World Bank Living Standards Measurement Study – Integrated Surveys of Agriculture (LSMS-ISA) team.[9] The survey contains detailed individual, household, and community-level data, ranging from information on household and agricultural activities to human capital, access to services, and food security. The ESS1 was implemented in 290 rural and 43 small town enumeration areas (EAs), which cover all regional states apart from Addis Ababa and are nationally representative of all rural and small town areas in Ethiopia[10]. Small towns are defined as those with a population estimate of less than 10,000 according to the 2007 population census.

The sampling followed a two-stage design, stratified at the regional level.[11] The first stage of sampling selected primary sampling units from the sample of CSA EAs, which had been selected based on probability proportional to

[9] The ESS1 survey was conducted in three rounds. The first round containing the post-planting agriculture questionnaire was conducted in September to October of 2011; the second round containing the livestock questionnaire was conducted in November to December of 2011; and the third round containing post-harvest agriculture, household, and community questionnaires was conducted from January to March 2012.
[10] Excluding three zones in the Afar region and six zones in the Somali region
[11] For more detailed information on the sampling design and survey set-up the reader is advised to consult the ESS1 survey documentation, available on the website of the World Bank's LSMS-Ethiopia.

size of the total EAs in each region. The second stage selected 12 households to be interviewed in each EA. In rural areas, ten of these households were randomly selected from the sample of 30 Annual Agricultural Sample Survey (AgSS) households, and were thus involved in farming or livestock activities. In addition, two households were randomly selected from all other households in the rural EA which were not involved in agriculture or livestock. In small towns these households were randomly selected without stratification based on household activities. Households were selected without replacement and the interview response rate amounted to 99.3%, yielding 3,969 household observations, all of which are weighted to represent the national-level population of rural and small town households of Ethiopia. The data is representative of five domains of analysis (DOA), which include the regions of Amhara, Oromiya, SNNP, and Tigray. The sample is insufficient to support region-specific estimates for the smaller regions of Afar, Benishangul, Gumuz, Dire Dawa, Gambella, Harari and Somalie, which are all combined to represent “Other”.

A final note concerns the definition of NFEs as used in the ESS household survey question identifying ownership of NFEs. This definition closely matches the definition set out in the introduction of this paper, and defines NFE ownership as the operation of a nonfarm enterprise involved in the provision of non-agricultural services such as carpentry, the processing and sale of agricultural by-products such as flour, trade, professional services, transportation services, and food services. This operationalization of the definition of NFE ownership is similar to that of Rijkers and Söderbom (2013), and consistent with the broader literature, allowing for comparability of results. A household was considered to operate an NFE in the survey if it reported to have operated one or more of these types of enterprises in the twelve months prior to the survey, including those ventures that had been shut down permanently or temporarily during that time.

2. NFEs and seasonality

Descriptive statistics on NFE characteristics can be found in Appendix Table S1. The ESS1 data indicate that 20% of households in rural and small town Ethiopia own at least one NFE.[12]NFE participation rates are significantly higher in small towns than in rural areas, with 54.8% of small town households operating at least one NFE, compared to 19.9% of households in rural areas.[13] While there is no difference in real consumption per capita for individuals from households that do and do not operate NFEs, we do observe a slight increase in NFE participation for households in higher welfare quintiles.[14] However, these results may be partially driven by the fact that NFEs are more prevalent in small towns, where the average household consumes significantly more than its rural counterpart.

Table 1 provides an overview of household characteristics among NFE and non-NFE households, for the overall sample as well as rural and small town areas. Overall, the average household head from an NFE household is significantly younger (45 vs. 41 years old) and has more education (2.4 vs. 1.7 years) than a head whose household does not operate an NFE. However, we find that this pattern is reversed when restricting the analysis to small towns; there, household heads from NFE-operating households have approximately half the years of schooling reported by non-NFE household heads (4.2 vs. 7.5 years). NFE and non-NFE households are equally likely

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[12] This figure is slightly lower than the NFE participation rate of 25% estimated by Loening *et al.* (2008) for the four largest regions of Oromiya, Tigray, SNNP and Amhara.[12] It also varies from Woldenhanna and Oskam (2001) who estimate that 28% of households. These discrepancies may be a result of the ESS1' wider regional coverage, the data's lack of urban coverage, variation in NFE activity across different years, or general time trends.

[13] The primary income-generating activities in rural and small town areas are agricultural activities and wage employment, respectively.

[14] The annual consumption aggregate used is the publicly available aggregate released by the LSMS team at the time of the analysis. Annual consumption expenditures include annualized measures of food consumption over the past 7 days, non-food expenditures, and educational expenditures, indexed for regional spatial price. Welfare quintiles are derived from adult equivalent annual consumption expenditures.

to have female heads in rural areas, but NFE households in small towns are more likely to have a female head than are non-NFE households (38 vs. 29 percent, respectively). Not surprisingly, households engaged in the NFE sector own fewer sheep and cattle than households without an NFE. Real annual expenditure per adult equivalent is higher among NFE households, as compared to non-NFE households, in rural areas, but is higher in non-NFE households in small towns, though neither difference is statistically significant.[15]

[15] The overall annual mean difference is 289 Birr, which is approximately US $17 if converted at the average market exchange rate for 2011, or US $53.5 if converted using 2011 purchasing power parity factors. Rijker and Söderbom's (2012) find similar results in their study of Amhara in which households that run an NFE are not found to have higher per adult annual expenditures than those households not engaged in Nativity.

Table 1: Socioeconomic characteristics of households by NFE ownership

	Overall			Small Town			Rural		
	NFE	**No NFE**	**Diff.**	**NFE**	**No NFE**	**Diff.**	**NFE**	**No NFE**	**Diff.**
	(1)	**(2)**	**(1)-(2)**	**(3)**	**(4)**	**(3)-(4)**	**(5)**	**(6)**	**(5)-(6)**
Household characteristics									
Size of HH	5.291	5.070	0.221	4.469	3.259	1.210***	5.315	5.081	0.234
	(0.127)	(0.062)		(0.151)	(0.195)		(0.130)	(0.062)	
Cattle per household	2.509	3.609	-1.100***	0.777	1.027	-0.250	2.560	3.625	-1.065***
	(0.193)	(0.180)		(0.329)	(0.517)		(0.199)	(0.181)	
Sheep per household	1.164	1.576	-0.412*	0.208	0.279	-0.071	1.192	1.584	-0.392**
	(0.183)	(0.144)		(0.060)	(0.096)		(0.189)	(0.145)	
Annual per adult equivalent	1,108.3	819.6	288.7	1,571.8	1,819.1	-247.3	1,097.2	816.8	280.4
expenditures (mean)	(220.2)	(48.6)		(135.6)	(232.0)		(225.2)	(48.8)	
Household head characteristics									
Age	40.703	45.394	-4.691***	42.998	37.388	5.610***	40.632	45.441	-4.809***
	(0.708)	(0.444)		(1.047)	(1.560)		(0.728)	(0.447)	
Female	0.188	0.205	0.017	0.383	0.293	0.090*	0.182	0.204	0.022
	(0.019)	(0.012)		(0.033)	(0.037)		(0.019)	(0.012)	
Years of schooling	2.347	1.672	0.675***	4.171	7.459	-3.288***	2.344	1.899	0.445**
	(0.172)	(0.122)		(0.274)	(0.663)		(0.147)	(0.101)	
Literate (%)	0.500	0.402	0.098**	0.626	0.705	-0.079	0.497	0.400	0.097**
	(0.032)	(0.019)		(0.037)	(0.052)		(0.033)	(0.019)	
Ever attended school (%)	0.467	0.338	0.129***	0.590	0.705	-0.115*	0.463	0.335	0.128***
	(0.028)	(0.020)		(0.031)	(0.053)		(0.029)	(0.020)	
Number of obs.	3,969			503			3,466		

Note: Standard errors in parentheses adjusted for EA clustering and stratification. Differences significant at *p<0.1, **p<0.05, and ***p<0.01.

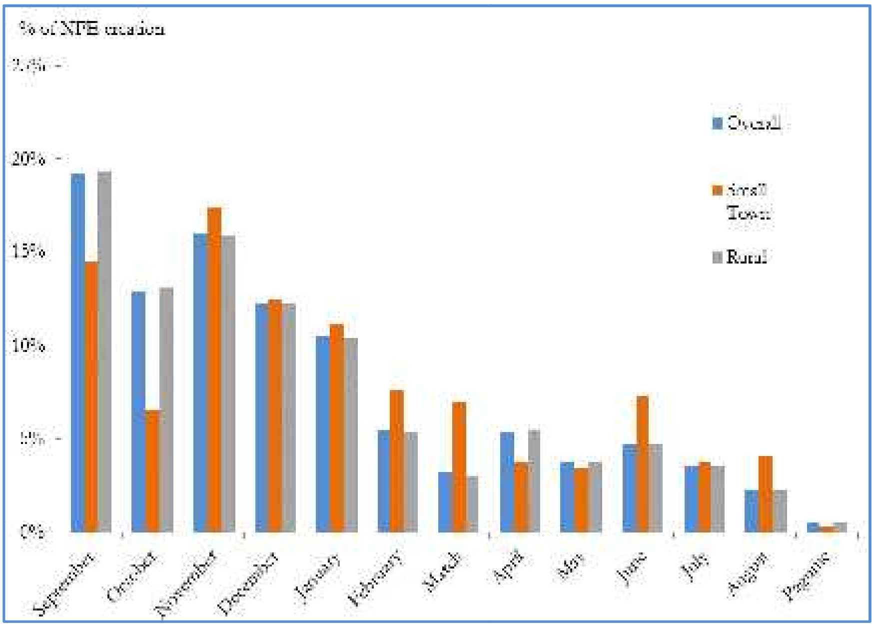
3.1 NFE seasonality

Overall, 53.4% of NFE-operating households reported that their NFEs operate seasonally. Reported seasonality differs significantly by subpopulation, with 33% of small town NFEs reporting to be seasonal compared to 54% of rural NFEs. Rural NFEs may plausibly experience one of two forms of seasonality. First, and perhaps most widely seen in the literature, households may channel excess labor supply into NFE activities during the agricultural off-season in order to generate alternative income streams throughout the year (Ellis, 2000). Employing the complementary seasonality of the two activities serves as an income diversification technique that can help smooth consumption across the year (Haggblade *et al.*, 2010). In this case we would expect to find NFE activity to be counter-cyclical with agricultural seasons. Second, households may be best able to generate income from NFEs during times when market demand for their goods is high, which is likely during and after the agricultural harvest when farmers are able to generate substantial income to expend (Reardon *et al.*, 1994).

We look further into the seasonality of NFEs and compare the timeline of NFE activity with the agricultural seasons. The main harvest period in Ethiopia, or the Meher season, typically occursfrom September to February. If NFE activity begins or peaks during the lean season, and thus is counter-cyclical with agriculture, we would have some *primafacie* evidence that NFEs aid households in smoothing consumption throughout the year. However, we observe the opposite temporal relationship between NFE and agricultural activities, with the timing of NFE activities strongly corresponding to the Meher season.

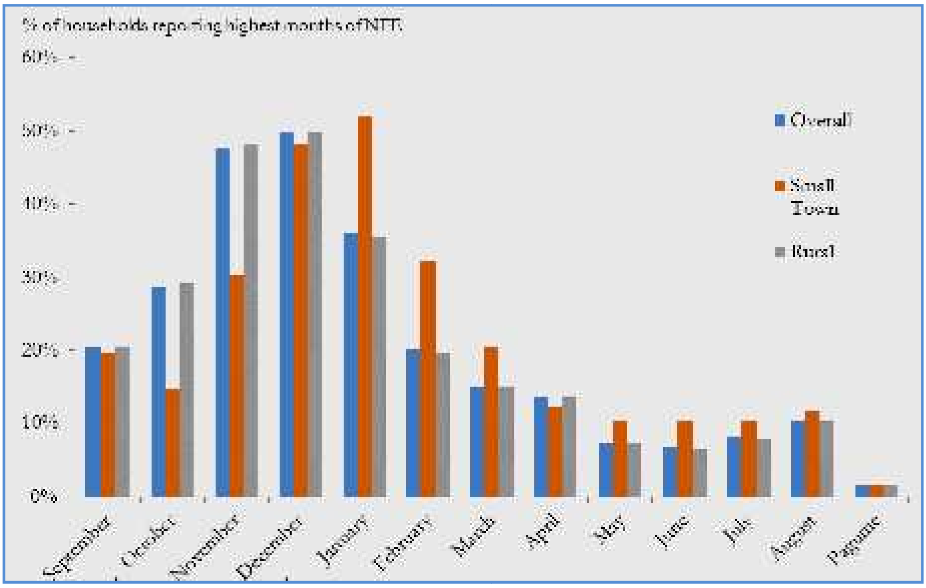
The ESS1 prompts respondents to report the month and year in which their NFE began operation; we find the month of inception largely coincides with the timing of the Meher season. As displayed in Figure 1, we observe that approximately 80% of NFEs first began operating between the months of September and January. NFE start-up rates gradually fall after November and remain lowest between the months of February and Pagume, which is also the lean season. The variability in timing of NFE start-ups is slightly less pronounced in small towns than in rural areas, a finding that we would expect given that small town NFEs report less overall seasonality and are less strongly tied to agriculture.

Figure 1: Month in which NFE began operation



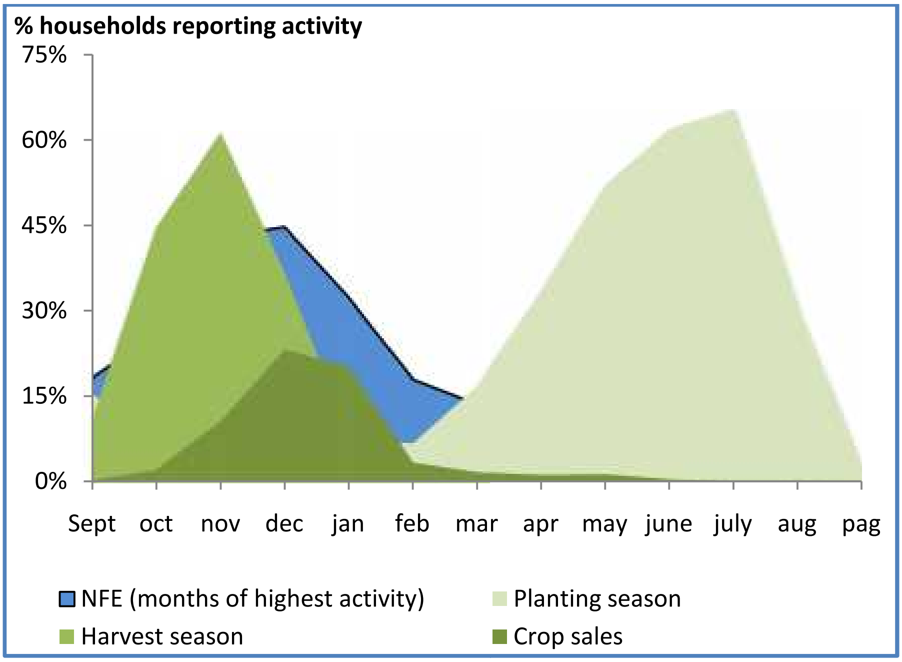
Second, we look at the results of a survey question that asked households in which months of the last year enterprise activity was highest. These findings are consistent with those on the timing of NFE start-ups, as the highest months of NFE activity largely correspond to the months with the highest NFE start-up rates, with a minor lag. Nonfarm enterprises tend to be most active during the months of November, December, and January, with 42.7%, 44.5%, and 32.2% of NFEs listing these as one of their three most important months of activity, respectively (see Figure 2). Conversely, NFE activity appears to be significantly lower from April to Pagume.

Figure 2: Highest months of NFE operation 2



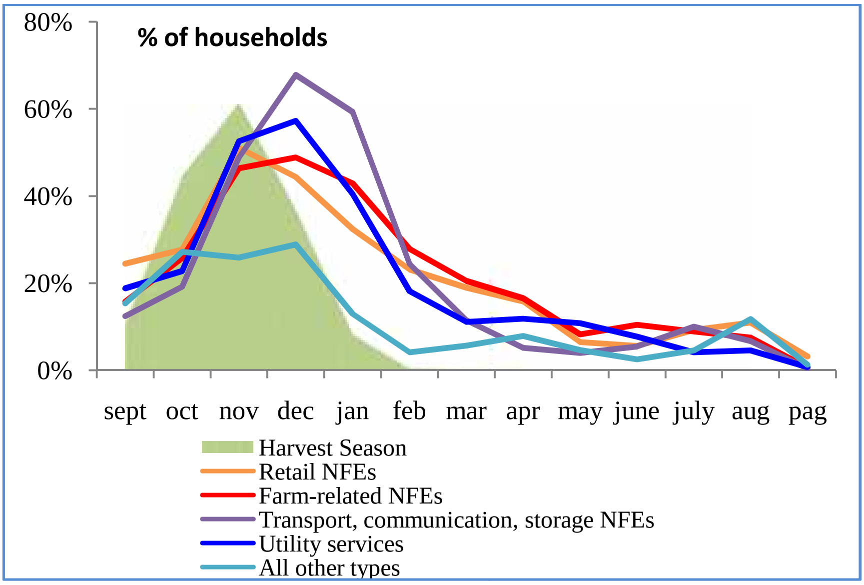
Despite minor differences in peak NFE activity between rural and small town populations, we find that the overall trends are the same and, further, that the timing of NFE activity strongly corresponds to the Meher harvest season (see Figure 3). The peak months for NFE activity line up with the harvest and crop sale seasons, peaking immediately after the harvest and almost simultaneously with the sale of crops. Furthermore, very few enterprises report high NFE activity during the months when planting season takes place.

Figure 3: NFE operation and agricultural seasons



These findings provide further evidence that NFE activity is pro-cyclical with agriculture. Rather than using NFEs to supplement periods of low agricultural income, households generate a disproportionately high influx of income from the months of October to January. Furthermore, this trend is observed across different NFE sectors. Even NFEs that do not rely on agricultural products as NFE inputs, such as retail and utility service enterprises, enjoy higher months of activity during and immediately after the Meher harvest (see Figure 4).

Figure 4: Harvest season and NFE operation, by type NFE sector



3.2 NFE seasonality and supply vs. demand

Expanding on the result that most NFEs are pro-cyclical with agriculture, and therefore not necessarily helping to generate an even stream of income throughout the year, we investigate the mechanisms through which NFE operation is linked to agricultural income. Agricultural income may encourage NFE activity through both supply-side and demand-side links. For example, NFEs may rely on agricultural income as a source of start-up funds or, alternatively, agricultural income might increase cash flow in the community, thus increasing the market demand for NFE goods.

On the supply-side, we find that most households rely on agricultural income to fund the creation of NFEs. Overall, agricultural income is reported as either the primary or secondary source of start-up capital for 64% of NFEs (see Table 2). The second most reported source of start-up capital is nonfarm self-employment income, noted as a primary or secondary source of funds by 18% of households. This result can be explained by the fact that some households operate multiple NFEs and may thus use the income from one NFE to start another. Our findings for agricultural start-up funds are consistent with those of Loening et al. (2008), who found that agricultural income represented 60% of start-up capital for NFEs.[99]

Table 1: Source of start-up funds for NFEs

	Overall (1)	Small Town (2)	Rural (3)	Difference (2)-(3)
Agricultural income	0.642	0.137	0.657	0.520***
	(.030)	(.020)	(.031)	
NFE self-employment	0.175	0.369	0.169	0.200***
	(.024)	(.049)	(.025)	
Family/friends	0.116	0.312	0.111	0.201***
	(.018)	(.040)	(.018)	
Money Lender	0.076	0.095	0.076	0.019
	(.017)	(.027)	(.018)	
Microfinance Institution	0.029	0.045	0.028	0.017
	(.009)	(.013)	(.009)	
Wage employment	0.016	0.088	0.014	0.074***
	(.004)	(.020)	(.004)	
Remittances	0.003	0.005	0.003	0.002
	(.002)	(.003)	(.002)	
Sale of assets	0.009	0.011	0.009	0.002
	(.004)	(.006)	(.004)	
Bank loan	0.006	0.014	0.006	0.008
	(.003)	(.009)	(.003)	
Other	0.055	0.101	0.054	0.047
	(.011)	(.026)	(.011)	
N	1,315	345	970	

Note: Standard errors corrected for EA clustering and stratification in parentheses. Differences are significant at * $p< 0.10$, ** $p< 0.05$, *** $p< 0.01$. Columns do not sum to one as numbers account for the proportion of NFEs reporting each source as either a primary or secondary source of start-up capital.

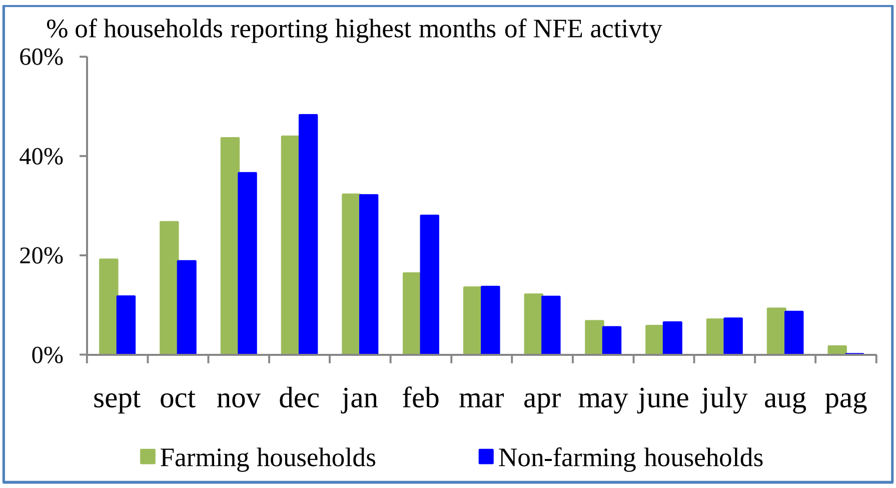
Rural NFEs, as compared to those in small town areas, tend to rely more heavily on agricultural income for start-up capital, with 65.7% of rural households citing agricultural income as a main source of funds for NFEs, as opposed to only 13.7% of small town households. Households in small

[99] However, they also find NFE self-employment to be of less importance and funding from family and friends to be more significant.

towns reported nonfarm self-employment income as the main source of start-up funds for NFEs, with 36.9% of NFE-operating households citing it as a main source, compared with only 16.9% in rural areas. The finding that small town NFEs rely less on agricultural start-up funds and display less seasonality suggests that the seasonality of NFE activity bears some relation to the supply-side effects of agricultural seasonality.

However, further exploration suggests that agricultural income's contribution to starting an NFE only partially explains the cyclical relationship between NFE and agriculture activity. Figure 5 demonstrates the temporal nature of NFEs for both farming and non-farming households. Although there is a statistically significant difference in the proportion of households reporting September, October, and November as a high month for NFE activity, there is no significant difference in the overall *trend* throughout the year for farming and non-farming households. Despite the fact that non-farm households don't rely on agricultural income to fund the operation of their NFEs, they still exhibit increased NFE activity from November to February.

Figure 5: NFE activity for farming and non-farming households



Therefore, we investigate the extent to which demand-side factors may be driving the seasonality of NFE activity by looking at the location and customer base for these NFEs, as well as self-reported demand-side constraints to NFE growth. We find that NFEs tend to operate locally, selling to local customers, and are thus constrained by the limits of local market demand, which fluctuates with seasonally driven agricultural income. Approximately 30.4% of NFEs operate from inside the household residence, compared to only 7.9% that operate outside. The fact that over one-third of NFEs operate from home suggests that the market they serve is mainly local. These results do not differ significantly by rural and small town subpopulations, implying that differences identified in the seasonality of NFEs by subpopulation are driven to a large extent by differences in the nature of local demand, rather than fundamental variations in the nature of NFE operation. Furthermore, the customer base of for NFEs appears to comprise mainly of the market, local consumers or passers-by, and traders, further indicative of the local nature of the markets they serve.

The data also show that NFEs perceive low demand and a lack of access to better markets as the primary operational barriers. While almost 40% of NFEs identified access to markets as one of three main obstacles, another 21.0% and 16.9% viewed low demand and difficulty to obtain market information, respectively, as key constraints; the top three constraints identified, out of more than 30 categories, were all related to markets. This further affirms that local market demand, which is mainly driven by seasonal agriculture, is often insufficient to generate sizeable NFE income throughout the year.

4. NFEs and risk mitigation

The previous section casts doubt on NFEs' ability to smooth households' consumption, or at the very least to temper seasonal changes in income. This section explores whether there is any evidence suggesting that, despite these findings, NFEs still enable households to protect against shocks and avoid seasonal food insecurity. Due to the strong interdependence between agriculture and NFE activity, particularly in rural areas, we might conjecture that aggregate shocks affecting agricultural production would also dampen the success of NFEs. However, other studies suggest that NFEs may still be a useful tool for insuring households against idiosyncratic shocks and, if employed as an income diversification tactic, may stave off food insecurity and other threats to well-being.

Using ESS1 data, we find no significant evidence that NFE households are better able to mitigate shocks, or that greater exposure to risk is associated with a higher likelihood of owning an NFE. Owning an NFE is not associated with the ability to better cope in the face of a shock. In the event of any negative shock in the previous 12 months, NFE and non-NFE households report statistically similar incidence of decreases in income (89 and 87 percent),assets (67 and 71 percent), and food purchases (58 and 54 percent).

We further assess the ability of NFEs to mitigate risk by looking specifically at the relationship between NFE ownership and food insecurity. We ask the following question based on the ESS1 survey: "Conditional on having been faced with severe shocks in the past 12 months, were NFE-owning households more or less likely to report experiencing food insecurity over this same period?". To answer this question, we estimate the following regression specification:

$$Pr(Fi)_h = \beta_0 + \beta_1 S_h + \beta_2 NFE_h + \beta_3 S_h \times NFE_h + \beta_4 Rural_h + \beta_5 Rural_h \times NFE_h + \beta_6 HHsize_h + \beta_7 Landsize_h$$

$Pr(Fi)_h$ is the probability that a household *h* has reported not having enough food to feed their family in the past 12 months; S_h indicates whether in the past 12 months the household has experienced a shock which it classified as one of the most severe of the year; NFE_h indicates whether the household operates a NFE; $Rural_h$ is a dummy variable equal to 1 if the household resides in a rural area, and 0 if the household resides in a small town; $HHsize_h$ controls for the size of the household, and $Landsize_h$ controls for household landholdings, which are a proxy for asset wealth and agricultural production potential. We focus on the impact of shocks on food insecurity rather than household consumption because food insecurity is a widespread and persistent phenomenon in Ethiopia. Even in a year with enough rainfall, it is estimated that approximately 4-5 million Ethiopians depend on food aid

(Devereux 2006). As such, in Ethiopia, food security is perhaps a far more salient indicator of welfare than consumption.[100]

Table 3 reports the average marginal effects estimated using the above specification, which paints an interesting picture. According to Model 1, being exposed to a shock of any kind is associated with a 31 percentage point increase in the likelihood of being food insecure, implying that mean reported food insecurity increases to 63.3% in the presence of shocks. Model 2 breaks down the shock variable to capture only the most commonly experienced and severe shocks, a categorization which is almost identical to that in Dercon (2005). Model 2 suggests that the relationship between shocks and food insecurity is mostly driven by the incidence of weather shocks, price shocks, and crop damage. Idiosyncratic shocks are also significantly and positively correlated with food insecurity.

These findings are consistent with previous studies demonstrating that weather variation significantly affects food security (Rosenzweig *et al.* 1995; Demeke and Zeller 2009). They are also consistent with Dercon's (2005) study of the effect of shocks in the past five years on present consumption. Similar to our results, his study shows that weather shocks and personal idiosyncratic shocks have high and significant negative effects on household consumption. Moreover, Models 1 and 2 highlight that weather may not be solely responsible for food insecurity in Ethiopia. While the correlation between the different shock types may be high (as suggested by a general

[100]Whilst our measure of food insecurity is self-reported and endogenous, and as such certainly does not capture all facets of a complex concept, it does have advantages. Unlike measures of food supply, it also encompasses a household's access to food, bowing to Sen's distinction between supply and availability (Sen, 1981). We thus rely on respondents' statements to tell us whether food was not *enough* at any point in the last 12 months, with the advantage that information they provide is measured against personal and cultural norms and may better indicate respondents' sense of deprivation (Webb, 2006).We chose not to complement our subjective measure of food insecurity with an objective measure because of the nature of those objective indicators available in the data. The indicators of calorie consumption and food purchases in our data refer to the seven days prior to the survey (and thus do not account for seasonal variation). Additionally, information on the average number of meals per day is not directly linked to the nutritional value of those meals.

shock variable which is lower than the sum of the individual coefficients), the findings call for an investigation into what is causing food insecurity in Ethiopia other than weather shocks.

In light of the framework outlined above, we find no significant indication that NFE ownership is associated with a lower likelihood of reporting being food insecure conditional on receiving a shock. We obtain this finding as we interact the variable for having received a shock (aggregated and disaggregated in models 1 and 2 respectively) with the dummy variable for NFE ownership. This allows us to estimate the difference between the conditional relationship linking shocks and food insecurity for those households that do and do not own a NFE. Whilst all the coefficients on these interactions have the expected negative sign, which would be predicted if NFEs enabled households to insure themselves against shocks, the coefficients are extremely small in magnitude and not statistically significant at conventional levels. It would appear that our data offers no support to the hypothesized role of NFE ownership as an insurance mechanism, as we fail to reject the null hypothesis that NFE ownership offers no protection against food insecurity when facing a shock. Moreover, the insignificant coefficient on NFE ownership can be interpreted to provide additional evidence that NFEs do not help smooth consumption, as NFE households do not appear to be significantly less likely to be food insecure even in the absence of shocks. This is most likely related, at least to some extent, to the failure of households to smooth consumption across the year.

We find that the insignificant association between NFE ownership and resilience to shocks is not specifically driven by NFEs that display stronger links with agriculture, such as those involved in the sale of agricultural by-products. This is found when we investigate whether specific types of NFEs are more likely to be associated with households reporting lower food insecurity. We thus explore the interactions between different NFE types and the general shock variable to both isolate and look beyond the resiliency of households operating NFEs that are more strongly tied to agriculture.[101] The results are presented in Model 3, and show an insignificant relationship

[101] For a description of the construction of the NFE type variable, please see Appendix Figure S1.

between different NFE types and food insecurity in the face of shocks. Not only does it appear that NFEs are unimportant in helping households cope with shocks, but these results do not seem to be driven by agricultural NFEs that may be particularly sensitive to weather shocks.[102] Across the different types, NFEs seem uncorrelated with food insecurity in the face of shocks.[103]

[102]An implicit assumption we are making in interpreting the results is that NFE ownership affects food insecurity, and not vice-versa. There are, however, theoretical reasons to believe that food insecurity affects NFE ownership. Fafchamps (1999) and Sen (1981), for instance, suggest that concerns about insufficient food supplies could reduce farmers' willingness to invest in crops and more productive nonfarm activities, while reducing the local demand for nonfarm products. As such, we might expect food insecurity to have a negative effect on NFE ownership, introducing a downward bias in our coefficients. On the other hand, risky environments such as those prone to frequent food insecurity may encourage diversification through nonfarm enterprises as a response to shocks, making our coefficients upward biased. Disentangling these potential sources of bias would require developing an identification strategy that would produce less biased estimates, as for example, using instrumental variable estimation.

[103] This finding is robust to different model specifications, such as interacting different types of NFEs with weather shocks specifically. We chose not to report all robustness checks to preserve the clarity of our output in the table.

Table 3: NFE ownership and reported food insecurity

	Model 1	Model 2	Model 3
Shock	0.306***		
	(0.035)		
Weather shock		0.251***	
		(0.043)	
Price shock		0.171***	
		(0.045)	
Idiosyncratic personal shock		0.101***	
		(0.032)	
Crop damage		0.174*	
		(0.090)	
Livestock loss		0.024	
		(0.056)	
Other type of shock		0.136**	
		(0.055)	
NFE owner	-0.094	-0.069	
Agribusiness owner	(0.096)	(0.087)	-0.057
			(0.083)
Non-agricultural business owner			-0.135
Shock * NFE owner	-0.035		(0.084)
	(0.066)		
Shock * Agribusiness owner			-0.011
			(0.132)
Shock * Non-agricultural business owner			-0.030
Weather shock * NFE owner		-0.023	(0.124)
		(0.077)	
Idiosyncratic shock * NFE owner		-0.004	
		(0.056)	
Crop damage * NFE owner		-0.016	
		(0.157)	
Livestock loss * NFE owner		-0.002	
		(0.105)	
Price shock * NFE owner		-0.016	
		(0.079)	
Other type of shock * NFE owner		-0.013	
		(0.096)	
Rural	0.021	0.021	0.156**
	(0.084)	(0.075)	(0.061)
Rural * NFE owner	-0.002	-0.002	
	(0.145)	(0.129)	
Household size	0.009	0.008	0.037***
	(0.006)	(0.006)	(0.010)
Size of land owned by household	-0.009*	-0.008*	-0.010*
	(0.004)	(0.004)	(0.005)
Observations	3,079	3,079	767

Note: All regressions report average marginal effects and are significant at $^{*}p<$ 0.10, $^{**}p<$ 0.05, $^{***}p<$ 0.01. Coefficients in models (1) and (2) are estimated using the full sample involved in agricultural activities. Coefficients in model (3) are estimated using the sample of NFE owners. The mean probability of reported food insecurity in the full sample is 32.7%. The mean of food insecurity among NFE owners is 37.3%.Standard errors adjusted for EA clustering and stratification in parentheses.

While we find that NFE-operating households are not less likely to report at least one incident of food insecurity, we look deeper to determine if NFEs might at least temper the timing or severity of food insecurity. For this, we utilize a survey question in which households are asked to identify specific months from the previous year during which they experienced food insecurity. Unsurprisingly, the most food-secure period takes place from November to March; this period coincides with both the Meher harvest as well as increased NFE activity (see Appendix Figure S2). However, during periods of increased food insecurity, April to October, NFE households do not report lower rates of food insecurity than their non-NFE counterparts.

We use a negative binomial regression model to estimate the effect of NFE income on food insecurity spells, as measured by the number of months a household was food insecure in the past year. The negative binomial distribution is an unbiased count estimator and is particularly useful for count data with an unbounded positive range when the sample variance is greater than the mean. We look at two separate specifications. In model 1, we regress months of food insecurity on consumption quintiles and income coming from four primary sources: farm, NFE, wage, and other. We might reasonably expect two households, at the same *level* of consumption, to exhibit different *patterns* of consumption throughout the year. Therefore, if we hypothesized that NFEs were helping households to buffer against food insecurity, we would expect each additional 1,000 Birr of NFE income to have a negative impact on months of food insecurity in our model. However, holding all other factors included in the model constant, we find that an additional 1,000 Birr of NFE income has no statistically significant bearing on months of food insecurity (see Table 4). In Model 2, we regress months of food insecurity on consumption quintiles, number of income sources, and whether one of these income sources is an NFE. Once again, we find no correlation between operating an NFE and facing fewer spells of food insecurity.

These results fail to support the notion that income diversification as a risk reduction strategy mitigates the incidence of food insecurity. Holding all other factors in the model constant, a household with three income sources, for example, does not face fewer months of food insecurity than a household with two income sources. Traditionally, expanding the income portfolio can help mitigate the risks associated with agricultural productivity and cultivate a more consistent, reliable stream of income (Davis & Bezemer 2001). In fact, the key motivation for diversifying one's income portfolio as a risk prevention strategy is to ensure that the elements of the portfolio have very few, if any, overlapping risks (Ellis 2000). Given our earlier finding of the pro-cyclicality of NFE and agricultural activities, it is clear that these two income sources are in fact strongly linked.

Table 4: Months of food insecurity and income sources

NFE income (1,000 Birr)	-0.017	
	(.017)	
Farm income (1,000 Birr)	-0.020***	
	(.007)	
Wage income (1,000 Birr)	-0.001	
	(.010)	
Other income (1,000 Birr)	-0.123**	
	(.054)	0.127
NFE operation		(.104)
		-0.025
Number of income sources		(.056)
		0.127
Consumption quintiles		
2nd	-0.192	-0.271
	(.159)	(.172)
3rd	-0.311**	-0.396**
	(.151)	(.165)
4th	-0.420***	-0.508***
	(.156)	(.174)
5th (richest)	-0.480***	-0.569***
	(.155)	(.172)
Observations	3,494	3,657

Note: Standard errors adjusted for clustering and stratification in parentheses. The regression reports average marginal effects, which are significant at * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The number of observations included in each model reflect the number of observations which are not missing any information on the covariates included; thus coefficients for models 1 and 2 are estimated using 3,494 and 3,657 households, respectively. The mean number of months facing food insecurity in this subsample is 0.87 months.

5. Conclusion

Overall, our findings show that NFE activity is seasonal and pro-cyclical with agriculture. NFEs both begin and exhibit they're highest operational activity during the main harvest period. Further exploratory analysis suggests this pro-cyclical seasonality is the result of two key factors; first, enterprise owners receive an influx of investment capital for their NFEs through harvest sales and, second, they react to an increase in local demand generated by agricultural income and seasonal purchasing power in the community. Furthermore, this interdependency between NFE operation and agricultural activity appears to matter across NFE sector, rural and small town households, and farm and nonfarm households, implying the pro-cyclical relationship is primarily demand-driven.

Our analysis also reveals that NFEs are unlikely to present households with effective consumption smoothing and risk mitigating opportunities. NFE income is not associated with a decreased likelihood of experiencing food insecurity nor with a shorter duration of food insecurity over the past 12 months, regardless of exposure to negative shocks over the same period. When interpreted in light of our findings on the strong links between NFEs and agricultural production, as well as the local nature of NFE markets, the result that NFEs do not significantly reduce household vulnerability to shocks is somewhat unsurprising. Dependency on seasonal local markets, which are highly susceptible to weather shocks, renders NFE households likewise exposed to risk. This further reduces the insurance potential of operating an NFE.

While the capacity of NFEs to generate income and provide a source of livelihood for rural and small town households is undisputed, our findings cast doubt on the temporal and consumption smoothing benefits of NFEs often presented in the literal. At least in the context of rural and small town Ethiopia, our results suggest that, in their current state, NFEs do not offer the buffer from food insecurity one might expect. Policies addressing food insecurity and other forms of vulnerability would be wise to not exclusively target the growth of non-farm enterprises as a means of protecting households from seasonal vulnerability.

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Appendix

Table S: Characteristics of NFEs 2

	Overall (1)	Small Town (2)	Rural (3)	Difference (2)-(3)
Age (Mean)	5.652 (.419)	8.302 (.668)	5.573 (.430)	3.271***
Age (Median)	2.153	4.153	2.153	
Number of HH workers	1.250 (.028)	1.463 (.065)	1.244 (.028)	0.219***
Number of hired workers	0.274 (.059)	0.353 (.069)	0.272 (.0617)	0.081
conditional on any hired workers	2.611 (.354)	2.107 (.333)	2.635 (.370)	-0.528
Total number of workers	1.537 (.060)	1.857 (.110)	1.528 (.062)	0.329**
Proportion of NFEs with a formal license	0.089 (.015)	0.298 (.046)	0.083 (.015)	0.215***
Gross entry rate	0.323 (.028)	0.175 (.025)	0.328 (.029)	-0.153***
Annual income per NFE (Mean)	2,552.2 (1,133.1)	1,524.6 (1,769.2)	2,582.3 (1,164.9)	-1,057.7
Annual income per NFE (Median)	700	1600	650	
N	1,337	352	985	

Standard errors corrected for clustering and stratification in parentheses. Standard errors are not reported for medians as we were unable to bootstrap in order to obtain them. This is due to the fact that there is little literature at the intersection of variance estimation in the presence of complex sample design and bootstrapping. We have attempted to use replicate weights, but median estimation using them was not possible.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Figure S1: Broader categories of NFE types

Processing and sale of agricultural by-products	(2)	Processing/sale of agricultural by-products (e.g. flour, excluding livestock by-products and fish)
Non-agricultural business	(1)	Non-agricultural services from home/ house-hold-owned shop (e.g. mechanic, tailor, barber)
	(4)	Sale of products/services offered on a street/in a market (e.g. firewood, mats, bricks)
	(5)	Professional office, professional services from home (e.g. doctor, translator, midwife)
	(6)	Transportation or moving services (e.g. driving a household-owned taxi or pick-up truck)
	(7)	Bar/restaurant ownership
Other	(3)	Trading business on a street/market
	(8)	Other non-agricultural business from home/on a street

Figure S2: Seasonality of Food Insecurity