Research article

Welfare impacts of non-farm employment in semi-arid areas: evidence from Burkina Faso[☆] Soumaïla Gansonré^{*}

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ABSTRACT

While several studies have linked rural welfare with non-farm employment, the available evidence suggests that whether participation in non-farm employment is welfare improving is intrinsically an empirical question. In addition, the existing literature places emphasis on food and total household expenditure such that there is a dearth of evidence as far as the role of non-food expenditure is concerned. Using household survey data from Burkina Faso, this paper shows that the extent of the impact varies with types of non-farm employment and household expenditure. The results show that participation in wage employment does not affect any type of expenditure. Non-farm self-employment during the dry season increases non-food expenditure but has no significant effect on food expenditure. Non-farm self-employment during both dry and cropping seasons, and total non-farm employment are associated with higher food and non-food expenditures, with higher impact on non-food expenditure. The general pattern of the results suggests that smallholder farmers tend to classify agriculture as the primary source of food while incomes from non-farm sources are preferably oriented towards non-food consumption. From a policy perspective, this shows that promoting the rural non-farm economy will improve welfare in the semi-arid areas. Potential areas of interventions include (i) implementation of the minimum guarantee wage scheme to improve earnings from wage employment and, (ii) development of a vibrant rural credit scheme to improve access to non-farm self-employment.

1. Introduction

Existing literature indicates that a buoyant rural non-farm sector fosters economic development (Dorosh and Thurlow, 2018; Diao and McMillan, 2018) and strengthens the livelihood of agricultural households (Barrett et al., 2001; Lanjouw and Lanjouw, 2001; Haggblade et al., 2010; Davis et al., 2017). Several studies have highlighted the contribution of non-farm employment to reduce poverty, vulnerability and food insecurity among rural households (Owusu et al., 2011; Fox and Sohnesen, 2016; Zereyesus et al., 2017; Dzanku, 2019; Bui and Hoang, 2020). If such evidence is already being mobilized to argue for a shift of anti-poverty policies from the emphasis on agricultural-based interventions towards building livelihood strategies that include the rural non-farm sector (Dzanku, 2019), there is more evidence that the benefit of non-farm employment is not obvious.

Indeed, empirical studies that have examined the association between non-farm employment and economic well-being have shown mixed results. While some authors have found that non-farm employment increases household well-being (Bezu et al., 2012; Scharf and Rahut, 2014; Hoang et al., 2014; Mishra et al., 2015), others have found it ineffective to protect households consumption (Porter, 2012; Rijkers and Söderbom, 2013) or that some types of non-farm employment decrease household consumption (Chang and Mishra, 2008; Chang and Yen, 2010). Apparently, the contribution of non-farm employment to economic well-being depends on the ability of participants to enter into more remunerative non-farm market niches (Scharf and Rahut, 2014). However, the distribution of enabling factors: assets, skills, networks, etc which shape non-farm participation is context specific. Whether non-farm employment improves economic well-being of smallholder households remains therefore contentious.

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This study contributes to the literature on the association between non-farm employment and economic well-being of smallholder households by exploring the effect of non-farm employment on food and non-food expenditures. Our contribution is twofold. First, prior studies have emphasized on food expenditure or total household expenditure and the question of whether rural non-farm employment also affects non-food expenditure of smallholder households remains uninvestigated. We disentangle the effect of non-farm employment on food and non-food expenditures. Second, we examine the effect of non-farm employment at different periods of the year, extending the contextual basis of empirical evidence. For instance, it is often argued that aggregation of different forms of non-farm employment partly explains some contradicting empirical findings (Scharf and Rahut, 2014). We show the extent to which participation in non-farm employment affects different sub-categories of household expenditure as well as the effect of working in the rural non-farm economy in the perspective of the seasonality. This is enabled by the uniqueness of our study area, which is characterized by a single rainy season over the year, allowing us to distinguish between non-farm employment that occurs during the dry season only, during the rainy season only, and during both dry and rainy seasons. As there may be some opportunity cost of working off the farm when labor is required on the farm (riskier but most profitable on average in rural areas), non-farm participants run the risk of obtaining lower returns than those who focus on farming (Gansonré, 2018). In addition, in the context of missing or imperfect credit markets, farm income may be used to finance low-return non-farm activities.

The empirical analysis uses repeated cross-sectional dataset of 3786 smallholder households from Burkina Faso. As we are using observational data and non-farm employment is not exogenously assigned, identifying the effect of non-farm employment is challenged by the presence of selection-based endogeneity given that smallholders may self-select themselves into non-farm employment (Emran and Shilpi, 2011; Clougherty et al., 2016). To address this potential source of bias, well-being and participation in non-farm employment are estimated simultaneously using linear regression with binary endogenous treatment. We found that non-farm self-employment during both dry and rainy seasons and total non-farm employment, positively affect both food and non-food expenditures. Non-farm self-employment during the dry season is found to be positively associated with non-food expenditure but has no significant effect on food expenditure. Wage employment does not have any significant effect on both types of expenditures. The general pattern of the results indicates a greater impact on household non-food expenditures. In line with some previous research, the results show that non-farm employment does not systematically improve well-being of smallholder households. For policymakers, this suggests that interventions aiming at improving well-being of smallholder households through the rural non-farm sector should address both entry barriers into and barriers to continued non-farm employment.

The remaining of the paper is organized as follows. In the next section, we present details of the contextual background of the research area. Section 3 presents the empirical approach to derive unbiased and consistent estimates. The data used and summary statistics of variables are discussed in section 4. Results are discussed in section 5 and section 6 concludes.

2. Settings and background

Understanding the contribution of non-farm employment to household welfare is particularly important in contexts where poverty and food insecurity are pervasive among smallholder households. In many developing countries like Burkina Faso, agricultural-based interventions have been slow reducing poverty and food insecurity. For instance, according to the National Institute of Statistics and Demography (INSD, 2017), poverty rate in Burkina Faso is estimated at more than 40%, with most of the poor (more than 90%) being smallholder households who rely on agricultural activities as a primary source of livelihood. Indeed, while

urban poverty has been around 17.5% between 1994 and 2014, poverty in the rural areas has been consistently above 50% over the same period, often reaching more than 70% in some areas (INSD, 2017; Ministry of Agriculture, 2017). The situation is the same as far as the state of food security is concerned. According to FAOSTAT (2019)¹, the prevalence of undernourishment and malnutrition in rural Burkina Faso is among the highest in the world.

This situation is explained by several factors, often interacting with each other, including the vagaries of weather, soil degradation, low uptake of modern agricultural technologies, poor agricultural infrastructure, etc (Reardon et al., 1992; Gansonré, 2018). The climatic conditions are also characterized by a single rainy season throughout the country. The length of the farming season varies from the northern to southern part of the country but remains shorter than the dry season in general. This feature of the rainy season offers farmers the opportunity to look for non-farm employment in response to production troughs but also to manage production risk ex-ante. Although this behavior appears as an opportunity to improve household well-being, there is no evidence to support this. Whether non-farm employment improves well-being depends on endowment in productive assets. Moreover, non-farm employment may directly compete with farming, affecting the household's achievable global returns.

Although prior studies have investigated the underlying factors that affect participation in non-farm employment (Reardon et al., 1992; Gansonré, 2019), only Reardon et al. (1992) have paid some attention to the effect of non-farm diversification on household level welfare indicators. However, the results of Reardon et al. (1992) are based on data from the early 1980s and now need to be updated. In addition, like research in other settings, the focus has been on food consumption. Finally, the focus was also on highlighting differences across agro-climatic zones. Both new and updated evidence on the nexus between non-farm employment and well-being are therefore important for policymaking in Burkina Faso and similar contexts.

3. Methodology

This section presents the empirical strategy to estimate the impact of non-farm employment on household expenditure. We emphasize on the statistical approach to derive unbiased and consistent estimates in the presence of selection-based endogeneity. To investigate the impact of non-farm employment on household expenditures, we specify the following equation:

$$h_{it} = \beta_0 + X_{it}'\beta_1 + \beta_2 F_{it} + \gamma_t + \varepsilon_{it} \quad (1)$$

where h_{it} represents food expenditure (or non-food expenditure) of household i in year t , X_{it} a vector of household socio-economic characteristics and geographic factors, F_{it} a dummy variable indicating whether any member of household i is engaged in the specified non-farm employment in year t or not. γ_t captures year fixed effect and ε_{it} is a stochastic error term. As indicated in section (1), participation is a decision made by the household and not a random assignment of the researcher. Whether $\widehat{\beta}_2$ is an unbiased and consistent estimate of the impact of participation in non-farm employment on household expenditure depends on whether corrective measures are undertaken to appropriately address the obvious selection-based endogeneity. This selection-based endogeneity is often presented as a sample-selection problem and the two-step approach is then used. Although the strategy to deal with this problem of self-selection is based on the Heckman procedure, the nature of the concerns associated with selection-based endogeneity is beyond sample-selection. In fact, the selection-based endogeneity present in Eq. (1) is of a different nature. Our outcome variables do not suffer from any truncation or censoring such that there is

¹ <http://www.fao.org/faostat/en/#country/233>.

no bias in the scope of the sample. For instance, in Eq. (1), the outcome variable h_{it} is observed for both $F_{it} = 1$ and $F_{it} = 0$. So, the endogeneity problem in this specification is rather a kind of threat to the internal validity given that some households may self-select themselves into one of the two mutually exclusive treatment and non-treatment groups (participating in non-farm employment versus not participating) based on unobservable characteristics that may be correlated with both outcome and the treatment variables.

Among the strategies that may be used to correct this selection bias, the latent variable approach is the most appropriate (Clougherty et al., 2016). In this approach, participation is modeled with a latent variable, assuming that participation is effective only if the latent variable exceeds some threshold. However, the problem associated with self-selection is more about the potential endogenous treatment that divides the sample into two sub-samples. We then model the participation equation as follows:

$$F_{it} = \begin{cases} 1 & \text{iff } F_{it}^* > 0 \\ 0 & F_{it}^* \leq 0 \end{cases} \quad (2)$$

with $F_{it}^* = \alpha Z_{it} + \mu_{it}$ where Z_{it} is a set of variables explaining the decision to participate in non-farm employment and μ_{it} a statistical error.

To put this into a more familiar context, we may model the decision to participate in non-farm employment based on a random utility framework (Gansonré, 2019). In year t , household i decides to work in non-farm employment by comparing the expected utility associated with participation (U_{it}^1) against the expected utility of not doing so (U_{it}^0). Although the utility associated with either option is not observable directly, it is reasonable to consider that the household has superior preference for the option with the greater utility; that is, the household chooses non-farm employment only if $U_{it}^1 > U_{it}^0$.

The latent variable is then observed when the expected utility from participation is greater than that of non-participation, that is, $U_{it}^1 > U_{it}^0 \Rightarrow F_{it} = 1$ and this may be expressed in terms of the conditional probability of participating: $P(F_{it} = 1) = P(U_{it}^1 > U_{it}^0)$. It is also common to assume that μ_{it} is normally distributed with mean 0 and variance σ_μ^2 . Eq. (2) therefore becomes a probit model and the variance-covariance matrix of the full model is given by:

$$\begin{pmatrix} \sigma_\varepsilon^2 & \rho\sigma_\varepsilon\sigma_\mu \\ \rho\sigma_\varepsilon\sigma_\mu & \sigma_\mu^2 \end{pmatrix} \quad (3)$$

where σ_ε^2 (respectively σ_μ^2) is the variance of the error term in the outcome (respectively the selection) equation and ρ the coefficient of correlation between the two error terms. Given that in the empirical framework, the selection bias arises from ε_{it} being correlated with μ_{it} , a $\rho \neq 0$ implies that Ordinary Least Squares (OLS) estimation of Eq. (1) is biased and inconsistent. On the other hand, a failure to reject the hypothesis that $\rho = 0$ implies that Eq. (1) should be estimated with OLS.

4. Data and summary statistics

4.1. Sources of data

Our analysis is based on household surveys conducted in 2011 and 2017 for the evaluation of phase II & III of the Programme National de Gestion des Terroirs (PNGT). The PNGT is a Community-based Rural Development Project launched in 2005 through a collaboration between the World Bank, the International Fund for Agricultural Development (IFAD) and the Ministry of Agriculture of Burkina Faso. The data used are from the last 2 survey rounds collected through the implementation of the second and the third phases of this project.

The data were collected nation-wide using multi-stage stratified sampling process in each round. The sampling starts with the

construction of three strata that divide all the 45 provinces of the country into: (i) provinces of direct intervention of the project, (ii) provinces indirectly affected by the project and, (iii) provinces unaffected by the project intervention. Using inverse probability to size to assure representativity at the national level, 2 to 7 villages were randomly selected per province. This resulted in 270 villages in total. In each village, 8 households were randomly selected, making a total sample of 2160 households. In each subsequent round, the previous sample was refreshed with a drop of 960 households which were replaced by new sub-sample selected using the above sampling strategy.

The same sampling methods and interview documents are used for both surveys. This enables us to consistently measure our variables of interest. Collected information are detailed enough to enable us to classify participation in non-farm employment based on the timing of the season, and to distinguish between wage employment and non-farm self-employment. We preferred to use this objective classification of the types of non-farm participation instead of classification based on subjective beliefs on the return to non-farm employment.

4.2. Variables and summary statistics

The primary outcome variables are per adult household food and non-food expenditures. The choice of expenditure per adult as the measure of household well-being is informed by the large empirical evidence that support the accuracy of measurement of consumption expenditure over measurement of income (Scharf and Rahut, 2014). Both expenditures are calculated based on information on consumption of agricultural and non-agricultural goods produced by the household, and goods purchased by the household. For each category of expenditure, the household reported goods that are purchased occasionally (once a year), then twice a year, quarterly and monthly. Expenditures made on the day to day basis were estimated as the monthly total. These detailed expenditures are aggregated into yearly food and non-food expenditures. Following the literature, we have excluded expenditures on large durable goods, jewelry, ceremonies, education and taxes. According to Dercon and Krishnan (2000), this narrowing of non-food expenditure avoids seasonal variations that may stem from large seasonal expenditures. However, inclusion of these expenditures did not show any significant changes in the results. The aggregated expenditures have been converted into daily per adult equivalent expenditure based on weighting of the World Health Organization (WHO) (see Dercon and Krishnan (1998)).

The key explanatory variable of interest is the decision to engage in non-farm employment or not. Non-farm activities are undertaken away from one's own farm, excluding work on farms of others within agriculture for wages or payment in kind. In this paper, wage employment refers to work for payment in non-agricultural activities. Self-employment covers the range of non-agricultural activities undertaken by households, mostly in the form of micro family enterprises. We first distinguish between participation in wage employment and holding a non-farm business. Further, we consider participation in non-farm self-employment in relation to the season: participation during the dry season, participation during rainy season and participation during both seasons. During the dry season, labor is not required on the farm in contrast to the rainy season. Households may then have more flexibility to allocate labor to non-farm employment. But during the rainy season, there is an opportunity cost to supplying labor to non-farm employment as they compete directly with farming activities. Households are then likely to keep running some businesses that were active during the dry season but not to start new ones.

Other household level control variables include, literacy, gender and the age of head, the number of male and female adults, and adult education. The age of the head is included to capture life-cycle effects. Most of the households did not attend any formal education (only 9% of the sampled households had some formal education). Given the importance of human capital in occupational choice and consumption decision, we

use a dummy for being literate or not and a dummy for having at least an adult with some formal education in the household. The number of male and female adults are included to capture the supply of labor by the household. Following [Scharf and Rahut \(2014\)](#), we have not considered livestock assets, wealth and children for endogeneity issues. Another factor that may play an important role in non-farm participation is idiosyncratic health shocks. For instance, health shocks during the rainy season may negatively affect farm outcomes and push households to look for supplementary non-farm income. In addition, during the dry season, health expenditure may reduce the household income and create incentives to look for non-farm work as well. However, we did not include idiosyncratic shocks for possible endogeneity between the health status of household members and household's well-being. We have rather focused on enabling factors such access to information (ownership of mobile phone or radio) and mobility assets (ownership of motorbike).

Community level factors include a dummy variable indicating whether the village of residence is accessible by vehicles all year round or not. We have also included the agro-ecological zoning, classifying households into the Sahel, the Soudano-Sahel and the Soudano-Guinea. The agro-ecological zones is based on the patterns of the rainfall distribution across the country and accounts for agricultural potential. Rainfall is highest in the Soudano-Guinea and lowest in the Sahel.

[Table 1](#) reports summary statistics of the outcome and key explanatory variables of interest for the pooled sample. The average expenditure is about 245 FCFA (about 0.5 USD) per adult per day, reflecting the prevalence of poverty among rural households. Food expenditure represents about 56% of the total expenditure. As household food expenditure includes own-consumption of produced agricultural commodities, this predominance of food expenditure is consistent with the subsistence nature of agriculture. This is also consistent with the situation poverty and food insecurity described in section (2).

As non-farm participation is concerned, the results indicate that it is relatively widespread. [Table 1](#) shows that about 65% of the sampled households are engaged in non-farm employment (either in wage employment or in non-farm self-employment). Participation in non-farm employment is dominated by self-employment in which 59% of the sampled households are involved. On the other hand, only 14% of the households are involved in wage employment. The prevalence of self-employment does not necessarily reflect a dynamic rural business environment. It may rather indicate a scarcity of good wage employment as argued [Bezu et al. \(2012\)](#) for rural Ethiopia.

As non-farm self-employment is concerned, [Table 1](#) suggests that participation in non-farm employment during the dry season is the most important, with 32% of households involved in this type of participation. Participation during both seasons is close to participation during the dry

season (30%). However, only 2% are involved in non-farm self-employment during the rainy season only. This is also the case of households that participate simultaneously in wage and self-employment (around 9%). This suggests that households are engaged in non-farm employment as a regular source of livelihood or as a complementary source of income when farm operations are completed. Given the small proportions of households engaged in the last two types of participation, we are not able to include them in the econometric analysis.

Further summary statistics are presented in [Table 2](#). Household heads are aged (the mean of the age is around 48 years) and mostly males (94%). Despite the low education among household heads, about 29% of them are literate and up to 22% of households have some educated adults. [Table 2](#) also reports that cellphones are available to 77% of the households, suggesting an increased access to information, while about 34% of households hold some motorbikes.

5. Results and discussion

For convenience, in this section we focus on the estimated coefficients of the impact of participation and report results for the selection equations and the full outcome equations in the appendix (Appendix A & B, respectively for food and non-food expenditures). We have also organized regression tables by category of household expenditure.

5.1. Non-farm participation and food expenditures

For all regressions, the Wald tests of independence between outcome and selection equations failed to reject the hypothesis that the two error terms are not correlated, except for wage employment. This suggests there are unobservable factors that affect both participation in non-farm self-employment and welfare. In addition, in all regressions, the Wald statistics of joint significance of the model also indicate a good fit of the estimated models. However, the rejection of the hypothesis on the correlation between wage employment and food expenditure, suggests that the impact of wage employment on food expenditure should be estimated by OLS.

Estimates of the impact of non-farm employment on food expenditure are presented in [Table 3](#). In column (1) and (2), we present the estimated coefficients of participation in wage employment by OLS and by Linear Regression with Endogenous Treatment (LRET). In column (3) and (4), we use non-farm self-employment during the dry season and non-farm employment during both dry and farming seasons as dependent variables. These two categories are then mutually exclusive. In the last column, we use a single dummy to capture the impact of total non-farm employment.

Table 1. Summary statistics: outcome and key independent variables.

Variables	Mean	s.d	Median
Wage employment	0.14	0.35	0.00
Participation in NFSE: dry season only	0.32	0.47	0.00
Participation in NFSE: rainy season only	0.02	0.15	0.00
Participation in NFSE: both seasons	0.30	0.46	0.00
Total participation in NFSE	0.59	0.49	1.00
Total participation in NFE	0.65	0.48	1.00
Participation in NFSE & wage employment	0.08	0.27	0.00
Food expenditure	137.79	116.50	107.41
Non-food expenditure	106.92	102.11	77.31
Household expenditure	244.71	190.38	200.85

Notes: Calculation of the author based on PNGT II & III survey data. In [Table 1](#), household expenditures are per adult equivalent per day in FCFA (1 USD ≈ 500 FCFA). Our adult equivalence scale is based on the World Health Organization weighting ([Dercon and Krishnan, 1998](#)). NFSE stands for non-farm self-employment, NFE for non-farm employment.

Table 2. Summary statistics of other control variables.

Variables	Mean	s.d	Median
Age of the head (years)	48.05	14.26	47.00
Head is male (1 = yes)	0.94	0.24	1.00
Head is literate (1 = yes)	0.29	0.45	0.00
Number of male adults	1.89	1.37	2.00
Number of female adults	2.28	1.57	2.00
Adult education (1 = presence of adults with some education)	0.22	0.42	0.00
Ownership of motorbike (1 = yes)	0.34	0.47	0.00
Ownership of cellphone (1 = yes)	0.77	0.42	1.00
Village is accessible all year (1 = yes)	0.23	0.42	0.00
Village is accessible only in dry season (1 = yes)	0.40	0.49	0.00
Soudanian zone	0.61	0.49	1.00
Soudano-sahelian zone	0.25	0.43	0.00

Notes: Calculation of the author based on PNGT II & III survey data. Adults are household members of prime working age (between 15 and 65 years).

Table 3. Estimates of the impact of non-farm participation on food expenditure.

	(1)	(2)	(3)	(4)	(5)
Wage employment (OLS)	0.004 (0.11)				
Wage employment		0.274 (0.68)			
NFSE: dry season only			-0.870 (-1.26)		
NFSE: both seasons				0.717*** (8.48)	
Total NFE					0.566*** (5.34)
Observations	3734	3734	3734	3707	3707
Wald	583.20	479.93	401.76	517.78	481.63
R-squared	0.14				
Correlation of error terms (ρ)		-0.20	0.68	-0.49	-0.36
Wald test of endogeneity (p-value)		0.24	0.00	0.00	0.00

Notes: Significance level: *** 1%, ** 5%, * 10%. t-statistics are in brackets. Standard errors are bootstrapped with 1000 replications. In all regressions, the dependent variable is the logarithm food expenditure per adult per day. NFSE stands for non-farm self-employment and NFE for non-farm employment. Other control variables include, age (and its squared), gender and literacy of household head; the number of male and female adults, and year and location fixed-effect. We use different instruments for different types of participation. For wage employment, instruments are the number of adults with some education, the ownership of motorbike and whether the village is accessible all year round by transport vehicles. For participation during the dry season, instruments are accessibility during both seasons or during dry season only. For participation during both seasons and total participation, we use the same instruments: access, ownership of motorbike, mobile phone, and distance to nearest paved road.

Column (1)–(3) of Table 3 suggest that participation in wage employment and participation in non-farm self-employment during the

dry season do not affect household food expenditure. However, participation in non-farm self-employment during both dry and farming seasons has a positive and significant effect on household food expenditure (column (4)). The positive effect of total employment observed in column (5) seems to be driven by the effect of this type of non-farm employment. For comparison, Figure 1 is a plot of the sizes of the magnitudes.

The distribution of the impacts is consistent with previous literature. For instance, Reardon et al. (1992); Chang and Mishra (2008); Chang and Yen (2010); Mishra et al. (2015) have found positive associations between non-farm employment and food expenditure in Burkina Faso, Taiwan and Bangladesh respectively. Bezu et al. (2012); Scharf and Rahut (2014) have also found that non-farm employment increases household expenditure in rural Ethiopia. These results also indirectly support empirical findings on the impact of non-farm employment on food security (Babatunde and Qaim, 2010; Imai et al., 2015; Tsiboe et al., 2016; Dzanku, 2019; Rahman and Mishra, 2020) and vulnerability to food insecurity (Imai et al., 2015; Zereyesus et al., 2017; Bui and Hoang, 2020).

However, as argued in section (1), not all types of non-farm employment are expected to be welfare improving. The results show that wage employment and non-farm employment during the dry season do not significantly affect food expenditure. These results are closer to findings by Scharf and Rahut (2014) which show the impact of non-farm employment to be positive and significant only for high return non-farm activities. Similar to their classification, we may consider wage employment and non-farm employment during the dry season as low-return for some reasons. First, given the prevalence of low level of education and work skills, it is likely that most wage employment are unskilled work which happens to be low paid (Bezu et al., 2012). Second, activities undertaken through the year are likely to be more profitable than activities undertaken during the dry season only. For instance, the opportunity cost of working off one's farm during the cropping season is higher given the direct competition for farm labor. Households are therefore likely to engage in, during cropping season, activities for which returns to labor are relatively higher than what might be obtained from the farm.

Figure 1. Estimated impacts of different types of NFE on household food expenditure. Notes: calculation of the author based on PNGT II & III survey data. NFSE stands for non-farm self-employment. NFE for non-farm employment.

Table 4. Estimates of the impact of non-farm participation on non-food expenditure.

	(1)	(2)	(3)	(4)
Wage employment	0.894 (1.46)			
NFSE: dry season only		0.605*** (2.61)		
NFSE: both seasons			1.222*** (26.85)	
Total NFE				1.186*** (25.68)
Observations	3734	3786	3707	3707
Wald	603.81	573.34	1341.44	1234.79
Correlation of error terms (ρ)	-0.62	-0.47	-0.76	-0.75
Wald test of endogeneity(p-value)	0.00	0.00	0.00	0.00

Notes: Significance level: *** 1%, ** 5%, * 10%. t-statistics are in brackets. Standard errors are bootstrapped with 1000 replications. In all regressions, the dependent variable is the logarithm of non-food expenditure per adult per day. NFSE stands for non-farm self-employment and NFE for non-farm employment. Other control variables include, age (and its squared), gender and literacy of household head; the number of male and female adults, and year and location fixed effect. We use different instruments for different types of participation. For wage employment, instruments are the number of adults with some education, the ownership of motorbike and whether the village is accessible all year round by transport vehicles. For participation during the dry season, instruments are accessibility during both seasons or during dry season only. For participation during both seasons and total participation, we use the same instruments: access, ownership of motorbike, mobile phone distance to nearest paved road.

The results show that all types of non-farm self-employment are associated with higher non-food expenditure in contrast to wage employment which does not affect non-food expenditure. Figure 2 plots the estimated magnitudes of the impacts. They are highest for self-employment during both seasons. The magnitudes are also higher for non-food expenditure as compared to the impact on food expenditure (almost double). This positive impact of non-farm self-employment during the dry season does not contradict the argument of lower return raised in section 5.1. Our context is particularly characterized by missing credit markets such that households who abandon their businesses during the farming season may have to spend some of the farm income (this may include early sales of crops when prices are low) to resume old businesses or start new ones. This may reduce farm produce that is available for consumption. Therefore, part of the returns from the non-farm business may be used to supplement food consumption (and this includes buying crops later when prices are high), constraining the budget allowable to food items.

This general pattern of greater impact of non-farm participation on non-food expenditure suggests that households prioritize income allocation according to the source. The primary use of income from non-farm employment might be the purchase of non-farm goods. This is plausible in agrarian settings characterized by a predominance of subsistence rain-fed farming carried out over a single cropping season. While farming may be the primary source of food consumed by the household, non-farm employment (when available) may be the preferred source of income for non-food consumption. This is particularly important as crop commercialization remains limited (Ouedraogo et al., 2018). As they highlighted with the PNGT 2011 data, about 45% of farmers do not sell any crop. Further, the prevalence of food insecurity (FAOSTAT, 2019)² together with the low commercialization of staple crops suggests that only

Figure 2. Estimated impacts of different types of NFE on household non-food expenditure. Notes: calculation of the author based on PNGT II & III survey data. NFSE stands for non-farm self-employment. NFE for non-farm employment.

5.2. Non-farm participation and non-food expenditure

Estimates of the impacts of participation in non-farm participation employment on non-food expenditure are presented in Table 4. As far as non-food expenditure is concerned, the Wald test of independence between outcome and selection equations is rejected for all regressions. Accordingly, LRET is used.

few households may produce a surplus that may be traded to purchase non-agricultural goods. The rural non-farm economy therefore seems to provide an avenue to supplement household food consumption with non-food consumption. Given that many households are unlikely to obtain

² <http://www.fao.org/faostat/en/#country/233>.

enough food from the farm, it also offers an avenue for food consumption. The distribution of impact also suggests that it is possible to classify non-farm employment by return based on the timing of participation.

6. Conclusion

Significant literature has investigated the importance of the rural non-farm economy in the livelihood of agricultural households in both developed and developing countries. Participation in non-farm employment has been found to be associated with better income and food security outcomes. However, its impact on well-being has less consensus. Many point to the role of heterogeneity while others have focused on food and total expenditure. The question of whether participation in non-farm employment also affects other types of expenditures, such as non-food expenditure, of smallholder farm households remains unaddressed.

This paper examines the impact of non-farm employment on both food and non-food expenditures of smallholder households using a large dataset from a developing country –Burkina Faso. We take advantage of the uniqueness of the settings to disaggregate non-farm participation into several sub-categories: participation in wage employment and participation in non-farm self-employment. For non-farm self-employment, we further distinguish between non-farm employment during the rainy season, or during the dry season, or during both seasons simultaneously. LRET are used to address the selection-based endogeneity associated with non-farm employment.

The results indicate that the impact of non-farm employment depends on the type of participation and the type of household expenditure. Participation in wage employment does not affect any type of household expenditure. Non-farm self-employment during the dry season positively affects non-food expenditure but does not have a significant effect on food expenditure. Participation during both dry and cropping seasons, and total non-farm employment are associated with higher food and non-food expenditures. The general pattern of the results is consistent with previous findings in other contexts. They particularly emphasize (i) a potential prioritization with farmers likely to classify agriculture as the primary source of food and non-farm employment (when available) as the most preferred source of income for non-food consumption; (ii) the possibility of building policy interventions aiming to improve livelihoods based on the type of participation. Therefore, while agricultural-based interventions may seek to enhance agricultural productivity for the sake of better food security, a development of the rural non-farm economy has the potential to increase non-food consumption, and then welfare of smallholder households. This is very important given its contribution to food consumption as well. Potential areas of interventions include (i) implementation of the minimum guaranteed wage to improve earnings from wage employment and, (ii) development of a vibrant rural credit scheme to improve access to non-farm self-employment.

Declarations

Author contribution statement

Soumaïla Gansonré: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix A. A participation in non-farm employment and food expenditure

Table A.1. Participation in wage employment and food expenditure: LERT.

	Food Expenditure	Wage Employment
Head is male	-0.018 (-0.31)	0.191 (1.31)
Age of the head	-0.009 (-1.46)	-0.041*** (-3.89)
Age of the head × Age of the head	0.000 (1.11)	0.000*** (3.57)
Head is literate	0.010 (0.35)	0.067 (1.08)
Number of male adults	-0.071*** (-5.70)	0.081*** (3.78)
Number of female adults	-0.050*** (-4.42)	-0.005 (-0.28)
Year	-0.462*** (-18.21)	-0.105 (-1.61)
Soudano-sahelian	0.076 (1.44)	-0.410*** (-4.76)
Soudanian	-0.015 (-0.37)	-0.291*** (-4.20)
Wage employment	0.274 (0.68)	
Ownership of motorbike		0.078 (0.82)
Adult education		0.007 (0.11)
Village is accessible all year		0.155** (2.51)
Constant	5.384*** (25.35)	-0.138 (-0.47)
Observations	3734	
Wald	479.93	
Correlation of error terms (ρ)	-0.20	
Wald test of endogeneity (p-value)	0.24	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table A.2. Participation in wage employment and food expenditure: OLS.

	(1)
Wage employment	0.004 (0.11)
Head is male	-0.059 (-1.01)
Age of the head	-0.011** (-2.13)
Age of the head × Age of the head	0.000* (1.81)
Head is literate	-0.005 (-0.20)
Number of male adults	-0.072*** (-6.87)

(continued on next page)

Table A.2 (continued)

	(1)
Number of female adults	-0.059*** (-5.33)
Ownership of motorbike	0.110*** (4.42)
Ownership of cellphone	0.165*** (5.65)
Adult education	0.000 (0.02)
Village is accessible all year	0.010 (0.36)
Year	-0.528*** (-20.58)
Soudano-sahelian	0.047 (1.27)
Soudanian	-0.038 (-1.19)
Constant	5.408*** (36.87)
Observations	3734
R-squared	0.14

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table A.3. Participation in non-farm self-employment and food expenditure: dry season only.

	Food Expenditure	NFSE dry season only
Head is male	0.019 (0.28)	0.131 (1.25)
Age of the head	-0.010* (-1.71)	0.006 (0.59)
Age of the head × Age of the head	0.000 (0.79)	-0.000 (-1.35)
Head is literate	0.040 (1.09)	0.102** (2.00)
Number of male adults	-0.076*** (-5.38)	-0.036* (-1.80)
Number of female adults	-0.038** (-2.48)	0.036** (2.20)
Year	-0.556*** (-7.39)	-0.294*** (-6.34)
Soudano-sahelian	-0.009 (-0.15)	-0.173** (-2.27)
Soudanian	-0.040 (-1.08)	-0.017 (-0.27)
NFSE: dry season only	-0.870 (-1.26)	
Village is accessible all year		0.101* (1.75)
Village is accessible dry season		0.056 (1.21)
Constant	5.804*** (19.13)	-0.439 (-1.59)
Observations	3734	
Wald	401.76	
Correlation of error terms (ρ)	0.68	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table A.4. Participation in non-farm self-employment and food expenditure: both seasons.

	Food Expenditure	NFSE: dry season only
Head is male	-0.015 (-0.25)	-0.122 (-1.23)
Age of the head	-0.017*** (-2.85)	0.024*** (2.67)
Age of the head × Age of the head	0.000** (2.50)	-0.000*** (-2.86)
Head is literate	-0.040 (-1.34)	0.176*** (3.60)
Number of male adults	-0.072*** (-6.51)	0.013 (0.70)
Number of female adults	-0.060*** (-5.48)	0.016 (0.98)
Year	-0.479*** (-18.70)	-0.082* (-1.73)
Soudano-sahelian	-0.003 (-0.07)	0.197*** (2.77)
Soudanian	-0.058* (-1.73)	0.080 (1.25)
NFSE: both seasons	0.717*** (8.48)	
Village is accessible all year		0.061 (1.20)
Ownership of motorbike		0.230*** (5.06)
Ownership of cellphone		0.335*** (5.91)
Nearest paved road (Km)		-0.000 (-0.50)
Constant	5.458*** (33.65)	-1.457*** (-5.78)
Observations	3707	
Wald	517.78	
Correlation of error terms (ρ)	-0.49	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table A.5. Participation in non-farm self-employment and food expenditure.

	Food Expenditure	NFE
Head is male	-0.048 (-0.82)	0.048 (0.52)
Age of the head	-0.012** (-2.09)	0.001 (0.13)
Age of the head × Age of the head	0.000* (1.95)	-0.000 (-1.02)
Head is literate	-0.031 (-1.06)	0.200*** (3.88)
Number of male adults	-0.067*** (-6.38)	0.002 (0.11)
Number of female adults	-0.060*** (-5.44)	0.023 (1.35)
Year	-0.430*** (-17.00)	-0.289*** (-5.88)
Soudano-sahelian	0.086** (2.28)	-0.197*** (-2.72)
Soudanian	-0.011	-0.144**

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Table A.5 (continued)

	Food Expenditure	NFE
	(-0.33)	(-2.15)
Total NFE	0.566***	
	(5.34)	
Village is accessible all year		0.097*
		(1.90)
Ownership of motorbike		0.184***
		(3.80)
Ownership of cellphone		0.247***
		(4.11)
Nearest paved road (Km)		-0.001**
		(-2.14)
Constant	5.112***	0.474*
	(29.09)	(1.77)
Observations	3707	
Wald	481.63	
Correlation of error terms (ρ)	-0.36	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

B Participation in non-farm employment and non-food expenditure

Table B.1. Participation in wage employment and non-food expenditure: LRET.

	non-Food Expenditure	Wage Employment
Head is male	-0.000	0.111
	(-0.00)	(0.67)
Age of the head	-0.014*	-0.041***
	(-1.79)	(-3.99)
Age of the head $\times$ Age of the head	0.000	0.000***
	(0.94)	(3.69)
Head is literate	0.120***	0.037
	(4.03)	(0.52)
Number of male adults	-0.060***	0.074***
	(-3.77)	(3.49)
Number of female adults	-0.018*	-0.013
	(-1.83)	(-0.69)
Year	0.461***	-0.160**
	(16.49)	(-2.34)
Soudano-sahelian	0.198***	-0.430***
	(2.97)	(-4.78)
Soudanian	0.119**	-0.311***
	(2.21)	(-4.49)
Wage employment	0.894	
	(1.46)	
Ownership of motorbike		0.336
		(1.35)
Adult education		0.039
		(0.59)
Village is accessible all year		0.173***
		(2.69)
Constant	4.509***	-0.077
	(16.36)	(-0.26)
Observations	3734	
Wald	603.81	
Correlation of error terms (ρ)	-0.62	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table B.2. Participation in non-farm self-employment and non-food expenditure: dry season only.

	non-Food Expenditure	NSFE: dry season only
Head is male	-0.021	0.061
	(-0.38)	(0.61)
Age of the head	-0.024***	0.007
	(-4.60)	(0.73)
Age of the head $\times$ Age of the head	0.000***	-0.000
	(3.53)	(-1.52)
Head is literate	0.120***	0.112**
	(4.05)	(2.33)
Number of male adults	-0.037***	-0.032
	(-3.34)	(-1.63)
Number of female adults	-0.027***	0.037**
	(-2.72)	(2.32)
Year	0.485***	-0.273***
	(14.27)	(-6.17)
Soudano-sahelian	0.174***	-0.216***
	(4.22)	(-3.01)
Soudanian	0.068**	-0.036
	(2.00)	(-0.58)
NSFE: dry season only	0.605***	
	(2.61)	
Village is accessible all year		0.205***
		(3.15)
Village is accessible dry season		0.090*
		(1.69)
Constant	4.674***	-0.439*
	(28.10)	(-1.71)
Observations	3786	
Wald	573.34	
Correlation of error terms (ρ)	-0.47	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table B.3. Participation in non-farm self-employment and non-food expenditure: both seasons.

	non-Food Expenditure	NSFE: both seasons
Head is male	0.040	-0.190**
	(0.62)	(-1.99)
Age of the head	-0.030***	0.022**
	(-5.24)	(2.46)
Age of the head $\times$ Age of the head	0.000***	-0.000**
	(4.17)	(-2.50)
Head is literate	0.040	0.131***
	(1.24)	(2.68)
Number of male adults	-0.055***	0.005
	(-4.61)	(0.27)
Number of female adults	-0.034***	-0.001
	(-3.35)	(-0.07)
Year	0.424***	-0.171***
	(14.51)	(-3.76)
Soudano-sahelian	0.028	0.140**
	(0.65)	(2.03)
Soudanian	0.017	0.028
	(0.46)	(0.45)

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Table B.3 (continued)

	non-Food Expenditure	NSFE: both seasons
NFSE: both seasons	1.222*** (26.85)	
Village is accessible all year		0.073 (1.64)
Ownership of motorbike		0.432*** (10.94)
Ownership of cellphone		0.515*** (11.09)
Nearest paved road (Km)		-0.001 (-1.43)
Constant	4.771*** (29.35)	-1.381*** (-5.69)
Observations	3707	
Wald	1341.44	
Correlation of error terms (ρ)	-0.76	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

Table B.4. Participation in non-farm self-employment and non-food expenditure.

	non-Food Expenditure	NFE
Head is male	-0.027 (-0.41)	-0.064 (-0.72)
Age of the head	-0.022*** (-3.64)	0.001 (0.12)
Age of the head $\times$ Age of the head	0.000*** (3.09)	-0.000 (-0.89)
Head is literate	0.037 (1.14)	0.166*** (3.29)
Number of male adults	-0.048*** (-3.91)	-0.003 (-0.14)
Number of female adults	-0.037*** (-3.49)	0.007 (0.40)
Year	0.524*** (18.61)	-0.382*** (-8.09)
Soudano-sahelian	0.192*** (4.38)	-0.200*** (-2.85)
Soudanian	0.105*** (2.80)	-0.148** (-2.31)
Total NFE	1.186*** (25.68)	
Village is accessible all year		0.076* (1.75)
Ownership of motorbike		0.414*** (10.39)
Ownership of cellphone		0.471*** (10.63)
Nearest paved road (Km)		-0.001*** (-2.86)
Constant	4.031*** (23.38)	0.401 (1.55)
Observations	3707	
Wald	1234.79	
Correlation of error terms (ρ)	-0.75	
Wald test of endogeneity (p-value)	0.00	

Notes: Significance level: *** 1%, ** 5%, * 10%. Standard errors are bootstrapped with 1000 replications.

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