

Ba, Mamoudou; Anwar, Amar; Mughal, Mazhar

Article — Published Version

Non-farm employment and poverty reduction in Mauritania

Journal of International Development

Provided in Cooperation with:

John Wiley & Sons

Suggested Citation: Ba, Mamoudou; Anwar, Amar; Mughal, Mazhar (2021) : Non-farm employment and poverty reduction in Mauritania, Journal of International Development, ISSN 1099-1328, Wiley, Hoboken, NJ, Vol. 33, Iss. 3, pp. 490-514, <https://doi.org/10.1002/jid.3533>

This Version is available at:

<https://hdl.handle.net/10419/241861>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<http://creativecommons.org/licenses/by-nc/4.0/>

Non-farm employment and poverty reduction in Mauritania

Mamoudou Ba¹ | Amar Anwar^{2,3}  | Mazhar Mughal⁴ 

¹CATT, University of Pau, Pau, France

²Shannon School of Business, Cape Breton University, Sydney, Nova Scotia, Canada

³International SEPT Program, Leipzig University, Leipzig, Germany

⁴Department of Finance, Pau Business School, Pau, France

Correspondence

Amar Anwar, International SEPT Program, Leipzig University, Leipzig, Germany.
Email: amar_anwar@cbu.ca

Funding information

Cape Breton University, Grant/Award Number: RISE8173

Abstract

This study examines the effect of non-farm labour participation on poverty reduction in rural Mauritania. Farm households with more land and livestock participate to a greater extent in non-farm activities compared with households with smaller land or cattle. We study poverty's relationship with non-farm labour activities in terms of the incidence as well as the intensity and severity of poverty. The study is the first to highlight the contribution of the non-agricultural sector in the reduction of poverty in the rural areas of Mauritania. We apply probit, propensity score matching and inverse probability weighting techniques to determine the signs and impacts of participation on poverty reduction. The results show that the probability of being poor is 5.9% lower among households that have at least one member participating in non-farm activities compared with those only associated with the agriculture sector. Participation in non-farm activities is associated with lower intensity and severity of poverty (3.6% and 1.9%, respectively). We find that surplus labour released by the agriculture sector is absorbed in the non-farm economy. Income generation through diversification into non-farm activities therefore seems to be an effective way to reduce poverty in rural areas.

KEYWORDS

Africa, Mauritania, non-farm employment, poverty

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes. © 2021 The Authors. *Journal of International Development* published by John Wiley & Sons Ltd.

JEL CLASSIFICATION

I30; O18; Q12; Q16; Q19; R11

1 | INTRODUCTION

Poverty reduction has over the years been a major concern for researchers, development practitioners and policymakers. Governments of developing countries along with development agencies and financial institutions such as the World Bank, the Asian Development Bank and the African Development Bank devised policies targeted to reduce poverty with particular focus on rural areas. These policies mostly deal with agriculture and provide incentives to farmers. For example, since the 2000s, the Mauritanian government has launched initiatives such as the Poverty Reduction Strategy Paper (PRSP) and Special Intervention Programme (PSI) with the assistance of international organisations in order to set up social safety nets and fight poverty. Debts worth US\$7 million owing to small farmers were cleared in order to reduce poverty and improve the livelihood of rural households. Similarly, the World Bank provided support to the Oasis Mutual Credit institutions by providing training and supervision to enhance the output of oasis agriculture. Other interventions and policies framed for improving agricultural output and combating poverty in the rural areas include the agropastoral policy law, the Rural Sector Development Strategy for 2025 (SDSR) and the National Agricultural Development Plan for the period 2015–2025 (PNDA). Nonetheless, the World Bank (2018) reported that government policies to foster the Mauritanian agriculture sector had not been greatly successful and had shown mixed outcomes in recent decades. In spite of the substantial increase in public allocations to the agriculture sector since the 2000s, Mauritania's agriculture output still covers only 30% of the country's food needs. Financial support provided through bank loans and microfinance is insufficient and requires guarantees that farm households find difficult to provide (World Bank, 2019b). Consequently, the productivity of the agriculture sector remains low, rendering it unable to meet the food needs of the growing rural population (Ba & Mughal, 2020; World Bank, 2018). Weather fluctuations pose an additional challenge. The country's farming largely depends upon adequate rainfall. About 80% of the country's surface area is arid. The country faces drought every 3 years on average (Famine Early Warning Systems Network [FEWS NET], 2013). Rainfall is highly variable over time and space, increasing from 50 mm in the north to 600 mm in the south. Although the livestock sector is in surplus and accounts for most of the food consumption providing meat and milk, production techniques are largely traditional and lack modern technology (MDR, 2004). Lack of rainfall and the recurrence of droughts in recent decades have considerably reduced agricultural output and aggravated hunger. As a result, poor households increasingly face extreme shocks with long-lasting consequences. Under sustained exposure to shocks and a steady decline in livelihoods to cope with these shocks, households must decide on new coping strategies to ensure future household well-being (Bryan et al., 2013). Households are more likely to adopt income diversification strategies by participating in the non-farm sector (Barrett et al., 2001). Mauritanian rural households are reported to be increasingly turning to non-farm activities for employment (*Office Nationale de la Statistique* [ONS], 2017; World Bank, 2018). The share of agricultural labour in the country's workforce has been falling since the 1990s (Figure 1). About half (55.3%) of the country's labour is currently associated with agriculture (World Bank, 2019a). Trade and sales activities occupy a predominant place in non-farm activities in rural Mauritania. As shown in Table 1, with the exception to food and craft industries, men engaged in non-farm activities are mostly employed in primary and secondary occupations. By engaging in off-farm activities, rural households have more opportunities to effectively respond to climate shocks, weather variability and seasonal agricultural shortages. This is of particular relevance to women who are usually employed in food and handicrafts sectors (ONS, 2014; World Bank, 2016).

A growing body of literature investigates the role of non-farm activities in reducing poverty and enhancing the standard of living of rural households. For example, Lanjouw (1999) finds an improvement in the poor income levels of Ecuador as a result of the enhancement of non-farm employment in the country. Similar effects are reported by

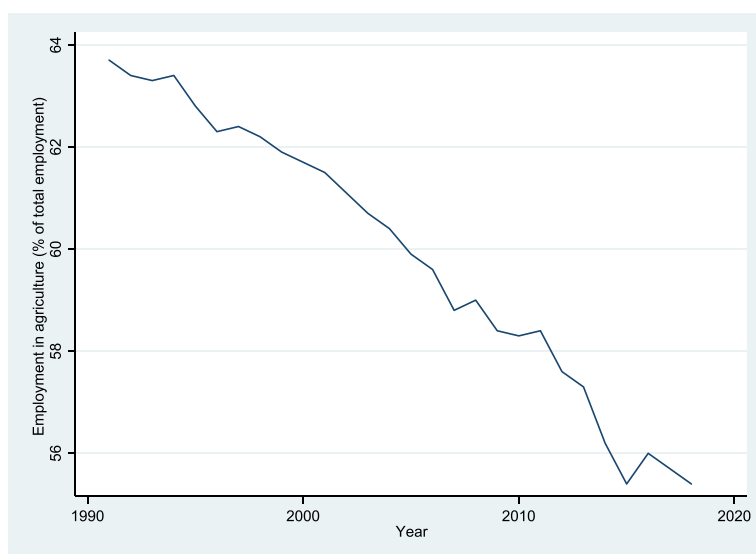


FIGURE 1 Employment in agriculture (% of total employment).
Source: World Bank (2019)
[Colour figure can be viewed at wileyonlinelibrary.com]

Source: World Bank (2019)

TABLE 1 Percentage of rural individuals participating in non-farm economy by sectors, genders and occupations

Sector	Principal occupations (%)		Secondary occupations (%)		
	Male	All	Male	Female	All
Mining and extraction ^a	1.02	0.67	1.19	0	0.87
Food industry	0.43	1.12	0.79	5.65	2.09
Artisanal industry	0.81	1.96	1.03	6.09	2.39
Building and public works	7.87	5.19	10.72	0.43	7.97
Transport	3.83	2.56	5.64	0	4.13
Communications	0.27	0.18	0.32	0	0.23
Trade/sale	46.25	42.23	37.33	46.3	39.73
Services	13.15	12.31	16.76	17.61	16.99
Education	5.34	4.49	6.51	4.35	5.93
Health	0.81	1.05	1.11	2.39	1.45
Administration	1.78	1.61	2.14	1.96	2.09
Other	18.44	26.62	16.44	15.22	16.11
Total	100	100	100	100	100

Source: Author's calculations using EPCV-2014.

^aThe number of observations for extraction is small and should be interpreted with caution.

De Janvry et al. (2005) in the case of China where non-farm activities are found to produce a positive effect on the farm production of the rural households. Lanjouw and Murgai (2009) find similar results for India. They report that non-farm sector expansion in rural India is associated with falling poverty, non-farm employment growth and increasing agricultural wages.

In this study, we examine the effect of non-farm labour participation on poverty reduction in rural Mauritania using data from the 2014 Permanent Survey on Household Living Conditions (EPCV) household survey. We examine the relationship, not only in terms of incidence but also in terms of the intensity and severity of poverty. To our knowledge, this is the first study to highlight the contribution of non-farm economy in rural poverty reduction in the context of Mauritania. We come up with evidence supporting strong poverty alleviation effects of non-farm activities. The probability of being poor is found to be 5.9% lower among households with at least one member participating in non-farm activities compared with those only associated with the agricultural sector. Non-farm participation is also associated with 3.6% and 1.9% lower intensity and severity of poverty among farm households.

The rest of the document is organised as follows. Section 2 briefly overviews relevant literature. Section 3 presents the background and data in the context of Mauritania. The same section also gives details on the methodology and descriptive statistics. Results are discussed in Section 4 followed by sensitivity and robustness measurements. Section 5 concludes the study.

2 | BRIEF LITERATURE REVIEW

In the absence of adequate access to agricultural credit and crop insurance, off-farm employment remains a crucial coping strategy for farm households in the developing countries (Adjognon et al., 2017; Ali & Peerlings, 2012; Zereyesus et al., 2017). Non-farm activities such as self-employment and small services are important sources of income for rural households (Escobal, 2001). Diversification of income-generating activities improves the livelihoods of rural households by increasing household income and consumption (AloboLoison, 2015; Barrett et al., 2001), thereby contributing to reduction in rural poverty (Ackah, 2013; Corral & Reardon, 2001; Reardon et al., 1992). In the households engaged in both farm and non-farm activities, off-farm income serves as a safety net allowing the household to cope with financial shocks caused by crop failures or seasonal variations (Scharf & Rahut, 2014; Stifel, 2010).

A number of studies have examined the role of non-farm activities in the rural economy. Dedehouanou et al. (2018), for instance, show that participation in off-farm self-employment leads to an increase in expenditure on agricultural inputs leading to higher agricultural productivity. This, in turn, results in an increase in agricultural production and improved income among poor farm households. Likewise, Adjognon et al. (2017) demonstrate that non-farm wage employment and non-farm self-employment improve welfare and reduce poverty through greater use of agricultural inputs that enhance the agricultural production of rural households. Non-farm income allows the poor farmers to adjust agricultural production practices, including the adoption of alternative labour-saving technologies such as herbicides and mechanisation (Dedehouanou et al., 2018; Nisrane et al., 2016). Corral and Reardon (2001) and Ackah (2013) show that non-farm activity is a significant factor in poverty reduction in Sub-Saharan Africa, providing significant income to the poor through increased labour intensity. Similarly, Timothy (2011) examines the role of non-farm activities in rural Nigeria and finds that diversification from subsistence farming into non-farm activities reduces poverty. Although the non-farm sector is not the dominant sector in Nigeria, it plays a significant role in creating employment opportunities among rural households and generating income.

Adams (1994) and De Janvry and Sadoulet (2001) argue that participation in off-farm employment reduces rural poverty by equalising income distribution and reducing household income inequalities in rural communities. This has a positive net effect on food security and nutrition, particularly for households living in areas with low agro-ecological potential (Rahman & Mishra, 2020; Zereyesus et al., 2017). Households with access to non-farm income are less prone to the low prevalence of stunting, underweight and wasting among children in areas with high levels of food insecurity (Babatunde & Qaim, 2010). Zereyesus et al. (2017) and Ali and Peerlings (2012) likewise report that income from non-farm activities reduces the vulnerability to food poverty of the farm households living in resource-poor areas. Women's participation in non-agricultural activities is the largest contributor to the availability of food nutrients in developing country households (Rijkers & Costa, 2012; Tsiboe et al., 2016; Van den Broeck &

Kilic, 2019), and off-farm income is strongly associated with greater food security in poor female-headed households (Dzanku, 2019).

Despite the above-described benefits of non-farm employment, a large proportion of rural households are unable to take advantage of non-farm activities (AloboLoison, 2015; Sani, 2017). Inadequate skills, liquidity and market access constraints are key factors that prevent rural households from participating in non-farm activities (Barrett et al., 2001; Sani, 2017). Another factor that limits the full realisation of non-farm activities' poverty reducing potential pertains to lack of specialisation. Although many farm households engage in diverse income-generating activities, they often find themselves unable to specialise in non-farm activities in the presence of labour, capital or geographical constraints. The share of income from agricultural activity therefore remains predominant (Davis et al., 2009; Owusu et al., 2011). Ellis (1998) and Hernandez et al. (2010) suggest the need for dynamic policies for the uplift of rural areas in order to expedite diversification of income through participation in non-farm activities. The success of non-farm activities in reducing poverty and increasing of household incomes largely depends on the removal of barriers to participation in the non-agricultural economy, enhancement in the ability to invest in non-farm assets and supportive policies in the non-farm sector (Lanjouw & Lanjouw, 2001; Reardon et al., 2007). The impact of the non-farm economy on income largely varies with the costs and specialisation of non-farm activities (Start, 2001). Governments can contribute by helping farm households enhance their skill sets and access to credit and by reducing market imperfections and transaction costs of non-farm activities (Barrett et al., 2001).

3 | METHODOLOGY

3.1 | Data

The data for this study come from the sixth wave of the survey of household living conditions (EPCV) carried out by the National Statistics Office (henceforth ONS) in 2014.

The survey was conducted at the national level and covered all the 13 regions. The sampling units each containing 1000 individuals (approximately 200 households) were randomly selected using the population maps drawn for the RGPH (2013) survey. The resulting sample includes 9557 households, out of which 5312 are urban and 4245 rural households. This study is based exclusively on data from rural households.

The survey collected data on households' demographic and socioeconomic characteristics, food and non-food consumption, employment, access to services and various idiosyncratic shocks that the households suffered during the past 12 months.¹ Household food expenditure is based on the responses of the household head to questions about the quantity of various food items consumed during the past 30 days. The indicator for nominal consumption is deflated by food price index, which is computed using market prices of various food items and energy prices observed in the commune.

3.2 | Model

The model used to explain the effect of participation in non-farm activities on household poverty is estimated by the following equation:

$$POVERTY = \beta_1 + \beta_2 E + \theta X + \varepsilon.$$

POVERTY is measured through binary (incidence) or continuous (intensity and severity) aspects of poverty. Participation in non-agricultural employment is represented by the variable *E*. β_2 captures the effect of non-farm activities on poverty, *X* is a set of control covariates including household characteristics and ε is the error term.

3.2.1 | Dependent variable

We calculate poverty index *à la* Foster et al. (1984) to assess the impact of non-farm labour participation on the incidence, intensity and severity of poverty in rural Mauritania. The three measures reflect the extent, depth and gravity of poverty situation of the households surveyed. The index is defined as follows:

$$P_{\alpha} = \frac{1}{N} \sum_{j=1}^q \left(\frac{z - y_j}{z} \right)^{\alpha}$$

P_{α} is the poverty index defined according to the aversion parameter α . When $\alpha = 0$, we get the incidence of poverty, $\alpha = 1$ the intensity of poverty and $\alpha = 2$ the severity of poverty. y_j represents the per capita expenditure of household j in the study area. N is the number of households, and z is the poverty line defined by this survey. The poverty line is calculated on the basis of total annual per capita household expenditure. Households living below the threshold are considered poor.

The first dependent variable is a binary variable that is referred to as the incidence of poverty. The other two poverty measures are continuous variables based on the international absolute poverty line of 3.1 USD/purchasing power parity (PPP) and defined as the average poverty gap in the population as a proportion of the poverty line (intensity) and the squared poverty gap (severity of poverty).

The resulting incidence, intensity and severity of poverty in rural Mauritania are estimated to be 33.7%, 10.0% and 4.3%, respectively (Table 2). Not surprisingly, compared with urban regions, the incidence of poverty is higher in the rural areas of Mauritania; the figures for urban areas are 10.2%, 2.3% and 0.8%, respectively, for the three poverty measures.

3.2.2 | Variable of interest

Our main variable of interest, non-farm participation, is constructed using self-reported information on household members' sectors of activity. Following Ellis (1998), Barrett et al. (2001) and Gordon and Craig (2001), we define the non-farm sectors as trade, services, building and various rural activities other than agriculture, livestock or subsistence fishing. The 2014 EPCV provides information about the industry, occupation, nature and status of employment and number of hours worked per week for Mauritanian households. Household members working in rural industries such as mining and extraction, food industry, cottage industry, other manufacturing industries, construction, transport, communications, trade or sales, miscellaneous services, education, health and administration are considered non-farm participants. To address various dimensions of the relationship between non-farm employment and rural poverty, we use three alternative proxies for our main independent variable. First, a binary variable is constructed, which takes the value of one if at least one household member is associated with non-farm employment, otherwise

TABLE 2 Rural poverty compared with the urban and national average

	Rural		Urban		National	
	Mean	SD	Mean	SD	Mean	SD
Incidence	0.337	0.472	0.102	0.303	0.223	0.416
Intensity	0.1	0.183	0.023	0.086	0.062	0.149
Gravity	0.043	0.108	0.008	0.041	0.026	0.084

Source: Author's calculations using EPCV-2014.

Note: Poverty line is measured by the international absolute poverty standard (3.1 USD/purchasing power parity [PPP]).

zero. The second variable counts the total number of household members employed in the non-agricultural sector, and the third variable represents the share of employees working in the non-farm economy among the working members of the household. The sign of the relationship between these variables and poverty is expected to be negative as we assume that non-farm participation significantly reduces poverty.

3.2.3 | Control variables

In addition to the main variable of interest, we include a list of control variables such as household assets, gender, age and education of the household head in our empirical analysis to control for the household demographic, socio-economic and locational characteristics.

Following Filmer and Pritchett (2001), the household wealth index is constructed using principal components analysis (PCA) based on a large number of household assets. Table A1 in the appendix shows the list of variables used for PCA. The wealth index achieved through PCA provides the greatest variance among the selected variables and a better proxy to measure household wealth (Vyas & Kumaranayake, 2006). We also use 'livestock units' as an alternative indicator of household wealth. Livestock ownership is often considered to be a proxy for permanent income of farm households in the developing countries; a decrease in these assets could reduce long-term household consumption and consequently lead to poverty (Dercon et al., 2005; Hoddinott, 2006; Porter, 2012). The livestock index helps differentiate between households that live solely on livestock and those that live both on livestock and agriculture. The index is measured by the tropical livestock unit, giving a weightage of 1 for camel or cow, 0.8 for horse or donkey and 0.2 for sheep or goat.

Following Reardon (1997) and Deininger and Olinto (2001), we expect a positive association between poverty reduction and household assets. The same is true for the education of the household head. We also consider female-headed households, which often face cultural, social and economic constraints and are therefore more vulnerable to poverty than their counterparts. The availability of infrastructure such as schools, transportation and financial institutions play an important role in improving the income of rural households (Gibson & Olivia, 2010). In addition, we include idiosyncratic family shocks (such as the death of a member), food shocks (shortages or price spikes) and livestock shocks (reduction of livestock due to disease or natural hazards). The variable family shocks represent one if an adult in the household died during the last 12 months, otherwise zero. We only considered adult member of the household who died during the year. The livestock shocks variable corresponds to loss of camels, cattle, sheep or goats. These shocks measure the ability of a household to handle distress and capacity to avoid falling into poverty (Kijima et al., 2006).

We include indicators of geographical location to account for regional disparities. There are four agro-ecological zones in Mauritania: the arid zone that covers 80% of the country with date farming as the major agricultural output, the Sahelian zone where households largely rely on livestock and pluvial agriculture, the Senegal River Valley area, which covers 2% of the territory and where households generally count on the agro-sylvo-pastoral system, and the 800-km long coastal zone (Diop et al., 2017) where the households are involved in small-scale fishing and peri-urban livestock farming. Table 3 gives the definitions and means or proportions of the variables included in our model.

3.3 | Empirical methodology

We estimate the model with poverty incidence as the binary dependent variable using probit estimator while the two continuous variables pertaining to the intensity and severity of poverty are estimated using ordinary least squares. These techniques could however not account for the possibility of self-selection bias or exclusion of unobservable characteristics (such as individuals' motivation, risk-taking aptitude and entrepreneur skills), which could influence both the participation in the non-farm economy and poverty. Several studies addressed this issue

TABLE 3 Summary statistics

Variables	Definition of the variables	Mean/ proportion
Poverty gap	Foster-Greer-Thorbecke (1984) index [0,1]	0.337
Intensity of poverty	Foster-Greer-Thorbecke (1984) index [0,1]	0.100
Severity of poverty	Foster-Greer-Thorbecke (1984) index [0,1]	0.043
Participation (1/0)	Dummy if at least one household member is associated with non-farm employment = 1; 0 otherwise	57.46%
Number of household members	The total number of household members employed in the non-farm sector	1.092
Share of household members	The share of employees working in the non-farm economy among the working members of the household	18.09%
Female	Gender of household head	34.86%
Age of head	Age of household head	51.375
Education (head)	Dummy if the household head has an education = 1; 0 otherwise	33.10%
Adults	Number of adults in household	2.627
Wealth index	First principal component of indicators of household asset variables	0.005
Tropical livestock units (TLUs)	Tropical livestock units (TLUs) (1 TLU equals 1 cow/horse, 0.8 donkeys and 0.2 sheep/goat)	15.843
Landless	Dummy if household has not owned any land = 1; 0 otherwise	0.055
Access to credit	Dummy if the household has an access to credit = 1; 0 otherwise	0.020
Log (transfers)	Log of income from transfer	4.052
Primary school	A primary school exists in the community = 1; 0 otherwise	0.663
Transport	Distance from common transport	4.074
Bank or Institution	A bank/microfinance institution exists in the community = 1; 0 otherwise	0.011
Shock family	Household negatively affected by the death of an adult family member = 1; 0 otherwise	0.107
Shock food	Household negatively affected by the food lack = 1; 0 otherwise	0.379
Shock livestock	Household negatively affected by the livestock loss = 1; 0 otherwise	0.454

through instrumental variables and heteroscedastic error terms (e.g., Dedehouanou et al., 2018; Hoang et al., 2014; Zereyesus et al., 2017). We are unable to follow this approach due to the lack of plausible instrumental variables. Additionally, these approaches are not always effective as differentiation depends only on the constant term (Rao & Qaim, 2011). As an alternative, we use propensity score matching (PSM) to address the potential problem of self-selection. The PSM approach assumes that the treatment is identical between the two groups, that is, that the two groups have the same characteristics (Becker & Ichino, 2002). To know the effect of non-farm participation on poverty between participants and non-participants, the PSM approach eliminates the selection bias that may exist between variables and reduces potential endogeneity problems. We also use inverse probability weighting (IPW), a technique that accounts for the difference between participants and non-participants. The advantage of the latter measure over PSM is that it gives more weight to households that are treated (participants) than the non-treated ones (non-participants). While adopting these approaches, we assume the two groups have similar characteristics and that the difference lies only in treatment. Table 4 shows the balancing properties of treated and non-treated groups for the variables used. Although households with more land and livestock units participate more in non-farm activities than the ones with a small piece of land or cattle, the standardised average difference is negligible (less than 10%) and shows an adequate balance between the two groups.

TABLE 4 Standard average difference between treated and untreated groups

Variables	Participants (mean)	Non-participants (mean)	Standard average difference (%)
Age of head	48.67	52.78	-0.264
Education (head)	0.37	0.29	0.166
Adults	2.91	2.14	0.467
Land size (ha)	59.87	47.51	0.021
Wealth index	0.01	-0.02	0.016
Livestock units (TLU)	18.36	11.13	0.168
Landless	0.05	0.06	-0.024
Access to credit	0.02	0.02	0.045
Log (transfer)	2.37	2.05	0.536
Primary school	0.67	0.66	0.004
Transport	4.05	4.12	-0.036
Bank	0.01	0.01	0.038
Family shock	0.09	0.12	-0.082
Food shock	0.38	0.37	0.009
Livestock stock	0.25	0.26	-0.024
Arid area	0.56	0.48	0.174
Sahelian area	0.92	0.96	-0.117
Senegal River valley area	0.43	0.52	-0.18
Maritime area	0.1	0.17	-0.229

Source: Author's calculations using EPCV-2014.

Abbreviation: TLU, tropical livestock unit.

4 | RESULTS AND DISCUSSION

4.1 | Descriptive statistics

We begin by presenting bivariate statistics. Table 4 shows the comparison between the participating households, that is, those involved in off-farm activities and non-participating ones, that is, those limited to agriculture. Participating households appear to be better endowed than the non-participating ones, both in physical and human capital. They are less likely to be landless and have larger farms, possess more assets and livestock and are somewhat more educated than corresponding non-participating households.

Table 5 provides the results of multivariate variance and covariance (MANOVA) tests to compare poverty incidence of participating and non-participating households. All the statistics reject the null hypothesis of equality of means at 1%, implying that non-farm employment participation has an impact on poverty different from non-participation. This is also evident from Figure 2, which shows that poverty levels are significantly lower in households involved in non-farm activities than those involved with agriculture alone.

4.2 | Non-farm participation activities and poverty

The models presented in Table 6 examine the relationship between participation in non-farm activities and the incidence, intensity and severity of poverty. Columns 1–3 provide estimates for poverty incidence regressed on three alternative proxies, namely, the presence of at least one person in the household (binary), the number of persons

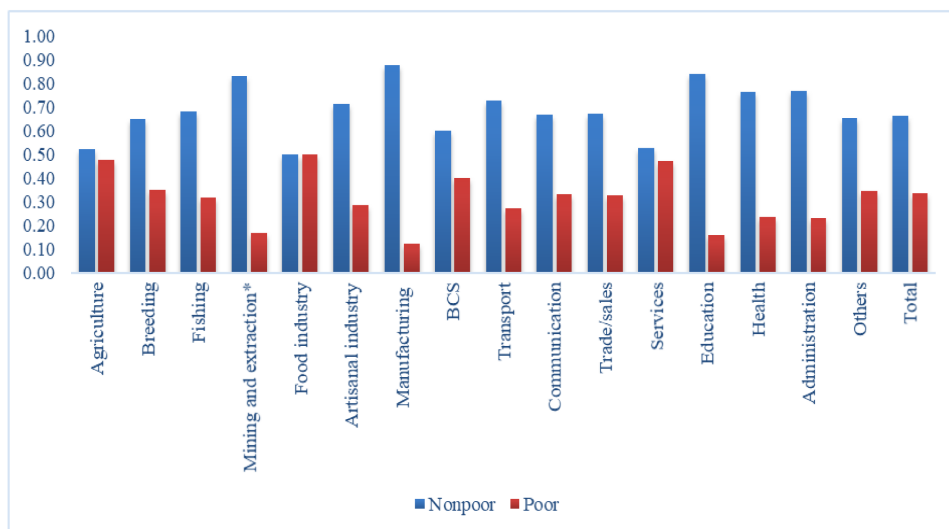
TABLE 5 Multivariate analysis of variance and covariance

Source	Statistic	df	F (df1, df2)	F	Prob > F	
Participation	W 0.9946	1	3, 4231	7.71	0	e
	P 0.0054		3, 4232	7.71	0	e
	L 0.0055		3, 4233	7.71	0	e
	R 0.0055		3, 4234	7.71	0	e
Residual		4233				
Total		4234				

Source: Author's calculations using EPCV-2014.

Note: e = exact, a = approximate, u = upper bound on F.

Abbreviations: L, Lawley–Hotelling trace; P, Pillai's trace; R, Roy's largest root; W, Wilks' lambda.



Source: Author's calculations using EPCV-2014

FIGURE 2 Farm and non-farm employment in rural Mauritania by sector (principal occupations of household head). Source: Author's calculations using EPCV-2014 [Colour figure can be viewed at wileyonlinelibrary.com]

(no. of HH) and the ratio of participating adults in the household (share of HH) engaged in non-farm activities, while Columns 4 to 6 and 7 to 9, respectively, show the estimates for the intensity and severity of household poverty regressed on the three measures of non-farm employment. All three measures show a negative and significant association. The marginal effects for the three indicators of non-farm work (Columns 1–3) show that the probability of being poor is 4.5% (binary), 1.3% (no. of HH) and 0.4% (share of HH) lower for households working in non-farm activities compared with those only engaged in agriculture. The figures for reduction in poverty intensity (Columns 4–6) and severity (Columns 7–9) are highly similar. These results are quite comparable with those reported in previous studies in other country contexts such as Van Den Berg and Kumbi (2006), Timothy (2011) and Dedehouanou et al. (2018).

TABLE 6 The effect of participation on poverty

	Incidence	Incidence	Incidence	Intensity	Intensity	Intensity	Intensity	Gravity	Gravity	Gravity
Participation (1/0)	-0.168** (0.061)			-0.018** (0.007)				-0.010** (0.004)		
Number of household members	-0.050*** (0.017)									-0.006** (0.003)
Share of man-day			0.001*** (0.001)							
Female	0.179** (0.067)	0.212*** (0.068)	0.233*** (0.068)	0.010* (0.005)	0.014** (0.005)	0.017*** (0.005)	0.005* (0.003)	0.007** (0.003)	0.009*** (0.003)	0.009*** (0.003)
Age of head	0.005* (0.002)	0.005** (0.002)	0.002 (0.002)	0.000 (0.000)	0.000* (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Education (head)	-0.145*** (0.049)	-0.149*** (0.049)	-0.135** (0.051)	-0.028*** (0.004)	-0.028*** (0.004)	-0.025*** (0.004)	-0.015*** (0.003)	-0.015*** (0.003)	-0.015*** (0.003)	-0.013*** (0.003)
Adults	0.008 (0.020)	0.013 (0.021)	-0.006 (0.020)	0.010*** (0.002)	0.011*** (0.002)	0.010*** (0.002)	0.007*** (0.001)	0.007*** (0.001)	0.007*** (0.001)	0.007*** (0.001)
Wealth index	-0.217*** (0.024)	-0.216*** (0.024)	-0.222*** (0.025)	-0.016*** (0.001)	-0.016*** (0.001)	-0.015*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)
Tropical livestock units (TLUs)	-0.003** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)
Landless	0.098 (0.081)	0.100 (0.080)	0.101 (0.076)	-0.005 (0.010)	-0.005 (0.010)	-0.005 (0.009)	-0.006 (0.006)	-0.006 (0.006)	-0.006 (0.006)	-0.006 (0.006)
Access to credit	0.007 (0.168)	0.001 (0.167)	0.009 (0.173)	-0.011 (0.017)	-0.012 (0.017)	-0.012 (0.016)	-0.007 (0.009)	-0.008 (0.009)	-0.008 (0.009)	-0.008 (0.009)
Log (transfers)	1.516*** (0.100)	1.506*** (0.102)	1.815*** (0.104)	0.095*** (0.007)	0.094*** (0.007)	0.113*** (0.006)	0.037*** (0.004)	0.037*** (0.004)	0.037*** (0.004)	0.049*** (0.004)
Primary school	-0.240*** (0.048)	-0.236*** (0.049)	-0.281*** (0.054)	-0.029*** (0.005)	-0.028*** (0.005)	-0.033*** (0.005)	-0.015*** (0.003)	-0.015*** (0.003)	-0.015*** (0.003)	-0.017*** (0.003)
Transport	0.241** (0.109)	0.246** (0.111)	0.289** (0.114)	-0.001 (0.001)	-0.001 (0.001)	-0.002 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.000 (0.001)
Bank or institution	0.006 (0.303)	0.000 (0.303)	0.049 (0.320)	-0.011 (0.015)	-0.011 (0.015)	-0.009 (0.016)	-0.002 (0.010)	-0.002 (0.010)	-0.002 (0.010)	-0.000 (0.010)

TABLE 6 (Continued)

	Incidence	Incidence	Incidence	Intensity	Intensity	Intensity	Intensity	Gravity	Gravity	Gravity
Shock family	-0.162** (0.062)	-0.159** (0.062)	-0.198*** (0.065)	-0.016** (0.007)	-0.016** (0.007)	-0.016** (0.007)	-0.018** (0.007)	-0.009* (0.005)	-0.009* (0.004)	-0.010** (0.004)
Shock food	-0.072 (0.068)	-0.069 (0.069)	-0.033 (0.070)	0.009 (0.007)	0.009 (0.007)	0.009 (0.007)	0.013* (0.006)	0.009** (0.004)	0.009** (0.004)	0.012*** (0.003)
Shock livestock	-0.303*** (0.063)	-0.304*** (0.062)	-0.336*** (0.066)	-0.049*** (0.005)	-0.049*** (0.005)	-0.049*** (0.005)	-0.049*** (0.005)	-0.026*** (0.003)	-0.026*** (0.003)	-0.026*** (0.003)
Average marginal effect	-0.043*** (0.015)	-0.012*** (0.004)	-0.000*** (0.000)							
Constant	-4.665*** (0.688)	-4.704*** (0.685)	-5.322*** (0.620)	-0.151*** (0.040)	-0.163*** (0.037)	-0.163*** (0.037)	-0.183*** (0.037)	-0.081*** (0.021)	-0.088*** (0.020)	-0.096*** (0.019)
Observations	4235	4235	4235	4235	4235	4235	4235	4235	4235	4235
R ²			0.183	0.182	0.182	0.182	0.211	0.117	0.116	0.148

Source: Author's calculations using EPCV-2014.

Note: When the dependent variable is binary, a probit is used, then the marginal effect is reported, and when it is continuous, a linear ordinary least squares (OLS) is applied. All agro-ecological zones, regions and communes' dummies were included but not shown. Standard errors are in parentheses. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

The signs and coefficients for others controls are in line with those reported in the literature. We find that rural Mauritanian females are greatly exposed to poverty. The result showing a negative association between household head education and poverty corresponds to that of Qureshi and Arif (1999). A more educated head of household is more likely to be able to reduce the household's vulnerability to poverty. It should be noted that the majority of household heads in our sample (64%) received only traditional Quranic education. Not surprisingly, households with tropical livestock and more assets are more likely to improve their living conditions by participating in the non-farm economy than households with fewer physical assets. Our results corroborate findings of earlier studies (i.e., Upton, 2004; and Randolph et al., 2007) report that possession of livestock improves the household's nutrition and the health outcomes and eventually contributes to enhancing income and reducing poverty. Investment in livestock raises farm production by utilising the land area and diversifies economic activities from pure crop growing to mixed farming systems. Similarly, ownership of more land (measured as the number of hectares of agricultural land the household owns) helps to absorb the household's labour, thereby generating more agriculture-related income leading to lower poverty (Deininger & Olinto, 2001; Reardon, 1997).

Estimates found through PSM are similar to those obtained through the baseline models (Table 7). The average treatment effect (ATE) difference between non-farm participant and agricultural households is 3.5%. Households participating in the non-farm economy are 3.9% less likely to be poor compared with non-participant households. Results for the intensity and depth of poverty are also similar. The ATEs for the two are 2% and 1%, respectively, while the ATEs on the treated (ATET) are 2.2% and 1.08%, respectively (Table 7, Columns 2–3).

Figure 3 shows the differences between treated and untreated groups. We see that differences between the three groups (i.e., incidence, intensity and gravity) are similar but not identical.

The estimates obtained from the IPW model are even stronger than the baseline and PSM results (Table 8). Households not participating in non-farm activities have at least a 5.9% more chance of being poor than participant households. There is also a significant difference in intensity and severity of poverty (3.6% and 1.9%, respectively) between participant and non-participant households.

4.3 | Alternative models using national poverty line

The estimations so far have been based on the international absolute poverty line of 3.1 USD/PPP. The ONS uses a threshold of 169 445 Mauritanian ouguiyas in real terms harmonised with 2014 price levels to calculate poverty. This national poverty line gives higher rates of poverty: the values of the incidence, intensity and severity of poverty thus calculated are 44.25%, 13.69% and 6.53%, respectively, compared with 33.7%, 10.0% and 4.3% using the international poverty line. The association between poverty and non-farm employment using these measures is similar, albeit slightly stronger than that observed in baseline estimations using international poverty line (Table 9). The marginal effects of non-farm work with respect to the three poverty measures are 8% (incidence), 0.9% (intensity) and 0.8% (severity), respectively.

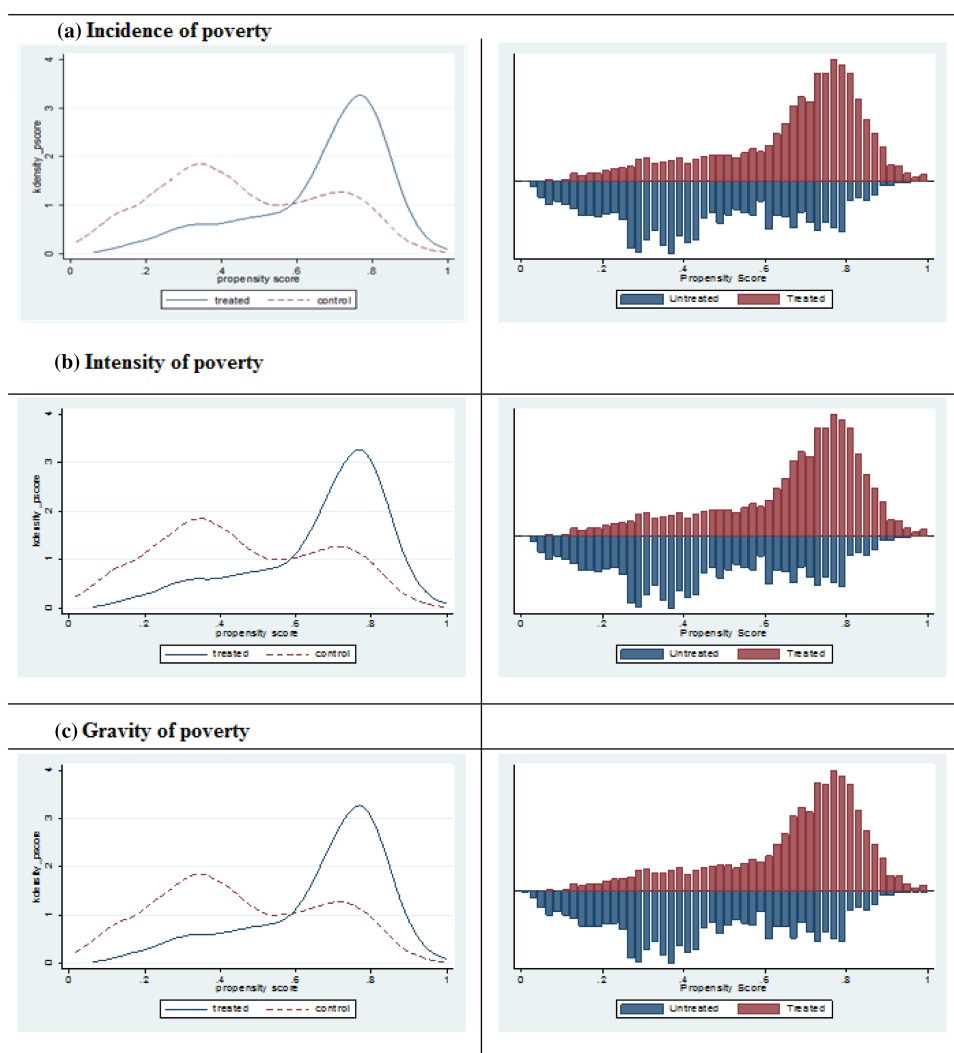
TABLE 7 Impact of participation (1/0) on poverty, propensity score matching estimates

Propensity score matching	Incidence	Intensity	Gravity
Average treatment effect (ATE)	-0.035* (0.017)	-0.020*** (0.006)	-0.010** (0.003)
Average treatment effect on treated (ATET)	-0.039* (0.022)	-0.022** (0.008)	-0.0108** (0.004)
Observations	4235	4235	4235

Source: Author's calculations using EPCV-2014.

Note: Standard errors in parentheses.

*** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.



Source: Author’s calculations using EPCV-2014.

FIGURE 3 (a–c) Density distribution for the estimated propensity scores.

Source: Author's calculations using EPCV-2014 [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 8 Inverse probability weights (IPWs)

	Incidence	Pomean	Intensity	Pomean	Gravity	Pomean
Average treatment effect (ATE)	-0.059** (0.025)	0.389*** (0.024)	-0.036** (0.015)	0.131*** (0.015)	-0.019** (0.008)	0.06*** (0.008)
Average treatment effect on treaties (ATET)	-0.085** (0.036)	0.451*** (0.036)	-0.051** (0.023)	0.158*** (0.023)	-0.027* (0.013)	0.072*** (0.013)
Observations	4235		4235		4235	

Source: Author's calculations using EPCV-2014.

Note: Standard errors in parentheses.

*** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

TABLE 9 Non-farm activities and poverty—national poverty line

	Incidence	Incidence	Incidence	Intensity	Intensity	Intensity	Gravity	Gravity	Gravity
Participation (1/0)	-0.201** (0.072)			-0.009** (0.006)	-0.013* (0.007)		-0.008** (0.004)		
Number of household members	-0.090* (0.052)						-0.008*		
Share of man-day		-0.108** (0.053)							-0.011** (0.005)
Female	0.138** (0.054)	0.123** (0.052)	0.089 (0.054)	0.013* (0.007)	0.018** (0.007)	0.015** (0.007)	0.006 (0.005)	0.009** (0.004)	0.007 (0.005)
Age of head	0.001 (0.002)	0.001 (0.001)	0.001 (0.002)	0.000* (0.000)	0.000** (0.000)	0.000* (0.000)	0.000 (0.000)	0.000* (0.000)	0.000 (0.000)
Education (head)	-0.234*** (0.050)	-0.236*** (0.050)	-0.223*** (0.051)	-0.034*** (0.007)	-0.034*** (0.007)	-0.034*** (0.007)	-0.020*** (0.004)	-0.020*** (0.004)	-0.019*** (0.004)
Adults	0.007 (0.018)	0.010 (0.018)	0.009 (0.018)	0.010*** (0.002)	0.010*** (0.002)	0.010*** (0.002)	0.008*** (0.001)	0.008*** (0.001)	0.008*** (0.001)
Wealth index	0.000 (0.000)	-0.211*** (0.015)	-0.216*** (0.016)	0.000 (0.000)	-0.021*** (0.002)	-0.022*** (0.002)	-0.000 (0.000)	-0.010*** (0.001)	-0.011*** (0.001)
Tropical livestock units (TLUs)	-0.212*** (0.015)	-0.002*** (0.001)	-0.002*** (0.001)	-0.021*** (0.002)	-0.000*** (0.000)	-0.000*** (0.000)	-0.011*** (0.001)	-0.000*** (0.000)	-0.000*** (0.000)
Landless	-0.002*** (0.001)	-0.011 (0.096)	0.002 (0.097)	-0.000*** (0.000)	-0.002 (0.013)	-0.001 (0.014)	-0.000*** (0.000)	-0.005 (0.008)	-0.005 (0.009)
Access to credit	-0.012 (0.096)	-0.266* (0.158)	-0.181 (0.165)	-0.002 (0.013)	-0.020 (0.021)	-0.017 (0.022)	-0.005 (0.008)	-0.013 (0.013)	-0.012 (0.014)
Log (transfers)	-0.263* (0.159)	1.338*** (0.057)	1.333*** (0.057)	-0.019 (0.021)	0.127*** (0.006)	0.130*** (0.007)	-0.012 (0.013)	0.058*** (0.004)	0.060*** (0.004)
Primary school	1.344*** (0.057)	-0.248*** (0.049)	-0.246*** (0.050)	0.128*** (0.006)	-0.034*** (0.007)	-0.034*** (0.007)	0.059*** (0.004)	-0.019*** (0.004)	-0.019*** (0.004)
Transport	-0.250*** (0.049)	-0.058*** (0.012)	-0.060*** (0.012)	-0.035*** (0.007)	-0.002 (0.002)	-0.002 (0.002)	-0.020*** (0.004)	0.000 (0.001)	-0.000 (0.001)
Bank or institution	-0.058*** (0.012)	0.064 (0.229)	0.059 (0.230)	-0.002 (0.002)	-0.008 (0.028)	-0.016 (0.029)	0.000 (0.001)	0.002 (0.018)	-0.002 (0.018)

TABLE 9 (Continued)

	Incidence	Incidence	Incidence	Intensity	Intensity	Intensity	Intensity	Gravity	Gravity	Gravity
Shock family	0.060 (0.229)	-0.058 (0.073)	-0.063 (0.074)	-0.007 (0.028)	-0.022** (0.010)	-0.024** (0.010)	0.002 (0.018)	-0.012* (0.006)	-0.013** (0.006)	
Shock food	-0.061 (0.073)	-0.034 (0.048)	-0.035 (0.048)	-0.023** (0.010)	0.007 (0.006)	0.007 (0.007)	-0.012* (0.006)	0.009** (0.004)	0.009** (0.004)	
Shock livestock	-0.037 (0.048)	-0.342*** (0.052)	-0.353*** (0.053)	0.006 (0.006)	-0.057*** (0.007)	-0.057*** (0.007)	0.009** (0.004)	-0.033*** (0.004)	-0.034*** (0.004)	
Average marginal effect	-0.080*** (0.030)	-0.026** (0.016)	-0.050** (0.018)							
Constant	-3.568*** (0.412)	-3.634*** (0.410)	-3.762*** (0.448)	-0.191*** (0.050)	-0.205*** (0.049)	-0.208*** (0.052)	-0.109*** (0.031)	-0.118*** (0.031)	-0.115*** (0.033)	
Observations	4235	4235	4235	4235	4235	4235	4235	4235	4235	
R ²				0.219	0.219	0.218	0.160	0.159	0.158	

Source: Author's calculations using EPCV-2014.

Note: When the dependent variable is binary, a probit is used, then the marginal effect is reported, and when it is continuous, a linear ordinary least squares (OLS) is applied. All agro-ecological zones, regions and communes' dummies were included but not shown. Standard errors are in parentheses. ****p* < 0.01. ***p* < 0.05. **p* < 0.1.

TABLE 10 Non-farm activities and poverty—adult-equivalent household expenditure

	Incidence	Incidence	Incidence	Intensity	Intensity	Intensity	Gravity	Gravity	Gravity
Participation (1/0)	-0.247*** (0.063)								
Number of household members	-0.112** (0.046)	-0.020*** (0.007)					-0.011** (0.004)		
Share of man-day		-0.257*** (0.075)						-0.008** (0.003)	
Female	0.095* (0.052)	0.163*** (0.053)	0.089* (0.050)	0.006 (0.005)	0.012** (0.005)	0.007 (0.005)	0.004 (0.003)	0.007* (0.003)	0.004 (0.003)
Age of head	0.017*** (0.002)	0.018*** (0.002)	0.016*** (0.002)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Education (head)	-0.091* (0.051)	-0.097* (0.051)	-0.080 (0.050)	-0.030*** (0.004)	-0.030*** (0.004)	-0.030*** (0.005)	-0.017*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)
Adults	0.057*** (0.019)	0.057*** (0.018)	0.057*** (0.019)	0.016*** (0.002)	0.016*** (0.002)	0.015*** (0.002)	0.010*** (0.002)	0.010*** (0.002)	0.010*** (0.002)
Wealth index	-0.210*** (0.024)	-0.207*** (0.023)	-0.206*** (0.025)	-0.018*** (0.002)	-0.018*** (0.002)	-0.019*** (0.002)	-0.009*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)
Tropical livestock units (TLUs)	-0.003*** (0.001)	-0.004*** (0.001)	-0.003*** (0.001)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Landless	0.007 (0.115)	0.010 (0.111)	0.015 (0.113)	-0.011 (0.010)	-0.011 (0.009)	-0.011 (0.009)	-0.009 (0.006)	-0.009 (0.006)	-0.009 (0.006)
Access to credit	0.024 (0.171)	0.011 (0.167)	0.087 (0.182)	-0.009 (0.016)	-0.011 (0.016)	-0.008 (0.020)	-0.005 (0.008)	-0.006 (0.008)	-0.006 (0.010)
Log (transfers)	1.009*** (0.053)	0.988*** (0.056)	0.996*** (0.054)	0.072*** (0.007)	0.071*** (0.007)	0.073*** (0.007)	0.025*** (0.005)	0.024*** (0.005)	0.025*** (0.005)
Primary school	-0.247*** (0.055)	-0.244*** (0.055)	-0.245*** (0.056)	-0.032*** (0.006)	-0.032*** (0.006)	-0.032*** (0.006)	-0.017*** (0.004)	-0.017*** (0.004)	-0.017*** (0.004)
Transport	0.189** (0.088)	0.194** (0.091)	0.190* (0.093)	-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.002)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)

TABLE 10 (Continued)

	Incidence	Incidence	Incidence	Intensity	Intensity	Intensity	Intensity	Gravity	Gravity	Gravity
Bank or institution	0.414 (0.279)	0.397 (0.277)	0.403 (0.275)	-0.008 (0.017)	-0.008 (0.017)	-0.010 (0.019)	-0.005 (0.011)	-0.005 (0.011)	-0.005 (0.012)	-0.005 (0.012)
Shock family	-0.112* (0.061)	-0.111* (0.061)	-0.118* (0.062)	-0.015 (0.009)	-0.014 (0.009)	-0.016* (0.009)	-0.009 (0.006)	-0.009 (0.006)	-0.009 (0.006)	-0.009 (0.006)
Shock food	-0.046 (0.060)	-0.039 (0.061)	-0.048 (0.062)	0.010 (0.008)	0.010 (0.008)	0.011 (0.008)	0.008 (0.005)	0.008* (0.005)	0.009* (0.005)	0.009* (0.005)
Shock livestock	-0.294*** (0.060)	-0.291*** (0.060)	-0.287*** (0.061)	-0.051*** (0.005)	-0.050*** (0.005)	-0.051*** (0.005)	-0.027*** (0.003)	-0.027*** (0.003)	-0.027*** (0.003)	-0.027*** (0.003)
Average marginal effect	-0.086*** (0.022)	-0.051** (0.015)	-0.072*** (0.021)							
Constant	-4.147*** (0.713)	-4.282*** (0.701)	-4.133*** (0.713)	-0.179*** (0.044)	-0.197*** (0.040)	-0.182*** (0.048)	-0.098*** (0.023)	-0.108*** (0.021)	-0.098*** (0.026)	-0.098*** (0.026)
Observations	4235	4235	4235	4235	4235	4235	4235	4235	4235	4235
R ²		0.185	0.183	0.182	0.123	0.122	0.122	0.121	0.121	0.121

Source: Author's calculations using EPCV-2014.

Note: We calculated poverty indices based on adult equivalent consumption expenditure. When the dependent variable is binary, a probit is used, then the marginal effect is reported, and when it is continuous, a linear ordinary least squares (OLS) is applied. All agro-ecological zones, regions and communes' dummies were included but not shown. Standard errors are in parentheses.

*** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

4.4 | Alternative models using adult-equivalent household consumption

Our poverty measures are generated using data on per capita household expenditure. The latter not only does not take into account intrahousehold inequalities that might exist between children and adult members of the household but also fail to account for the economies of scale that result from sharing household resources (Deaton, 2005). To solve this problem, we use an alternative set of poverty measures calculated using adult equivalent expenditure. Children, female and male members of the household are assigned a weightage of 0.2, 0.8 and 1, respectively.

Results of estimations based on corresponding poverty measures are shown in Table 10. They are similar in sign and magnitude to the results of baseline estimations. Participation in non-farm activities, for instance, is associated with 8.6% lower incidence of poverty compared with agriculture.

4.5 | Alternative models using days of off-farm work

The results for the association between participation in non-farm activities and poverty provide an idea of labour effects on poverty at the extensive margins. We replace the work indicator by the days of week a household allocates to non-farm activities as a proportion to the total number of days worked per week to find about the intensive

TABLE 11 Proportion of days of non-farm work and poverty

	Incidence	Intensity	Gravity
Participation (1/0)	-0.045** (0.054)	-0.009** (0.006)	-0.008** (0.004)
Female	0.142** (0.056)	0.010 (0.006)	0.005 (0.004)
Age of head	0.003** (0.002)	0.000* (0.000)	0.000 (0.000)
Education (head)	-0.229*** (0.053)	-0.028*** (0.006)	-0.015*** (0.004)
Adults	0.009 (0.017)	0.010*** (0.002)	0.007*** (0.001)
Wealth index	-0.209*** (0.017)	-0.017*** (0.002)	-0.008*** (0.001)
Tropical livestock units (TLUs)	-0.003*** (0.001)	-0.000*** (0.000)	-0.000** (0.000)
Landless	0.044 (0.097)	-0.004 (0.012)	-0.006 (0.007)
Access to credit	-0.101 (0.169)	-0.016 (0.019)	-0.011 (0.012)
Log (transfers)	1.345*** (0.061)	0.095*** (0.006)	0.038*** (0.003)
Primary school	-0.221*** (0.051)	-0.028*** (0.006)	-0.015*** (0.004)
Transport	-0.045*** (0.012)	-0.001 (0.001)	0.001 (0.001)
Bank or institution	-0.361 (0.273)	-0.009 (0.025)	0.002 (0.016)
Shock family	-0.200*** (0.075)	-0.017** (0.009)	-0.009* (0.005)
Shock food	-0.034 (0.049)	0.010* (0.006)	0.010*** (0.004)
Shock livestock	-0.371*** (0.055)	-0.049*** (0.006)	-0.026*** (0.004)
Average marginal effect	-0.009* (0.005)		
Constant	-3.818*** (0.453)	-0.166*** (0.045)	-0.087*** (0.028)
Observations	4235	4235	4235
R ²		0.184	0.119

Source: Author's calculations using EPCV-2014.

Note: When the dependent variable is binary, a probit is used, then the marginal effect is reported, and when it is continuous, a linear ordinary least squares (OLS) is applied. All agro-ecological zones, regions and communes' dummies were included but not shown. Standard errors are in parentheses.

*** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

margins of the labour effects. A Mauritanian household allocates 3.2 days out of the total 6.23 days worked (about 51%) to non-farm activities. Results for estimations carried out using the proportion of work days of non-farm activities shown in Table 11 are again found to be similar to the baseline results.

4.6 | Placebo effect

We carried out a placebo test to check if households really benefited from participation in non-farm activities or it is a statistical artefact. We use the change in the average temperature² of the country in the year of the survey to test this possibility. Average temperatures in the country are a consequence of the households engaging in non-farm activities. As expected, we find no impact of non-farm work on temperatures (Table 12).

4.7 | Sensitivity analysis

We performed a sensitivity analysis using Rosenbaum's (2002) limit test. The value $\Gamma = 1$ indicates that there is no hidden bias (Table 13). Also, the values of the Mantel–Haenszel bounds highlight significant treatment effects at 10%. As we proceed with different gamma values, we can conclude that there is a strong effect of non-farm participation on poverty.

TABLE 12 The effect of temperature change on non-farm participation—placebo effect

	PSM	IPW
Average treatment effect (ATE)	0.001 (0.120)	−0.002 (0.231)
Average treatment effect on treaties (ATET)	−0.001 (0.081)	−0.001 (0.082)
Observations	4235	4235

Source: Author's calculations using EPCV-2014. Note: Standard errors in parentheses.

Abbreviations: IPW, inverse probability weighting; PSM, propensity score matching.

*** $p < 0.01$. ** $p < 0.05$. * $p < 0.1$.

TABLE 13 Sensitivity analysis for participation and poverty reduction

Gamma (Γ)	Mantel–Haenszel bounds		Significance level	
	Maximum	Minimum	Maximum	Minimum
1	1.474	1.474	0.07	0.07
1.05	0.796	2.152	0.212	0.015
1.1	0.149	2.8	0.44	0.002
1.15	0.396	3.419	0.346	0
1.2	0.987	4.012	0.161	0
1.25	1.555	4.582	0.059	0
1.3	2.1	5.13	0.017	0
1.35	2.625	5.658	0.004	0
1.4	3.131	6.167	0	0
1.45	3.62	6.66	0	0
1.5	4.093	7.136	0	0

Source: Author's calculations using EPCV-2014.

5 | CONCLUSION

In this study, we investigated the relationship between participation in non-farm activities and poverty among rural households in Mauritania. In this country, land scarcity is one of the major issues along with low productivity of arable land and massive youth unemployment in rural areas. To address the poverty and unemployment issues in rural areas, most government policies have focused on the agriculture sector. We found that there is a significant association between poverty in the rural areas and participating in non-farm activities. This raises doubts on the desirability and effectiveness of a predominant focus on these policies as a means to alleviate poverty. Using survey data on household living conditions (EPCV, 2014) and applying different estimation techniques, we found that participation in non-farm activities has a significant relationship with poverty. This is reflected in significantly lower incidence, depth and gravity of poverty seen among participating households compared with non-participating ones. The findings point to substantial differences between households involved in off-farm activities and those exclusively working in agriculture. This additional income attained through non-farm activities eases liquidity constraints, allowing households to invest in farming by hiring more workers and acquiring better inputs such as fertilisers or advanced technology that ultimately improve agricultural output. The findings of this study point to a different policy orientation than what has been so far followed. One possibility could be to devise measures to promote rural entrepreneurship. Rural population could be provided training aimed at developing skills and adoption of modern technology that improves the agricultural productivity and better links the agriculture sector with the support and auxiliary services. Providing opportunities for produce from rural areas to reach the cities is another possible policy action. These policy shifts will allow farm households to enter non-farm activities, diversify their sources of income and ultimately improve their standard of living.

The findings of this study need to be interpreted with caution given the non-causal nature of our estimations. Besides, lack of data on household income prevents us from examining sector-wise analysis of labour participation in non-farm activities.

ACKNOWLEDGEMENTS

This research was financially supported by Cape Breton University (grant number RISE8173). We thank participants of the 49th Atlantic Schools of Business Conference at Cape Breton University, Canada, from 27 to 29 September 2019, for their helpful comments and suggestions on an earlier draft of the paper. We also would like to thank Cindy Butler for her editorial assistance. The usual disclaimer applies. Open access funding enabled and organized by Projekt DEAL.

DATA AVAILABILITY STATEMENT

The data for this study come from a survey of household living conditions carried out in 2014 by the National Statistical Office (<http://www.ons.mr/>). The data are not openly available.

ORCID

Amar Anwar  <https://orcid.org/0000-0002-9247-8452>

Mazhar Mughal  <https://orcid.org/0000-0001-7846-9632>

ENDNOTES

¹ The data and description of variables are available on the International Household Survey Network (IHSN) website.

² The data on the average temperature are taken from the FAOSTAT database (2014).

REFERENCES

- Ackah, C. (2013). Nonfarm employment and incomes in rural Ghana. *Journal of International Development*, 25(3), 325–339.
- Adams, R. H. Jr. (1994). Non-farm income and inequality in rural Pakistan: A decomposition analysis. *The Journal of Development Studies*, 31(1), 110–133.

- Adjognon, G.S., Liverpool-Tasie, S.L., de la Fuente, A., & Benfica, R. (2017). Rural non-farm employment and household welfare: Evidence from Malawi, Policy Research Working Papers. The World Bank. <https://doi.org/10.1596/1813-9450-8096>
- Ali, M., & Peerlings, J. (2012). Farm households and nonfarm activities in Ethiopia: Does clustering influence entry and exit? *Agricultural Economics*, 43, 253–266. <https://doi.org/10.1111/j.1574-0862.2012.00580.x>
- AloboLoison, S. (2015). Rural livelihood diversification in Sub-Saharan Africa: A literature review. *The Journal of Development Studies*, 51, 1125–1138. <https://doi.org/10.1080/00220388.2015.1046445>
- Ba, M., & Mughal, M. (2020). Chocs climatiques, stratégies d'adaptation et bien-être des ménages: Cas de la Mauritanie rurale.
- Babatunde, R. O., & Qaim, M. (2010). Impact of off-farm income on food security and nutrition in Nigeria. *Food Policy*, 35, 303–311. <https://doi.org/10.1016/j.foodpol.2010.01.006>
- Barrett, C. B., Reardon, T., & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: Concepts, dynamics, and policy implications. *Food Policy*, 26, 315–331. [https://doi.org/10.1016/S0306-9192\(01\)00014-8](https://doi.org/10.1016/S0306-9192(01)00014-8)
- Becker, S., & Ichino, A. (2002). Estimation of average treatment effects based on propensity scores. *Stata Journal*, 2(4), 358–377.
- Bryan, E., Ringler, C., Okoba, B., Roncoli, C., Silvestri, S., & Herrero, M. (2013). Adapting agriculture to climate change in Kenya: Household strategies and determinants. *Journal of Environmental Management*, 114, 26–35.
- Corral, L., & Reardon, T. (2001). Rural nonfarm incomes in Nicaragua. *World Development*, 29(3), 427–442.
- Davis, B., Winters, P., Reardon, T., & Stamoulis, K. (2009). Rural nonfarm employment and farming: Household-level linkages. *Agricultural Economics*, 40(2), 119–123.
- De Janvry, A., & Sadoulet, E. (2001). Income strategies among rural households in Mexico: The role of off-farm activities. *World Development*, 29(3), 467–480.
- De Janvry, A., Sadoulet, E., & Zhu, N. (2005). The role of non-farm incomes in reducing rural poverty and inequality in China.
- Deaton, A. (2005). Measuring poverty in a growing world (or measuring growth in a poor world). *The Review of Economics and Statistics*, 87, 1–19. <https://doi.org/10.1162/0034653053327612>
- Dedehouanou, S. F. A., Araar, A., Ousseini, A., Harouna, A. L., & Jabir, M. (2018). Spillovers from off-farm self-employment opportunities in rural Niger. *World Development*, 105, 428–442.
- Deininger, K., & Olinto, P. (2001). Rural nonfarm employment and income diversification in Colombia. *World Development*, 29(3), 455–465.
- Dercon, S., Hoddinott, J., & Woldehanna, T. (2005). Shocks and consumption in 15 Ethiopian villages, 1999–2004. *Journal of African Economies*, 14(4), 559–585.
- Diop, M., Ould Baheida, S., & Ould Abdellahi, C. (2017). Étude sur l'agriculture familiale à petite échelle au Proche-Orient et Afrique du Nord. Pays focus: Mauritanie|FAO.
- Dzanku, F. M. (2019). Food security in rural sub-Saharan Africa: Exploring the nexus between gender, geography and off-farm employment. *World Development*, 113, 26–43. <https://doi.org/10.1016/j.worlddev.2018.08.017>
- Ellis, F. (1998). Household strategies and rural livelihood diversification. *The Journal of Development Studies*, 35(1), 1–38.
- Escobal, J. (2001). The determinants of nonfarm income diversification in rural Peru. *World Development*, 29(3), 497–508.
- EPCV. (2014). Enquête Permanente sur les Conditions de Vie des ménages, Office National de la Statistique de la Mauritanie.
- FEWS NET. (2013). Mauritania Livelihood Zoning Plus. Famine Early Warning Systems Network (FEWS NET).
- Filmer, D., & Pritchett, L. H. (2001). Estimating wealth effects without expenditure data-or tears: An application to educational enrollments in states of India. *Demography*, 38(1), 115–132.
- Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica*, 52(3), 761–766.
- Gibson, J., & Olivia, S. (2010). The effect of infrastructure access and quality on non-farm enterprises in rural Indonesia. *World Development*, 38(5), 717–726.
- Gordon, A., & Craig, C. (2001). Rural non-farm activities and poverty alleviation in Sub-Saharan Africa (NRI Policy Series 14).
- Hernandez, R., Reardon, T., & Guan, Z. (2010). Rural nonfarm employment and agricultural modernization and diversification in Guatemala (2010 Annual Meeting, July 25–27, 2010, Denver, Colorado No. 61686).
- Hoang, T. X., Pham, C. S., & Ulubaşoğlu, M. A. (2014). Non-farm activity, household expenditure, and poverty reduction in rural Vietnam: 2002–2008. *World Development*, 64(C), 554–568.
- Hoddinott, J. (2006). Shocks and their consequences across and within households in rural Zimbabwe. *The Journal of Development Studies*, 42(2), 301–321.
- Kijima, Y., Matsumoto, T., & Yamano, T. (2006). Nonfarm employment, agricultural shocks, and poverty dynamics: Evidence from rural Uganda. *Agricultural Economics*, 35(s3), 459–467.

- Lanjouw, J. O., & Lanjouw, P. (2001). The rural non-farm sector: Issues and evidence from developing countries. *Agricultural Economics*, 26(1), 1–23.
- Lanjouw, P. (1999). Rural non-agricultural employment and poverty in Ecuador. *Economic Development and Cultural Change*, 48(1), 91–122.
- Lanjouw, P., & Murgai, R. (2009). Poverty decline, agricultural wages, and non-farm employment in rural India: 1983–2004. *Agricultural Economics*, 40(2), 243–263.
- Ministère du Développement Rural et de l'Environnement (MDR). (2004). Programme d'Action National d'Adaptation aux changements climatiques PANA-RIM.
- Nisrane, B. F., Guush, B., Bart, M., & Seyoum, T. A. (2016). Non-farm income and labor markets in rural Ethiopia. Intl Food Policy Res Inst.
- ONS. (2014). *Situation de l'emploi et du secteur informel en Mauritanie en 2012*. Mauritanie: Office Nationale de la statistique (ONS).
- ONS. (2017). *Situation de l'emploi et du secteur informel en Mauritanie en 2017*. ONS, Mauritanie. Mauritanie: Office Nationale de la statistique.
- Owusu, V., Abdulai, A., & Abdul-Rahman, S. (2011). Non-farm work and food security among farm households in Northern Ghana. *Food Policy*, 36(2), 108–118.
- Porter, C. (2012). Shocks, consumption and income diversification in rural Ethiopia. *The Journal of Development Studies*, 48(9), 1209–1222.
- Qureshi, S. K., & Arif, G. M. (1999). Profile of poverty in Pakistan, 1998–99. Pakistan Institute of Development Economics.
- Rahman, A., & Mishra, S. (2020). Does non-farm income affect food security? Evidence from India. *The Journal of Development Studies*, 56, 1190–1209.
- Randolph, T. F., Schelling, E., Grace, D., Nicholson, C. F., Leroy, J. L., Cole, D. C., & Ruel, M. (2007). Invited review: Role of livestock in human nutrition and health for poverty reduction in developing countries. *Journal of Animal Science*, 85(11), 2788–2800.
- Rao, E. J. O., & Qaim, M. (2011). Supermarkets, farm household income, and poverty: Insights from Kenya. *World Development*, 39(5), 784–796.
- Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development*, 25(5), 735–747.
- Reardon, T., Delgado, C., & Matlon, P. (1992). Determinants and effects of income diversification amongst farm households in Burkina Faso. *The Journal of Development Studies*, 28(2), 264–296.
- Reardon, T., Stamoulis, K., & Pingali, P. (2007). Rural nonfarm employment in developing countries in an era of globalization. *Agricultural Economics*, 37(s1), 173–183.
- Rijkers, B. & Costa, R. (2012). Gender and rural non-farm entrepreneurship. *World Development*, 40(12), 2411–2426.
- Rosenbaum, P. R. (2002). Covariance adjustment in randomized experiments and observational studies. *Statistical Science*, 17(3), 286–327.
- Sani, S. (2017). Rural households' towards off-farm and non-farm employment opportunities in Assosa zone, Western Ethiopia. *Journal of Agricultural Economics, Extension and Rural Development*, 5, 579–589.
- Scharf, M. M., & Rahut, D. B. (2014). Nonfarm employment and rural welfare: Evidence from the Himalayas. *American Journal of Agricultural Economics*, 96, 1183–1197.
- Start, D. (2001). The rise and fall of the rural non-farm economy: Poverty impacts and policy options. *Development Policy Review*, 19(4), 491–505.
- Stifel, D. (2010). The rural non-farm economy, livelihood strategies and household welfare. *African Journal of Agricultural and Resource Economics*, 4(311-2016-5532), 82–109.
- World Bank. (2016). Islamic Republic of Mauritania poverty dynamics and social mobility 2008–2014.
- World Bank. (2018). Mauritanie: Transformation de la trajectoire de l'emploi des jeunes vulnérables (No. 125037; pp. 1–93).
- World Bank. (2019a). Agriculture and Food.
- World Bank. (2019b). World Bank Annual Report 2019.
- Timothy, A. (2011). Rural non-farm incomes and poverty reduction in Nigeria.
- Tsiboe, F., Zereyesus, Y. A., & Osei, E. (2016). Non-farm work, food poverty, and nutrient availability in Northern Ghana. *Journal of Rural Studies*, 47, 97–107. <https://doi.org/10.1016/j.jrurstud.2016.07.027>
- Upton, M. (2004). The role of livestock in economic development and poverty reduction (No. 855-2016-56231).
- Van Den Berg, M., & Kumbi, G. E. (2006). Poverty and the rural nonfarm economy in Oromia, Ethiopia. *Agricultural Economics*, 35, 469–475.
- Van den Broeck, G., & Kilic, T. (2019). Dynamics of off-farm employment in Sub-Saharan Africa: A gender perspective. *World Development*, 119, 81–99. <https://doi.org/10.1016/j.worlddev.2019.03.008>
- Vyas, S., & Kumaranayake, L. (2006). Constructing socio-economic status indices: How to use principal components analysis. *Health Policy and Planning*, 21(6), 459–468. <https://doi.org/10.1093/heapol/czl029>

Zereyesus, Y. A., Embaye, W. T., Tsiboe, F., & Amanor-Boadu, V. (2017). Implications of non-farm work to vulnerability to food poverty-recent evidence from Northern Ghana. *World Development*, 91, 113–124. <https://doi.org/10.1016/j.worlddev.2016.10.015>

How to cite this article: Ba M, Anwar A, Mughal M. Non-farm employment and poverty reduction in Mauritania. *J. Int. Dev.* 2021;33:490–514. <https://doi.org/10.1002/jid.3533>

APPENDIX A

Variable	Mean	SD	PCA
Fridge	0.013	0.112	0.211
Television	0.067	0.251	0.296
Parabolic antenna	0.052	0.222	0.313
Bank account	0.024	0.154	0.195
Radio	0.366	0.482	0.111
Modern kitchen	0.028	0.164	0.184
Car	0.023	0.151	0.135
Telephone	0.024	0.152	0.053
Gold jewellery	0.088	0.283	0.048
Motorcycle or bicycle	0.014	0.117	0.071
Cart	0.352	0.478	−0.046
Wheelbarrow	0.024	0.153	0.084
Full salon	0.043	0.203	0.233
Simple mattress	0.618	0.486	0.108
Bed and mattress	0.258	0.438	0.091
Drinking	0.215	0.411	0.153
Housing	0.347	0.476	0.221
Roof	0.293	0.455	0.300
Wall	0.176	0.381	0.229
Soil	0.275	0.447	0.284
Toilet	0.279	0.449	0.290
Source	0.580	0.494	0.154
Lighting	0.125	0.033	0.315
Energy	0.204	0.403	0.268
Eigenvalue			4.160
Explained variance			0.172
Weight	70.947	16.160	

TABLE A1 Variables used for constructing wealth index

Source: Author's calculations using EPCV-2014.

Abbreviation: PCA, principal components analysis.