

Exploitation of non-timber food products and its influence on income inequality in rural Burkina Faso

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Abstract

This paper examines the role of non-timber forest product (NTFP) exploitation in reducing rural income inequality in Burkina Faso. Using primary data collected in 2023 from 530 randomly selected rural households, the study adopts an econometric simulation approach that treats NTFP income as a substitute for other household earnings. Counterfactual income distributions are constructed by simulating household incomes in the absence of NTFP revenues. The results reveal that the Gini coefficient of rural household incomes would be 12.09% higher without NTFP income, indicating a substantial inequality-reducing effect. These findings underscore the significant contribution of NTFPs to improving income equity in rural areas and highlight the need for policies that promote their sustainable and inclusive development.

Key words: Burkina Faso, endogenous switching regression, simulation approach, non-timber forest products, income inequality

1. Introduction

There is growing evidence that non-timber forest products (NTFPs) make a significant contribution to improving rural livelihoods in Africa, Asia and other parts of the developing world (Angelsen & Wunder 2003; Shackleton & Pullanikkatil 2019). NTFPs refer to biological products, other than wood and wildlife, derived from forests, woodlands or trees outside forests (FAO 1999). Examples include leaves, flowers, fruits, bark, roots, non-lignified stems, sap, gums, resins and their by-products. Case studies in Africa have shown that NTFPs are an important source of income. In West Africa, Rachid *et al.* (2023) found that NTFPs contribute around 3% of gross domestic product (GDP), playing a major role in the region's economies. Similarly, Angelsen *et al.* (2014) estimated that NTFPs accounted for an average of 22% of rural household income in several sub-Saharan African countries, highlighting their significant contribution to improving rural livelihoods.

NTFPs fulfil three main functions in rural households' livelihoods. First, they help meet day-to-day household needs, whether for nutrition or medical care (Angelsen & Wunder 2003). Second, they act

as a safety net in times of crisis, such as crop failure or loss of income from other sources (Belcher 2005). Finally, some NTFPs generate regular cash income, enabling households to improve their standard of living or reduce poverty (Nugroho *et al.* 2023). NTFP harvesting is typically a labour-intensive activity offering immediate returns, while requiring very little in the way of finance, skills or technology (Sunderlin *et al.* 2005). Moreover, access to NTFP extraction sites is generally open or semi-open (Wunder *et al.* 2014). These characteristics make NTFPs an attractive and crucial source of income for poor rural households (Angelsen & Wunder 2003). In sub-Saharan Africa, where rural areas are recognised as the main production sites for forest resources such as NTFPs, the exploitation of these products is expected to contribute to solving the problem of inequality by providing food, cash income and medicinal products to the poorest of the poor (Cavendish 1999; Makoudjou *et al.* 2017).

Reducing poverty and income inequality remains particularly topical in sub-Saharan Africa. Although the region experienced a 3.4 percentage point decline in the unweighted average Gini coefficient between 1991 and 2011 (UNDP 2017), it continues to rank among the most unequal regions in the world. Indeed, the UNDP (2017) estimates that 10 of the 19 most unequal countries globally are located in sub-Saharan Africa. Moreover, according to the World Bank (2021), the Covid-19 pandemic pushed around 100 million additional people into extreme poverty and further exacerbated income inequalities in 2020. As in other Sub-Saharan African countries, inequalities are still very pronounced in Burkina Faso. Indeed, the distribution of resources between households is highly unequal, with a Gini concentration index estimated at 0.49 at the national level (INSD 2022). In Burkina Faso, the decline in the incidence of poverty in recent years has not been accompanied by a reduction in inequality. Indeed, inequality in terms of consumer spending measured by the GINI index increased from 0.35 in 2014 to 0.38 in 2018. Furthermore, estimates by the INSD (2022) show that almost half of total consumer spending is accounted for by the richest 20% of the population, while the remaining 80% account for the other half.

Despite the existence of some research on the subject, the persistence of inequalities in sub-Saharan Africa means that the question of the effects of NTFP exploitation on income distribution between rich and poor households remains relevant and topical (Chekouri 2023). In addition, reducing poverty and income inequality is at the heart of the Sustainable Development Goals (SDGs) (United Nations Department of Economic and Social Affairs (UN DESA) 2023). The research question is therefore as follows: What is the effect of NTFPs on income inequalities in rural Burkina Faso? The answer to this question will enable us to find solutions for the effective use of NTFPs to reduce inequalities in Burkina Faso, but also in other sub-Saharan countries sharing the same realities (Liu *et al.* 2023).

The aim of this article is to analyse the effects of NTFP exploitation on income inequalities in Burkina Faso. The diversity of empirical results between regions and countries invites us to revisit the relationship between NTFPs and inequalities from a methodological point of view. Furthermore, Davis (2020) and Sebri and Dachraoui (2021) have shown that the divergence of results on the subject is linked to the smallness of the analysis samples, the problem of measuring income from NTFPs and the method of analysis. All these factors call for a reassessment of the relationship between NTFPs and income inequality, both in terms of the measurement of the variables and the method used.

This research therefore contributes to the literature on several methodological levels. First, in line with the farm household model, which suggests that rural households are both producers and consumers of goods (Singh *et al.* 1986), it integrates self-consumption into the evaluation of NTFP income, a dimension that has rarely been incorporated in previous studies. To do this, it uses a combination of market prices for NTFPs with market values and an approach based on the opportunity

cost of time for non-marketed NTFPs. This method better reflects the total contribution of NTFPs to the livelihoods of rural households.

Second, it considers NTFP income as a “potential substitute” for other locally generated household earnings and simulates the counterfactual of what incomes and income inequality levels would be in the absence of access to these products. To do this, it relies on the endogenous switching regression model. Indeed, in all the studies carried out to date, we have not come across any that use this methodology to study the relationship between NTFPs and income inequality. Yet this model makes it possible to include the indirect effects or opportunity costs of participation in NTFP exploitation in the analysis.

Third, this study narrows its scope to eight locally important woody species, chosen for their significant socio-economic value and broad distribution across sub-Saharan Africa. These species are *Parkia biglobosa*, *Vitellaria paradoxa*, *Tamarindus indica*, *Adansonia digitata*, *Saba senegalensis*, *Bombax costatum*, *Balanites aegyptiaca* and *Senegalia macrostachya*. Overall, the findings of this study offer valuable policy insights for decision makers seeking to address persistent inequalities and climate change, while also contributing to the conservation of forest ecosystems. This research is highly relevant to the economic and social development of Burkina Faso, as well as other sub-Saharan African countries facing similar challenges.

The remainder of this research is organised into four sections. The first section reviews the literature on the relationship between NTFP exploitation and income inequality. The second section presents the methodology and econometric techniques used. The third section presents, interprets and economically discusses the results obtained, while the fourth section concludes.

2. Methodology

2.1 Conceptual framework

NTFPs play an important role in rural livelihoods, not only for the poor but also for wealthier households. However, poor households are generally more engaged in NTFP harvesting (Angelsen *et al.* 2014). This is largely because NTFP exploitation requires little or no start-up capital, the resources are often open-access or semi-open-access (freely available for collection), and they provide immediate cash or subsistence benefits. These characteristics make NTFP exploitation a pro-poor livelihood activity, lowering barriers to entry and offering quick returns (Belcher 2005). In contexts of widespread rural poverty and income disparities, such attributes position NTFPs as a potentially important pathway for reducing inequality (Cavendish & Campbell 2008). The sustainable livelihoods approach is recognised as a suitable framework for studying the links between people and the environment. Developed by Chambers and Conway (1992) and Scoones (1998), it has been widely applied to analyse the relationship between livelihood diversification strategies and household socio-economic outcomes (Kimengsi *et al.* 2020).

Building on insights from the sustainable livelihoods approach, this research developed the conceptual framework illustrated in Figure 1 to explore the relationship between NTFPs and income inequality. The framework shows that rural households' access to and control over various livelihood assets, such as natural capital (local woody species), financial assets (credit) and physical assets (information and market access), influence their participation in NTFP exploitation (livelihood strategy). Such participation can help households achieve key livelihood objectives, including increasing income, improving food security, enhancing well-being and reducing inequalities.

Finally, household livelihood outcomes are shaped by internal (socio-economic) factors such as age, gender, household size, education and asset ownership, as well as by external factors such as government and local policies (taxation, regulations, prices and market access). When positive outcomes such as higher incomes are achieved through NTFP activities, poor households can reinvest in additional assets, thereby contributing to a more balanced distribution of rural income in the long term.

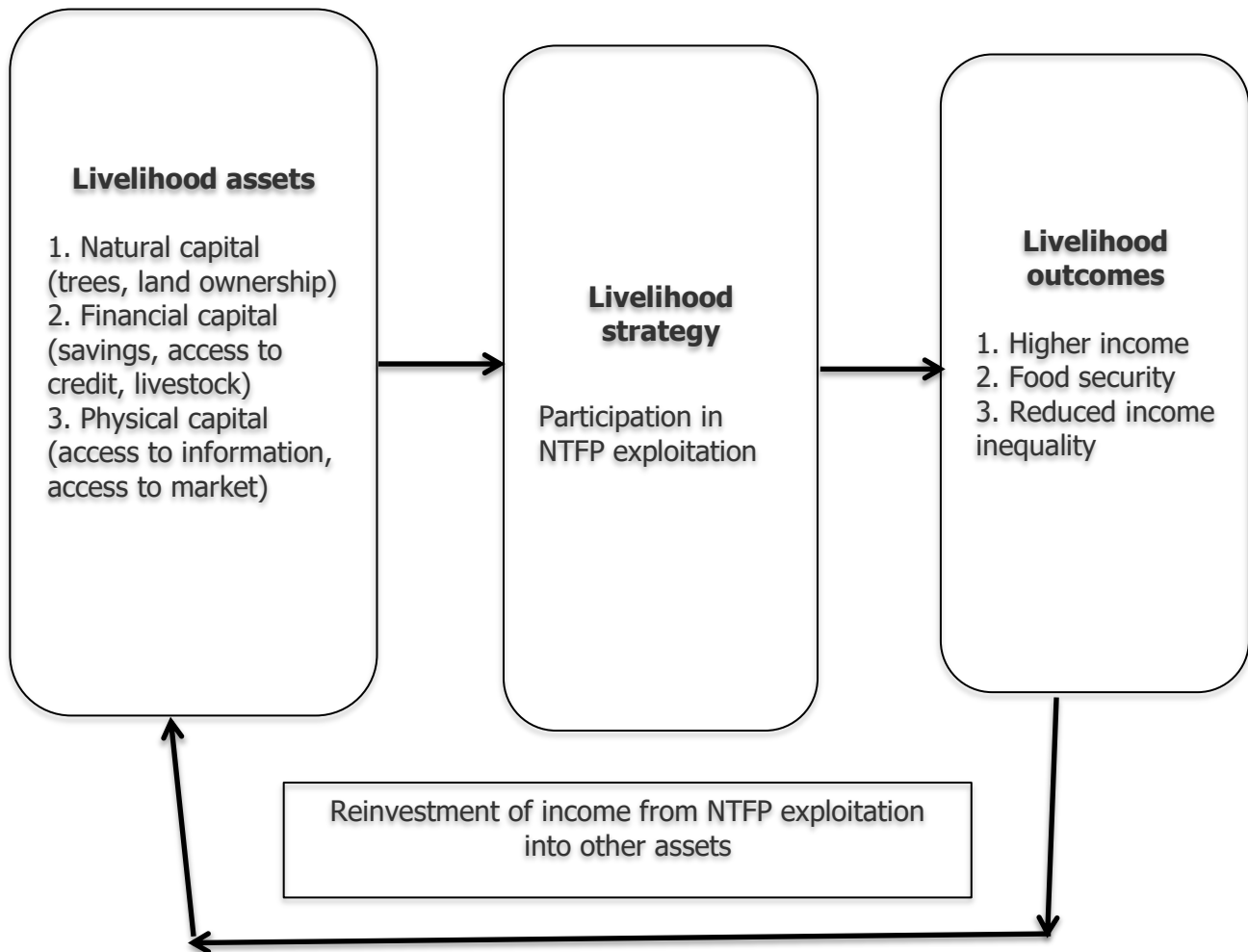


Figure 1: Conceptual framework analysing the relationship between NTFPs and income inequality

Source: Author

To our knowledge, all studies aimed at determining the effects of NTFPs on income inequality have considered income from NTFP exploitation as an “exogenous transfer” of income that adds to the household’s pre-existing total income. These studies then examined its effects on income inequality using Gini index decomposition techniques, notably by comparing estimates of Gini indices with and without NTFP income. While this approach is important and used in the present research to ensure its robustness, it does not always allow us to estimate the net impact of NTFP exploitation on income inequalities. Indeed, when there is substitutability between participation in NTFP-related activities and other productive activities, the decomposition performed in this approach may be biased. In other words, this method does not take into account the indirect effects associated with participation in NTFP exploitation (Dang *et al.* 2014).

With this in mind, the present research adopts a more in-depth analysis, considering income from NTFP exploitation as a “potential substitute” for locally generated household earnings. This methodological approach makes it possible to compare the actual distribution of household income with a hypothetical counterfactual distribution, representing a situation without access to NTFPs (Dang *et al.* 2014). In concrete terms, it consists of substituting the income derived from NTFPs with the income that households would have generated in their absence. To simulate these hypothetical incomes, the endogenous switching regression model is used, as it enables potential incomes to be estimated while taking into account the complex interactions between different household economic activities.

2.2 Empirical model

As rational agents, rural households seek to maximise their utility by optimising their decisions to participate in various productive activities and allocating their working time between them (Diamoutene & Jatoe 2021). However, participation in NTFP exploitation is neither random nor universal. Some households are better positioned to participate due to factors such as their proximity to forest resources, their access to information or their availability of human capital. This phenomenon of voluntary self-selection is a source of endogeneity in the economic analysis of these activities (Takam-Fongang *et al.* 2019). To solve this methodological problem, an endogenous switching regression model is used. This model is particularly suitable when there is a non-random allocation of subjects between a treated group and a non-treated group (Diamoutene & Jatoe 2021). It is based on the simultaneous estimation of a selection equation, which determines participation or non-participation status, and two outcome equations, which estimate total household income as a function of this status (Lokshin & Sajaia 2004).

By controlling for selection bias, the endogenous switching regression model enables the estimation of the probability of participation in NTFP-related activities and the assessment of their impact on total rural household income. Furthermore, it allows for the simulation of household income in counterfactual scenarios, such as the absence of participation (Lokshin & Sajaia 2004).

Following Diamoutene and Jatoe (2021), the decision to exploit NTFPs is modelled within a random utility framework. Let D^* denote the difference between the utility from participation (U_{i1}) and the utility from non-participation (U_{i0}). A household i will choose to exploit NTFPs if $D^* = U_{i1} - U_{i0} > 0$. Because the two utilities are unobservable, they can be expressed as functions of observable components through the latent variable model, presented below:

$$D_i^* = \alpha Z_i + \varepsilon_i \quad \text{with} \quad D_i = \begin{cases} 1 & \text{if } D_i^* > 0 \\ 0 & \text{otherwise} \end{cases}, \quad (1)$$

where D_i is a binary variable reflecting participation in the exploitation of NTFPs or not. $D_i = 1$ if the household exploits NTFPs and $D_i = 0$ otherwise. α is a vector of parameters to be estimated, Z_i is a vector that represents the household's socio-economic and environmental characteristics, and ε_i is the random error term.

According to Takam-Fongang *et al.* (2019) and Diamoutene and Jatoe (2021), the vector Z_i in the participation model (Equation (1)) must include at least one selection instrument in addition to those generated automatically by the non-linearity of the selection model to ensure the proper identification of the endogenous switching regression (ESR). The selection instruments used in this research include

distance to forest resources, perceived availability of NTFPs, membership of a forest management group and exposure to economic shocks.

Following Di Falco *et al.* (2011) and Takam-Fongang *et al.* (2019), the validity of these instruments was assessed using a falsification test. A variable is considered a valid selection instrument if it affects the decision to exploit NTFPs but does not affect the welfare outcome. The results indicate that the selected instruments satisfy this condition: they are jointly statistically significant in explaining the exploitation decision [LR $\chi^2 = 130.51$ ($p = 0.000$)], but they are not statistically significant in the outcome equation [$F(3, 109) = 1.01$ ($p = 0.39$)].¹

The two outcome regression equations, conditional on the exploitation decision, can be expressed as:

$$\text{Regime 1 (participating households): } Y_{i1} = X_i\beta_1 + \mu_{i1}, \quad \text{if } D_i = 1 \quad (2)$$

$$\text{Regime 2 (non-participating households): } Y_{i0} = X_i\beta_0 + \mu_{i0}, \quad \text{if } D_i = 0 \quad (3)$$

In these equations:

- Y_{i1} and Y_{i0} are the total per capita income for household i under participation and non-participation, respectively;
- X_i is a vector of exogenous variables influencing income;
- β_1 and β_0 are vectors of parameters; and
- μ_{i1} and μ_{i0} are vectors of parameters.

The error terms (ε_i , μ_{i1} , μ_{i0}) follow a trivariate normal distribution with a zero mean vector and covariance matrix

$$\Sigma = \begin{bmatrix} 1 & \rho_1 & \rho_0 \\ \rho_1 & \sigma_1^2 & \cdot \\ \rho_0 & \cdot & \sigma_0^2 \end{bmatrix} \quad (4)$$

Here, σ_1^2 and σ_0^2 are the variances of μ_{i1} and μ_{i0} , and ρ_1 and ρ_0 are the covariances between ε_i and μ_{i1} , and ε_i and μ_{i0} , respectively. Since participation and non-participation outcomes are mutually exclusive, the covariance between μ_{i1} and μ_{i0} is undefined.

To address the selection bias, a one-step maximum likelihood estimation method is used, as recommended by Lokshin and Sajaia (2004). This approach efficiently estimates the participation and income equations simultaneously.

The endogenous switching regression model also enables the simulation of counterfactual scenarios. For example, it predicts the income that households currently exploiting NTFPs would have earned in the absence of these activities, based on the coefficients of NTFPs income regression equations.

Following Dang *et al.* (2014), we propose the following steps to obtain the income that households currently exploiting NTFPs would have earned in the absence of these products.

¹ Detailed results for the falsification test are not presented in the paper, but they can be provided to individuals on request.

Step 1: Estimate Equation (3) and obtain the predicted coefficients $\hat{\beta}_0$ and predicted residuals $\hat{\mu}_{i0}$.

Step 2: For each household involved in NTFP exploitation, take a random draw with replacement from the empirical distribution of the predicted residuals, $\hat{\mu}_{i0}$, obtained in step 1 and denote it by $\hat{\hat{\mu}}_{i0}$. Then, using the predicted coefficients, $\hat{\beta}_0$, and the residual $\hat{\hat{\mu}}_{i0}$, estimate, for each household involved in NTFP exploitation, its income level in the absence of NTFPs, as follows:

$$\hat{Y}_{i0}' = X_i \hat{\beta}_0 + \hat{\hat{\mu}}_{i0} \quad (5)$$

Step 3: Repeat step 2 R times, then calculate the average of the R replications to estimate the simulated income in the absence of NTFPs for each household involved in their exploitation. Following Dang *et al.* (2014), we use $R = 500$ in our simulations below.

For households not involved in NTFP exploitation activities, their income in the absence of NTFPs is equivalent to their observed income.

Comparing the predicted income distribution under this counterfactual scenario with the observed distribution provides insights into the role of NTFPs in shaping household welfare and income inequality. First, we calculate the Gini index for observed incomes. Then, we compute the same index for simulated incomes in the absence of NTFPs. Finally, we compare the Gini indices of observed and simulated incomes to assess the impact of NTFP exploitation on income inequality in rural areas. The comparison of the Gini inequality index, calculated based on simulated household income in the absence of NTFPs, and observed household income, accounting for the entire sample population (NTFP participants and non-participants), reveals a difference corresponding to the average treatment effect (ATE) (Dang *et al.* 2014). In other words, it measures the average impact of participation in NTFP exploitation on all households, regardless of whether they participated in NTFP exploitation or not.

2.3 Data sources

This study covers 12 villages across two regions, Centre-Ouest and Hauts-Bassins, with six villages per region. The regions were purposefully selected based on their NTFP production potential, the dynamics of resource exploitation, and the prevailing security context related to terrorism. Within these regions, the villages were randomly chosen to ensure representativeness.

A survey was carried out among 530 households, selected on a random and stratified basis, with the 12 villages forming the strata. This survey, inspired by the methodologies of CIFOR (2007) and Sawadogo *et al.* (2023), took place over three months, from June to September 2023. It gathered information on the socio-economic characteristics of households, production factors, agricultural and livestock production, and the types, quantities and uses of NTFPs exploited.

A preliminary census of all 2 653 households residing in the villages studied was carried out to form the sampling frame. From this population, a sample of 530 households was selected, representing a sampling rate of 20%, applied uniformly in each village.

Rural household incomes, from a variety of sources, were grouped into four categories: (i) crop production income, (ii) livestock income, (iii) NTFP income and (iv) other income. The first three

categories were assessed on the basis of farm accounts, where income corresponds to the difference between gross product and associated production costs.

In line with Sawadogo *et al.* (2023), NTFP-related income is distinguished into two components: (i) cash income, derived from the sale of NTFPs on local markets, and (ii) subsistence income, corresponding to the valuation of NTFP self-consumption (food, gifts, etc.). To be precise, only NTFPs sold on local markets were valued at observed market prices. NTFPs consumed by the household but lacking a direct market reference were valued using an opportunity cost of time approach, based on the average rural daily agricultural wage of 2 000 FCFA reported by the Institut National de la Statistique et de la Démographie (INSD 2022).

3. Results and discussion

This section presents and discusses the descriptive and econometric results relating to the analysis of the impact of NTFP exploitation on income inequalities.

3.1 Descriptive analysis

Table 1 presents descriptive statistics on the socio-economic and demographic characteristics of the households studied. Participating and non-participating households differ markedly along most dimensions: households exploiting NTFPs are somewhat more often male-headed (90.6% versus 86.4%), more frequently living in couples (96.5% versus 84%) and polygamous (40.7% versus 24.8%), and have older heads on average (44.9 versus 40.8 years). They are also larger (9.1 versus 6.6 members on average) and hold more land (6.3 versus 4.2 hectares), while experiencing more economic shocks on average (1.23 versus 0.30).

Table 1: Descriptive statistics of household socio-economic characteristics

Household characteristics		Participating households	Non-participating households	Full sample
Qualitative variables				
Variables	Modality	Proportion (%)	Proportion (%)	Proportion (%)
Gender of the head of household (HH)	Female	9.38	13.60	10.38
	Male	90.62	86.40	89.62
Education of the HH	Alphabet	19.75	20.80	20.00
	Illiterate	80.25	79.20	80.00
Marital status of the HH	Single	3.46	16.00	6.42
	Monogamous	55.80	59.20	56.60
	Polygamous	40.74	24.80	36.98
Availability of NTFPs	High	60.00	23.20	51.32
	Low	40.00	76.80	48.68
Quantitative variables				
Variables		Mean	Mean	Mean
Age of head of household (years)		44.90	40.75	43.92
Household size (number)		9.14	6.58	8.54
Size of household's fields (hectare)		6.31	4.19	5.81
Economic shocks (number)		1.23	0.30	0.87
Household's residence – NTFP site (km)		2.50	3.69	2.78
Household's residence – Market (km)		6.31	7.87	6.68

Source: Author, based on household survey data from the research

In terms of location, NTFP-exploiting households live closer to both collection sites (2.5 km versus 3.7 km) and markets (6.3 km versus 7.9 km) than non-exploiting households, and they perceive NTFP availability as high far more often (60% versus 23.2%). Educational attainment is comparatively

similar across the two groups, with illiteracy affecting roughly four in five household heads overall. Full details of all variables are reported in Table 1 above.

3.2 Income source decomposition and Gini index techniques

Table 2 presents the results of the decomposition of the Gini index by income source. It shows the contributions of NTFP income and other sources of income to total per capita income and total per capita income inequality. The Gini coefficient for each income source is shown in column 3, while the share of each income source in total inequality is shown in column 5. As columns 3 and 5 show, income from NTFP exploitation has the lowest Gini coefficient (0.6948), after agriculture (0.6860). NTFP income also contributes the least to total inequality (0.1236), after livestock (0.0616). In column 4, the Gini correlation of NTFP income with total income (0.6324) is lower than its source Gini coefficient (0.6948). Following Fisher (2004) and Fonta and Ayuk (2013), this means that, if the share of NTFP income is increased, all other things being equal, total income inequality will be reduced in the study area.

Furthermore, column 6 shows that a 1% increase in NTFP income, all other things being equal, reduces the Gini coefficient of total per capita income inequality by 3.83% in the study area. Overall, in terms of relative marginal effect (RME), NTFP income is more pro-poor and has a greater income-equalising effect than any other source of income in the study area. In other words, the results suggest that NTFPs offer a more egalitarian source of income compared with most other sources at the study sites. Thus, policy initiatives that stimulate improved NTFP income would have the effect of reducing rural income inequality. This would require improving rural populations' access to NTFPs.

Table 2: Gini decomposition by income source

Source (1)	S_K (2)	G_K (3)	R_K (4)	S_G (5)	RME (6)
Agriculture	0.5176	0.6860	0.8529	0.5264	0.0088
Livestock	0.0727	0.8541	0.5706	0.0616	-0.0111
NTFPS	0.1619	0.6948	0.6324	0.1236	-0.0383
Other	0.2478	0.8328	0.8039	0.2884	0.0405
Total income	1.000	0.5753	1.000		

Note: The last column of the table (RME) refers to the impact that a 1% change in the respective income source will have on inequality. Four additional items are included in the results table: the share of each income source in total income (S_K), the source Gini (G_K), the Gini correlation of source k income with the total income distribution (R_K), and the share of each income source in total inequality (S_G).

Source: Author, based on household survey data from the research

As shown in Table 3, excluding NTFP income from inequality calculations increases the Gini coefficient for total rural household income per head by 7.93%. In contrast, including NTFP income reduces measured inequality by the same percentage.

Table 3: Gini coefficient with and without NTFP income

Parameter	Coefficient
Gini with NTFP income (1)	0.57530
Gini without NTFP income (2)	0.62092
Difference (2)-(1)	0.04562
Rate of change (2)/(1)	7.93%
Number of observations	530

Source: Author, based on household survey data from the research

3.3 Econometric results

Table 4 presents the estimation results of the endogenous switching regression model. The adequacy of this model was verified through three tests: the overall significance test, the rho significance test, and the coefficient stability test between the two regimes. The Wald test for overall significance was highly significant ($\text{Prob} > \chi^2 = 0.000$), indicating that the model explains well the variations of the dependent variable. The likelihood ratio test for rho was also significant ($p < 0.05$), confirming the presence of endogeneity and justifying the use of the endogenous switching model. Finally, the Wald test for coefficient stability between regimes showed significant differences ($p < 0.05$), demonstrating that the determinants of the dependent variable vary across regimes. Overall, these results confirm that the model is appropriate, and the econometric estimates are robust and reliable for economic interpretation.

The regression results for the equation on participation in NTFP exploitation reveal that certain factors increase the likelihood of a household engaging in the economic exploitation of NTFPs. These include the marital status of the household head, the number of women in the household, the household's land area, the number of economic shocks experienced by the household, and the perceived availability of NTFPs. In contrast, factors such as the education level of the household head, the distance from the household to NTFP harvesting sites, and the distance to the nearest market decrease the likelihood of participation.

Among these determinants, the number of women in the household and the household's land area deserve particular attention. The positive effect of the number of women reflects the strongly gendered division of labour in NTFP collection: this activity is predominantly carried out by women, given its low opportunity cost relative to their limited access to formal employment and its compatibility with domestic responsibilities (Heubach *et al.* 2011; Ouédraogo *et al.* 2025).

The positive effect of land area operates through a different, largely institutional channel. Under customary rules in the study area, harvesting rights over NTFP-bearing trees found on a cultivated plot generally belong to the landowner. Larger landholdings therefore increase a household's exposure to and control over woody NTFP resources, while also easing the liquidity constraint that could otherwise limit engagement in a labour-intensive collection activity. This effect on the participation decision is also reported by Ouédraogo *et al.* (2025), although the same study finds that larger landowners tend to derive a smaller relative share of their income from NTFPs, as they diversify into other economic activities.

The remaining determinants align with expectations. Married household heads participate more, likely reflecting greater income diversification needs to support larger families. A higher frequency of economic shocks pushes households toward NTFPs as a coping mechanism in the absence of credit or insurance markets. A favourable perception of NTFP availability naturally encourages participation. In contrast, education reduces participation by opening access to non-farm employment, raising the opportunity cost of collection time. Greater distance to harvesting sites and markets both raise transaction and access costs, discouraging participation, which is consistent with Walle and Nayak (2022).

Estimates of the income equations reveal that variables such as the education level of the household head, the number of women, land ownership, access to credit, proximity to the nearest market, and participation in gold-panning activities positively influence per capita household income. In contrast, factors such as household size have a negative impact on income levels.

Following the methodological approach proposed by Dang *et al.* (2014), these econometric estimates are used to simulate the incomes that households would have obtained in the absence of NTFPs.

Table 4: Results of the endogenous switching model regressions

Variables	Participating households		Non-participating households		Participation equation	
	Coefficients	Z	Coefficients	Z	Marginal effect	Z
Sex of HH	0.051	(0.30)	-0.462	(1.52)	0.028	(0.51)
Age of HH	-0.003	(0.98)	0.008	(1.11)	0.002	(1.60)
Marital status of HH	0.410	(1.55)	-0.410	(1.27)	0.204***	(3.16)
Education of HH	0.180	(0.98)	1.134***	(3.47)	-0.124**	(2.12)
Household size	-0.036*	(1.81)	-0.113***	(2.58)	0.003	(0.38)
Number of women	0.030***	(2.90)	-0.019	(0.76)	0.009**	(2.07)
Size of household's fields	0.054***	(6.16)	0.050**	(2.33)	0.012***	(3.43)
Access to credit	0.243*	(1.74)	-0.207	(0.62)	0.042	(0.77)
Distance to market	0.010*	(1.66)	0.014	(1.17)	-0.004*	(1.94)
Participation in gold-panning	0.476***	(4.64)	0.491**	(2.20)	0.013	(0.37)
Economic shocks					0.080***	(3.24)
Availability of NTFPs					0.250***	(8.23)
Member of forest user group					0.059**	(2.09)
Distance to NTFP site					-0.011	(2.42)
Constant	11.184***	(32.9)	12.226***	(31.8)	-1.084***	(2.79)
/lns1			-0.089**			(1.97)
/lns2			0.055			(0.68)
/r1			0.675***			(3.51)
/r2			0.341			(1.27)
Log likelihood					-914.86	
Wald test chi ² (10)					92.07***	
LR test of independent equations chi ² (1)					8.26***	
Number of observations					530	

Note: Absolute value of student's z statistics in brackets; * = significant at 10%; ** = significant at 5%; *** = significant at 1%; HH = household head

Source: Author, based on household survey data from the research

Given that the opportunity cost of rural labour is not zero, participation in NTFP exploitation and other rural activities can be considered interdependent. Simulating the income households would have in the absence of NTFPs allows for a comparison of the Gini index of this simulated income with that of observed income. The results, presented in Table 5 and Figure 2, reveal that the Gini index of the simulated per capita income distribution is 12.09% higher than that of the observed per capita income. This finding indicates that NTFP exploitation reduces income inequality even when interactions between participation in various productive activities are considered. It aligns with those obtained using the Gini index decomposition method in the previous section and corroborates findings from other studies in sub-Saharan Africa, such as those of Fonta and Ayuk (2013) in Nigeria, Gatiso and Wossen (2014) in Ethiopia, and Sumukwo (2017) in Kenya. These studies similarly highlight the significant role of non-timber forest products in reducing income inequality.

Table 5: Distribution of observed and simulated per capita income

Variable	Coefficient
Gini of observed income (1)	0.57530
Gini of simulated income in the absence of NTFPs (2)	0.64483
Difference (1)-(2)	-0.06953
Rate of change (2)/(1)	-12.09%
Number of observations	530

Source: Author, based on household survey data from the research

Furthermore, the results demonstrate that participation in NTFP exploitation can increase the income of poor households more significantly than that of wealthier households, thereby contributing to a reduction in rural income inequality. This pro-poor nature of NTFP activities reflects their accessibility, since they require little initial capital, rely primarily on local ecological resources and can be undertaken by vulnerable groups such as women and low-income households. The effect is achieved by expanding livelihood opportunities for rural populations, especially those with limited access to land, credit or formal employment. Consequently, restricting access to NTFPs for rural households would likely exacerbate income disparities and lead to a substantial decline in overall welfare.

In addition, NTFP revenues serve as an alternative and flexible source of income that households often reinvest in agriculture, livestock activities and human capital accumulation. Such reinvestments can enhance productivity, strengthen asset portfolios and improve long-term resilience. Over time, these dynamics have the potential to reduce rural income inequality even further by enabling poorer households to gradually narrow the welfare gap. Ensuring access to NTFPs is therefore not only essential for reducing current income disparities but also for promoting sustainable rural economic development through reinvestments that generate benefits for future generations.

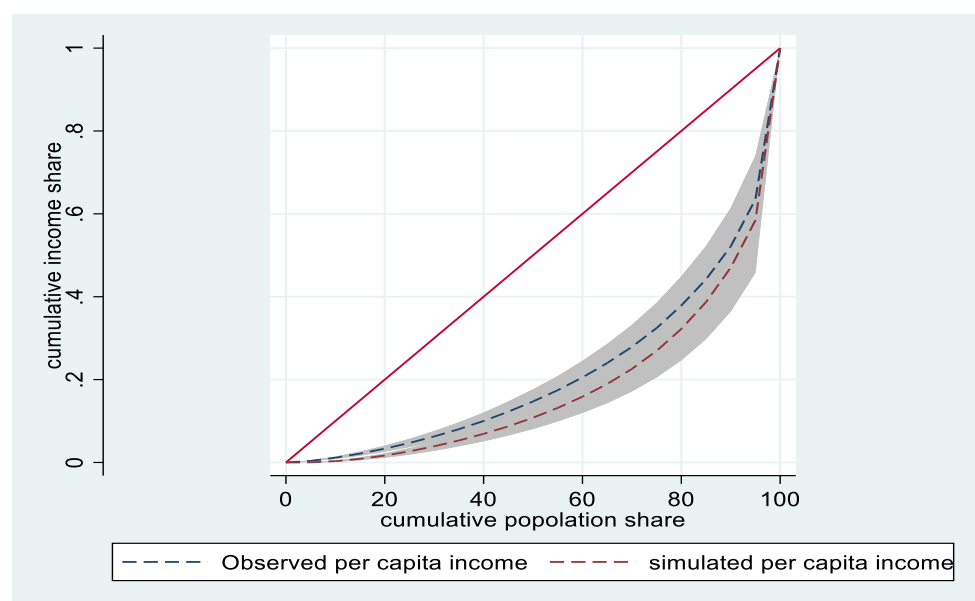


Figure 2: Lorenz curves for observed and simulated income in the absence of NTFPs

Note: Lorenz curves show the degree and extent of inequality in a given society or region. The diagonal line indicates perfect equality, and deviations from the line (the curves) measure the extent of inequality. The further the curve is from the diagonal line, the greater the inequality.

Source: Author, based on household survey data from the research

4. Conclusion

This research examined the impact of non-timber forest product exploitation on rural income inequality in Burkina Faso using an econometric simulation approach that treats NTFP income as a substitute for other household earnings. By constructing a counterfactual income distribution that simulates household incomes in the absence of NTFP revenues, the study provides an assessment of income inequality under constrained access to forest resources. The results show that the Gini index of simulated per capita income is 12.09% higher than that of observed income, indicating that NTFPs play a substantial role in reducing income inequality in rural areas.

These findings suggest that NTFP-related activities function as an important income-equalising mechanism, particularly for poorer households that face limited opportunities in formal labour markets. Through the income generated from NTFP exploitation, vulnerable households are better able to smooth consumption and reinvest in productive assets, which contributes to a more balanced distribution of rural income over time.

From a policy perspective, the results imply that restricting access to NTFPs could exacerbate rural income disparities and weaken household welfare. Rural development strategies should therefore explicitly incorporate NTFPs as a component of inclusive growth and inequality reduction policies. However, the distributive benefits of NTFP exploitation critically depend on the sustainability of forest resources. Policies promoting the domestication and planting of key NTFP species, alongside effective and sustainable natural forest management, are essential to preserve ecosystems while maintaining income opportunities. Ensuring equitable access to NTFPs for the poorest households remains central to strengthening rural livelihoods and supporting long-term poverty reduction.

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