



Gendered pathways from side jobs to labor market resilience in farming households: Implications for sustainable agriculture

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ABSTRACT

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The research question in this paper is to determine how household composition, gender, and sectoral paths of livelihood diversification determine working hours and the risk of underemployment within farming households in Indonesia. Using data from Sakernas August 2024, the research applies and estimates logit and OLS models with robust standard errors, with a focus on gender and elderly household member interactions. Three major results are obtained: (i) there is an ongoing gender difference in the probability of having a side job, but the existence of elderly representatives is a kind of time substitution that raises the rates of female participation; (ii) side jobs are related to an increase in the total number of working hours per week and a decrease in underemployment between populations, although the initial susceptibility of women is higher; (iii) the quality of the trajectories of diversification is more decisive than the presence of side jobs, with construction being a high-hours, low-underemployment trajectory, followed by trade and manufacturing. On the whole, the results indicate that the sectoral orientation of diversification is a primary factor in changing side jobs as a survival strategy into a source of labor market stability, with significant consequences for sustainable agriculture.

Contribution/Originality: This study advances the literature by integrating care economy mechanisms with rural nonfarm employment to explain gendered diversification in farming households. It identifies elderly presence as a determinant of labor allocation and shows that the sectoral quality of side jobs, rather than participation alone, drives labor-market resilience and sustainability.

1. INTRODUCTION

The economy of agricultural households in Indonesia is highly vulnerable to external shocks, particularly those resulting from seasonal fluctuations, climate change, and limited access to markets. This vulnerability drives farming households to adopt multiple livelihood strategies, one of which is through non-agricultural side employment. The literature on the rural non-farm economy (RNFE) emphasizes that non-agricultural activities increasingly play a role in supporting rural household income in many developing countries, in line with structural transformation and

urbanization processes (Hazell, Haggblade, & Reardon, 2024). Household economic stability is also recognized as a prerequisite for the adoption of sustainable agricultural practices that require initial investments in both costs and time (Mnukwa, Mdoda, & Mudhara, 2025). Thus, analyzing the factors that drive multiple livelihood strategies is important for understanding labor market resilience in farming households, with broader implications for the sustainability of food production systems. One determinant that is often overlooked is household composition, particularly the presence of elderly members (aged 65 years and over). The presence of elderly members can be regarded as a household composition shock that influences livelihood strategies through two main mechanisms. First, dependency burden, i.e., the rise in consumption and caregiving needs plus the fall in income contribution by the aged, which stimulates the working hours or acceptance of another job by the productive members of the age group. Second, time substitution; that is, older people are occupied with taking care of the grandchildren, leaving the rest of the members of the household to take part in the workforce, mainly the women. It is empirically confirmed that women with gendered caregiving burdens have limited economic engagement, and access to family caregivers, such as grandparents, expands the employment opportunities of women, especially mothers (Heintz, 2018; Miller, O'Reilly, & Wright, 2024). A recent report highlights the importance of the urgency to improve the care ecosystem to guarantee the sustainability of women regarding their participation in the labor market throughout the life cycle in the Indonesian context (World Bank, 2024). The relevance of this issue is further reinforced by demographic factors in Indonesia. According to the Indonesia Longitudinal Aging Survey (ILAS) 2023, population aging has increased at a faster rate, and reforms in social protection systems, health services, and management of elderly care are needed (Asian Development Bank, 2024). Population aging directly influences the redistribution of caregiving loads at the household level, consequently impacting time allocation, livelihood choices, and work intensity. Thus, aging, gender, and various livelihood strategies will be interactive concerns in rural economic development.

The sustenance of the agricultural sector might be affected by the adoption of various livelihoods using income and labor allocation mechanisms. On the one hand, by creating space in non-agricultural employment-related cash flows, the household incentive to adopt unsustainable on-farm activities, including prematurely harvested crops or overuse of fertilizers, can be decreased, and the space to finance environmentally friendly operations is created (Reardon, 2015). Conversely, labor involvement in other areas than farming can compromise the quality of cultivation since less time and concentration are devoted to on-farm activities. A U-shaped relationship is shown by empirical studies in the North China Plain, which suggests that, at low levels, off-farm participation decreases land eco-efficiency, but, at one point beyond that, it becomes positive due to income reinvestment processes (Zhang, Li, Yuan, & Zhao, 2024). These results highlight the importance of creating policies that may lead the various livelihood strategies in directions such that economic returns do not end up contrary to the aims of sustainable agriculture.

It is in this context that the research paper specifically answers three major questions: (i) Does the presence of older individuals increase the likelihood of households pursuing multiple livelihood strategies, and does the effect vary by gender; (ii) how do the strategies relate to working hours and the likelihood of underemployment (less than 35 hours), given the interaction of elderly x gender; (iii) does sectoral diversification toward specific non-agricultural sectors relate to higher working hours as well as reduced chances of underemployment?

This study contributes both theoretically and practically. Theoretically, it combines the view of the care economy, through the mechanisms of dependency burden and time substitution, with the RNFE framework to describe the dynamics of multiple livelihood strategies. On the policy side, the results are anticipated to support two broad agendas, namely, enhancing infrastructure for the provision of older care to alleviate gender burdens and enhance women's labor participation, and providing quality non-agricultural work to increase working time and alleviate underemployment, thus making the labor market resilient. Such resilience creates enabling conditions for the effective implementation and upscaling of sustainable, climate-smart agricultural practices (Das, Ansari, Ghosh, Patnaik, & Maji, 2025).

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The literature on the rural non-farm economy (RNFE) shows that diversification into non-agricultural employment is closely associated with processes of structural transformation and contributes to improving household economic resilience and mitigating income vulnerability in developing countries (Akosikumah, Alhassan, & Kwakwa, 2025; O Campos, Admasu, Covarrubias, Davis, & Gonzalez, 2025). Given the uncertainty of production, price volatility, and climate-related risks, cross-sector labor allocation can be interpreted as a rational response to stabilize income and decrease vulnerability. Nevertheless, instead of paying much attention to the labor-market resilience dimension manifested in the accumulation of working hours and the risk of underemployment, most studies of the RNFE attempt to capture only the effect on income and its reduction. This is especially true in rural economies with informal and seasonal labor, where total weekly working hours and the likelihood of underemployment are better positioned to describe the quality of labor participation than employment status alone (Cheli, Coli, & Regoli, 2024; International Labour Organization, 2025). Multiple job holding is often treated as an adaptive tool in the contemporary labor market literature in cases where the primary job lacks adequate working hours or income (Collins, 2025; Pouliakas & Wieteke, 2023). The expansion of working hours and economic stability of households through secondary employment can be achieved, but instability or dependence on short-term demand can also signify labor fragmentation. Existing scholarly research on precarious employment and work instability illustrates that poor predictability of work schedules can be a source of economic vulnerability, despite the fact that the person is employed (Schneider & Harknett, 2021; Walther & Pilarz, 2024). Thus, the impacts of diversification should not be judged in terms of participation alone, but should also be viewed in terms of how more jobs will determine total working hours and lower the chances of working below standard hourly thresholds. Decisions on diversification and the construction of working hours cannot be disconnected from household structure and the distribution of roles between males and females. In the literature on the care economy, unpaid caregiving duties prove to be a systematic cause of time constraints and issues concerning women's participation and work intensity (Aguilar-Gomez, Arceo-Gomez, & Cruz Toledo, 2019; Sinha, Sedai, Rahut, & Sonobe, 2024). The two potentially conflicting mechanisms are created by the presence of elderly household members. The first is the dependency burden mechanism, whereby elderly members raise their level of care and consumption demand, thus constraining the working ability of prime-age household members. Second is a time-replacement mechanism, according to which senior members of society take part in childcare responsibilities, freeing women's time and enabling them to engage in paid jobs (Miller et al., 2024; Sudo et al., 2025). These dynamics are more applicable to describing household labor-allocation strategies in the context of rapid population aging in most developing countries, including Indonesia (Asian Development Bank, 2024).

In addition to household variables, the sectoral orientation of diversification is also significant in promoting the quality of engagement in labor. According to labor market segmentation theory, the various sectors vary in terms of demand structure, consistency of schedules, and mechanisms of working-hours construction (Kalleberg, 2009; Milkovich, 1972). Project-based industries like the construction industry are more likely to offer more consolidated and controllable working hours; on the other hand, the service sector is usually typified by unstable demand changes and disjointed work schedules, which endanger workers in a low-hours trap (Lu & Leicht, 2025). Non-agricultural participation in the agricultural setting also entails consequences for the sustainability of farming activities in terms of stabilizing cash flows and income-reinvestment strategies, though the impacts are heterogeneous and vary in intensity and quality based on the quality and intensity of sectoral participation (Zhang et al., 2024).

According to this review of the literature, the paper combines the insights of RNFE, multiple jobholding, the care economy, as well as labor market segmentation in one analytical framework. Diversification is perceived as a reaction to income and time limitations of working hours, and the structure of the household, especially the relationship between gender and the presence of older individuals, determines the time constraints modulating these choices. Simultaneously, the sectoral nature of diversification defines secondary employment as either a mere survival tool or a source of labor market resilience by accumulating working hours and minimizing the threat of

underemployment. Therefore, it is not only the presence of side jobs that determines the resilience of agricultural households, but also the interplay of household composition, gender, and the quality of diversification channels in the sector.

3. METHODOLOGY

This study uses Sakernas (August 2024), with the unit of analysis being individuals aged ≥ 15 years. The main sample is restricted to primary agricultural workers, identified from the main-job sector question ($r17a \in \{1-4\}$). Two analytical sets are constructed: (i) for RQ1–RQ2, all primary agricultural workers, including those without a side job; and (ii) for RQ3, the subsample with a side job, whose side-job sector can be mapped into five groups: agriculture, manufacturing, construction, trade, and services. Observations with missing key information (e.g., weekly hours, side-job indicator, or side-sector) are removed via listwise deletion. The analysis focuses on conditional associations given the cross-sectional design, and inference relies on robust standard errors, with cluster-robust SEs at the household level as a robustness check. Table 1 summarizes the operational definitions of the main variables used in the empirical analysis, including the outcome variables, household composition indicators, demographic controls, and sectoral classification of side jobs.

Table 1. Operationalization of Variables.

Variables	Operational definition
Primary agricultural worker	=1 if main job sector is agriculture
Working status	=1 if employed/has a job last week
Elder present (65+)	=1 if ≥ 1 HH member aged ≥ 65 (Household roster)
Side job (Multiple job holding)	=1 if > 1 job
Total weekly hours	Hours in all jobs last week
Underemployment	=1 if $0 < \text{hours_total} < 35$
Side-job sector (5 groups)	Map 17 sectors to 5 groups
Female	=1 if female
Age; Age squared	Age and its square
Education	Highest education: $\leq \text{SD/MI}$; SMP/MTs ; SMA/SMK/MA ; Diploma I/II/III ; $\geq \text{DIV/S1}$
Urban	=1 if urban
Island FE	Macro-region from province code

This study employs three models.

RQ1 - Participation in side job (logit)

$$PR(M_i = 1) = \text{logit}^{-1}(\beta_0 + \beta_1 F_i + \beta_2 E_h + \beta_3 (F_i \times E_h) + \gamma' X_i + \delta' Z_i) \quad (1)$$

M_i : Multi_job.

F_i : female (is_female).

E_h : elder present (65+) in household h (hh_elder_65p).

X_i : controls (Age, age², education).

Z_i : context (Urban) and island fixed effects.

Focus: β_3 tests gender-differential effects of elder presence. Report AME and PP (Margins).

RQ2 - Consequences of diversification:

(a) Total hours (OLS)

$$H_i = \alpha_i + \alpha_1 M_i + \alpha_2 F_i + \alpha_3 E_h + \alpha_4 (M_i \times F_i) + \alpha_5 (M_i \times E_h) + \alpha_6 (F_i \times E_h) + \alpha_7 (M_i \times F_i \times E_h) + I' X_i + \Delta' Z_i + \mu_i \quad (2)$$

With H_i = Hours_total.

(b) Underemployment (logit)

$$PR(U_i = 1) = \text{logit}^{-1}(\theta_i + \theta_{i1} M_i + \theta_{i2} F_i + \theta_{i3} E_h + \theta_{i4} (M_i \times F_i) + \theta_{i5} (M_i \times E_h) + \theta_{i6} (F_i \times E_h) + \theta_{i7} (M_i \times F_i \times E_h) + \theta X_i + \Pi' Z_i) \quad (3)$$

With $U_i = \text{underemp}$

- α_1, θ_1 : Average effect of side job.
- α_7, θ_7 : Triple interaction, does the side-job effect differ by gender $\times$ elder presence?

RQ3 - Direction of diversification among side-job holders.

(a) Total hours (OLS)

$$H_i = \phi_0 + \sum_k \phi_k \text{Sektor}_{ik} + \Phi' X_i + \Psi' Z_i + e_i \quad (4)$$

(b) Underemployment (logit)

$$\Pr(U_i = 1) = \text{logit}^{-1}(\lambda_0 + \sum_k \phi_k \text{Sektor}_{ik} + \Lambda' X_i + \Omega' Z_i + e_i) \quad (5)$$

ϕ_k : Difference in hours for sector kkk vs Agriculture.

λ_k : Difference in underemployment probability for sector kkk vs Agriculture.

Multiple comparisons are handled using the Bonferroni adjustment on *pwcompare (effects)*. The limitations of this study are as follows. First, the cross-sectional design does not permit strong causal inference, and the findings are interpreted as conditional correlations. Second, the possibility of omitted variable bias (e.g., work preferences, elderly health conditions) remains despite the inclusion of control variables. Third, the measurement of working hours and side job status relies on weekly reporting, so longer-term seasonal fluctuations are not captured.

4. RESULTS AND DISCUSSION

The findings of this study prove the presence of a gender aspect in side jobs. Women are always less likely than men to take up extra jobs, as indicated in Table 2. But when there are older members of the household who are 65 years and above, this trend changes. The older members are twofold since they increase consumption and caregiving needs (dependency burden) and, at the same time, may replace some part of caregiving (time substitution) (Backhaus & Barslund, 2021; Kotamäki & Lehtimäki, 2025; Mudrazija & Aranda, 2025; Xu, Wang, & Li, 2022). With this combination, women can now participate in or increase their interest in paid work. Therefore, the dependency issue of elderly members is not the only one, but may instead be a form of composition shock in a household that leads to income diversification, especially within a household that is headed by a woman. Table 2 gives the results of the logit estimation of the probability of having a side job.

Table 2. Logit Probability of Having a Side Job (*multi_job*).

Variables	Coef.	Robust SE	z	p-value	95% Conf. Interval
Female (=1)	-0.885	0.016	-55.87	0.000	[-0.917, -0.854]
Elder 65+ in household (=1)	0.123	0.036	3.45	0.001	[0.053, 0.194]
Female $\times$ Elder 65+	0.149	0.048	3.09	0.002	[0.055, 0.244]
Age	0.151	0.004	43.05	0.000	[0.144, 0.158]
Age ²	-0.002	0.001	-37.78	0.000	[-0.002, -0.001]
Education: Junior Secondary (SMP/MTs)	0.026	0.019	1.39	0.165	[-0.011, 0.064]
Education: Senior Secondary (SMA/K/MA)	0.105	0.019	5.63	0.000	[0.068, 0.141]
Education: Diploma I/II/III	-0.033	0.092	-0.36	0.719	[-0.214, 0.147]
Education: $\geq$ DIV/S1+	0.063	0.051	1.24	0.215	[-0.036, 0.162]
Urban (=1)	-0.328	0.019	-17.26	0.000	[-0.365, -0.291]
Island: Java	0.586	0.020	29.51	0.000	[0.547, 0.624]
Island: Bali	0.651	0.052	12.59	0.000	[0.549, 0.752]
Island: Nusa Tenggara	0.653	0.023	28.97	0.000	[0.609, 0.697]
Island: Kalimantan	0.076	0.025	3.06	0.002	[0.027, 0.124]
Island: Sulawesi	0.013	0.020	0.63	0.529	[-0.027, 0.053]
Island: Maluku & Papua	-1.451	0.028	-52.46	0.000	[-1.504, -1.396]
Constant	-4.683	0.077	-60.81	0.000	[-4.834, -4.532]

Note: Model summary: N = 170,040; Wald $\chi^2(16) = 10,973.40$; Log pseudolikelihood = -71,271.965; Pseudo-R² = 0.0941.
Reference categories: Male; no elder 65+; education $\leq$ SD/MI; Rural; Island = Sumatra

Source: Data Processed (2025).

To facilitate substantive interpretation, Table 3 reports the predicted probabilities based on the interaction between gender and the presence of elderly household members.

Table 3. Predicted Probabilities from Margins.

Group (Gender × Elder 65+)	No elder	With elder
Men	0.216	0.236
Women	0.107	0.134

Source: Data Processed (2025).

The age-related life cycle, as well as the human capital perspective, indicates that the likelihood of a side job is likely to grow with age, but this level stops at some point, reaching its highest at midlife and declining thereafter. These results align with labor market dynamics documented in recent studies of multiple jobholding (Bailey & Spletzer, 2021; Lalé, 2025).

The most consistent variable identified in relation to the probability of side jobs is upper-secondary education. This implies that the non-agricultural jobs in rural environments, constituting the rural non-farm economy (RNFE), assign more importance to applied skills and work experience than to higher educational qualifications. Stated differently, side jobs function as a more accessible entry channel for workers with secondary education backgrounds, consistent with evidence that educational attainment significantly increases participation in non-farm activities among rural households (Chekol, 2024).

These dynamics are also emphasized by the spatial dimension. Urban residence is also negatively associated with the probability of having a side job, which may be explained by the fact that primary jobs are more stable and time-consuming and leave little time to develop diversification. On the other hand, high levels of heterogeneity are present in rural regions: Java, Bali, and Nusa Tenggara are much more engaged in side jobs, and Maluku and Papua fall far behind. The trend is symptomatic of differences in access to RNFE opportunities, the quality of local economic infrastructure, and local market organization.

The policy implications of these findings rest on two complementary strategies. First, strengthening the care ecosystem, including services for the elderly and childcare, can transform the presence of elderly members from a dependency burden into an opportunity for time release for women (Deng, Zhou, & Hu, 2023; Han, Liu, & Zheng, 2025; Zhang, Dong, Li, & Fang, 2026).

Second, expanding quality non-agricultural employment opportunities in rural areas, aligned with intermediate skills and supported by access to short-term training or certification as well as market connectivity, can enhance the role of side jobs as an income buffer.

In this way, household composition shocks can be leveraged not as vulnerabilities but as policy levers to strengthen household economic resilience while ensuring the sustainability of rural livelihoods.

4.1. Effects of Side Job on Weekly Hours and Underemployment (RQ2)

Sample: agricultural main-job workers (BPS-Statistics Indonesia, 2024). Controls in all models: age, age², education (5 categories), urban, island fixed effects; robust SE. Groups are defined by Gender × Elder (65+) in the household.

All deltas (Δ) below are pairwise differences between predicted outcomes with and without a side job from the fitted models. The effects of side jobs on total weekly working hours are presented in Table 4, which reports predicted means across gender–elderly groups.

Table 4. Panel Weekly total hours.

Group	No side job	With side job	Δ hours
Men, no elder	30.707	41.843	+11.136
Men, with elder	31.021	44.808	+13.787
Women, no elder	23.670	34.998	+11.329
Women, with elder	25.224	36.981	+11.757

Note: Predicted means from OLS with robust SE. All Δ are significant at $p < 0.001$.

Meanwhile, an examination of the effects of livelihood diversification reveals that side jobs tend to raise the total number of working hours per week for individuals. With side jobs, agricultural workers work more hours on average than people who work in only one main job. Nonetheless, the effect is not evenly distributed. From a gender perspective, the increase in working hours associated with side jobs is more pronounced among men than among women. This trend indicates that side employment opens up room for diversification among women, but the amount of time available to them due to household chores still restricts the amount of time they can devote to employment. Put differently, in the case of women, side jobs usually become a partial, but not a full, extension of paid working time (Kleven, Landais, Posch, Steinhauer, & Zweimüller, 2019).

The presence of older adults in the family also contributes to this tendency. In families that have older adults, side jobs have a higher likelihood of raising the working hours of women than families that do not have older adults. With the older family members taking over some of the care giving roles, women are less constrained in terms of time and have the opportunity to increase their participation in the labor market. Therefore, the inclusion of the aged members does not only enhances the probability of side jobs (RQ1), but also their impact on working hours. Table 5 presents the OLS estimates of weekly total working hours, including the interaction between side-job holding, gender, and the presence of elderly household members.

Table 5. OLS Estimates of Weekly Total Hours.

Variables	Coef.	Robust SE	t	p-value	95% CI
Side job (=1)	11.136	0.130	85.83	0.000	[10.882, 11.390]
Female (=1)	-7.037	0.079	-89.23	0.000	[-7.192, -6.883]
Side job $\times$ Female	0.192	0.226	0.85	0.000	[-0.250, 0.634]
Elder 65+ in HH (=1)	0.313	0.225	1.39	0.000	[-0.127, 0.754]
Side job $\times$ Elder 65+	2.651	0.363	7.30	0.000	[1.940, 3.363]
Female $\times$ Elder 65+	1.241	0.249	4.98	0.000	[0.753, 1.729]
Side job $\times$ Female $\times$ Elder 65+	-2.223	0.694	-3.21	0.001	[-3.582, -0.864]
Age	1.055	0.015	70.89	0.000	[1.026, 1.085]
Age ²	-0.0117	0.00018	-65.26	0.000	[-0.0121, -0.0114]
Education: SMP/MTs	-1.807	0.098	-18.39	0.000	[-2.000, -1.615]
Education: SMA/K/MA	-1.216	0.100	-12.14	0.000	[-1.412, -1.020]
Education: Diploma I/II/III	-2.523	0.527	-4.79	0.000	[-3.555, -1.490]
Education: $\geq$ DIV/S1+	-3.804	0.294	-12.95	0.000	[-4.380, -3.228]
Urban (=1)	0.810	0.113	7.16	0.000	[0.588, 1.032]
Island: Java	-1.327	0.121	-10.99	0.000	[-1.564, -1.091]
Island: Bali	0.547	0.319	1.71	0.087	[-0.080, 1.173]
Island: Nusa Tenggara	-4.101	0.134	-30.50	0.000	[-4.364, -3.837]
Island: Kalimantan	-0.615	0.142	-4.33	0.000	[-0.893, -0.336]
Island: Sulawesi	0.989	0.121	8.20	0.000	[0.753, 1.226]
Island: Maluku & Papua	3.258	0.096	34.12	0.000	[3.071, 3.445]
Constant	9.895	0.309	32.00	0.000	[9.289, 10.501]

Note: Linear regression with robust standard errors. Controls include age, age², education dummies, urban residence, and island fixed effects. Reference categories: no side job, male, no elder 65+, education $\leq$ SD/MI, rural, and Sumatra. Model statistics: N = 170,040; F(20, 170,019) = 1,927.04; R² = 0.1847; Root MSE = 14.29.

Also, when one analyses the underemployment risk (which is being employed for less than 35 hours a week), it is found that diversification via side jobs guarantees that workers are less likely to be underemployed. Similarly, workers who have side jobs are not as common in situations of low working time. These benefits, however, are more

male-dominated when considered by gender. In the case of women, having side jobs does not completely eradicate the chances of underemployment, except in families with older people. Such a trend restates the centrality of the family care ecosystem as an intermediary variable that establishes the degree to which diversification can indeed enhance the quality of women's labor participation (Hermes, Krauß, Lergetporer, Peter, & Wiederhold, 2022; Huang, Xu, Liu, Yu, & Yu, 2021).

On the whole, the findings of RQ2 suggest that side jobs can be regarded as a significant tool to prolong working hours and decrease cases of underemployment among agricultural workers. However, the effects are not spread evenly: women still have to live with limitations, unless there is role substitution in caregiving offered by elderly family members. Therefore, the correlation between family organization and gender will play a central role in defining the levels to which livelihood diversification can be used as a labor-market protection mechanism.

Table 6. Logit Estimates Probability of Underemployment.

Variables	Coef.	Robust SE	z	p-value	95% CI
Side job (=1)	-0.945	0.018	-52.36	0.000	[-0.980, -0.910]
Female (=1)	0.950	0.013	75.53	0.000	[0.925, 0.975]
Side job × Female	-0.163	0.032	-5.11	0.000	[-0.225, -0.100]
Elder 65+ in HH (=1)	-0.159	0.032	-4.99	0.000	[-0.221, -0.097]
Side job × Elder 65+	-0.191	0.050	-3.79	0.000	[-0.290, -0.092]
Female × Elder 65+	-0.171	0.042	-4.07	0.000	[-0.253, -0.088]
Side job × Female × Elder 65+	0.291	0.102	2.85	0.004	[0.091, 0.491]
Age	-0.125	0.002	-50.49	0.000	[-0.130, -0.120]
Age ²	0.001	0.001	46.52	0.000	[0.001, 0.001]
Education: SMP/MTs	0.190	0.015	12.96	0.000	[0.161, 0.218]
Education: SMA/K/MA	0.153	0.015	10.42	0.000	[0.124, 0.182]
Education: Diploma I/II/III	0.341	0.075	4.56	0.000	[0.194, 0.488]
Education: ≥DIV/S1+	0.369	0.041	8.97	0.000	[0.288, 0.449]
Urban (=1)	-0.146	0.015	-9.64	0.000	[-0.175, -0.116]
Island: Java	0.170	0.017	9.79	0.000	[0.136, 0.204]
Island: Bali	0.002	0.048	0.05	0.959	[-0.091, 0.096]
Island: Nusa Tenggara	0.520	0.021	25.09	0.000	[0.480, 0.561]
Island: Kalimantan	0.113	0.021	5.48	0.000	[0.072, 0.153]
Island: Sulawesi	-0.117	0.016	-7.11	0.000	[-0.149, -0.085]
Island: Maluku & Papua	-0.247	0.015	-16.30	0.000	[-0.277, -0.217]
Constant	2.634	0.051	51.72	0.000	[2.534, 2.734]

Note: Logit estimates with robust SE. Reference categories: no side job, male, no elder 65+, ≤primary education, rural, and Sumatra. N = 170,040; Wald $\chi^2(20)$ = 16,443.95; Pseudo-R² = 0.0831.

The results of the logit estimation presented in Table 6 should be interpreted in terms of the reference group, i.e., males not living in households with old members. In this regard, the side job coefficient is the background impact of having a secondary job on the likelihood of underemployment in this reference group. This baseline effect is then adjusted by the interaction coefficients: Side job x Female shows the difference in the effect of secondary employment between females and males; Side job x Elder 65+ shows the difference in the effect of secondary employment between households with elderly members and females; and Side job x Female x Elder 65+ shows the further adjustment of the marginal effect of the intervention in the case of females living in households with elderly members. Since the logit model is nonlinear, prediction of probabilities and average marginal effects are not based on the raw coefficients, but on the predicted probabilities and average marginal effects (Tables 7 and 8). The margin results indicate that secondary employment lowers the likelihood of underemployment by about 21 to 25 percentage points across all the categories, but there are still differences in the baseline risk between men and women.

To avoid misinterpretation of nonlinear interaction terms, Tables 7 and 8 report predicted probabilities and average marginal effects derived from the fitted model.

Table 7. Panel Predicted Probability by Group and Side Job Status.

Group	No side job	With side job	Δ percentage points
Men, no elder	0.538	0.321	-21.71
Men, with elder	0.500	0.253	-24.73
Women, no elder	0.744	0.500	-24.39
Women with an elder	0.679	0.446	-23.32

Note: Logit with robust SE; controls: age, age², education dummies, urban, island; full interaction side job $\times$ gender $\times$ elder 65+. N = 170,040.
(Panel A): Predicted probabilities from the fitted logit model. Δ is the difference (With – without side job) in percentage points. All Δ are significant at $p < 0.001$.

Table 8. Panel Average Marginal Effect (AME) of Side Job on Underemployment.

Group	AME (Δ p.p.)	Std. Err.	z	p-value
Men, no elder	-21.71	0.39	-56.14	<0.001
Men, with elder	-24.73	0.93	-26.73	<0.001
Women, no elder	-24.39	0.62	-39.26	<0.001
Women, with elder	-23.32	1.97	-11.86	<0.001

Note: (Panel B): AME are discrete changes in probability (Percentage points) when moving from no side job to having a side job within each gender–elder group; robust SE from margins, $\text{dydx}(\text{multi_job})$ over (is_female hh_elder_65p).

Gender-wise, women are more likely to be underemployed than men when they do not work part-time (0.744 against 0.538 in families that do not have aged people). Nevertheless, the gains of side jobs in minimizing the risk of underemployment are fairly equal between the genders, as can be seen in the average marginal effects (Table 8), with varying values between -23 and -25 percentage points. It means that, despite the fact that women are more susceptible to underemployment, the number of side jobs can significantly reduce the disparity.

This is an additional aspect of the presence of senior individuals in the family. The likelihood of underemployment is somewhat lower in households with elderly members (e.g., men with elderly members), and the side-job effect is even stronger in this sector (Δ -24.7 men; Δ -23.3 women). This trend follows the same mechanism of time substitution, where participation in domestic caregiving activities by elderly members frees productive members to work longer hours, consequently decreasing the chances of underemployment (Miller et al., 2024).

These results support the thesis that various livelihood strategies are dual in nature, improving the number of total working hours (RQ2a) as well as, in fact, alleviating the susceptibility to underemployment. Accordingly, side jobs may be considered a valuable tool for enhancing the labor market sustainability of agricultural families. However, these gains fail to fully eradicate gender differences because the level of risk of underemployment among women is still high. The most significant factors have been structural issues like the distribution of domestic duties and the lack of access to more stable non-agricultural jobs for women. Table 9 presents the OLS estimates of weekly total hours by side-job sector.

Table 9. OLS Weekly Total Hours by Side-Job Sector.

Variables	Coef.	Robust SE	t	p-value
Side-job sector				
Manufacturing	1.431	0.428	3.34	0.001
Construction	4.748	0.772	6.15	<0.001
Trade	2.860	0.385	7.43	<0.001
Services	-0.061	0.312	-0.20	0.845
Age & education				
Age	0.765	0.050	15.19	<0.001
Age ²	-0.0085	0.00056	-15.36	<0.001
Junior secondary (SMP/MTs)	-0.899	0.256	-3.52	<0.001
Senior secondary (SMA/K/MA)	-1.016	0.253	-4.02	<0.001
Diploma I/II/III	-1.681	1.374	-1.22	0.221
$\geq$ Diploma IV/BA+	-2.583	0.703	-3.67	<0.001
Other controls				

Variables	Coef.	Robust SE	t	p-value
Urban (vs rural)	1.049	0.265	3.95	<0.001
Island: Java	1.202	0.256	4.69	<0.001
Island: Bali	2.003	0.629	3.19	0.001
Island: Nusa Tenggara	-1.781	0.290	-6.14	<0.001
Island: Kalimantan	0.476	0.327	1.46	0.145
Island: Sulawesi	1.187	0.285	4.17	<0.001
Island: Maluku & Papua	5.443	0.457	11.90	<0.001
Women (vs men)	-7.040	0.204	-34.59	<0.001
Elderly 65+ in HH	0.885	0.458	1.93	0.053
Constant	25.465	1.147	22.21	<0.001

Note: Linear regression with robust SE. Controls: age, age², education dummies, urban, island, gender, elder 65+. Reference categories: Side-job sector = Agriculture, Education = ≤Primary, Urban = Rural, Island = Sumatra, Gender = Men, Elder 65+ = No. Model stats: N = 29,641; F(19, 29,621) = 109.40; R² = 0.0658; Root MSE = 15.385.

The interest of these findings at this point lies in the areas of side jobs, where a number of patterns are observed. Variations in working hours in the industry suggest that the pattern of diversification is a crucial factor in work intensity. Relative to agriculture as a reference, side jobs in construction increase by about 4.75 hours per week, preceded by trade (+2.86 hours per week) and manufacturing (+1.43 hours per week), while services do not change significantly compared to agriculture. This implies that industries with project-oriented work, deadlines, and specific output targets (e.g., building) are more prone to longer shifts and higher labor demand, whereas services, despite their flexibility, are more subject to dispersed and varying demand, and their weekly hours are not consolidated.

The concave age effect brings out the life-cycle dynamics whereby working hours accumulate with experience and networks to a certain level, after which they decrease as the individual gets older. The comparatively negative coefficients of education (at ≤ primary school) are indicative of the paradox in RNFE: the more hours worked in side jobs per week, the less need there is for advanced academic qualifications, but there might be practical skills or short-term qualifications applicable to field tasks. The high level of the gender gap (women: -7 hours) indicates the existence of domestic time limits and the probability of women being concentrated in areas where the number of hours is more stable, which subsequently influences the aggregation of total working hours.

Table 10. Predicted Weekly Total Hours by Side-Job Sector (OLS with Robust SE).

Side-job sector	Predicted hours
Agriculture (Agri)	39.76
Manufacturing	41.19
Construction	44.51
Trade	42.62
Services	39.70

Note: Controls: age, age², education dummies, urban, island, gender, elder 65+. Predicted means from regress hours_total i.sidecat ..., vce(robust). Joint test of sector dummies: F(4, 29,621)=24.84, p<0.001.

Table 10 affirms the hierarchy of working hours suggested in the OLS coefficients. The highest predicted average of 44.5 hours/week in construction is followed by trade (42.6 hours) and manufacturing (about 41.2 hours), whereas agriculture and services are essentially close (39.7 hours).

The test of sectoral dummies is jointly significant and shows that these deviations are not random results of sample composition. Substantively, these findings indicate that entry into the RNFE is not enough, but the sector that a household enters dictates how many working hours the household can amass as an income buffer. To program designers, these numbers provide a clear indication of sectoral priorities if the policy goal is to raise aggregate working hours.

Table 11. Predicted Probability of Underemployment (<35 hours/week) by Side-Job Sector (Logit with Robust SE).

Side-job sector	Predicted probability
Agriculture (Agri)	0.361
Manufacturing	0.334
Construction	0.278
Trade	0.338
Services	0.388

Note: Controls: Age, age², education dummies, urban, island, gender, elder 65+. Probabilities from logit underemp i.sidecat ..., vce(robust) followed by margins sidecat.

The following question is whether this hierarchy of working hours is connected to the threat of underemployment. Table 11 answers the question unequivocally, as the underemployment risk gradient is a reflection of the working-hours pattern. It has the lowest probability of 0.278 in construction, 0.334 in manufacturing, and 0.338 in trade, and the highest is in agriculture (0.361) and services (0.388). This distinction is based on sector-specific formation of hours, with controls on individual and contextual characteristics. Construction offers a minimum-hours floor with long shifts and project pipelines; services are subject to daily and seasonal volatility in demand, which consequently exposes them to working less than 35 hours per week. These results spell out a trade-off of flexibility versus stability in services: flexibility in services can easily achieve entry at the price of the risk of short hours.

Table 12. Average Marginal Effect (AME) of Side-Job Sector on Underemployment Relative to Agri (Percentage points).

Comparison vs Agri	Δ p.p.	Std. Err.	z	p-value
Manufacturing	-2.71	1.17	-2.31	0.021
Construction	-8.26	1.97	-4.20	<0.001
Trade	-2.26	1.05	-2.15	0.031
Services	+2.74	0.92	3.00	0.003

Note: From margins, dydx(i.sidecat). Robust standard errors in parentheses. Δ is the discrete change in probability (Percentage points) relative to having an agricultural side job. Negative values indicate lower risk of underemployment than Agri; positive values indicate higher risk.

Table 12 indicates the magnitude of sectoral effects on underemployment. The average marginal effects ultimately give an approximation, which could be interpreted directly in percentages. The conversion of an agricultural part-time job into a construction job lowers the likelihood of underemployment by approximately 8.26 percentage points, which is a significant influence. The moves toward manufacturing (-2.71) and trade (-2.26) have a moderate level of protection, whereas the transition to services actually raises the risk (+2.74). Given the fact that the AME quantifies the nonlinear logit coefficients into changes in probability, these findings further support the thesis that the quality of the diversification path is more relevant than the status of a side job.

Table 13. Underemployment (<35 hours/week) Among Side-Job Holders, Logistic Regression with Robust SE.

Side-job sector (Agri = Base)	Coef. (log-odds)	Robust SE	z	p-value	95% CI
Manufacturing	-0.1255**	0.0553	-2.27	0.023	[-0.2338, -0.0172]
Construction	-0.4001***	0.1021	-3.92	0.000	[-0.6003, -0.1999]
Trade	-0.1041**	0.0490	-2.13	0.033	[-0.2001, -0.0082]
Services	0.1231***	0.0406	3.03	0.002	[0.0434, 0.2027]

Note: Baseline sector = Agriculture (Agri). Controls included: age, age², education (5 categories), urban, island dummies, female, elder 65+. N = 29,641 (Side-job holders only). Wald $\chi^2(19) = 1,366.57$; Prob > $\chi^2 = 0.0000$; Pseudo R² = 0.0369. Asterisks indicate statistical significance: ** p < 0.01, and *** p < 0.001.

The homogeneity of these results is also put to the test in the logit model that is restricted to side-job holders (Table 13). The sectoral coefficients reproduce the earlier sequence, as the negative coefficients for construction (-0.400), manufacturing (-0.125), and trade (-0.104) are positive predictors of underemployment in comparison with agriculture, whereas services augment the threat of underemployment (+0.123). The internal validity of the results is improved by the consistency of the signs and statistical significance across specifications and by the good global fit.

However, the cross-sectional design does not rule out the possibility of sectoral selection (that is, preferences for working longer hours or network benefits that make it easier to enter the construction industry), and therefore, causal interpretations should be considered cautiously.

Table 14. Predicted Probability of Underemployment by Side-Job Sector.

Side-job sector	Predicted probability	95% CI
Agri (Base)	0.3609	[0.3546, 0.3671]
Manufacturing	0.3338	[0.3116, 0.3559]
Construction	0.2782	[0.2402, 0.3163]
Trade	0.3383	[0.3188, 0.3578]
Services	0.3883	[0.3716, 0.4050]

Note: Predicted Pr(underemployment) from the model above (Margins), holding controls as in the fitted model.

The accuracy and stability of the sectoral ranking are also indicated by the confidence levels in Table 14. Construction has been ranked very low compared with agriculture and services (confidence intervals are also very close), and manufacturing and trade are closely positioned. As a policymaker, this structure of the confidence intervals will help decrease fears about spurious differences and allow a more specific focus on sectors when the primary goal of the policy is to minimize underemployment.

Such sectoral results also give a fresh perspective on understanding the gender differences that are already known to exist. As women, on average, spend fewer hours and are more targeted by underemployment, the concentration of women in areas with more stable working hours, including services and portions of trade, can be a mediating factor that can perpetuate the gender gap, even though the protective role of side jobs against underemployment is substantial for all groups. In this context, the data on the presence of elderly members of the household as time replacements will be topical: the release of household duties for the female population may lead to more gender-balanced benefits of side jobs, i.e., construction or formal trade (Lee, Lee, & Yang, 2025; Miller et al., 2024).

In substance, the series of evidence provided in Tables 10-14 summarises the thesis to change the status of side jobs from a survival strategy into a tool for improving employment. The immediate policy implication is that there is a need to manage diversification into those sectors (which have high working hours and low risk of underemployment) with short-term training, skills certification, and job matching based on projects and, at the same time, increase the care ecosystem such that time substitution can actually be workable for women. Meanwhile, the quality of jobs in the services sector should be enhanced, such as by minimum guaranteed hours and clear schedules, to avoid flexibility trapping them in a low-hours trap (Lambert, Haley-Lock, & Henly, 2012). Since the cross-sectional design is open to sectoral (or network, preferences, or physical) selection that may not be exhaustively contained, further analysis with panel data or implementation of a doubly robust methodology would fortify causal arguments. However, the regularity of indications and statistical significance across specifications offers solid empirical evidence for the conclusion that the direction of diversification is the most significant determinant of the effect of side jobs in agricultural families on the labor market (Jain, Barrett, Solomon, & Ghezzi-Kopel, 2023).

5. POLICY IMPLICATIONS

The results show that the success of livelihood diversification does not rely on the mere existence of side jobs but rather depends on the sectoral avenues where diversification is made. The areas of intensive and stable hours formation, specifically construction, and then trade and manufacturing, and the services sector need to be redesigned to allow flexibility to avoid low-hours traps, which should be prioritized as high-hours and low-underemployment trajectories. Since the involvement of women is highly mediated by time replacement by older family members, strategies in labor market frameworks should be combined with the care ecosystem, such as community-based eldercare and childcare, as viable conditions enabling women to continue engaging in stable employment options.

It is necessary to focus skills development policies on short-cycle, sector-specific technical training and project-based employment pipelines so that a targeted transition can be made between training and work. In parallel, institutional measures, including minimum laid-off hours, transparency of schedules, and enhanced labor legislation, are needed to make working hours stable and less volatile, especially in the services sector. The design of the policies must be place-based, heterogeneous across the region based on opportunities in RNFE, and must embrace weekly total hours and underemployment probability as the key monitoring variables, as opposed to employment status alone. With concerted sectoral curation, care infrastructure, and specific skilling, side jobs can transform from a survival strategy into a source of sustainable and inclusive rural employment.

6. CONCLUSION

In this research, there are three main questions that will be answered concerning the issue of livelihood diversification in farming families. To begin with, it validates the fact that diversification in terms of side jobs works as a time-allocation and income-adjustment mechanism influenced by household structure and gender. There has always been a continuing gender difference regarding the possibility of having a side job, but the availability of elderly relatives in the household has been a time substitution that increases the possibilities of paid employment, especially among women, although it also creates potential dependency costs. Second, side jobs are linked to more total weekly working hours and reduced risk of underemployment by groups, although they cannot completely reduce the underlying susceptibility of women. Third, the quality of the diversification paths is more decisive than the presence of side jobs. High working hours and low underemployment, which are the features of the paths, provide more protection than the services sector. This trend exemplifies industry-specific arrangements of working hours, including minimum hours under project-based employment versus more unstable hours under on-call or part-time employment. Although it is impossible to interpret results causally because of the cross-sectional design and the possible selection of the sector, the similarity of the results across the model specifications allows drawing one central conclusion: The direction and sectoral orientation of diversification play a critical role in changing side jobs from a survival mechanism into a path to more inclusive and sustainable rural job employment.

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