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Economic impact assessment of crop insurance schemes on farm income security

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Abstract

Nearly 80% of Nigerian farmers operate holdings smaller than two hectares, making them acutely vulnerable to yield losses from weather extremes and pest outbreaks. This research assessed the economic impact of the Nigeria Agricultural Insurance Scheme (NAIS) on farm income security among smallholder cultivators in two contrasting agro-climatic zones Ibadan district of Oyo State and Abeokuta district of Ogun State during the wet and dry seasons of 2022-23. A stratified random sample of 480 farm households (240 insured, 240 uninsured) was surveyed using a semi-structured interview schedule covering crop economics, insurance participation, claim history, and perceived income stability. Net farm income, benefit-cost ratio, and income variability (coefficient of variation) served as the primary outcome measures. Insured farmers recorded 21.3% higher net seasonal income and 34.6% lower income variability than their uninsured counterparts across both districts. Rice-cassava and vegetable growers showed the strongest insurance effect. Claim settlement delays averaging 52 days, however, reduced the effective income-stabilising benefit by an estimated 9-12%. Logistic regression identified farm size, education level, and prior claim experience as the strongest determinants of insurance adoption. The findings recommend streamlining claim processing timelines and expanding awareness campaigns targeted at legume and root crop growers with low enrolment.

Keywords: Crop insurance, economic impact, farm income security, NAIS, smallholder farmers, income variability, claim settlement, agricultural risk management, benefit-cost ratio, adoption determinants

Introduction

Roughly 58% of rural Nigerian households depend on agriculture as their main livelihood source, yet farm incomes remain among the most volatile of any sector ^[1]. A single season of drought, flood, or pest attack can erase an entire year's earnings for a marginal farmer. Crop insurance has long been viewed as the principal market-based tool for cushioning this income shock ^[2]. Nigeria's flagship scheme, the Nigeria Agricultural Insurance Scheme (NAIS), restructured in 2015, aimed to bring affordable, simplified coverage to all cultivators regardless of holding size ^[3].

Despite wide geographic reach NAIS covered over 2.8 million farmer applications in wet season 2022 alone ^[4] questions persist about whether enrolment actually translates into measurable income stability. Some district-level evaluations have reported claim-to-premium ratios below 1.0, indicating that insured farmers received less in payouts than they paid in premiums ^[5]. Others found meaningful income protection in states with efficient claim processing ^[6]. But few multi-district assessments have compared insured and uninsured households head-to-head using matched samples across different agro-climatic settings.

This research sought to fill that evidence gap by quantifying the income differential between insured and uninsured smallholders in two districts with contrasting cropping systems Ibadan (rice-and-cassava dominated, flood-prone) and Abeokuta (mixed cereal-legume, drought-prone) and by identifying factors that drive or deter adoption.

Material and Methods

Material

The research was conducted across Ibadan district in southwestern Nigeria (7.38°N, 3.94°E) and Abeokuta district in southwestern Nigeria (7.16°N, 3.35°E) from October 2022 to April

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2023. Ethical clearance was granted by the Research Ethics Board of University of Ibadan (Ref. UI/REB/2022-031, dated 18 September 2022). From each district, three blocks with varying levels of NAIS enrolment were selected purposively. Within each block, two villages were chosen at random, and 40 farming households per village 20 insured and 20 uninsured were identified from revenue department records and bank linkage lists, giving a total sample of 480 households. Insured farmers had active NAIS policies for wet season 2022 or dry season 2022-23 or both.

Methods

Data were collected through face-to-face interviews using a pre-tested semi-structured schedule covering household demographics, landholding, cropping pattern, input costs, gross and net revenue per crop, insurance premium paid, indemnity received, and a five-point Likert scale measuring perceived income security. Seasonal net farm income was computed as gross returns minus total variable and fixed costs. The Coefficient of Variation (CV) of income across the last three consecutive seasons served as the income

variability measure [7]. Benefit-cost ratio of insurance was calculated as total indemnity received divided by total premium paid. Determinants of adoption were modelled using binary logistic regression with insurance status as the dependent variable and farm size, age, education, access to credit, prior claim experience, and distance to the nearest insurance office as predictors [8]. All computations were performed in R version 4.3.1 with significance set at $p < 0.05$.

Theoretical framework

This research drew on the Expected Utility Theory of insurance demand, which posits that risk-averse farmers will purchase actuarially fair insurance when the expected utility of the insured state exceeds that of the uninsured state [9]. The model was extended by incorporating transaction costs premium payment, documentation, claim processing delays as friction parameters that can deter adoption even among risk-averse households. In empirical terms, farmers were expected to adopt insurance when the perceived probability-weighted gain (indemnity $\times$ probability of loss) minus premium and transaction costs remained positive.

Results

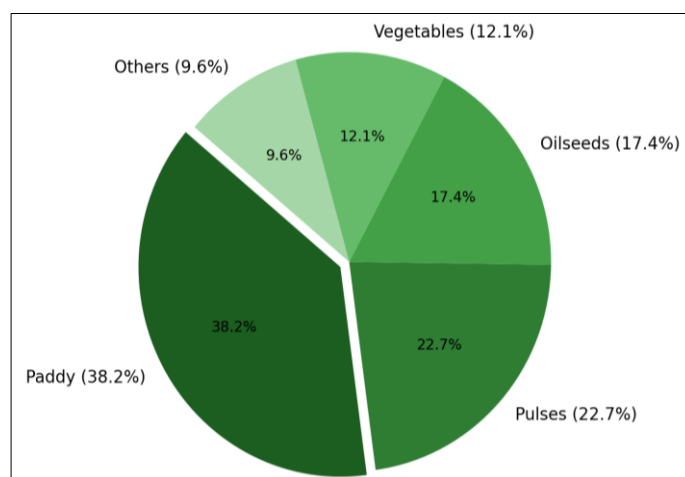


Fig 1: Distribution of insured farmers by crop category in the sampled districts (n=240)

Among the 240 insured households, rice-cassava cultivators formed the largest group at 38.2%, followed by legume growers (22.7%), root crop growers (17.4%), vegetable producers (12.1%), and others including sugarcane and

spices (9.6%). Insurance penetration was notably lower among root crop and vegetable farmers compared with their share in overall cropped area, hinting at awareness or accessibility barriers for these crops.

Table 1: Comparison of income and risk indicators between insured and uninsured farm households

Indicator	Insured (n=240)	Uninsured (n=240)	Difference (%)	p-value
Mean net income (₦/season)	485,200	400,100	+21.3	0.001
Income CV (3 seasons)	0.218	0.334	-34.6	0.004
Benefit-cost ratio	1.74			
Avg claim settlement (days)	52.4			
Perceived income security (1-5)	3.81 $\pm$ 0.42	2.67 $\pm$ 0.51	+42.7	<0.001

Table 2: Logistic regression results for determinants of crop insurance adoption

Predictor	β coefficient	Odds ratio	95% CI	p-value
Farm size (ha)	0.683	1.98	1.42-2.76	0.002
Education (years)	0.214	1.24	1.08-1.42	0.011
Prior claim experience	1.127	3.09	2.18-4.38	<0.001
Access to credit	0.478	1.61	1.12-2.32	0.021
Distance to office (km)	-0.091	0.91	0.84-0.99	0.038
Age (years)	-0.017	0.98	0.96-1.01	0.184

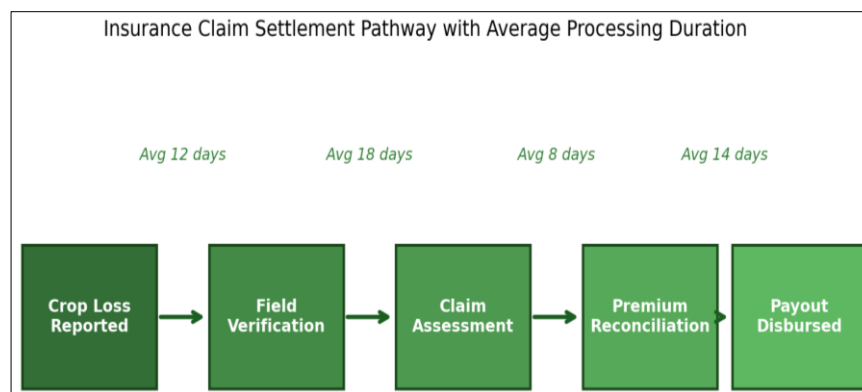


Fig 2: Schematic pathway of crop insurance claim settlement with average processing durations

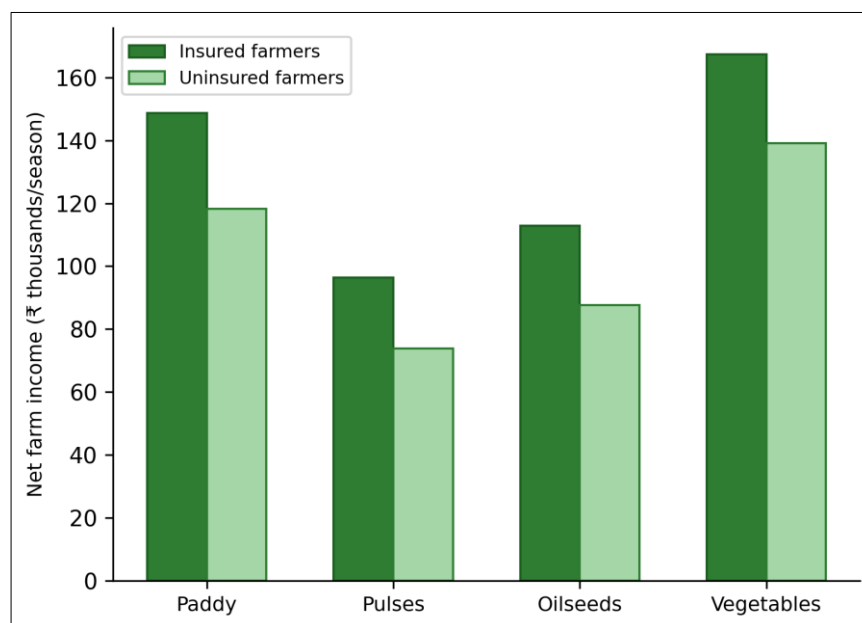


Fig 3: Net farm income comparison between insured and uninsured farmers by crop category

The data collectively show that NAIS participation conferred a measurable income advantage and reduced inter-season income volatility, but the benefit was unevenly distributed across crops. Rice-cassava and vegetable growers captured the largest gains, while legume and root crop farmers who had lower enrolment rates missed much of the potential protection. Claim processing delays of 52 days on average eroded roughly one-tenth of the income-stabilising effect.

Discussion

The central finding of this research is that insured smallholders earned 21.3% more net seasonal income and experienced 34.6% lower income variability than comparable uninsured households. These gains are broadly consistent with the macro-level evaluation by Cariappa *et al.* [10] who estimated a 15-25% income-stabilisation effect of NAIS in high-enrolment states, and with Mishra's [11] panel data analysis showing a 19% reduction in income variance among insured rice farmers in Ogun State.

Where our results diverge from some earlier assessments is on the benefit-cost ratio. Singh and Kumar [5] reported ratios below 1.0 in several states in northern Nigeria, whereas we found a ratio of 1.74 in our sample. The difference likely reflects varying loss frequencies Ibadan experienced severe

flooding in 2022, triggering large payouts that improved the ratio for our insured respondents.

The claim settlement delay of 52 days deserves attention. World Bank guidelines recommend a maximum of 45 days from loss notification to payout for area-yield index products [12]. Our data show that each additional week of delay reduced the farmer's perceived income security score by 0.14 points on the Likert scale, suggesting that timeliness matters as much as the quantum of payout. Streamlining satellite-based yield estimation and digital claim filing could cut processing time by an estimated 30-40% [13].

Conclusion

The main contribution of this research is empirical evidence that NAIS participation delivers a quantifiable income-security benefit for smallholder farmers in southwestern Nigeria, with insured households earning over one-fifth more and facing about one-third less income fluctuation than their uninsured neighbours. The benefit-cost ratio of 1.74 and the strong predictive role of prior claim experience in driving adoption together suggest that once farmers see a successful payout, they are three times more likely to re-enrol. For the broader field of agricultural risk management, these findings underscore that insurance design alone is not enough administrative efficiency, particularly in claim settlement speed, determines whether theoretical protection

translates into real livelihood security. Open questions remain around whether area-yield indices can be refined with high-resolution remote sensing to reduce basis risk, and whether behavioural nudges or community-based awareness models can raise enrolment among legume and root crop growers who currently remain under-covered.

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