

Impact of Contractual Arrangements on the Income of Honey Producers in Eswatini

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ABSTRACT

Background and Objective: Contractual arrangements such as formal and informal agreements play a key role in shaping market participation and income generation among smallholder honey producers in Eswatini. However, farmers self-select into contract types based on both observed and unobserved factors, complicating efforts to measure the true impact of contracting on income outcomes. This study aims to assess the effects of different contractual arrangements on the income of honey producers in Eswatini.

Materials and Methods: This study applies an Endogenous Switching Regression (ESR) model to account for selection bias and estimate the causal effects of formal, informal, and non-contractual arrangements on three income measures: Total revenue, gross margin, and honey yield value. Data from 307 honey producers were used across three ESR comparisons: Formal vs. informal (N = 221), formal vs. no contract (N = 225), and informal vs. no contract (N = 168). **Results:** The participation in formal contracts significantly improves income outcomes, with increases of up to 75.16% in revenue and 71.48% in gross margin compared to non-contractual arrangements. Informal contracts also provide income benefits over no contract, though to a lesser extent. Differences in honey yield value were less pronounced across contract types. **Conclusions:** These findings offer robust, statistically grounded evidence that formal contracting arrangements confer substantial income benefits to smallholder honey producers, underlining the importance of structured market relationships in enhancing farm-level profitability.

KEYWORDS

Contractual arrangements, honey producers, income, endogenous switching regression, average treatment effects

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INTRODUCTION

Contractual arrangements play an increasingly important role in agricultural markets, providing structured agreements that outline the responsibilities and obligations of producers and buyers and help mitigate production and marketing risks¹. Globally, contract farming has long been used for commodities requiring a consistent supply and strict quality control². These arrangements vary from informal handshake agreements to formal written contracts and commonly include production and marketing specifications designed to coordinate supply chains more efficiently³. The expansion of supermarket-driven value chains has further intensified the demand for vertically coordinated procurement systems that favour preferred suppliers, high-quality standards, and reliable volume conditions that smallholder farmers often struggle to meet^{4,5}. As a result, contract farming has emerged⁴ as a potential mechanism to improve smallholder integration into formal markets.



In Eswatini, beekeeping has evolved from traditional honey hunting to a more organized apiculture sector supported by training programs, institutional development, and value chain investments⁶. Despite this progress, the sector continues to face challenges, including inconsistent productivity, limited market information, and weak integration into lucrative domestic and export markets. Smallholder beekeepers often lack stable buyers, face price volatility, and struggle to secure inputs and technical support, constraining their ability to generate sustainable income⁷. Although contractual arrangements could address these challenges by improving market access, stabilizing prices, and facilitating access to credit and inputs, many beekeepers remain excluded due to variable production volumes, quality concerns, and high transaction costs⁸⁻¹⁰. Importantly, despite the growing use of contract farming by honey processors and export companies, no empirical studies have examined how different contractual arrangements affect income among Eswatini's honey producers.

Understanding the performance of formal, informal, and non-contractual arrangements is therefore essential for designing interventions that strengthen beekeeper participation in high-value markets. This study addresses this gap by applying an Endogenous Switching Regression (ESR) model to estimate the causal impact of different contractual arrangements on income outcomes among smallholder honey producers in Eswatini. By accounting for both observed and unobserved self-selection factors, the study provides robust evidence on how contractual arrangements influence total revenue, gross margin, and honey yield value. The findings contribute new insights to apiculture literature and inform market-linkage strategies aimed at improving smallholder livelihoods and market integration in Eswatini.

MATERIALS AND METHODS

Study area: The study was conducted between February and December 2024 in Eswatini and focused on honey bee farmers located across the country's four regions: Hhohho, Manzini, Lubombo, and Shiselweni. Honey production in Eswatini is predominantly carried out by smallholder farmers, many of whom operate on Swazi Nation Land, which is largely underdeveloped. These rural areas provide the necessary land area and floral coverage to support honey production.

Sample selection: This study adopted a stratified random sampling technique. To ensure a representative sample, a sample size of 307 respondents was determined using Cochran's formula. The honey farmers are distributed across four regions in Eswatini: Hhohho, Lubombo, Manzini, and Shiselweni. In each region, the farmers were stratified according to their contract status, allowing the capture of the diversity of experiences and practices of honey producers.

Data collection procedures: Primary data for this study were collected using a structured questionnaire administered to honey producers. The data collection process involved visiting the farmers on-site to ensure higher response rates and to obtain firsthand information. Ethical approval for the study was obtained from the Agricultural Economics department. All participants provided informed consent before data collection. Participation was voluntary, and confidentiality was maintained by anonymizing respondents' identities.

Data analysis and model specification: The collected data were coded, entered into Excel spreadsheets, cleaned, processed, and finally imported into STATA version 14 spreadsheets, where statistical analyses were carried out. One, descriptive statistical analysis was carried out on the socioeconomic, farm, and institutional characteristics of the honey producers' households. Two, to assess the effects of varying contractual arrangements on the income of honey producers in Eswatini, the study employed the

Endogenous Switching Regression (ESR) model. The ESR model addresses the issue of selection bias that arises when farmers self-select into contract farming. This approach enables researchers to estimate counterfactual outcomes by modeling the decision to participate and the resultant performance simultaneously.

The ESR models incorporate instrumental variables (IVs) to control for unobservable factors influencing contract participation. For example, distance to input suppliers or access to extension services can serve as valid instruments that affect the likelihood of contracting but do not directly impact productivity^{11,12}. Additionally, ESR frameworks allow for the identification and quantification of mediating and intervening variables. Mediating variables such as improved technical skills or access to better inputs explain the pathway through which contract farming affects productivity, while intervening variables, such as market fluctuations, may modify the strength of the contract's impact¹².

Addressing these variables is crucial for establishing a causal relationship between contract participation and performance outcomes, as it helps disentangle direct effects from those arising through secondary channels. Recent empirical work has demonstrated that incorporating these methodological nuances can substantially enhance the robustness of impact evaluations in contract farming studies^{5,11}.

Regime equation:

Regime 1

$$Y_{FC} = \alpha_1 Z_{ii} + \theta_1 Z_{ii} + u_{ii}, \text{ if } l=1, j = 2,3,4 \tag{1}$$

Regime 2

$$Y_{IC} = \alpha_1 Z_{ii} + \theta_1 Z_{ii} + u_{ii}, \text{ if } l=j \tag{2}$$

Outcome equation:

Regime 1

$$y_{i1} = \beta_1 X_{i1} + v_{i1}, \text{ if contractual arrangement} = 1$$

Regime 0

$$y_{i0} = \beta_0 X_{i0} + v_{i0}, \text{ if contractual arrangement} = 0, m = 2,3,4$$

Formal contract vs Informal contract:

Outcome variables

Regime 1: Formal contract

Y_{FC} = Total revenue, Gross margins or Honey yield value

Regime 0: Informal contract

y_{IC} = Total revenue, Gross margins or Honey yield value

X_i = Explanatory variables

X_1 = House hold size (#)

X_2 = Size of Land (ha)

X_3 = Providing feed (1 = not often, 2 = often & 3 = very often)

X_4 = Fencing (1 = yes, No = 0)

X_5 = Checking_hives (1 = yes, No = 0)

X_6 = Market distance (km)

v_i = Error term specific to regime

Selection equation:

$$U^* = \alpha_i + \gamma_i IV_i + \varepsilon_i \quad (3)$$

Where:

U^* = Selection function (determining whether a farmer is in a formal or informal contract)

IV_i = Instrumental variables

IV_1 = Number of hive boxes (#)

IV_2 = Expin years (years)

IV_3 = Market distance (km)

RESULTS AND DISCUSSION

Characteristics of the sampled households: In Table 1, farmers under formal contracts exhibit substantially higher income levels, with average total revenue (E2,471) and gross margin (E1,836) far exceeding those of informal and non-contract farmers. Honey yield value per hive is highest under formal arrangements, though differences across groups are less pronounced than for revenue. Experience and number of hives are markedly greater among formal contract farmers, suggesting scale and expertise advantages.

Endogenous switching regression model for formal vs informal contractual arrangements: The outcome equation in Table 2 distinguishes the determinants of total revenue between formal (Totalrevenuepq1) and informal (Totalrevenuepq0) farmers. A key finding is that the number of hive boxes significantly increases total revenue for both groups ($p = 0.0000$), with formal farmers gaining E403.11 per additional hive box compared to E372.28 for informal farmers. This aligns with studies emphasizing scale economies in beekeeping, where higher hive numbers enhance pollination efficiency and honey yield¹³. The selection equation (FC_IC) identifies determinants of farmers' choice to operate formal or informal contracts. Having credit has a significant positive association with formal contract farming participation and is the strongest predictor ($p < 0.01$) of farmers' decision to participate in formal contracts. This reflects the credit access's role in easing liquidity constraints and enabling investments in productivity-enhancing inputs, as observed in agricultural commercialization studies¹⁴.

Endogenous switching regression model for formal vs. no-contract contractual arrangements: In Table 3, the number of hive boxes significantly increases total revenue in both groups, with each additional hive box contributing E421.16 ($p < 0.01$) for formal contract farmers and E182.86 ($p < 0.01$) for no contract farmers. Fencing has a significantly positive association (0.9864, $p < 0.05$), suggesting that farmers who invest in fencing are more likely to engage in formal contracts. This may be due to fencing serving as an indicator of better resource management and investment readiness, making these farmers more attractive for formal agreements. Experience in years is also significantly positive (0.9344, $p < 0.001$), reinforcing that experienced farmers are more inclined toward formal contracts due to their superior market knowledge and management skills. This aligns with research¹⁵, which emphasizes experience as a key factor in formalizing agricultural value chains.

Endogenous switching regression model for informal vs no contract contractual arrangements: In Table 4 size of land has a significantly positive effect (0.0410, $p < 0.1$), suggesting that farmers with larger landholdings are more likely to participate in informal contracts. This may be due to the flexibility larger farms offer in balancing production between formal and informal markets. This finding is consistent with research highlighting land size as a key determinant in market participation decisions¹⁵.

Table 1: Variable definitions and descriptive statistics of the sample households

Variable name	Description	Formal contract (n = 139)	Informal contract (n = 82)	No contract (n = 86)	Total sample (n = 307)
Outcome variables					
Total revenue	Total income from honey sales (E)	2471.24 (1697.19)	1583.76 (1101.95)	1155.90 (821.45)	1865.73 (1461.97)
Gross margin	Total revenue minus total variable costs	1835.54 (1453.91)	1050.58 (1024.29)	614.42 (789.77)	1283.80 (1297.33)
Honey yield value	Honey yield value per hive	450.00 (264.69)	439.225 (258.61)	316.21 (219.52)	409.65 (257.13)
Household covariates					
Age	Farmers' age	52.597 (12.90)	51.878 (11.44)	52.12 (11.16)	52.27 (12.02)
Gender	Gender of farmer	1.446 (0.50)	1.610 (0.49)	1.42 (0.50)	1.48 (0.50)
Marital status	Marital status of farmer	1.295 (0.57)	1.195 (0.48)	1.17 (0.47)	1.24 (0.52)
Household size	Number of people in a household	5.99 (1.55)	5.854 (1.57)	6.15 (1.44)	5.99 (1.52)
Farm covariates					
Experience	Farmers' experience in years	7.40 (0.85)	7.06 (1.04)	4.80 (1.62)	2.58 (1.62)
Number of hives	Number of active hive boxes	5.53 (2.61)	3.67 (1.68)	3.98 (2.59)	4.60 (2.54)
Type of hivebox	hive box used (Langstroth = 1, Top Bar = 2?)	1.98 (0.15)	2.00 (0.00)	2.00 (0.00)	1.99 (0.09)
Fencing	= 1 if apiary site is fenced	1.96 (0.20)	1.92 (0.28)	1.88 (0.32)	1.93 (0.26)
Provide feed	(Not Often = 1, Often = 2, Very often = 3)	1.26 (0.44)	1.12 (0.33)	1.11 (0.31)	1.18 (0.38)
Checking hives	Frequency of hive inspection (Not Often=1, Often=2, Very often=3)	2.20 (0.45)	2.05 (0.35)	1.99 (0.40)	2.10 (0.42)
Market distance	Distance to nearest honey market (km)	0.74 (2.87)	0.27 (1.25)	0.66 (2.73)	0.59 (2.50)
Institutional covariates					
Credit facility	= 1 if farmer has access to credit	1.94 (0.23)	1.56 (0.50)	1.01 (0.11)	1.58 (0.50)

Impact of contractual arrangements on income: Table 5 shows the estimation results that demonstrate the impact of varying contractual arrangements on total revenue (Log TR), gross margins (Log GM), and honey yield value (Log HYV) using the Average Treatment Effects on the Treated (ATT) framework. The t-values for all mean outcomes from the t-tests were significant at $p < 0.01$, confirming that there are statistically significant differences in revenue, profitability, and yield across contractual arrangements. However, while the ATT results for total revenue and gross margins are consistently significant, the impact on honey yield is either insignificant or only marginally positive, highlighting the different mechanisms through which contractual arrangements affect farmers' income.

The findings of this study provide robust empirical evidence on the significant role of contractual arrangements in shaping the economic outcomes of beekeepers, particularly in terms of total revenue and gross margins. The endogenous switching regression (ESR) models consistently reveal that formal contract farmers achieve substantially higher income levels compared to both informal and no-contract counterparts. This is strongly supported by the Average Treatment Effects on the Treated (ATT), which

Table 2: ESR model for formal vs informal contracts (N = 221)

	TR1 coefficient	TR0 coefficient	GMvc1 coefficient	GMvc0 coefficient	HYV1 coefficient	HYV0 coefficient
Outcome equation results						
#ofhvebx	403.11***	372.2751***	318.1251***	275.1044***	-9.307	-12.165
Experience in years	-16.06	160.084	-7.69	127.521	3.273	36.693
Market distance	-29.27	-25.847	-6.408	42.806	-7.385	-5.049
Selection equation results						
Constant	654.94	-1186.2	545.032	-1283.333*	529.4801**	123.659
HH size	0.05	0.06	0.022	0.056	0.061	0.060
Size of land	0.01	0.02	0.012	0.021	0.007	0.023
credit_facility	1.65***	0.266	1.53662***	0.258	1.637832***	0.282
Fencing	0.231	0.403	0.100	0.351	0.250	0.392
provide_feed	0.6215062**	0.304	0.7274493**	0.280	0.6021862**	0.306
checking_hives	0.5517088*	0.296	0.6337051**	0.275	0.5442285*	0.299
Constant	-5.61***	1.242	-5.35***	1.168	-5.63***	1.235
Sigma (σ_1)	1326.092	92.943	1263.319	95.662	1263.319	95.662
Sigma (σ_2)	878.605	78.135	915.663	89.735	915.663	89.735
Rho (ρ_1)	-0.445	0.178	-0.695	0.123	-0.695	0.123
Rho (ρ_2)	-0.406	0.205	-0.571	0.185	-0.571	0.185
Wald test	47.27***		24.84***		2.570	
LR (χ^2)	6.24**		13.55***		6.31**	

Significance levels are denoted as follows: ***p<0.01, **p<0.05, *p<0.10. TR1 refers to total revenue for farmers operating under formal contracts. TR0 refers to total revenue for farmers operating under informal contracts. GMvc1 represents gross margin for formal contract farmers, while GMvc0 represents gross margin for informal contract farmers. HYV1 denotes the honey yield value per hive for farmers under formal contracts, and HYV0 denotes the honey yield value per hive for farmers under informal contracts

Table 3: ESR Model for formal vs no-contract (N = 225)

	TR1 coefficient	TR0 coefficient	GMvc1 coefficient	GMvc0 coefficient	HYV1 coefficient	HYV0 coefficient
Outcome equation results						
#ofhvebx	421.16***	182.86***	333.43***	162.87***	-5.23	-15.30*
credit_facility	258.5005	64.73159	-11.6628	15.02669	116.0552	-44.3524
Constant	-652.797	118.6634	-232.122	42.614	252.9942	446.99**
Selection equation results						
HH size	0.004763	0.071493	0.037348	0.068643	0.033652	0.078753
Size of land	0.016765	0.069414	0.010419	0.069854	0.032961	0.086645
provide_feed	-0.21529	0.329087	-0.14484	0.342391	0.009393	0.385123
Fencing	1.092***	0.322674	1.1242***	0.340082	0.9863981**	0.414051
checking_hives	0.020091	0.297805	0.15614	0.296638	0.302828	0.385115
Market distance	0.04595	0.047218	0.041409	0.048198	0.061681	0.055358
Experience in years	.923676***	0.125352	0.925629***	0.127501	0.93445***	0.130801
Constant	-7.5996***	1.383917	-8.2031 ***	1.323537	-8.5495***	1.29944
Sigma (σ_1)	1378.132	100.5	1226.553	99.93481	261.9788	15.7127
Sigma (σ_2)	674.7636	51.092	669.2807	50.75713	218.7365	16.77909
Rho (ρ_1)	0.199149	0.4548	0.713638	0.213531	0.109602	0.688277
Rho (ρ_2)	0.731623	0.1837	0.299982	0.196931	-1	.
Wald test	45.15***		34.39***		2.92	
LR (χ^2)	5.52 *		3.75		1.86	

Significance levels are denoted as follows: ***p<0.01, **p<0.05, *p<0.10. TR1 refers to total revenue for farmers operating under formal contracts. TR0 refers to total revenue for farmers operating under no contracts. GMvc1 represents gross margin for formal contract farmers, while GMvc0 represents gross margin for no contract farmers. HYV1 denotes the honey yield value per hive for farmers under formal contracts, and HYV0 denotes the honey yield value per hive for farmers without contracts

how a 33.12% increase in total revenue and a 22.98% increase in gross margins for formal versus informal contracts. These results align with established literature on agricultural value chains, where formal contracts are linked to reduced transaction costs, stable market access, and improved bargaining power^{16,17}. The critical drivers of formalization, access to credit, provision of feed, and regular hive checks further underscore the importance of financial capital and proactive management practices in facilitating entry into and success within formal markets.

Table 4: ESR model for informal vs no contract (N = 168)

	TR1 coefficient	TR0 coefficient	GMvc1 coefficient	GMvc0 coefficient	HYV1 coefficient	HYV0 coefficient
Outcome equation results						
Market distance	3.433124	0.968817	62.13797	37.61637	-18.8674	-6.53518
Experience in years	298.3551	-6.24935	127.535	13.25045	52.08095*	-43.138**
Constant	-1558.48	202.1064	-1096.88	-383.909	163.9554	339.67***
Selection equation results						
HH Size	-0.03649	0.048626	.0502419*	0.027132	.0432955***	0.007061
Size of Land	.0410127*	0.017277	0.023674	0.029828	0.011769	0.010878
provide_feed	0.229514	0.154189	-.4893421***	0.156132	0.437275	0.403406
Fencing	0.041653	0.168276	0.270444	0.174137	-0.3978	0.399972
checking_hives	0.120494	0.375863	0.102627	0.239499	0.299888	0.416314
#ofhvebx	-0.0466	0.053743	-0.00327	0.042959	-.17035***	0.049282
Constant	-0.1684	0.76474	-0.54592	0.512798	0.402005	0.587916
Sigma (σ_1)	1535.851	216.0651	1595.094	.	263.3101	30.62639
Sigma (σ_2)	1237.012	121.3023	1243.34	13.5107	312.367	29.95386
Rho (ρ_1)	0.947474	0.075177	0.992101	0.006902	-0.39362	0.310542
Rho (ρ_2)	-1	.	-0.98777	0.009508	-1	.
Wald test	0.68		1.76		3.32	
LR (χ^2)	57.47***		41.55***		43.22***	

Significance levels are denoted as follows: ***p<0.01, **p<0.05, *p<0.10. TR1 refers to total revenue for farmers operating under informal contracts. TR0 refers to total revenue for farmers operating under no contracts. GMvc1 represents gross margin for informal contract farmers, while GMvc0 represents gross margin for no contract farmers. HYV1 denotes honey yield value per hive for farmers under informal contracts, and HYV0 denotes honey yield value per hive for farmers under no contracts

Table 5: Average treatment effects on treated

		Log TR	Log GM	Log HYV
Formal	(n = 139)	7.5824	7.1337	5.9553
Informal	(n = 82)	7.0774	6.6744	5.8808
ATT (FC_IC)	(n = 221)	.3312***	.2298***	-0.0057
% Diff (FC_IC)	(n = 221)	4.68	3.44	0.1
Formal	(n = 139)	7.5824	7.1337	5.9553
No Contract	(n = 86)	6.8512	6.2721	5.5896
ATT (FC_NC)	(n = 225)	.7516***	.7148***	.4524**
% Diff (FC_NC)	(n = 225)	10.97	11.4	8.09
Informal	(n = 82)	7.0774	6.6744	5.8808
No Contract	(n = 86)	6.8512	6.2721	5.5896
ATT (IC_NC)	(n = 168)	.4446**	0.4853	0.284
% Diff (IC_NC)	(n = 168)	6.49	7.74	5.08

Significance levels are denoted as follows: ***p<0.01, **p<0.05, *p<0.10. Log TR refers to the natural logarithm of total revenue for farmers under the specified contractual arrangement. Log GM refers to the natural logarithm of gross margin for farmers under the specified contractual arrangement. Log HYV refers to the natural logarithm of honey yield value per hive. ATT (FC_IC) represents the Average Treatment Effect on the treated, comparing formal contract farmers to informal contract farmers. % Diff (FC_IC) indicates the percentage difference in outcomes between formal and informal contract farmers

A key insight from this research is the distinct impact of contractual status on different dimensions of farm performance. While formal contracts significantly enhance financial outcomes like revenue and profitability, their effect on physical production efficiency, measured as honey yield value per hive, is negligible when compared to informal arrangements. This suggests that formalization primarily operates through market-based mechanisms rather than direct improvements in technical productivity. Farmers under formal contracts benefit from better pricing, guaranteed off-take agreements, and potential access to subsidized inputs, but these advantages do not necessarily translate into increased per-hive yields. This finding resonates with a study by Bellemare and Novak¹⁸, which argues that contract farming can improve welfare without altering on-farm production technology, highlighting a separation between commercialization benefits and productivity gains.

In contrast, the comparison between informal and no-contract farmers reveals a more nuanced picture. Informal contracts also yield significant economic benefits, increasing total revenue and gross margins by 6.49 and 7.74%, respectively, over independent farming. Notably, informal participation leads to a

statistically significant 5.08% increase in honey yield value, a result not observed in the formal vs. informal comparison. This implies that even unstructured market engagement provides incentives for farmers to adopt better management practices, such as improved hive maintenance or supplemental feeding, thereby enhancing output. The selection equations further indicate that factors like land size and household labor influence the choice of informal contracts, suggesting that resource availability and labor capacity play a crucial role in determining how smallholders engage with markets outside formal frameworks.

The study also highlights the pivotal role of enabling factors in shaping farmers' choices and outcomes. Access to credit emerges as the strongest predictor of formal contract participation across all models, confirming its function as a critical enabler for investment in productive assets and adherence to quality standards required by formal buyers¹⁴. Similarly, practices such as routine hive checking and providing supplemental feed are positively associated with formalization, reflecting the link between good apicultural management and market integration. The negative and significant constants in the selection equations suggest substantial barriers to contract farming in the absence of these facilitators, emphasizing the need for targeted policy interventions to support smallholder inclusion in formal value chains.

Overall, this research contributes to the growing body of knowledge on agricultural contract farming by demonstrating that while formal contracts offer superior financial returns, informal arrangements still provide meaningful economic and productivity benefits relative to non-participation. Future research should explore the long-term dynamics of contract evolution, including how informal agreements might transition into formal ones with appropriate institutional support. Additionally, investigating the role of cooperatives, extension services, and digital platforms in bridging the gap between informal and formal markets could offer valuable insights for policymakers aiming to enhance smallholder resilience and competitiveness in agri-food systems.

From the analysis, the results clearly demonstrate that contractual arrangements, particularly formal contracts, have a statistically significant positive effect on farmers' income, productivity, and market stability. Farmers engaged in formal contracts achieved the highest total revenue (E2,471.24) and gross margin (E1,835.54), compared to informal contract farmers (E1,583.76 and E1,050.58, respectively) and non-contracted farmers (E1,155.89 and E614.42). This indicates that formal contracts not only secure better prices but also enhance income predictability and reduce marketing risks. These outcomes validate existing theoretical and empirical literature, which posits that formalized agreements improve access to markets, technology, and inputs, leading to enhanced profitability^{7,17}.

Farmer cooperatives should be formally supported to act as intermediaries between producers and contractors. By pooling resources and standardizing production, cooperatives can negotiate better contract terms, reduce transaction costs, and enhance traceability and compliance with export regulations. The establishment of microfinance schemes and credit facilities tailored to beekeepers would enable them to purchase modern hives, smokers, full bee suits, and other essential equipment. Such financing should be linked to contract performance, where buyers can serve as guarantors for loan repayment.

CONCLUSION

The study provides strong empirical evidence that contractual arrangements play a decisive role in shaping income outcomes in Eswatini's honey value chain. Farmers participating in formal contracts consistently achieved higher total revenue and gross margins than those operating under informal or no contracts, demonstrating the financial advantages of structured and reliable market relationships. Informal contracts also conferred income benefits over non-participation, indicating that even limited coordination can improve producers' market performance. Across all comparisons, the most substantial gains occurred in financial returns rather than in per-hive productivity, underscoring that contractual arrangements enhance income primarily through improved market access, stable pricing, and reduced marketing risks rather than through changes in technical efficiency.

These findings contribute to the broader literature on smallholder commercialization by highlighting how well-designed contractual mechanisms can strengthen smallholder integration into higher-value markets. The results point to the importance of supportive institutions such as credit access, extension services, and buyer–producer relationships in enabling farmers to meet contract requirements and benefit from formalization. Strengthening these enabling conditions can help bridge existing participation gaps, promote fairer market opportunities, and enhance the resilience of honey producers within Eswatini’s evolving apiculture sector.

SIGNIFICANCE STATEMENT

Smallholder honey farmers often choose between formal contracts, informal contracts, or no contracts with buyers, which can influence their incomes. This study examines how these different arrangements causally affect farmers’ revenue and profitability. Using an Endogenous Switching Regression (ESR) approach on survey data from Eswatini beekeepers, we find that formal contracts significantly increase farmers’ total revenue and gross margin compared to informal or no-contract arrangements. In contrast, only limited differences appear for honey yield value per hive. These results imply that formal contracts can boost incomes by providing stability and scale benefits, while the lack of formal agreements constrains earnings. The findings are based on rigorous statistical modeling that accounts for farmers’ self-selection into contract types, underscoring the robustness of the evidence..

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