Journal DOI: 10.36713/epra1013 | SJIF Impact Factor (2025): 8.619 ISSN: 2347-4378
EPRA International Journal of Economics, Business and Management Studies (EBMS)
Volume: 12 | Issue: 12 | December 2025 -Peer-Reviewed Journal

EFFECT OF PRICING STRATEGY ON MACADAMIA NUT PRODUCTION: A QUANTITATIVE STUDY AMONG SMALL-SCALE FARMERS IN KIRINYAGA COUNTY, KENYA

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ABSTRACT
Macadamia farming offers an important source of income for producers worldwide and especially for small-scale farmers in Kenya. Kirinyaga County is one of the major macadamia producers within the central and eastern highlands of Kenya. The crop is a major source of income for small-scale farmers. However, the county is experiencing low average yields, with trees producing only 50% of the crop potential. With such low yields, the livelihood of small-scale farmers is at risk. The objective of the study was to analyze the effect of pricing strategy on macadamia nut production among small-scale farmers in Kirinyaga County. The study was anchored on the Cobweb theory. The target population was 8,004 small-scale macadamia farmers in Kirinyaga County. The study used a descriptive survey design and the multistage random sampling technique. A structured questionnaire was used, and the data was analyzed with the aid of SPSS version 26. A simple linear regression model was used in data analysis. The OLS assumptions were tested before conducting regression analysis. The results revealed a positive and significant association between pricing strategy and production of macadamia nuts ($r = 0.379$, $p = 0.000$) and $R^2 = 0.143$, meaning that 14.3% of the variance in production of macadamia nuts is explained by pricing strategy. ANOVA analysis reported an F-statistic (53.379) with a $p = .000$. The t-value of 6.318 was higher than the critical t-statistic (1.96). The null hypothesis that "There is no significant effect of pricing strategy on production of macadamia nuts by small-scale farmers in Kirinyaga County" was therefore rejected. The study concluded that the pricing strategy had a significant effect on the production of macadamia nuts by small-scale farmers in Kirinyaga County. The study recommended that the government, through the ministry of agriculture, should facilitate a partnership between macadamia farmers and macadamia processors in which a pricing strategy that protects their mutual interests is crafted.

KEYWORDS: *Small-Scale Farmers, Pricing Strategy, Productivity And Production Of Macadamia Nuts, Cobweb Theory.*

1.0 INTRODUCTION

Macadamia farming is a significant agricultural activity, particularly in parts of Kenya. Renowned for their high-value nuts, macadamia trees offer lucrative opportunities for farmers and agribusiness alike. The crop has become an important socio-economic asset, contributing to household incomes, rural employment, and national revenue. However, the performance of the macadamia sector is shaped not only by agronomic practices but also by the pricing strategies that guide farmers' production decisions. In smallholder agriculture, pricing strategy reflects the decisions farmers make about setting output prices and planning their production investments (Mwendwa, Muiruri & Mbuthia, 2024). These decisions are strongly shaped by farmers' price expectations (Nyamongo, 2024), which in turn are influenced by factors such as pricing methods, price fluctuations, input price levels, and farmers' price expectations (Kasina et al., 2023).

Globally, studies have reported that pricing strategy significantly influences macadamia production by shaping farmers' willingness to invest in orchard management. In Australia, competitive farm-gate pricing methods and long-term contract pricing provided farmers with predictable price expectations. This enabled better planning and improved orchard management. Zilekhe (2017) emphasizes that stable and strong prices are essential for sustained farm investment and yield maximization. However, Australian growers also faced challenges such as high input prices, limited bargaining power, and dependence on intermediaries. These issues constrained the effectiveness of pricing strategies (AMC, 2022).

In China, government-led interventions, including subsidized inputs and minimum guaranteed pricing schemes, reflect deliberate pricing strategies aimed at stabilizing farmer income and promoting production (Li, Zhang & Huang, 2021; Wang & Cheng, 2020). These measures shaped both price expectations and investment behavior. However, domestic price fluctuations continued to pose challenges for growers (Zhang & Liu, 2022).

In the United States, particularly Hawaii, research by USDA (2021) found that transparent pricing systems and federally supported insurance programs stabilized farmer income and shaped price expectations. This helped reduce uncertainty in production planning. Nonetheless, production levels remained constrained by input costs relative to farm-gate returns.

Across Africa, evidence further shows that pricing strategies, especially price stability and the mechanisms through which prices are determined, play a significant role in influencing macadamia production. In South Africa, pricing strategies strongly affect small-scale farmers' production decisions (Sibulali, 2018). As a leading global producer, South Africa accounted for 29 percent of global production in 2019 (INC, 2020). According to Jaskiewicz (2015), smallholder farmers managing about 1,000 trees on 3 hectares have a yield potential of up to 4 MT per hectare. However, inconsistent pricing methods, limited access to reliable price information, and price volatility reduced incentives to invest in inputs and orchard management (Sibulali, 2018).

In Malawi, processor-driven price-setting methods significantly limited farmers' bargaining power and suppressed investment in production expansion (Parshotam, 2018). Low and unstable farm-gate prices reduced orchard management investments. This demonstrated the role of price expectations and fluctuation in shaping productivity outcomes.

In East Africa, pricing and market inefficiencies have been widely reported as constraints to smallholder macadamia production. In Tanzania, Demeke et al. (2012) showed that price manipulation by intermediaries, weak regulatory structures, and poor infrastructure kept farm-gate prices low and unpredictable. These fluctuations limited farmers' ability to purchase fertilizers, pesticides, and apply recommended post-harvest practices. Processor domination in some regions also contributed to premature harvesting and poor nut quality. This was driven largely by unfavorable price expectations (FAO, 2017).

In Kenya, macadamia is recognized as a high-value crop with strong export potential. However, farm-gate price volatility continues to undermine productivity. The Agriculture and Food Authority (2021, 2022) reports that national productivity ranges between 67 and 179 kg per tree depending on cultivar and management practices (AFA, 2022). Farm-gate prices declined sharply from KSH 150/kg to as low as KSH 20–30/kg during 2022–2023. This shift shaped negative price expectations among farmers and prompted premature harvesting and reduced investment in orchard care (Daily Nation, 2023). FreshPlaza (2024) reported that 25 percent of national output was lost due to poor orchard management, and another 25 percent was rejected at processing. High price volatility discouraged investment in productivity-enhancing practices such as fertilization and pest control (Stepen et al., 2017).

Within Kirinyaga County, production remains low despite favorable agro-ecological conditions. Between 2016 and 2020, the county's share of national production declined, with farmers achieving an average of 38 kg per tree compared to the potential 70–100 kg (AFA, 2020, 2022). Studies indicate that unstable pricing methods, fluctuating prices, high input costs, and unfavorable price expectations discourage farmers from making long-term investment decisions. This has resulted in low orchard management expenditure, reduced productivity, and inconsistent nut quality. These local dynamics reflect broader global and regional trends and show that pricing strategy through its various indicators plays a critical role in shaping the production of macadamia nuts among small-scale farmers

1.1 Statement of the Problem

Macadamia is a high-value crop in Kenya with strong local and international demand, contributing significantly to household incomes, rural employment, and foreign exchange earnings. National productivity ranges between 67 and 179 kg per tree depending on cultivar and management practices (AFA, 2021, 2022). Small-scale farmers' production decisions are influenced by pricing strategies, including pricing methods, price fluctuations, input costs, and price expectations (Mwendwa, Muiruri & Mbuthia, 2024; Nyamongo, 2024; Kasina et al., 2023).

Despite its economic potential, production remains low and inconsistent. Farm-gate prices fluctuated from KSH 150/kg to KSH 20–30/kg during 2022–2023, creating uncertainty for small-scale farmers (Daily Nation, 2023). High input costs, poor pricing methods, and low price expectations discourage investment in orchard management, limiting fertilization, pest control, and post-harvest handling, with Kirinyaga County averaging only 38 kg per tree compared to a potential of 70–100 kg (Stepen et al., 2017; Murioga et al., 2016; AFA, 2020, 2022).

These constraints may prompt farmers to reduce investment or switch to alternative crops, threatening incomes, rural employment, and Kenya's competitiveness in the macadamia market. While previous studies have documented the effects of price volatility, limited empirical evidence exists on how pricing strategies influence small-scale farmers' production decisions in Kenya. Research by Murioga et al. (2016), Masira (2017), and Nyamongo (2024) highlights the impact of price uncertainty but does not systematically assess deliberate pricing strategies at the county level.

This gap calls for an empirical assessment of how pricing strategies affect macadamia nut production among small-scale farmers in Kirinyaga County to inform approaches that enhance investment, orchard management, and overall productivity.

1.2 Objective of the Study

The objective of the study was to assess the effect of pricing strategy on the production of macadamia nuts by small-scale farmers in Kirinyaga County.

1.3 Research Hypothesis

HO1: There is no significant effect of pricing strategy on production of macadamia nuts by small-scale farmers in Kirinyaga County.

2.1 Theoretical Framework

The study is anchored on the cobweb theory. The cobweb theory was coined by Kaldor in 1934 (Ronald, Willy-Marcel & Charles, 2018). This theory is applicable to those markets where production takes time, where the quantity produced depends on the price anticipated at the time of sale, and where supply at the time of sale determines the actual market price (Poitras, 2022). The basic assumption of the cobweb theory is that the current production of an agricultural commodity is determined by the price in the previous period (Xie & Wang, 2017). The theory posits that production is largely determined by the producers' response to price (Aina et al., 2015). In this study, the theory explains the relationship between macadamia price fluctuations and the high or low levels of macadamia production, often measured in kilograms per tree or per acre of land.

Xie and Wang (2017) used cobweb theory in their study on the impact of agricultural product price fluctuations on China's grain yield. The findings confirmed that when the price of an agricultural product fluctuates abnormally, farmers will spontaneously adjust the agricultural planting structure in the next period. If the prices of some agricultural products continue to fall, the farmers will choose other crops with higher economic value.

Gaspard, Félicien, Noel, Claude, Claude & Mburu (2023) applied cobweb theory to study the effect of agricultural product price fluctuation on small-scale farmers' welfare in Rwanda. The study found that there was a relationship between price fluctuations and seasonal production, implying that the current production of a commodity is determined by the price in the previous period. One of the challenges of the cobweb theory occurs when farmers lack a convenient way to obtain agricultural product prices and cannot make next year's planting plan based on the prices of the previous season. This shortcoming can have a positive or negative impact on production and is one of the reasons why prices fluctuate.

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2.2 The Conceptual Framework

The conceptual framework in Figure 1 presents the relationship between the independent variable (pricing strategy) and the dependent variable (production of macadamia nuts). Pricing strategy was conceptualized to be measured using pricing strategies, price stability, price of inputs, and price expectation, while production of macadamia nuts was measured using past trends and projected future trends of production and of productivity.

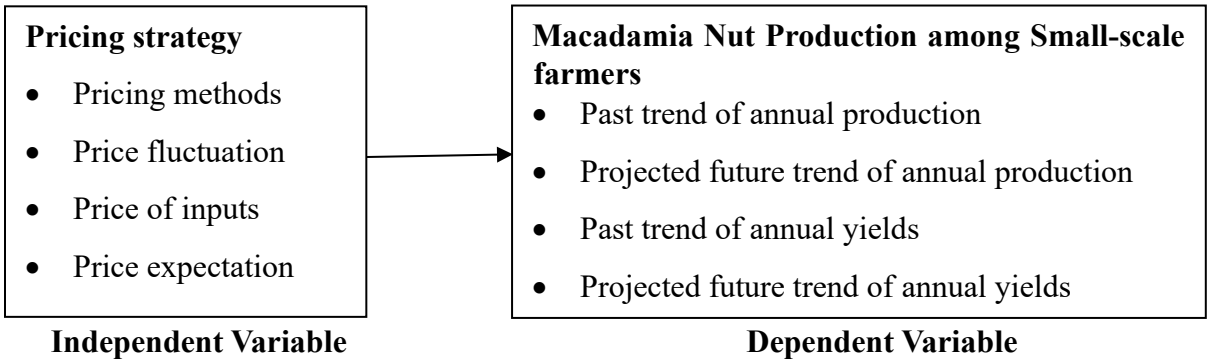

Figure 1: The Conceptual Framework

2.2.1 Pricing strategy

Pricing strategy is one of the four core elements of the marketing mix, alongside product, place, and promotion. It refers to the systematic decisions a business makes regarding how much to charge for a product or service, with the aim of maximizing profitability while meeting customer demand. In contrast, price is the actual monetary amount a buyer pays to acquire a product or service (Kotler et al., 2015). Although pricing strategy is often considered the most flexible element of the marketing mix due to its ability to adjust quickly to changing market conditions (Kotler & Keller, 2016), this flexibility is considerably constrained in agricultural markets. Agricultural commodities are affected by factors such as seasonality, perishability, and unpredictable fluctuations in supply and demand (Rapsomanikis, 2015; Ogunniyi, 2020).

Pricing strategies refer to the methods and actors involved in setting prices and the extent to which farmers influence pricing decisions. In many small-scale agricultural markets, farmers are price takers, with middlemen or processors exerting significant control over prices (Ndlovu & Nyoni, 2019). This limits farmers' initiative to invest in quality-enhancing practices, such as uniformity and superior post-harvest handling (Muriuki, Kimani & Wambua, 2022).

As outlined by Kotler (2017), pricing strategy directly shapes the production decisions of small-scale macadamia farmers. For agricultural producers, the price they expect to receive acts as the strongest economic signal influencing decisions on how much to invest in their orchards. When prices are stable, predictable, and sufficiently high, farmers are more willing and able to purchase quality inputs, adopt improved agronomic practices, and manage orchards properly—factors that collectively increase macadamia nut production. Conversely, unstable or low prices reduce expected returns from farming, weaken farmers' confidence, and discourage investment in critical production inputs such as fertilizers, pest-control measures, pruning, and harvest management. As a result, productivity declines, and the crop fails to reach its full potential.

In the context of macadamia farming, pricing strategy influences production through four key dimensions: price stability, input price levels, price expectations, and pricing technique. Pricing techniques determine how prices are set by buyers, processors, or prevailing market forces, while price stability reflects the consistency or volatility of farm-gate prices. Input price levels, including the costs of fertilizers, seedlings, labor, and pesticides, directly affect farmers' capacity to invest in orchard management. Price expectations, or farmers' perceptions of future market trends, guide their planning and production decisions. Together, these elements shape farmer investment behavior, which ultimately determines macadamia nut production levels. Therefore, pricing strategy is not only a marketing concept but also a critical driver of agricultural output among small-scale macadamia growers in Kirinyaga County.

2.2.2 Production of Macadamia Nuts

In this study, production of macadamia nuts refers to the total quantity of nuts harvested by small-scale farmers, measured in kilograms per year (Agriculture and Food Authority [AFA], 2022). In contrast, yield, or productivity, denotes the average quantity of nuts produced per tree per year, also measured in kilograms (AFA, 2022). These definitions distinguish between overall farm output and tree-level productivity, both of which are essential for understanding differences in performance among farmers.

The indicators used in this study were categorized into past trends and projected future trends for both production and productivity. This temporal classification reflects the increasing recognition that agricultural performance must be understood through both historical evidence and forward-looking expectations. Such an approach ensures that the analysis captures not only factors that have shaped the sector so far but also farmers' anticipations regarding future production.

Past trends provided empirical evidence on how macadamia farming systems had evolved over time. These trends were shaped by factors such as technological adoption, market conditions, environmental variability, and institutional support (Gitonga et al., 2017; Wasilwa, Karuri, Muthoni, & Wanyoike, 2019). They also helped identify persistent constraints—including inadequate marketing infrastructure and limited access to quality planting materials—that hindered growth and productivity (Masira, 2017).

Projected future trends, on the other hand, were derived from farmers' expectations regarding anticipated production levels. Although inherently subjective, these projections offered valuable insights into farmers' confidence in the sector, perceived risks, and planned investments (Central Bank of Kenya, 2023). Understanding these perceptions is crucial because farmers' expectations often influence key decisions, including planting, input use, and participation in markets.

By integrating both past and projected trends, the study provided a more comprehensive understanding of the sector's current performance and likely future trajectory. This dual perspective illuminated shifts occurring in macadamia farming and the factors driving them, thereby strengthening the formulation of evidence-based policies and targeted interventions aimed at enhancing production and productivity among small-scale farmers.

2.3 Empirical Review

Kumbhar (2011) examined the impact of the Minimum Support Price (MSP) on cultivated area, productivity, and production levels of rice, wheat, pulses, cotton, and sugarcane in India using time-series data from 1980–81 to 2009–10. Quantitative analysis with a simple linear regression model revealed that guaranteed minimum prices encouraged farmers to maintain and even increase production. Farmers were also motivated to adopt high-yielding seeds and higher fertilizer application because the assured prices secured their minimum income. This study highlights the importance of pricing methods and price expectations on production decisions.

Barmon and Chaudhory (2012) found that farmers are motivated to cultivate crops when assured of profitable market prices. The study emphasizes that security in expected prices increases willingness to invest in farm inputs and adopt improved agronomic practices, directly linking price expectations and pricing methods to production outcomes.

Jaskiewicz (2015) investigated value chain integration of small-scale macadamia farmers in Limpopo, South Africa. Using a mixed-methods approach with 99 respondents, the study reported an average 20% annual increase in macadamia prices, which led to a threefold increase in output between 2000 and 2012. However, the lack of government price regulation exposed farmers to volatility, highlighting the significance of price stability and price expectations.

Bandason, Parwada, and Mushunje (2022) analyzed the macadamia value chain in Zimbabwe. Their study found that poor access to market information and fluctuating prices limited producers' ability to extract optimal value, reducing incentives to expand production. The findings underscore the effects of price fluctuation and pricing methods on smallholder motivation and output.

The Government of Rwanda (2019) reported that farm-gate prices for raw macadamia nuts rose from Rwf 800 to Rwf 2,000 per kilogram within a year. The high prices encouraged small-scale farmers to allocate more land to macadamia cultivation and invest in inputs. However, the rising cost of seedlings (Rwf 5,000 each) constrained smallholder participation, demonstrating the dual impact of input price levels and price expectations on production.

Murioga et al. (2016) studied the efficiency of agrifood marketing systems in Central Kenya. Using a descriptive survey of 2,587 traders, including 1,620 macadamia farmers, the study found that monthly price fluctuations made income projections difficult, discouraging long-term investment in productivity-enhancing practices. This illustrates the role of price fluctuation and price expectations in affecting production decisions.

Minai et al. (2014) assessed the influence of coffee prices on reinvestment and yields in Kirinyaga County, Kenya. Data from 251 farmers showed that higher prices encouraged reinvestment, but yields were not significantly higher due to constraints like unaffordable inputs and limited access to credit. This highlights the interaction of input price levels, price expectations, and pricing methods in determining output.

Wang, Huo, Guo, and Xu (2022**)** analyzed pricing strategies in agricultural supply chains with farmer cooperatives as core enterprises. Coordinated pricing and revenue-sharing contracts increased overall supply chain profits and producer incentives, demonstrating that pricing methods and price expectations can operate at both micro and supply chain levels to influence production.

Anno, Emase, and Natapar (2023) studied the effect of pricing strategies on livestock market performance in Turkana, Kenya. They found that uncoordinated price setting and weak institutions undermined small traders' performance, while cooperative-based price coordination stabilized markets and encouraged production. The study emphasizes pricing methods, price stability, and price expectations as key drivers of production outcomes.

Agboola and Ayo (2024) examined the effect of innovative pricing strategies on agricultural SMEs' profitability in Nigeria. Survey findings from 190 enterprises indicated a strong positive effect of strategic pricing on profitability, showing how pricing methods and price expectations encourage investment and production decisions in small-scale agriculture.

3.0 RESEARCH METHODOLOGY

The study adopted a descriptive survey design, which is an efficient method for systematically collecting data from a broad spectrum of individuals. The target population comprised 8,004 small-scale macadamia farmers in Kirinyaga Central, Mwea, Gichugu, and Ndia Constituencies in Kirinyaga County. A sample of 381 respondents was selected using Yamane's (1967) simplified formula. This sampling technique ensured that each constituency and its respective wards were adequately represented. Primary data were collected through a self-administered, unstructured questionnaire.

A pilot test was conducted with 30 respondents, in line with Mugenda's (2008) recommendation of 10% of the population. Content validity and reliability were confirmed through expert consultation and the Cronbach's alpha coefficient, a commonly used measure of internal consistency (Mugenda & Mugenda, 2012).

Descriptive statistics were used to summarize the distribution of responses on a 4-point Likert scale, while percentages, means, and standard deviations were jointly employed to present the data. Further, linear regression analysis was conducted to ascertain the relationship between pricing strategy and production of macadamia nuts. Tests for the ordinary least squares assumptions were performed to eliminate biases within the conceptualized regression model (Flatt & Jacobs, 2019). The findings of the study are presented using tables and figures.

4.0 DATA ANALYSIS, RESULTS, AND DISCUSSION

4.1 Descriptive Analysis for Price and Production of Macadamia Nuts

The study analyzed the effect of pricing strategy on the production of macadamia nuts by small-scale farmers in Kirinyaga County. Pricing strategy was measured using seven items. These items are price offered, price stability, affordability of farm inputs, price expectation, and price offered by organizations, profit margin, and price set by the farmer. Using a Likert scale of 1–4, where 1= Strongly Disagree (SD), 2= Disagree (D), 3= Agree (A), and 4= Strongly

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Agree (SD), the study sought to find out respondents' extent of agreement or disagreement with the statements relating to the pricing strategy of macadamia marketing. This information was expected to show the price factors with the highest and lowest influence on farmers' investment decisions in their macadamia farming. Descriptive statistics such as percentage, mean, and standard deviation were jointly used to summarize the responses, and the results are presented in Table 1.

Table 1. Descriptive Statistics for Pricing Strategy and Production of Macadamia Nuts

Statements	SD	D	A	SA	Mean	Std Dev
I normally sell my macadamia produce at the price that the buyer offers	13.8%	12.8%	30.0%	43.4%	3.03	1.056
The macadamia selling prices have been very stable year after year	46.6%	22.7%	19.4%	11.3%	1.96	1.058
The price of farm inputs required in macadamia farming are always affordable	17.5%	33.2%	30.9%	18.4%	2.50	.985
I normally increase investments in my macadamia farm whenever I expect a higher selling price of macadamia produce in the coming seasons	10.3%	12.2%	49.1%	28.4%	2.95	.905
I normally sell my macadamia produce at the price set by our farmers' groups/Associations/cooperative societies or processing companies.	35.0%	19.1%	18.1%	27.8%	2.39	1.225
When selling my macadamia, I normally consider the costs incurred in the process of macadamia farming practices before accepting the price offered by buyer.	28.4%	23.8%	25.9%	21.9%	2.41	1.118
Normally, I am the one who sets the price at which I sell my macadamia produce	46.3%	37.2%	7.8%	8.7%	1.79	.920
Average					**2.432**	**1.038**

KEY			
Mean	**Decision Criteria**	**Standard Deviation**	**Decision Criteria**
1–2.50	Low level of agreement	Less than 2	Responses are valid
2.51-5	High level of agreement	More than 2	Responses not valid

The findings show that 73.4% (30%+43.4%) of the respondents agreed that they sell their macadamia at the price that buyers offer, while 26.6% disagreed with the statement. The findings also show that 69.3% (46.6%+22.7%) disagreed with the statement that macadamia selling prices have been very stable year after year, while 30.7% agreed. The finding further showed that the majority of respondents could not afford the price of farm inputs, as indicated by the 50.7% (17.5%+33.2%) who disagreed and the 49.3% who agreed with the statement that the price of farm inputs used in macadamia farming is always affordable.

The study further sought to know the decisions made by farmers in response to price expectations. The findings show that 77.5% (49.1%+28.4%) agreed that they would normally increase investment in their macadamia farms whenever they expect a higher selling price in the coming seasons, while 22.5% disagreed with the statement. The findings also show that 54.1% disagreed with the statement that they normally sell their macadamia produce at the price set by their farmers' groups/associations/cooperative societies or processing companies, while 45.9% agreed with the statement. The study further sought to establish whether farmers normally set the price at which they sell their macadamia. The findings reveal that 83.5% (46.3%+37.2%) disagreed, while 16.5% agreed with the statement.

Overall, the mean of 2.432, which is below the group mean of 2.5, and a standard deviation of 1.038, which is below 2, revealed that respondents disagreed with the statements concerning pricing strategy, which normally improves production of macadamia nuts. The findings indicate that macadamia market prices were very unstable, as they kept on rising and falling unpredictably. The results imply that farmers were not able to predict their expected future earnings. The finding is supported by Rapsomanikis (2015), who found that variation in prices becomes a problem

when they are large, sudden, and cannot be anticipated and therefore, create a level of uncertainty for producers and may lead to sub-optimal planting decisions.

The finding is also supported by the finding of Huka et al. (2014), who concluded that unstable prices make it difficult for farmers to make production decisions because of uncertainty about future prices. The finding is also supported by the report of Demeke et al. (2012) that when prices are unstable, households reduce their spending on farm inputs, and this may have a negative impact on the quantity of crop produced.

4.2 Inferential Analysis

4.2.1 Correlation Analysis

The data were further subjected to correlation analysis to measure the existence, the degree, and the direction of the relationship between the two variables. The results are presented in Table 2.

Table 2: Pearson Correlation Coefficient Between pricing strategy and production of macadamia nuts.

Correlations

		Production	Price
Production	Pearson Correlation	1	.379
	Sig. (2-tailed)		.000
	N	321	321
Price	Pearson Correlation	.379	1
	Sig. (2-tailed)	.000	
	N	321	321

**. Correlation is significant at the 0.01 level (2-tailed).

The results of correlation analysis indicate a positive and significant association between pricing strategy and production of macadamia nuts ($r = 0.379$, $p = 0.000$). This implies that the pricing strategy and production of macadamia nuts change in the same direction. Further, the correlation coefficient of 0.379 reveals a moderate association between pricing strategy and production of macadamia nuts in Kirinyaga County.

In addition, the correlation between these two variables being significant at $p = 0.000$ implies a linear relationship between pricing strategy and production of macadamia nuts. This means that 37.9% of macadamia production by small-scale farmers in Kirinyaga County is explained by pricing strategy. The findings agree with Barmon & Chaudhury (2012) that production mainly depends on price fluctuation; hence, high prices influence yields positively. However, the findings contradict Minai et al. (2014), who found that although price had a positive correlation with coffee yields, it may not necessarily lead to significantly higher yields.

4.2.2 Regression Analysis

The data were further subjected to regression analysis to investigate the relationship between pricing strategy and macadamia production. The ordinary least squares model was used to analyze the strength of the effect, and results are presented in Tables 3, 4, and 5, respectively.

Table 3: Model Fitness

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.379	.143	.141	.87565	1.707

a. Predictors: (Constant), Price
b. Dependent Variable: Production

To determine how well the model fits the data, the goodness-of-fit statistics in Table 3 were examined. R is the strength of the correlation between pricing strategy and production of macadamia nuts in Kirinyaga County. The finding shows a moderate correlation of $r = .379$ between the two variables. R-squared indicates how much of the variance in the dependent variable is explained by the independent variable. R-squared values range from 0 to 1 and are commonly stated in percentages from 0% to 100%. The higher the R^2 value, the better the model fits the data. The finding shows $r^2 = .143$. The R-squared value of 0.143 indicates that approximately 14.3% of the variation in the production of macadamia nuts can be explained by the pricing strategy. This suggests that while price has some

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influence, a substantial portion of the variation is driven by other factors not captured by this model. Despite the relatively low R-squared value, the model was deemed suitable for further analysis.

While the R-squared value of 0.143 may appear low, it is within an acceptable range for cross-sectional or agricultural data, where numerous uncontrolled factors influence outcome. As noted by **Field (2013),** Woodbridge (2012), and Gujarati and Porter (2009), low R-squared values do not invalidate a model's usefulness, especially when key variables are statistically significant and aligned with theological expectations. The Dab-Watson statistic (d = 1.707) falls within the acceptable range of 1.5 to 2.5, suggesting that there is no significant autocorrelation in the residuals.

Table 4: Analysis of Variance

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.929	1	40.929	53.379	.000
	Residual	244.598	319	.767		
	Total	285.527	320			

a. Dependent Variable: Production
b. Predictors: (Constant), Price

Analysis of variance consists of calculations that provide information about levels of variability within a regression model and form the basis for tests of significance. F is a test for statistical significance of the regression equation. It tests how good the regression equation is in predicting values of Y for given values of X. The F-value and the associated p-value tell whether the model is statistically significant.

The results in Table 4 show an F-value of 53.379 with a p-value of .000, which is less than the conventional 0.05. The results indicate that pricing strategy had a significant effect on the production of macadamia nuts. Since the F statistic (53.379) is greater than the F-critical (3.8415), the study concluded that the regression model linking pricing strategy and production of macadamia nuts is statistically significant.

Table 5: Regression Coefficients and Hypothesis Test

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.615	.256		6.318	.000
	Price	.744	.102	.379	7.306	.000

a. Dependent Variable: Production

The study evaluated the regression coefficients to test the effect of pricing strategy on the production of macadamia nuts and to test the hypothesis. The beta coefficients can be positive or negative and have a t-value and a significance of a t-value. The beta coefficient is the degree of change in the outcome variable for every 1 unit of change in the predictor variable. The findings indicate a beta coefficient value of .744, which is significant at p = .000, which is less than alpha 0.05; see Table 5. Therefore, the results imply that for every 1-unit change of the pricing strategy, production of macadamia nuts will change by .744 units. Furthermore, the beta value of .744 was used to present the regression model Y = abx.

Production of macadamia nuts Y = 1.615 constant + 0.744 pricing strategy

The study also tested the second null hypothesis, which is that

H01: There is no significant effect of pricing strategy on production of macadamia nuts by small-scale farmers in Kirinyaga County.

The hypothesis was tested using a t-test statistic at a significance level of 0.05. The decision rule was to reject the hypotheses if the t-test statistic was greater than 0.05 (t > 0.05) and fail to reject the hypotheses if the t-test statistic was less than 0.05 (t < 0.05). The hypothesis was rejected by a t value of 6.318 that was higher than the critical t statistic (1.96). The study concluded that pricing strategy had a significant effect on the production of macadamia nuts by small-scale farmers.

The study findings agree with the cobweb theory, which explains the persistent fluctuations of prices in a selected agricultural market. According to this theory, current production of an agricultural commodity is determined by the price in the previous period. Aina (2015) also argued that production is largely determined by the producers' response to price. The findings further conform to Xie (2017), who posits that when the price of an agricultural product fluctuates abnormally, farmers will adjust the agricultural planting structure in the period, and if it continues to fall, farmers will choose other crops with higher economic value. According to cobweb theory, when the price of macadamia produce fluctuates abnormally, farmers will reduce the usage of production inputs in macadamia farming.

4.3 CONCLUSION

This study investigated the influence of pricing strategy on macadamia production among small-scale farmers. The t-test results ($t = 6.318 > 1.96$) indicated a statistically significant relationship between price and production. However, the squared value of 0.143 suggests that price accounts for only 14.3% of the valuation in macadamia production. This implies that although price is a relevant factor, it is not the primary determinant of production decisions.

The findings are consistent with the cobweb theory, which posits that current production levels are influenced by past price trends. Market price instability and high input costs emerged as significant barriers to sustained investments in macadamia farming. These challenges contribute to reduced profitability and increased uncertainty, thereby discouraging farmers from expanding production. The study concluded that the influence of price on macadamia production is constrained by volatile market conditions and high production costs. Hence, without targeted interventions, small-scale farmers are likely to remain vulnerable and unable to optimize production levels.

4.4 Policy Recommendation

To enhance the productivity and resilience of small-scale macadamia producers, the following policy measures are recommended:

i. **Price stabilization strategy:** The government, in collaboration with macadamia processors and other stakeholders, should implement a predictable and fair pricing strategy that guarantees minimum prices to reduce risks and stabilize farmers' income expectations.

ii. **Farmer-processor partnerships:** Formal partnerships, such as contract farming arrangements, should be promoted to provide pre-agreed pricing, technical support, and reliable market access.

iii. **Input subsidies and cooperative systems:** The high cost of inputs, including fertilizers and pesticides, can be mitigated through targeted input subsidy programs or cooperative purchasing models to lower production costs for small-scale farmers.

iv. **Promote cooperatives and farmers' organizations:** Encouraging farmers to organize into cooperatives or farmers' organizations can strengthen bargaining power, facilitate collective marketing, reduce input costs, and improve access to credit.

v. **Support research and development:** Investment in R&D focused on climate resilience, pest management, and sustainable farming practices is essential for enhancing long-term productivity and profitability.

REFERENCES

1. *Agriculture and Food Authority (2022). Nuts And Oil Crops Validated Statistical Report 2021. Nuts and Oil Crops Directorate, Kenya*
2. *Agriculture and Food Authority (2021). Nuts And Oil Crops Validated Statistical Report 2020. Nuts and Oil Crops Directorate, Kenya*
3. ***Agriculture and Food Authority (AFA).*** *(2020). Macadamia Production Statistics by County. Nairobi, Kenya: Agriculture and Food Authority*
4. *Aina, I. V., Ayinde, O., & Falola, A. (2015). Effect of Price Variation on Rice Production in Nigeria (1970-*
5. *2011) (No. 1008-2016-80269*
6. *Barmon, B. K., & Chaudhury, M. (2012). Impact of price and price variability on acreage allocation in rice and wheat production in Bangladesh. The Agriculturists, 10(1), 23-30.*
7. *Bandason, W., Parwada, C., & Mushunje, A. (2022). Macadamia nuts (Macadamia intergrifolia) value chain and technical efficiency among the small-scale farmers in Zimbabwe. Research on World Agricultural Economy, 3(4), 25-35.*
8. *Bhattarai, B. K., & GC, A. (2020). Government Intervention Strategy in Agriculture Price Policy: A Case of Minimum Support Price in Nepal. Ministry of Agriculture and Livestock Development Singhdurbar, Kathmandu.*
9. *Dairy Nation. (2023). Macadamia Farmers Grapple with Plunging Prices. Nairobi, Kenya: Dairy Nation Media Group.*

10. *Demeke,M., Dawe, D., Tefft, J., Ferede, T. and Bell, W (2014). The challenges of managing agricultural price and production risks in sub-Saharan Africa. Food and Agriculture Organization of the United Nations*
11. *Demeke,M., Dawe, D., Tefft, J., Ferede, T. and Bell, W (2012). Stabilizing price incentives forstaple grain producers in the context of broader agricultural policies: debates and country experiences, Food and Agriculture*
12. *Organization of the United Nations.*
13. *FreshPlaza. (2024). Kenyan Macadamia Sector Faces Postharvest Losses and Rejections. Retrieved from*
14. *www.freshplaza.com*
15. *Food and Agriculture Organization of the United Nations. (2017): Productivity and Efficiency Measurements in Agriculture: A literature review*
16. *Field, A. (2013). Discovering statistics using IBM SPSS statistics (4th ed.). London, UK: SAGE Publications.*
17. *Gaspard, N., Félicien, N., Noel, M. J. C., Claude, T. J., Claude, M. J., & Mburu, D. M. (2023). Effect of agricultural products price fluctuations on smallholder farmer's welfare in Rwanda. A case study of Gicumbi, Nyagatare, Nyaruguru, Rubavu Districts. International Journal of Agricultural and Applied Sciences, 4(1), 43-49.*
18. *Government of Rwanda. (2019). National Agricultural Export Development Board. Rwanda.*
19. *Gujarati, D. N., & Porter, D. C. (2009). Basic Econometrics (5th ed.). McGraw-Hill Education.*
20. *Huka, H., Ruoja, C., & Mchopa, A. (2014). Price fluctuation of agricultural products and its impact on small-scale farmers' development: Case analysis from Kilimanjaro Tanzania.*
21. *International Nut and Dried Fruits Council (2020). Nut and Dried Fruits Statistical year Book 2019/2020*
22. *Jaskiewicz, K. (2015). Macadamia nuts The New Gold of South Africa? Inclusive Value Chain Integration of Macadamia Nut Small-Scale Farmers in Limpopo, South Africa (Doctoral dissertation, International Development Studies).*
23. *Kotler, P., & Keller, K. L. (2016). Marketing Management Global Edition. Pearson Education Limited.*
24. *Kotler, P., Burton, S., Deans, K., Brown, L., & Armstrong, G. (2015). Marketing. Pearson Higher Education AU.*
25. *Kumbhar, V. M. (2011). Impact of MSP on area under cultivation and level of production: A study of selected crops in India. Available at SSRN 1748342.*
26. *Masira, I. (2017). Agriculture and Food Authority Nuts and Oil crops Directorate. Busia County Production and Market Research.*
27. *Minai, J. M., Nyairo, N., & Mbataru, P. (2014). Analysis of socio-economic factors affecting the coffee yields of smallholder farmers in Kirinyaga County, Kenya. Journal of Agricultural and Crop Research, 2(12), 228-235.*
28. *Minot, N. (2012). Food price volatility in Africa: Has it really increased?*
29. *Mugenda, O. M. & Mugenda, AG (2012). Research Methods: Quantitative and Qualitative Approaches. Nairobi County.*
30. *Murioga, W. M., Amutabi, M., Mbugua, C., & Ajuoga, M. (2016). Efficiency of Agrifood Marketing Systems in Kenya "The Case Study of Macadamia Nuts in the Central Kenya Highlands". Journal of Business and*
31. *Management, 18(7), 91-104.*
32. *Parshotam, A. (2018). Occasional Paper 278 Cultivating Smallholder Inclusion in Southern Africa 'S Macadamia; South African Institute of International Affairs: Pretoria, South Africa.*
33. *Poitras, G. (2022). Cobweb Theory, Market Stability and Price Expectations.*
34. *Quiroz, D., Kuepper, B., Wachira, J., & Emmott, A. (2019). Value chain analysis of macadamia nuts in Kenya. The Centre for the Promotion of Imports from Developing Countries (CBI), Profundo, Amsterdam, the Netherlands.*
35. *Rockhampton Regional Council, (2022). Rookwood Weir Macadamia Commodity Report. Australia*
36. *Sibulali, A. (2018). Market Intelligence Report. Macadamia Nuts Industry. Western Cape, South Africa.*
37. *Stephen P. D., Jorge C., John L., and Simon S. (2015). Kenya Agricultural Sector Risk Assessment. World Bank Group Report Number 97887*
38. *The Standard. (2024). Quality Concerns Persist Despite New Macadamia Price Floors. Nairobi, Kenya: Standard Media Group.*
39. *Wooldridge, J. M. (2012). Introductory Econometrics: A Modern Approach (5th ed.). South-Western Cengage Learning.*
40. *Xie, H., & Wang, B. (2017). An empirical analysis of the impact of agricultural product price fluctuations on China's grain yield. Sustainability, 9(6), 906.*
41. *Ziehlke, L. (2017). Australia Macadamias Yearbook. Trade Newsletter*