The Role of Rural Tourism in Driving Agricultural Economic Revitalization: A Study of Guangnan District, Yunnan Province

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ABSTRACT

Under China's rural revitalization strategy, rural tourism has become an important means of activating rural resources, increasing farmers' income, and promoting agricultural transformation. However, converting tourism development into sustainable agricultural benefits remains a challenge in underdeveloped agricultural regions with weak industrial foundations. Taking Guangnan District in Wenshan Prefecture, Yunnan Province, as the research area, this study examines the effect of rural tourism on agricultural economic revitalization and the mediating role of industrial integration. Annual data from 2005 to 2025 are examined using Bayesian methods. The findings show that rural tourism has a significant positive long-term effect on agricultural economic revitalization. Industrial integration plays a partial mediating role, indicating that rural tourism promotes agricultural development both directly and indirectly through agriculture–tourism integration. The marginal contribution of rural tourism declines as tourism expands, while its economic benefits are mainly realized through long-term accumulation. Guangnan District should therefore shift from tourism scale expansion to quality improvement, strengthen the links between tourism and local agricultural production, processing, and marketing, and improve transportation, cold-chain logistics, and digital infrastructure. These measures can promote deeper agriculture–tourism integration and sustainable rural economic development.

Keywords: rural tourism, agricultural economic revitalization, industrial integration, Bayesian analysis, Guangnan District

INTRODUCTION

Rural tourism has become an important instrument in China's rural revitalization agenda because it can convert landscape, culture, farming practices, and local products into marketable experiences. Visitor spending can widen the demand base for agricultural products, create non-farm employment, and encourage local processing and branding. These benefits are not automatic. Where tourism businesses purchase inputs from outside the destination, or where agriculture and tourism operate as separate sectors, much of the expenditure leaks out of the local economy and the agricultural sector captures only a limited share of tourism growth.

Guangnan District in Wenshan Prefecture provides a demanding setting in which to examine this mechanism. The district lies in southeastern Yunnan near the borders with Guangxi and Guizhou. It remains economically less developed, and the primary sector represented 26.14% of gross regional product in 2023 (Guangnan People's Government, 2024, 2026). Mountainous and semi-mountainous terrain covers 94.7% of the district, and extensive karst landscapes create ecological sensitivity and constraints on conventional agricultural expansion (Z. Li et al., 2024). At the same time, Guangnan has developed tourism around dendrobium cultivation, rice heritage, ethnic culture, farm experiences, and local specialty products (Visit Yunnan, 2024). These characteristics make it a useful case for studying whether tourism can support agriculture under structural and environmental constraints.

The district's policy challenge is not simply to attract more visitors. Agricultural producers must be connected to accommodation, catering, retail, transport, and experience providers if tourism demand is to raise local

value added. Guangnan still faces weak industrial linkages, limited processing, and restricted income opportunities in many rural communities (Yunnan Daily, 2024). A district-level analysis can therefore reveal mechanisms that are obscured in provincial or national studies and can inform other underdeveloped agricultural regions pursuing tourism-led development.

This article addresses two questions: whether rural tourism has a positive long-run association with agricultural economic revitalization in Guangnan, and whether industrial integration transmits part of that association. It contributes by combining district-level time-series evidence with a formal Bayesian mediation framework suited to a small annual sample. It also tests short-run dynamics and a nonlinear specification, allowing the analysis to distinguish cumulative benefits from immediate changes and to assess whether tourism's marginal contribution declines at higher development levels.

LITERATURE REVIEW

Theoretical foundations

Industrial integration theory explains how previously separate production and service activities become linked through market demand, shared resources, technology, and policy. In an agri-tourism system, farms supply food, landscapes, cultural knowledge, and experiences; tourism businesses provide access to visitors, marketing, accommodation, and distribution channels. Integration can lengthen agricultural value chains, raise product recognition, and enable households to combine production with service income (H. Y. Li et al., 2024; Liu et al., 2023). The relevant outcome is therefore not tourism growth alone but the degree to which agricultural resources and producers participate in the tourism value chain.

Multiplier theory complements this account by explaining how an initial injection of visitor expenditure can generate successive rounds of local income and consumption (Moretti, 2010). The multiplier is larger when businesses procure locally and residents retain and re-spend income within the district. It is smaller when imported goods, external ownership, or weak local supply capacity create leakage. Industrial integration is the institutional and commercial mechanism that can retain tourism expenditure locally, while the multiplier describes how retained expenditure circulates through the rural economy.

Empirical evidence and research gap

A substantial literature associates rural tourism with income growth, employment diversification, and community development (He et al., 2021; Romanenko et al., 2020). Chinese evidence similarly indicates that agri-tourism integration and demonstration policies can raise farmers' income and local output (Shen et al., 2023). However, these effects vary with the strength of local supply linkages. Local sourcing allows tourism firms to market farm products and retain expenditure, whereas dependence on imports reduces the benefits captured by rural communities (Ciolac et al., 2020; Torres & Momsen, 2004).

Recent studies increasingly treat integration as a mechanism rather than a parallel outcome. Cross-city evidence links agriculture-tourism integration to rural revitalization and agricultural productivity (Liu et al., 2023; Ma et al., 2024). Policy and governance also shape distributional outcomes: regional coordination can strengthen tourism-led growth (Song et al., 2025), while externally financed or weakly participatory development can erode rural social and cultural assets (Dai et al., 2023). Residents' trust in government and their assessment of benefits and costs also influence support for tourism development (Woosnam et al., 2024).

Three gaps remain. First, much quantitative work uses provincial or city panels and can miss county-specific trajectories. Second, mediation is often asserted conceptually but not estimated directly. Third, small district-level samples make asymptotic inference uncertain. A Bayesian framework produces full posterior distributions and allows direct estimation of an indirect effect, while regularising a small-sample model.

Research hypotheses

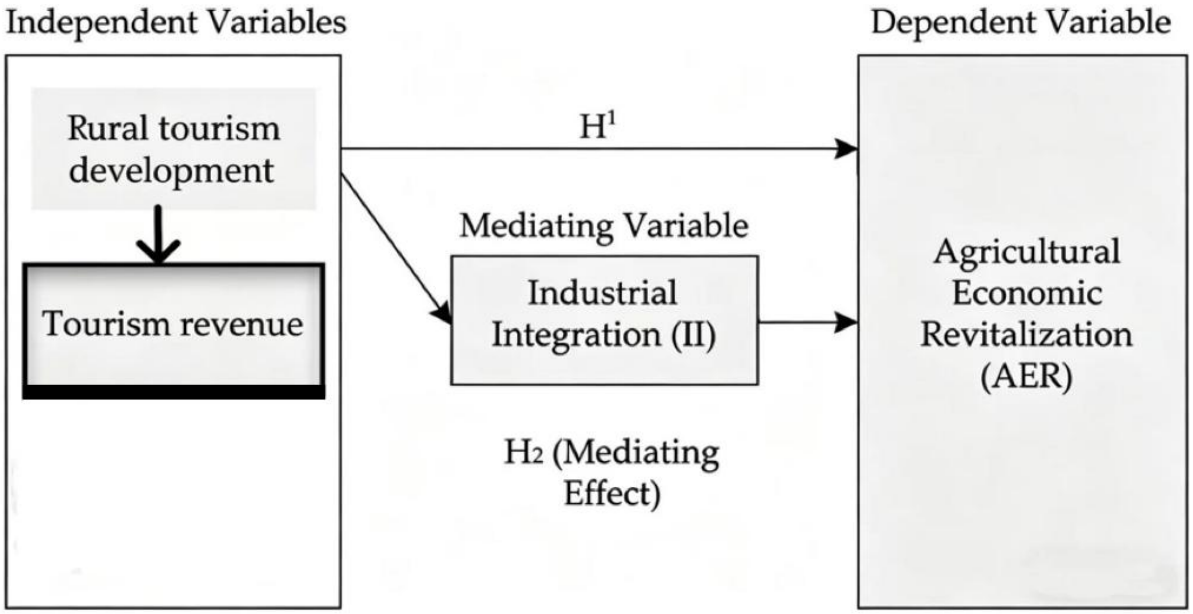
Drawing on the above analysis, this paper puts forward two research hypotheses:

H1: Rural tourism has a significant positive effect on agricultural economic revitalization in Guangnan District.

H2: Industrial integration mediates the relationship between rural tourism and agricultural economic revitalization in Guangnan District.

Figure 1 shows these hypothesized direct and mediated relationships and the operational variables used in the empirical model.

Figure 1: Conceptual framework



METHODOLOGY

Study area, data, and variables

The analysis uses 21 annual observations for Guangnan District from 2005 to 2025. Secondary data were compiled from the Guangnan District statistical bulletins, Wenshan statistical yearbooks, government reports, and official news releases. A consistent district-level series was constructed for four variables. Tourism revenue (TR, CNY 100 million) measures rural tourism development. The number of rural tourism enterprises (RTE) proxies the breadth of agri-tourism industrial integration. Total agricultural output value (AOV, CNY 100 million) measures agricultural economic revitalization. Government expenditure on agriculture, forestry, and water affairs (GS, CNY 10,000) controls for public support. Table 1 summarises the operational definitions.

Table 1: Variable definitions and measurements

Role	Variable	Symbol	Measurement
Independent	Rural tourism development	TR	Tourism revenue (CNY 100 million)
Mediator	Agri-tourism industrial integration	RTE	Number of rural tourism enterprises
Dependent	Agricultural economic revitalization	AOV	Agricultural output value (CNY 100 million)
Control	Government support	GS	Agriculture, forestry, and water expenditure (CNY 10,000)

RTE is an observable but necessarily partial proxy for integration. It captures the expansion of rural tourism business entities but not the intensity of farm procurement, household participation, product processing, or revenue sharing. The analysis therefore interprets RTE as the scale of the organizational interface between tourism and the rural economy, not as a complete index of integration quality.

Econometric strategy

All continuous variables are transformed into natural logarithms, allowing coefficients to be interpreted as elasticities and reducing scale differences. Time-series properties are evaluated with Augmented Dickey-Fuller and Phillips-Perron tests, supplemented by the Zivot-Andrews test allowing one endogenous break (Dickey & Fuller, 1979, 1981; Phillips & Perron, 1988; Zivot & Andrews, 1992). Because non-stationary level series can produce spurious regression, the Johansen trace procedure tests whether ln AOV, ln TR, ln RTE, and ln GS share stable long-run relationships (Johansen, 1988). The long-run level models are estimated only after cointegration is established; first-difference models provide a short-run robustness check.

Bayesian mediation model specification

Following the mediation framework of Baron and Kenny (1986), three linear regression models are specified. The logged variables ln AOV, ln TR, ln RTE, and ln GS represent agricultural output value, tourism revenue, rural tourism enterprises, and government support, respectively. A linear Trend term controls for long-term structural and macroeconomic changes.

Model M (Path M model). This equation estimates whether rural tourism promotes industrial integration:

$$\ln RTE = \alpha_0 + \alpha_1 \ln TR + \alpha_2 \ln GS + \alpha_3 Trend + \varepsilon$$

Here, α_1 measures the effect of rural tourism on industrial integration; α_2 and α_3 are the coefficients for government support and the time trend, respectively.

Model Y1 (Total effect model). This equation estimates the total effect of rural tourism on agricultural economic revitalization:

$$\ln AOV = \beta_0 + \beta_1 \ln TR + \beta_2 \ln GS + \beta_3 Trend + \varepsilon$$

Here, β_1 is the total effect of rural tourism on agricultural economic revitalization, comprising both direct and indirect effects; β_2 and β_3 are the coefficients for government support and the time trend.

Model Y2 (Full mediation model). This equation separates the direct tourism effect from the mediator-to-outcome path:

$$\ln AOV = \gamma_0 + \gamma_1 \ln TR + \gamma_2 \ln RTE + \gamma_3 \ln GS + \gamma_4 Trend + \varepsilon$$

Here, γ_1 is the direct effect of rural tourism after controlling for industrial integration, and γ_2 is the effect of industrial integration after controlling for rural tourism. The subscript t denotes the year (t = 1, 2, ..., 21), and the error terms are assumed to be independently and identically normally distributed with mean zero and variance σ^2.

The indirect effect is the product of the tourism-to-integration path and the integration-to-outcome path, $\alpha_1 \times \gamma_2$. The total effect, direct effect, and indirect effect are related as follows:

$$\beta_1 = \gamma_1 + \alpha_1 \times \gamma_2$$

The share of the total effect transmitted through industrial integration is:

$$\text{Proportion mediated} = (\alpha_1 \times \gamma_2) / \beta_1$$

The indirect effect is evaluated directly from posterior draws. Partial mediation is supported when the 95% credible intervals for α_1, γ_2, and $\alpha_1 \times \gamma_2$ exclude zero while γ_1 remains credible.

Bayesian estimation is appropriate because the sample contains only 21 observations and the indirect effect has a non-normal sampling distribution. Weakly informative priors regularize coefficients without overriding the data (Gelman et al., 2013; Miocevic et al., 2017; Yuan & MacKinnon, 2009). Posterior sampling uses the No-U-Turn Sampler with four chains, 4,000 iterations per chain, and 1,000 warm-up iterations, leaving 12,000 posterior draws (Hoffman & Gelman, 2014). Convergence requires R-hat below 1.01 and effective sample sizes above 400 (Vehtari et al., 2021). Posterior predictive checks and Bayesian R-squared assess fit (Gelman et al., 2019). Bridge sampling provides the Bayes factor comparing Model Y2 with Model Y1; values just above one represent only weak support after penalizing additional complexity (Gronau et al., 2020; Kass & Raftery, 1995).

Two robustness analyzes address alternative explanations. First-difference models remove common long-run trends and isolate year-to-year changes (Wooldridge, 2020). A nonlinear model adds squared ln TR to test whether tourism has diminishing marginal effects. A positive linear coefficient together with a negative quadratic coefficient implies an inverted U-shaped relationship, consistent with resource constraints, land-use competition, and market saturation at advanced stages of tourism development (Deller et al., 2001; Sharpley, 2002).

RESULTS

Descriptive evidence and time-series properties

The variables changed substantially over the study period. Tourism revenue averaged CNY 43.154 million and ranged from CNY 0.290 million to CNY 143.500 million. The number of rural tourism enterprises increased across a range of 1 to 62. Agricultural output value and government support also display wide dispersion, as shown in Table 2.

Table 2: Descriptive statistics of the main variables

Variable	Mean	SD	Minimum	Median	Maximum
TR	43.154	50.208	0.290	12.800	143.500
RTE	24.619	23.196	1.000	17.000	62.000
AOV	7,628.143	5,147.589	1,200.000	7,295.000	16,938.000
GS	57,407.619	35,438.230	15,200.000	49,500.000	116,362.000

Note. TR and AOV are in CNY 100 million; RTE is a count; GS is in CNY 10,000; n = 21 (2005-2025).

At levels, all four logged series fail to reject the unit-root null in the ADF and PP tests. Zivot-Andrews statistics are also above the 10% critical value of -4.82 after allowing an endogenous break. First differences are stationary for ln TR, ln RTE, and ln GS, while evidence for ln AOV is mixed across tests, a common finite-sample problem (Maddala & Kim, 1999). The weight of evidence supports treating the series as integrated of order one and proceeding to a cointegration test.

The Johansen results in Table 3 reject no cointegration and reject ranks of at most one and two, but do not reject rank at most three. The estimated rank is therefore three. The four variables share stable long-run relationships, so level regressions with trend controls describe long-run equilibrium associations rather than unrelated trending series (Engle & Granger, 1987).

Table 3: Johansen cointegration trace test

Null hypothesis	Trace statistic	10% critical	5% critical	Decision at 5%
r = 0	110.40	59.14	62.99	Reject
r <= 1	65.13	39.06	42.44	Reject
r <= 2	30.85	22.76	25.32	Reject
r <= 3	5.66	10.49	12.25	Do not reject

Note : System variables are ln AOV, ln TR, ln RTE, and ln GS. A linear trend and two lags are used.

Bayesian mediation estimates

Table 4 reports the baseline posterior estimates. In Model M, a 1% increase in tourism revenue is associated with a 0.38% increase in the number of rural tourism enterprises (95% credible interval [0.10, 0.68]). In Model Y1, the total elasticity of agricultural output value with respect to tourism revenue is 0.25 [0.10, 0.39]. When industrial integration is added in Model Y2, the direct tourism elasticity falls to 0.16 but remains credible [0.01, 0.32], while the elasticity on ln RTE is 0.24 [0.01, 0.46]. Government support and the time trend do not have credible conditional coefficients in these models.

Table 4: Bayesian regression estimates

Parameter	Model M: ln RTE	Model Y1: ln AOV	Model Y2: ln AOV
Intercept	-9.65 [-19.31, 0.91]	1.09 [-4.37, 6.56]	4.02 [-1.69, 9.57]
ln TR	0.38 [0.10, 0.68]	0.25 [0.10, 0.39]	0.16 [0.01, 0.32]
ln RTE	-	-	0.24 [0.01, 0.46]
ln GS	1.04 [-0.04, 2.03]	0.20 [-0.37, 0.76]	-0.12 [-0.69, 0.47]
Trend	-0.00 [-0.12, 0.12]	-0.00 [-0.06, 0.06]	-0.00 [-0.05, 0.05]
Residual SD	0.28	0.14	0.12

Note. Entries are posterior means with 95% credible intervals in brackets, except residual SD.

The effect decomposition in Table 5 supports both hypotheses. The total effect is 0.25, and the direct effect after accounting for industrial integration is 0.16. The indirect effect is 0.092, with a 95% credible interval of [0.0004, 0.225] that lies above zero. Approximately 36.9% of the total effect is transmitted through the expansion of rural tourism enterprises. H1 is supported because tourism retains a positive total and direct association with agricultural output; H2 is supported because both component paths and their product are credible, while the remaining direct effect indicates partial rather than complete mediation.

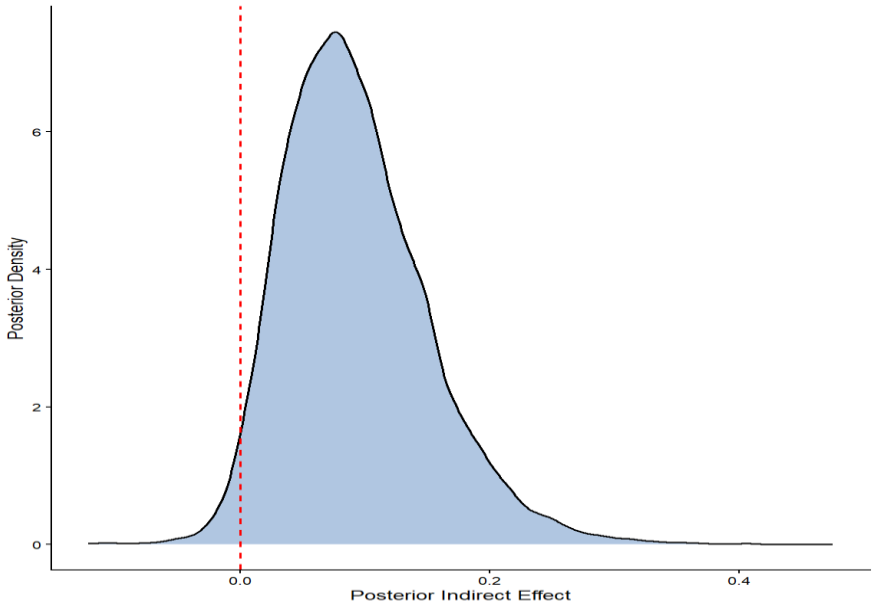
Table 5: Posterior decomposition of tourism effects

Effect	Posterior mean	95% credible interval
Total effect (c)	0.25	[0.10, 0.39]

Direct effect (c')	0.16	[0.01, 0.32]
Indirect effect (a x b)	0.092	[0.0004, 0.225]
Proportion mediated	36.9%	-

Figure 2 visualizes the posterior distribution of the indirect effect. Almost all posterior mass lies above zero, although the right-skewed distribution reflects uncertainty generated by the small sample. The Bayes factor comparing Model Y2 with Model Y1 is 1.148 in favour of the mediation model. This is weak model-level evidence, not a contradiction of the positive indirect-effect interval: the Bayes factor penalises the additional mediator parameter, whereas the indirect-effect posterior addresses a specific path product.

Figure 2: Posterior distribution of the indirect effect



Diagnostics and robustness

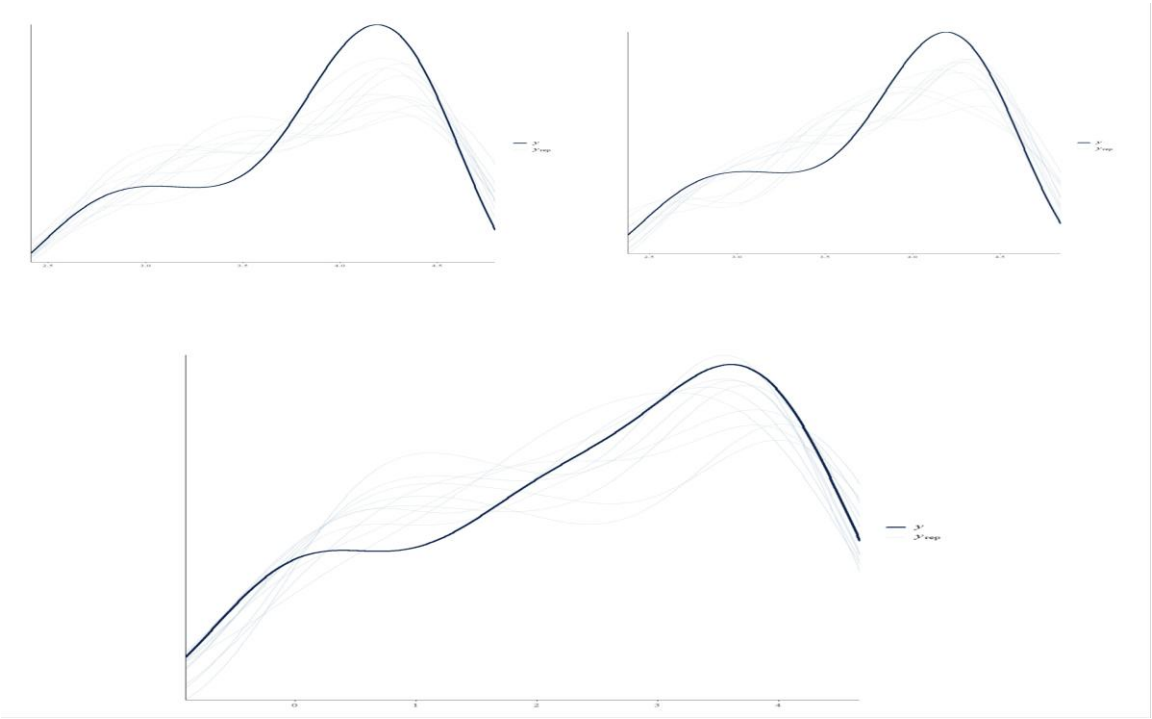
The diagnostic summary in Table 6 indicates stable sampling and strong in-sample fit. Maximum R-hat is 1.00 in every model, and minimum bulk and tail effective sample sizes greatly exceed 400. Bayesian R-squared ranges from 0.958 to 0.969. Figure 3 presents the posterior predictive checks for Model M, Model Y1, and Model Y2. In all three models, the posterior predictive density curves closely follow the observed density distributions. Although slight deviations are observed across individual posterior draws, the replicated distributions generally overlap with the observed data, indicating that the Bayesian models adequately reproduce the empirical distributions of the response variables. Therefore, the overall model fit is considered satisfactory, providing a reliable basis for subsequent parameter estimation and mediation analysis. These diagnostics reduce concern that the mediation result is an artefact of non-convergence or poor baseline fit.

Table 6: Bayesian model diagnostics

Model	Max R-hat	Min bulk ESS	Min tail ESS	Bayesian R2	95% credible interval
M	1.00	5,387	4,995	0.969	[0.953, 0.975]
Y1	1.00	5,581	5,986	0.958	[0.936, 0.966]
Y2	1.00	5,951	6,256	0.967	[0.948, 0.974]

Note. ESS = effective sample size. Recommended thresholds are R-hat < 1.01 and ESS > 400.

Figure 3: Posterior predictive checks for Model M, Model Y1, and Model Y2



First-difference results in Table 7 are weaker than the long-run estimates. The credible intervals for changes in tourism revenue, rural tourism enterprises, and government support include zero across the short-run equations. This pattern implies that a single year's tourism change does not immediately alter integration or agricultural output in a detectable way. It is consistent with a cumulative mechanism requiring enterprise formation, supplier relationships, investment, and repeat demand rather than an instantaneous response.

Table 7: First-difference Bayesian models

Parameter	**Model DM**	**Model DY1**	**Model DY2**
Delta ln TR	-0.07 [-0.44, 0.32]	0.09 [-0.02, 0.19]	0.09 [-0.02, 0.20]
Delta ln RTE	-	-	0.04 [-0.11, 0.18]
Delta ln GS	0.81 [-0.51, 2.04]	0.01 [-0.44, 0.46]	-0.03 [-0.54, 0.49]

Note. Posterior means with 95% credible intervals in brackets. All models have R-hat = 1.00 and bulk ESS > 10,000.

The nonlinear model in Table 8 retains a positive coefficient on ln TR and estimates a negative coefficient on its square. Both credible intervals exclude zero. The implied turning point is ln TR = 4.36, within the observed range of -1.24 to 4.97, and Bayesian R-squared rises to 0.978. The result indicates that tourism remains beneficial over much of the development path but its marginal contribution declines and can turn negative at sufficiently high levels.

Table 8: Nonlinear Bayesian regression

Parameter	**Posterior mean**	**95% credible interval**
ln TR	0.22	[0.09, 0.35]
(ln TR) squared	-0.03	[-0.04, -0.01]

ln RTE	0.07	[-0.14, 0.29]
ln GS	0.28	[-0.30, 0.85]
Trend	0.01	[-0.03, 0.06]
Bayesian R2	0.978	[0.964, 0.984]
Turning point (ln TR)	4.36	-

DISCUSSION

The positive long-run tourism elasticity is consistent with research linking rural tourism to employment, market diversification, and local income (He et al., 2021; Romanenko et al., 2020; Shen et al., 2023). In Guangnan, tourism demand can expand the market for specialty foods, agricultural experiences, homestays, and culturally embedded products. The result is best interpreted as a long-run association within a cointegrated system, not as a claim that every short-run increase in visitor spending immediately raises farm output. The insignificant first-difference results make this temporal distinction explicit.

The mediation result clarifies why local linkage matters. Tourism revenue is associated with more rural tourism enterprises, and those enterprises are in turn associated with greater agricultural output. The mediated share of 36.9% is economically meaningful but leaves a direct pathway, which may include infrastructure, labor demand, destination visibility, and household income effects not captured by the enterprise-count proxy. This partial mediation supports the conceptual argument that agriculture-tourism integration retains and redistributes visitor expenditure locally (Ciolac et al., 2020; Liu et al., 2023; Torres & Momsen, 2004).

The Bayes factor of 1.148 calls for measured interpretation. It offers only weak comparative evidence that the full mediation model outperforms the simpler total-effect model after complexity is penalised. The path-specific posterior nevertheless indicates a positive indirect effect. Reporting both findings avoids overstating the mechanism: the data are compatible with partial mediation, but a larger sample and richer integration measure are needed before treating the estimated share as a stable structural parameter.

The nonlinear result adds an important boundary condition. Tourism's contribution diminishes as development expands, and the estimated turning point lies within the observed data. Beyond this point, congestion, environmental pressure, labor and land competition, or market saturation may offset additional demand. The finding aligns with broader arguments that rural tourism cannot be expanded indefinitely without weakening the amenities and agricultural base on which it depends (Deller et al., 2001; Sharpley, 2002). Quality, local value capture, and carrying capacity therefore matter more than visitor volume alone.

CONCLUSION AND POLICY IMPLICATIONS

Using annual data for 2005-2025, this study finds that rural tourism is positively associated with agricultural economic revitalization in Guangnan District over the long run. The total tourism elasticity is 0.25, and industrial integration transmits an estimated 0.092 indirect effect, or 36.9% of the total. The remaining direct effect is positive, supporting partial mediation. Diagnostics indicate adequate convergence and fit, first-difference models show that the effects are cumulative rather than immediate, and the nonlinear model identifies diminishing marginal returns.

Policy should first shift from scale expansion to value creation. Guangnan should manage carrying capacity, prioritise longer stays and higher-spending experiences, and support products that combine agriculture, culture, health, and landscape assets. Boutique homestays, farm-to-table services, dendrobium health experiences, rice-culture activities, and certified specialty products can increase expenditure per visitor while reducing pressure to pursue volume growth.

Second, industrial integration should be treated as an implementation mechanism. Financial and technical support should target enterprises that purchase from local farms, process local products, employ rural residents, and offer agricultural experiences. A district linkage platform could connect farms, cooperatives, accommodation providers, restaurants, retailers, and online sales channels. Procurement agreements, shared quality standards, traceability, and certification would help translate visitor demand into stable agricultural orders and premium pricing.

Third, government support should focus on enabling conditions rather than undifferentiated expenditure. Rural roads, cold-chain logistics, water and waste systems, digital connectivity, and visitor facilities can lower transaction costs for integrated businesses. Cross-department coordination among agriculture, tourism, commerce, and rural development agencies is also necessary. Monitoring should track local procurement, farm participation, value added, environmental indicators, and tourism intensity relative to the estimated turning point so that policy can respond before growth produces adverse spillovers.

Limitations And Future Research

This study has four main limitations. First, the sample comprises only 21 annual observations, which—despite the use of Bayesian regularisation—constrains model complexity and estimation precision. Second, the single-district design limits the generalizability of findings to other contexts. Third, the RTE indicator captures only the number of integration events, without reflecting their depth, quality, or substantive significance. Fourth, the use of agricultural output value as the sole outcome measure addresses only the economic dimension of rural revitalization, leaving aside distributional equity, social welfare, cultural vitality, and ecological sustainability.

Future research should extend the series, use quarterly data, or construct multi-county panels; develop an integration index covering local procurement, processing, farm participation, and revenue retention; and evaluate policy shocks with event-study or difference-in-differences designs. Household and enterprise surveys could test how benefits are distributed, while ecological and cultural indicators would show whether tourism-led gains are sustainable. These extensions would provide a stronger causal and welfare interpretation of the mechanism identified here.

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Conflict Of Interest

The author declares no conflict of interest.

Ethical Approval

The study uses publicly available aggregate secondary data and does not involve human participants, identifiable personal data, or animals; institutional ethical approval was therefore not required.

Data Availability

The study is based on publicly accessible statistical bulletins, yearbooks, government reports, and official news releases cited in the article. The compiled analytical dataset is available from the corresponding author on reasonable request, subject to the terms of the original sources.

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