

Marginal effects of tourism, gender and biodiversity on the local economic development of the Santiago Basin, Baja California Sur

Efectos marginales del turismo, género y biodiversidad en el desarrollo económico local de la Cuenca de Santiago, Baja California Sur

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ABSTRACT

The study analyzes the marginal effects of tourism, gender and biodiversity on local economic development, using discrete choice models (Logit and Probit) in the Santiago Basin, municipality of Los Cabos, Baja California Sur. The marginal effects of variables associated with business activity, associativity, perceptions of tourism, environmental impact and gender equity are estimated. The research is based on the theory of endogenous development, with an innovation system approach that recognizes tourism as an economic engine, gender equity as an axis of inclusion and biodiversity as a strategic resource. The methodology applied is quantitative-descriptive of cross-sectional, using the questionnaire as a research instrument. The results show that the positive perception of tourism increases the probability of recognizing local economic benefits; that gender variables are related to the perception of equal opportunities for entrepreneurship and that age, income, sex, and schooling influence the perception of the environmental impact of economic activities in La Ribera, Miraflores, and Santiago.

KEYWORDS: biodiversity, gender, local economic development, marginal effects, probability models, tourism



RESUMEN

El estudio analiza los efectos marginales del turismo, género y biodiversidad en el desarrollo económico local, mediante modelos de elección discreta (Logit y Probit) en la Cuenca de Santiago, municipio de Los Cabos, Baja California Sur. Se estiman los efectos marginales de variables asociadas con la actividad empresarial, la asociatividad, las percepciones del turismo, el impacto ambiental y la equidad de género. La investigación se sustenta en la teoría del desarrollo endógeno, con un enfoque de sistema de innovación que reconoce al turismo como motor económico, a la equidad de género como eje de inclusión y la biodiversidad como recurso estratégico. La metodología aplicada es cuantitativa-descriptiva de corte transversal, utilizando el cuestionario como instrumento de investigación. Los resultados muestran que la percepción positiva del turismo, incrementa la probabilidad de reconocer beneficios económicos locales; que las variables de género se relacionan con la percepción de igualdad de oportunidades para emprender y que la edad, el ingreso, el sexo y la escolaridad influyen en la percepción del impacto ambiental de las actividades económicas en La Ribera, Miraflores y Santiago.

PALABRAS CLAVE: biodiversidad, desarrollo económico local, efectos marginales, género, modelos de probabilidad, turismo

INTRODUCTION

This study uses variables related to tourism, gender, and biodiversity to analyze local economic development (LED) in the Santiago Basin, in the municipality of Los Cabos. The rural communities included in the study are the municipal districts of Miraflores, Santiago, and La Ribera.

From the perspective of endogenous development theory, territorial growth is explained, in part, by local actors' capacity to coordinate resources, knowledge, business networks, and advantages derived from proximity. This proximity fosters inter-business relationships, cooperation, and the formation of agreements aimed at strengthening productive units linked to the territory (Boisier, 2001; Brunet & Baltar, 2010; Vázquez, 2002). In the case of the Santiago Basin, these dynamics are particularly relevant given its proximity to the tourist hubs of Cabo San Lucas and San José del Cabo (Montaña et al., 2022, 2025).

The natural resources in the Santiago Basin represent potential for the local tourism sector; however, constraints persist in rural communities that prevent these resources from being transformed into assets, resulting in a significant portion of demand going unmet due to insufficient supply capacity, which, in turn, is affected by social, environmental, and cultural constraints that inhibit the organic growth of rural communities. This problem is widespread in rural communities, which lack the specific tools and knowledge needed to foster positive local development (Ortega & Marín, 2019).

In this context, the lack of information that addresses the issue comprehensively—economic, social, and environmental—limits proposals for territorial development. Therefore, this study provides an analysis that can serve as empirical support for formulating proposals for territorial economic development (DEL), as well as econometric models that help understand regional realities and facilitate decision-making.

The analysis employs nonlinear probability models, which provide probabilistic consistency to the interpretation of the results. This means that the estimated probabilities remain within the range of 0 to 1, making it easier to interpret the marginal effects of the explanatory variables on the variable of interest in probabilistic terms—unlike linear probability models, in which estimates can yield values outside this range.

Estimating marginal effects helps understand the economic dynamics of the Santiago Basin and provides initial evidence for a qualitative assessment of the study area. In this regard, this study is intended as an empirical contribution to support the formulation of public policies and territorial strategies related to tourism, gender, and biodiversity in rural communities in Los Cabos.

Unlike studies that focus on a single dimension—such as tourism potential or the environmental dimension—the contribution of this study lies in analyzing three dimensions. Thus, in this research, all variables are integrated into a single analytical model, enabling identification of their marginal effects on local economic development and providing a broader understanding of the territorial processes at play in the study area.

In this way, the article provides a multidimensional perspective on local economic development. It offers useful insights for guiding public policies, partnership strategies, and territorial management actions with a sustainable and inclusive approach.

LITERATURE REVIEW

Discussing local economic development (LED) involves acknowledging the contributions of endogenous development theory, which posits that capital accumulation, technological progress, productive organization, innovation, and coordination among local actors are the key drivers of economic growth in a specific territory. From this perspective, economic growth results from processes that foster the creation and diffusion of innovations within the productive system, the adaptation of production, agglomeration economies, and the diversity of activities within a single territorial hub. Together, these factors enhance the potential for local economic growth (Vázquez, 2002). Similarly, collaboration plays an important role in this theory, given that cooperation among the actors involved fosters endogenous development through the creation of agreements that promote improvements in areas of opportunity and facilitate economic growth in a mutually beneficial and cooperative manner (Aguirre & Herrera, 2025; Brunet & Baltar, 2010; Lucero, 2025; Quito et al., 2021).

Recent literature has linked DEL to dimensions such as gender, tourism, and biodiversity; however, these are often analyzed independently. This separation limits a comprehensive understanding of territorial processes, especially in rural communities where economic activity depends on natural resources, local productive capacities, cooperative relationships, and the differentiated participation of women and men.

In this context, associativity plays a key role, as collaborative networks among local actors help reduce vulnerabilities and, at the same time, facilitate better use of available opportunities. Montero and Calderón (2020) analyze traditional models of associativity as potential catalysts for DEL; however, their research found that unilateral leadership favoring men can limit the participation of women and young people. This finding highlights that associativity does not always operate neutrally but may be shaped by gender relations linked to the distribution of opportunities within the territory. In this sense, the gender dimension is introduced as a relevant factor in associative dynamics and, therefore, in DEL (Chaparro et al., 2023).

The environmental dimension is also central to understanding local development in rural areas that depend heavily on natural resources. Ortiz and Alejandre (2020) and Zirufu and Pelegrín (2023) note that incorporating environmental factors can strengthen community resilience and the sustainability of development models. However, a recurring limitation in these approaches is that biodiversity is often studied from a general sustainability perspective, without being explicitly integrated with economic, tourism, and gender variables.

For its part, tourism has been extensively analyzed as a driver of growth in rural communities (González et al., 2023; Izábal de la Garza et al., 2025). Cervantes et al. (2023) highlight its potential to revitalize local economies; however, many of these studies prioritize the economic dimension of tourism and pay less attention to the social, associative, and environmental conditions that determine its territorial appropriation. This omission is significant, as tourism development depends not only on the presence of attractions but also on local capacities, organizational forms, and mechanisms for environmental conservation.

A comprehensive review of the literature reveals that the dimensions of tourism, gender, and biodiversity have been addressed in association with local economic development (LED), but predominantly in isolation. This separation limits a comprehensive understanding of local development, particularly in rural communities where tourism depends on natural resources, local productive capacities, the differentiated participation of women and men, and forms of collaboration among economic actors.

To address this limitation, this study proposes integrating these dimensions into a single empirical analysis using Logit and Probit probability models, which allow for the analysis of binary dependent variables, the estimation of probabilities of occurrence, and the calculation of marginal effects of the explanatory variables (Medina, 2003). The added value of this study lies in providing region-specific evidence on the Santiago Basin and offering a multidimensional interpretation of the DEL that helps guide strategies for public policy, territorial management, and sustainable rural development.

MATERIALS AND METHODS

The research was conducted using a quantitative-descriptive, cross-sectional approach, focused on analyzing the dimensions of tourism, gender, and biodiversity in the Santiago Basin, municipality of Los Cabos, Baja California Sur, with the aim of identifying the limiting (or triggering) variables for DEL in that region.

To collect data, a survey technique was employed using a structured questionnaire administered to 46 business units. The questionnaire consisted of six sections that gathered general and economic information about the businesses, as well as social and personal perceptions related to tourism, gender, and biodiversity.

The study's target population consists of microenterprises and startups located in the municipal districts of Santiago, Miraflores, and La Ribera within the Santiago Basin. Given the absence of a comprehensive sampling framework and the high level of informality among the business units in the area, a non-probability convenience sampling method was chosen, in which economic actors who were available and willing to participate in the fieldwork were selected.

Of the 46 questionnaires, 42 were deemed valid after the data cleaning process. Using Cronbach's alpha coefficient, an internal consistency test was conducted for items related to perceptions of tourism, gender, and biodiversity; the result (a value of 0.7) indicated acceptable reliability. The survey was conducted in person through direct interviews with the managers of each production unit during the 2024–2025 period. Given the small sample size and the use of non-probabilistic convenience sampling, the results should be interpreted as exploratory and not as generalizable to the entire Santiago Basin.

The variables included sociodemographic characteristics (age, gender, education level), business data (activity, length of operation, number of employees, revenue), and perceptions regarding the relationship between tourism, gender, biodiversity, and DEL. Thus, the following holds true:

$$DEL_i = f(Turismo_i, Género_i, Biodiversidad_i, X_i); X_i \text{ are control variables}$$

With these data, we proceeded to the econometric modeling phase, with the aim of estimating the marginal effects of the aforementioned dimensions; to this end, we used binary choice, logit, and probit models, which differ in the type of function they employ. Since the logit model uses a logistic function, the specification of this type of model is expressed as:

$$P(Y_i = 1|x_i) = P(Y_i > 0|x_i) = \frac{1}{1+e^{-\alpha-x_i\beta}} = \frac{e^{\alpha+x_i\beta}}{1+e^{\alpha+x_i\beta}} \quad (1)$$

In the case of probit models, they use a standardized normal function:

$$P(Y_i = 1|x_i) = P(Y_i > 0|x_i) = \int_{-\infty}^{\alpha+x_i\beta} \frac{1}{\sqrt{2\pi}} e^{-\frac{s^2}{2}} ds \quad (2)$$

The probit model is simplified as follows:

$$P(Y_i = 1|x_i) = P(Y_i > 0|x_i) = \Phi(x_i\beta) \quad (3)$$

Where:

β = Vector of parameters to be estimated.

Φ = Cumulative normal distribution function.

$Y_i = 1$ si $Y_i^* > 0$, $Y_i = 0$ in all other cases.

x_i = Vector of explanatory variables associated with the dimensions of tourism, gender, and biodiversity.

Having specified the above, it is stipulated that for this research study, a probabilistic model (logit or probit) is used, in which the estimates of the marginal effects are determined by the following logistic function:

$$P(Y_i = 1|x_i) = P(Y_i > 0|x_i) = \frac{1}{1+e^{-\alpha-x_i\beta}} \quad (4)$$

Where:

β = Vector of parameters to be estimated.

$Y_i = 1$ si $Y_i^* > 0$, $Y_i = 0$ in all other cases.

x_i = Vector of explanatory variables associated with the dimensions of tourism, gender, and biodiversity.

α = Constant term.

e = Exponential value.

As previously mentioned, the questionnaire consists of six sections, which, in line with the stated objectives, cover the following aspects of the study area: sociodemographic information (1), economic activity (2), perceptions of tourism (3), community involvement (4), biodiversity (5), and gender (6). To facilitate a better understanding of the explanatory variables and the resulting models, the following table is provided, detailing the operational definitions of the variables as well as their respective coding. It should be noted that Table 1 also shows how the variables were recoded and used in the model specification, but not necessarily the original form in which they were presented in the questionnaire.

Table 1

Operational Definition and Coding of Variables Used in the Models

Dimension	Code	Variable description	Variable type
Sociodemographic	Age	Age of the respondent	Continuous Quantitative
	Gender_female	The respondent is female	Dummy variable derived from a nominal variable
	Dsexo_man	The respondent is a man	Dummy variable derived from a nominal variable
	No_education_1	No schooling	Dummy variable derived from an ordinal variable
	No_Education_2	Incomplete elementary education	Dummy variable derived from an ordinal variable
	No_schooling_3	Completed elementary school	Dummy variable derived from an ordinal variable
	School_Dropout_4	Incomplete secondary education	Dummy variable derived from an ordinal variable
	No schooling_5	Completed secondary education	Dummy variable derived from an ordinal variable
	No schooling_6	Incomplete high school	Dummy variable derived from an ordinal variable
	No schooling_7	High school completed	Dummy variable derived from an ordinal variable
Economic	School_leaving_8	Incomplete bachelor's or engineering degree	Dummy variable derived from an ordinal variable
	School_9	Completed bachelor's or engineering degree	Dummy variable derived from an ordinal variable
	Schooling_10	Graduate degree	Dummy variable derived from an ordinal variable
	Occupation	Primary occupation	Qualitative, nominal, open-ended
	Income	Monthly income (MXN)	Quantitative, continuous
	Source of Income_1	Main source of income: own business	Dummy variable derived from nominal variable
Training	IncomeSource_2	Main income: third parties	Dummy variable derived from a nominal variable
	IncomeSource_3	Main income: pension	Dummy variable derived from a nominal variable
	IncomeSource_4	Main source of income: wages or salary	Dummy variable derived from nominal variable
	D_training_yes	Use of training mechanisms	Dummy
Associativity	D_training_no	No use of training mechanisms	Dummy
	Dred_yes	Willingness to form partnerships	Dummy
	Dred_no	Unwillingness to form partnerships	Dummy
	COLAB_1	collaboration based on family ties	Ordinal (1–5 Likert scale)
	COLAB_2	collaboration based on social relationships	Ordinal (1–5 Likert scale)
	COLAB_3	collaboration through business associations	Ordinal (1–5 Likert scale)
Tourism	COLAB_4	collaboration through government agencies	Ordinal (Likert scale 1–5)
	TUR_1	Tourism has benefited the town	Ordinal (Likert scale 1–5)
	TUR_2	Tourism should be the main economic activity	Ordinal (Likert scale 1–5)
	TUR_3	The town is attractive to tourists	Ordinal (Likert scale 1–5)
	TUR_4	The town has tourism infrastructure	Ordinal (Likert scale 1–5)

Biodiversity	BIO_1	Drinking water quality	Ordinal (Likert scale 1–5)
	BIO_2	There is no water shortage	Ordinal (Likert scale 1–5)
	BIO_3	The air is not polluted	Ordinal (Likert scale 1–5)
	BIO_4	Environmental stewardship drives development	Ordinal (Likert scale 1–5)
	BIO_5	Economic activities harm the environment	Ordinal (Likert scale 1–5)
	BIO_6	Problems with waste management	Ordinal (Likert scale 1–5)
	BIO_7	Waste separation	Ordinal (Likert scale 1–5)
	BIO_8	Economic Use of Endemic Vegetation	Ordinal (Likert scale 1–5)
	BIO_9	Economic use of endemic fauna	Ordinal (1–5 Likert scale)
Gender	GEN_1	Major barriers for women in entrepreneurship	Ordinal (Likert scale 1–5)
	GEN_2	Major barriers for women in finding employment	Ordinal (Likert scale 1–5)
	GEN_3	Equal opportunities for entrepreneurship	Ordinal (Likert scale 1–5)
	GEN_4	Equal rights for women and men	Ordinal (1–5 Likert scale)

To estimate the marginal effects of tourism dimensions, gender, and biodiversity on the DEL of the Santiago Basin, these constructs are operationalized using observable proxy variables. This process follows the methodological criterion of conceptual representativeness, which is used when the construct of interest is not directly measurable (Babbie, 2010; Gujarati & Porter, 2009).

Accordingly, five questionnaire variables were selected as empirical approximations of the dimensions under analysis. For the gender dimension, the perception of equal entrepreneurial opportunities between women and men (GEN_3) was used; for the tourism dimension, the perception that tourism has benefited the locality (TUR_1); and for the biodiversity dimension, the perception that economic activities harm the local environment (BIO_5). Likewise, the variable representing the economic dimension was the reliance on one's own business as the primary source of income (Dfuentedeingreso_1), and for the associative dimension, the willingness to form partnerships with other productive units (Dred_si). In the estimated models, these variables are operationalized as dichotomous dependent variables (1 = affirmative response; 0 = otherwise).

To select the most appropriate model type for the observed variable and the selected explanatory variables, the econometric literature indicates that the best selection criterion is the percentage of observations correctly classified by each model type; therefore, the best model selected will be the one with the highest percentage (Greene, 2018; Hosmer et al., 2013; Long & Freese, 2014).

It is important to note that the sample size used to estimate the models—which varies between 37 and 41 observations depending on the model specification—constitutes a limitation of the study. This limitation stems from the characteristics of the analyzed context, particularly the high level of economic informality and the geographical dispersion of productive units across rural communities.

RESULTS AND DISCUSSION

Descriptive Statistics of the Sample

Based on the information collected through the questionnaire, the average age of the respondents was found to be 51 years. Regarding the gender of the respondents, of the total valid surveys (42), 14 were completed by men (33.33% of the sample), while 28 surveys were completed by women, equivalent to 66.67% of the questionnaires administered. As shown in Table 2, the city of Santiago accounted for the largest proportion of participants (40.48%), followed by Miraflores (33.33%), while La Ribera had the lowest participation rate (9.52%). Furthermore, the average age of the respondents ranged from 50 to 54 years, depending on their city of residence.

Table 2*Descriptive statistics of the sample*

Location	Valid Surveys	Sample participation	Women	Men	Average age	Average monthly income	Most common level of education
Miraflores	14	33.33%	42.86%	57.14%	50 years	\$17,341.67	Incomplete secondary education
La Ribera	4	9.52%	75.00%	25.00%	53 years	\$1,666.67	High school graduate
Santiago	17	40.48%	82.35%	17.65%	53 years	\$4,941.18	No formal education
No fixed residence	7	16.67%	71.43%	28.57%	54 years	\$11,000.00	High school graduate
Total sample	42	100.00%	66.67%	33.33%	51 years	\$11,421.62	High school graduate

With regard to occupation and economic activity, the average monthly income of respondents was found to be \$11,421.62 pesos. As for the primary source of income, 86% stated that it comes from their own business, while the remaining 14% indicated that their main income comes from a salary or other sources.

Regarding the characteristics of the business units, all of the enterprises analyzed are microenterprises with between 1 and 10 employees. These businesses operate in a variety of sectors, including livestock farming, retail trade, tourism services, the production of regional sweets and handcrafted furniture, food production, and leather goods, among others. Furthermore, it was found that these microenterprises were established on average in 1998, reflecting the considerable longevity of the businesses in the study area.

Marginal Effects of Tourism, Gender, and Biodiversity on the DEL in the Santiago Basin Using Probability Models

Based on the methodological operationalization, this section presents the results of the logit and probit models estimated for each of the proxy variables representing the explanatory dimensions of the DEL.

Table 3*Results of Model 1 (Probit): Tourism has benefited the locality*

Variable	Coefficient	Standard Error	z	p-value	Marginal effect
Constant	-8.3425	3.7682	-2.214	0.0268 **	—
Age	0.0229	0.0313	0.73	0.4656	0.00431
Revenue	0.0000874	0.0000812	1.076	0.2821	0.0000165
Gender_female	2.1425	1.2978	1.651	0.0988 *	0.5794
Dsource_income_1	2.0065	1.0334	1.942	0.0522 *	0.6155
TUR_2	2.2818	0.9797	2.329	0.0199 **	0.6192
TUR_3	2.0858	1.2343	1.69	0.0911 *	0.6641
School Dropout_5	3.0733	1.7573	1.749	0.0803 *	0.3166

Note: Probit model estimated using maximum likelihood. McFadden's pseudo $R^2 = 0.5268$. Akaike Information Criterion (AIC) = 36.4323. Schwartz Information Criterion (BIC) = 49.3197. Hannan–Quinn criterion = 40.9757. Likelihood ratio test: $\chi^2(7) = 22.7487$, $p = 0.0019$. Number of observations = 37. Marginal effects were calculated at the mean of the independent variables. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

As shown in Table 3, to assess the DEL of the Santiago Basin in terms of tourism, the proxy variable TUR_1 was used, which indicates that the respondent perceives that tourism has benefited their locality. Among this set of selected explanatory variables, the probit model provides the best fit, with 86.5% of observations correctly classified.

Being female (Dsexo_mujer) has a positive coefficient and is statistically significant at the 10% level, which suggests, in terms of marginal effects, that being female increases the probability of considering that tourism has benefited the locality's development by 57.94 percentage points, compared to men and holding all other variables constant. With a positive coefficient and statistical significance at the 10% level, the resulting model also suggests that having one's own business (Dfuentedeingreso_1) as the primary source of income has a positive relationship with the perception that tourism has benefited the community's development. The marginal effect of the model indicates that, if the primary source of income is one's own business, the probability of believing that tourism has benefited the community's development increases by 61.55 percentage points.

Table 4

Results of Model 2 (Probit): Equal Opportunities for Entrepreneurship

Variable	Coefficient	Standard Error	z	p-value	Marginal effect
Constant	0.6958	1.5306	0.455	0.6494	—
Age	0.0174	0.0285	0.61	0.5418	0.00135
Gender_female	-0.5568	0.897	-0.621	0.5348	-0.03703
GEN_4	1.7422	0.8031	2.169	0.0301 **	0.31256
GEN_2	-1.7677	0.7731	-2.287	0.0222 **	-0.30591
D_capacity_if	-1.2269	0.8732	-1.405	0.16	-0.16492

Note: Probit model estimated using maximum likelihood. McFadden's pseudo $R^2 = 0.4630$. Akaike Information Criterion (AIC) = 30.3323. Schwartz Information Criterion (BIC) = 40.6137. Hannan–Quinn Criterion = 34.0762. Likelihood ratio test: $\chi^2(5) = 15.8052$, $p = 0.0074$. Number of observations = 41. Marginal effects were calculated at the mean of the independent variables. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4 shows the use of the proxy variable GEN_3 to analyze the gender dimension, which assumes that men and women have the same opportunities to start a business. In this case, the probit model provides the best fit, with 88.10% of observations correctly classified.

In this model, only the variables GEN_2 and GEN_4 were statistically significant, both at the 5% level. The belief that women face greater barriers to employment is positively associated with the perception that men and women have equal opportunities to start a business. Conversely, the belief that men and women have equal rights has a negative effect. In the marginal context, if it is believed that women face greater barriers to finding employment, the probability that men and women have equal opportunities to start a business decreases by 30.59 percentage points. Conversely, if it is believed that men and women have equal rights, the probability increases by 31.25 percentage points.

Table 5

Results of Model 3 (Probit): Economic Activities Harm the Environment

Variable	Coefficient	Standard Error	z	p-value	Marginal effect
Constant	-2.9636	1.8368	-1.613	0.1066	—
Age	0.0393	0.0236	1.666	0.0956 *	0.01075
Revenue	-0.00004	0.0000222	-1.823	0.0682 *	-0.000011
Gender_female	-1.3753	0.7251	-1.897	0.0579 *	-0.43814
TUR_1	1.3792	0.8739	1.578	0.1145	0.27948
BIO_6	0.4443	0.5593	0.794	0.427	0.12312
School Dropout_7	1.5763	0.7751	2.034	0.0420 **	0.5372

Note: Probit model estimated using maximum likelihood. McFadden's pseudo $R^2 = 0.2139$. Akaike Information Criterion (AIC) = 47.9450. Schwartz Information Criterion (BIC) = 59.2215. Hannan–Quinn Criterion = 51.9205. Likelihood ratio test: $\chi^2(6) = 9.2360$, $p = 0.1607$. Number of observations = 37. Marginal effects were calculated at the mean of the independent variables. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

For the biodiversity dimension, the proxy variable BIO_5 was used, which refers to whether the locality's economic activities negatively affect the environment. According to Table 5, the probit model showed the best fit, with 81.10% of observations correctly classified.

In this model, the sociodemographic variables of age and income were statistically significant at the 10% level, suggesting that both are related to the perception that economic activities negatively affect the environment. This relationship is positive for age and negative for income. The marginal effect indicates that, for each additional year of age, the probability of believing that economic activities affect the environment increases by 1.07 percentage points. In the case of income, the opposite effect is observed: for each additional monetary unit (MXN), the probability of believing that these activities affect the environment decreases by 0.0011 percentage points.

The variables *Dsexo_mujer* and *Descolaridad_7* (completion of high school or upper secondary education) were also statistically significant at the 10% and 5% levels, respectively. Being female is negatively associated with the perception that economic activities affect the environment, while *Descolaridad_7* is positively associated with the same perception. The marginal effects indicate that being female reduces the probability of believing that economic activities negatively affect the environment by 43.81 percentage points. In the case of the educational variable, having completed high school increases this probability by 53.72 percentage points.

Table 6

Results of Model 4 (Logit): Willingness to Join an Association

Variable	Coefficient	Standard Error	z	p-value	Marginal effect
Constant	6.9883	3.9592	1.765	0.0775 *	—
Age	0.0531	0.053	1.003	0.316	0.00923
Revenue	-0.0000918	0.00004	-2.294	0.0218 **	-0.0000159
TUR_2	-3.3096	1.947	-1.7	0.0892 *	-0.408
TUR_4	-3.2656	1.4616	-2.234	0.0255 **	-0.6328
Gender_female	-2.6882	1.4429	-1.863	0.0625 *	-0.3489
School Dropout_2	-8.441	3.2365	-2.608	0.0091 ***	-0.9133
School Dropout_3	-4.0307	2.2056	-1.828	0.0676 *	-0.7406
School Dropout_5	-3.2298	1.636	-1.974	0.0484 **	-0.6524

Note: Logit model estimated using maximum likelihood. McFadden's pseudo $R^2 = 0.4345$. Akaike Information Criterion (AIC) = 45.1278. Schwartz Information Criterion (BIC) = 59.6261. Hannan–Quinn Criterion = 50.2392. Likelihood ratio test: $\chi^2(8) = 20.8448$, $p = 0.0076$. Number of observations = 37. Marginal effects were calculated at the mean of the independent variables. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

For the associative dimension, the proxy variable Dred_si was used, which refers to the respondent's willingness to join an association. Based on the set of selected explanatory variables, the logit model provided the best fit, with 86.5% of observations correctly classified.

Table 6 shows that the income variable was statistically significant at the 5% level, suggesting that income has a negative relationship with the willingness to join an association. The marginal effect indicates that, for every additional monetary unit of monthly income (MXN), the probability that a person is willing to join an association decreases by 0.000159 percentage points.

Regarding the gender variable, *Dsexo_mujer* has a negative coefficient and is statistically significant at the 10% level, suggesting that being female is negatively associated with the willingness to join an association. The marginal effect indicates that being female reduces the probability of being willing to join an association by 34.89 percentage points compared to men.

In terms of educational attainment, the variables *Descolaridad_2* (incomplete primary education), *Descolaridad_3* (complete primary education), and *Descolaridad_5* (complete secondary education) were statistically significant at the 1%, 10%, and 5% levels, respectively. All show negative relationships with the willingness to form a partnership.

Table 7

Results of Model 5 (Probit): Own Business as the Main Source of Income

Variable	Coefficient	Standard Error	z	p-value	Marginal effect
Constant	-1.6586	2.4451	-0.678	0.4976	—
Age	0.0556	0.0427	1.304	0.1924	0.00029
TUR_1	4.939	2.3697	2.084	0.0371**	0.7065
TUR_4	-2.8401	1.6047	-1.77	0.0767*	-0.1401
COLAB_1	2.0187	1.1381	1.774	0.0761*	0.0345
Gender_female	-2.0529	1.2983	-1.581	0.1138	-0.0107
COLAB_3	-4.1239	2.3415	-1.761	0.0782*	-0.7486

Note: Probit model estimated using maximum likelihood. McFadden's pseudo $R^2 = 0.4784$. Akaike Information Criterion (AIC) = 31.8065. Schwartz Information Criterion (BIC) = 43.8015. Hannan–Quinn criterion = 36.1744. Likelihood ratio test: $\chi^2(6) = 16.3309$, $p = 0.0121$. Number of observations = 41. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 7 presents the results of the analysis of the main source of income using the proxy variable *Dfuentedeingreso_1*, which identifies whether the respondent's main income comes from their own business. Among the estimated specifications, the probit model showed the best fit, achieving a correct classification rate of 86.5% of the observations. In this model, the tourism variable *TUR_1* was statistically significant at the 5% level, suggesting that, in marginal effects, the perception that tourism has benefited the locality increases the probability that the individual has their own business as their primary source of income by 70.65 percentage points.

As for the collaboration variables *COLAB_1* and *COLAB_3*, they were statistically significant at the 10% level. The variable *COLAB_1*, referring to collaboration based on family ties, shows a positive relationship with the probability that the primary source of income is one's own business. The marginal effect suggests that, if their collaboration networks are based on family ties, this probability increases by 3.45 percentage points. In contrast, the *COLAB_3* variable, associated with collaboration networks originating from business associations, shows a negative relationship, reducing the probability that the primary source of income comes from a self-owned business by 74.86 percentage points.

DISCUSSION

Regarding the tourism dimension, the results indicate that perceptions of tourism's benefits follow a logic linked to local economic dynamics; that is, when people depend on their own businesses as their main source of income, they tend to recognize more clearly that tourism has benefited the locality. This result suggests that tourism is perceived as a significant factor in local economic development, which is consistent with the findings of González et al. (2023), Cervantes et al. (2023), and Izábal de la Garza et al. (2025), who highlight tourism as a resource that generates growth and economic opportunities in rural communities.

Regarding the gender dimension, the models indicate that perceptions of equal rights and opportunities between men and women also follow a logical pattern; furthermore, when people acknowledge legal equality, they tend to believe that women have the same opportunities to start a business. This finding suggests that perceptions of gender equality extend across various dimensions of LED. This is consistent with Montero and Calderón (2020), who note that community organizing and local leadership can promote local economic development. However, they also caution that these processes may limit the participation of women and young people when male leadership predominates.

The results for the environmental dimension show that variables such as age, income, and education also influence perceptions of the negative environmental impacts of economic activities. This finding is consistent with Ortiz and Alejandro (2020) and Zirufó and Pelegrín (2023), who argue that the environmental dimension not only complements but also determines the sustainability of local development models, especially in areas highly dependent on natural resources. Regarding age, the marginal effects indicate that as age increases, the probability of believing that economic activities negatively affect the environment increases; this can be explained by greater accumulated experience and the ability to identify environmental changes over time. Similarly, a higher level of education facilitates the acquisition of criteria for recognizing not only the economic benefits but also the environmental consequences of productive activities.

Regarding the willingness to form partnerships, the marginal effects indicate that higher income reduces the probability that an individual will collaborate with other actors. This is interpreted to mean that individuals with higher incomes tend to be more self-sufficient. At the same time, those in the early stages of entrepreneurship more frequently require collaborative mechanisms to drive their economic activity. This finding is consistent with Aguirre and Herrera (2025), Lucero (2025), and Quito et al. (2021), who highlight that cooperation among local actors fosters endogenous development by creating agreements and collaborative networks.

The results regarding educational attainment reinforce this interpretation, as the marginal effects indicate that greater academic training may foster an understanding of the advantages of collaboration relative to the costs of operating individually.

Finally, results on the primary source of income indicate that a positive perception of tourism significantly increases the likelihood that individuals will start their own business. Given that tourism is a major economic activity in the region and that economic diversification is limited, it follows that business ideas are closely linked to this sector. This finding is consistent with studies that recognize tourism as a catalyst for economic opportunities in rural areas (Cervantes et al., 2023; González et al., 2023; Izábal de la Garza et al., 2025). In contrast, when tourism infrastructure is perceived as sufficient, the marginal effects show a decrease in the probability of entrepreneurship, suggesting that some people consider their direct participation through their own business unnecessary or perceive that economic opportunities are already taken.

Likewise, the effects associated with forms of collaboration show that family relationships increase the probability that the primary income will come from one's own business, which is consistent with the organizational structure of many local ventures, where trust and family ties play a central role. Conversely, when collaboration is facilitated through business associations, the probability that the business will be the primary source of income decreases. This result may indicate that such associations are not always established as effective mechanisms for supporting small local enterprises.

Overall, the estimated marginal effects indicate that DEL in the Santiago Basin is shaped by interactions among perceptions of tourism, sociodemographic characteristics, educational levels, gender dynamics, environmental factors, and forms of Collaboration. This demonstrates that economic growth driven by this activity does not operate in isolation but rather in relation to the local social, economic, and environmental structure. However, due to the small sample size and convenience sampling, the results should be interpreted as exploratory evidence applicable to the business units analyzed, rather than as conclusions that can be generalized to the entire Santiago Basin.

CONCLUSIONS

The results indicate that the variables associated with the constructs of tourism, gender, and biodiversity are significant for contextualizing the DEL in the Santiago Basin.

The constructs proposed were significant for evaluating their effect on DEL in the study area, with variables associated with tourism standing out as having the greatest weight within the estimated models. This result is consistent with the context of the study area, since, as a region with significant tourism potential, it is the variables linked to this activity that underpin that potential.

Taken together, the results and information presented in this document are intended to serve as an additional tool and as empirical evidence that can be considered in future research and in the design of local public policies. The ultimate goal is to help harness the tourism potential of the Santiago Basin and, eventually, to foster gradual growth in the region that translates into sustained improvements in the well-being of its population, based on its own economic resources and human capital.

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ADDITIONAL INFORMATION

JEL Code: C25, J16, O18, Q57, Z32.