JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S3

Tourism-Driven Urban Transformation and Business Ecosystem Changes in Heritage Cities: A Mixed-Methods Analysis of Cartagena's Historic District (2015-2023)

José Marcelo Torres Ortega[1], Hernán Javier Guzmán Murillo[2], William Niebles[3]

1. Doctor en Economía y Empresas, Doctor en Estudios Políticos, Universidad de Sucre, jose.torres@unisucre.edu.co, https://orcid.org/0000-0001-8107-8763
2. Doctor en Ciencias de la Educación, Universidad de Sucre, hernan.guzman@unisucre.edu.co, https://orcid.org/0000-0002-6757-4549
3. Doctor en Ciencias Gerenciales, Universidad de Sucre, williamniebles@yahoo.com.mx, https://orcid.org/0000-0001-9411-4583

Abstract
This research analyzed the effects of tourism growth on local business ecosystems in Cartagena's historic district from 2015 to 2023. The study measured relationships between tourism indicators and business composition changes through multiple statistical procedures. The methodology integrated regression analysis, difference-in-differences estimation, and vector autoregression modeling to test hypotheses about tourism-driven transformation. Data collection included business registration records, commercial rent prices, employment patterns, and tourism metrics from municipal databases and field surveys. The research established spatial patterns of business transformation, with high-tourism zones experiencing stronger effects than low-tourism areas. Multiple regression results indicated that tourist arrivals and expenditure patterns predicted business ecosystem changes (R^2 = 0.78-0.82), while difference-in-differences analysis found increased business turnover rates in high-tourism zones (14 percentage points) compared to low-tourism zones (4 percentage points). Vector autoregression modeling identified two-quarter lag effects of tourism growth on business composition changes ($F = 8.624$, $p = 0.003$). The findings extended existing theoretical frameworks through analysis of transformation processes in Latin American heritage contexts. The results supported policy development for sustainable tourism management while highlighting unique characteristics of business adaptation in colonial urban environments.
Keywords: Tourism-driven transformation, Business ecosystem adaptation, Heritage tourism, Urban economics, Commercial gentrification

Introduction

The impact of tourism growth on urban spaces created challenges for heritage cities worldwide, particularly affecting local business ecosystems in historic districts. Tourism-driven transformation processes altered traditional commercial activities, modified business composition, and influenced local economic structures. These changes warranted investigation through rigorous analysis of business adaptation patterns, market dynamics, and community responses to tourism pressure.

Cartagena's historic district presented an opportunity to analyze tourism-driven transformation in a Latin American heritage context. The city's UNESCO World Heritage status, combined with rapid tourism growth between 2015 and 2023, created conditions for studying how tourism development influenced local business ecosystems. The colonial urban layout, traditional commercial practices, and cultural characteristics of the historic district added dimensions to understanding tourism effects on business transformation.

The research aimed to measure relationships between tourism growth and business ecosystem changes in Cartagena's historic district. The study analyzed how tourism indicators, such as visitor arrivals and expenditure patterns, correlated with shifts in business composition and commercial activities. Additional objectives included identification of spatial patterns in business transformation and assessment of temporal relationships between tourism growth and commercial changes.

The study tested the hypothesis that increased tourism activity led to changes in local business composition through displacement of traditional establishments. The research question focused on how tourism growth affected the sustainability and composition of local business ecosystems in heritage areas. The

[1]Write to this author who is the owner and responsible for this document

methodology integrated multiple statistical approaches, including regression analysis, difference-in-differences estimation, and vector autoregression modeling.Tourism-driven transformation in heritage cities attracted research attention across various contexts. Studies in European cities established frameworks for analyzing business displacement patterns, while Asian research advanced understanding of tourist flow effects on commercial development. However, Latin American perspectives remained limited in theoretical discussions of tourism impacts on business ecosystems. This study aimed to address this gap through analysis of transformation processes in Cartagena's historic district.The research design incorporated quantitative and qualitative approaches to measuring tourism effects on local businesses. Data collection included business registration records, commercial rent prices, employment patterns, and tourism indicators from 2015 to 2023. The analysis utilized multiple statistical procedures to validate data quality and test research hypotheses. The methodology built upon established approaches while accounting for unique characteristics of Latin American heritage contexts.

The study results offered implications for tourism management and urban planning in heritage cities. The findings could support policy development for preserving business diversity in tourist zones while facilitating sustainable tourism growth. The research created foundations for comparative analysis across Latin American heritage cities, potentially advancing understanding of tourism-driven transformation in colonial urban environments.

This paper organized the research presentation into six sections. The literature review established theoretical foundations and identified research gaps. The methodology detailed data collection and analysis procedures. The results presented statistical findings from multiple analytical approaches. The discussion connected results to existing theoretical frameworks, while the conclusion summarized key findings and implications. Each section maintained focus on expanding understanding of tourism-driven transformation in heritage city contexts.

Literature Review

Tourism-driven urban transformation theory establishes the framework for understanding how tourism growth alters local business ecosystems in heritage areas. According to Kowalczyk-Anioł (2023), the theory posits that tourism development initiates a cyclical process of economic and social changes within urban spaces, particularly affecting commercial activities and local business dynamics. Additionally, this theoretical approach argues that tourism growth creates distinct spatial patterns of economic transformation, with effects radiating outward from tourist-centric zones through neighboring areas.

Place-based displacement theory established foundations for understanding commercial transformation in tourist areas. Cocola-Gant (2023) analyzed how tourism pressure created distinct patterns of business relocation in heritage cities. The research tracked business displacement patterns through longitudinal analysis, identifying stages of commercial transformation from initial tourism investment through complete business ecosystem restructuring. The current study extends this framework to Cartagena's context, adding Latin American perspectives to place-based displacement theory.

Tourist flow analysis connected physical movement patterns to business transformation processes. Through spatial analysis of visitor movements, Wen et al. (2023) mapped relationships between tourist routes and commercial gentrification intensification. Their research established measurement techniques for analyzing how tourist behavior patterns influenced business location decisions. The current study applies these methodological approaches to Cartagena's historic district, testing the applicability of tourist flow theory in Caribbean heritage contexts.

Institutional response theory added regulatory dimensions to tourism transformation analysis. Ma and Su (2024) examined how government interventions modified tourism-driven change processes through policy implementation studies. Their research identified variations in transformation patterns across different regulatory environments, establishing frameworks for analyzing policy effects. This study extends their work by analyzing institutional responses in Cartagena's heritage management context.

Local perception studies enhanced understanding of community influences on business transformation. Lin et al. (2023) measured how resident attitudes shaped business adaptation strategies through mixed-method analysis. Their research established connections between community acceptance and business survival rates in tourist areas. The current study applies these measurement approaches to Cartagena's community context, adding Caribbean cultural perspectives to perception analysis.

Retail diversity theory created frameworks for analyzing business mix evolution in tourist areas. Cheung and Yiu (2024) tracked changes in business composition through longitudinal studies of retail patterns. Their research established measurement techniques for analyzing how tourism intensity influenced

business specialization processes. This study tests their theoretical framework in Cartagena's context, examining retail diversity patterns in Latin American heritage cities.

Adaptive cycle analysis enhanced understanding of tourism development phases. Nieuwland et al. (2025) applied time-series analysis to tourism indicators in Valencia, tracking relationships between development stages and business transformation. Their research established measurement approaches for analyzing temporal patterns in tourism-driven change. The current study extends these methodological approaches to Cartagena, testing adaptive cycle theory in Caribbean urban contexts.

Spatial regression techniques advanced understanding of business distribution patterns. Anguera-Torrell and Cerdan (2021) analyzed coagglomeration effects in Barcelona's tourism sector through geographic information systems. Their research established measurement approaches for analyzing spatial relationships between tourism infrastructure and business locations. This study applies their methodological framework to Cartagena's spatial context, testing coagglomeration patterns in colonial urban layouts.

Platform-mediated tourism analysis connected digital and physical transformation processes. Minoia and Jokela (2022) examined how digital platforms modified traditional tourism-business interactions through mixed-method analysis. Their research established frameworks for measuring online-offline connections in tourism economies. The current study extends their analysis to Cartagena's digital tourism context, adding Latin American perspectives to platform-mediation theory.

These theoretical frameworks guide the current study's analysis of tourism-driven transformation in Cartagena. The research tests established theories in new geographic and cultural contexts, potentially extending theoretical understanding of how tourism transforms business ecosystems in Global South heritage cities. The study's results might modify existing theories or generate new theoretical insights specific to Latin American urban contexts.

The methodological approaches developed across these studies inform the current research design. Through integration of spatial analysis, time-series techniques, and mixed-method approaches, this study creates comprehensive frameworks for analyzing tourism-driven transformation in Cartagena. The methodology adapts established approaches while acknowledging unique characteristics of Caribbean heritage contexts.

The current study enhances existing research through examination of tourism-driven transformation in Latin American contexts. While previous studies focused on European and Asian cases, this research adds Caribbean perspectives to theoretical understanding. The results might identify unique patterns of business transformation specific to Latin American heritage cities.

Business displacement patterns in Cartagena might differ from European cases due to distinct urban morphologies and regulatory contexts. The study's analysis of commercial transformation in colonial urban layouts might extend place-based displacement theory to new spatial contexts. The results could establish specific patterns of business relocation in Latin American heritage cities.

Tourist flow patterns in Cartagena's historic district might reveal unique spatial relationships due to colonial street layouts. The study's analysis of visitor movements through historic neighborhoods might modify existing theoretical frameworks. The results could establish specific patterns of tourist behavior in Caribbean urban contexts.

Institutional responses in Cartagena might reflect distinct approaches to heritage management and tourism development. The study's analysis of policy implementation in Latin American contexts might extend institutional response theory. The results could identify unique patterns of regulatory intervention in Global South heritage cities.

Community responses in Cartagena might reflect distinct cultural approaches to tourism development. The study's analysis of resident perceptions in Caribbean contexts might modify existing theoretical frameworks. The results could establish specific patterns of community influence on business transformation in Latin American cities.Retail diversity patterns in Cartagena might reflect distinct market structures and consumer preferences. The study's analysis of business mix evolution in Latin American contexts might extend retail diversity theory. The results could identify unique patterns of business specialization in Caribbean heritage cities.

Digital platform effects in Cartagena might reflect distinct patterns of technology adoption and use. The study's analysis of platform-mediated tourism in Latin American contexts might modify existing theoretical frameworks. The results could establish specific patterns of digital-physical interaction in Global South tourism economies.

Urban regeneration research established frameworks for analyzing tourism impacts on city development. Leccis (2023) created methods for measuring tourism pressure effects on urban renewal

processes in Cagliari, while Bosma and van Doorn (2024) analyzed how digital platforms influenced physical business spaces through Airbnb professionalization patterns. These studies established measurement approaches for complex interactions between tourism growth and urban transformation, connecting digital dynamics to physical market changes.

Rural and protected area studies expanded understanding of tourism effects across different contexts. Yang and Xu (2022) examined tourism impacts on rural business ecosystems in China, while Li et al. (2024) analyzed tourism effects on land markets in protected areas. These studies integrated social, economic, and spatial indicators to measure tourism-driven changes, creating frameworks applicable to diverse geographic contexts.Cultural and policy research enhanced understanding of community and institutional factors in tourism development. Gocer et al. (2024) measured how cultural resources influenced business adaptation to tourism pressure, while Barata-Salgueiro and Guimarães (2020) evaluated policy effectiveness in managing tourism-driven change in Lisbon. Their methodologies integrated social network analysis with economic indicators, establishing measurement approaches for community and institutional responses to tourism transformation.

Colombian research contributed regional perspectives through diverse methodological approaches. de la Puente Pacheco et al. (2024a) analyzed economic interventions in urban contexts through experimental methods, while de la Puente Pacheco et al. (2024b) examined human capital development in transforming economies. These studies established quantitative frameworks for analyzing economic change processes in Latin American urban environments.

Service sector studies in Colombia advanced understanding of institutional effects on market development. De La Puente et al. (2023) analyzed healthcare service transformation through quasi-experimental approaches, while de la Puente Pacheco et al. (2021) examined medical tourism development in Barranquilla. Their research established frameworks for analyzing how institutional changes influenced service sector evolution and market participation.Export industry research in Colombia enhanced understanding of business responses to international forces. Landazury et al. (2022) analyzed management practices in export companies through mixed-method approaches, establishing measurement techniques for business adaptation processes. Their methodology combined financial metrics with organizational analysis, creating frameworks for studying business transformation in globalizing markets.

The current study extends these theoretical frameworks through empirical testing in Cartagena's historic district. While Cocola-Gant and Gago (2021) examined residential displacement in Lisbon, this research applies similar approaches to commercial displacement in Latin American contexts. The results align with Wen et al.'s (2023) tourist flow network theory while adding temporal dimensions to business ecosystem transformation analysis.

These methodological approaches inform the current study's analysis of tourism-driven transformation in Cartagena's heritage context. Through integration of experimental, quasi-experimental, and mixed-method techniques, the research establishes measurement approaches for analyzing business ecosystem changes in Latin American urban environments. The methodology adapts established frameworks while acknowledging unique characteristics of heritage tourism contexts.

This research creates opportunities for future studies of tourism-driven transformation in heritage areas. Further investigations could examine digital platform effects on business transformation, policy intervention effectiveness in preserving business diversity, or resilience strategy development for traditional enterprises in tourist zones. The study establishes foundations for comparative analyses across heritage cities, potentially enhancing understanding of how local contexts modify tourism-driven transformation patterns.

Research method

The research method investigated the effects of tourism-driven commercial gentrification on local business ecosystems in Cartagena's historic district from 2015 to 2023. The study area encompassed the walled city and Getsemaní neighborhood, both parts of the UNESCO World Heritage site.The question asked: What are the effects of tourism-driven commercial gentrification on the sustainability and composition of local business ecosystems in Cartagena's historic district, and what implications exist for preserving community enterprises while promoting tourism development?

The study tested the hypothesis that tourism growth leads to changes in local business composition through displacement of traditional community establishments, while creating transformation opportunities for local enterprises that adapt to tourism markets.The methodology classified businesses into three groups: community-serving establishments (grocery stores, hardware stores, local restaurants), tourism-oriented ventures (souvenir shops, luxury restaurants, tour agencies), and hybrid businesses serving both markets. Each business was coded based on ownership structure, employment patterns, and supply chain characteristics.

Data collection included business registry records from the Chamber of Commerce for business types and ownership, municipal licensing records for business turnover rates, real estate market reports for commercial rent prices, and labor office statistics for employment patterns.The research gathered quantitative data through databases and surveys, while qualitative information came from interviews with 150 business owners and eight focus groups with business associations and municipal authorities. A board of business leaders, heritage experts, and urban planners guided the research process.

Statistical procedures required specific datasets: monthly tourist arrivals, quarterly commercial rent prices per square meter, annual business registration records, monthly employment statistics, and spatial coordinates of businesses over the study period.

Data validation used Cronbach's Alpha to test internal consistency of business metrics, while interview and focus group data underwent member checking and peer review. Research assistants verified spatial data through field validation.Time series analysis tracked changes in business composition using annual counts of establishments by type. Variables included the number of businesses in each category, their spatial distribution, and survival rates.

Correlation analysis measured relationships between tourism indicators (tourist arrivals, seasonal peaks) and commercial variables (rent prices, business turnover). The analysis required monthly data points for both sets of variables over eight years.

Multiple regression modeling estimated tourism effects on business composition while controlling for external factors. Independent variables included tourist arrivals, seasonal indicators, and macroeconomic controls. Dependent variables covered business counts by type, rent prices, and employment metrics.Geographic Information Systems tracked spatial patterns of business distribution through time. The analysis used coordinate data for each business, categorized by type and year of operation.

The survival analysis examined business longevity patterns across categories. The procedure used entry and exit dates for each business, along with their classifications and locations.Employment analysis calculated job creation rates, wage levels, and local hiring percentages across business types. Data requirements included monthly employment records, wage data, and employee residence information. Also, the commercial rent analysis compared prices across zones using hedonic pricing models. Variables included rent prices, building characteristics, location attributes, and historical designation status.Business adaptation analysis tracked changes in product offerings, price structures, and supply chain relationships. Data came from annual business surveys and quarterly market observations.

The mixed-methods approach generated quantitative metrics for policy evaluation and qualitative understanding of commercial gentrification in heritage tourism contexts. The methodology aims to understand tourism growth effects on local business ecosystems and identify sustainable tourism development strategies.

Table 1 presents the foundation for analyzing business ecosystem changes in Cartagena's historic district over the eight-year study period. The data indicates a clear shift in business composition, with community-serving establishments decreasing by 36% while tourism-oriented businesses increased by 87%.

The turnover rates suggest higher stability among tourism-oriented businesses (18%) compared to community-serving establishments (32%), potentially indicating economic pressures on traditional local businesses. This pattern correlates with average monthly revenue figures, where tourism-oriented businesses generate substantially higher income.

Table 1: Business Composition Metrics.

Business Type	Count 2015	Count 2023	Turnover Rate	Avg Monthly Revenue	Local Ownership %
Community-serving	245	156	32%	$8,500	85%
Tourism-oriented	167	312	18%	$22,000	45%
Hybrid	89	178	24%	$15,500	62%

Local ownership percentages show a strong presence of local entrepreneurs in community-serving businesses (85%), while tourism-oriented establishments have a more balanced ownership structure with 45% local ownership. This metric helps understand the economic integration of local communities in the tourism sector.

The hybrid business category shows intermediate values across all metrics, suggesting these businesses might represent a sustainable model for local economic development in tourism contexts. Their

moderate turnover rate (24%) and substantial local ownership (62%) indicate potential resilience to market pressures.

Table 2: Commercial Real Estate Dynamics.

Zone	Avg Rent 2015 ($/m²)	Avg Rent 2023 ($/m²)	Vacancy Rate	Tourism Density
Historic Center	$28	$75	5%	High
Getsemaní	$22	$58	8%	Medium
San Diego	$25	$62	6%	Medium-High
La Matuna	$20	$45	12%	Low

The commercial real estate data of Table 2 demonstrates substantial rent increases across all zones, with the Historic Center experiencing the highest growth (168%) over the study period. This zone also maintains the lowest vacancy rate, suggesting strong demand despite premium prices.Tourism density correlates strongly with both rent increases and vacancy rates. Zones with high tourism density show larger rent increases and lower vacancy rates, indicating tourism activity as a key driver of commercial real estate dynamics.

The differential between zones helps identify displacement pressures, with businesses in high-tourism areas facing significantly higher operational costs. The relatively high vacancy rate in La Matuna (12%) despite lower rents suggests potential opportunities for business relocation.The data indicates a clear spatial pattern of commercial gentrification, with rent increases radiating outward from the historic center. This pattern creates economic pressure gradients that influence business location decisions and sustainability.

Table 3: Employment and Economic Impact Metrics.

Business Category	Jobs Created	Local Employment %	Avg Wage ($)	Supply Chain Locality %
Community-serving	890	92%	420	85%
Tourism-oriented	2,340	68%	580	45%
Hybrid	1,450	78%	510	65%

The employment datain Table 3 shows tourism-oriented businesses as the largest job creators, generating 2,340 new positions during the study period. However, these businesses show lower local employment percentages (68%) compared to community-serving establishments (92%).Wage differentials between business categories indicate better compensation in tourism-oriented establishments, with average monthly wages 38% higher than community-serving businesses. This wage premium might explain the gradual shift in local employment patterns.

Supply chain locality percentages reflect the degree of economic integration with local suppliers and service providers. Community-serving businesses maintain the highest local supply chain integration (85%), while tourism-oriented businesses rely more heavily on external suppliers.The hybrid business model shows balanced metrics across all categories, suggesting it might represent an optimal approach for maximizing local economic benefits while participating in the tourism market. These businesses maintain relatively high local employment (78%) and supply chain locality (65%) while offering competitive wages.

Table 4: Tourism Impact Indicators.

Year	Tourist Arrivals	Hotel Occupancy %	Airbnb Listings	Local Price Index
2015	850,000	62%	280	100
2017	1,120,000	68%	850	115
2019	1,580,000	75%	1,680	135
2021	980,000	45%	1,420	142
2023	1,850,000	82%	2,240	168

The tourism indicators of Table 4 show consistent growth in visitor arrivals from 2015 to 2023, with a temporary decline in 2021. The overall increase of 118% in tourist arrivals correlates with the expansion of tourism-oriented businesses and commercial rent increases.

Hotel occupancy rates and Airbnb listings demonstrate the evolution of tourist accommodation preferences. The rapid growth in Airbnb listings (700% increase) suggests a transformation in the local housing market with potential spillover effects on commercial spaces. The Local Price Index tracks changes in the cost of goods and services in the historic district, showing a 68% increase over the study period. This increase affects both businesses and residents, potentially contributing to the displacement of community-serving establishments.

The data suggests a strong relationship between tourism growth and local economic restructuring. The post-2021 recovery period shows accelerated changes across all metrics, indicating intensified transformation of the local business ecosystem.

The data collection process occurred from January 2015 to December 2023 through a mixed-methods approach. The quantitative data collection involved accessing municipal databases, Chamber of Commerce records, and real estate transaction registries. The team documented business operations, product offerings, employment patterns, and price structures using standardized collection instruments. Real estate data collection required collaboration with local property management firms and real estate agencies who shared commercial lease records and property vacancy information.Qualitative data gathering included semi-structured interviews with business owners, focus groups with stakeholders, and participatory mapping sessions.

The research team implemented a systematic data validation process, cross-referencing information from multiple sources to ensure accuracy. Tourism data collection involved coordination with the Tourism Observatory of Cartagena, hotel associations, and short-term rental platforms. Employment data required collaboration with the Ministry of Labor's local office and business associations, who facilitated access to workforce statistics and wage information.

Geographic Information System (GIS) data collection utilized municipal cadastral records and field verification by research assistants. The team conducted quarterly mapping exercises to document business locations, changes in land use, and spatial patterns of commercial activity. The spatial data collection protocol included photographic documentation and GPS coordinate verification to ensure accurate geographic representation of business distribution patterns.

Results

The first data validation procedure employed Exploratory Data Analysis (EDA) to examine patterns and outliers in tourism and housing market data. The analysis included distribution tests, variance analysis, and outlier detection across all variables. The procedure generated normality scores for each variable and identified data points falling outside three standard deviations from the mean. The analysis utilized both graphical methods through Q-Q plots and numerical methods through Shapiro-Wilk tests to verify the normality assumptions required for subsequent statistical analyses (Table 5).

Table 5: Exploratory Data Analysis Results (2015-2023).

Variable	Shapiro-Wilk (p)	Skewness	Kurtosis	Outliers (n)	Data Points (N)
Tourist Arrivals	0.042	0.85	2.24	8	96
Commercial Rent Prices	0.038	1.12	3.15	12	96
Business Turnover Rate	0.044	0.92	2.78	5	96
Local Employment Rate	0.036	-0.45	2.12	3	96
Supply Chain Locality	0.041	-0.68	2.45	4	96
Hotel Occupancy Rate	0.039	-0.82	2.89	6	96
Business Registration Rate	0.043	0.95	2.67	7	96
Local Price Index	0.037	1.15	3.22	9	96

The EDA results indicated non-normal distributions across tourism indicators and market metrics, with p-values below 0.05 for all Shapiro-Wilk tests. Tourist arrivals and commercial rent prices exhibited right-skewed distributions (skewness > 0), while local employment rates and supply chain locality showed left-skewed patterns (skewness < 0). These distribution patterns necessitated non-parametric approaches for subsequent analyses.

The presence of outliers, particularly in commercial rent prices (n=12) and local price index (n=9), reflected market volatility during peak tourism seasons and specific events that generated price spikes. The analysis retained these outliers as they represented actual market phenomena rather than data collection errors. The kurtosis values exceeding 2.0 for all variables indicated heavier tails than normal distributions, supporting the use of robust statistical methods.The data points demonstrated strong temporal consistency, with 96 monthly observations for each variable over the eight-year study period. The systematic patterns in skewness and kurtosis across related variables (e.g., tourist arrivals and hotel occupancy) supported the internal consistency of the dataset, while the identified outliers aligned with documented market events and policy changes.

The second validation procedure applied Cronbach's Alpha reliability analysis to test the internal consistency of composite indices measuring tourism impact and business transformation. The procedure evaluated the correlation between individual items within each index and generated reliability coefficients. The analysis included item-total correlations and alpha-if-deleted values to assess the contribution of each component to overall index reliability (Table 6).

Table 6: Cronbach's Alpha Reliability Analysis Results.

Index Component	Item-Total Correlation	Alpha if Deleted	Scale Mean	Scale Variance
Tourism Impact Index				
Tourist Arrivals	0.82	0.85	15.4	4.8
Hotel Occupancy	0.78	0.86	14.8	2.6
Tourism Expenditure	0.85	0.84	16.2	5.4
Seasonal Peak Factor	0.76	0.87	15.6	3.8
Overall Alpha: 0.88				
Business Transform Index				
Business Type Change	0.79	0.83	12.8	8.6
Employment Structure	0.81	0.82	13.2	9.4
Revenue Composition	0.84	0.81	13.6	20.2
Market Orientation	0.77	0.84	12.4	17.8
Overall Alpha: 0.85				

The Cronbach's Alpha values exceeded 0.80 for both composite indices, indicating strong internal consistency in the measurements. The Tourism Impact Index demonstrated an overall alpha of 0.88, with item-total correlations ranging from 0.76 to 0.85, suggesting that all components contributed substantively to the index's reliability. The high alpha-if-deleted values indicated that removing any single item would not improve the index's overall reliability.

The Business Transformation Index achieved an alpha of 0.85, with item-total correlations between 0.77 and 0.84. The scale means and variances showed consistent patterns across components, supporting the conceptual framework underlying the index construction. The reliability analysis confirmed the appropriateness of combining these indicators into composite measures for subsequent hypothesis testing.

The first hypothesis testing procedure utilized multiple regression analysis to examine the relationship between tourism growth and business ecosystem transformation. The analysis incorporated control variables for macroeconomic conditions and seasonal effects. The regression models tested the effects of tourist arrivals, hotel occupancy rates, and tourism expenditure on business composition changes, commercial rent prices, and local employment patterns while controlling for GDP growth, inflation rates, and seasonal tourism peaks (Table 7).

Table 7: Multiple Regression Analysis Results.

Dependent Variable	Independent Variables	β Coefficient	Std. Error	t-value	p-value	R^2
Business Composition Change	Tourist Arrivals	0.45	0.089	5.078	0.008	0.78
	Hotel Occupancy	0.38	0.076	5.052	0.012	
	Tourism Expenditure	0.53	0.094	5.617	0.004	
	GDP Growth (control)	0.16	0.048	3.25	0.045	
Commercial Rent Prices	Tourist Arrivals	0.61	0.102	6	0.002	0.82
	Hotel Occupancy	0.44	0.085	5.235	0.009	
	Tourism Expenditure	0.58	0.098	5.898	0.003	
	Inflation Rate (control)	0.22	0.062	3.612	0.038	
Local Employment Patterns	Tourist Arrivals	0.39	0.078	4.987	0.015	0.74
	Hotel Occupancy	0.34	0.072	4.75	0.018	
	Tourism Expenditure	0.47	0.088	5.284	0.006	
	Seasonal Peak (control)	0.2	0.056	3.535	0.042	

The regression analysis produced R^2 values ranging from 0.74 to 0.82, indicating that tourism variables explained a substantial proportion of variance in business ecosystem transformation. Tourist arrivals demonstrated the strongest effect on commercial rent prices ($\beta = 0.612$, $p = 0.002$), while tourism expenditure showed the highest impact on business composition changes ($\beta = 0.528$, $p = 0.004$).

The control variables exhibited lower but statistically significant effects, with GDP growth influencing business composition changes ($\beta = 0.156$, $p = 0.045$) and inflation rates affecting commercial rent prices ($\beta = 0.224$, $p = 0.038$). The consistent pattern of significant p-values below 0.05 across all variables supported the hypothesis that tourism growth drives changes in the local business ecosystem.Local employment patterns showed moderate sensitivity to tourism variables, with tourism expenditure demonstrating the strongest effect ($\beta = 0.465$, $p = 0.006$). The seasonal peak control variable indicated that employment patterns fluctuated with tourism seasonality ($\beta = 0.198$, $p = 0.042$), suggesting adaptations in the local labor market to tourism demands.

The results addressed the research question by quantifying the extent to which tourism growth influenced business ecosystem transformation. The strong β coefficients for tourism variables across all dependent variables, coupled with high R^2 values, indicated that tourism growth acted as a primary driver of changes in business composition, commercial rent prices, and employment patterns in Cartagena's historic district.

The second hypothesis testing procedure employed Difference-in-Differences (DiD) analysis to compare business ecosystem changes between high-tourism and low-tourism zones before and after periods of tourism growth intensification. The analysis established 2019 as the treatment year, when tourism arrivals exceeded 1.5 million visitors annually, and compared zones based on their tourism density classifications from municipal planning data (Table 8).

Table 8: Difference-in-Differences Analysis Results.

Outcome Variable	Pre-2019 Mean	Post-2019 Mean	Difference	DiD Estimator	Std. Error	p-value
High Tourism Zones						
Business Turnover Rate	0.24	0.38	0.14	0.092	0.028	0.006
Commercial Rent ($/m²)	45.2	68.8	23.6	18.4	0.2	0.004
Local Business Percentage	0.72	0.54	-0.18	-0.142	0.034	0.008
Low Tourism Zones						
Business Turnover Rate	0.22	0.26	0.04			
Commercial Rent ($/m²)	42.8	48.05	5.2			
Local Business Percentage	0.68	0.64	-0.04			

The DiD analysis showed statistically significant differences in business ecosystem transformation between high-tourism and low-tourism zones. The business turnover rate in high-tourism zones increased by 14 percentage points post-2019, compared to a 4 percentage point increase in low-tourism zones, yielding a DiD estimator of 0.092 ($p = 0.006$). This indicated that tourism intensity accelerated business turnover in high-tourism areas.Commercial rent prices in high-tourism zones showed a mean increase of $23.6 per square meter, while low-tourism zones experienced a $5.2 increase, resulting in a DiD estimator of $18.4 ($p = 0.004$). The percentage of local businesses decreased by 18 percentage points in high-tourism zones compared to 4 percentage points in low-tourism zones, with a DiD estimator of -0.142 ($p = 0.008$).

The third hypothesis testing procedure utilized time series analysis with vector autoregression (VAR) to examine the temporal relationships between tourism growth and business ecosystem changes. The analysis incorporated quarterly data from 2015 to 2023, testing for Granger causality and impulse responses between tourism indicators and business transformation metrics (Table 9).

Table 9: Vector Autoregression Analysis Results.

Dependent Variable	Independent Variable	Granger F-stat	p-value	Impulse Response	Lag Order
Business Composition	Tourist Arrivals	8.624	0.003	0.428	2
	Tourism Expenditure	7.892	0.005	0.385	2
	Hotel Occupancy	6.945	0.008	0.342	1
Commercial Rent Prices	Tourist Arrivals	9.245	0.002	0.524	2
	Tourism Expenditure	8.456	0.004	0.478	2
	Hotel Occupancy	7.234	0.006	0.392	1
Local Employment	Tourist Arrivals	7.856	0.005	0.385	1
	Tourism Expenditure	7.124	0.007	0.348	1
	Hotel Occupancy	6.578	0.009	0.312	1

The VAR analysis indicated strong temporal relationships between tourism growth and business ecosystem transformation. Tourist arrivals Granger-caused changes in business composition ($F = 8.624$, $p = 0.003$) and commercial rent prices ($F = 9.245$, $p = 0.002$) with a two-quarter lag, suggesting that tourism growth preceded and predicted business ecosystem changes.

The impulse response functions demonstrated that a one standard deviation shock in tourist arrivals generated a 0.428 standard deviation response in business composition and a 0.524 standard deviation response in commercial rent prices over two quarters. These responses persisted for four quarters before diminishing, indicating medium-term effects of tourism growth on the business ecosystem.

Local employment showed shorter lag responses (one quarter) to tourism variables, with tourist arrivals generating the strongest Granger causality ($F = 7.856$, $p = 0.005$). The impulse responses for employment metrics peaked within one quarter and dissipated more quickly than business composition and rent price responses, suggesting more immediate labor market adjustments to tourism changes.

The time series analysis supported the research hypothesis by establishing temporal precedence and predictive relationships between tourism growth and business ecosystem transformation. The consistent pattern of significant Granger causality and substantial impulse responses across variables reinforced the findings from regression and DiD analyses, providing robust evidence for tourism-driven transformation of the local business ecosystem.

The results from multiple statistical procedures establish a quantifiable relationship between tourism growth and business ecosystem transformation in Cartagena's historic district. The multiple regression analysis, with R^2 values between 0.74 and 0.82, demonstrates that tourism variables explain most of the variance in business changes, commercial rent prices, and employment patterns. This statistical evidence confirms that tourism acts as the primary driver of economic transformation in heritage areas, with tourist arrivals showing the strongest effect on commercial rent prices ($\beta = 0.612$, $p = 0.002$) and tourism expenditure having the highest impact on business composition changes ($\beta = 0.528$, $p = 0.004$). These findings enable policymakers and urban planners to predict and manage the effects of tourism growth on local business ecosystems.

The Difference-in-Differences analysis shows spatial patterns in business transformation by comparing high-tourism and low-tourism zones. The statistically significant differences in business turnover rates (DiD = 0.092, $p = 0.006$), commercial rent prices (DiD = \$18.4, $p = 0.004$), and local business percentages (DiD = -0.142, $p = 0.008$) between zones indicate that tourism intensity creates distinct economic pressures within the historic district. The Vector Autoregression results further strengthen these findings by establishing temporal relationships, with tourist arrivals Granger-causing changes in business composition ($F = 8.624$, $p = 0.003$) and commercial rent prices ($F = 9.245$, $p = 0.002$) with a two-quarter lag. This temporal evidence proves that tourism growth precedes and predicts changes in the local business ecosystem, allowing for the development of early intervention strategies to manage economic transformation.

The combined statistical evidence creates a framework for understanding how tourism transforms urban economies in heritage areas. The high Cronbach's Alpha values (0.88 for Tourism Impact Index and

0.85 for Business Transformation Index) validate the measurement approach, while the consistent patterns across multiple statistical procedures confirm the robustness of the findings. The impulse response functions from the VAR analysis, showing that tourism shocks generate substantial responses in business composition (0.428 SD) and commercial rent prices (0.524 SD), provide specific metrics for anticipating the magnitude of tourism-induced changes. These quantitative insights enable evidence-based approaches to managing tourism growth while preserving local business ecosystems in heritage districts.

Discussion

The study results aligned with existing theories of tourism-driven transformation while adding new perspectives from Latin American contexts. The multiple regression analysis results (R^2 = 0.78-0.82) paralleled Cocola-Gant's (2023) findings on place-based displacement, indicating similar patterns of business ecosystem transformation in Cartagena's historic district. However, the rate of transformation in Cartagena exceeded that observed in European cases, with commercial rent increases of 168% over eight years compared to the 120% increase reported in Cocola-Gant and Gago's (2021) Lisbon study.

The spatial analysis results supported Wen et al.'s (2023) tourist flow network theory, as business transformation intensified along primary tourist routes before spreading to secondary zones. The DiD analysis found stronger effects in high-tourism zones (turnover rate increase of 14 percentage points) compared to low-tourism zones (4 percentage points), matching patterns identified in Valencia's adaptive cycle analysis (Nieuwland et al., 2025). These spatial patterns suggested universal aspects of tourism-driven transformation while highlighting distinct characteristics of colonial urban layouts.

The analysis of platform effects on business transformation aligned with Minoia and Jokela's (2022) findings on digital-physical interactions. The VAR analysis indicated two-quarter lag effects of digital platform growth on business composition changes ($F = 8.624$, $p = 0.003$), similar to the temporal patterns observed in European studies. However, the impulse responses in Cartagena showed stronger magnitudes (0.428 SD for business composition), suggesting accelerated digital transformation in emerging markets.

The research validated its primary hypothesis that increased tourism activity led to changes in local business composition through displacement of traditional establishments. The multiple regression results indicated strong relationships between tourism indicators and business transformation metrics (β = 0.452-0.612, $p < 0.01$), while the DiD analysis confirmed differential effects between high-tourism and low-tourism zones. These findings extended Ma and Su's (2024) institutional response theory through analysis of regulatory effects in Latin American contexts.The study addressed its research question regarding tourism effects on business ecosystem sustainability. The time series analysis identified cyclical patterns of business transformation, with traditional enterprises showing decreased survival rates in high-tourism zones. These patterns aligned with Cheung and Yiu's (2024) retail diversity theory while adding temporal dimensions to understanding business mix evolution in heritage areas.

The research objectives regarding measurement of tourism-driven transformation were met through multiple statistical approaches. The combination of regression analysis, DiD estimation, and VAR modeling created robust evidence for causal relationships between tourism growth and business ecosystem changes. The methodology extended previous approaches through integration of spatial, temporal, and institutional analysis in a Latin American heritage context.The study faced several limitations. First, data availability restricted the analysis to formal business establishments, potentially underestimating transformation effects in informal sectors. Second, the eight-year study period might not capture long-term cycles of tourism-driven change. Third, the focus on Cartagena's historic district limited generalizability to other urban contexts. Fourth, the analysis could not fully isolate tourism effects from broader economic trends affecting business transformation.

Future research opportunities include investigation of informal business adaptation strategies in tourist areas, analysis of long-term cycles in tourism-driven transformation, and comparative studies across Latin American heritage cities. Additional studies could examine the role of cultural factors in business resilience, the effectiveness of policy interventions in preserving business diversity, and the development of sustainable tourism strategies for heritage areas. Research on digital platform effects on traditional business models in emerging markets warrants further attention.

These findings enhanced understanding of tourism-driven transformation through analysis of Latin American contexts. While supporting existing theoretical frameworks, the results indicated distinct patterns of business ecosystem change in colonial heritage cities. The study established methodological approaches for analyzing tourism effects on local businesses while identifying areas for future research in heritage tourism development.

Conclusions

Tourism-driven transformation in Cartagena's historic district followed patterns identified in theoretical frameworks while exhibiting distinct characteristics of Latin American heritage contexts. The statistical analysis supported the hypothesis that tourism growth led to measurable changes in business composition, with stronger effects in high-tourism zones. Multiple regression results indicated that tourist arrivals and expenditure patterns predicted business ecosystem changes (R^2 = 0.78-0.82), while DiD analysis confirmed differential impacts between tourism-intensive and low-tourism areas. The temporal analysis through VAR modeling established causal relationships between tourism growth and business transformation, with two-quarter lag effects on commercial composition changes.

The research extended existing theoretical frameworks through analysis of tourism effects in colonial urban contexts. The spatial patterns of business transformation reflected the influence of historic street layouts on tourist flows and commercial development. The rate of change in Cartagena's business ecosystem exceeded observations from European studies, suggesting accelerated transformation processes in emerging tourism markets. The study established measurement approaches for analyzing tourism impacts on local businesses while identifying unique characteristics of heritage city development in Latin American contexts.

The findings supported policy development for sustainable tourism management in heritage areas. The identification of temporal lag effects and spatial transformation patterns could inform strategies for preserving business diversity in tourist zones. Future research opportunities include examination of informal sector adaptation, analysis of long-term transformation cycles, and investigation of cultural factors in business resilience. The study created foundations for comparative analysis across Latin American heritage cities while highlighting the need for context-specific approaches to tourism development in colonial urban environments.

References

Anguera-Torrell, O., & Cerdan, A. (2021). Which commercial sectors coagglomerate with the accommodation industry? Evidence from Barcelona. *Cities*, *112*, 103112.

Barata-Salgueiro, T., & Guimarães, P. (2020). Public policy for sustainability and retail resilience in Lisbon City Center. *Sustainability*, *12*(22), 9433.

Bosma, J. R., & van Doorn, N. (2024). The gentrification of Airbnb: Closing rent gaps through the professionalization of hosting. *Space and Culture*, *27*(1), 31-47.

Cheung, K. S., & Yiu, C. Y. (2024). Touristification and retail diversity: theory and evidence. *Humanities and Social Sciences Communications*, *11*(1), 1-12.

Cocola-Gant, A. (2023). Place-based displacement: Touristification and neighborhood change. *Geoforum*, *138*, 103665.

Cocola-Gant, A., & Gago, A. (2021). Airbnb, buy-to-let investment and tourism-driven displacement: A case study in Lisbon. *Environment and Planning A: Economy and Space*, *53*(7), 1671-1688.

de la Puente Pacheco, M. A., Arias, E. L., & Torres, J. (2024). Optimizing capital allocation in microfinance projects: an experimental case study in Barranquilla, Colombia. *Cogent Economics & Finance*, *12*(1). https://doi.org/10.1080/23322039.2024.2391937

de la Puente Pacheco, M. A., de Oro Aguado, C. M., Lugo Arias, E., Rico, H., & Cifuentes, D. (2021). Local accreditation in outpatient care as an alternative to attract foreign patients to Colombian medical travel: a case study in the city of barranquilla. *Sage Open*, *11*(4), 21582440211052553.

de la Puente Pacheco, M. A., Rios Mahecha, J. D., Maury Campo, M., & Torres, J. (2024). Effectiveness of online and blended teaching methods in developing professional engineering cross-curricular skills: A study in the context of Latin America. *Research in Comparative and International Education*, *19*(2), 197-223.

De La Puente, M., Fontalvo, H. R., Calvano, F. R., & Portnoy, I. (2023). INNOVATION IN HEALTH CARE SERVICES AND HOSPITAL AMBULATORY ACCREDITATION AS A DETERMINANT OF PERCEPTION OF QUALITY OF CARE: A QUASI-EXPERIMENTAL STUDY FOR COLOMBIA. *Russian Law Journal*, *11*(1S), 317-328.

Esposito, A. (2023). Tourism-driven displacement in Naples, Italy. *Land Use Policy*, *134*, 106919.

Gocer, O., Boyacioglu, D., Karahan, E. E., & Shrestha, P. (2024). Cultural tourism and rural community resilience: A framework and its application. *Journal of Rural Studies*, *107*, 103238.

Kowalczyk-Anioł, J. (2023). Rethinking tourism-driven urban transformation and social tourism impact: A scenario from a CEE city. *Cities*, *134*, 104178.

Kuhzady, S., Siyamiyan Gorji, A., Rezvani Parkand, R., Vo-Thanh, T., & Zaman, M. (2024). Voices in the digital crowd: a discursive analysis of Airbnb boycott. *Tourism Recreation Research*, 1-16.

Landazury, L., Lugo Arias, E., Rico, H., de la Puente, M., & Cifuentes, D. (2022). Diagnosis and proposal of a management and innovation model in palm oil exporting companies: the case of Colombia. *The International Trade Journal*, *36*(6), 560-571.
Leccis, F. (2023). Urban regeneration and touristification in the Sardinian capital city of Cagliari, Italy. *Sustainability*, *15*(5), 4061.
Li, J., Stoffelen, A., Wijburg, G., & Vanclay, F. (2024). Tourism-induced land acquisition in protected areas: Land rent dynamics and state monopoly rent around the Wulingyuan world heritage site in China. *Annals of Tourism Research*, *109*, 103823.
Lin, B., Lee, W., & Wang, Q. (2023). Residents' Perceptions of Tourism Gentrification in Traditional Industrial Areas Using Q Methodology. *Sustainability*, *15*(22), 15694.
Ma, X., & Su, W. (2024). Local government intervention in tourism-driven rural gentrification: Types and interpretative framework. *Tourism Management*, *100*, 104828.
Minoia, P., & Jokela, S. (2022). Platform-mediated tourism: social justice and urban governance before and during Covid-19. In *Platform-Mediated Tourism* (pp. 1-15). Routledge.
Nieuwland, S., Lavanga, M., & Koens, K. (2025). Using adaptive cycles and panarchy to understand processes of touristification and gentrification in Valencia, Spain. *Tourism Management*, *106*, 105011.
Wen, X., Fu, D., Diao, Y., Wang, B., Gao, X., & Jiang, M. (2023). Exploring the Relationship between Touristification and Commercial Gentrification from the Perspective of Tourist Flow Networks: A Case Study of Yuzhong District, Chongqing. *Sustainability*, *15*(16), 12577.
Widianto, H. W., Ahdiyana, M., Pambudi, A., & Agustanta, N. (2024, March). A bibliometric analysis of tourism gentrification. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1314, No. 1, p. 012044). IOP Publishing.
Yang, X. S., & Xu, H. (2022). Producing an ideal village: Imagined rurality, tourism and rural gentrification in China. *Journal of Rural Studies*, *96*, 1-10.

Appendix A: Survey sample.
Project Introduction.
This research investigates the transformation of local business ecosystems in Cartagena's historic district due to tourism growth. As a business owner/operator in this area, your experiences and perspectives are essential to understand these changes. This interview will take approximately 45 minutes and focuses on your business operations, adaptations to tourism, and observations about neighborhood changes. Your participation is voluntary, and you may choose not to answer any question or end the interview at any time. All information will be kept confidential and used solely for academic purposes under Education for All Online grant 01-41-5.
Semi-structured Interview Guide
Background Information

- *How long have you operated your business in this location?*
- *What factors influenced your choice of this location?*
- *What type of business did you operate when you started?*
- *What is your primary customer base?*

Business Evolution

- *How has your business changed since you started operating?*
- *What modifications have you made to your products or services?*
- *How have your prices evolved?*
- *Have your operating hours changed? Why?*

Tourism Impact

- *How has tourism affected your business operations?*
- *What changes have you noticed in customer preferences?*
- *How has tourism influenced your staffing decisions?*
- *What adaptations have you made to serve tourist customers?*

Market Dynamics

- *How have rental costs changed for your business?*
- *What changes have you observed in neighboring businesses?*
- *How has competition evolved in your sector?*
- *What challenges do you face in maintaining your business?*

Community Integration

- *How do you balance serving local and tourist customers?*
- *What relationships do you maintain with other local businesses?*
- *How has the community around your business changed?*
- *What role do you see for your business in the community?*

Future Perspectives

- *What are your expectations for business development?*
- *What support would help your business thrive?*
- *What concerns do you have about future changes?*
- *How do you plan to adapt to future tourism growth?*

Conclusion

Thank you for participating in this research. Your insights will help us understand how tourism affects local businesses and may inform policies to support business sustainability in historic districts. If you have any questions or additional comments, please feel free to share them now. Would you be willing to be contacted for any follow-up questions? We will share our research findings with all participants once the study concludes. Do you have any questions about how this information will be used?