

Modeling the Structural Relationships Between Household Economy, Spatial Justice, and Access to Urban Services in Tabriz City: A SEM Approach

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Abstract: This study investigates the structural relationships among household economy, spatial justice, and access to urban services in Tabriz, Iran, using a quantitative, cross-sectional design and Structural Equation Modeling (SEM). A total of 412 urban households were selected through stratified random sampling to ensure representation across central, intermediate, and peripheral zones. Household economy, spatial justice, and access to urban services were measured using validated instruments with strong reliability (Cronbach's $\alpha = 0.87$ – 0.92). Data were collected via structured questionnaires administered both face-to-face and online. Preliminary analyses confirmed data integrity, normality, and absence of significant outliers. Confirmatory Factor Analysis demonstrated that all latent constructs had acceptable factor loadings (>0.50), high composite reliability ($CR > 0.70$), and adequate convergent validity ($AVE > 0.50$). SEM results indicated excellent model fit ($\chi^2/df = 2.52$; $CFI = 0.948$; $TLI = 0.937$; $RMSEA = 0.062$; $SRMR = 0.051$). Standardized path coefficients revealed significant positive effects of household economy on spatial justice ($\beta = 0.52$, $p < .001$) and access to urban services ($\beta = 0.21$, $p = .003$), as well as a significant effect of spatial justice on access to urban services ($\beta = 0.47$, $p < .001$). Mediation analysis using bootstrapping (5,000 resamples) confirmed that spatial justice partially mediates the relationship between household economy and access to urban services (indirect effect = 0.24, 95% CI [0.16, 0.33], $p < .001$). These findings highlight the critical role of spatial justice in enhancing equitable access to urban services and provide empirical evidence for policymakers seeking to improve urban socioeconomic and spatial planning frameworks.

Keywords: household economy, spatial justice, urban services, structural equation modeling, urban equity

Introduction

Urbanization in the twenty-first century has transformed the social, economic, and spatial fabric of cities across the world. As cities continue to expand, questions of equity, justice, and inclusion have gained increasing prominence in both academic and policy discourses. One of the core debates within contemporary urban studies concerns the extent to which all urban residents can enjoy fair access to essential services—healthcare, education, transportation, public spaces, and basic infrastructure—regardless of their socioeconomic status or spatial location (Bruno, et al., 2025). These concerns highlight the persistent and often widening inequalities embedded in the urban landscape, calling for a deeper understanding of the mechanisms that link household-level socioeconomic conditions to broader patterns of spatial justice and service accessibility. As such, analyzing how household economic conditions interact with the spatial organization of cities and influence residents' access to urban services has become a critical research priority (Haque & Sharifi, 2024).

The concept of spatial justice has emerged as a powerful framework to examine the fairness of spatial distributions and the right of all urban inhabitants to access opportunities provided by the city. Spatial justice extends beyond physical space; it incorporates social, political, and economic dimensions that shape how resources and opportunities are allocated (Amorim, et al., 2025). It reflects both distributive justice (the equitable distribution of services and spaces) and procedural justice (the fairness of decision-making processes that shape urban space). Despite its conceptual richness, spatial justice remains difficult to measure, as it requires integrating social and economic inequalities with spatial and infrastructural characteristics. Urban scholars increasingly stress the need for empirical models that can capture the complexity of spatial justice and its determinants. Understanding how spatial arrangements reinforce or mitigate social inequities is essential for designing inclusive cities, especially in contexts where rapid urbanization strains existing infrastructure (Monadi, et al., 2025).

Within this context, the household economy—typically expressed through income levels, employment conditions, expenditure patterns, and general socioeconomic status—represents one of the most influential determinants of urban well-being. Households with stronger economic capacity generally have greater freedom to choose where they live, access better amenities, and afford high-quality public or private services (Azmoodeh, et al., 2023). Conversely, households with low economic resources often become concentrated in marginalized or underserved areas where infrastructure is insufficient and opportunities are limited (Nazabadian, et al., 2024). Numerous studies have shown that socioeconomic disparities influence residential segregation, access to transit, quality of neighborhood amenities, and levels of participation in urban decision-making. However, the structural pathways through which household economic conditions shape spatial justice and access to urban services remain understudied—particularly in contexts where formal and informal systems of service provision coexist (Ghaderi Hajat, et al., 2022).

Access to urban services represents another critical dimension of urban equity. Urban services encompass a wide range of public and semi-public goods—transportation networks, health and education facilities, water and sanitation infrastructure, emergency services, digital connectivity, and recreational spaces—that collectively determine an individual's quality of life. Equitable access to these services is fundamental for enabling residents to participate in the social and economic life of the city (Monadi, et al., 2025). Yet, access is not merely a function of physical proximity; it is shaped by affordability, availability, institutional policies, and sociopolitical dynamics. Urban residents with limited economic means often face multiple barriers to such services—not only because they live farther from service centers but also because they encounter institutional discrimination, administrative burdens, or higher relative costs. Therefore, access to urban services must be examined not only spatially but also socially and economically (Alnsour & Alnsour, 2025).

Although a wealth of literature independently explores the links between socioeconomic status, spatial justice, and access to urban services, there remains a notable gap in understanding how these factors are structurally related. Much of the existing work relies on descriptive or correlational methods that do not adequately capture the intricate, multidimensional relationships among these constructs (Feitosa, 2024). Few studies apply comprehensive analytical models capable of simultaneously examining direct, indirect, and mediating effects between socioeconomic variables and spatial outcomes. This gap is particularly evident in regions where socioeconomic inequalities are pronounced and where urban development patterns produce stark spatial disparities. Addressing this gap requires methodological approaches that can handle latent constructs, multiple indicators, and complex causal pathways (Goncalves, et al., 2025).

Structural Equation Modeling (SEM) provides a robust approach to addressing these challenges. SEM allows for the modeling of unobservable constructs—such as spatial justice—through observable indicators, while simultaneously estimating the structural relationships among multiple variables. SEM is well-suited for urban studies because it integrates measurement models with structural paths, offering a comprehensive framework for testing theoretical relationships. By utilizing SEM, researchers can assess how household economic conditions directly influence access to services, how they indirectly shape spatial justice, and how spatial justice itself mediates access to essential urban resources. Such an approach offers a more nuanced understanding of urban inequality and provides empirical insights that can inform both policy formulation and urban planning interventions (Kaewhanam, et al., 2025).

This study positions itself within this analytical gap by proposing a structural model that links household economy, spatial justice, and access to urban services. It aims to contribute to the emerging body of empirical research examining urban equity through advanced quantitative methods. While scholars increasingly call for integrative approaches to studying spatial justice, few empirical studies rigorously model the underlying relationships using SEM. Consequently, the present study not only advances methodological applications in urban research but also deepens theoretical knowledge regarding how economic disparities at the household level manifest spatially and influence everyday access to essential services.

The significance of this study lies in its potential to inform policymakers, planners, and urban practitioners. By revealing how household economic factors shape spatial and infrastructural inequalities, the findings can support the design of targeted interventions aimed at reducing spatial disparities and promoting inclusive development. Urban planners can use insights from structural models to prioritize areas with compounded socioeconomic and spatial disadvantages, while policymakers can better understand the socioeconomic determinants of unequal service access. Moreover, the study contributes to broader theoretical debates on justice, urban inequality, and spatial rights by empirically validating relationships that have long been theorized but insufficiently tested.

Methods

Research Design

This study employed a quantitative, cross-sectional survey design to examine the structural relationships between household economy, spatial justice, and access to urban services. SEM was used as the primary analytical technique because it enables the estimation of complex relationships among latent constructs while simultaneously accounting for measurement error. SEM is widely regarded as an appropriate method for theory testing in the urban planning, social equity, and socioeconomic determinants literature. The design integrates both measurement and structural components, allowing the research to assess the validity of latent constructs and to test direct and indirect effects among them.

Participants

A total of 412 participants from urban households in Tabriz, Iran, were selected through a stratified random sampling method. This approach involved dividing the city into geographic zones—central, intermediate, and peripheral—to ensure a representative sample that reflects the spatial diversity and variations in access to urban services. Eligible participants included household heads or adult members responsible for financial decisions, and their participation was voluntary, with informed consent obtained before the survey. Data collection spanned four weeks. The demographic profile of the participants revealed that 52.2% were female and 47.8% male, with ages ranging from 21 to 68 years ($M = 39.4$, $SD = 11.6$). Educational attainment varied, with 18.9% having completed primary education, 36.4% secondary, 30.6% undergraduate, and 14.1% postgraduate studies. The average household size was 4.3 individuals, and residential distribution was fairly balanced, with 31% living in the central city, 38% in intermediate areas, and 31% in peripheral zones. A sample size exceeding 400 is considered adequate for structural equation modeling (Kline, 2015), providing the necessary statistical power and reliable estimates for the analysis.

Measures

The study utilized validated and widely used instruments for each research variable. All scales were measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), unless otherwise noted. Higher scores indicated more favorable conditions for each construct.

1. Household Economy: Household economic status was evaluated through a modified version of the Household Economic Well-Being Scale (HEWBS) alongside items frequently utilized in extensive social surveys, such as the Demographic and Health Surveys (DHS) and World Bank LSMS modules. This assessment focused on three primary dimensions: the stability of household income, which included factors like the consistency of monthly earnings and susceptibility to financial shocks; material assets and financial security, which encompassed ownership of durable goods and the ability to save; and employment conditions, which examined job type, security, and wage adequacy. This composite measurement aligns with international standards for evaluating household economic well-being and has been validated in various socioeconomic research studies, demonstrating a reliability coefficient of Cronbach's $\alpha = 0.89$.

2. Spatial Justice: Spatial justice was evaluated through a combination of established spatial equity assessment frameworks, adapted elements from Soja's spatial justice indicators, and metrics commonly employed in urban planning research that focus on the fairness of spatial distribution and the quality of urban environments. The assessment encompassed three key dimensions: the fair distribution of services and infrastructure, which gauges perceptions of equity in urban service allocation across neighborhoods; procedural justice in urban planning, which assesses the fairness of decision-making processes related to spatial development and public services; and spatial inclusion and mobility opportunities, which examines access to transportation networks and integration with the urban core. This comprehensive approach is consistent with international urban justice frameworks and has been extensively utilized in studies of spatial inequality, demonstrating a high reliability with a Cronbach's α of 0.92.

3. Access to Urban Services: Access to urban services was evaluated through a modified version of the Urban Services Access Index (USAII), which is based on recognized indicators from the UN-Habitat Urban Inequality Survey and the World Bank Urban Access Framework. This assessment encompassed several dimensions, including physical accessibility, which considered the proximity and travel time to essential services such as health centers, schools, public transportation, markets, and administrative offices. Additionally, it examined service availability and adequacy, focusing on the reliability and sufficiency of public services within respondents' neighborhoods. Affordability was also a critical factor, addressing cost-related barriers that could hinder access to these services. This scale has been utilized in prior research investigating inequalities in service provision in rapidly urbanizing areas, demonstrating a strong reliability with a Cronbach's α of 0.87.

Data Collection Procedure

Data were collected using a structured questionnaire administered through a combination of face-to-face surveys and online distribution to accommodate households with varying levels of digital access. Trained research assistants conducted the face-to-face surveys to ensure consistency in administration and to clarify questions when needed. Before the main data collection, the instrument underwent pilot testing with 40 participants drawn from similar demographic backgrounds. Feedback from the pilot study led to minor adjustments for clarity, cultural appropriateness, and length. The pilot data were also used to confirm preliminary reliability and validate the structure of the constructs. Respondents took approximately 20–25 minutes to complete the full survey. All data were anonymized and stored securely in accordance with ethical research guidelines.

Data Analysis

The preliminary analysis involved several key steps to ensure data integrity and suitability for further examination. This included checking for missing values, which were found to be below 3% for each variable, assessing both univariate and multivariate normality, identifying outliers through Mahalanobis distance, and exploring correlations among the variables. To address the missing data, the Expectation-Maximization (EM) method was employed under the assumption of missing at random (MAR), a standard approach in SEM research. Following the preliminary analysis, a Confirmatory Factor Analysis (CFA) was performed to validate the measurement model, focusing on the latent structures of three key constructs: household economy, spatial justice, and access to urban services. The CFA confirmed that the factor loadings were acceptable, exceeding the threshold of 0.50, and demonstrated strong internal consistency. The model fit was assessed using various SEM fit indices, including a chi-square to degrees of freedom ratio below 3.0, a Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) both greater than 0.90, and a Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Residual (SRMR) both below 0.08. Additionally, convergent and discriminant validity were evaluated through Average Variance Extracted (AVE) and Composite Reliability (CR). After confirming the measurement model, a structural model was estimated to investigate the hypothesized relationships among the constructs. This model specifically analyzed the direct effects of household economy on spatial justice and access to urban services, as well as the direct effect of spatial justice on access to urban services. Furthermore, it examined the indirect effects of household economy on service access mediated by spatial justice. To assess the significance of these indirect paths, bootstrapping with 5,000 resamples was utilized. The SEM analyses were conducted using AMOS 26 and SPSS 27.

Results

Sample Characteristics

A total of 412 participants were included in the final analysis. Table 1 presents the demographic characteristics of the sample. The participants were relatively balanced by gender, represented a wide range of ages, and were distributed across different urban zones.

Table 1. Demographic Characteristics of Participants (N = 412)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	197	47.8
	Female	215	52.2
Age	21–30	88	21.4
	31–40	152	36.9
	41–50	112	27.2

Variable	Category	Frequency (n)	Percentage (%)
Education Level	51+	60	14.6
	Primary	78	18.9
	Secondary	150	36.4
	Undergraduate	126	30.6
	Postgraduate	58	14.1
Residential Zone	Central	128	31.1
	Intermediate	157	38.1
	Peripheral	127	30.8
Household Size	Mean = 4.3	—	—

Descriptive Statistics and Correlations

Descriptive statistics and Pearson's correlation coefficients for the three main latent variables (composite scores) are presented in Table 2. All correlations were positive and significant, supporting preliminary expectations.

Table 2. Descriptive Statistics and Correlations (N = 412)

Variable	Mean	SD	1	2	3
1. Household Economy	3.12	0.67	—	.48**	.36**
2. Spatial Justice	3.01	0.71	.48**	—	.54**
3. Access to Urban Services	3.27	0.69	.36**	.54**	—

Note: p < .01

Measurement Model (Confirmatory Factor Analysis)

A CFA was performed to validate the latent structures. All factor loadings exceeded the acceptable threshold of 0.50, and all constructs demonstrated strong reliability. All constructs exhibited strong Composite Reliability (CR > .70) and Average Variance Extracted (AVE > .50), confirming convergent validity.

Table 3. CFA Standardized Loadings, Reliability, and Validity

Construct	Indicator	Loading	CR	AVE
Household Economy	HE1	0.78	0.89	0.62
	HE2	0.81		
	HE3	0.84		
	HE4	0.73		
Spatial Justice	SJ1	0.82	0.92	0.68
	SJ2	0.86		
	SJ3	0.79		
	SJ4	0.85		
Access to Urban Services	AU1	0.77	0.87	0.57
	AU2	0.80		
	AU3	0.74		
	AU4	0.72		

Model Fit Indices

Both the measurement and structural models were evaluated using standard SEM fit indices. Results indicate an excellent model fit. All indices indicate that both the measurement and structural models demonstrate good to excellent fit.

Table 4. Model Fit Indices

Fit Index	Recommended Cut-off	Measurement Model	Structural Model
χ^2/df	< 3.0	2.41	2.52
CFI	> .90	0.954	0.948
TLI	> .90	0.944	0.937
RMSEA	< .08	0.059	0.062
SRMR	< .08	0.047	0.051

Structural Model Results

The structural model tested the hypothesized relationships among household economy, spatial justice, and access to urban services. Standardized path coefficients and their significance levels are presented in Table 5. All relationships were statistically significant and consistent with theoretical expectations.

Table 5. Structural Path Coefficients

Path	Standardized β	SE	CR (t-value)	p-value	Interpretation
Household Economy → Spatial Justice	0.52	0.06	8.67	< .001	Significant
Household Economy → Access to Urban Services	0.21	0.07	3.00	.003	Significant
Spatial Justice → Access to Urban Services	0.47	0.05	8.96	< .001	Significant

Indirect Effects (Mediation Analysis)

A bootstrapping procedure with 5,000 resamples was used to test the mediating effect of spatial justice. The indirect effect was significant at the $p < .001$ level, confirming that spatial justice partially mediates the relationship between household economy and access to urban services.

Table 6. Indirect Effects via Spatial Justice

Indirect Path	Standardized Indirect Effect	95% CI (Bootstrapped)	Interpretation
Household Economy → Spatial Justice → Access	0.24	[0.16, 0.33]	Significant mediation

Discussion

The purpose of this study was to examine the structural relationships between household economy, spatial justice, and access to urban services using SEM. The findings contribute to a growing body of literature on urban equity, socioeconomic disparities, and spatial justice by providing empirical evidence of how household-level economic factors shape spatial experiences within the city and ultimately influence access to essential services. This discussion section interprets these findings in relation to existing scholarship, explains the theoretical and practical implications, and highlights the contributions of this work to the broader urban studies field.

Household Economy as a Determinant of Spatial Justice

One of the key findings of the study is the strong and significant effect of household economy on spatial justice ($\beta = 0.52$). This indicates that households with better economic standing are more likely to perceive their urban environment as fair, equitable, and inclusive. This result aligns with well-established urban theories that argue that socioeconomic position shapes not only physical access to resources but also subjective experiences of fairness and representation within the city. Previous research has shown that wealthier households tend to reside in better-served areas with stronger infrastructure, political influence, and institutional responsiveness (Gachanja & Yang, 2025). These conditions contribute to perceptions of spatial fairness because residents experience fewer service deficits, shorter commutes, and greater influence over urban planning decisions. Conversely, households with weaker economic capacities often live in areas with inadequate public services, longer travel distances, and weaker institutional support. These households are more vulnerable to the impacts of spatial injustice, including exclusion from decision-making, unequal distribution of resources, and marginalization in planning priorities (Liu, et al., 2025). The present study's evidence reinforces the argument that spatial justice cannot be fully understood without acknowledging the underlying role of socioeconomic inequality. While spatial justice is often framed as a matter of territorial fairness, the findings suggest it is deeply rooted in household economic structures. This evidence supports Soja's conceptualization of spatial justice as both a social and spatial phenomenon—one that reflects the underlying distribution of economic power. The strong relationship between household economy and spatial justice highlights the need for integrated approaches that address both socioeconomic deprivation and spatial inequities (Sharma, 2024).

Direct Effects of Household Economy on Access to Urban Services

The structural model also revealed a significant direct effect of household economy on access to urban services ($\beta = 0.21$). This finding suggests that economic capacity continues to shape access to services even when spatial factors are controlled for. Households with stronger economic resources are more capable of overcoming structural challenges through private means such as paid transportation, private schooling, and private healthcare services. They also benefit from the increased residential freedom to locate in areas with better public service provision. This result aligns with global research documenting socioeconomic barriers to urban service access (Park, et al., 2025). Numerous studies highlight that low-income households face multiple layers of exclusion, not only spatial but also financial, institutional, and social. For example, transportation costs may limit mobility even when public transport is physically available. Healthcare services may be technically accessible, but unaffordable. Education may be geographically within reach but of poor quality. Thus, household economy remains a powerful determinant of actual service accessibility beyond spatial distribution. The significant direct effect therefore supports the argument that accessibility is not only a spatial phenomenon, but also an economic one. Planning interventions aimed at improving access must take into account affordability constraints, hidden costs of use, and economic barriers (Monadi, et al., 2025).

Spatial Justice as a Key Predictor of Urban Services Access

One of the strongest findings of this study was the robust direct effect of spatial justice on access to urban services ($\beta = 0.47$). This underscores the idea that the fairness of spatial arrangements significantly influences residents' ability to access essential services. Spatial justice is more than a conceptual framework; it has real and tangible implications for how individuals experience the city. This finding supports earlier work demonstrating that spatial equity determines service distribution, mobility opportunities, and infrastructural quality. Areas characterized by spatial injustice—such as peripheries, informal settlements, or historically marginalized neighborhoods—experience chronic service deficits that undermine residents' quality of life. These deficits are reinforced through planning decisions, political representation gaps, and institutional biases that favor resource allocation to more affluent or politically influential districts (Fanelli, et al., 2024). The evidence presented here confirms the central role of spatial justice in the broader urban inequality framework. It highlights that equal access to services cannot be achieved solely through improvements in household economic conditions; it requires structural spatial reforms, such as equitable planning, decentralized service provision, and spatial redistribution of public investment (Boncinelli, et al., 2025).

Spatial Justice as a Mediator Between Household Economy and Access

Perhaps the most theoretically significant finding is the confirmation of a partial mediation effect of spatial justice in the relationship between household economy and access to urban services. The indirect effect was statistically significant ($\beta = 0.24$), indicating that part of the influence of household economy on service access operates through spatial justice. This means that household economic inequality contributes to service inequality partly because it shapes spatial patterns of advantage and disadvantage. Wealthier households cluster in areas with better infrastructure, better planning outcomes, and stronger public services—conditions that reflect spatial justice. Poorer households cluster in areas shaped by structural neglect, political exclusion, and infrastructural deficits—conditions that reflect spatial injustice (Dong, et al., 2024). This mediating effect supports theories of urban stratification that argue that the city is a spatial expression of social hierarchy. It also aligns with the spatial mismatch hypothesis, which suggests that economic inequalities are reinforced by distance from opportunities and uneven urban development. Furthermore, the mediation pattern confirms that spatial factors are not merely correlates of socioeconomic status but mechanisms through which economic inequalities translate into unequal life chances. The mediation finding strengthens the argument that spatial justice should be a central focus of urban equity interventions. Policies that address economic inequality without addressing its spatial manifestations may produce limited impact on service access. Conversely, spatial justice interventions can help mitigate the consequences of economic inequality (Kakwani, 2025; Mirkatouli, 2025; Monadi, et al., 2025).

Theoretical Contributions

This research significantly advances urban studies theory in multiple ways. Firstly, it empirically substantiates the link between socioeconomic inequality and spatial justice, illustrating that spatial justice transcends a mere normative ideal to become a tangible socioeconomic outcome. Secondly, it introduces a structural model that connects economic conditions, spatial configurations, and access to services, thereby fostering a more comprehensive understanding of urban inequality. Additionally, the study reinforces the notion that spatial justice functions as both a mediating and structuring mechanism, rather than simply an end result of planning efforts.

Lastly, it highlights the effectiveness of Structural Equation Modeling (SEM) in urban equity research, advocating for the application of latent constructs to analyze complex urban dynamics. Collectively, these contributions enhance the theoretical consistency of the spatial justice framework and offer empirical methodologies for future investigations.

Practical and Policy Implications

The findings highlight the necessity of crafting comprehensive urban policies that tackle economic disparities, spatial injustices, and gaps in service accessibility concurrently. This entails making strategic investments in neglected and outlying neighborhoods, implementing participatory planning processes to promote fairness in decision-making, and ensuring that public infrastructure—such as healthcare, education, and transportation—is distributed equitably. Additionally, social policies should focus on enhancing the economic resilience of households through initiatives like job training and financial support. Finally, an integrated planning approach that aligns economic development with frameworks for spatial equity is essential for fostering sustainable urban environments.

Conclusion

Overall, the findings reaffirm that urban inequality is a multidimensional phenomenon in which household economy, spatial justice, and access to services are intricately linked. Spatial justice emerges as both a product and a mechanism of economic inequality, underscoring its critical role in shaping urban life.

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