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Confirmatory Factor Analysis of the Sustainable Development Goals Derived Gentrification Scale in the Context of the Pandemic

Julio E. Crespo[1], Cruz García Lirios[2], Celia Yaneth Quiroz Campas[3], Arturo Sánchez Sánchez[4], Jorge E. Chaparro Medina[5], Isabel Cristina Rincón Rodríguez[6]

Abstract

In the context of human development goals, gentrification has emerged as a significant and unpredictable phenomenon amid the ongoing health crisis, potentially impacting the sustainable development goals (SDGs). This study aimed to analyze the theoretical framework of gentrification and its empirical indicators in the unique context of the pandemic, foreseeing potential risk scenarios. A cross-sectional, psychometric, and correlational study was conducted with 100 university students dedicated to the SDGs during the pandemic. The findings revealed the prevalence of two out of seven factors associated with poverty alleviation and institutional justice for peace. Given the observation of seven factors in the current literature, this study recommends expanding the indicators to enhance the variance percentage and aligning the theoretical model with empirical evidence. It underscores the pressing need for collaborative efforts in urban and sustainable development.

Keywords: *Construction, Franchising, Gentrification, Centrality, Clustering, Mediation, SDGs.*

Introduction

The concept of nature is based on ecosystem services; from a critical perspective, it is undeniable that more green spaces are needed. Political Ecology already provides elements in that direction (Cole et al., 2021). Without questioning anything, interventions based on Green Cities belong to the green current of thought, addressing issues such as the excessive growth of cities, real estate, and extractives, in which some win and others lose. The naturalized inequality in cities concerning facilities and public spaces. They look at the low visibility of women, people with disabilities, and older adults in cities.

It is noted that the entire approach is anthropocentric, in this case, the quality of human life and climate change (Crespo et al., 2023). Everything in Latin America seems to lead to gentrification (Han et al., 2021). The intersection between the benefits of green areas and health must also be analyzed in its intersection with inequalities and symbolic violence for specific groups.

Women are essential in managing anthropogenic climate change through their wisdom and everyday practices. From caring for the home to working in the fields, their actions contribute significantly to environmental sustainability (Hwang and Shrimali, 2023). However, despite being pillars in the fight against climate change, women often face discrimination in both urban and rural areas. This discrimination is unjust and undermines collective efforts to address the climate crisis. It is imperative to recognize and empower women as agents of change, ensuring their voices are heard, and their contributions are valued in decision-making at all levels. Only then can we move towards a more equitable and sustainable future.

The reality of the three-hour commute to the study center. This situation represents a logistical challenge and implies discrimination in gentrified areas, where socioeconomic differences become more evident and palpable (Hyra and Lees, 2021). By reshaping the urban fabric, gentrification often displaces long-term residents and creates invisible barriers of segregation. There is an urgent need for inclusive policies that recognize but also celebrate the diversity and cultural richness that residents of metropolitan areas bring to

[1] Universidad de Los Lagos, Osorno, Chile. E mail: crespo@ulagos.cl (Corresponding Author
[2] Universidad de la Salud, CDMX, México.
[3] Instituto Tecnológico de Sonora, Navojoa, México.
[4] Universidad Autónoma de Tlaxcala, México
[5] Universidad de Investigación y Desarrollo UDI, Colombia
[6] Universidad de Investigación y Desarrollo UDI, Colombia

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the metropolis (see Table 1). For example, income inequality in the same work environment and access to spaces such as museums, auditoriums, cafés, or cinemas.

Table 1. Comparison between gentrification and the SDGs before and after the pandemic

Aspect	Before the Pandemic (COVID-19)	After the Pandemic (COVID-19)
Impact on SDG 1: End poverty	Gentrification displaced vulnerable communities, increasing urban poverty.	Increased poverty due to job losses and economic precarization exacerbates the adverse effects of gentrification in marginalized communities.
Impact on SDG 3: Good health and well-being	Gentrification often improved health infrastructure in urban areas but at the cost of displacing vulnerable populations with limited access to these services.	Access to health has become more critical, with displaced communities facing increased challenges in accessing health services amid the global health crisis.
Impact on SDG 10: Reducing inequalities	Gentrification contributed to socioeconomic polarization, creating enclaves of wealth and marginalizing low-income populations.	Inequalities have worsened due to the economic and health crisis, with a widening gap in access to resources and opportunities between communities affected by gentrification.
Impact on SDG 11: Sustainable cities and communities	Gentrification drove urban development, but often at the expense of social and economic sustainability, displacing original residents.	The need to rethink urban planning to create more inclusive and resilient cities was stressed, highlighting the importance of protecting vulnerable communities in recovery.
Impact on SDG 8: Decent work and economic growth	Gentrification often created construction and service jobs, but these were short-term and did not provide long-term benefits to displaced communities.	The global recession has diminished job opportunities in gentrified areas, further affecting vulnerable communities that had already been displaced and highlighting the need for sustainable jobs.
Impact on SDG 16: Peace, justice, and strong institutions	Gentrification often generated local conflicts and social tensions due to the displacement of communities and changes in the social dynamics of neighborhoods.	The pandemic exacerbated social tensions and conflicts, highlighting the need for inclusive policies that address social justice in the post-pandemic urban context.

Methods

Design. A documentary, cross-sectional, exploratory, and retrospective study was conducted with a sample of sources indexed in international repositories, considering keyword searches and the publication period from 2020 to 2024.

Instrument. The Gentrification Impact Scale on the SDGs was used (Annex A). It includes dimensions such as 1) Community Displacement, 2) End of Poverty, 3) Health and Well-being, 4) Reduction of Inequalities, 5) Sustainable Cities, 6) Work and Economic Growth, and 7) Peace, Justice, and Institutionalism.

Procedure. To consider the period from 2020 to 2024, a search was conducted on Google Scholar using the keywords "Gentrification" and "COVID." The abstracts were analyzed using the Delphi technique, and averages were established based on the judges' ratings and keyword frequencies.

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Analysis. The data were captured in Excel and processed in JAS version 18.2 (Annex B). The centrality, clustering, and structuring parameters were estimated to contrast the null hypothesis related to the significant differences between the structure of relationships between the keywords disseminated in the literature and the structure observed in the present study.

Results

The reliability analysis suggests the instrument's internal consistency, measuring the variables to be observed in their structural relationships (Table 1). The results indicate that the alpha and omega coefficients exceed the minimum threshold essential to carry out the most robust analyses confirming the factorial structure.

Table 1. Reliability

	Coefficient ω	Coefficient α
Factor 1	0.684	0.695
Factor 2	0.684	0.636
total	0.628	0.670
Second order	0.684	

The fit analysis indicates whether the sample matches the model specification regarding the number of variables, relationships, and unknowns (Table 2). The results suggest that the model specification matches the sample.

Table 2. Kaiser-Meyer- Olkin (KMO) test

Indicator	MSA
episode 1	0.645
episode 2	0.633
episode 3	0.686
pji1	0.682
pji2	0.613
pji3	0.629
In general	0.605

The analysis of the factor loadings indicates the correlation structure between the underlying factors based on the indicators (Table 3). The results indicate that the loadings range between 0.309 and 0.994 and meet the requirement for construct validity.

Table 3. Factor loadings

						95% confidence interval	
Factor	Indicator	Estimate	Standard error	z value	P	Lower	Superior
Factor 1	episode 1	0.994	214.318	0.005	0.996	-419.061	421.050
	episode 2	0.363	35.057	0.005	0.996	-68.548	68,873
	episode 3	0.530	114.306	0.005	0.996	-223.504	224.565
Factor 2	pji1	0.739					
	pji2	0.320					

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Table 3. Factor loadings

Factor	Indicator	Estimate	Standard error	z value	P	95% confidence interval	
						Lower	Superior
	pji3	0.309					

The analysis of the intercepts suggests that the items are predicted when considering that they are different from zero, and such prediction is not attributable to chance (Table 4). The values were significantly lower than zero, so it is assumed that other factors and indicators influence the measurement of the model structure.

Table 4. Inter sections

Indicator	Estimate	Standard error	z value	P	95% confidence interval	
					Lower	Superior
episode 1	0.697	0.125	5.580	< .001	0.452	0.942
episode 2	0.667	0.082	8.124	< .001	0.506	0.828
episode 3	0.697	0.137	5.102	< .001	0.429	0.965
pji1	0.778	0.118	6.576	< .001	0.546	1.010
pji2	0.980	0.020	48.747	< .001	0.940	1.019
pji3	2.515	0.063	40.012	< .001	2.392	2.638

The diagonal analysis of the matrix of the variances involved predicts the fit of the theoretical model with the matrix of the empirical or observed model (Table 5). The results show values more significant than one, so the fit analysis is recommended for the empirical test of the model and the non-rejection of the fit hypothesis.

Table 5. Implicit covariance matrix

episode 1	episode 2	episode 3	pji1	pji2	pji3
1,545					
0.152	0.667				
0.494	0.081	1.848			
0.000	0.000	0.000	1.385		
0.000	0.000	0.000	-0.015	0.040	
0.000	0.000	0.000	-0.007	$1.817\times^{10-4}$	0.391

The analysis of the diagonal of the residual covariance matrix shows the differences between the structure of the theoretical model and the structure of the observed model (Table 6). The results indicate significant differences, suggesting that the hypothesis of differences between the theoretical and empirical structures cannot be rejected.

Table 6. Residual covariance matrix

episode 1	episode 2	episode 3	pji1	pji2	pji3
< .001					
< .001	< .001				
< .001	< .001	< .001			

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Table 6. Residual covariance matrix

episode 1	episode 2	episode 3	pji1	pji2	pji3
0.327	0.340	0.367	< .001		
< .001	0.013	0.024	< .001	< .001	
< .001	< .001	0.287	< .001	< .001	< .001

The confirmatory factor analysis model analysis suggests the structure of relationships between indicators, factors, and the second-order construct that the literature identifies as gentrification (Fig. 1). The findings indicate that ending poverty and peace with institutional justice are preponderant factors in the impact of gentrification on the SDGs during the pandemic.

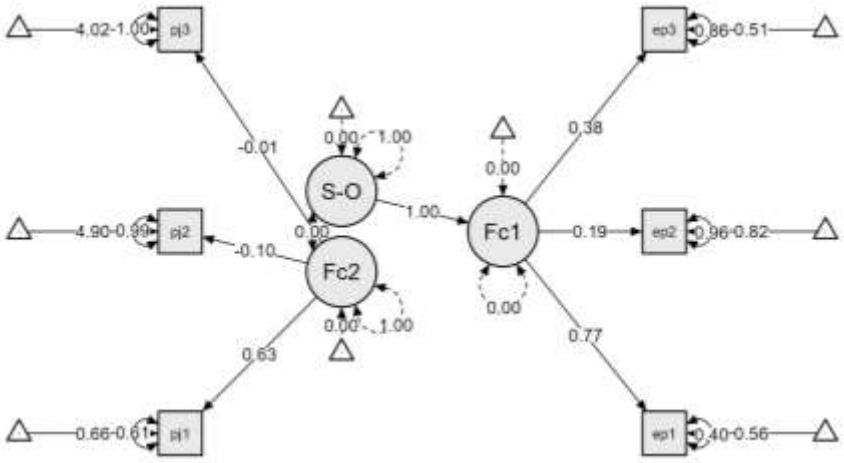

Figure 1. Confirmatory factor model of gentrification in the pandemic scenario.

The value of the R square establishes the analysis of the total explained variance (Table 7). The first indicator of the end of poverty explains the highest percentage, followed by the first indicator of the second factor relating to peace and institutional justice.

Table 7. R-Square

	R^2
episode 1	0.600
episode 2	0.037
episode 3	0.143
pji1	0.395
pji2	0.010
pji3	$2{,}165\times 10\text{-}4$
Factor 1	1,000

The fit and residual values ⌈ $\chi 2$ = 44.131 (8gl) p = 0.001; RFI = 1.00; GFI = 0.991; RMSEA = 0.008 ⌋ suggest that the hypothesis regarding the significant differences between the theoretical model reported in the literature and the empirical model observed in the present study is not rejected.

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Discussion

This work is significant because it establishes a confirmatory factor model with two prevailing dimensions out of seven. The factors of ending poverty and achieving peace through institutional justice explain the most significant percentage of the total variance. However, residual covariances' values suggest including other indicators in the model.

Gentrification is a complex and multifaceted phenomenon that has been the subject of much debate and study in urban geography and sociology (Starr-Morris, 2021). A critical review of the main theories of gentrification that have emerged over the last decade argues that the income gap and the production of gentrifiers are partial explanations that are necessary but insufficient (Mendes, 2021). The concept of gentrification in the revanchist city context highlights the impact of frontier urban development (Broitman, 2023).

A reappraisal of gentrification moves towards a geography of gentrification to better understand its spatial dynamics (Santos-Izquierdo et al., 2023). The changing state of gentrification focuses on greater state involvement in neighborhood processes (Wilson, 2023). The concept of super gentrification sheds light on the intensification of gentrification processes (Shan et al., 2023). Gentrification in a global context frames a form of urban neocolonialism that impacts cities worldwide (Nelson and Hibberd, 2023). The notion of new-build residential developments in urban centers as examples of gentrification contributes to the process (Hayes and Zaban, 2020).

The study of gentrification and displacement emphasizes the importance of incorporating social justice into gentrification research (Turman et al., 2021). The histories, trajectories, and critical geographies of new-build gentrification address the divergent pathways of gentrification, developing a conceptual framework on the social pathways of gentrification and introducing a method of systematic social observation to detect neighborhood changes (Finley, 2022). An enduring racial hierarchy governs residential selection in gentrifying neighborhoods, emphasizing the role of social dynamics in the process.

Gentrification is an emerging phenomenon in areas with a high supply of specialized labor. However, the mediation of sociodemographic and socioeconomic variables inherent to intellectual capital has not been observed as a mediator of the effect of labor gentrification (Ferrini and Gori, 2021). The work explores the theoretical structure of gentrification reported in the literature regarding the observations of its learning networks (Turman et al., 2021). Regarding the state of the art where gentrification is conceptualized as a real estate process, it is recommended that this work be expanded to observe the incidence of gentrification areas as attractors of intellectual capital and the intermediation of educational and occupational variables.

The literature review, up to the state of the art, lays in establishing a model of mediating factors that affect the effect of franchises on buildings (Hyra and Lees, 2021). The educational level mediates such a relationship. As franchises increase, intellectual capital concentrates on gentrification and promotes the emergence of real estate projects such as buildings. The centrality analysis indicates the degree of distance, proximity, intermediation, and influence between the gentrification variables (Rajan and Cherian, 2021). Taxes are the axis on which the other variables intersect to explain an area of gentrification. The cluster analysis suggests the degree of configuration of a hegemonic node concerning the other gentrification variables. The other variables are reconfigured around income. Consequently, income concentrates on analyzing the reviewed literature as an explanatory node of gentrification (Andreucci and Marvuglia, 2021). The degree of learning of a system such as gentrification by establishing the beginning and end of the process. The system starts with franchises and culminates in buildings. This means that gentrification seems to have started with the appearance of branches and culminated in increased buildings (Turman et al., 2021)- the incidence of an established predictor, such as franchising, on an outcome such as buildings. Franchises affect buildings whenever highly educated users or consumers mediate their effects.

This paper associates the concept of gentrification with the emergence of franchises and their impact on construction. This relationship, mediated by sociodemographic and socioeconomic variables, suggests a

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line of research related to the rejection or acceptance of gentrification as a system of resettlement of inhabitants and various services.

Conclusion

The objective of this work was to establish the differences between the gentrification structure reported in the literature and the observations made in this work. The results support the literature review that focuses on the proliferation of buildings as an indicator of gentrification. In this sense, the sociodemographic and socioeconomic variables that mediate the relationship between franchises and buildings open the discussion around the reconfiguration of gentrification areas as scenarios for attracting employment and consequently offering real estate services.

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ANNEX A

Gentrification Scale and Impact on SDGs During the Pandemic

Instructions: Please indicate the degree to which you agree or disagree with the following statements, where 1 means "Strongly Disagree" and 5 means "Strongly Agree."

Dimension 1: Community Displacement

1. Access to affordable housing was substantially reduced in my community during the pandemic

1 2 3 4 5

2. Urbanization policies implemented during the pandemic favored new residents rather than the original population.

1 2 3 4 5

3. I noticed an increase in the displacement of low-income residents in my neighborhood during the pandemic.

1 2 3 4 5

Dimension 2: Impact on SDG 1 (End of poverty)

4. The pandemic exacerbated economic hardship in my community, especially among low-income residents.

1 2 3 4 5

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5. Urban development projects during the pandemic have increased the poverty gap in my neighborhood.

1 2 3 4 5

Dimension 3: Impact on SDG 3 (Health and well-being)

6. Access to health services became more difficult for displaced residents due to gentrification during the pandemic.

1 2 3 4 5

7. Inequalities in access to health care increased in my community due to gentrification during the pandemic.

1 2 3 4 5

Dimension 4: Impact on SDG 10 (Reduction of inequalities)

8. Socioeconomic inequalities between new and original residents increased during the pandemic.

1 2 3 4 5

9. Gentrification during the pandemic has intensified social exclusion in my community.

1 2 3 4 5

Dimension 5: Impact on SDG 11 (Sustainable cities and communities)

10. Urban developments during the pandemic have not considered the needs of the original residents.

1 2 3 4 5

11. Gentrification during the pandemic has negatively affected my community's social cohesion and sustainability.

1 2 3 4 5

Dimension 6: Impact on SDG 8 (Decent work and economic growth)

12. Employment opportunities generated by gentrification during the pandemic did not benefit original residents.

1 2 3 4 5

13. Gentrification during the pandemic has contributed to job insecurity in my community.

1 2 3 4 5

Dimension 7: Impact on SDG 16 (Peace, justice and strong institutions)

14. Social conflicts in my community increased due to gentrification during the pandemic.

1 2 3 4 5

15. Local institutions have not adequately protected vulnerable communities during the gentrification process in the pandemic.

1 2 3 4 5

Interpretation of results:

- Low scores (1-2): Indicate a lower perceived impact of gentrification on the SDGs during the pandemic.
- Moderate scores (3): Suggest a noticeable, but not extreme, impact on the relationship between gentrification and the SDGs.
- High scores (4-5): Indicate a high impact of gentrification on the SDGs during the pandemic, with negative implications for sustainability and community well-being.

ANNEX B

```
# Installing necessary libraries
! pipe install Semopy Pandas and Numpy
# Import the necessary libraries
```

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```
import pandas as pd
import numpy as np
from semopy import Model, Optimizer
from semopy.inspector import inspect_model
#Upload The SDG File
file_path = '/ mnt /data/SEM CFA Gentrification.ods '
data = pd.read_excel ( file_path , engine=' odf ')
# View the first rows of the file to verify correct loading
print ( data.head ( ))
# Define the model for the AFC (adjust according to specific items)
model_desc = """
Offset =~ element1 + element2 + element3
Poverty =~ item4 + item5
Health_wellness =~ item6 + item7
Inequality =~ item8 + item9
Sustainable_community =~ item10 + item11
Decent_work =~ item12 + item13
Justice =~ article 14 + article 15
# Covariances between factors (optional)
Displacement ~~ Poverty + Health_wellness + Inequality + Sustainable_community +
        Decent_work + Justice
Poverty ~~ Health_wellness + Inequality + Sustainable_community + Decent_work + Justice
Health_wellness ~~ Inequality + Sustainable_community + Decent_work + Justice
Inequality ~~ Sustainable Community + Decent Work + Justice
Sustainable_Community ~~ Decent_Work + Justice
Decent_work ~~ Justice
"""
#Create the model
model = Model (model_desc)
# Optimize (fit) the model
opt = Optimizer (model)
result = opt.optimize (data)
# Inspect the fitted model
params = inspect_model (model)
print ("Parameters of the fitted model:")
print (parameters)
# Model fit metrics
from semopy import calc_stats
stats = calc_stats (model, data)
print ("Model fit statistics:")
print (statistics)
# Visualization of factor loadings
import matplotlib.pyplot as plt
import networkx as nx
from semopy import plot_model
g = plot_model (model, display=True)
plt.show ()
# Save the results to a CSV file (optional)
params.to_csv ("/ mnt /data/afc_results.csv", index =False)
```

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