In-Depth Analytical Report on Bikesharing in Spain

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1. Executive Summary

This report presents an in-depth analysis of bikesharing behavior in Santander, Spain, based on primary data collected from 370 participants. Using advanced statistical tools and visualizations, we uncover critical demographic, behavioral, and regional insights, particularly concerning willingness to pay (WTP) and e-bike adoption. Our findings offer direct implications for urban mobility planning and bikesharing service optimization.

2. Background & Objectives

The transformation of urban mobility is closely tied to the rise of shared transportation modes, especially bikesharing. This study aims to: (1) Understand the socio-demographic profile of users; (2) Identify factors influencing usage; (3) Explore stated preferences for pricing; and (4) Evaluate the influence of location, age, gender, and education on bikesharing adoption. The ultimate goal is to inform evidence-based urban transportation policy.

3. Data Description and Methodology

The dataset is structured in two key sections: demographic profiling and stated preference (SP) scenarios. Demographic data include gender, age, employment, education, and place of residence. The SP section includes WTP analysis under three pricing models: per-use, annual, and hybrid. Statistical tools used: Chi-square test for independence, descriptive statistics, frequency distribution analysis.

4. Key Demographic Insights with Visual Analysis

Age Analysis:

- Usage peaks between ages 25–54.

- Decline after 65 due to physical and technological barriers.

Employment:

- Employed and student populations are dominant users.

- Houseworkers show negligible use.

Education:

- University-educated individuals aredisproportionately high users.

- Very low usage among non-educated groups.

Gender:

- Near-equal representation suggests gender-neutral adoption.

These insights suggest that bikesharing is most viable among tech-savvy, economically active urban populations.

5. Regional Distribution and Engagement

Santander users form the majority, indicating local infrastructure and integration are effective.

Moderate adoption in Cantabria and other Spanish cities.

Outside-Spain users show low current use but high WTP for e-bikes, highlighting potential for tourism-focused expansions.

6. E-Bike vs Regular Bike Preferences

E-bike adoption is significantly higher across all demographics.

79.1% of Santander respondents reject regular bikes.

E-bike demand is higher in peripheral regions — likely due to ease-of-use on challenging terrain or longer trip purposes.

This indicates a clear market shift toward electrified, convenient personal transport.

7. Chi-Square Statistical Tests

Tests were run on combinations of demographic variables and bikesharing behaviors. Significant relationships include:

- Education vs Bikesharing ($p < 0.05$): Strong correlation between higher education and adoption.

- Employment vs E-Bike Use ($p < 0.05$): Regular income correlates with willingness to pay.

- Age vs E-Bike Use ($p < 0.05$): Younger and middle-aged respondents are more likely to prefer e-bikes.

These findings validate that demographic identity significantly influences transport behavior and service engagement.

8. Policy and Strategic Implications

- Introduce flexible pricing models to target different user groups.

- Expand e-bike infrastructure over regular bikes.

- Invest in user education for tech-inexperienced demographics.

- Partner with local employers for commuter-friendly packages.

- Develop tourism-oriented e-bike solutions for non-local users.

9. Limitations and Future Work

While insightful, this study focuses only on Santander. Future studies should explore:

- Multi-city comparisons across Spain

- Behavioral tracking using app data

- Longitudinal surveys to capture adoption trends over time

10. Conclusion

The bikesharing landscape in Spain, especially e-bike services, shows immense promise if guided by demographic understanding and localized infrastructure strategies. There is clear evidence of strong latent demand for flexible, accessible, and modern mobility solutions.

Appendix: Graphs & Visualizations

- Some Graphs given in our Datapaper

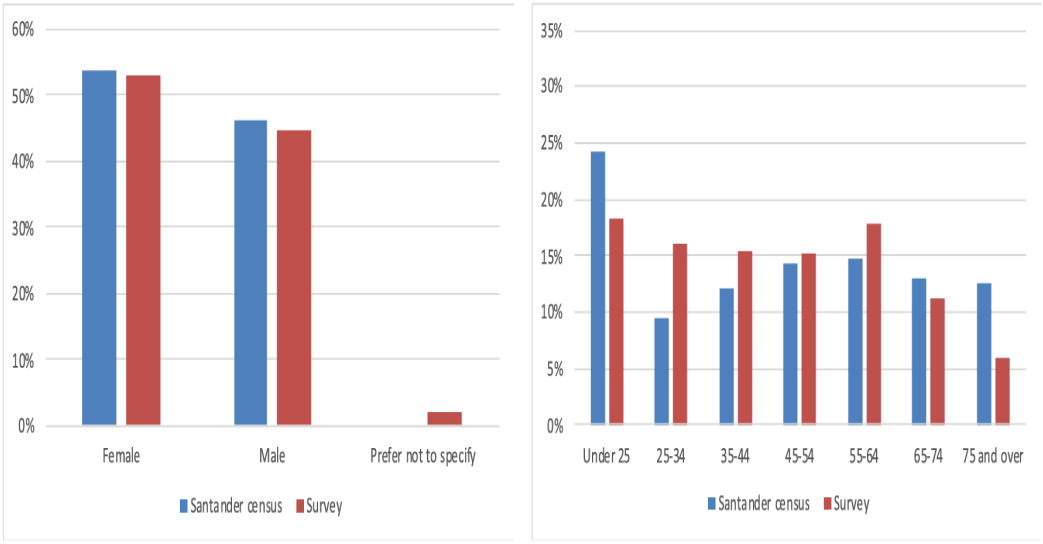


Fig. 1. Comparison of responses between the actual census and the sample.

Table 3

Scenarios of the SP experiment.

Scenario	Type Fare	Subscription fare (€)	Price per 30 min (€)
1	Annual	35	0,5
2	susbscrip-	20	0,25
3	tion + Price	50	0
4	per 30 min	50	0,25
5		20	0,5
6		35	0
10	Price per 30	0	1,5
11	min	0	1
12		0	0,5

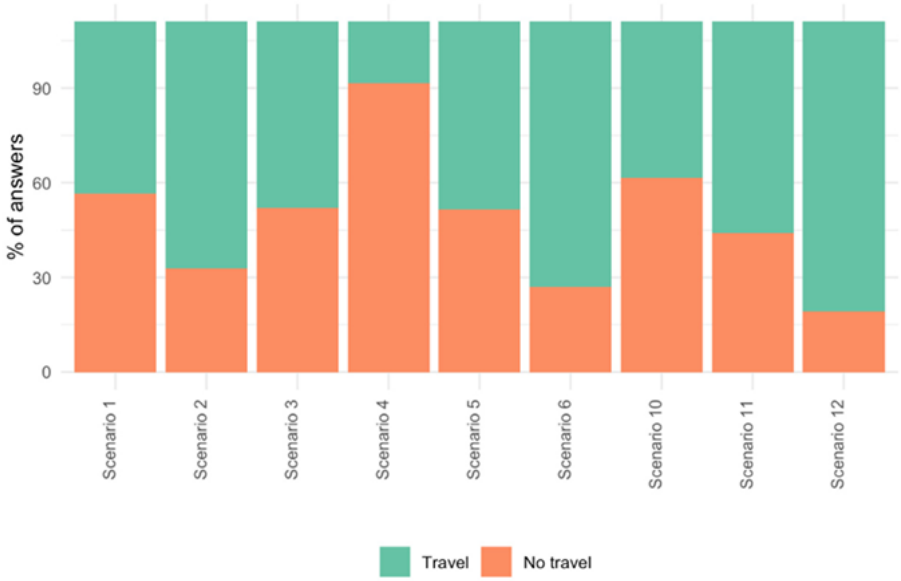
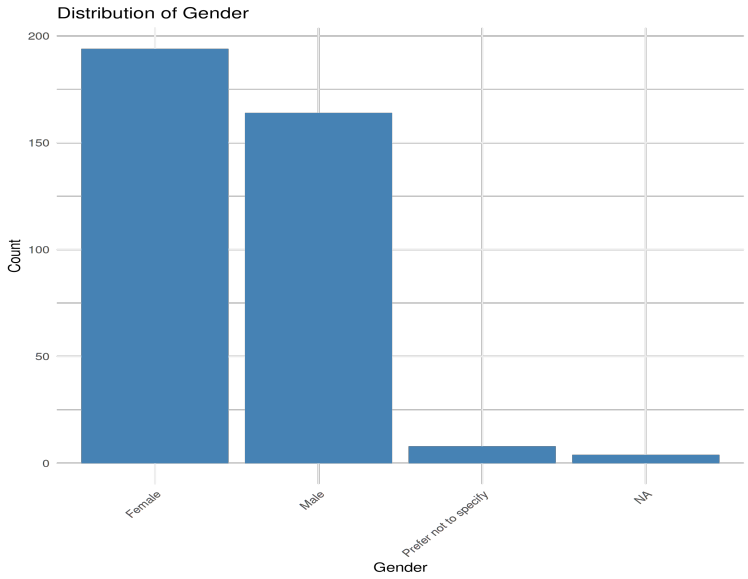
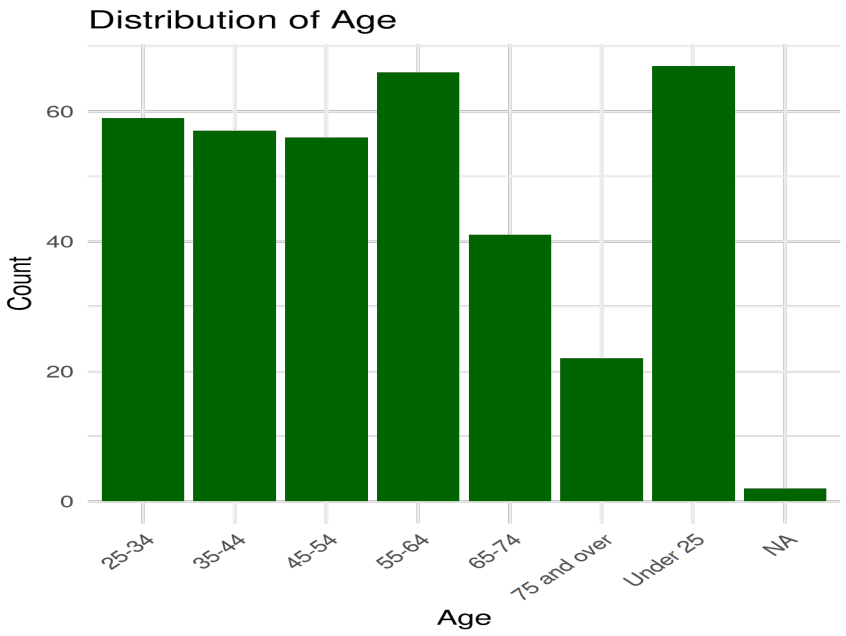
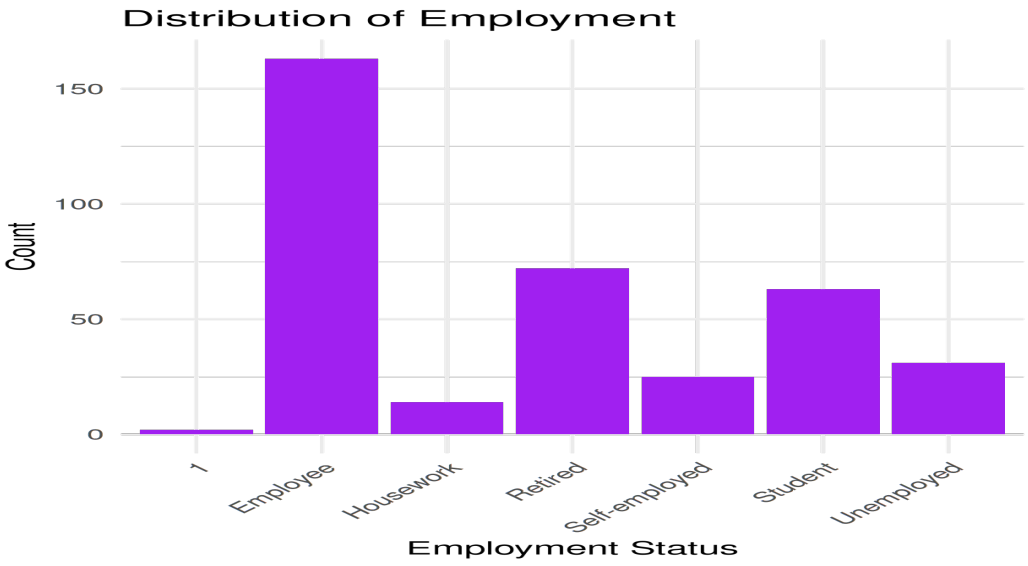


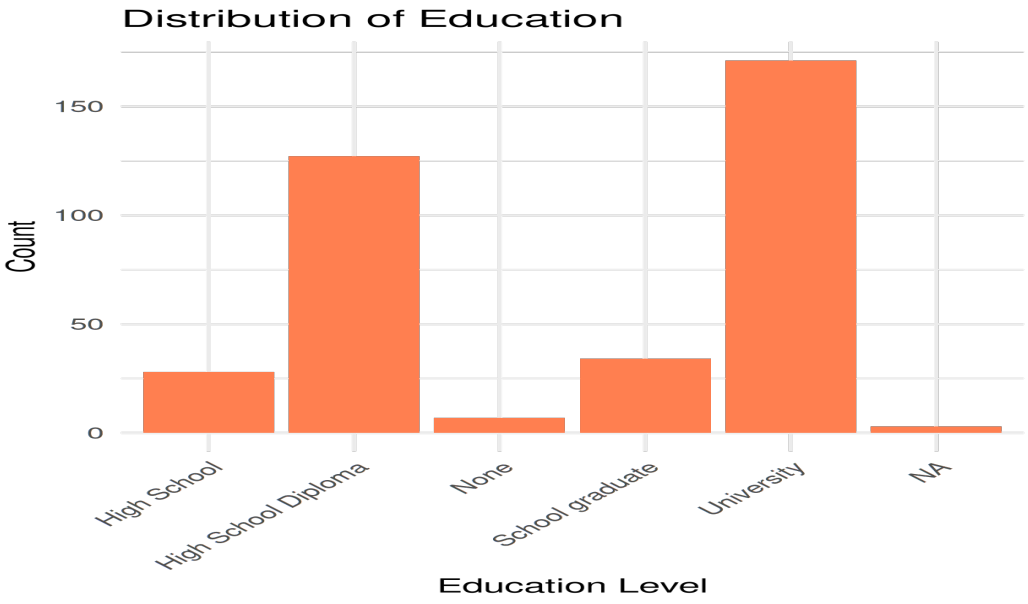
Fig. 2. Distribution of responses in the SP scenarios.

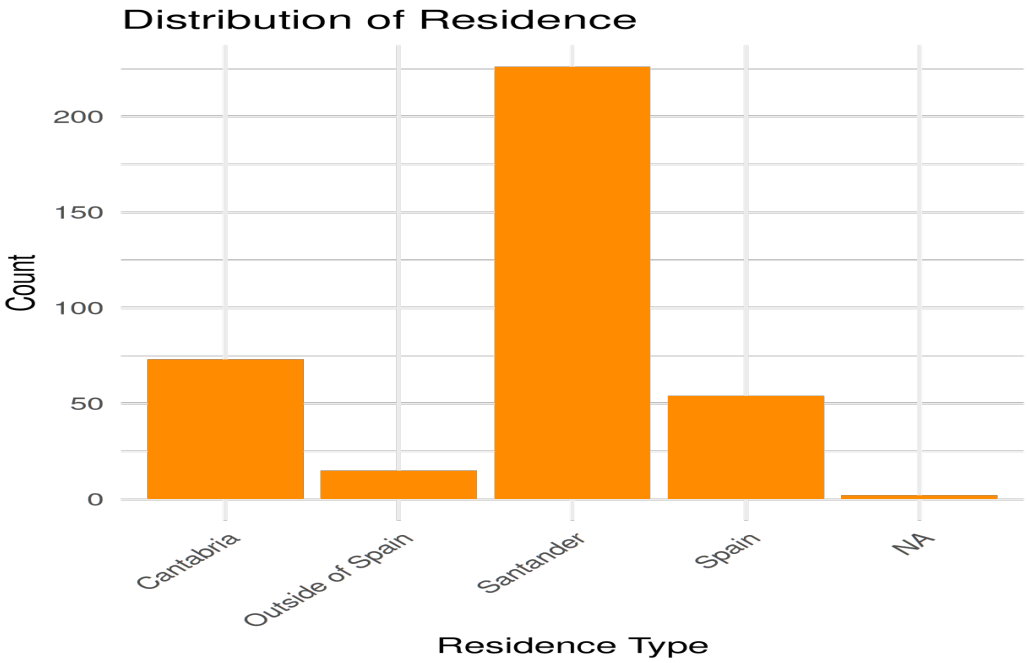
- Bar Graphs

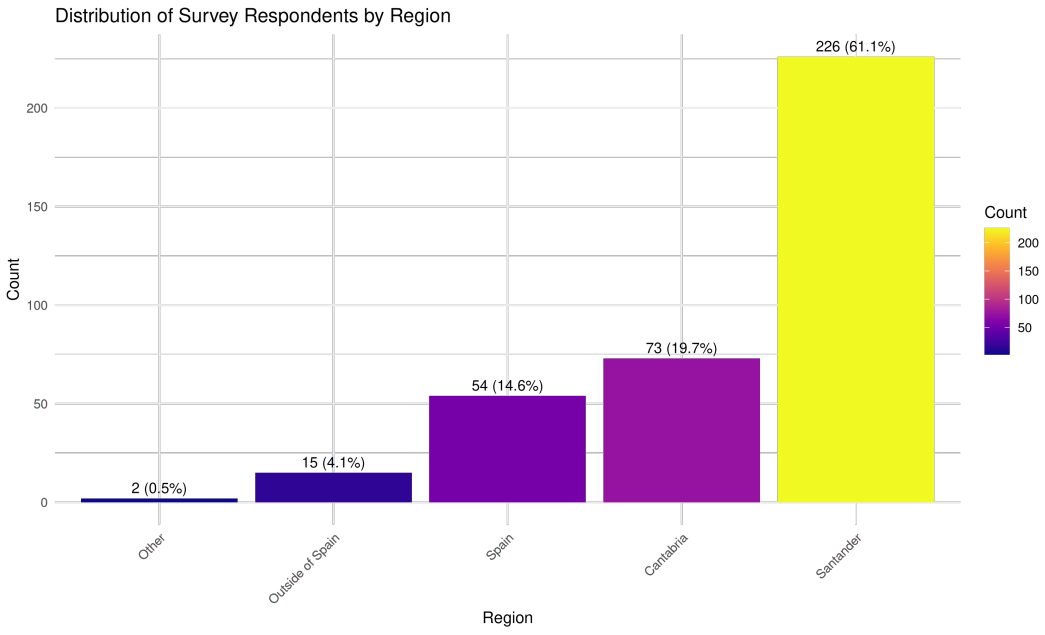



Distribution of Age
Count
60
40
20
0
25-34
35-44
45-54
55-64
65-74
75 and over
Under 25
NA
Age

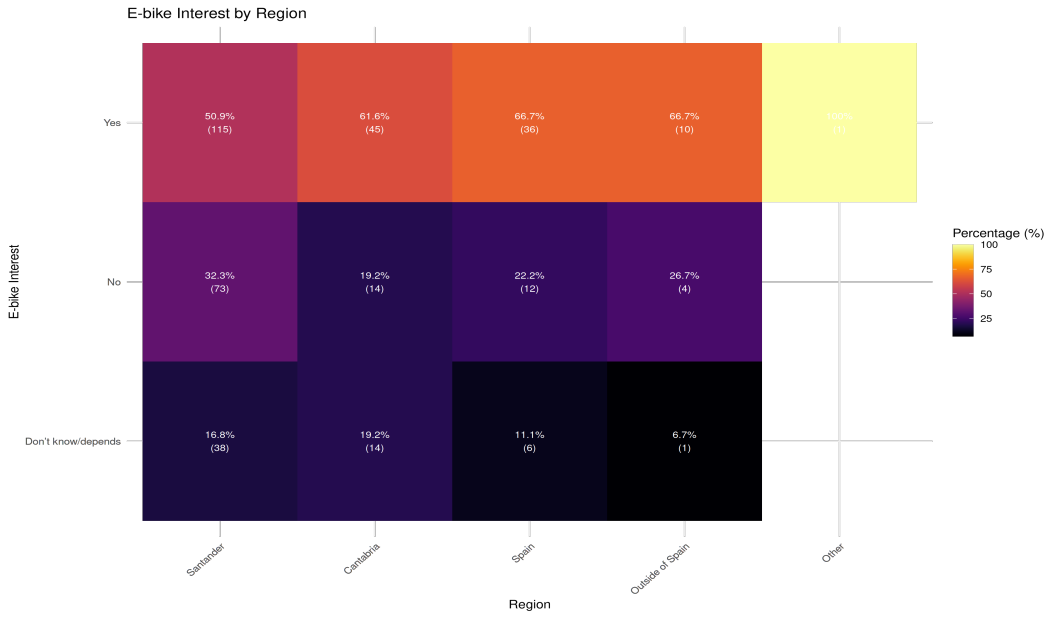

Distribution of Employment
Count
150
100
50
0
1
Employee
Housework
Retired
Self-employed
Student
Unemployed
Employment Status

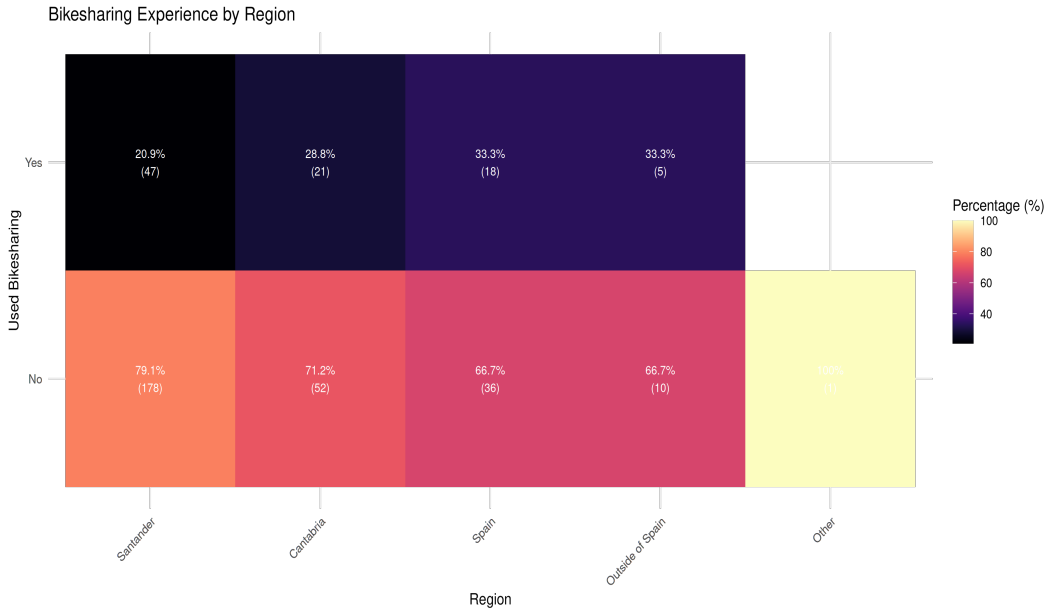

Distribution of Education
Count
150
100
50
0
High School
High School Diploma
None
School graduate
University
NA
Education Level

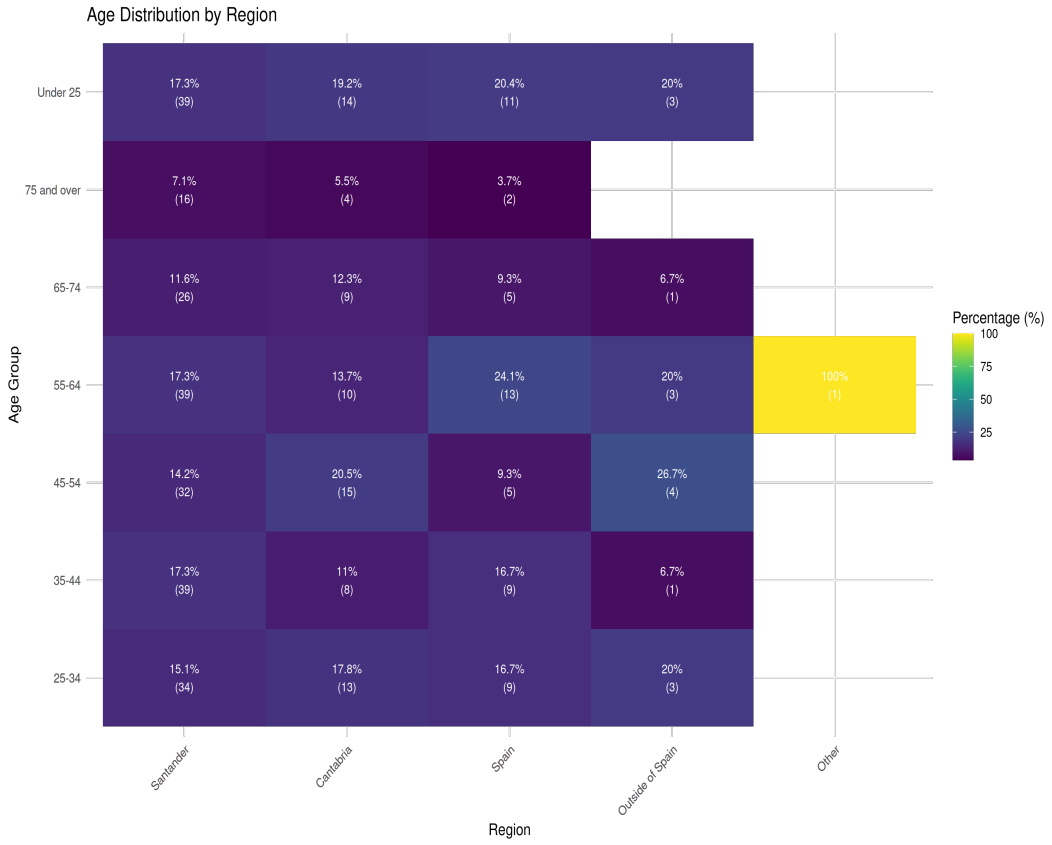




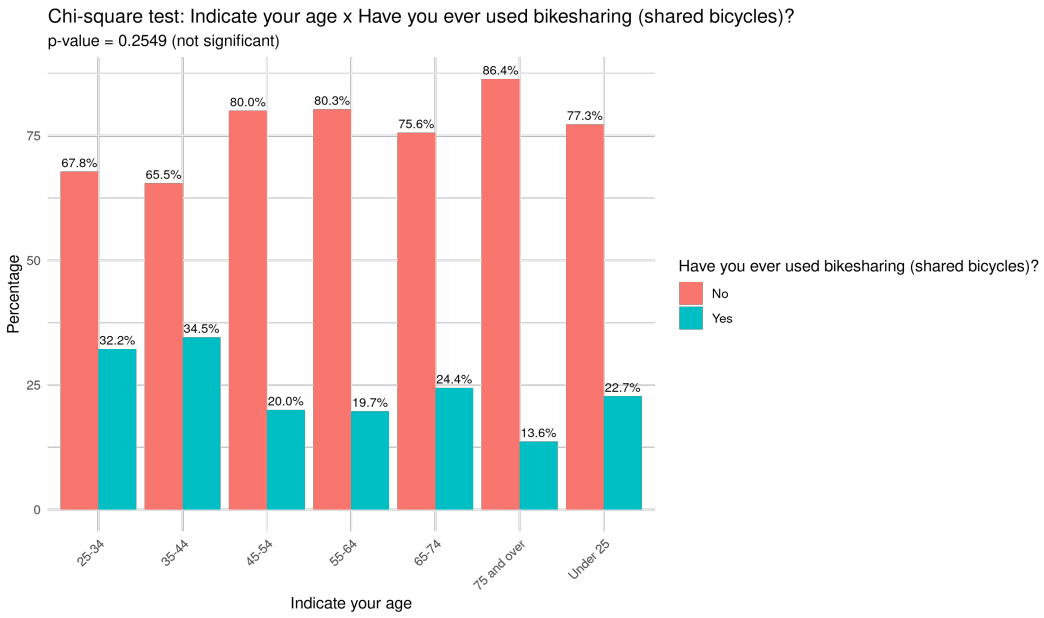
- Region Heatmaps

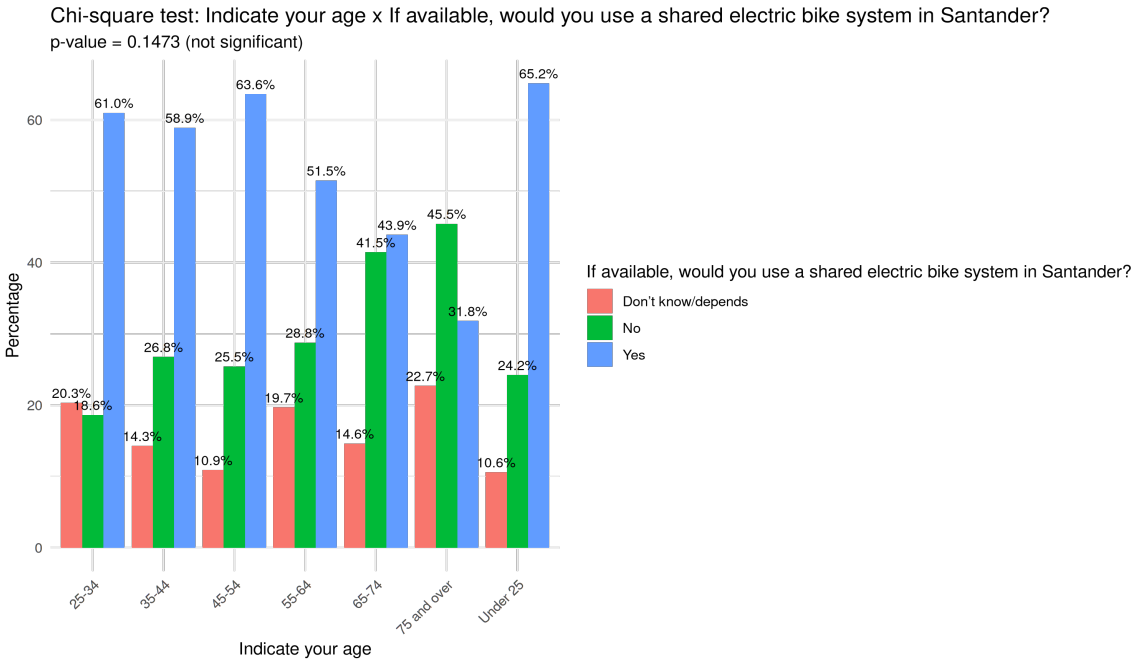

E-bike Interest by Region
Yes
No
Don't know/depends
E-bike Interest
50.9%
(115)
61.6%
(45)
66.7%
(36)
66.7%
(10)
100%
(1)
32.3%
(73)
19.2%
(14)
22.2%
(12)
26.7%
(4)
16.8%
(38)
19.2%
(14)
11.1%
(6)
6.7%
(1)
Santander
Cantabria
Spain
Outside of Spain
Other
Region
Percentage (%)
100
75
50
25


Bikesharing Experience by Region
Yes
No
Used Bikesharing
20.9%
(47)
28.8%
(21)
33.3%
(18)
33.3%
(5)
79.1%
(178)
71.2%
(52)
66.7%
(36)
66.7%
(10)
100%
(1)
Santander
Cantabria
Spain
Outside of Spain
Other
Region
Percentage (%)
100
80
60
40


Age Distribution by Region
Under 25
75 and over
65-74
55-64
45-54
35-44
25-34
Age Group
17.3% (39)
19.2% (14)
20.4% (11)
20% (3)
7.1% (16)
5.5% (4)
3.7% (2)
11.6% (26)
12.3% (9)
9.3% (5)
6.7% (1)
17.3% (39)
13.7% (10)
24.1% (13)
20% (3)
100% (1)
14.2% (32)
20.5% (15)
9.3% (5)
26.7% (4)
17.3% (39)
11% (8)
16.7% (9)
6.7% (1)
15.1% (34)
17.8% (13)
16.7% (9)
20% (3)
Santander
Cantabria
Spain
Outside of Spain
Other
Region
Percentage (%)
100
75
50
25

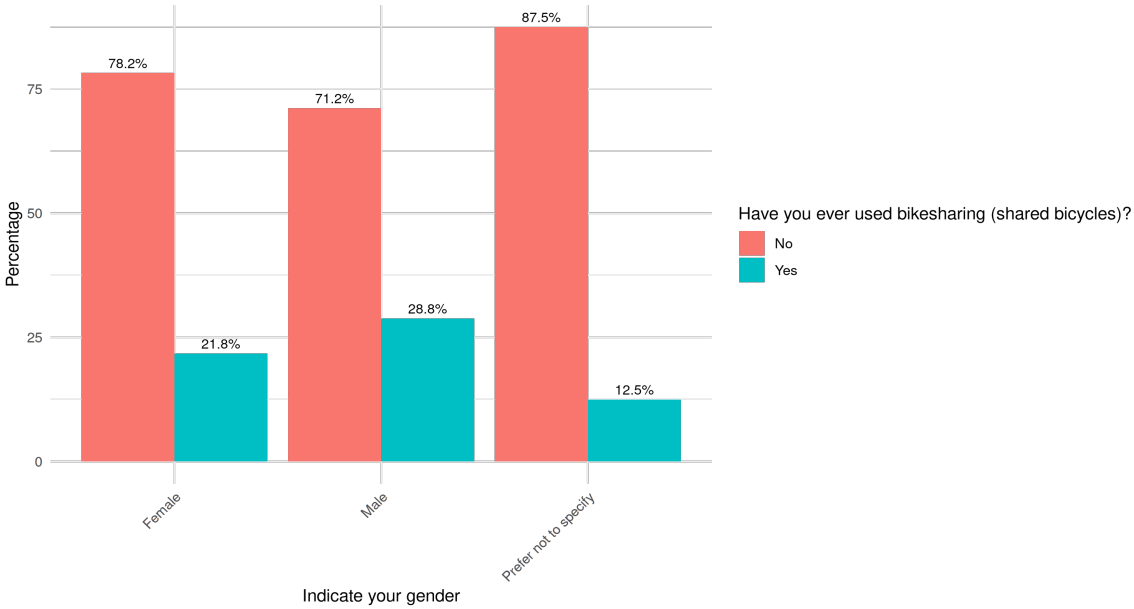
• Chi-Squared Test Graphs





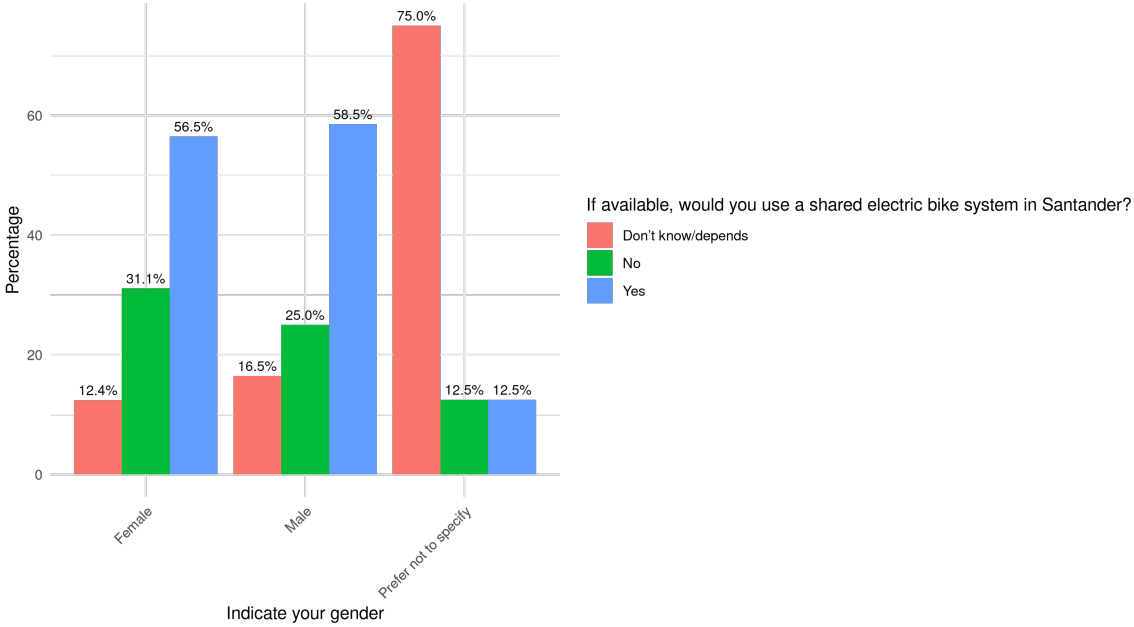
Chi-square test: Indicate your gender x Have you ever used bikesharing (shared bicycles)?

p-value = 0.2196 (not significant)



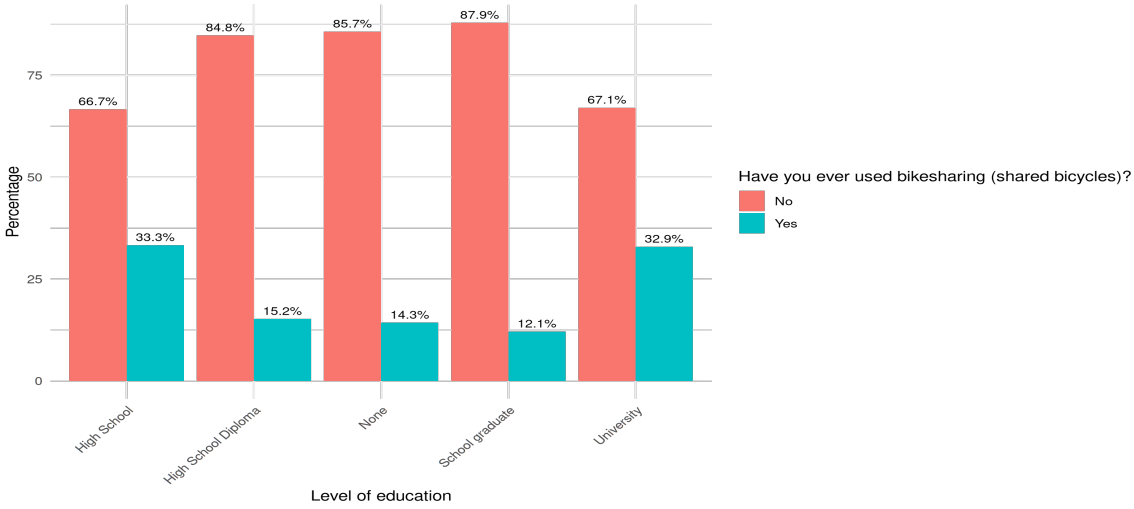
Chi-square test: Indicate your gender x If available, would you use a shared electric bike system in Santander?

p-value = 1e-04 (significant)



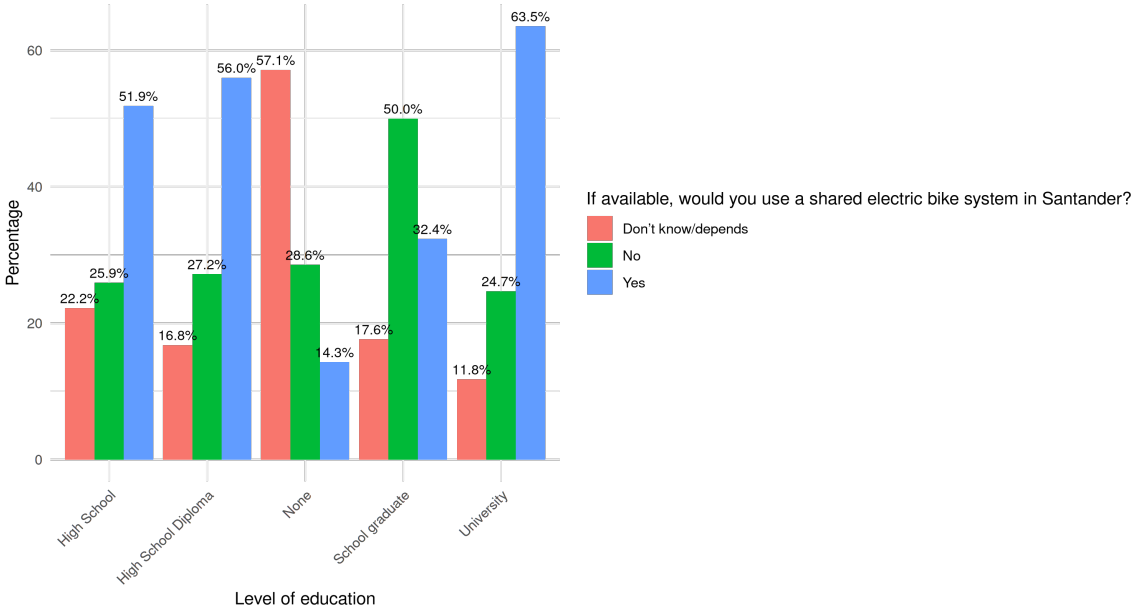
Chi-square test: Level of education x Have you ever used bikesharing (shared bicycles)?

p-value = 0.0023 (significant)



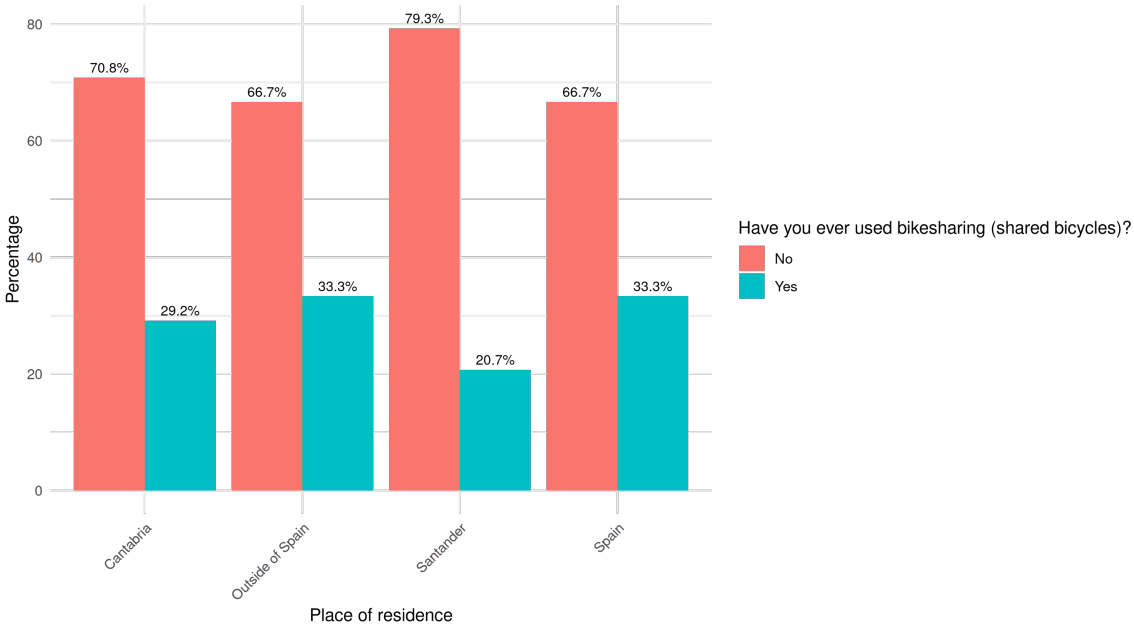
Chi-square test: Level of education x If available, would you use a shared electric bike system in Santander?

p-value = 0.0021 (significant)



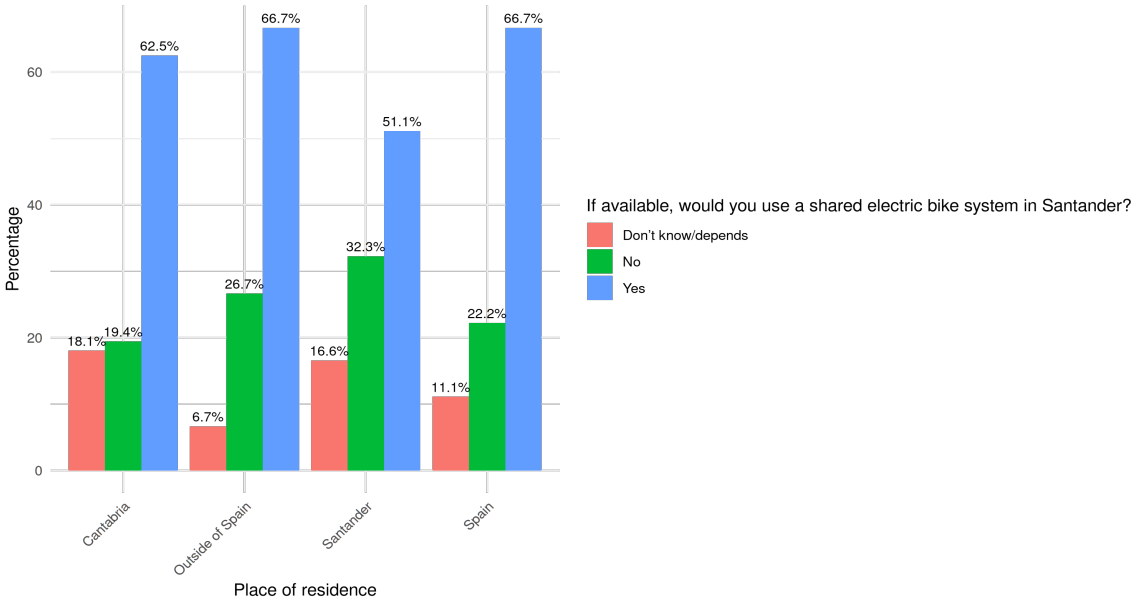
Chi-square test: Place of residence x Have you ever used bikesharing (shared bicycles)?

p-value = 0.144 (not significant)



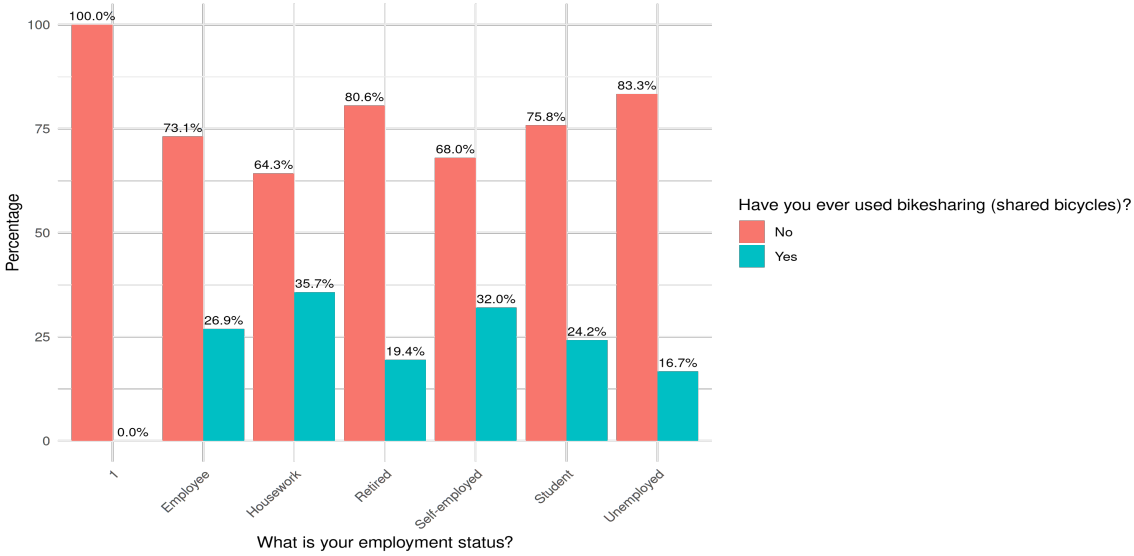
Chi-square test: Place of residence x If available, would you use a shared electric bike system in Santander?

p-value = 0.1886 (not significant)



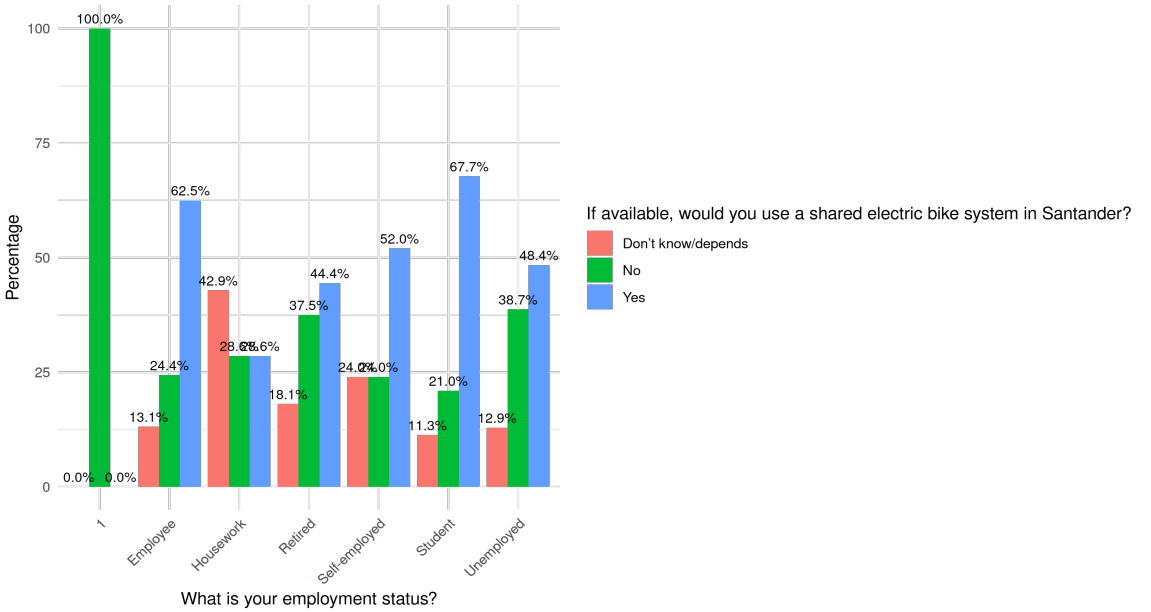
Chi-square test: What is your employment status? x Have you ever used bikesharing (shared bicycles)?

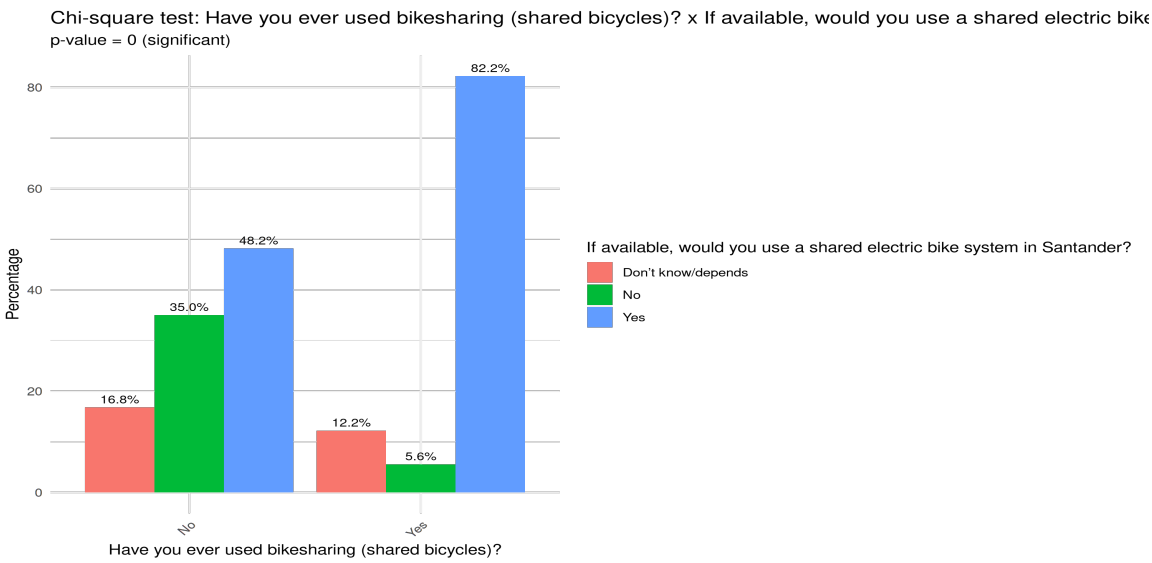
p-value = 0.612 (not significant)



Chi-square test: What is your employment status? x If available, would you use a shared electric bike system in Santa

p-value = 0.018 (significant)





Summary Table for Chi-Squared Tests:

	Relationship	ChiSquare	DoF	PValue	Significant
X-squared4	Place of residence vs bikesharing	5.412068	3	1.439936e-01	FALSE
X-squared6	Indicate your age vs e-bike	17.060918	12	1.473201e-01	FALSE
X-squared9	Place of residence vs e-bike	8.741993	6	1.886165e-01	FALSE
X-squared	Indicate your gender vs bikesharing	3.031914	2	2.195979e-01	FALSE
X-squared1	Indicate your age vs bikesharing	7.776459	6	2.549422e-01	FALSE
X-squared3	What is your employment status? vs bikesharing	4.479960	6	6.120140e-01	FALSE
X-squared10	bikesharing vs e-bike	35.999092	2	1.523689e-08	TRUE
X-squared5	Indicate your gender vs e-bike	24.129855	4	7.522731e-05	TRUE
X-squared7	Level of education vs e-bike	24.170757	8	2.145450e-03	TRUE
X-squared2	Level of education vs bikesharing	16.620097	4	2.290571e-03	TRUE
X-squared8	What is your employment status? vs e-bike	24.394309	12	1.796873e-02	TRUE

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