Green Urban Planning and Consumer Satisfaction: Evidence from Barcelona's Superblock Model[1]

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Abstract

This paper examines how green urban interventions affect consumer satisfaction and emotional well-being. We exploit the staggered implementation of Barcelona's Superblocks—an internationally recognized model of pedestrian-oriented, traffic-calmed urban design—to provide causal evidence on the customers' socio-emotional impacts of environmental improvements. Using a difference-in-differences framework, we analyze geolocated TripAdvisor restaurant reviews inside and around Superblocks, combining ratings with sentiment and emotion scores derived from natural language processing. We find that Superblocks significantly increase consumer satisfaction, raise sentiment scores, and foster positive emotions such as joy, while reducing negative emotions, including sadness, disgust, and fear. These effects are particularly pronounced among local residents, who possess deeper knowledge of the long-term benefits of urban redesign. Our findings demonstrate that green urban planning generates measurable socio-emotional benefits that spill over to local businesses, offering robust evidence on the broader well-being implications of pedestrian-friendly city design.

Keywords: Green urban design; Superblocks; Consumer satisfaction; Sentiment analysis; Emotions; Local businesses

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1 Introduction

Cities worldwide are increasingly adopting green urban planning strategies to address challenges such as air pollution, climate change, traffic congestion, and declining quality of life. Among these strategies, pedestrianization, traffic calming, and the creation of multifunctional public spaces—such as the Superblock model—have emerged as central tools to promote sustainable urban development (Gehl 2010, Nieuwenhuijsen 2020, Eggimann 2025). Prior studies have shown that such interventions can improve health (Mehdipanah et al. 2019, Cash-Gibson et al. 2024, López et al. 2025, Pérez et al. 2025), reduce air and noise pollution and promote physical activity (Mueller et al. 2020), improve perceptions of urban livability and well-being (Mouratidis 2021, Nieuwenhuijsen et al. 2024, Montgomery 2013), and foster stronger expressions of social capital in public spaces (Morales-Flores & Marmolejo-Duarte 2025). However, their broader consequences for customers and local businesses remain less understood. This paper addresses this gap by examining how Barcelona's Superblock model—an internationally recognized example of pedestrian-oriented urban design—affects consumer satisfaction and emotional well-being.

Barcelona's Superblocks provide a unique natural experiment for this study.[1] A Superblock typically consists of a cluster of multiple city blocks (commonly 3x3) with a sharply-defined perimeter. Within a Superblock, through-traffic is diverted to perimeter roads, drastically reducing motor vehicle use within the interior. Key features include pedestrianized streets, limited vehicular access (restricted to residents and essential services at low speeds), expanded green spaces, and prioritized infrastructure for walking, cycling, and public transportation. For each Barcelona's Superblock intervention under study, we geolocalize restaurants situated within the Superblock'

[1] Other cities that have adopted Superblock-inspired initiatives include Vitoria-Gasteiz (Superblocks), Ghent (Cirulation Plan), Brussels (Pentagon circulation plan), Vienna (Supergrätzl Favoriten), Milan (Piazze Aperte), Valencia (Supermanzana Orriols), Paris (Zone à Trafic Limité), Berlin (Kiezblocks), Copenhagen (Supercykelstier; Klimakvarter Østerbro), and London (Mini-Holland).

perimeter (treatment group) and those located immediately outside their boundaries (control group). Specifically, we assign restaurants to the treatment groups if they are located in fully or partially pacified streets. On the other hand, a control group consists of restaurants located within a 200-meter buffer zone. We use consumer review data from TripAdvisor[2] and measure consumer satisfaction using several proxies including consumer ratings, sentiment scores constructed from the textual reviews on TripAdvisor using Yelp-trained Natural Language Processing (NLP) models, and Ekman's basic emotions (Ekman 1999): joy, sadness, fear, anger, and disgust using NLP models.

To measure the causal impact of green urban planning on consumer satisfaction and emotional well-being, we implement a difference-in-differences (DID) approach with event-time dynamics, comparing outcomes for near-boundary establishments in short windows before and after activation. Narrow spatial buffers minimize neighborhood composition differences and mitigate broader area-level dynamics, while restaurant- and time-fixed effects absorb time-invariant heterogeneity and common shocks. Moreover, the treatment is plausibly exogenous to any single business's quality driven by city planning, budgeting, and street geometry rather than restaurant performance, which reduces concerns about endogeneity. Together, the sharp geography, precise timing, and high-frequency review data provide a setting ideally suited to identify causal impacts on satisfaction and sentiment, with limited scope for interference beyond the boundary and transparent tests for pre-trends and anticipation.

Our analysis focuses on the five Superblocks that have been fully implemented in Barcelona prior to December 31, 2019: Poblenou, Sant Antoni, Horta, Maternitat, and Hostafrancs.[3] Figure 1

[2]TripAdvisor is a global online platform for user-generated reviews of restaurants, hotels, and attractions that provides crowd-sourced ratings and textual feedback widely used in tourism and consumer behavior research.

[3]We restrict the treatment cohort to Superblocks inaugurated by December 2019 and, in the baseline, censor outcomes before the onset of the pandemic (ending the sample in February 2020). The COVID-19 shock introduced abrupt, heterogeneous changes to restaurant operations and demand (temporary closures; capacity limits; a collapse in international tourism and a shift toward local patrons), altered the volume and composition of online reviews, and triggered citywide mobility and street-reallocation measures that partially mimic our treatment. These forces risk

shows the location of these Superblocks.

[Insert Figure 1 here]

Figures 2 and 3 show examples of the urban transformation in the Superblocks of Sant Antoni and Ploblenou, respectively.

[Insert Figures 2 and 3 here]

Our main findings show a significant and sustained increase in consumer satisfaction after the inauguration of the Superblock. The average rating rose by 1.19 in the month after implementation. Parallel trends assumption is validated and we find no evidence of significant pre-intervention trends for any of our consumer satisfaction measures. These results are corroborated by the robust treatment effects in different time windows. Importantly, these effects are particularly pronounced among local consumers. The analysis of the sentiment scores reveals a significant improvement in consumer sentiments in treated areas. Sentiment scores derived from the Yelp-trained model increased by about 0.65, reflecting improved consumer perceptions of dining experiences. Superblocks significantly influenced emotional responses, as treated areas experienced increases in joy and reductions in sadness, disgust, and fear. However, anger shows a decrease post intervention, this effect is not statistically significant. Moreover, reviews mentioning terraces or family-friendly attributes increased significantly after Superblock inaugurations, suggesting an increase in social interactions in newly pacified spaces.

In the academic literature, relatively few studies have examined the impact of urban improvements on consumer satisfaction. On the one hand, prior research has focused on the economic

violating parallel trends and blurring the treated–control contrast through nonclassical treatment misclassification. Limiting the analysis to pre-COVID interventions and review windows preserves a clean identification environment in which post-treatment changes can be attributed to Superblocks rather than pandemic-era confounders.

effects of pedestrianization and green urban spaces, showing that retail stores in pedestrianized environments tend to experience increased sales and higher foot traffic compared to non-pedestrianized areas (Yoshimura et al. 2022). On the other hand, previous research has not studied the effects of interventions or redesigns (changes), but the effects of designs. Notably, De Nisco & Warnaby (2014) show that perceived urban aesthetics and tenant variety correlate with shoppers' emotions and approach behavior in a town-center survey and Van Ryzin (2004) find that consumers' expectations play a fundamental role in the formation of satisfaction judgments regarding the quality of urban services using data from a New York City citizen survey. However, to the best of our knowledge, there is no study on the causal evidence that a large-scale, green urban design intervention—such as the Barcelona Superblock program—raises consumer satisfaction and positive emotions in the immediate business environment, using detailed geolocated reviews and a boundary-focused empirical design.

Our paper also contributes to a growing body of literature that employs sentiment analysis to assess public reactions to urban design initiatives. Social media data, including geolocated check-ins and social media generated content, has been used to measure public sentiment towards green spaces and pedestrianization efforts (Lai & Deal 2022, Roberts et al. 2019, Yang et al. 2022). These studies highlight the role of accessibility, environmental quality, and human mobility in shaping public perceptions. However, existing research has primarily focused on generalized public sentiment, often measured through broad social media analysis, rather than the specific experiences and satisfaction of consumers in urban commercial spaces. We contribute to this literature by combining sentiment analysis with emotion classification, derived from natural language processing of restaurant reviews, to capture consumer responses to urban design changes, and shifting the focus towards consumer satisfaction in specific local businesses (restaurants).

The remainder of the paper is organized as follows. Section 2 presents the data and describes the empirical design, including the descriptive statistics. Section 3 presents our main result, robustness checks, heterogeneity tests, followed by the analysis of sentiment scores and emotions. Finally, Section 4 concludes, summarizing the main findings and their implications.

2 Data and Empirical Design

2.1 Data

Our sample period goes from July 1, 2016 to February 29, 2020. The first five Superblocks were inaugurated during that period, as summarized in Table 1 in Section 1.[4]

To construct the quasi-experimental design for our empirical analysis, we geolocated the universe of restaurants in Barcelona that are present on TripAdvisor, a popular online platform that provides reviews, recommendations, and other travel-related information. We extracted restaurant ratings based on user feedback, users' textual reviews about their experiences with restaurants, as well as user- and reviewer-specific characteristics such as total ratings by the reviewer, number of helpful votes on a particular review, user's average rating, and year of joining the platform. We also use all these textual reviews to construct sentiment scores and emotion indexes: [5] TripAdvisor ratings (i.e., rating scores provided by consumers), sentiment scores (i.e., text reviews sentiment analysis scores based on models trained with Yelp data), and emotions (Ekman's 5 basic emotions indexes: joy,

[4]As explained in Section 1, we deliberately exclude the COVID-19 period and its aftermath from our analysis in order to avoid confounding effects related to mobility restrictions, changes in consumer behavior, and structural shifts in the restaurant sector that could bias our estimates. The first lockdown in Spain was declared on March 14, 2020 to be effective on March 15, 2020

[5]The methodology for generating the sentiment scores and emotion indexes is described in Section 3.2.

sadness, fear, anger, and disgust).

We obtain data from TripAdvisor for at least 2 months before work initiated for Superblocks and 2 months after the Superblocks' inauguration (for timeline, see Table 1).[6] Then, we identify all restaurants that were located in fully or partially pacified streets within Barcelona's City Council-defined Superblock on the date of inauguration of each Superblock. These Superblock-treated restaurants were assigned a dummy variable *treatment* that takes the value 1 if the restaurant fell within the identification boundary at the time of its inauguration and 0 if the restaurant is in the control group. The control group consists of those restaurants located within a 200-meter ring outside the treatment delimitation.

[Insert Table 1 here]

Table 2 reports the summary statistics for the main dependent variables used in our analysis, distinguishing between treated restaurants (those located within Superblocks) and control restaurants (those outside). Results are presented for two time windows around the implementation of the interventions: Panel A covers two months (one month before and one month after), while Panel B extends the window to three months (1.5 months before and 1.5 months after). The variables include average ratings, sentiment-derived measures of joy, sadness, fear, anger, and disgust, as well as the Yelp-trained sentiment score index. For each specification, we report means for the combined sample, the treated group, and the control group, along with the difference in means (Treated – Control) and corresponding t-statistics.

The results show that, in the two-month window (Panel A), treated restaurants received an average rating of 4.148 compared to 3.699 for control restaurants, a difference that is statistically significant at the 1% level. This effect becomes even stronger when using the three-month window

[6]Table A1 in the Appendix provides a detailed definition of the main variables that we use in this study.

(Panel B), where the treated–control difference rises to 0.623 points. Overall, the descriptive statistics reveal systematic differences between treated and control restaurants, with higher ratings and more positive emotional content (particularly joy) in treated areas following the introduction of Superblocks. The statistical significance of these differences, especially in consumer satisfaction and sentiment, suggests that the interventions were associated with meaningful improvements in how consumers perceived their dining experiences.

[Insert Table 2 here]

Table 3 presents the mean values of the dependent variables used in our study during the pre- and post-intervention periods. It provides preliminary evidence on changes in different satisfaction measures for the treated group relative to the control group. For example, in the two-month window reported in Panel A, the average TripAdvisor rating for treated restaurants increased from 4.090 in the pre-intervention period to 4.250 in the post-intervention period. By contrast, the corresponding rating for control restaurants declined from 3.801 to 3.566 over the same period. These figures highlight descriptive patterns consistent with a positive effect of the intervention; however, they should not be interpreted as causal estimates. The formal identification strategy, presented in the following section, is required to establish the causal impact of Superblocks on consumer satisfaction and sentiment.

[Insert Table 3 here]

2.2 Empirical Strategy

We exploit the staggered implementation of Superblocks in Barcelona to identify the impact of this urban planning intervention on consumer satisfaction. Satisfaction is measured using TripAdvisor

ratings, as well as sentiment and emotion indexes constructed through textual analysis of consumer reviews. The treated group consists of restaurants located just within the boundaries of Superblocks, while the control group comprises restaurants located just outside these boundaries. Our identification strategy compares the evolution of outcomes between treated and control restaurants in the post-implementation period, under the standard difference-in-differences assumption that, in the absence of Superblocks, both groups would have followed parallel trends. Using restaurants located immediately outside the boundaries as the control group strengthens the credibility of this assumption, as these establishments are likely to share similar neighborhood characteristics and demand fundamentals with treated restaurants, while not being directly exposed to the intervention.[7]

To test whether consumer satisfaction increased for the treated group relative to the control group following the Superblock implementation, we estimate the following staggered difference-in-difference model:

$$\begin{aligned} Y_{i,j,t} = \beta_0 + \beta_1 \cdot (Treatment \times Post\ Superblock\ Inauguration)_{i,j} \\ + \beta_2 \cdot Post\ Superblock\ Inauguration_{i,j} + \gamma \cdot X_{k,j} + y_i + z_t + \varepsilon_{it}, \end{aligned} \tag{1}$$

where $Y_{i,j,t}$ is the consumer satisfaction experienced by a reviewer from restaurant i in Superblock j in time t. Our primary measure of consumer satisfaction is the *Rating Number* reported by a reviewer on the TripAdvisor platform. In addition to the *Rating Number*, we use machine learning natural language processing model to perform textual analysis on the text review provided by the reviewers and create sentiment and emotion indexes as alternative measures of consumer satisfaction. *Treatment* is an indicator variable with value 1 if the restaurant receiving the rating fell within the

[7]We formally test the parallel trends assumption in the next section and show that pre-treatment trends in ratings, sentiment, and emotions are statistically indistinguishable between treated and control restaurants.

boundary of identification at the time of its inauguration and 0 if the restaurant is located within a 200-meter ring outside the Superblocks' boundary. Figure 4 illustrates the spatial distribution of restaurants across the treatment and control areas within the Sant Antoni Superblock.

[Insert Figure 4 here]

Post Superblock Inauguration is an indicator equal to one on the date of the inauguration of the Superblock and the following months, and zero before the Superblock's construction start date. We omit the time between a Superblock's construction start date and it's inauguration date. All the regressions include time fixed effects, z_t, (year fixed effects or year $\times$ month fixed effects depending upong the specification) as well as restaurant fixed effects, y_i. As a robustness check, we also control for the reviewer's characteristics, $X_{k,t}$, such as *Total Ratings by Reviewer* (number of attractions a reviewer has rated till date); *Number of Helpful Votes* (number of upvotes a reviewer's ratings have received till date); *Average Rating by Reviewer*; as well as *Year TripAdvisor joined Fixed Effects* (controlling for the year in which a reviewer has joined the TripAdvisor platform). Standard errors, ε_{it}, are clustered at the restaurant level.

3 Results

This section presents our empirical results, examining the effect of the Superblocks' implementation on consumer satisfaction for restaurants that fell within the boundary of Superblock identification at the time of its inauguration (treated restaurants) relative to those located just outside the boundaries but within a 200-meter ring (control restaurants).[8] The analysis relies on the staggered difference-

[8]The 200-meter radius is chosen to ensure that control restaurants are geographically close enough to share similar neighborhood characteristics and demand conditions with treated restaurants, while remaining outside the direct area of

in-difference model specified in equation (1).

3.1 Ratings

Table 4 presents results from our restaurant level rating regressions. Ratings are measured as TripAdvisor ratings from individual customers' reviews of restaurants located in the treatment or control groups around the Superblocks. Columns [1]-[2] show results when using a time window of two months (one month before and one month after the event). Similarly, columns [3]-[4] and columns [5]-[6] report results when using time windows of three months and four months, respectively. Columns [1], [3], and [5] present specifications when using year fixed effects, while columns [2], [4], and [6] show specifications when using year-month fixed effects. All the columns control for the restaurant fixed effects.

[Insert Table 4 here]

We find that $Treatment \times Post\ Superblocks\ Inauguration$, the interaction term of interest, enters all estimations in Table 4 with a significantly positive coefficient. Focusing on columns [2], [4], and [6], specifications with year-month and restaurants fixed effects, the coefficients on the interaction term indicate that rating increased for the treated group relative to the control group in the magnitude of 1.189 units (column [2], 2 months time window), 0.633 units (column [4], 3 months time window), and 0.418 units (column [6], 4 months time window), respectively, following Superblocks' implementation.

These results suggest that ratings for treated restaurants increased following Superblocks' implementation as consumers rate their experiences in peaceful streets more than the experiences

intervention. Our results are robust to alternative definitions of the control group based on different distance thresholds. Specifically, we re-estimate the model using restaurants located within 100 meters and within 300 meters of Superblock boundaries as controls, and the main findings remain qualitatively unchanged.

consuming in noisy ones.

3.1.1 Robustness and Heterogeneity Tests

In our main regressions, we control for the time and restaurant fixed effects. However, given that our dependent variable is rating number from TripAdvisor, one may argue that this rating can be biased based on reviewer's (person who provides the rating) characteristics. To alleviate this concern, we control for different reviewer characteristics: *Total Ratings by Reviewer* (number of attractions a reviewer has rated till date); *Number of Helpful Votes* (number of upvotes a reviewer's ratings have received till date); *Average Rating by Reviewer* (average of all the ratings a reviewer have given on TripAdvisor till date); and *Year TripAdvisor joined Fixed Effects* (controlling for the year in which a reviewer has joined the TripAdvisor platform).

Table 5 present these results after controlling for reviewer specific characteristics. We find that our interaction term of interest, $Treatment \times Post\ Superblocks\ Inauguration$, is positive and statistically significant across all specifications. This confirms that our results are not driven by reviewer specific characteristics.

[Insert Table 5 here]

Next, we examine how review ratings for treated versus control restaurants responds to the Superblocks' inauguration event if restaurants are divided based on the origin of the review writer, review language, and primary category of the restaurant. Specifically, we divide our sample based on three criteria: (1) whether a review was written from Barcelona city or from outside Barcelona city; (2) whether language of the review is Spanish or not Spanish; and (3) whether a restaurant is local (labeled as Catalan, Spanish, or Mediterranean) or non-local (labeled anything other than

Catalan, Spanish, or Mediterranean, such as Asian, Mexican etc.). These results are reported in Table 6.

[Insert Table 6 here]

Panel A shows the results based on the origin of review. We find that the results are driven by reviews originated from the Barcelona city. For reviews originated from outside, results are are only significant for smaller time window of 2 months. Panel B reports similar results but for sub-samples based on whether a review is written in Spanish language or non-Spanish language. These results show that the positive effect of Superblocks inauguration is driven by reviews written in the Spanish language. Lastly, Panel C presents results for sub-samples formed on primary type of the restaurant. Here, we find confirmation that local restaurants drive our main results. Overall, results in Panels A, B, and C provide evidence that our main results are driven primarily by local factors.

We also address the concern that the distribution of ratings (our dependent variable) could be skewed. For this, we re-run our main results by using natural logarithm of number of ratings. As shown in Appendix Table A2, results across all the specifications are robust to this concern.

One potential concern with any difference-in-difference design is that the post-treatment effect could be the consequence of a preexisting trend unrelated to the treatment (inauguration of Superblock in our case) itself. For this to occur in an staggered difference-in-difference design, these potential preexisting trends would have to happen multiple times and be staggered, like the actual treatment effects, which is very unlikely. Nevertheless, we conduct formal parallel trend tests in Figure 5, which plots weekly coefficients on the interaction term of interest, together with ninety-five-percent confidence intervals. The regression specification is the the same as that reported in column [2] of Table 4, except that the effect of treatment is allowed to vary by week for each

week starting four weeks prior to the event and ending four weeks after. Figure 5 shows that there is no evidence of significant pre-inauguration trends for our main dependent variable.

[Insert Figure 5 here]

3.2 Sentiment Score and Emotions

In the previous section, we presented results based on a objective measure of consumer satisfaction, namely a numberical rating number observed on the TripAdvisor platform. But as noted earlier, we also get access to the textual review written by a reviewer along with the numerical rating number. We tap on this textual review and with the help of machine learning's natural language processing (NLP), we generate a sentiment index and various emotion based indexes based on reviews' textual comments.

First, we develop a continuous sentiment score (ranging from 1 to 5, the higher the more positive) from textual analysis of the reviews using a natural language processing model. This model was trained on 600,000 Yelp restaurant reviews spanning 2005 to 2019 across the United States, achieving a 94% accuracy in classifying review sentiments.[9] We use this score as an alternative measure of consumer satisfaction. Column [1] of Table 7 presents these results. Similar to results reported in previous section, Panel A, B, and C use a time window of two, three, and four months, respectively. We find that the coefficient estimate on $Treatment \times Post\ Superblocks\ Inauguration$ in Panel A and B is positive and statistically significant, confirming a positive effect of Superblock inauguration on this alternative measure of consumer satisfaction. Figure 6 shows no indication that these results are due to a violation of the parallel trend assumption.

[9]Application programming interface (API) used to develop this score is available at *https://huggingface.co/mrcaelumn/yelp_restaurant_review_sentiment_analysis*.

[Insert Table 7 here]

[Insert Figure 6 here]

Next, we use the machine learning's natural language processing (NLP) to carry out textual analysis and construct emotion scores based on the review text. In other words, we mine the sentiment at emotional level of the individual TripAdvisor reviews' textual comments. These emotion scores are continuous (ranging from 1 to 5, the higher the more presence of the emotion). The model used in this case was trained on 58,000 Reddit comments from 2005 to 2019, achieving approximately 94% accuracy in emotion classification.[10] The developed indexes covered the following spectrum of emotions: *Joy*, *Sadness*, *Fear*, *Anger*, and *Disgust*.

Columns [2]-[6] of Table 7 report results when using these emotion indexes as the dependent variables. Focusing on *Joy*, we find evidence (see Panel A), that consumers experienced increased joy following the inauguration of Superblocks. Results in column [3] (see Panel C) shows that consumers' review had a decreased content of *sandness* after the event. Column [4] suggests lower degree of *Fear* (see Panel A, B, and C) in consumers' textual review post the Superblock inauguration. Column [5] reports result for *Anger* showing negative coefficient estimate on our interaction term of interest. Nevertheless, it is not statistically significant in any of the Panels, therefore, we cannot comment anything conclusively for this emotion index. Finally, column [6] shows evidence that the *Disgust* emotion in consumers' textual review has decreased following the inauguration of Superblocks (see Panel A and B). Overall, using alternative measures of emotions constructed through machine learning model, columns [2]-[6] in Table 7 provide evidence that consumers' satisfaction has improved after the inauguration of SuperBlocks.[11] This suggests that

[10]Application programming interface (API) used to develop this score is available at *https://huggingface.co/SamLowe/roberta-base-go_emotions*

[11]Appendix Table A3 shows that results in Table 7 are robust if we use natural logarithm of sentiment or emotion based indexes as dependent variable.

local consumers welcomed government's decision of pacifying these particular blocks of Barcelona city. Figure 7 shows that the parallel trend assumption holds for the variables considered in columns [2]-[6] in Table 7.

[Insert Figure 7 here]

One open question is whether such an urban planning implementation increases consumer satisfaction by providing an open air space availability which at the same time is more family friendly. To test this, we again carried out textual analysis and constructed a measure based on terrace or family friendly reviews. Specifically, we constructed an indicator variable that takes value one if the Tripadvisor review mentions terrace-related words or references (terraze, terrazze, terrace, sunny, outdoors, patio, outdoor, moon, sky, sun, breezy, outside) or family-related words or references (kid, kids, son, daughter, family, baby) at least once, or zero otherwise. We then use this as dependent variable and report these results in Table 8. Columns [2] and [3] in Table 8 show that terrace or family friendly reviews indeed increased post SuperBlock inauguration, showing another evidence of increased consumer satisfaction.

[Insert Table 8 here]

4 Conclusions and Policy Implications

This study examines the causal impact of green urban planning interventions on consumer satisfaction, sentiment, and emotions, using the implementation of Barcelona's Superblocks as a natural experiment. Leveraging geolocated TripAdvisor reviews of restaurants, we identify treatment and

control groups based on street pacification and estimate effects using a difference-in-differences design with time and restaurant fixed effects, as well as other relevant controls. Consumer satisfaction is measured through ratings, text-based sentiment, and emotional content derived from natural language processing.

We find that Superblocks significantly improve consumer experiences: ratings increase by an average of 1.19 points and sentiment scores by 0.65 points. Emotional analysis reveals a marked rise in joy and a decline in sadness, disgust, and fear. These effects are especially pronounced among local users relative to non-locals (e.g., tourists), suggesting that residents benefit most from enhanced neighborhood quality. In addition, reviews increasingly mention outdoor seating and family-friendly environments, indicating that the interventions foster social interaction and leisure opportunities. Methodologically, this paper demonstrates the value of linking geolocated consumer data with advanced sentiment and emotion analysis to capture the socio-emotional dimensions of urban interventions that are often overlooked in conventional evaluations.

Our findings suggest that the mechanisms underlying these improvements include reduced noise and air pollution, enhanced walkability, expanded green space, and safer public areas. These urban design changes not only contribute to environmental and public health objectives but also generate positive spillovers for local businesses, underscoring the economic as well as social value of green urban planning.

The evidence presented here has direct implications for urban policy and planning. First, interventions such as Superblocks not only advance environmental and public health objectives but also enhance the social and economic vitality of neighborhoods by improving consumer satisfaction and local business performance. Second, the stronger benefits observed among local residents highlight the importance of designing urban policies that prioritize community well-being and

inclusivity, rather than focusing solely on tourism-driven development. Third, the observed increases in joy and reductions in negative emotions suggest that pedestrian-oriented interventions can serve as effective tools for fostering social cohesion and resilience in dense urban areas. Policymakers should therefore view green urban planning as a multidimensional investment that simultaneously addresses environmental sustainability, public health, economic competitiveness, and social welfare.

Future research should explore the long-term sustainability of these effects, their distributional impacts across different socioeconomic groups, and the extent to which they can be generalized to other urban contexts beyond Barcelona. Comparative studies across cities could shed light on the scalability and transferability of the Superblock model.

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Tables and Figures

Table 1: Timeline and Characteristics of Superblock Projects. This table presents a comprehensive timeline and key details of various Superblock projects, including the name, construction start date, inauguration date, and a brief description of each project. The descriptions highlight the primary interventions and objectives, such as pedestrianization, traffic calming measures, and urban design improvements, reflecting the evolution and implementation of the Superblock concept in different neighborhoods.

Superblock name	Construction start date	Inauguration date	Description
Poblenou	2016-09-01	2019-12-30	First official Superblock; comprehensive pedestrianization and traffic redirection.
Sant Antoni	2017-09-01	2019-11-30	Traffic calming measures with green corridors; partial pedestrianization.
Maternitat	2017-12-01	2018-07-30	Tactical urbanism interventions, including street closures and reorganization of traffic flows.
Horta	2018-10-15	2019-09-15	Localized traffic reductions with street redesign and creation of new cycling infrastructure.
Hostafrancs	2017-12-01	2018-07-30	Small-scale interventions focusing on improving local mobility and reducing vehicular dominance.

Table 2: Descriptive Statistics of Dependent Variables. This table presents the mean values for the main dependent variables analyzed in our study, broken down into three groups: the combined sample, treated restaurants, and control restaurants. Additionally, the difference in means between treated and control groups (Treated - Control) is reported, with corresponding t-statistics shown in parentheses. Panels A and B display the results for 2 and 3 months time windows, respectively, that is, panel A (panel B) includes a time window of 1 month (1.5 months) before construction starts and time window of 1 month (1.5 months) after inauguration. Statistical significance levels are indicated by ***, **, and *, corresponding to 1%, 5%, and 10% significance levels.

Mean	Rating Number	Joy	Sadness	Fear	Anger	Disgust	Yelp	Obs.
Panel A - Time Window: 2 Months								
Combined Sample	3.813	2.700	1.117	1.050	1.065	1.245	4.356	747
Treated	4.148	3.203	1.108	1.057	1.126	1.253	4.622	189
Control	3.699	2.530	1.120	1.047	1.044	1.243	4.266	558
Treated - Control	0.449***	0.674***	-0.012	0.010	0.083***	0.011	0.356***	
	(3.64)	(5.16)	(-0.33)	(0.38)	(3.65)	(0.19)	(4.63)	
Panel B - Time Window: 3 Months								
Combined Sample	3.765	2.688	1.114	1.058	1.064	1.241	4.321	1,150
Treated	4.223	3.135	1.121	1.090	1.108	1.271	4.603	305
Control	3.600	2.527	1.112	1.046	1.048	1.230	4.219	845
Treated - Control	0.623***	0.609***	0.009	0.045**	0.060***	0.041	0.384***	
	(6.12)	(5.97)	(0.32)	(2.09)	(3.62)	(0.92)	(6.15)	

Table 3: Descriptive Statistics: Pre versus Post Event. This table presents the mean values for the main dependent variables analyzed in our study during pre and post event period for both treated and control restaurants. Panels A and B display the results for 2 and 3 months time windows, respectively, that is, panel A (panel B) includes a time window of 1 month (1.5 months) before construction starts and time window of 1 month (1.5 months) after inauguration.

Mean	Rating Number	Joy	Sadness	Fear	Anger	Disgust	Yelp	Obs.
Panel A - Time Window: 2 Months								
Pre-event Treated	4.091	3.186	1.125	1.082	1.139	1.291	4.574	121
Post-event Treated	4.250	3.235	1.077	1.014	1.104	1.187	4.707	68
Pre-event Control	3.801	2.602	1.136	1.051	1.040	1.246	4.176	316
Post-event Control	3.566	2.435	1.098	1.042	1.048	1.238	4.382	242
Panel B - Time Window: 3 Months								
Pre-event Treated	4.194	3.166	1.135	1.134	1.108	1.292	4.583	191
Post-event Treated	4.272	3.084	1.096	1.016	1.107	1.236	4.636	114
Pre-event Control	3.669	2.540	1.137	1.058	1.050	1.239	4.143	465
Post-event Control	3.516	2.510	1.081	1.031	1.046	1.220	4.311	380

Table 4: Rating Number of Treated Restaurants after Superblock Implementation. This table presents estimations from rating number regressions. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variable in all the columns is the Tripadvisor rating numbered from 1 (lowest) to 5 (highest). Columns [1]-[2], [3]-[4], and [5]-[6] uses a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Rating Number					
	Time Window: 2 Months		Time Window: 3 Months		Time Window: 4 Months	
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment × Post Superblock Inauguration	1.189***	1.189***	0.648***	0.633***	0.388**	0.418**
	(3.95)	(3.85)	(3.07)	(3.01)	(2.08)	(2.30)
Post Superblock Inauguration	−0.809**	Absorbed	−0.501	Absorbed	−1.125***	Absorbed
	(-2.23)		(-1.16)		(-3.33)	
Year Fixed Effects	Yes	No	Yes	No	Yes	No
Year-Month Fixed Effects	No	Yes	No	Yes	No	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	747	747	1,150	1,150	1,479	1,475
Number of Restaurants	109	109	136	136	158	156
Adjusted - R^2	0.520	0.516	0.551	0.573	0.529	0.547

Table 5: Rating Number of Treated Restaurants after Superblock Implementation: Controlling for Reviewer Characteristics. This table presents estimations from rating number regressions while controlling for different characteristics of the rating providers. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variable in all the columns is the Tripadvisor rating numbered from 1 (lowest) to 5 (highest). Columns [1]-[4], [5]-[8], and [9]-[12] use a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Rating Number											
	Time Window: 2 Months				Time Window: 3 Months				Time Window: 4 Months			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Treatment × Post Inauguration	1.094***	0.890**	1.046***	0.902***	0.596**	0.383	0.636***	0.591***	0.524***	0.452**	0.561***	0.540***
	(3.33)	(2.22)	(3.80)	(3.07)	(2.59)	(1.42)	(3.18)	(2.95)	(2.83)	(2.26)	(3.50)	(3.14)
Total Ratings by Reviewer	−0.001	0.001	0.001	0.001	−0.001	0.001	0.001	0.001	−0.001	0.001	0.001	0.001
	(-0.37)	(0.23)	(0.13)	(0.09)	(-0.28)	(0.46)	(0.52)	(0.54)	(-0.32)	(0.83)	(0.85)	(0.87)
Number of Hepful Votes		−0.003	0.002	0.002		−0.002	0.001	0.001		−0.003	−0.001	0.001
		(-0.85)	(0.54)	(0.68)		(-0.88)	(0.28)	(0.62)		(-1.55)	(-0.30)	(0.05)
Average Rating by Reviewer			0.877***	0.892***			0.964***	0.960***			0.947***	0.942***
			(5.78)	(6.29)			(7.68)	(7.93)			(8.87)	(8.90)
Year Tripadvisor joined Fixed Effects				Yes				Yes				Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Post Inauguration	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	551	427	343	343	851	668	541	541	1,132	891	708	708
Number of Restaurants	109	97	85	85	136	117	109	109	156	140	127	127
Adjusted - R^2	0.327	0.296	0.461	0.474	0.268	0.293	0.484	0.491	0.280	0.294	0.439	0.441

Table 6: Rating Number of Treated Restaurants after Superblock Implementation: Heterogeneity Tests. This table presents estimations from rating number regressions. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variable in all the columns is the Tripadvisor rating numbered from 1 (lowest) to 5 (highest). Columns [1]-[2], [3]-[4], and [5]-[6] uses a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively. Panel A, B, and C present results based on the origin of the review writer, review language, and primary category of the restaurant, respectively. The restaurant category is defined as *Local* if a restaurant is exclusively labeled as Catalan, Spanish, or Mediterranean. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Rating Number					
	Time Window: 2 Months		Time Window: 3 Months		Time Window: 4 Months	
	Panel A: Origin of Review					
	Barcelona	Non-Barcelona	Barcelona	Non-Barcelona	Barcelona	Non-Barcelona
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment × Post Inauguration	2.461**	1.053***	2.162***	0.067	1.250***	0.271
	(2.61)	(2.81)	(3.39)	(0.24)	(2.95)	(1.25)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	91	392	162	621	223	840
Number of Restaurants	36	77	57	105	71	128
Adjusted - R^2	0.259	0.347	0.402	0.270	0.404	0.280
	Panel B: Review Language					
	Spanish	Non-Spanish	Spanish	Non-Spanish	Spanish	Non-Spanish
Treatment × Post Superblock Inauguration	1.126**	1.312**	1.142***	0.001	0.822***	−0.064
	(2.09)	(2.13)	(3.03)	(0.00)	(2.73)	(-0.21)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	304	401	469	627	616	797
Number of Restaurants	65	58	87	75	106	88
Adjusted - R^2	0.458	0.581	0.402	0.692	0.396	0.703
	Panel C: Restaurant Category					
	Local	Non-Local	Local	Non-Local	Local	Non-Local
Treatment × Post Superblock Inauguration	1.867***	1.046***	1.907***	0.381	0.952***	0.224
	(4.20)	(2.66)	(4.06)	(1.47)	(2.68)	(0.96)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	272	472	388	760	464	1,009
Number of Restaurants	29	79	35	101	39	117
Adjusted - R^2	0.568	0.232	0.642	0.185	0.639	0.204

Table 7: Sentiment Indexes of Treated Restaurants after Superblock Implementation. This table presents estimations from sentiment index regressions. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variables in columns [1] to [6] are Yelp index, Joy index, Sadness index, Fear index, Anger index, and Disgust index, respectively. These indexes are constructed by textual analysis using large language models (LLMs) in machine learning. Panel A, B, and C use a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Panel A: Time Window: 2 months					
Dep. variables:	Yelp	Joy	Sadness	Fear	Anger	Disgust
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment × Post Inauguration	0.652***	0.844**	−0.097	−0.100**	−0.099	−0.482**
	(2.98)	(2.50)	(-1.41)	(-2.10)	(-1.42)	(-2.40)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	747	747	747	747	747	747
Number of Restaurants	109	109	109	109	109	109
R^2	0.675	0.536	0.360	0.133	0.194	0.378
	Panel B: Time Window: 3 months					
Treatment × Post Inauguration	0.312**	0.316	−0.084	−0.093**	−0.021	−0.255*
	(2.28)	(1.02)	(-1.26)	(-2.10)	(-0.47)	(-1.75)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	1,150	1,150	1,150	1,150	1,150	1,150
Number of Restaurants	136	136	136	136	136	136
R^2	0.656	0.473	0.306	0.114	0.161	0.302
	Panel C: Time Window: 4 months					
Treatment × Post Inauguration	−0.007	0.103	−0.103**	−0.077*	−0.020	−0.092
	(-0.06)	(0.35)	(-2.28)	(-1.68)	(-0.52)	(-0.68)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	1,475	1,475	1,475	1,475	1,475	1,475
Number of Restaurants	156	156	156	156	156	156
R^2	0.595	0.433	0.259	0.116	0.223	0.270

Table 8: Terrace and Family Friendly Reviews after Superblock Implementation. This table presents estimations from review tone regressions. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variable in all the columns is an indicator equals to one if the Tripadvisor review mentions terrace (terraze, terrazze, terrace, sunny, outdoors, patio, outdoor, moon, sky, sun, breezy, outside) or family friendly words (kid, kids, son, daughter, family, baby) at least once, or zero otherwise. Columns [1], [2], and [3] use a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively.. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Terrace or Family Friendly Review		
	Time Window: 2 Months	Time Window: 3 Months	Time Window: 4 Months
	[1]	[2]	[3]
Treatment × Post Inauguration	0.071	0.077*	0.121***
	(1.19)	(1.83)	(2.61)
Year-Month Fixed Effects	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed
Observations	699	1,086	1,387
Number of Restaurants	109	136	156
R^2	0.317	0.276	0.220

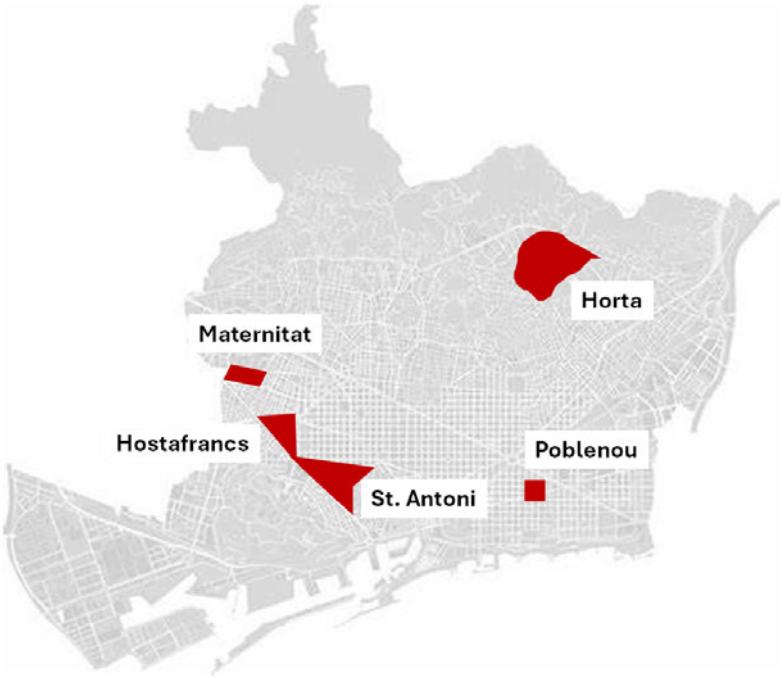

Figure 1: Spatial Distribution of Barcelona Superblocks. This map highlights the five Superblocks analyzed in this study—Poblenou, Sant Antoni, La Maternitat, Horta, and Hostafrancs—showing each Superblock's exact boundaries within Barcelona's street network. The visualization makes clear how these traffic-calmed zones are distributed across distinct neighborhoods. Map data and elaboration sourced from the Barcelona City Council.

Figure 2: Street Pacification in Sant Antoni's Superblock. The left image (2024) shows the area following the Superblock implementation, while the right image (2015) depicts the same location before the Superblock. Authors' elaboration using Google Street View.

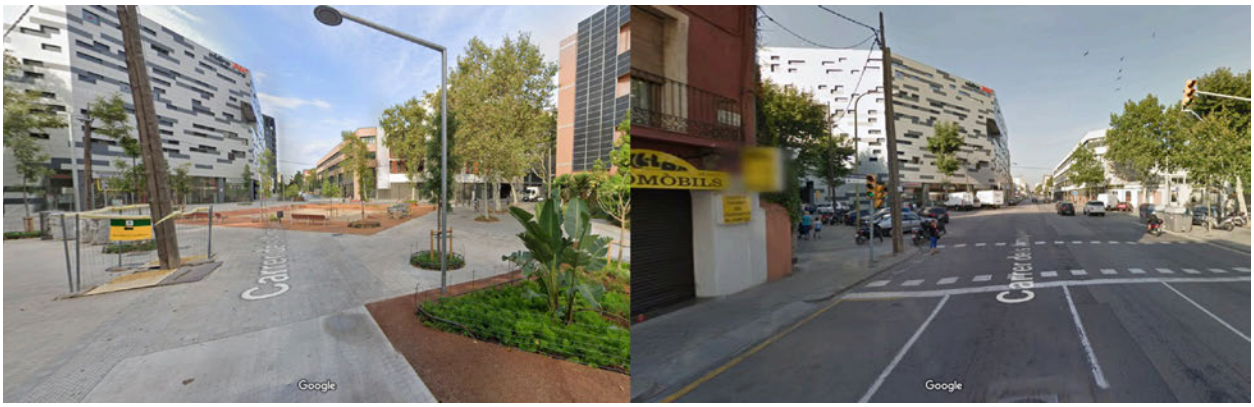

Figure 3: Street Pacification in Poblenou's Superblock. The left image shows the area after the implementation of the Superblock in 2024, and the right image shows the same location before the implementation of the Superblock in 2014. Authors' elaboration using Google Street View.

Figure 4: Identification of Treatment and Control Groups: Example from Sant Antoni's Superblock. The left panel illustrates the identification of fully pacified streets (in green) as specified by official Council documentation following the implementation of the Superblock. The right panel presents our classification: treatment restaurants (in red) located within the fully pacified streets depicted on the left panel and control restaurants (in blue) situated immediately outside but adjacent to the pacified area. Authors' elaboration.

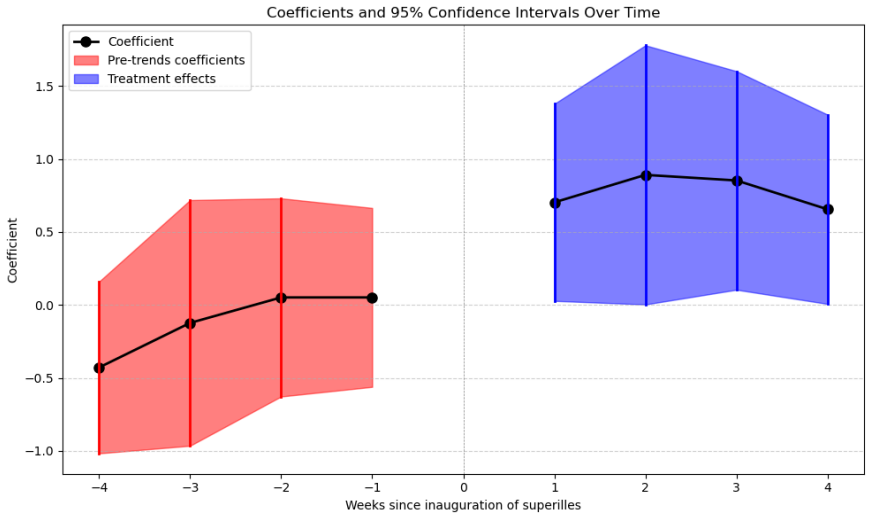

Figure 5: Effect of the Implementation of Urban Planning on Consumer Satisfaction. This figure shows the estimated effects of the implementation of Superblocks (Superblocks) in Barcelona on Tripadvisor ratings from individual customers' reviews of restaurants. The coefficients that we show in this figure are estimated using the same specification as column (2) in Table 4, except that the effect of treatment is allowed to vary by week for each week starting four weeks prior to the event and ending four weeks after. Their 95% confidence intervals (in bands) are also plotted.

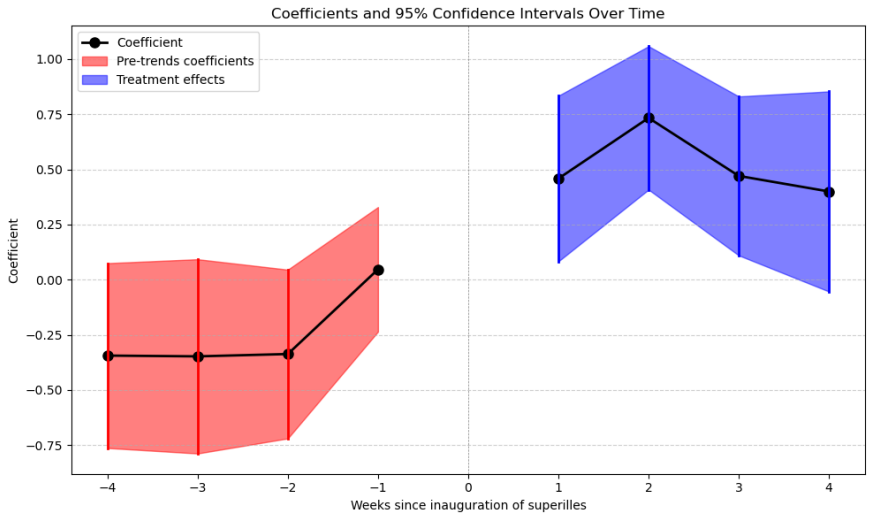

Figure 6: Effect of the Implementation of Urban Planning on Consumer Sentiment. This figure shows the estimated effects of the implementation of Superblocks (Superblocks) in Barcelona on Tripadvisor ratings from individual customers' reviews of restaurants after performing sentiment analysis of the individual Tripadvisor reviews' textual comments. The coefficients that we show in this figure are estimated using the same specification as column (1) in Table 7, except that the effect of treatment is allowed to vary by week for each week starting four weeks prior to the event and ending four weeks after. Their 95% confidence intervals (in bands) are also plotted. Trained Model using Yelp data: *https://github.com/mrcaelumn/yelp_restaurant_review_sentiment_analysis*.

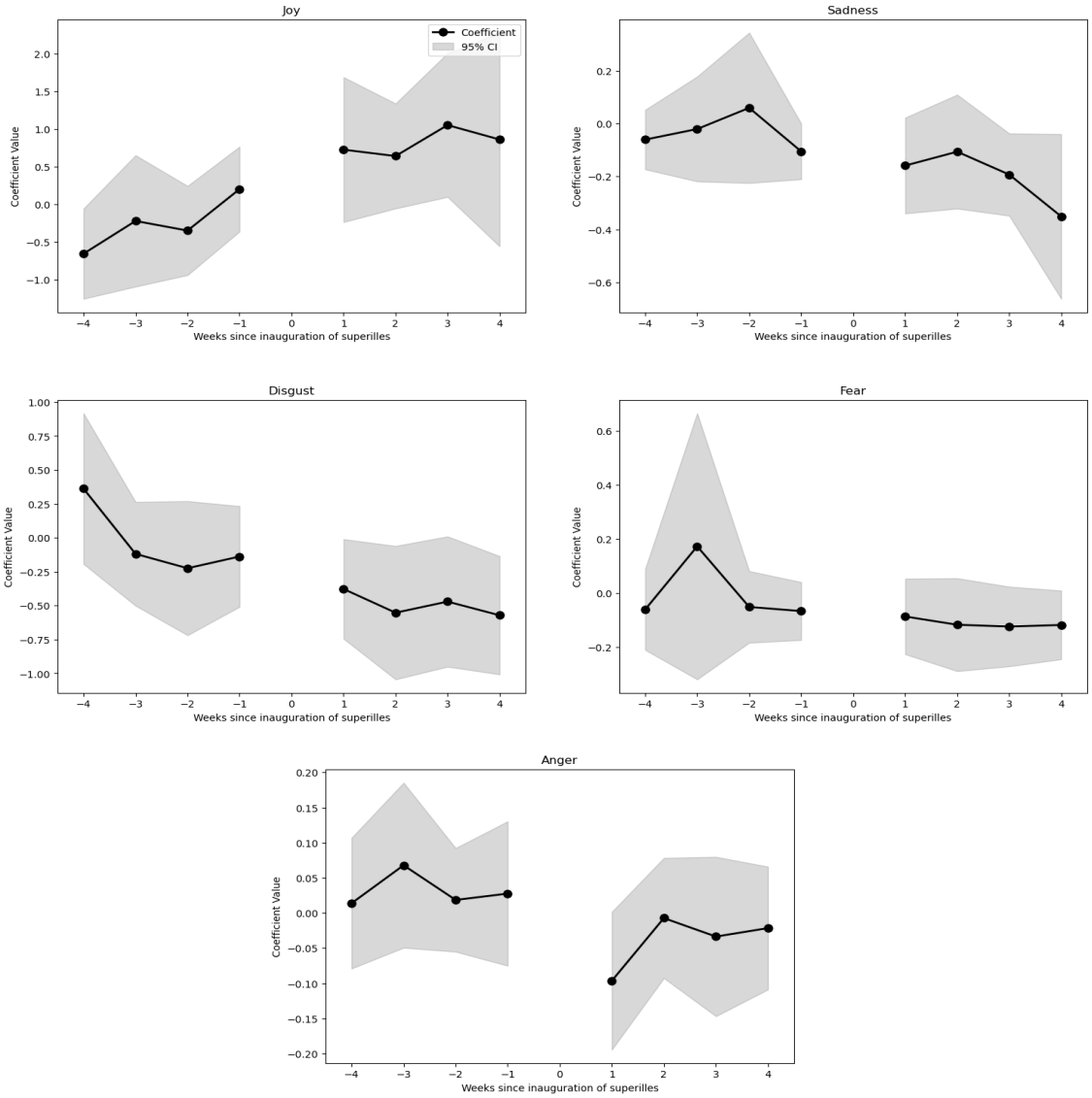

Figure 7: Parallel Trends for all the Emotions Scores. This figure shows the estimated effects of the implementation of Superblocks (Superblocks) in Barcelona on various emotion scores (Joy, Sadness, Disgust, Fear, Anger, and Surprise). The coefficients that we show in this figure are estimated using the same specification as column (2)-(6) in Table 7, except that the effect of treatment is allowed to vary by week for each week starting four weeks prior to the event and ending four weeks after. Their 95% confidence intervals (in bands) are also plotted.

Online Appendix

Table A1: Description of Variables. This table provides detailed descriptions of the primary variables utilized in our empirical analysis.

Variable Name	Description
id	Unique code for each review
attraction_id	Unique code for each restaurant
user_id	Unique code for each reviewer
published_date	Publishing date for each review
longitude	Geo-Coordinates of the restaurant
latitude	Geo-Coordinates of the restaurant
location_name	Unique name for each restaurant
text	Textual review
rating_number	Score (ranging from 1 to 5, the higher the more positive) review
origin_review	Location where the account of reviewer was created
review_language	Language at which the review was written
category	Type of food served in the restaurant (e.g., Italian, Chinese, etc.)
number_helpful_votes	Number of positive reviews
average_rating	Historic average rating for the reviewer at the moment of the review
year_joined	Year when the reviewer joined Tripadvisor
yelp	A continuous sentiment score (ranging from 1 to 5, the higher the more positive) was developed through textual analysis of the reviews using a natural language processing model. This model was trained on 600,000 Yelp restaurant reviews, achieving a 94% accuracy in classifying review sentiments. *https://huggingface.co/mrcaelumn/yelp_restaurant_review_sentiment_analysis*
joy	Continuous emotion scores (ranging from 1 to 5, the higher the more presence of the emotion) was developed through textual analysis of the reviews using a natural language processing model. This model was trained on 58,000 Reddit comments. It achieves approximately 94% accuracy in emotion classification. *https://huggingface.co/SamLowe/roberta-base-go_emotions*
sadness	Emotion score derived from textual analysis similar to the one described above for "joy"
fear	Emotion score derived from textual analysis similar to the one described above for "joy"
anger	Emotion score derived from textual analysis similar to the one described above for "joy"
disgust	Emotion score derived from textual analysis similar to the one described above for "joy"

Table A2: Rating Number of Treated Restaurants after Superblocks Inauguration: Using Log Index. This table presents robustness of rating number regressions while using the log measure. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variable in all the columns is the natural logarithm of Trip Advisor rating numbered from 1 (lowest) to 5 (highest). Columns [1]-[2], [3]-[4], and [5]-[6] use a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Log of Rating Number					
	Time Window: 2 Months		Time Window: 3 Months		Time Window: 4 Months	
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment × Post Superblocks Inauguration	0.394***	0.386***	0.229***	0.215***	0.161**	0.168**
	(3.67)	(3.52)	(2.85)	(2.72)	(2.23)	(2.41)
Post Superblocks Inauguration	−0.484***	Absorbed	−0.344*	Absorbed	−0.515***	Absorbed
	(-3.00)		(-1.96)		(-3.60)	
Year Fixed Effects	Yes	No	Yes	No	Yes	No
Year-Month Fixed Effects	No	Yes	No	Yes	No	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	747	747	1,150	1,150	1,479	1,475
Number of Restaurants	109	109	136	136	158	156
Adjusted - R^2	0.494	0.491	0.551	0.580	0.537	0.561

Table A3: Sentiment Indexes of Treated Restaurants after Superblocks Inauguration: Using Log Measures. This table presents robustness of sentiment index regressions while using log measures. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. The dependent variables in columns [1] to [6] are natural logarithm of Yelp index, Joy index, Sadness index, Fear index, Anger index, and Disgust index, respectively. These indexes are constructed by textual analysis using large language models (LLMs) in machine learning. Panel A, B, and C use a time window of 1, 1.5, and 2 months before the beginning of each Superblock's construction and after their inauguration, respectively. Standard errors are clustered at the restaurant level. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Panel A: Time Window: 2 months					
Dep. variables:	Log Yelp	Log Joy	Log Sadness	Log Fear	Log Anger	Log Disgust
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment × Post Superblocks Inauguration	0.183***	0.382***	−0.046	−0.053**	−0.056	−0.215**
	(2.96)	(2.77)	(-1.09)	(-2.20)	(-1.36)	(-2.40)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	747	747	747	747	747	747
Number of Restaurants	109	109	109	109	109	109
R^2	0.639	0.573	0.367	0.152	0.218	0.410
	Panel B: Time Window: 3 months					
Treatment × Post Superblocks Inauguration	0.088**	0.119	−0.037	−0.051*	−0.010	−0.114*
	(2.26)	(0.95)	(-0.99)	(-1.94)	(-0.38)	(-1.68)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	1,150	1,150	1,150	1,150	1,150	1,150
Number of Restaurants	136	136	136	136	136	136
R^2	0.622	0.519	0.304	0.151	0.184	0.332
	Panel C: Time Window: 4 months					
Treatment × Post Superblocks Inauguration	−0.006	0.037	−0.046*	−0.041	−0.005	−0.040
	(-0.17)	(0.31)	(-1.76)	(-1.59)	(-0.21)	(-0.62)
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restaurant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Treatment	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed	Absorbed
Observations	1,475	1,475	1,475	1,475	1,475	1,475
Number of Restaurants	156	156	156	156	156	156
R^2	0.558	0.477	0.262	0.134	0.291	0.303