

# Green Urban Planning and Consumer Satisfaction: Evidence from Barcelona's Superblock Model<sup>1</sup>

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## Abstract

This paper examines how green urban interventions affect consumer satisfaction and emotional experience. 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 restaurant ratings, review sentiment, and emotion-related content. 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 increase consumer satisfaction, with higher sentiment scores and more joy-related language, as well as less sadness-, disgust-, and fear-related language. These effects are particularly pronounced among Barcelona-based and Spanish-language reviewers, who are likely to be more familiar with the local urban context. Our findings show that green urban planning generates measurable improvements in reviewed consumer experiences in local commercial environments, offering evidence on the socio-emotional 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 consumers in local commercial environments 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, review sentiment, and emotional experience.

Barcelona’s Superblocks provide a unique natural experiment for this study.<sup>1</sup> A Superblock typically consists of a cluster of multiple city blocks, commonly arranged in a 3-by-3 configuration, 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.

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<sup>1</sup>Other cities that have adopted Superblock-inspired initiatives include Vitoria-Gasteiz (Superblocks), Ghent (Circulation 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).

Barcelona's Superblocks should be understood not only as physical street redesigns, but also as part of an evolving urban policy agenda. The model emerged from a longer local trajectory aimed at reorganizing mobility, reclaiming street space from private vehicles, improving environmental quality, and promoting healthier, more human-centered neighborhoods. Superblocks therefore operate simultaneously as mobility interventions, public-space strategies, and neighborhood-scale governance tools. This broader interpretation is especially relevant in Barcelona, where the model has been progressively incorporated into planning frameworks beyond isolated traffic-calming projects.

Recent work similarly emphasizes that Barcelona's Superblocks should be understood as more than localized traffic-calming or street-design interventions. Camerin (2023) shows that Barcelona's human-centered public-space agenda preceded COVID-19, but that the pandemic strengthened political and social support for healthier, more inclusive, and more resilient public-space strategies.<sup>2</sup> Related work connects this evolution to post-COVID debates on the 15-minute city and tactical urbanism, where Superblocks are interpreted as instruments for sustainable urban transition, neighborhood accessibility, public health, and governance (Fabris et al. 2023, Camerin 2022*b*). Accordingly, while our empirical design exploits the localized implementation of five pre-pandemic Superblocks, we interpret these interventions as part of a broader and evolving urban policy agenda rather than as isolated design changes.

Although our empirical analysis deliberately excludes the COVID-19 period to preserve a clean identification setting, the pandemic accelerated global debates about proximity-based, healthier, and more flexible forms of urbanism. This literature makes clear that the transferability of Superblock-inspired models is not only a design question, but also a governance and equity question: similar

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<sup>2</sup>In this context, the 2021 "Barcelona Superblocks Government Measure" extended Superblock principles into broader planning and governance processes.

interventions must be adapted to local institutional capacity, mobility systems, neighborhood structure, and social conditions. Public-space improvements may generate broad benefits, but they may also produce uneven gains or contribute to gentrification pressures without inclusive governance and housing or affordability safeguards. We therefore treat Barcelona not merely as a local case of traffic calming, but as an internationally influential example of how neighborhood-scale street redesign enters broader debates on urban regeneration, public health, accessibility, and social equity. This interpretation also implies that Superblocks should be viewed as bundled public-space transformations rather than as pedestrianization alone. Camerin & Longato (2025) show that the recovery of traffic space in Poblenou (Barcelona) supported socially attractive public spaces and greenery, while also interacting with post-pandemic city-branding dynamics and potential gentrification effects. At the same time, Barcelona's public-space transformations are embedded in a broader urban political economy of regeneration, tertiarisation, commodification, place branding, and gentrification (Camarin 2022a). These perspectives guide the interpretation of our estimates. Improvements in restaurant ratings and review sentiment may reflect healthier, quieter, greener, and more attractive consumption environments, but they may also be related to amenity-led upgrading, changing place images, and selective consumption geographies. We therefore interpret our estimates as the reduced-form effect of a co-produced Superblock package on reviewed consumer experiences in treated commercial environments.

For each Barcelona Superblock intervention under study, we geolocalize restaurants situated within the Superblock perimeter (treatment group) and those located immediately outside their boundaries (control group). Specifically, we assign restaurants to the treatment group if they are located on fully or partially pacified streets. The control group consists of restaurants located within a 200-meter buffer outside the treated boundary. We use consumer review data from Tripadvisor<sup>3</sup>

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<sup>3</sup> Tripadvisor is a global online platform for user-generated reviews of restaurants, hotels, and attractions that

and measure consumer satisfaction using several proxies, including consumer ratings and text-based measures derived from Tripadvisor reviews. We construct sentiment scores using both a multilingual BERT model and a Yelp-trained restaurant-review model, and emotion indexes based on an Ekman-inspired set of core emotions (Ekman 1999): joy, sadness, fear, anger, and disgust.

To estimate the effect of green urban planning on consumer satisfaction and emotional experience, 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, treatment assignment is plausibly unrelated to any single restaurant’s quality because implementation was 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 for estimating the causal effects on ratings, sentiment, and emotion-related content, with 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.<sup>4</sup> Figure 1 shows the location of these Superblocks.

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provides crowd-sourced ratings and textual feedback widely used in tourism and consumer behavior research.

<sup>4</sup>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 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.

[Insert Figure 1 here]

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

[Insert Figures 2 and 3 here]

Our main findings show that restaurant reviews became more favorable after Superblock inauguration. In the two-month event window, treated restaurants' average Tripadvisor rating rises from 4.09 before Superblock implementation to 4.25 afterward, while nearby control restaurants experience a decline from 3.80 to 3.57; in the corresponding difference-in-differences specification with restaurant and year-month fixed effects, this translates into a 1.19-point relative increase in ratings. We find no evidence of differential pre-intervention trends for our main review-based outcomes, and the estimates remain positive across alternative event windows. The effects are particularly pronounced among Barcelona-based reviews, Spanish-language reviews, and restaurants classified as local, suggesting that the intervention was especially salient in more local consumption settings. Text-based sentiment measures also improve after Superblock implementation in treated areas. The multilingual BERT sentiment score increases by about 1.26 points in the two-month window, while the Yelp-trained sentiment score increases by about 0.65 points, indicating that the positive effect is not specific to a single NLP model. Emotion-related content also changes: treated reviews contain more joy-related content and less sadness-, disgust-, and fear-related content. The anger estimate is negative but not statistically significant. Moreover, reviews mentioning terraces or family-friendly attributes increase after Superblock inauguration, consistent with the interpretation that the redesigned public-space environment became more conducive to outdoor and family-oriented consumption.

In the academic literature, relatively few studies have directly examined how urban improvements affect consumer satisfaction, but related research suggests several reasons to expect urban design to shape consumer experiences in local commercial settings. Restaurant and retail experiences are not determined only by product quality or service quality; they are also embedded in the surrounding physical and social environment. Foundational work on servicescapes and retail atmospherics shows that physical surroundings, ambient conditions, spatial layout, aesthetics, and environmental cues influence consumers' affective responses, evaluations, and approach behavior (Donovan & Rossiter 1982, Bitner 1992). These mechanisms are particularly relevant in dense urban neighborhoods, where consumption often extends beyond the interior of establishments into terraces, sidewalks, plazas, and other semi-public spaces. More recently, although in a rural setting, Yang & Luo (2021) show that outdoor dining environments, including atmosphere, landscape elements, facilities, and environmental quality, are associated with customer satisfaction. In urban studies, the built environment has also been linked to subjective well-being through pathways such as accessibility, environmental quality, safety, leisure, social interaction, and emotional responses (Mouratidis 2021). Consistent with this broader literature, De Nisco & Warnaby (2014) show that perceived urban aesthetics and tenant variety are associated with shoppers' emotions and approach behavior in a town-center setting, while Van Ryzin (2004) finds that expectations and perceived performance 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. Focusing on the economic effects of pedestrianization, Yoshimura et al. (2022) show that retail stores in pedestrianized environments tend to experience increased sales and higher foot traffic compared to those in non-pedestrianized areas, suggesting that street redesign can affect commercial activity as well as the consumer environment. However, to the best of our knowledge, no prior study provides causal evidence that a

large-scale green urban design intervention—such as Barcelona’s Superblock program—improves restaurant ratings, review sentiment, and emotion-related content in the immediate commercial 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, have been used to measure public sentiment toward 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 and emotion classification from restaurant reviews, shifting the focus from generalized public sentiment to reviewed consumer experiences in a specific local commercial setting.

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 the main results, robustness checks, heterogeneity tests, and the analysis of sentiment scores and emotion indexes. Finally, Section 4 concludes, summarizing the main findings and their implications.

## 2 Data and Empirical Design

### 2.1 Data

Our sample period runs from July 1, 2016, to February 29, 2020. The first five Superblocks were inaugurated during that period, as summarized in Table 1.<sup>5</sup>

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 the textual reviews to construct sentiment scores and emotion indexes.<sup>6</sup> Our main outcomes are Tripadvisor ratings, sentiment scores based on review text, and five Ekman-inspired emotion indexes: joy, sadness, fear, anger, and disgust.

The use of Tripadvisor reviews offers important advantages for our setting: the data are high-frequency, geolocated, and contain both numerical ratings and textual evaluations of restaurant experiences. At the same time, these data also have limitations. Tripadvisor reviews are user-generated platform data and should therefore be interpreted as posted consumer evaluations rather than as a representative survey of all restaurant customers. Similarly, the sentiment and emotion variables constructed from review text are model-based proxies for the tone and emotional content

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<sup>5</sup>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, and became effective on March 15, 2020.

<sup>6</sup>The methodology for generating the sentiment scores and emotion indexes is described in Section 3.2.

of reviews, not direct psychological measurements. These measures are useful for summarizing large volumes of textual information, but they may reflect how reviewers express experiences on the platform as well as the underlying experience itself.

For this reason, our empirical interpretation focuses on reviewed consumer experiences rather than on all consumers or direct business performance. The data allow us to study changes in ratings, textual sentiment, and emotion-related content, but they do not directly measure restaurant sales, profits, rents, employment, or survival. Several features of the research design help mitigate these limitations: the difference-in-differences framework compares changes over time for treated restaurants relative to nearby control restaurants; restaurant fixed effects absorb time-invariant differences across establishments; time fixed effects absorb common shocks; and the robustness analyses control for observable reviewer characteristics. We also examine heterogeneity by reviewer origin, review language, and restaurant category, which helps assess whether the results are concentrated among particular types of reviewers or establishments.

For each Superblock, we obtain Tripadvisor data for at least two months before construction began and two months after inauguration (see Table 1 for the timeline).<sup>7</sup> We then identify all restaurants located on fully or partially pacified streets within the City Council-defined boundary of each Superblock at the time of its inauguration. We define a *treatment* indicator equal to one if a restaurant was located on a fully or partially pacified street within the Superblock boundary at the time of inauguration, and zero if the restaurant belongs to the control group. The control group consists of those restaurants located within a 200-meter ring outside the treatment delimitation. The 200-meter distance corresponds to a very short walking catchment around the treated streets, approximately a two- to three-minute walk, and is therefore narrow enough to capture restaurants

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<sup>7</sup>Table A1 in the Appendix provides a detailed definition of the main variables that we use in this study.

operating in the same immediate neighborhood market, exposed to similar pedestrian flows, local demand conditions, transit access, and commercial environments. At the same time, it is wide enough to retain a sufficient number of control restaurants across the five Superblocks. A narrower ring would maximize spatial proximity but would leave too few control establishments in some Superblocks, while a substantially wider ring would increase the risk of comparing treated restaurants with establishments located in different neighborhood markets.

[Insert Table 1 here]

To provide additional background on the treated and control areas, Appendix Table A2 reports descriptive statistics on commercial activity, baseline composition, urban-density structure, and socioeconomic characteristics for restaurants located in treated and control groups. We complement our Tripadvisor data with official Barcelona city-block and land-parcel data to characterize the built environment around each restaurant, including dwellings per urban hectare, total built intensity, above-ground built intensity, the share of commercial units, the share of residential units, and commercial units per dwelling, measured within a 100-meter buffer around each restaurant. We also match restaurants to census-section socioeconomic indicators, including the IST socioeconomic index and income measures from the INE Atlas of Household Income Distribution.

These additional measures show that treated and control restaurants are located in areas with very similar density, land-use, and socioeconomic structures. None of the urban-density or built-form variables differs statistically across groups. The same holds for baseline socioeconomic characteristics: treated and control restaurants do not differ significantly in the IST socioeconomic index, net income per person, mean income per consumption unit, or median income per consumption unit. Restaurant-level commercial activity and baseline local composition are also statistically similar across treated and control restaurants. Taken together, these descriptive patterns provide additional

support for the use of nearby restaurants in the 200-meter external ring as a reasonable comparison group.

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 two trained sentiment-score indexes. 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 difference becomes even larger when using the three-month window (Panel B), where the treated–control difference rises to 0.623 points. Overall, the descriptive statistics show that treated restaurants have higher ratings and more positive review content, particularly joy-related content, than nearby control restaurants in the event windows around Superblock inauguration. These descriptive differences are consistent with more favorable posted evaluations in treated areas, although the difference-in-differences design below is required for causal interpretation.

[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 the main review-based outcomes 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 increases from 4.09 in the pre-intervention period to 4.25 in the post-intervention period. By contrast, the corresponding rating for control restaurants declines from 3.80 to 3.57 over the same period. These figures highlight descriptive patterns consistent with a positive effect of the intervention; however, they should be interpreted only as descriptive evidence rather than as causal estimates. The formal identification strategy, presented in the following section, is required to establish the causal effect of Superblocks on ratings, sentiment, and emotion-related content.

[Insert Table 3 here]

## **2.2 Empirical Strategy**

We exploit the staggered implementation of Superblocks in Barcelona to estimate the effect of this urban planning intervention on consumer satisfaction. We measure reviewed consumer experiences using Tripadvisor ratings, sentiment scores, 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.<sup>8</sup>

This boundary-based design requires clarifying the spatial theory of treatment. The Superblock model has evolved from localized traffic pacification toward the broader Barcelona Superblock strategy, which aims at neighborhood-scale public-space transformation rather than only micro-scale street redesign (Camerin 2022*b*). Our empirical design focuses on the first implemented pre-COVID Superblocks and defines treatment at the level of restaurants located on fully or partially pacified streets. The estimated coefficient should therefore be interpreted as the localized short-run effect of being directly exposed to implemented street pacification and public-space redesign, rather than as the full neighborhood-scale effect of the broader Barcelona Superblock strategy.

Potential interference across the treatment boundary is nevertheless possible. Nearby control restaurants may benefit indirectly from the Superblock through increased pedestrian flows, improved neighborhood image, or more attractive public spaces. If this occurs, both treated and nearby control restaurants would improve, and the estimated treatment effect would likely understate the direct benefit of being located on a pacified street. The opposite case is also possible: if traffic displacement or other disruptions worsened conditions just outside the Superblock boundary, the estimated effect could overstate the direct treatment effect. Several features of the research design mitigate this potential spillover concern. We use short event windows around inauguration, omit the construction period, compare restaurants in very close geographic proximity, include restaurant and time fixed effects, formally test for pre-trends, and show that the main results are robust to alternative controlling definitions using 100-meter and 300-meter buffers. Thus, while we cannot rule out all forms of spatial spillover, the design is intended to capture the immediate effect of direct exposure to treated streets under limited interference, and the broader neighborhood-scale consequences of the

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<sup>8</sup>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.

Barcelona Superblock implementation remain an important topic for future research.

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-differences model:

$$Y_{i,j,t} = \beta_0 + \beta_1 \cdot (Treatment \times Post\ Superblock\ Inauguration)_{i,j} + \beta_2 \cdot Post\ Superblock\ Inauguration_{i,j} + \gamma \cdot X_k + y_i + z_t + \epsilon_{it}, \quad (1)$$

where  $Y_{i,j,t}$  denotes the review-level outcome for restaurant  $i$  in Superblock area  $j$  at time  $t$ . Our primary outcome is the Tripadvisor rating reported by a reviewer, *Rating Number*. In addition to ratings, we use machine-learning-based natural language processing to analyze review text and construct sentiment scores and emotion indexes as complementary measures of the reviewed consumer experience. *Treatment* is an indicator equal to one if the restaurant was located on a fully or partially pacified street within the Superblock boundary at the time of inauguration, and zero if the restaurant was located within the 200-meter control ring outside the treated 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 for reviews posted after the inauguration of the relevant Superblock and zero for reviews posted before the start of construction. We omit the time between a Superblock's construction start date and its inauguration date. All the regressions include time fixed effects,  $z_t$ , (year fixed effects or year  $\times$  month fixed effects depending upon the specification) as well as restaurant fixed effects,  $y_i$ . As a robustness check, we also control

for the reviewer’s characteristics,  $X_k$ , such as *Total Ratings by Reviewer* (number of attractions a reviewer has rated to 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,  $\varepsilon_{it}$ , 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).<sup>9</sup> The analysis relies on the staggered difference-in-differences 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]

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<sup>9</sup>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 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.

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 columns include restaurant fixed effects.

[Insert Table 4 here]

We find that  $Treatment \times Post\ Superblocks\ Inauguration$ , the interaction term of interest, is positive and statistically significant across all specifications in Table 4. Focusing on columns [2], [4], and [6], which include restaurant and year-month fixed effects, the coefficients on the interaction term indicate that ratings increased for treated restaurants relative to nearby control restaurants by 1.189 points in the two-month window, 0.633 points in the three-month window, and 0.418 points in the four-month window following Superblock implementation.

These results indicate that ratings increased for restaurants directly exposed to Superblock street pacification relative to nearby controls. A plausible interpretation is that traffic calming and public-space improvements made the immediate consumption environment more pleasant.

### 3.1.1 Robustness and Heterogeneity Tests

In our main regressions, we control for time and restaurant fixed effects. However, since our dependent variable is a user-generated Tripadvisor rating, it may partly reflect reviewer-specific tendencies. We therefore control for Total Ratings by Reviewer, Number of Helpful Votes, Average Rating by Reviewer, and Year Tripadvisor Joined fixed effects.

More broadly, user-generated ratings may reflect platform-specific biases. Choi (2021), for example, shows that Yelp ratings can be influenced by non-experimental factors such as reviewer

expectations, business category, familiarity, perceived authenticity, and social-psychological mechanisms. Although our rating outcome comes from Tripadvisor rather than Yelp, similar concerns may apply to online review platforms more generally. Our difference-in-differences design mitigates these concerns because restaurant fixed effects absorb persistent differences in restaurant quality, category, reputation, and clientele, while time fixed effects absorb common reviewing patterns.

Table 5 shows that our results are robust to controlling for reviewer characteristics. Thus, such biases would threaten our interpretation only if they changed differentially for treated restaurants relative to nearby controls exactly around Superblock implementation. 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]

As an additional robustness check, Appendix Table A6 shows that the estimated effect remains positive and statistically significant when we include Superblock  $\times$  year and Superblock  $\times$  year-month fixed effects in the four-month window. These specifications absorb broader Superblock-specific time shocks and further mitigate concerns about differential area-level trends.

Next, we examine how review ratings for treated versus control restaurants respond 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 the review is associated with Barcelona or with a non-Barcelona origin; (2) whether the review is written in Spanish or in another language; and (3) whether a restaurant is local (labeled as Catalan, Spanish, or Mediterranean) or non-local (labeled as any category other

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

[Insert Table 6 here]

Panel A shows the results based on the origin of the review. We find that the estimates are larger and more persistent for reviews associated with Barcelona. For non-Barcelona reviews, the estimates are statistically significant only in the two-month window. Panel B reports similar results for sub-samples based on whether a review is written in Spanish or in another language. These results suggest that the positive effect of Superblock inauguration is concentrated among Spanish-language reviews. Lastly, Panel C presents results for sub-samples formed on the primary type of restaurant. Here, we find that the estimates are larger for restaurants classified as local. Overall, Panels A, B, and C suggest that the main effects are concentrated among reviews and restaurants more closely connected to local consumption patterns.

We also address the concern that the distribution of ratings (our dependent variable) could be skewed. To address this concern, we re-estimate the main specifications using the natural logarithm of the rating score. As shown in Appendix Table A4, results across all the specifications are robust to this concern.

One potential concern with any difference-in-differences 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. In our staggered setting, such preexisting trends would need to coincide with the timing of multiple Superblock inaugurations, which reduces but does not eliminate this concern. 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 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 no evidence of differential pre-inauguration trends for our main rating outcome.

[Insert Figure 5 here]

### 3.2 Sentiment Score and Emotions

The previous section examined Tripadvisor ratings, an observed numerical measure of posted consumer evaluation. We now use the accompanying review text to construct sentiment scores and emotion indexes using machine-learning-based natural language processing (NLP).

First, we construct a discrete sentiment score using a multilingual transformer-based model.<sup>10</sup> The model is fine-tuned for review sentiment in six languages (English, Dutch, German, French, Spanish, and Italian) and predicts sentiment directly as a one-to-five star score. This is well suited to our setting because the Tripadvisor corpus is multilingual and the numerical Tripadvisor rating is also measured on a one-to-five scale. At the same time, the measure should be interpreted as a model-based proxy for the tone of posted reviews, not as a direct measure of consumers' psychological states. Column [1] of Table 7 reports the results using this multilingual BERT sentiment score. Similar to the rating results, Panels A, B, and C use event windows of two, three, and four months, respectively. The coefficient on  $Treatment \times Post\ Superblocks\ Inauguration$  is positive and statistically significant across all three windows, indicating that Superblock implementation increases the positivity of review text. Figure 6 reports the corresponding event-study estimates for the multilingual BERT score and shows no evidence of differential pre-treatment trends.

Second, we construct an additional sentiment score using a natural language processing model

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<sup>10</sup>The model is available at <https://huggingface.co/nlptown/bert-base-multilingual-uncased-sentiment>.

trained on 600,000 Yelp restaurant reviews from the United States, spanning 2005 to 2019.<sup>11</sup> This model produces a continuous score ranging from 1 to 5, with higher values indicating more positive sentiment. Column [2] of Table 7 reports the results using the Yelp-trained sentiment score. The estimated coefficient is positive and statistically significant in the two- and three-month windows, providing additional evidence that Superblock implementation improved the sentiment expressed in restaurant reviews. Because both sentiment measures are generated by automated NLP models, we interpret them cautiously and use them as complementary proxies for review tone. The multilingual BERT score directly addresses language-variation concerns in the Barcelona Tripadvisor corpus, while the Yelp-trained score provides an additional restaurant-review-based benchmark. To further increase transparency, Appendix Table A3 reports illustrative review excerpts from the four-month regression sample together with their Tripadvisor ratings, Yelp-trained scores, and multilingual BERT scores. These examples show how the sentiment scores map into the underlying text for positive, negative, mixed, and non-English reviews.

[Insert Table 7 here]

[Insert Figure 6 here]

Next, we use NLP-based textual analysis to construct emotion scores from the review text. These scores are continuous and range from 1 to 5, with higher values indicating a stronger presence of the corresponding emotion-related content. The model used in this case was trained on 58,000 Reddit comments from 2005 to 2019, achieving approximately 94% accuracy in emotion classification.<sup>12</sup> We focus on five emotion indexes—joy, sadness, fear, anger, and disgust—which provide an Ekman-inspired set of core positive and negative affective responses (Ekman 1999). This set is well suited

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<sup>11</sup>The model is available at [https://huggingface.co/mrcaelumn/yelp\\_restaurant\\_review\\_sentiment\\_analysis](https://huggingface.co/mrcaelumn/yelp_restaurant_review_sentiment_analysis).

<sup>12</sup>The application programming interface (API) used to construct this score is available at [https://huggingface.co/SamLowe/roberta-base-go\\_emotions](https://huggingface.co/SamLowe/roberta-base-go_emotions)

to our setting because restaurant reviews frequently express enjoyment, dissatisfaction, frustration, safety-related concerns, and aversive sensory or environmental experiences. Joy captures positive affect, while sadness, fear, anger, and disgust capture distinct forms of negative affect that may be related to the dining experience and the surrounding urban environment.

Columns [3]-[7] of Table 7 report results when using these emotion indexes as the dependent variables. For *joy*, the estimates indicate an increase in joy-related content in the two-month window. For *sadness*, the estimates indicate a decline in sadness-related content in the four-month window. For *fear*, the estimates are negative and statistically significant across the two-, three-, and four-month windows. The *anger* coefficient is negative but not statistically significant in any window, so we do not draw conclusions from the anger estimates. Finally, the *disgust* estimates are negative and statistically significant in the two- and three-month windows. Overall, the emotion-index results provide complementary evidence that posted consumer evaluations became more favorable after Superblock inauguration (see columns [3]-[7] in Table 7).<sup>13</sup> This pattern is consistent with reviewers responding positively to the newly pacified and redesigned public-space environment. Figure 7 shows no evidence of differential pre-treatment trends for the emotion indexes considered in Table 7.

[Insert Figure 7 here]

The emotion-specific estimates also provide insight into the channels through which Superblocks may affect consumer experiences. Although all emotion scores are generated using the same NLP model, differences in coefficient magnitudes across emotion categories should be interpreted as suggestive rather than as direct evidence that one psychological response changed more intensely

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<sup>13</sup>Appendix Table A5 shows that results in Table 7 are robust if we use the natural logarithm of sentiment or emotion-based indexes as the dependent variable.

than another. With this caveat in mind, the pattern in Table 7 is informative. In particular, the estimated reduction in disgust is larger than the estimated reduction in fear in the two- and three-month windows. One plausible interpretation is that disgust-related content in restaurant reviews captures aversive sensory and environmental experiences, such as unpleasant surroundings, traffic-related pollution, noise, dirtiness, or discomfort in the immediate street environment. These are dimensions that pedestrianization, traffic calming, and public-space improvements are likely to affect directly by reducing vehicle exposure and making streets more pleasant for outdoor consumption. Fear-related content, by contrast, is more closely associated with perceived danger, crime, or acute personal safety concerns. Such concerns may be less frequently expressed in restaurant reviews and may respond less strongly in the short run, particularly in already dense and active commercial neighborhoods. Thus, the stronger decline in disgust is consistent with Superblocks improving the sensory and environmental quality of the consumption setting, whereas the smaller decline in fear suggests a more limited or less frequently articulated safety-related channel.

This interpretation is also consistent with the possibility that Superblocks improve consumer satisfaction by expanding comfortable open-air space and making the immediate restaurant environment more family-friendly. To explore this mechanism, we construct a review-level indicator for terrace- or family-friendly content. Specifically, we construct an indicator equal to one if the Tripadvisor review mentions terrace-, outdoor-, or family-related terms at least once, and zero otherwise.<sup>14</sup> We then use this indicator as the dependent variable and report these results in Table 8. Columns [2] and [3] in Table 8 show that terrace- or family-friendly review content increases after Superblock inauguration, providing additional evidence that the intervention changed how reviewers described the immediate consumption environment.

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<sup>14</sup>This dictionary includes words such as terraze, terrazze, terrace, sunny, outdoors, patio, outdoor, sky, sun, breezy, outside, kid, kids, son, daughter, family, and baby.

[Insert Table 8 here]

## 4 Conclusions and Policy Implications

This study examines the effect of green urban planning interventions on reviewed consumer experiences, 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. We measure reviewed consumer experience through ratings, text-based sentiment, and emotion-related content derived from natural language processing.

We find that Superblocks significantly improve reviewed consumer experiences: ratings increase by an average of 1.19 points, the multilingual BERT sentiment score increases by 1.26 points, and the Yelp-trained sentiment score increases by 0.65 points in the two-month window. The emotion-index results show more joy-related content and less sadness-, disgust-, and fear-related content. These effects are larger among Barcelona-associated reviews and Spanish-language reviews, suggesting that neighborhood-level improvements may be especially salient to consumers more familiar with the local context. In addition, reviews increasingly mention outdoor seating and family-friendly environments, indicating that the interventions changed how reviewers described the immediate consumption setting. Methodologically, this paper demonstrates the value of linking geolocated consumer data with sentiment and emotion analysis to capture dimensions of reviewed consumer experience that are often overlooked in conventional evaluations.

Our findings suggest that the mechanisms underlying these improvements are best understood as a bundle of co-produced changes rather than as the effect of pedestrianization alone. Superblocks combine traffic calming, reduced vehicle exposure, improved walkability, greening, open-space redesign, and new opportunities for social use. These changes can jointly transform the immediate restaurant environment by making streets quieter, cleaner, safer, more comfortable, and more attractive for outdoor consumption and interaction. This interpretation is consistent with the increase in terrace- and family-related review mentions, as well as with the decline in negative affective language related to disgust and fear. At the same time, because these design components are implemented together, our estimates should be interpreted as the reduced-form effect of the Superblock package rather than as separate effects of pedestrianization, greenery, or public-space redesign. The same improvements that make public spaces more attractive may also contribute to uneven benefits or gentrification pressures if not accompanied by inclusive governance and affordability safeguards.

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 may also improve how consumers evaluate local commercial environments in posted reviews.

Second, the stronger effects observed among Barcelona-associated and Spanish-language reviews highlight the importance of designing urban policies that are salient for local consumption environments and attentive to inclusivity, rather than focusing solely on tourism-driven development. Third, the observed changes in sentiment and emotion-related content suggest that pedestrian-oriented interventions may contribute to more pleasant, socially active, and accessible public spaces in dense urban areas. These findings also speak to broader post-COVID debates on the 15-minute city, tactical urbanism, and the international transferability of Superblock-inspired models.

Barcelona's experience suggests that neighborhood-scale street redesign can contribute to more pleasant and socially active public spaces, but transferability requires attention to local governance capacity, existing mobility systems, neighborhood socioeconomic conditions, and the potential for uneven benefits or gentrification pressures. Policymakers should therefore view green urban planning as a multidimensional investment that can support environmental sustainability, public health, and more favorable consumer experiences, while also requiring complementary policies to ensure inclusivity and affordability.

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 results for two- and three-month event windows, respectively: Panel A includes one month before construction starts and one month after inauguration, while Panel B includes 1.5 months before construction starts and 1.5 months after inauguration. Statistical significance levels are indicated by \*\*\*, \*\*, and \*, corresponding to 1%, 5%, and 10% significance levels.

| Mean                            | Rating<br>Number   | Joy                | Sadness           | Fear              | Anger              | Disgust         | Multilingual<br>BERT | Yelp               | Obs.  |
|---------------------------------|--------------------|--------------------|-------------------|-------------------|--------------------|-----------------|----------------------|--------------------|-------|
| Panel A - Time Window: 2 Months |                    |                    |                   |                   |                    |                 |                      |                    |       |
| Combined Sample                 | 3.813              | 2.700              | 1.117             | 1.050             | 1.065              | 1.245           | 3.950                | 4.356              | 747   |
| Treated                         | 4.148              | 3.203              | 1.108             | 1.057             | 1.126              | 1.253           | 4.020                | 4.622              | 189   |
| Control                         | 3.699              | 2.530              | 1.120             | 1.047             | 1.044              | 1.243           | 3.926                | 4.266              | 558   |
| Treated - Control               | 0.449***<br>(3.64) | 0.674***<br>(5.16) | -0.012<br>(-0.33) | 0.010<br>(0.38)   | 0.083***<br>(3.65) | 0.011<br>(0.19) | 0.093<br>(0.92)      | 0.356***<br>(4.63) |       |
| Panel B - Time Window: 3 Months |                    |                    |                   |                   |                    |                 |                      |                    |       |
| Combined Sample                 | 3.765              | 2.688              | 1.114             | 1.058             | 1.064              | 1.241           | 3.952                | 4.321              | 1,150 |
| Treated                         | 4.223              | 3.135              | 1.121             | 1.090             | 1.108              | 1.271           | 4.010                | 4.603              | 305   |
| Control                         | 3.600              | 2.527              | 1.112             | 1.046             | 1.048              | 1.230           | 3.932                | 4.219              | 845   |
| Treated - Control               | 0.623***<br>(6.12) | 0.609***<br>(5.97) | 0.009<br>(0.32)   | 0.045**<br>(2.09) | 0.060***<br>(3.62) | 0.041<br>(0.92) | 0.078<br>(0.95)      | 0.384***<br>(6.15) |       |

**Table 3: Descriptive Statistics: Pre versus Post Event.** This table presents mean values for the main dependent variables during the pre- and post-event periods for both treated and control restaurants. Panels A and B display results for two- and three-month event windows, respectively: Panel A includes one month before construction starts and one month after inauguration, while Panel B includes 1.5 months before construction starts and 1.5 months after inauguration.

| Mean                            | Rating<br>Number | Joy   | Sadness | Fear  | Anger | Disgust | Multilingual<br>BERT | Yelp  | Obs. |
|---------------------------------|------------------|-------|---------|-------|-------|---------|----------------------|-------|------|
| Panel A - Time Window: 2 Months |                  |       |         |       |       |         |                      |       |      |
| Pre-event Treated               | 4.091            | 3.186 | 1.125   | 1.082 | 1.139 | 1.291   | 3.968                | 4.574 | 121  |
| Post-event Treated              | 4.250            | 3.235 | 1.077   | 1.014 | 1.104 | 1.187   | 4.101                | 4.707 | 68   |
| Pre-event Control               | 3.801            | 2.602 | 1.136   | 1.051 | 1.040 | 1.246   | 3.902                | 4.176 | 316  |
| Post-event Control              | 3.566            | 2.435 | 1.098   | 1.042 | 1.048 | 1.238   | 3.958                | 4.382 | 242  |
| Panel B - Time Window: 3 Months |                  |       |         |       |       |         |                      |       |      |
| Pre-event Treated               | 4.194            | 3.166 | 1.135   | 1.134 | 1.108 | 1.292   | 3.918                | 4.583 | 191  |
| Post-event Treated              | 4.272            | 3.084 | 1.096   | 1.016 | 1.107 | 1.236   | 4.157                | 4.636 | 114  |
| Pre-event Control               | 3.669            | 2.540 | 1.137   | 1.058 | 1.050 | 1.239   | 3.913                | 4.143 | 465  |
| Post-event Control              | 3.516            | 2.510 | 1.081   | 1.031 | 1.046 | 1.220   | 3.955                | 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] use event windows of two, three, and four months, respectively, corresponding to 1, 1.5, and 2 months before construction begins and 1, 1.5, and 2 months after inauguration. 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:<br>2 Months |                    | Time Window:<br>3 Months |                    | Time Window:<br>4 Months |                   |
|                                                 | [1]                      | [2]                | [3]                      | [4]                | [5]                      | [6]               |
| Treatment $\times$ Post Superblock Inauguration | 1.189***<br>(3.95)       | 1.189***<br>(3.85) | 0.648***<br>(3.07)       | 0.633***<br>(3.01) | 0.388**<br>(2.08)        | 0.418**<br>(2.30) |
| Post Superblock Inauguration                    | -0.809**<br>(-2.23)      | Absorbed           | -0.501<br>(-1.16)        | Absorbed           | -1.125***<br>(-3.33)     | Absorbed          |
| 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 event windows of two, three, and four months, respectively, corresponding to 1, 1.5, and 2 months before construction begins and 1, 1.5, and 2 months after inauguration. 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:<br>2 Months |                   |                    |                    | Time Window:<br>3 Months |                   |                    |                    | Time Window:<br>4 Months |                   |                    |                    |
|                                       | [1]                      | [2]               | [3]                | [4]                | [5]                      | [6]               | [7]                | [8]                | [9]                      | [10]              | [11]               | [12]               |
| Treatment × Post Inauguration         | 1.094***<br>(3.33)       | 0.890**<br>(2.22) | 1.046***<br>(3.80) | 0.902***<br>(3.07) | 0.596**<br>(2.59)        | 0.383<br>(1.42)   | 0.636***<br>(3.18) | 0.591***<br>(2.95) | 0.524***<br>(2.83)       | 0.452**<br>(2.26) | 0.561***<br>(3.50) | 0.540***<br>(3.14) |
| Total Ratings by Reviewer             | -0.001<br>(-0.37)        | 0.001<br>(0.23)   | 0.001<br>(0.13)    | 0.001<br>(0.09)    | -0.001<br>(-0.28)        | 0.001<br>(0.46)   | 0.001<br>(0.52)    | 0.001<br>(0.54)    | -0.001<br>(-0.32)        | 0.001<br>(0.83)   | 0.001<br>(0.85)    | 0.001<br>(0.87)    |
| Number of Helpful Votes               |                          | -0.003<br>(-0.85) | 0.002<br>(0.54)    | 0.002<br>(0.68)    |                          | -0.002<br>(-0.88) | 0.001<br>(0.28)    | 0.001<br>(0.62)    |                          | -0.003<br>(-1.55) | -0.001<br>(-0.30)  | 0.001<br>(0.05)    |
| Average Rating by Reviewer            |                          |                   | 0.877***<br>(5.78) | 0.892***<br>(6.29) |                          |                   | 0.964***<br>(7.68) | 0.960***<br>(7.93) |                          |                   | 0.947***<br>(8.87) | 0.942***<br>(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] use event windows of two, three, and four months, respectively, corresponding to 1, 1.5, and 2 months before construction begins and 1, 1.5, and 2 months after inauguration. 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.

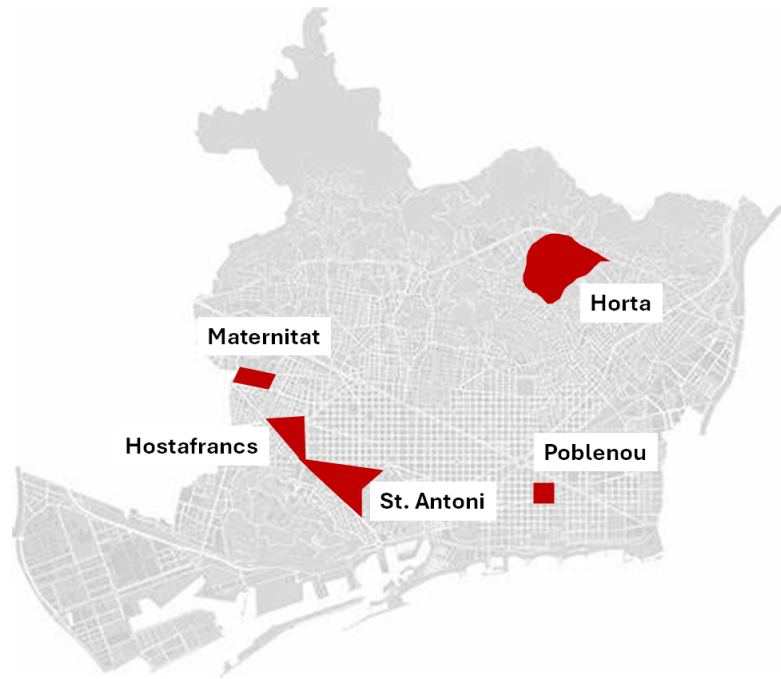
| Dep. variable:                           | Rating Number             |                    |                          |                 |                          |                   |
|------------------------------------------|---------------------------|--------------------|--------------------------|-----------------|--------------------------|-------------------|
|                                          | Time Window:<br>2 Months  |                    | Time Window:<br>3 Months |                 | Time Window:<br>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**<br>(2.61)         | 1.053***<br>(2.81) | 2.162***<br>(3.39)       | 0.067<br>(0.24) | 1.250***<br>(2.95)       | 0.271<br>(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**<br>(2.09)         | 1.312**<br>(2.13)  | 1.142***<br>(3.03)       | 0.001<br>(0.00) | 0.822***<br>(2.73)       | −0.064<br>(-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***<br>(4.20)        | 1.046***<br>(2.66) | 1.907***<br>(4.06)       | 0.381<br>(1.47) | 0.952***<br>(2.68)       | 0.224<br>(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 [7] are the multilingual BERT sentiment index, Yelp-trained sentiment index, joy index, sadness index, fear index, anger index, and disgust index, respectively. These indexes are constructed from review text using machine-learning-based natural language processing models. Panel A, B, and C use event windows of two, three, and four months, respectively, corresponding to 1, 1.5, and 2 months before construction begins and 1, 1.5, and 2 months after inauguration. 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. variables:                           | Time Window: 2 months |                    |                   |                     |                     |                   |                     |
|-------------------------------------------|-----------------------|--------------------|-------------------|---------------------|---------------------|-------------------|---------------------|
|                                           | Multilingual BERT [1] | Yelp [2]           | Joy [3]           | Sadness [4]         | Fear [5]            | Anger [6]         | Disgust [7]         |
| Treatment × Post Superblocks Inauguration | 1.261***<br>(3.34)    | 0.652***<br>(2.98) | 0.844**<br>(2.50) | −0.097<br>(−1.41)   | −0.100**<br>(−2.10) | −0.099<br>(−1.42) | −0.482**<br>(−2.40) |
| Year-Month Fixed Effects                  | Yes                   | Yes                | Yes               | Yes                 | Yes                 | Yes               | Yes                 |
| Restaurant Fixed Effects                  | Yes                   | Yes                | Yes               | Yes                 | Yes                 | Yes               | Yes                 |
| Treatment                                 | Absorbed              | Absorbed           | Absorbed          | Absorbed            | Absorbed            | Absorbed          | Absorbed            |
| Observations                              | 747                   | 747                | 747               | 747                 | 747                 | 747               | 747                 |
| Number of Restaurants                     | 109                   | 109                | 109               | 109                 | 109                 | 109               | 109                 |
| <i>R</i> <sup>2</sup>                     | 0.482                 | 0.675              | 0.536             | 0.360               | 0.133               | 0.194             | 0.378               |
| Dep. variables:                           | Time Window: 3 months |                    |                   |                     |                     |                   |                     |
|                                           | Multilingual BERT [1] | Yelp [2]           | Joy [3]           | Sadness [4]         | Fear [5]            | Anger [6]         | Disgust [7]         |
| Treatment × Post Superblocks Inauguration | 0.844***<br>(3.49)    | 0.312**<br>(2.28)  | 0.316<br>(1.02)   | −0.084<br>(−1.26)   | −0.093**<br>(−2.10) | −0.021<br>(−0.47) | −0.255*<br>(−1.75)  |
| Year-Month Fixed Effects                  | Yes                   | Yes                | Yes               | Yes                 | Yes                 | Yes               | Yes                 |
| Restaurant Fixed Effects                  | Yes                   | Yes                | Yes               | Yes                 | Yes                 | Yes               | Yes                 |
| Treatment                                 | Absorbed              | Absorbed           | Absorbed          | Absorbed            | Absorbed            | Absorbed          | Absorbed            |
| Observations                              | 1,150                 | 1,150              | 1,150             | 1,150               | 1,150               | 1,150             | 1,150               |
| Number of Restaurants                     | 136                   | 136                | 136               | 136                 | 136                 | 136               | 136                 |
| <i>R</i> <sup>2</sup>                     | 0.398                 | 0.656              | 0.473             | 0.306               | 0.114               | 0.161             | 0.302               |
| Dep. variables:                           | Time Window: 4 months |                    |                   |                     |                     |                   |                     |
|                                           | Multilingual BERT [1] | Yelp [2]           | Joy [3]           | Sadness [4]         | Fear [5]            | Anger [6]         | Disgust [7]         |
| Treatment × Post Superblocks Inauguration | 0.377*<br>(1.80)      | −0.007<br>(−0.06)  | 0.103<br>(0.35)   | −0.103**<br>(−2.28) | −0.077*<br>(−1.68)  | −0.020<br>(−0.52) | −0.092<br>(−0.68)   |
| Year-Month Fixed Effects                  | Yes                   | Yes                | Yes               | Yes                 | Yes                 | Yes               | Yes                 |
| Restaurant Fixed Effects                  | Yes                   | Yes                | Yes               | Yes                 | Yes                 | Yes               | Yes                 |
| Treatment                                 | Absorbed              | Absorbed           | Absorbed          | Absorbed            | Absorbed            | Absorbed          | Absorbed            |
| Observations                              | 1,475                 | 1,475              | 1,475             | 1,475               | 1,475               | 1,475             | 1,475               |
| Number of Restaurants                     | 156                   | 156                | 156               | 156                 | 156                 | 156               | 156                 |
| <i>R</i> <sup>2</sup>                     | 0.381                 | 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 columns is an indicator equal to one if the Tripadvisor review mentions terrace- or family-friendly terms at least once, and zero otherwise. Columns [1], [2], and [3] use event windows of two, three, and four months, respectively, corresponding to 1, 1.5, and 2 months before construction begins and 1, 1.5, and 2 months after inauguration. 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.

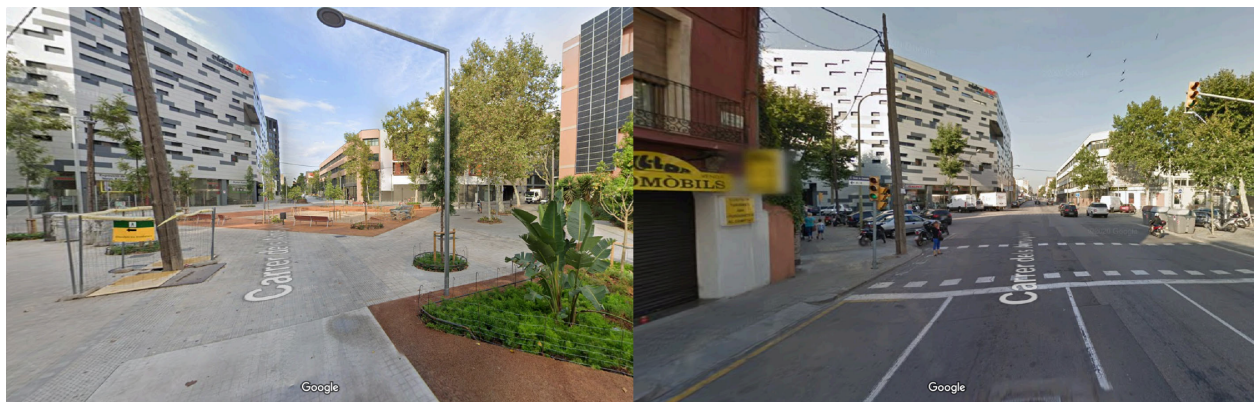
| Dep. variable:                       | Terrace or Family-Friendly Review |                          |                          |
|--------------------------------------|-----------------------------------|--------------------------|--------------------------|
|                                      | Time Window:<br>2 Months          | Time Window:<br>3 Months | Time Window:<br>4 Months |
|                                      | [1]                               | [2]                      | [3]                      |
| Treatment $\times$ Post Inauguration | 0.071<br>(1.19)                   | 0.077*<br>(1.83)         | 0.121***<br>(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.

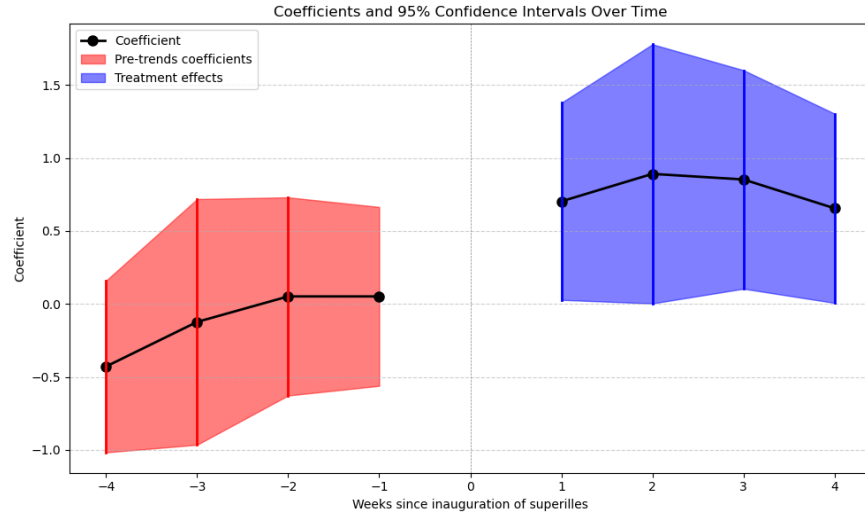


**Figure 2: Street Pacification in Sant Antoni's Superblock.** The left image (2024) shows the area following the Superblock implementation, while the right image (2015) depicts the same location before the Superblock. Authors' elaboration using Google Street View.

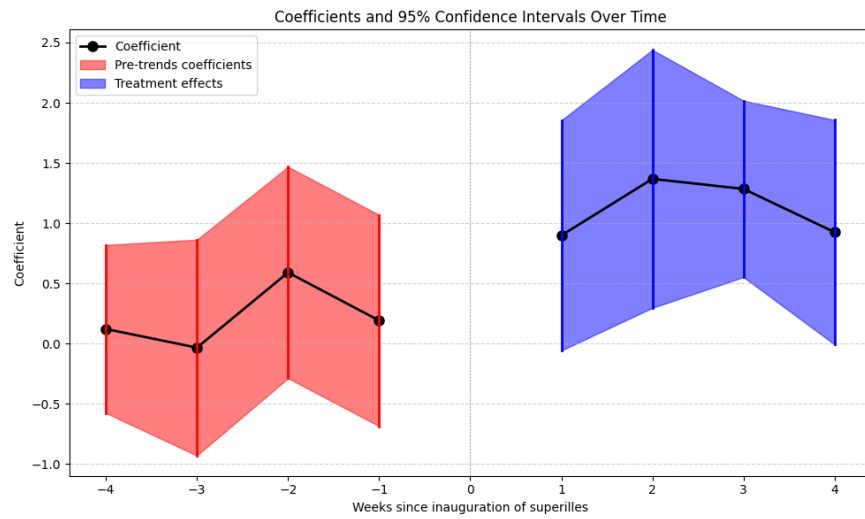


**Figure 3: Street Pacification in Poblenou's Superblock.** The left image shows the area after the implementation of the Superblock in 2024, and the right image shows the same location before the implementation of the Superblock in 2014. Authors' elaboration using Google Street View.

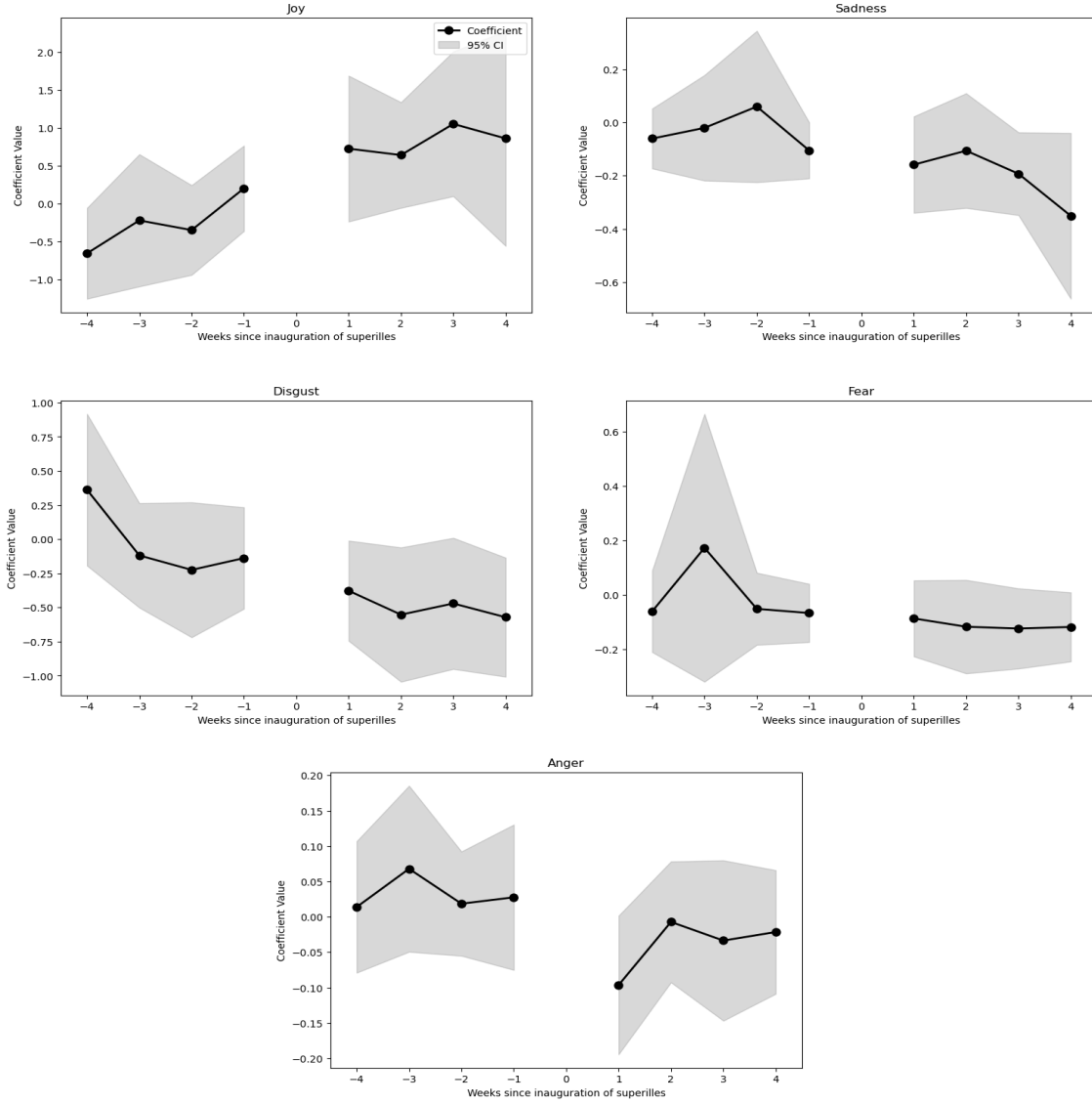




**Figure 5: Effect of the Implementation of Urban Planning on Consumer Satisfaction.** This figure shows event-time estimates of the effect of Superblock implementation in Barcelona on Tripadvisor restaurant ratings. The coefficients that we show in this figure are estimated using the same specification 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 event-time estimates of the effect of Superblock implementation in Barcelona on the multilingual BERT sentiment score constructed from Tripadvisor review text. 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. Sentiment model: <https://huggingface.co/nlptown/bert-base-multilingual-uncased-sentiment>.



**Figure 7: Parallel Trends for Emotion Scores.** This figure shows event-time estimates of the effect of Superblock implementation in Barcelona on various emotion scores (Joy, Sadness, Disgust, Fear, and Anger). The coefficients that we show in this figure are estimated using the same specification as column [3]-[7] 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            | Restaurant longitude                                                                                                                                                                                                                                                                                                               |
| latitude             | Restaurant latitude                                                                                                                                                                                                                                                                                                                |
| location_name        | Unique name for each restaurant                                                                                                                                                                                                                                                                                                    |
| text                 | Textual review                                                                                                                                                                                                                                                                                                                     |
| rating_number        | Tripadvisor review score, ranging from 1 to 5, with higher values indicating more positive evaluations                                                                                                                                                                                                                             |
| origin_review        | Location associated with the reviewer account                                                                                                                                                                                                                                                                                      |
| review_language      | Language in which the review was written                                                                                                                                                                                                                                                                                           |
| category             | Type of food served in the restaurant (e.g., Italian, Chinese, etc.)                                                                                                                                                                                                                                                               |
| number_helpful_votes | Number of helpful votes received by the review                                                                                                                                                                                                                                                                                     |
| average_rating       | Reviewer’s historical average rating at the moment of the review                                                                                                                                                                                                                                                                   |
| year_joined          | Year when the reviewer joined Tripadvisor                                                                                                                                                                                                                                                                                          |
| Multilingual_BERT    | A discrete sentiment score ranging from 1 to 5, developed using the multilingual BERT model <code>nlptown/bert-base-multilingual-uncased-sentiment</code> . The model is fine-tuned for review sentiment in English, Dutch, German, French, Spanish, and Italian.                                                                  |
| yelp                 | A continuous sentiment score ranging from 1 to 5. Model trained on 600,000 Yelp restaurant reviews, achieving a 94% accuracy in classifying review sentiments. <a href="https://huggingface.co/mrcaelumn/yelp_restaurant_review_sentiment_analysis">https://huggingface.co/mrcaelumn/yelp_restaurant_review_sentiment_analysis</a> |
| joy                  | Continuous emotion scores ranging from 1 to 5. This model was trained on 58,000 Reddit comments. It achieves approximately 94% accuracy in emotion classification. <a href="https://huggingface.co/SamLowe/roberta-base-go_emotions">https://huggingface.co/SamLowe/roberta-base-go_emotions</a>                                   |
| sadness              | Emotion score derived from textual analysis                                                                                                                                                                                                                                                                                        |
| fear                 | Emotion score derived from textual analysis                                                                                                                                                                                                                                                                                        |
| anger                | Emotion score derived from textual analysis                                                                                                                                                                                                                                                                                        |
| disgust              | Emotion score derived from textual analysis                                                                                                                                                                                                                                                                                        |

**Table A2: Commercial Activity, Urban Structure, and Baseline Characteristics of Treated and Control Restaurants.** This table reports descriptive statistics on commercial activity, urban structure, local composition, and baseline socioeconomic characteristics for restaurants located in treated and control groups. Panels A–C report group averages. Urban-density and built-form variables in Panel A are constructed using official Barcelona city-block and land-parcel data and measured within a 100-meter buffer around each restaurant. Local restaurants in Panel B are defined as restaurants whose primary category is Spanish, Mediterranean, or Catalan. Local reviews and local unique reviewers are proxied by observations scraped from [www.tripadvisor.es](http://www.tripadvisor.es). Socioeconomic variables in Panel C are measured at the census-section level and assigned to restaurants based on their geographic coordinates. The IST socioeconomic index is from Idescat and is normalized so that Catalonia equals 100; it is a synthetic index based on employment, low-skilled employment, low educational attainment, young population without post-compulsory education, foreign population from low- or middle-income countries, and median income per person. Income variables are from the INE Atlas of Household Income Distribution. Differences are treated minus control. T-statistics and p-values are reported for restaurant-level mean differences. The pre-period refers to observations before the beginning of Superblock construction. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

| Variable                                             | Treated | Control | Difference | t-stat | p-value |
|------------------------------------------------------|---------|---------|------------|--------|---------|
| <i>Panel A: Urban-density and built-form balance</i> |         |         |            |        |         |
| Dwellings per urban ha                               | 292.66  | 287.16  | 5.50       | 0.36   | 0.720   |
| Total built intensity                                | 4.45    | 4.55    | -0.10      | -0.58  | 0.560   |
| Above-ground built intensity                         | 4.00    | 4.01    | -0.02      | -0.10  | 0.920   |
| Share of commercial units                            | 0.53    | 0.53    | 0.00       | 0.08   | 0.940   |
| Share of residential units                           | 0.25    | 0.26    | -0.01      | -0.76  | 0.450   |
| Commercial units per dwelling                        | 2.21    | 2.56    | -0.34      | -0.83  | 0.410   |
| <i>Panel B: Baseline local composition</i>           |         |         |            |        |         |
| Pre-period share of local restaurants                | 27.3%   | 28.4%   | -1.1 p.p.  | -0.16  | 0.874   |
| Pre-period share of local reviews                    | 54.4%   | 51.5%   | 2.9 p.p.   | 0.42   | 0.677   |
| Pre-period share of local unique reviewers           | 54.8%   | 51.7%   | 3.1 p.p.   | 0.45   | 0.653   |
| <i>Panel C: Baseline socioeconomic balance</i>       |         |         |            |        |         |
| IST socioeconomic index                              | 108.3   | 108.6   | -0.3       | -0.32  | 0.751   |
| Mean net income per person                           | 14,463  | 14,625  | -162       | -0.65  | 0.519   |
| Mean income per consumption unit                     | 20,959  | 21,507  | -548       | -1.38  | 0.170   |
| Median income per consumption unit                   | 18,397  | 18,614  | -218       | -0.61  | 0.542   |

**Table A3: Examples of Review Text and Sentiment Scores.** This table presents illustrative review excerpts and their corresponding sentiment scores. The multilingual BERT score is the main sentiment measure reported in column [1] of Table 7. The Yelp-trained score provides an additional restaurant-review-based benchmark. All examples are drawn from the four-month event-window regression sample used in the paper. Review excerpts are shortened for readability. The examples were selected from pre-specified categories to illustrate how the sentiment measures map into the underlying review text and to show both cross-language consistency and the usefulness of the multilingual sentiment score.

| Example                         | Review excerpt                                                                                                                                                                                                                                                                                             | Tripadvisor rating | Yelp-trained score | Multilingual score | Interpretation                                                                                                                             |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Clear positive review           | “Came here few times on our short stay in Barcelona. Everything, the food, ambience, staff were amazing. Highly recommend!! Perfect day to start your day with positive vibes and delicious food.”                                                                                                         | 5.00               | 5.00               | 5.00               | The text is clearly positive, and both sentiment scores closely match the Tripadvisor rating.                                              |
| Clear negative review           | “As most reviews point out, the worst thing about the restaurant is the dining room. The food is very good, and the place is nicely decorated. The problem lies with the management/owner. You can’t run a restaurant with a capacity of 91 people and...” Translated from Spanish using Google Translate. | 2.00               | 1.91               | 2.00               | The review contains a clear negative assessment despite acknowledging some positive aspects, and both scores classify it as low sentiment. |
| Mixed or moderate review        | “Cute breakfast place. Too bad the staff were not so pleasant. A smile makes the morning coffee smoother.”                                                                                                                                                                                                 | 3.00               | 3.05               | 3.00               | The review combines positive and negative elements, consistent with an intermediate sentiment score.                                       |
| Non-English review illustration | “The perfect place to enjoy a delicious brunch. Fresh, high-quality ingredients, and an atmosphere and service that live up to the venue’s reputation: top-notch! I highly recommend it!” Translated from French using Google Translate.                                                                   | 5.00               | 5.00               | 5.00               | This non-English review is strongly positive, and both models assign a high sentiment score.                                               |

**Table A4: 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 Tripadvisor 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:<br>2 Months |                    | Time Window:<br>3 Months |                    | Time Window:<br>4 Months |                   |
|                                                  | [1]                      | [2]                | [3]                      | [4]                | [5]                      | [6]               |
| Treatment $\times$ Post Superblocks Inauguration | 0.394***<br>(3.67)       | 0.386***<br>(3.52) | 0.229***<br>(2.85)       | 0.215***<br>(2.72) | 0.161**<br>(2.23)        | 0.168**<br>(2.41) |
| Post Superblocks Inauguration                    | -0.484***<br>(-3.00)     | Absorbed           | -0.344*<br>(-1.96)       | Absorbed           | -0.515***<br>(-3.60)     | Absorbed          |
| 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 A5: 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 from review text using machine-learning-based natural language processing models. Panels A, B, and C use event windows of two, three, and four months, respectively, corresponding to 1, 1.5, and 2 months before construction begins and 1, 1.5, and 2 months after inauguration. 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. variables:                                  | Panel A: Time Window: 2 months |                    |                    |                     |                   |                     |
|--------------------------------------------------|--------------------------------|--------------------|--------------------|---------------------|-------------------|---------------------|
|                                                  | Log Yelp                       | Log Joy            | Log Sadness        | Log Fear            | Log Anger         | Log Disgust         |
|                                                  | [1]                            | [2]                | [3]                | [4]                 | [5]               | [6]                 |
| Treatment $\times$ Post Superblocks Inauguration | 0.183***<br>(2.96)             | 0.382***<br>(2.77) | -0.046<br>(-1.09)  | -0.053**<br>(-2.20) | -0.056<br>(-1.36) | -0.215**<br>(-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               |
| Dep. variables:                                  | Panel B: Time Window: 3 months |                    |                    |                     |                   |                     |
|                                                  | Log Yelp                       | Log Joy            | Log Sadness        | Log Fear            | Log Anger         | Log Disgust         |
|                                                  | [1]                            | [2]                | [3]                | [4]                 | [5]               | [6]                 |
| Treatment $\times$ Post Superblocks Inauguration | 0.088**<br>(2.26)              | 0.119<br>(0.95)    | -0.037<br>(-0.99)  | -0.051*<br>(-1.94)  | -0.010<br>(-0.38) | -0.114*<br>(-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               |
| Dep. variables:                                  | Panel C: Time Window: 4 months |                    |                    |                     |                   |                     |
|                                                  | Log Yelp                       | Log Joy            | Log Sadness        | Log Fear            | Log Anger         | Log Disgust         |
|                                                  | [1]                            | [2]                | [3]                | [4]                 | [5]               | [6]                 |
| Treatment $\times$ Post Superblocks Inauguration | -0.006<br>(-0.17)              | 0.037<br>(0.31)    | -0.046*<br>(-1.76) | -0.041<br>(-1.59)   | -0.005<br>(-0.21) | -0.040<br>(-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               |

**Table A6: Rating Number of Treated Restaurants after Superblock Implementation: Controlling for Superblocks  $\times$  Time Fixed Effects.** This table presents estimates from rating-number regressions using the four-month event window, corresponding to two months before construction begins and two months after inauguration. The sample includes restaurant-consumer-review-level data for the period July 2016 – February 2020. 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       |                   |
|--------------------------------------------------|---------------------|-------------------|
|                                                  | [1]                 | [2]               |
| Treatment $\times$ Post Superblocks Inauguration | 0.406**<br>(2.23)   | 0.413**<br>(2.27) |
| Post Superblocks Inauguration                    | -2.277**<br>(-2.01) | Absorbed          |
| Year Fixed Effects                               | Yes                 | No                |
| Year-Month Fixed Effects                         | No                  | Yes               |
| Restaurant Fixed Effects                         | Yes                 | Yes               |
| Superblocks $\times$ Year Fixed Effects          | Yes                 | No                |
| Superblocks $\times$ Year-Month Fixed Effects    | No                  | Yes               |
| Treatment                                        | Absorbed            | Absorbed          |
| Observations                                     | 1,479               | 1,475             |
| Number of Restaurants                            | 158                 | 156               |
| Adjusted - $R^2$                                 | 0.529               | 0.547             |