UNIVERSITÀ DEGLI STUDI DI BRESCIA

# The Effect of TripAdvisor Reviews on the Pricing of Hotels in Rome

## A Regression Discontinuity Design Approach

*Causal Inference and Impact Evaluation*
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# Introduction:

The aim is to understand the Economic Impact of Online Reviews:
•Investigating how even small differences in review scores can have significant economic consequences.

We do that by applying Causal Inference Framework:
•Utilizing a Regression Discontinuity Design (RDD) on TripAdvisor data.
•Aims to determine if crossing the 4-star to 4.5-star threshold causally impacts pricing.

# Motivations – for Business

- **Crucial for Revenue Management:**
  - Understanding the pricing impact of changing from a 4-star to a 4.5-star rating (and vice-versa) is vital.
  - Informs **reputation management** and **pricing strategy** efforts.

- **Actionable Insights & ROI:**
  - Provides clear guidance on the **Return on Investment (ROI)** for improving customer satisfaction.
  - Directly links efforts to enhance service with potential increases in online review scores and subsequent pricing power.

# Motivations – for Consumers

- **Understanding Price Disparities:**
  - Helps discern if and how seemingly small rating differences lead to tangible price variations.
- **Informing Travel Decisions:**
  - Alerts travelers to potential **"hidden" price premiums** associated with slightly higher-rated establishments.
  - Empowers more informed booking choices.

# Research Question

Does crossing the 4-star to 4.5-star average bubble rating threshold on TripAdvisor causally impact pricing?

# Expected Answer

**A Price Premium**

We anticipate that **prices will be higher** for establishments crossing the threshold from 4-stars to 4.5-stars.

**Why this occurs:**

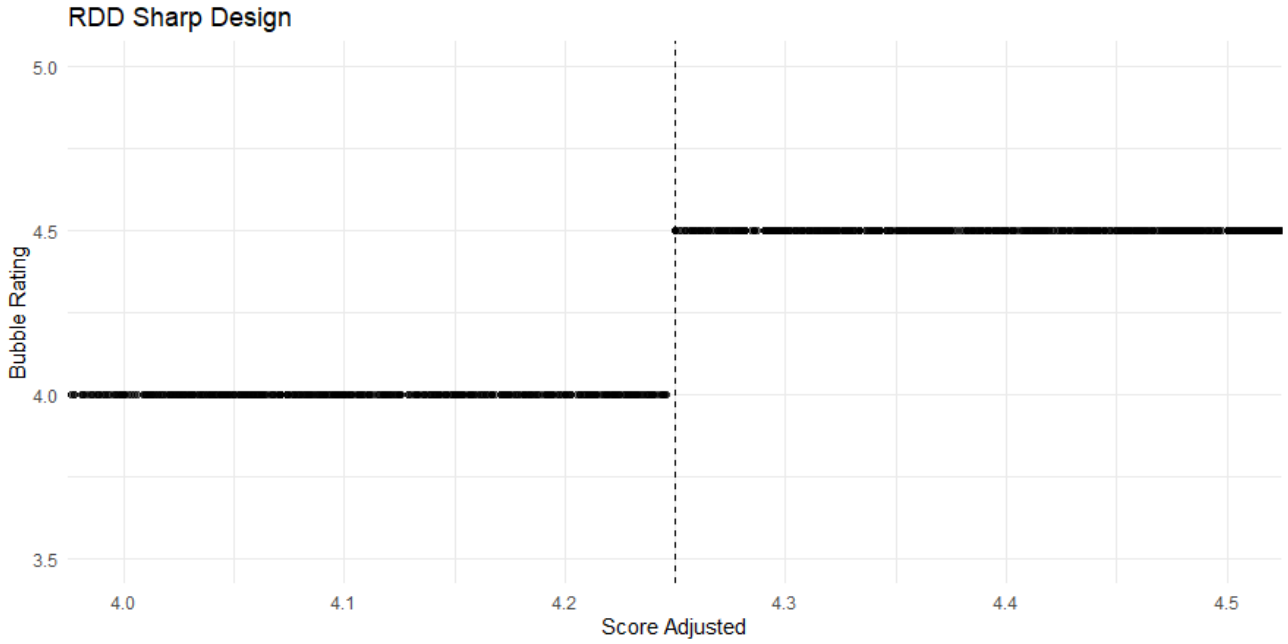
- **Perceived Quality & Value:**
  - A half-star shift significantly alters consumer perception.
  - 4.5-stars signals "excellent" or "very good" vs. "good" or "above average" for 4-stars.
  - Consumers are willing to pay more for higher perceived value.
- **Increased Demand:**
  - Higher ratings lead to enhanced visibility and trust on platforms.
  - Resulting in higher demand, allowing businesses to command increased prices.

# Specification

**Leveraging a Natural Experiment:**

The discrete nature of TripAdvisor's bubble scores (specifically the 4-star/4.5-star cutoff that happens at the average score’s threshold of 4.25) presents a compelling natural experiment, allowing for a robust Regression Discontinuity Design.

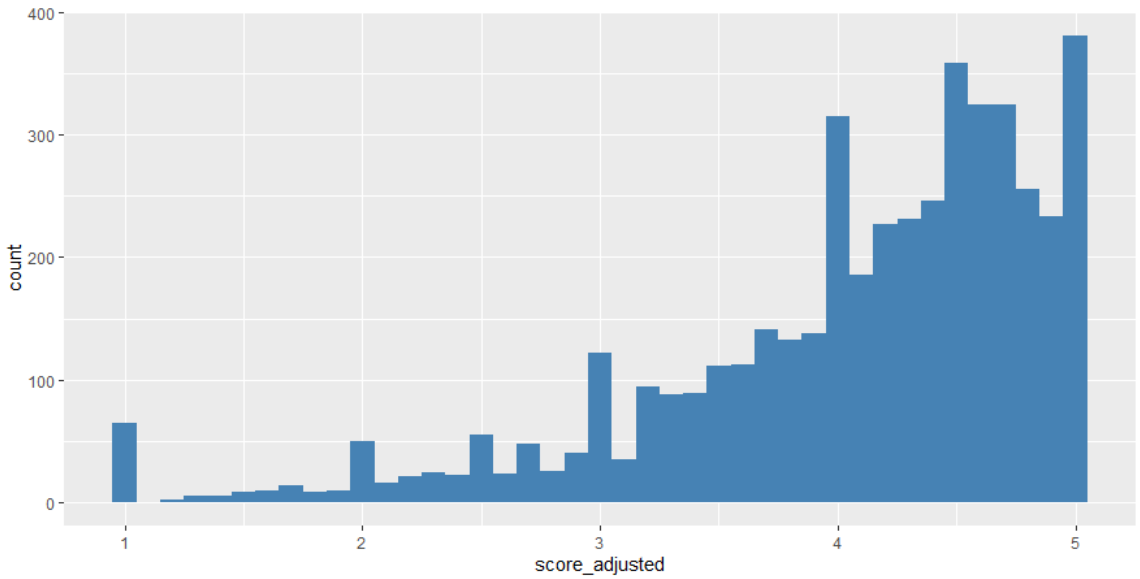
# Specification - RDD




- The cutoff at 4.25 is interesting because it represents a jump for many users (from 'good' to 'very good')
- Since treatment is a deterministic function of the running variable, we defined a Sharp RD Design

# Specification

- **Outcome:** current prices
- **Running variable:** bubble rating (*score_adjusted*)
- **Covariates:** Views (per day), Class (Hotel “stars”), Air Conditioning and Bar Lounge (binaries)




# Data

- **Source:** TripAdvisor (Hotels in Rome, December 2019)
- Number of **Observations:** 4599
- **Variables:** 273

This dataset includes nearly all hotels listed on TripAdvisor for the region, with only a small number excluded due to missing key information

# Validating the RD Design

1) Test the hypothesis that the **density** of the running variable is **continuous at the cutoff;**

2) Check for a **discontinuity** in the outcome **at the cutoff;**

3) Test the hypothesis of **no jump** in baseline covariates;

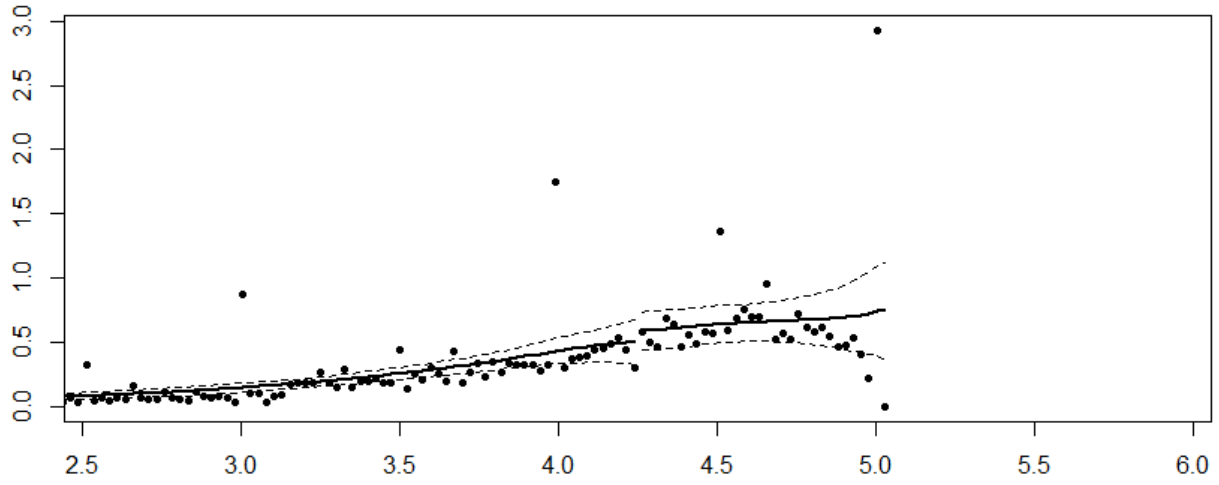
4) Test the hypothesis of **no jumps** on the outcome variable at alternative cutoffs (placebo tests).

# 1) McCrary Test

- The McCrary density test is used to check whether units are sorting on the running variable (in this case, bought reviews)

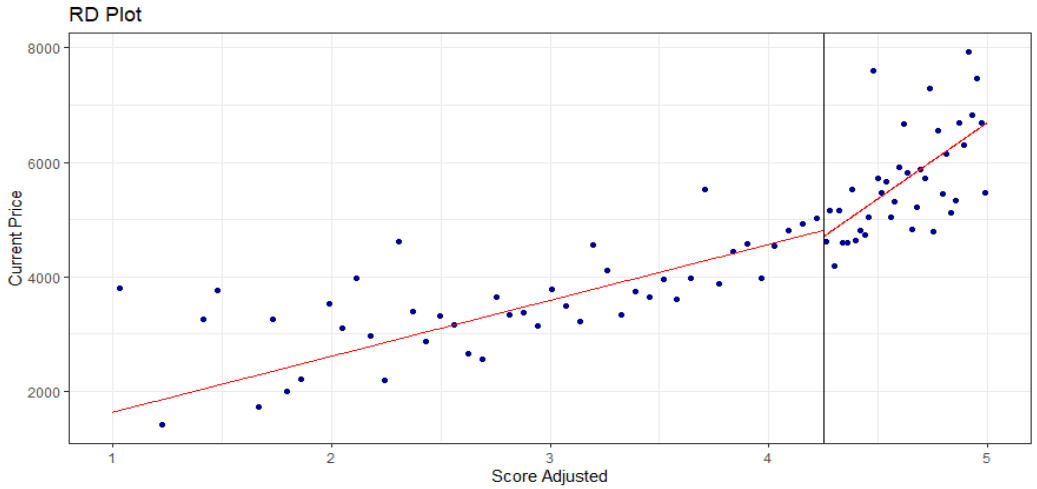
- Testing if the hypothesis that the density of the running variable is continuous at the cutoff

- p-value = 0.02795552

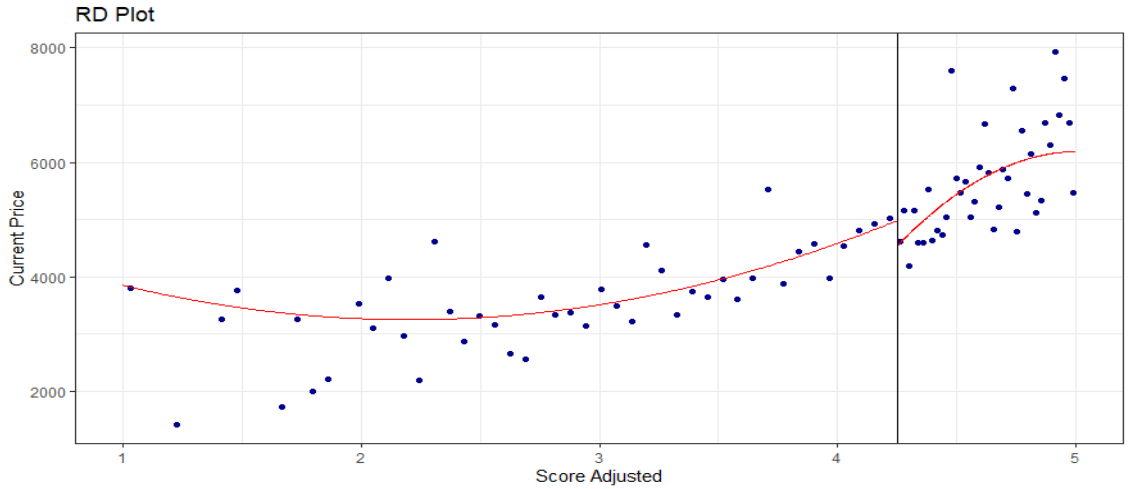


# 2) Check for a discontinuity in the outcome at the cutoff

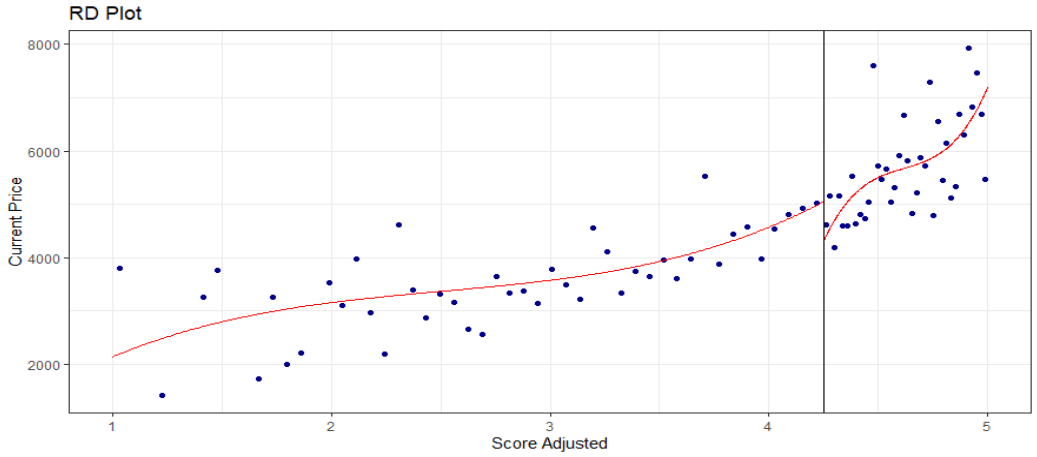
Polynomial of order 1:



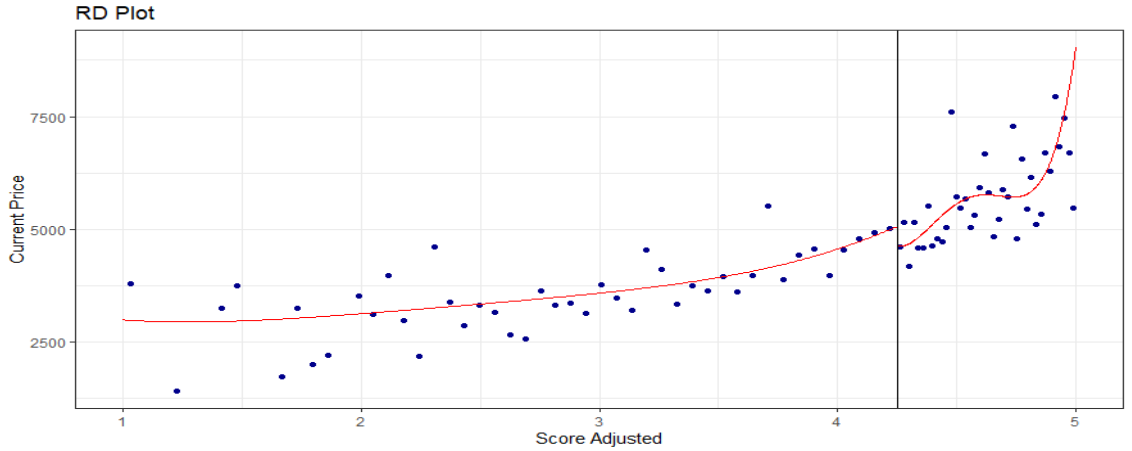

Polynomial of order 2:



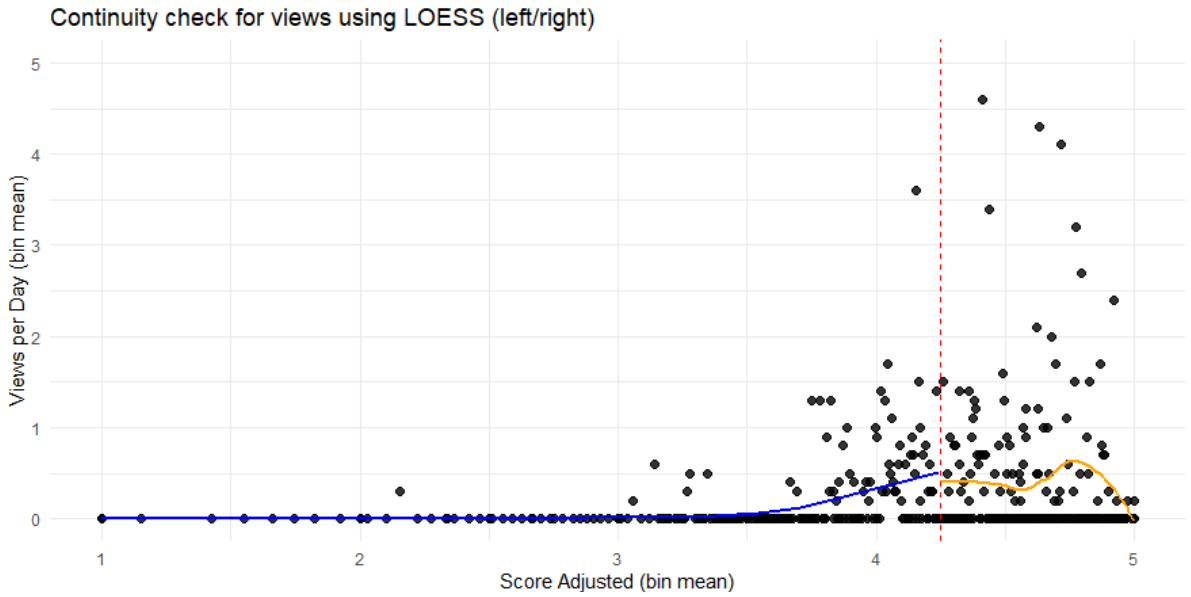

Polynomial of order 3:

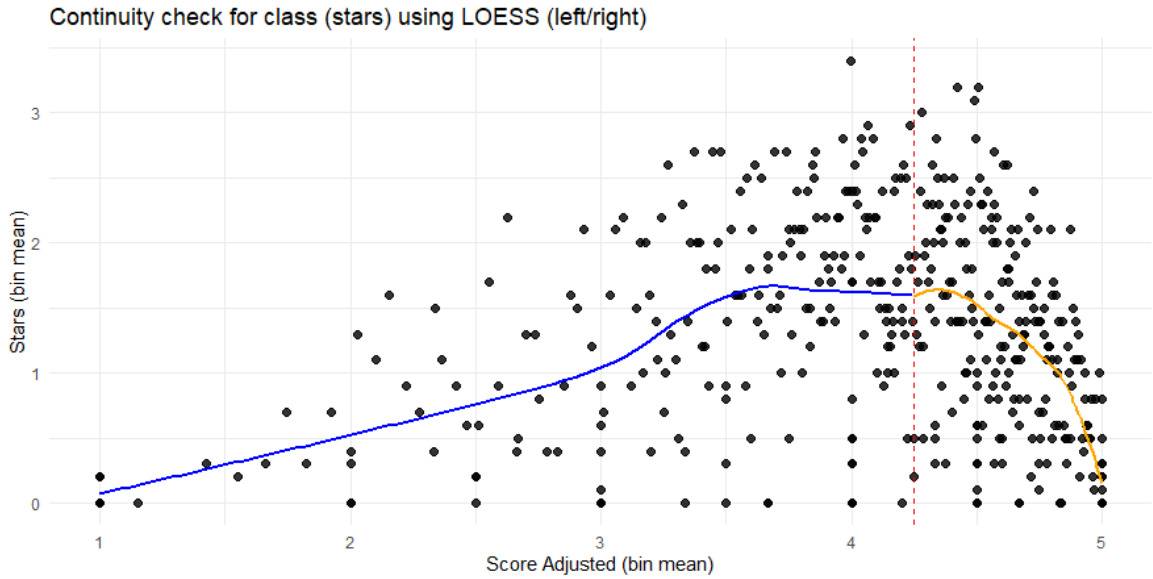


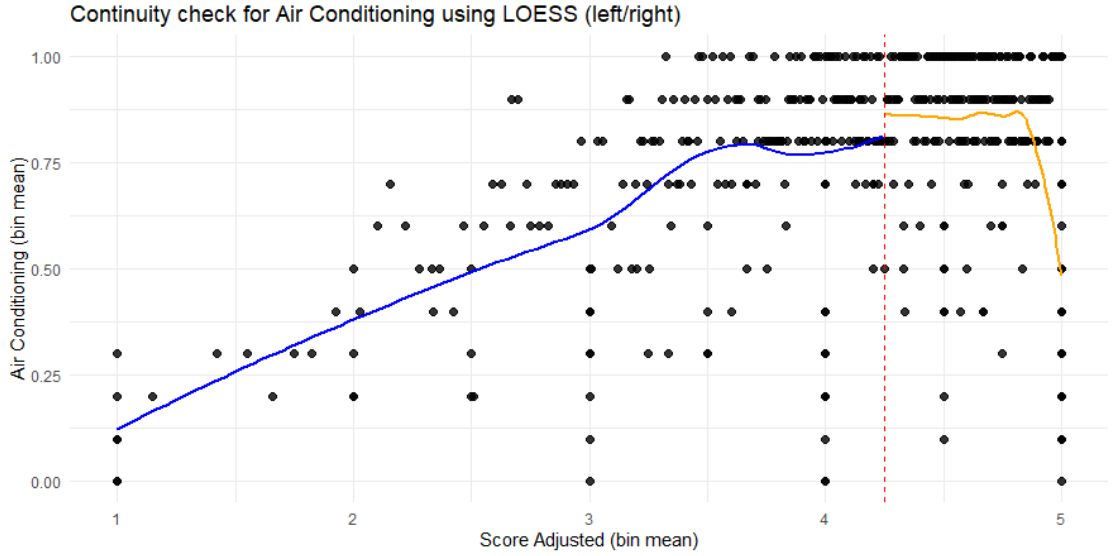

Polynomial of order 4:

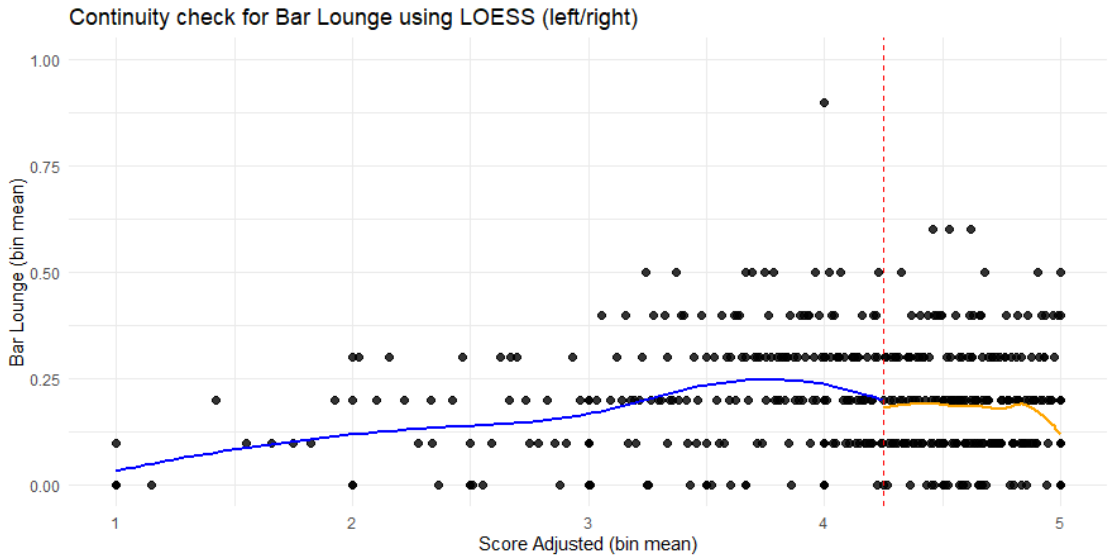


# 3) Continuity of covariates



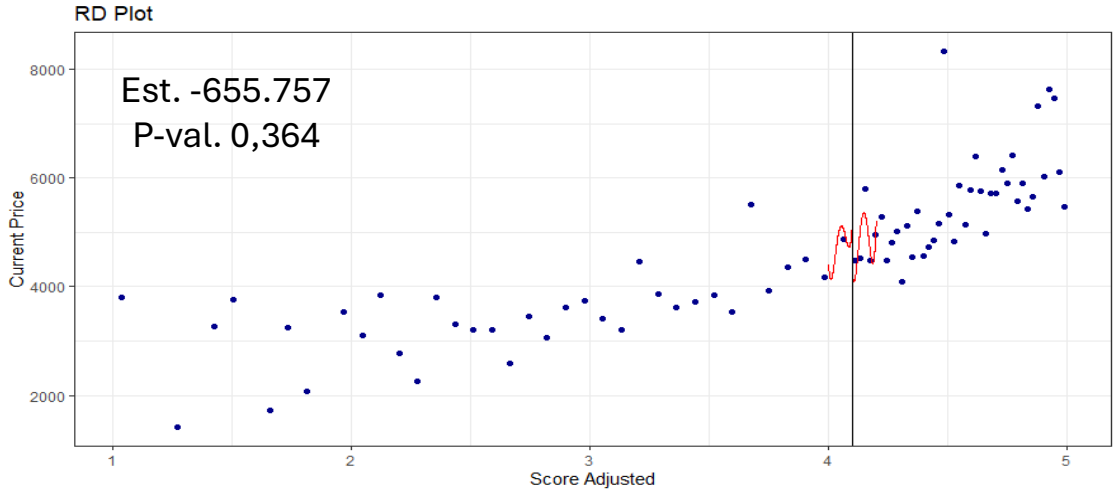



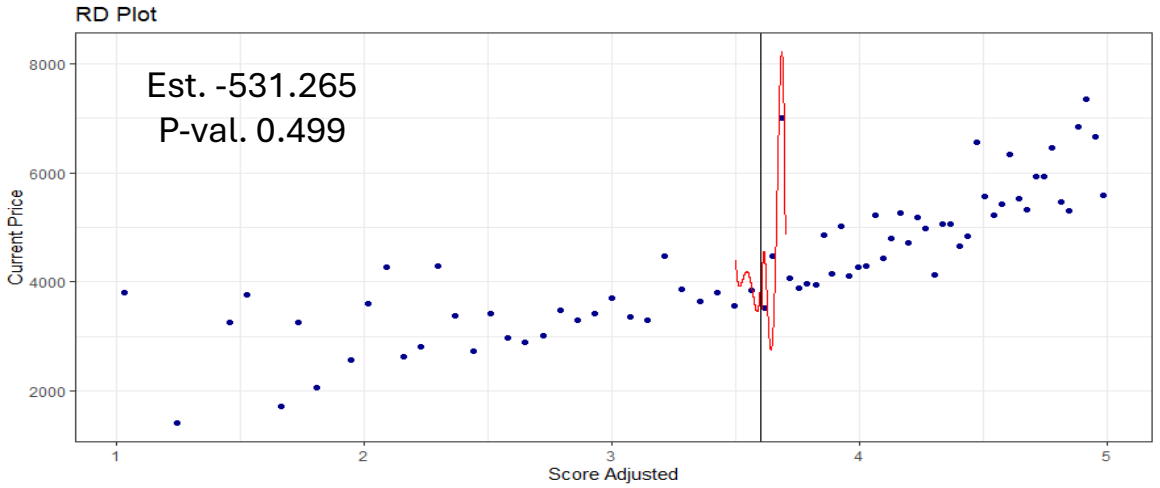



# 4) Placebo Tests

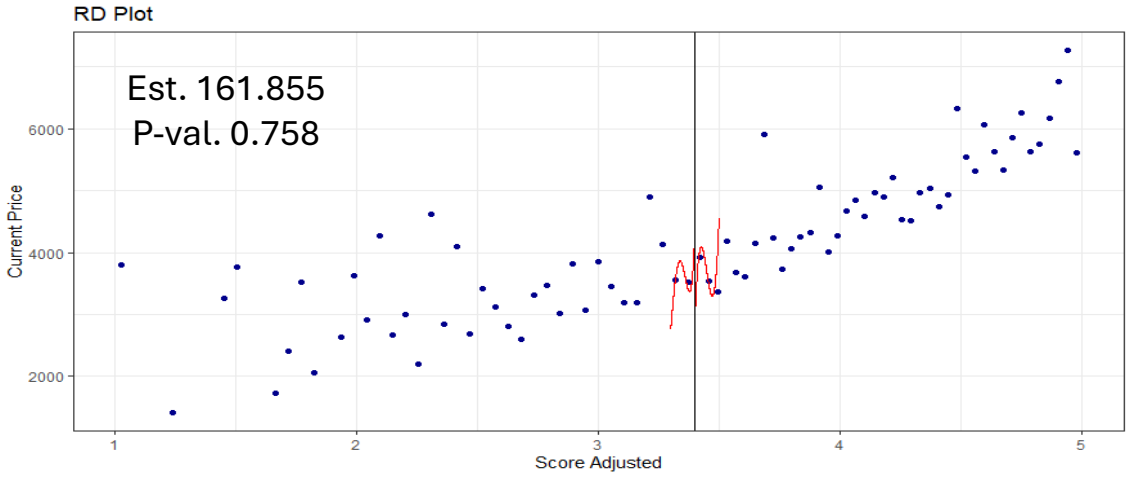
Placebo cut-off: 4.1 (range 0.1)



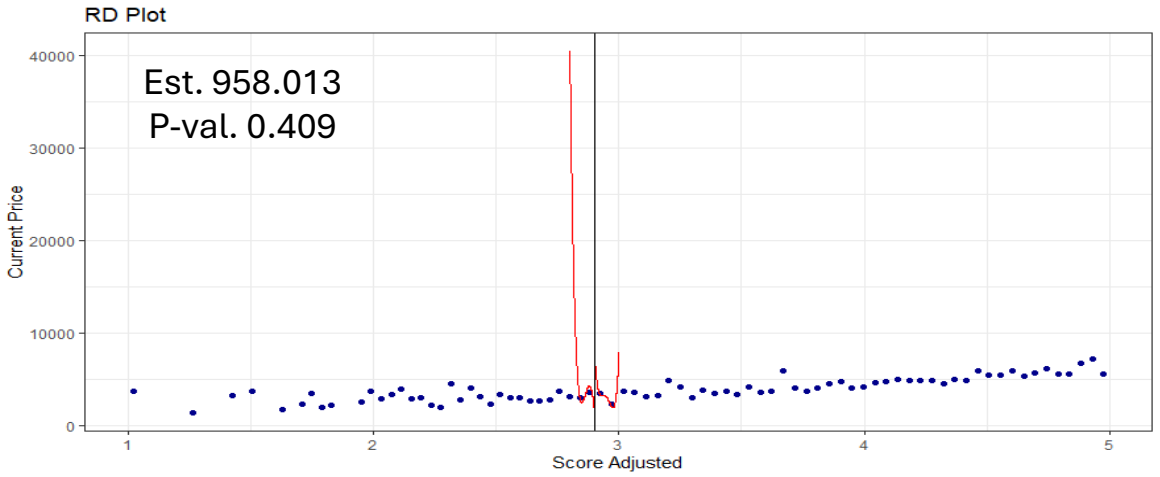

Placebo cut-off: 3.6 (range 0.1)




Placebo cut-off: 3.4 (range 0.1)




Placebo cut-off: 2.9 (range 0.1)



# Results

Table 1: RD Estimates of the Effect of Higher Bubble Scores on the Pricing of Hotels in Rome, Different Models with various covariates

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Estimate | 48.338 | -19.762 | -191.781 | 89.941 | -37.378 | -67.202 |
| | (671.783) | (661.465) | (655.572) | (604.724) | (625.174) | (620.882) |
| | [0.943] | [0.976] | [0.770] | [0.882] | [0.952] | [0.914] |
| Views | No | Yes | Yes | Yes | No | Yes |
| Class | No | No | Yes | No | Yes | Yes |
| Air Conditioning | No | No | No | Yes | Yes | Yes |
| Bar Lounge | No | No | No | Yes | Yes | Yes |
| Number of observations | 680 | 680 | 680 | 680 | 680 | 680 |

*Note: Standard errors in parentheses.* $^{*}$, $^{**}$, $^{***}$ *indicate significance at the 10%, 5%, and 1% levels, respectively. P-values are in square brackets. Bandwidth = 0.25, Order of Polynomials = 4*

Table 2: RD Estimates of the Effect of Higher Bubble Scores on the Pricing of Hotels in Rome, Different Bandwidths and Polynomial's Orders

| **Bandwidths** | **0.25** | **0.20** | **0.15** | **0.10** | **0.05** |
|---|---|---|---|---|---|
| *Polynomial of order:* | | | | | |
| **Zero** | 1.800 | -101.760 | -151.821 | -193.843 | -122.150 |
| | (214.786) | (234.651) | (256.618) | (291.227) | (349.339) |
| **One** | -443.970 | -285.411 | -370.314 | -304.178 | 249.726 |
| | (359.038) | (386.100) | (434.026) | (452.911) | (510.319) |
| **Two** | -31.366 | -220.183 | -154.833 | 46.107 | -299.708 |
| | (491.716) | (515.391) | (511.461) | (580.255) | (855.418) |
| **Three** | -431.145 | 169.747 | -413.017 | 39.452 | 369.180 |
| | (545.920) | (538.243) | (663.534) | (758.935) | (1113.778) |
| **Four** | -67.202 | -464.690 | 124.929 | 8.165 | -913.386 |
| | (620.882) | (747.148) | (827.983) | (1050.655) | (1684.673) |
| **Observations** | 680 | 542 | 412 | 269 | 133 |

*Note: Standard errors in parentheses.* $^{*}$, $^{**}$, $^{***}$ *indicate significance at the 10%, 5%, and 1% levels, respectively. These models include all the covariates.*

# Results

# Conclusions

**No statistically significant Causal Effect at the 4.25-Star Threshold**

- **Possible Interpretations:**
  - **Threshold:** This specific 0.5-star difference may not be perceived as a strong enough quality signal for immediate price adjustments by consumers or businesses.
  - **More important factors:** Other factors (e.g., location, brand) might be stronger drivers of pricing at this margin.
  - **Management choices:** Pricing adjustments related to ratings might be less gradual or based on broader metrics.
- **Implications:**
  - **For Businesses:** While ratings are important, this specific increment may not be a direct lever for immediate price increases.
  - **For Consumers:** At this cutoff, the hypothesized "hidden" price premium does not appear to be present.
- **Future Research:**
  - Investigate other rating thresholds (e.g., 3.5/4 or 4.5/5 stars).
  - Examine longer-term effects or impacts on other outcomes (e.g., booking volume).
  - Conduct similar analyses across different markets.

# Conclusions Validity

Threats to external validity:

- Other platforms (e.g. «booking.com») may lead to different results
- Geographical/cultural context (e.g. Milan/Florence)
- Time period of data collection (high/low demand seasons)

# References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- Calonico, S., Cattaneo, M.D., Titiunik, R., 2015. rdrobust: An r package for robust nonparametric inference in regression-discontinuity designs. R J. 7, 38–51
- Calonico, S., Cattaneo, M.D., Farrell, M.H., 2020. Optimal bandwidth choice for robust bias-corrected inference in regression discontinuity designs. Econom. J. Forthcomin.
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