Shirking with Good Reputation? Evidence from Hotel Industry

Fang-Chang Kuo

National Chung Cheng University

May 5, 2021

Motivation

- Online reviews and ratings have become an important source of information while consumers are making decisions.
  - TripAdvisor contains near half billion reviews, receives 400 million monthly unique visitors, covers to 7 million accommodations
  - Yelp is the leading review website and app for local businesses
  - Online marketplaces: Amazon, eBay, and Taobao
- Extensive studies have shown that reputation mechanisms help mitigate asymmetric information problems.
- Firms, or products with better reputation are rewarded by more sales, and higher prices.
- Reputation effects on endogenous product characteristics remain unexplored empirically.

Research questions

How do online ratings affect investment incentives?

- Theoretical Framework (Board and Meyer-ter-Vehn 2013 ECMA):
  - A model of dynamic investment and reputation
  - Firms may view their reputation as a valuable asset and try to maintain it by keep investing in quality. (shirk-work equilibrium)
  - Firms may run down its reputation by delaying investment because consumers believe that product quality is still good. (work-shirk equilibrium)
  - Ambiguous relationship depending on information structure

This paper:

- Hotel industry:
  - Product: a night of stay, experience good
  - Information: slow individual learning, online ratings
  - Dynamic quality: depreciating over time, affected by past investments and maintenance
- Data:
  - Investment: Monthly panel of hotel investment expenditures,
  - Reputation: TripAdvisor consumer ratings
- Empirical Strategy:
  - Regression discontinuity design, TripAdvisor rounding rules
- Main Findings:
  - Inverted-U relationship between investment and average TripAdvisor ratings
  - RD estimates are consistent with work-shirk equilibrium from Board and Meyer-ter-Vehn (2013)

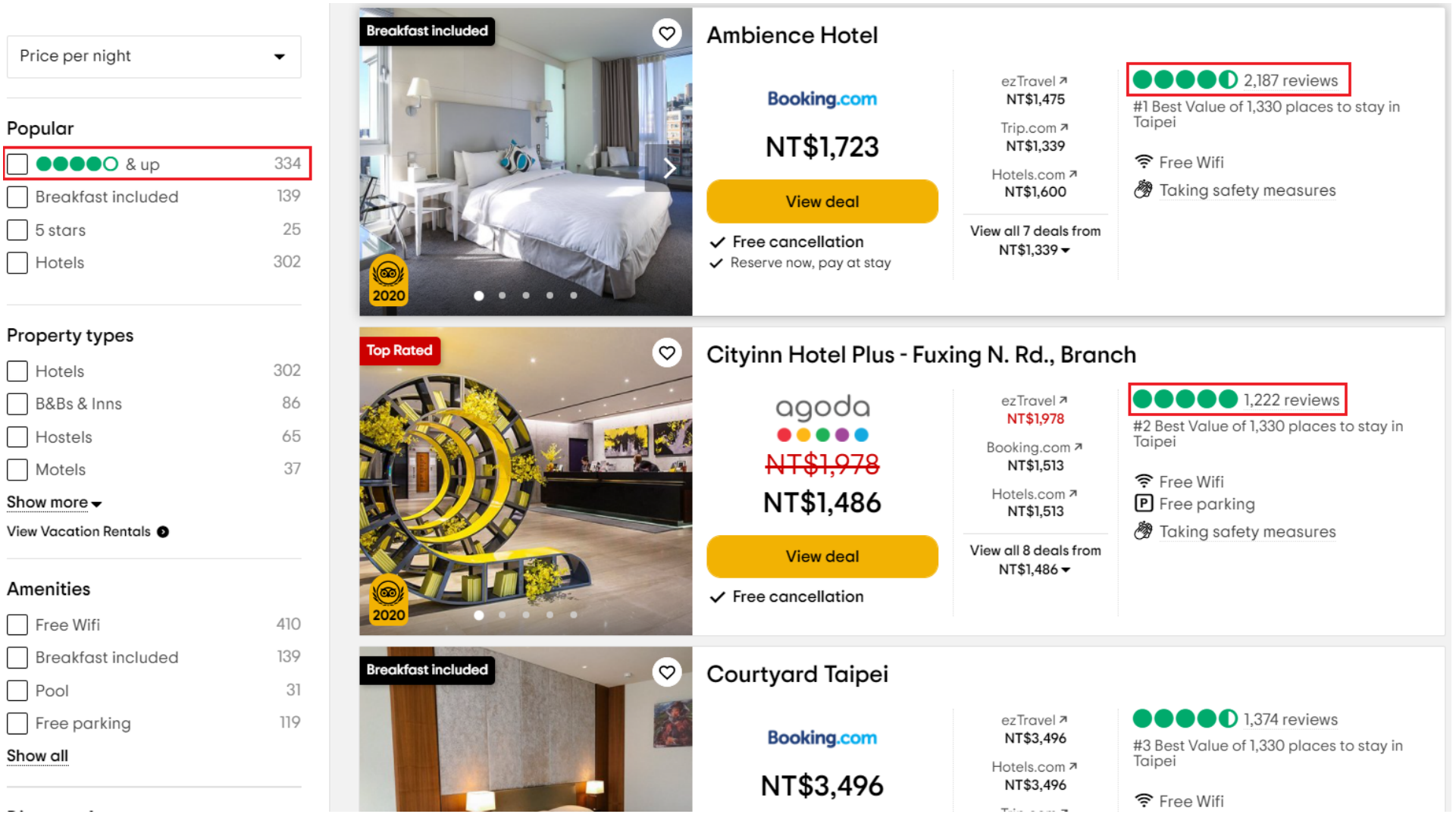
Related Literature

- Theory on reputation and quality:
  - Board and Meyer-ter-Vehn (2013)
- Impact of user ratings:
  - Chevalier and Mayzlin (2006), Anderson and Magruder (2012), Luca (2016)
- Information provision and product quality:
  - Jin and Leslie (2003), Ater and Orlov (2015)
- Strategic Response in Ad spending:
  - Hollenbeck, Moorthy, and Proserpio (2020)

Data

- Hotel data:
  - Source: the Bureau of Tourism in Taiwan
  - Sample period: 2009/01-2016/06
  - Monthly panel of sales, room revenues, investments, employments, and number of rooms
  - Investment: expenditure on durable goods, and fixed assets
- Online rating data:
  - Source: TripAdvisor
  - Stay date, review date, and consumer rating
- Sample selection:
  - Focus on observations with 25 or more consumer reviews

TripAdvisor Search Results



Other Rating Platforms

Figure: Agoda

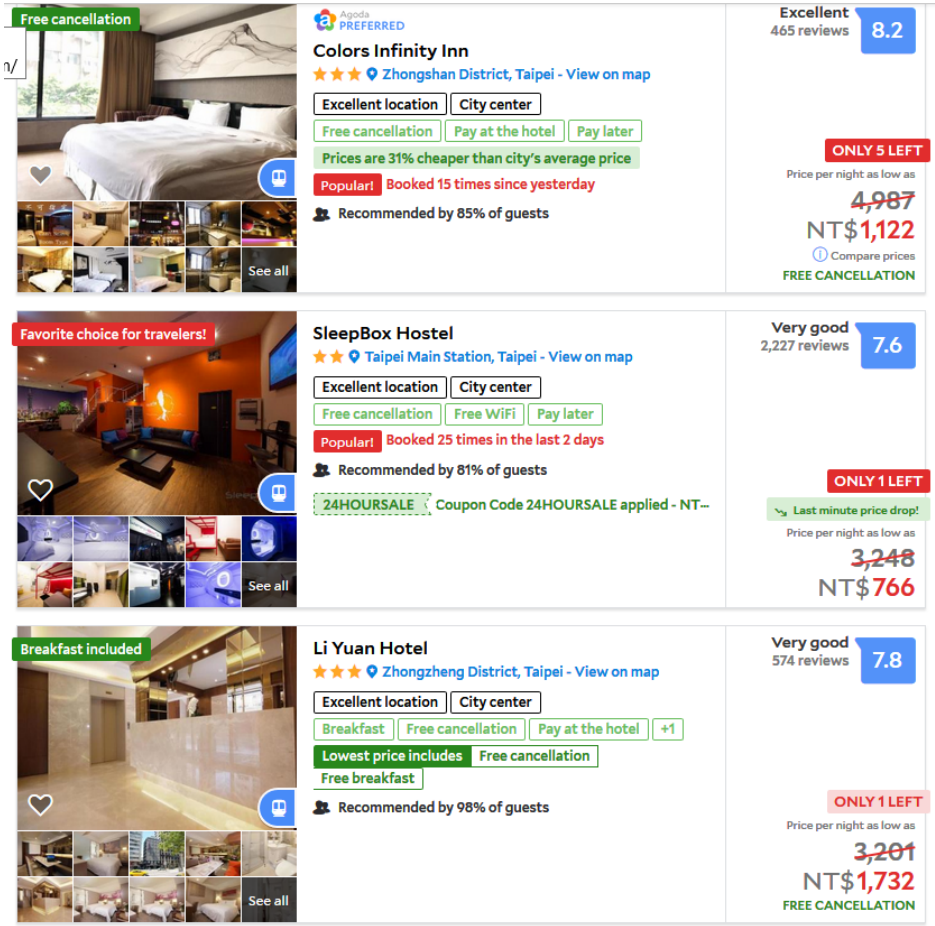
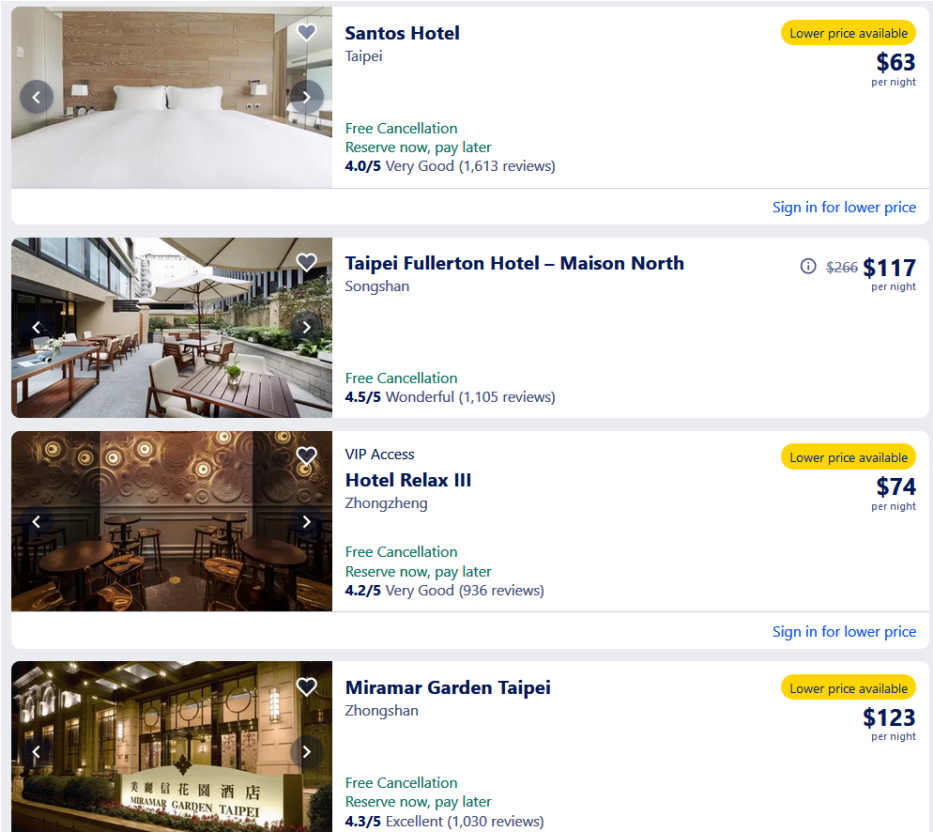
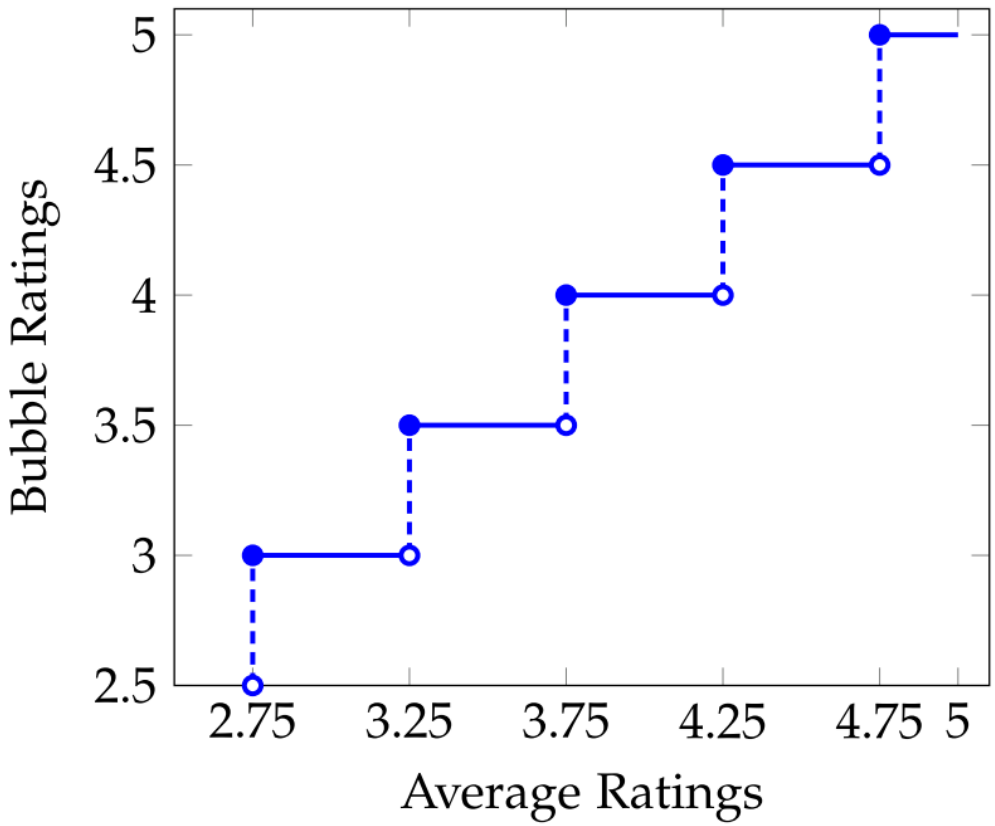


Figure: Expedia



Regression Discontinuity Design

- Regression Discontinuity Designs using thresholds from 5-point bubble rating system:
  - Yelp: Anderson and Magruder (2012), and Luca (2016)
  - TripAdvisor: Hollenbeck, Moorthy, and Proserpio (2020)
  - Key: Ratings are rounded to nearest half-star, a step function



Distribution of TripAdvisor Bubble Rating

Figure: Unconditional

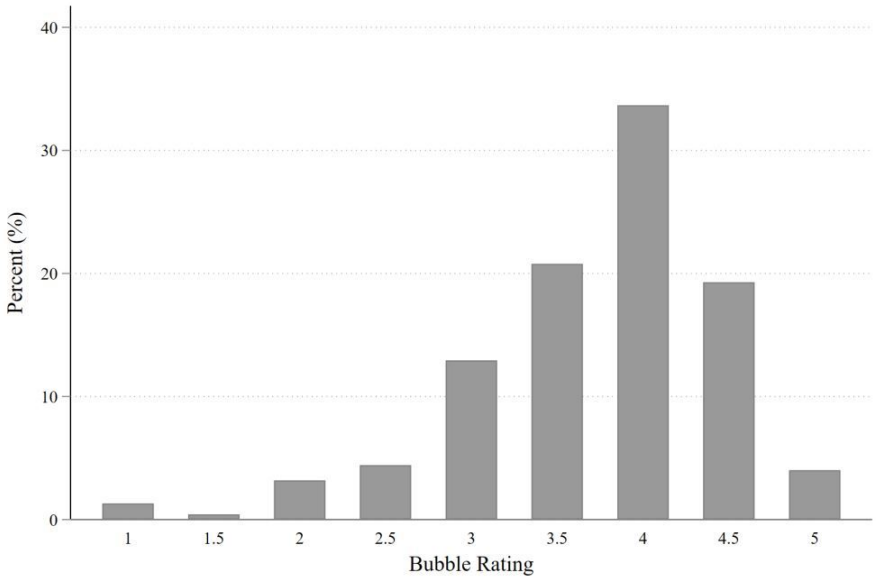
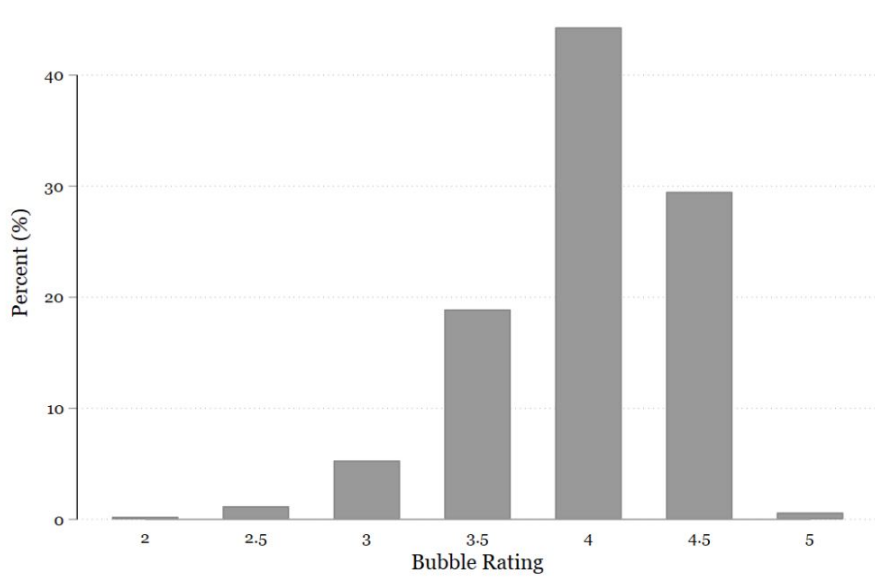


Figure: 25 or more



Descriptive Relationship

Figure: Intensive Margin

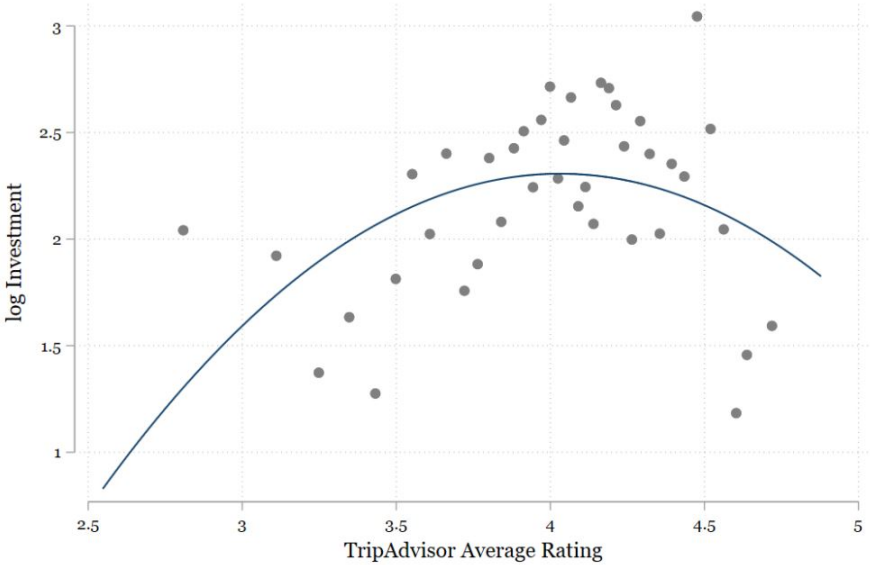
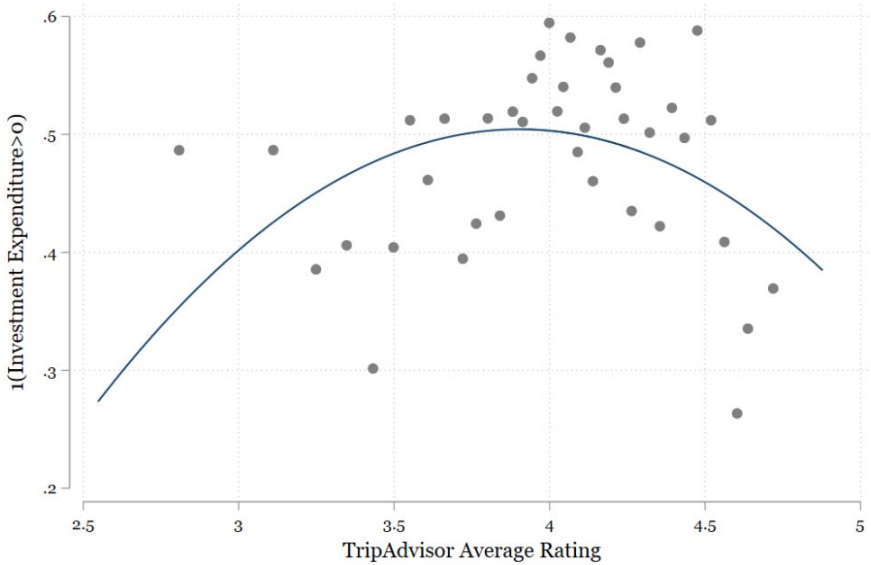
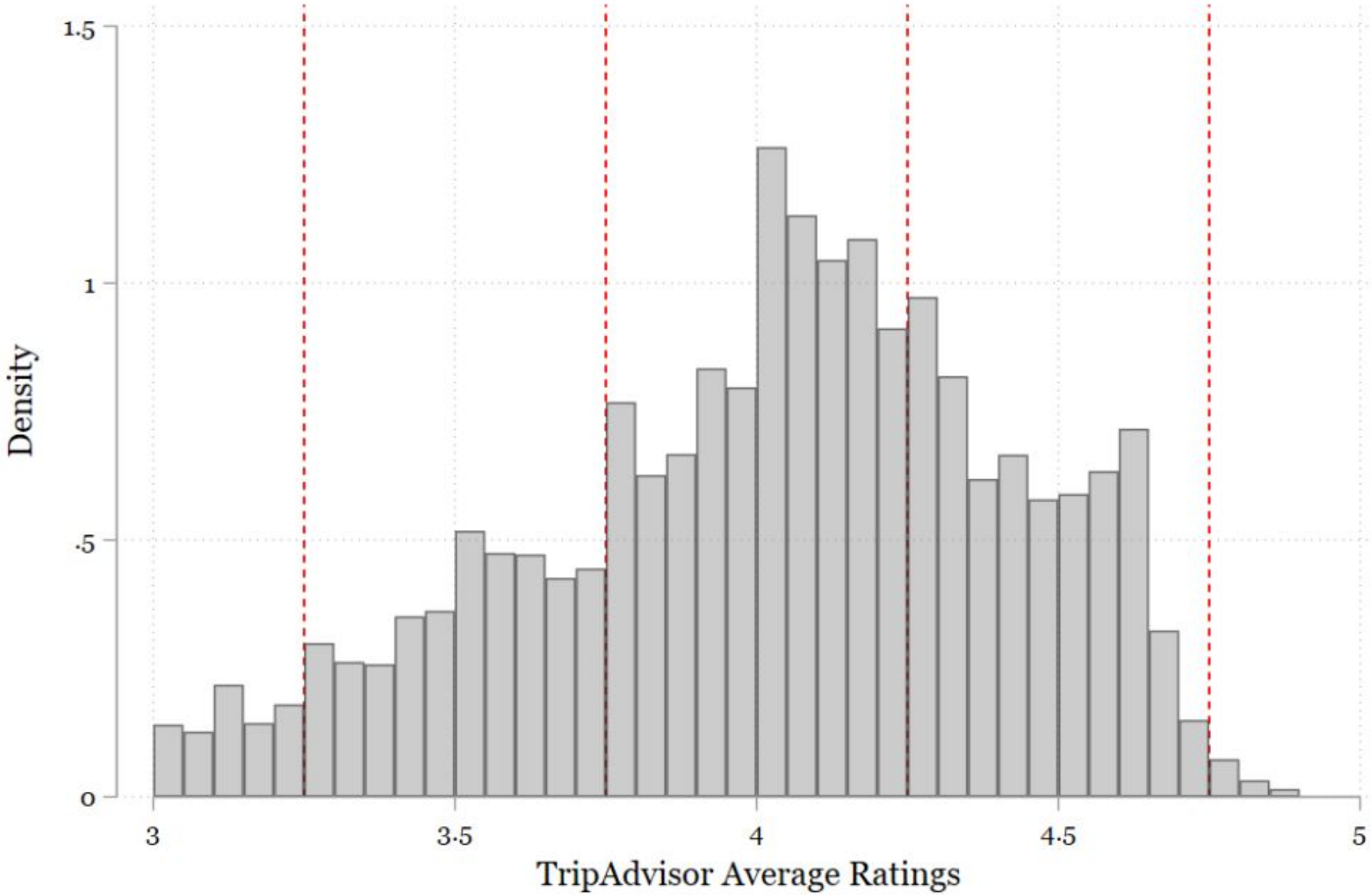


Figure: Extensive Margin

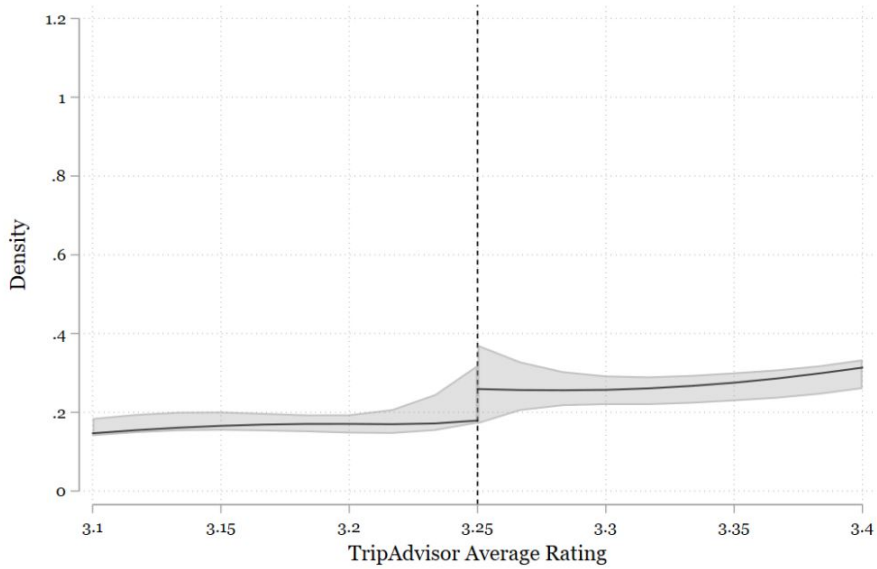


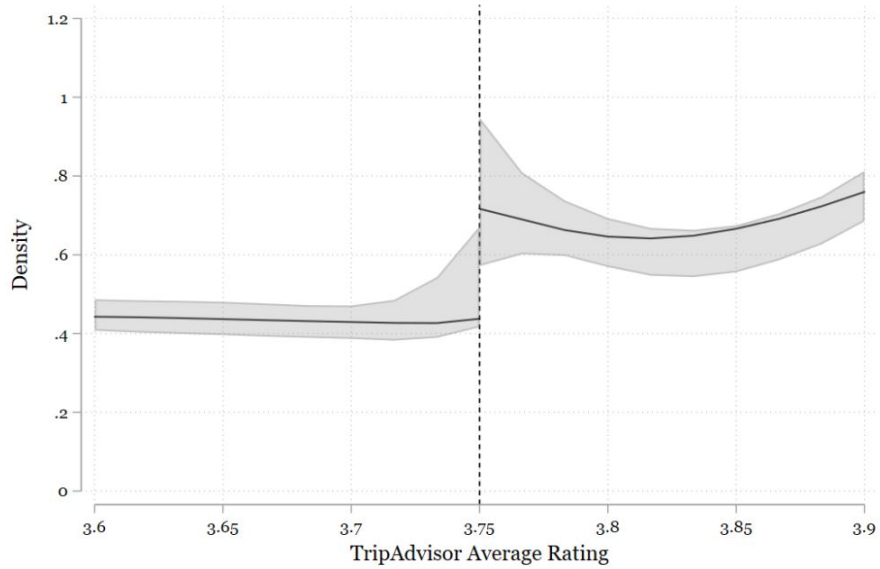
Notes: The above two figures present binscatter plots and associated quadratic fits in two different measures of investment. The x-axis is the cumulative average TripAdvisor rating in the previous month. Only hotels with 25 or more reviews are included.

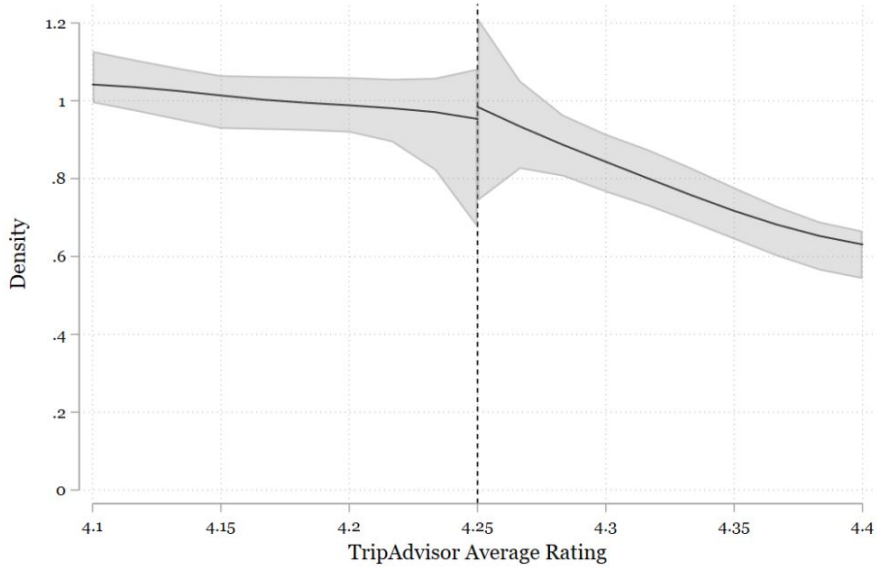
Distribution of Average Ratings: Validity Check

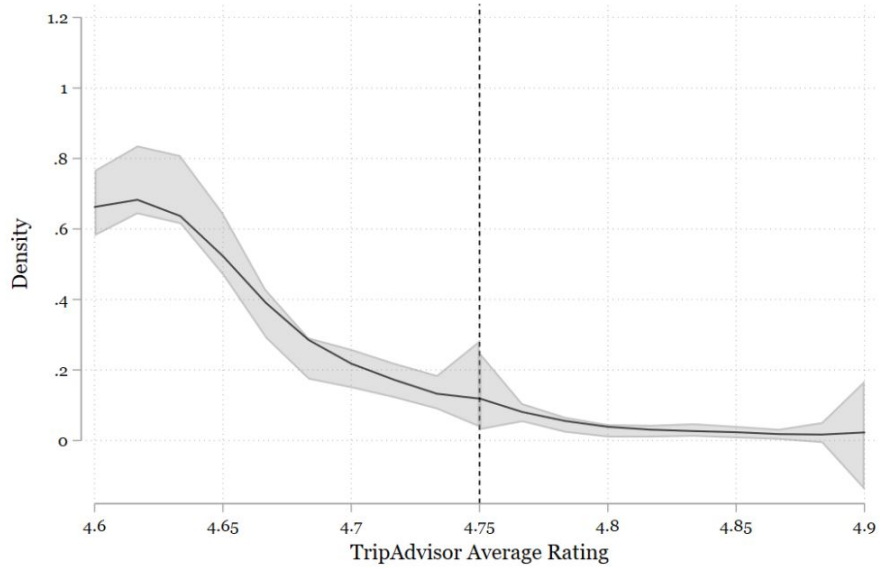


RD Densities: Validity Check









Intuitions for RDD

Figure: RD in Sharp RD Design

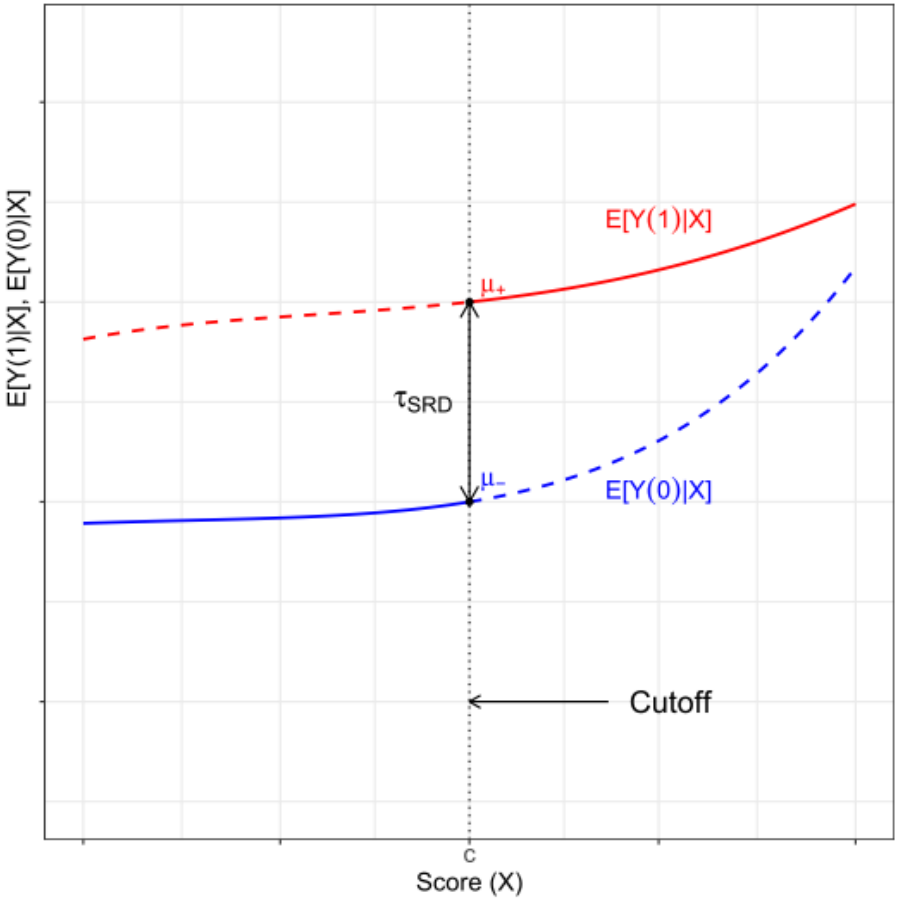
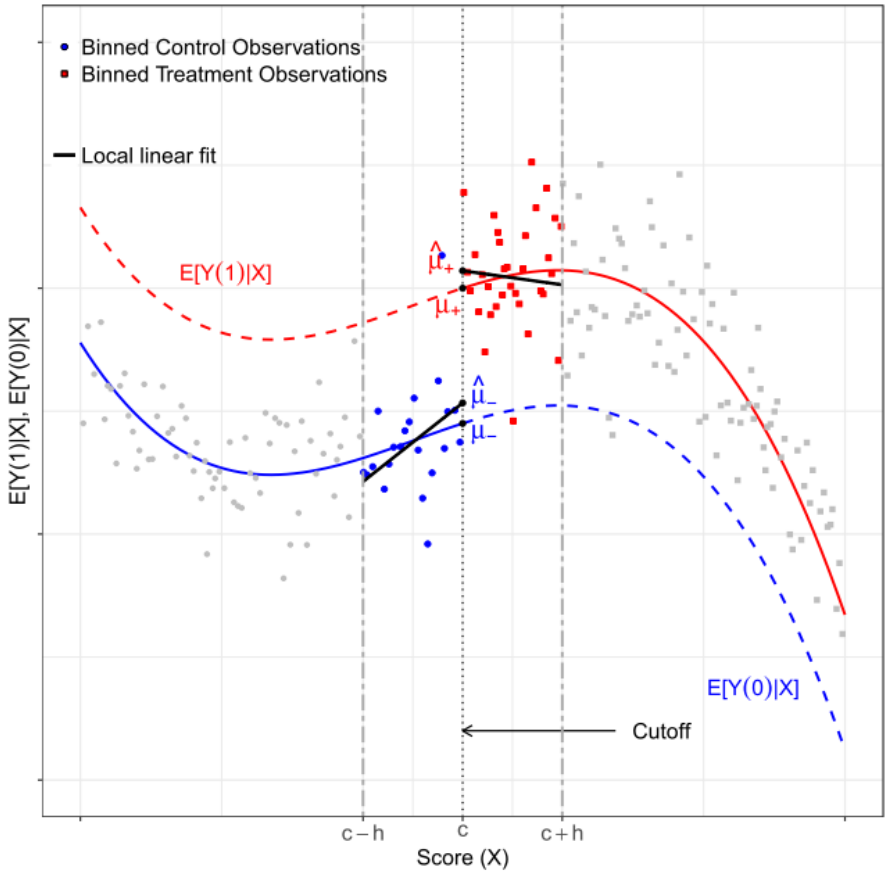


Figure: Local Polynomial Estimation



Local Linear Regression Approach

RD treatment effect parameter τ is defined by

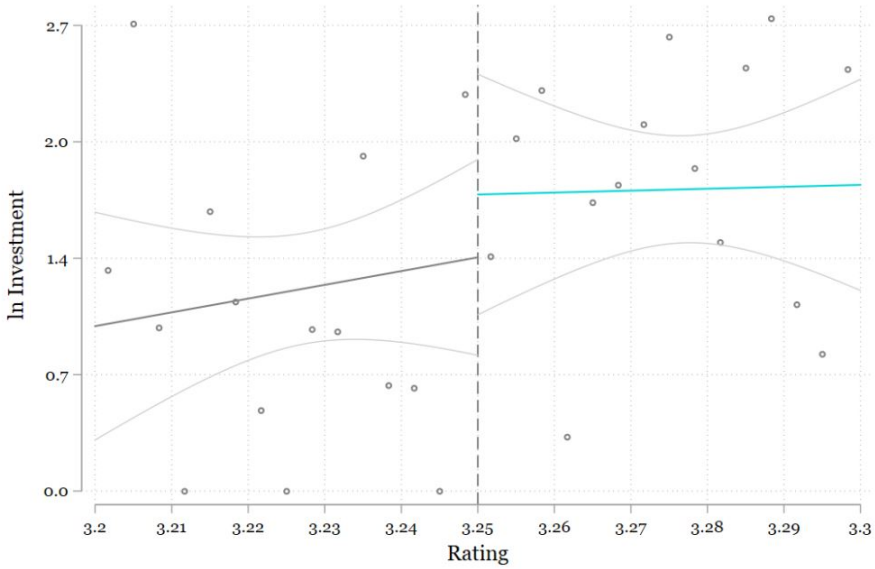
$$\tau = \lim_{x \downarrow c} E[Y_{it}|X_{it} = x] - \lim_{x \uparrow c} E[Y_{it}|X_{it} = x]$$

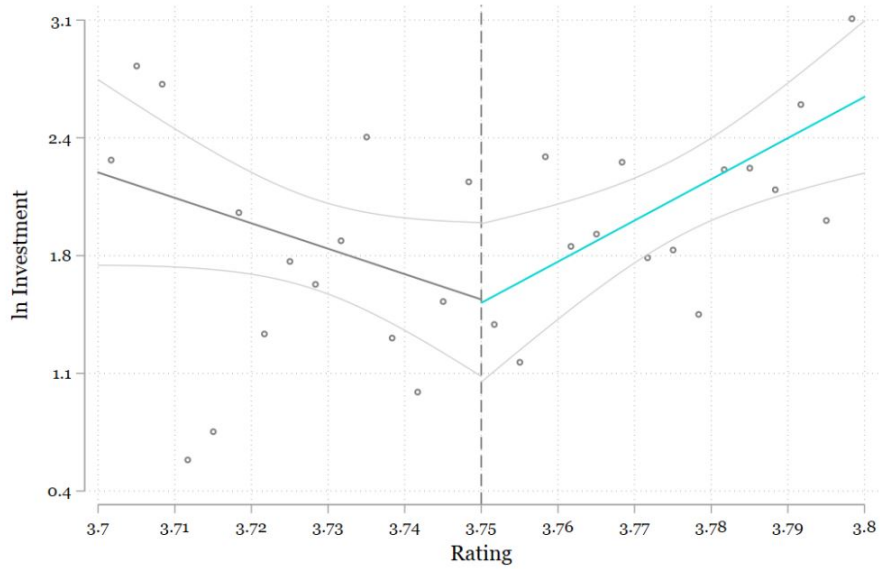
Empirical model can be written as:

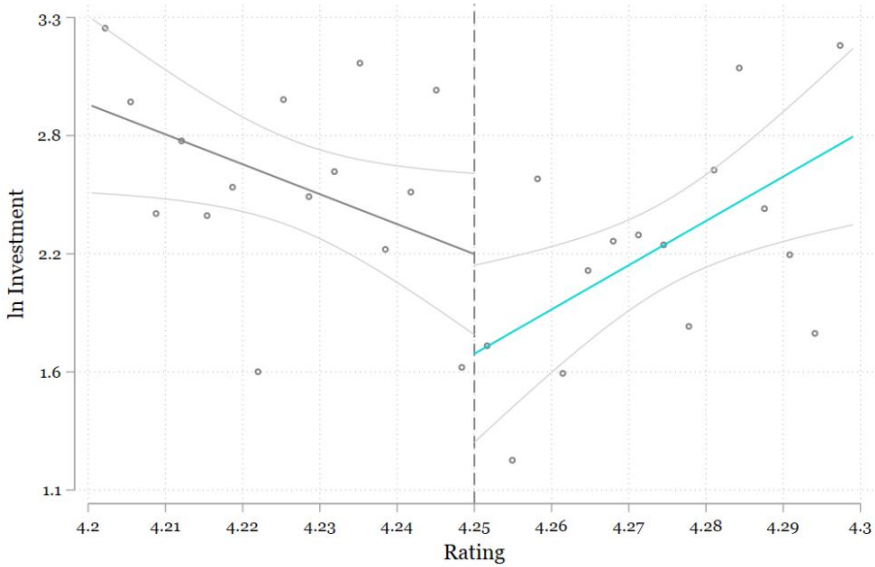
$$Y_{it} = \alpha + \tau\ \mathbf{1}(X_{it} > c) + \beta_1(X_{it} - c) + \beta_2\ \mathbf{1}(X_{it} > c) \times (X_{it} - c) + \epsilon_{it},$$
$$\forall X_{it} \in (c - h, c + h)$$

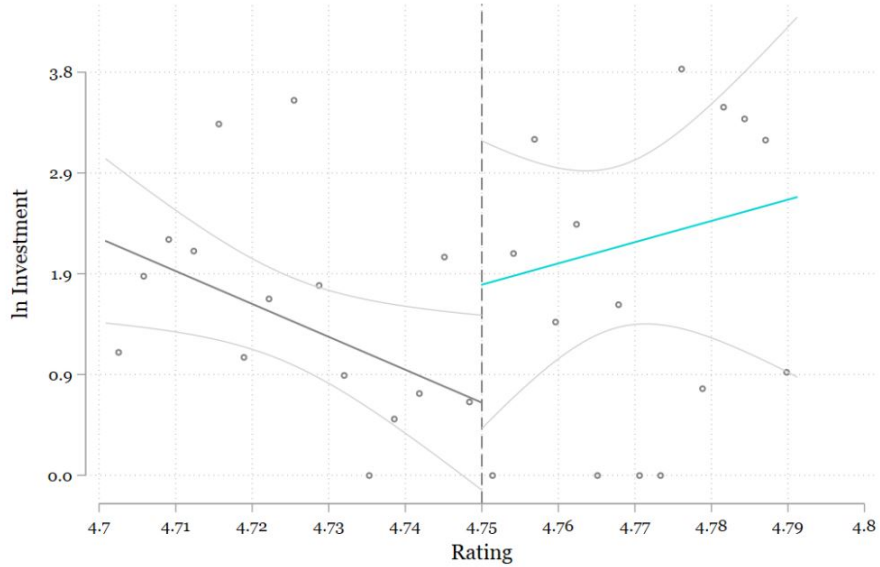
- Y_{it} is the outcome variable, investment
- X_{it} is the running variable, average rating at the end of last month
- $c \in \{3.25, 3.75, 4.25, 4.75\}$ is one of the thresholds in TripAdvisor Bubble Rating System
- h is the bandwidth around thresholds
- β_1 and β_2 are separate slopes below and above cutoffs which allow for flexible linear relationships

RD Plots: Intensive Margin

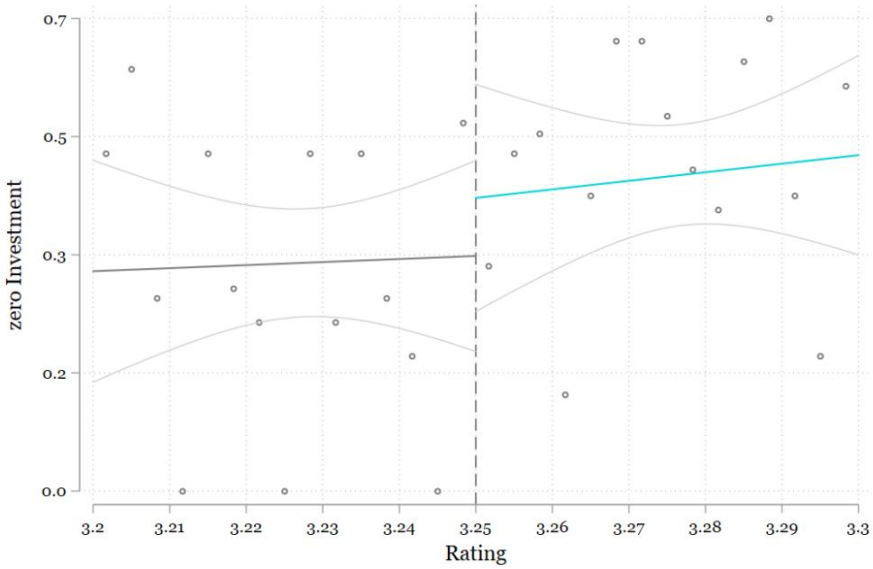


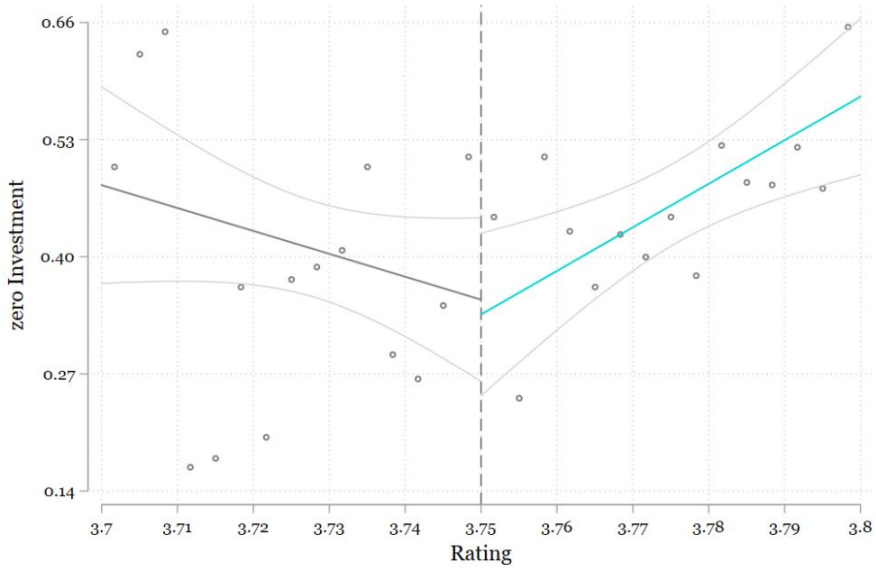


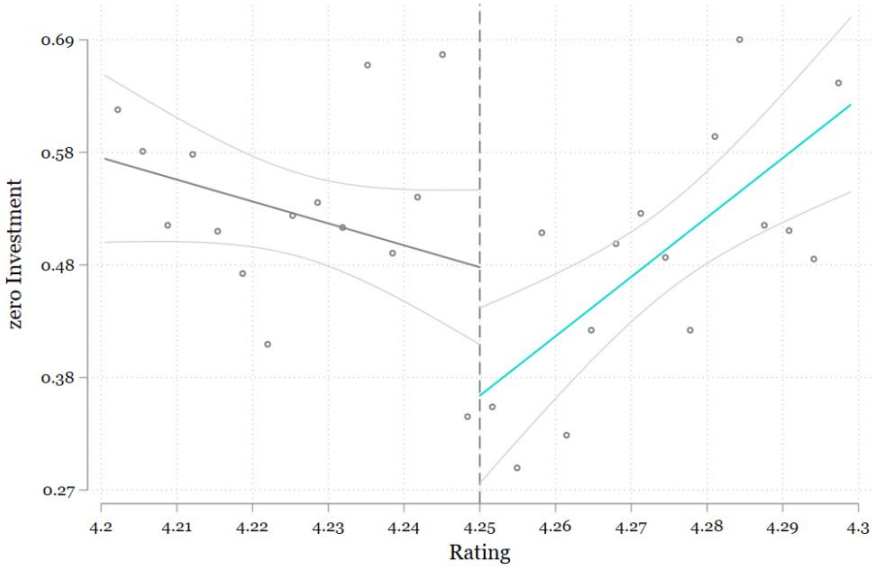


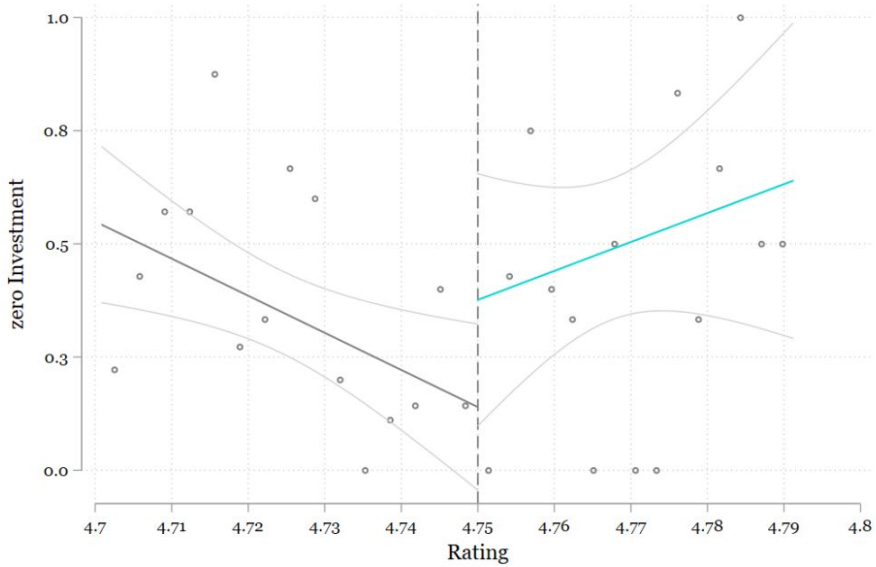


RD Plots: Extensive Margin









RD Estimates: Intensive Margin

Outcome	Log of Investment					
Polynomial	Linear				Quadratic	Cubic
Bandwidth	$\tilde{h}_1$	$\hat{h}_1$	$\hat{h}_1/2$	$2\hat{h}_1$	$\hat{h}_2$	$\hat{h}_3$
Covariates	No	Yes	Yes	Yes	Yes	Yes
			Panel A: 3.25 Cutoff			
RD_Estimate	1.361***	0.348**	0.356	0.138	0.426**	0.440**
	(0.521)	(0.187)	(0.237)	(0.164)	(0.201)	(0.220)
Bandwidth	0.234	0.236	0.118	0.472	0.365	0.445
Obs	1,424	1,437	682	3,019	2,296	2,862
			Panel B: 3.75 Cutoff			
RD_Estimate	0.307	0.216	0.377	−0.008	0.238	0.260
	(0.524)	(0.207)	(0.269)	(0.157)	(0.202)	(0.196)
Bandwidth	0.222	0.172	0.086	0.344	0.274	0.408
Obs	3,523	2,584	1,285	5,817	4,450	6,948
			Panel C: 4.25 Cutoff			
RD_Estimate	−0.546	−0.315**	−0.346*	−0.270**	−0.319*	−0.324
	(0.499)	(0.147)	(0.199)	(0.112)	(0.191)	(0.224)
Bandwidth	0.151	0.151	0.076	0.302	0.179	0.215
Obs	3,616	3,620	1,895	6,877	4,251	5,060
			Panel D: 4.75 Cutoff			
RD_Estimate	0.190	0.098	0.069	0.120	0.106	0.187
	(0.732)	(0.396)	(0.481)	(0.286)	(0.490)	(0.523)
Bandwidth	0.101	0.087	0.044	0.175	0.090	0.105
Obs	433	332	148	1,125	342	455

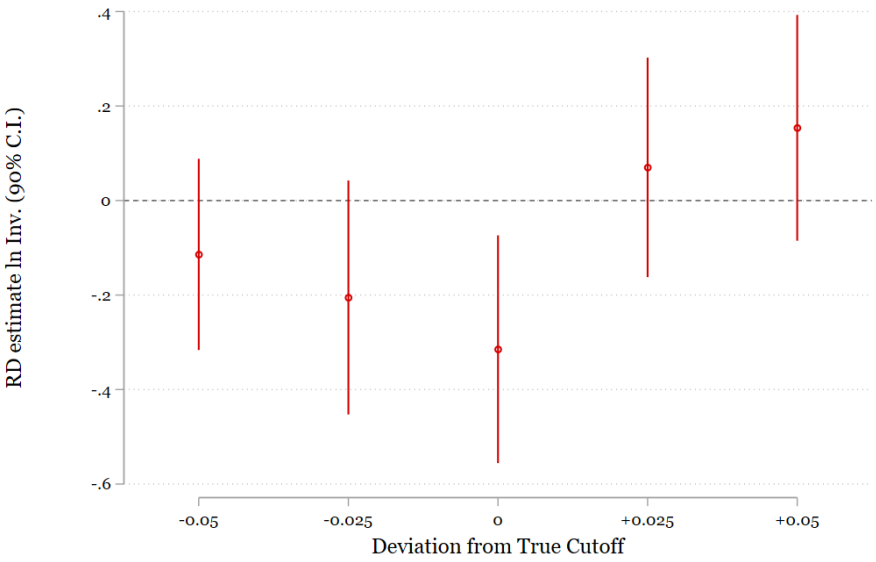
Notes: Notes: Only hotels with more 25 reviews are included. Bandwidths are computed for different order of polynomial at various cutoffs. One common MSE-optimal bandwidth is used for both sides around cutoffs. All specifications use triangular kernel function. Standard errors are robust and clustered at firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

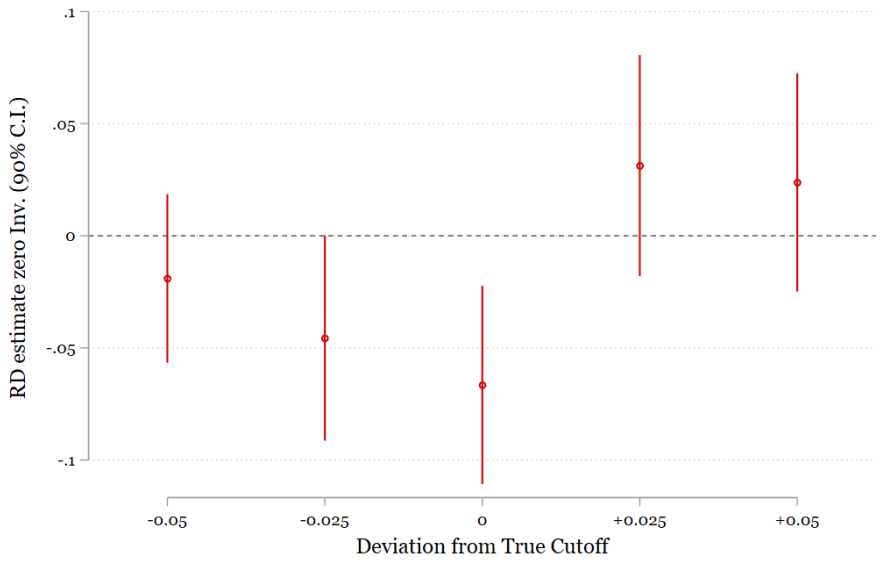
RD Estimates: Extensive Margin

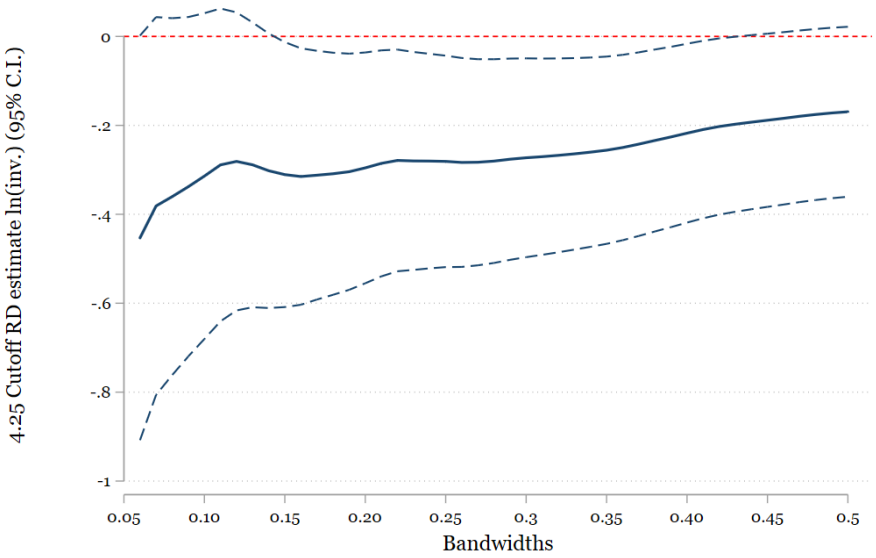
Outcome	$\mathbf{1}$(Investment > 0)					
Polynomial	Linear				Quadratic	Cubic
Bandwidth	$\tilde{h}_1$	$\hat{h}_1$	$\hat{h}_1/2$	$2\hat{h}_1$	$\hat{h}_2$	$\hat{h}_3$
Covariates	No	Yes	Yes	Yes	Yes	Yes
			Panel A: 3.25 Cutoff			
RD_Estimate	0.271**	0.059*	0.071*	0.040	0.073*	0.073
	(0.126)	(0.034)	(0.043)	(0.028)	(0.040)	(0.045)
Bandwidth	0.259	0.304	0.152	0.609	0.376	0.451
Obs	1,948	2,305	1,079	5,072	2,853	3,466
			Panel B: 3.75 Cutoff			
RD_Estimate	0.021	0.011	0.038	−0.004	0.022	0.033
	(0.107)	(0.030)	(0.036)	(0.025)	(0.033)	(0.035)
Bandwidth	0.282	0.248	0.124	0.496	0.352	0.412
Obs	5,230	4,395	2,091	9,416	6,762	7,872
			Panel C: 4.25 Cutoff			
RD_Estimate	−0.084	−0.054**	−0.067*	−0.040**	−0.067*	−0.078*
	(0.093)	(0.025)	(0.037)	(0.019)	(0.037)	(0.043)
Bandwidth	0.156	0.188	0.094	0.376	0.176	0.215
Obs	4,010	4,793	2,489	8,976	4,515	5,493
			Panel D: 4.75 Cutoff			
RD_Estimate	0.056	0.037	0.075	0.051	0.078	0.094
	(0.168)	(0.081)	(0.082)	(0.060)	(0.088)	(0.095)
Bandwidth	0.108	0.058	0.029	0.117	0.063	0.090
Obs	486	203	104	589	220	342

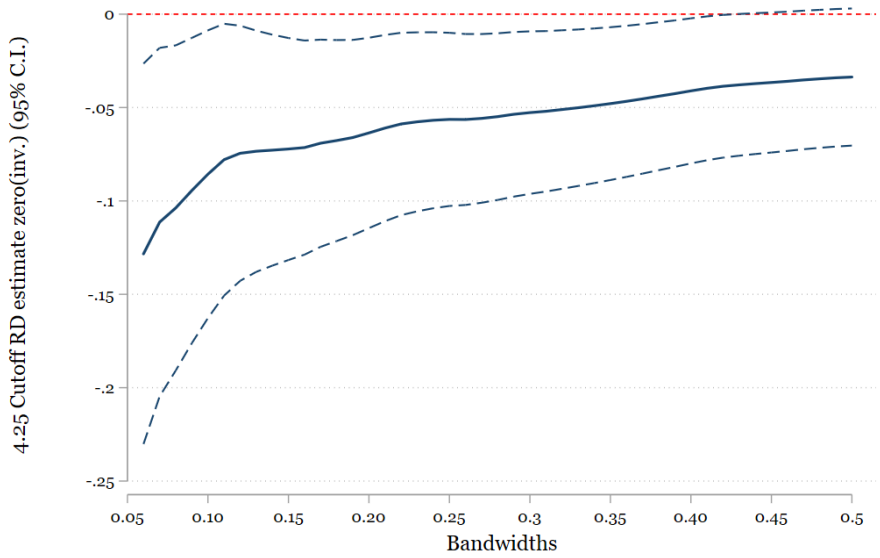
Notes: Notes: Only hotels with more 25 reviews are included. Bandwidths are computed for different order of polynomial at various cutoffs. One common MSE-optimal bandwidth is used for both sides around cutoffs. All specifications use triangular kernel function. Standard errors are robust and clustered at firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Robustness Checks: Placebo Cutoffs, Bandwidths









Fixed Effects Specification for Intensive Margin

	3.25	3.75	4.25	4.75
Above Cutoff	0.114	0.102	-0.299**	0.237
	(0.174)	(0.179)	(0.129)	(0.536)
Average Rating	-2.310	-3.048	1.474	20.016
	(2.582)	(2.120)	(2.381)	(11.305)
Above Cutoff X Average Rating	6.622*	1.512	0.761	-28.383
	(3.369)	(2.839)	(3.418)	(18.100)
Lagged log Inv.	0.344***	0.324***	0.422***	0.303
	(0.066)	(0.051)	(0.059)	(0.257)
Covariates	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Hotel FE	Yes	Yes	Yes	Yes
Bandwidth	.168	.152	.130	.070
Observations	1001	2273	3125	203
R-square	0.659	0.690	0.655	0.732

Notes: Only hotels with more 25 reviews are included. Covariates include lagged dependent variable, and other controls. One common MSE-optimal bandwidth is used for both sides around cutoffs. Standard errors are robust and clustered at firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Fixed Effects Specification for Extensive Margin

	3.25	3.75	4.25	4.75
Above Cutoff	-0.003	0.035	-0.058**	0.121
	(0.054)	(0.040)	(0.025)	(0.125)
Average Rating	-0.112	-0.696	0.063	2.076
	(0.737)	(0.443)	(0.419)	(2.278)
Above Cutoff X Average Rating	1.108	0.490	0.227	-1.612
	(0.861)	(0.665)	(0.616)	(5.139)
Lagged 1(Inv.> 0)	0.066***	0.071***	0.066***	0.036
	(0.014)	(0.012)	(0.008)	(0.054)
Covariates	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Hotel FE	Yes	Yes	Yes	Yes
Bandwidth	.173	.150	.125	.065
Observations	1027	2255	3033	176
R-square	0.726	0.687	0.679	0.740

Notes: Only hotels with more 25 reviews are included. Covariates include lagged dependent variable, and other controls. One common MSE-optimal bandwidth is used for both sides around cutoffs. Standard errors are robust and clustered at firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Conclusion

Intuitions for jumping from 4 to 4.5:

- $\downarrow$ return from additional investment
- $\uparrow$ opportunity cost of investment
- Hard to punish hotels under average rating system

Conclusion:

- Negative impact of online ratings on investments
- Consistent with theoretical work-shirk equilibrium with cut-off of 4 star to 4.5 star
- Modification to current average rating system