

Shirking with Good Reputation? Evidence from Hotel Industry

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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.

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)

- 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

Price per night

Popular

- ☒ 4.5 & up 334
- ☐ Breakfast included 139
- ☐ 5 stars 25
- ☐ Hotels 302

Property types

- ☐ Hotels 302
- ☐ B&Bs & Inns 86
- ☐ Hostels 65
- ☐ Motels 37

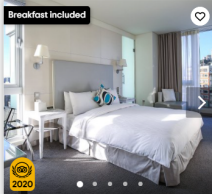
Show more

View Vacation Rentals

Amenities

- ☐ Free Wifi 410
- ☐ Breakfast included 139
- ☐ Pool 31
- ☐ Free parking 119

Show all



Ambience Hotel

Booking.com

NT\$1,723

View deal

- ✓ Free cancellation
- ✓ Reserve now, pay at stay

ezTravel

NT\$1,475

Trip.com

NT\$1,339

Hotels.com

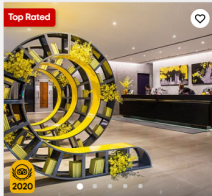
NT\$1,600

View all 7 deals from
NT\$1,339

4.5 2,187 reviews

#1 Best Value of 1,330 places to stay in Taipei

- Free Wifi
- Taking safety measures



Cityinn Hotel Plus - Fuxing N. Rd., Branch

agoda

NT\$1,978

NT\$1,486

View deal

- ✓ Free cancellation

ezTravel

NT\$1,787

Booking.com

NT\$1,513

Hotels.com

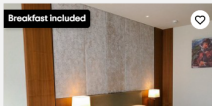
NT\$1,513

View all 8 deals from
NT\$1,486

4.5 1,222 reviews

#2 Best Value of 1,330 places to stay in Taipei

- Free Wifi
- Free parking
- Taking safety measures



Courtyard Taipei

Booking.com

NT\$3,496

ezTravel

NT\$3,496

Hotels.com

NT\$3,496

4.5 1,374 reviews

#3 Best Value of 1,330 places to stay in Taipei

- Free Wifi

Other Rating Platforms

Figure: Agoda

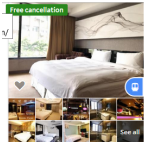
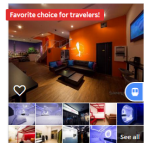
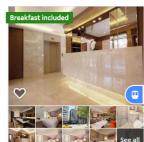




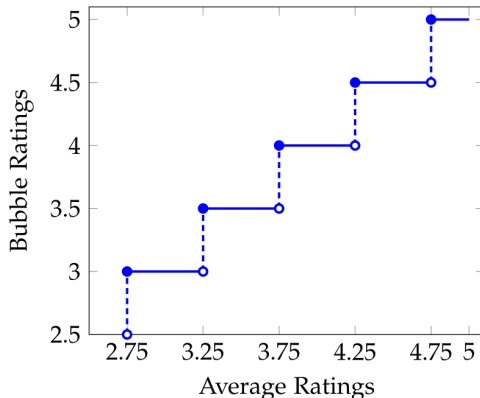
<p>Free cancellation</p>  <p>See all</p>	<p>Agoda PREFERRED</p> <p>Colors Infinity Inn</p> <p>★ ★ ★ Zhongshan District, Taipei - View on map</p> <p>Excellent location City center</p> <p>Free cancellation Pay at the hotel Pay later</p> <p>Prices are 31% cheaper than city's average price</p> <p>Popular! Booked 15 times since yesterday</p> <p>Recommended by 85% of guests</p>	<p>Excellent 465 reviews 8.2</p> <p>ONLY 5 LEFT</p> <p>Price per night as low as 4,987</p> <p>NT\$1,122</p> <p>Compare prices</p> <p>FREE CANCELLATION</p>
<p>Favorite choice for travelers!</p>  <p>See all</p>	<p>SleepBox Hostel</p> <p>★ ★ ★ Taipei Main Station, Taipei - View on map</p> <p>Excellent location City center</p> <p>Free cancellation Free WiFi Pay later</p> <p>Popular! Booked 25 times in the last 2 days</p> <p>Recommended by 81% of guests</p> <p>24HOURS SALE : Coupon Code 24HOURS SALE applied - NT-</p>	<p>Very good 3,227 reviews 7.6</p> <p>ONLY 1 LEFT</p> <p>Last minute price drop!</p> <p>Price per night as low as 3,248</p> <p>NT\$766</p>
<p>Breakfast Included</p>  <p>See all</p>	<p>Li Yuan Hotel</p> <p>★ ★ ★ Zhongzheng District, Taipei - View on map</p> <p>Excellent location City center</p> <p>Breakfast Free cancellation Pay at the hotel +1</p> <p>Lowest price includes Free cancellation Free breakfast</p> <p>Recommended by 98% of guests</p>	<p>Very good 574 reviews 7.8</p> <p>ONLY 1 LEFT</p> <p>Price per night as low as 3,201</p> <p>NT\$1,732</p> <p>FREE CANCELLATION</p>

Figure: Expedia

	<p>Santos Hotel</p> <p>Taipei</p> <p>Lower price available</p> <p>\$63 per night</p> <p>Free Cancellation</p> <p>Reserve now, pay later</p> <p>4.0/5 Very Good (1,613 reviews)</p> <p>Sign in for lower price</p>
	<p>Taipei Fullerton Hotel – Maison North</p> <p>Songshan</p> <p>① \$266 \$117 per night</p> <p>Free Cancellation</p> <p>4.5/5 Wonderful (1,105 reviews)</p>
	<p>VIP Access</p> <p>Hotel Relax III</p> <p>Zhongzheng</p> <p>Lower price available</p> <p>\$74 per night</p> <p>Free Cancellation</p> <p>Reserve now, pay later</p> <p>4.2/5 Very Good (936 reviews)</p> <p>Sign in for lower price</p>
	<p>Miramar Garden Taipei</p> <p>Zhongshan</p> <p>Lower price available</p> <p>\$123 per night</p> <p>Free Cancellation</p> <p>Reserve now, pay later</p> <p>4.3/5 Excellent (1,030 reviews)</p>

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

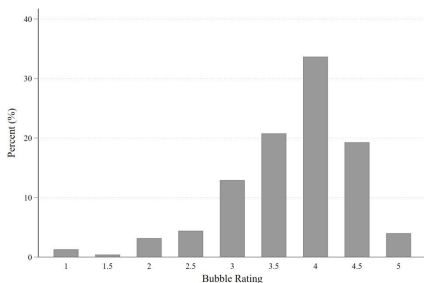
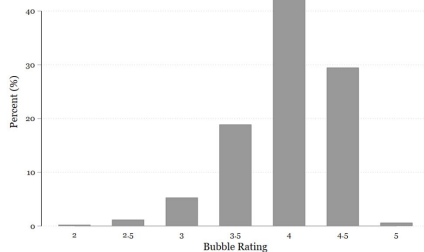


Figure: 25 or more



Descriptive Relationship

Figure: Intensive Margin

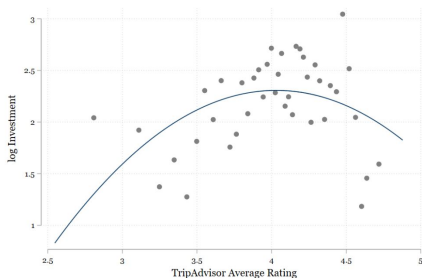
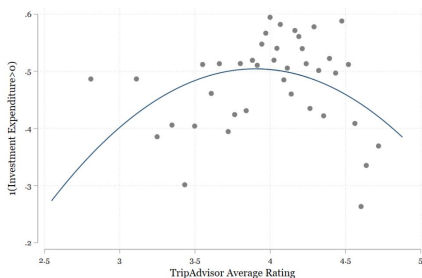
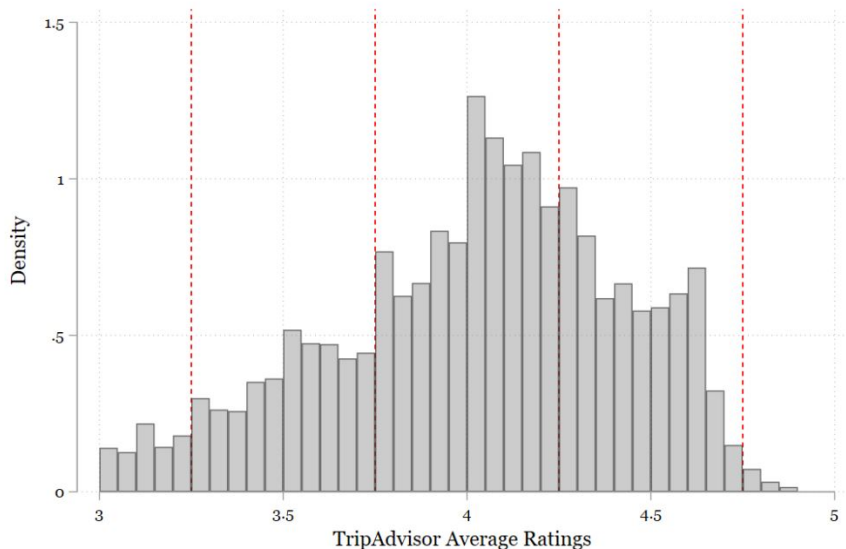


Figure: Extensive Margin

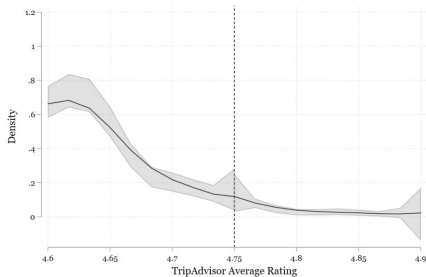
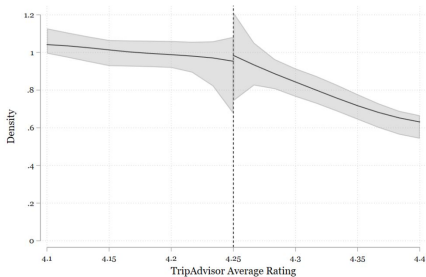
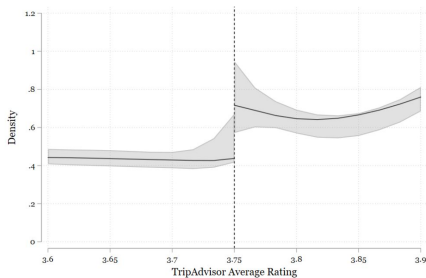
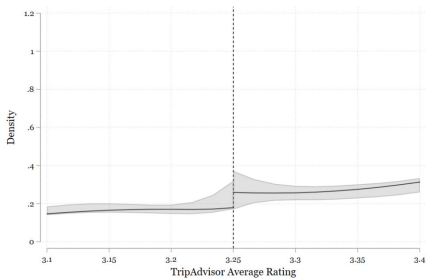


Notes: The above two figures present binscatter plots and associated quadratic fits in two different measures of investment. The x-axis is the cumulative average TripAdvisor rating in the previous month. Only hotels with 25 or more reviews are included.

Distribution of Average Ratings: Validity Check



RD Densities: Validity Check



Intuitions for RDD

Figure: RD in Sharp RD Design

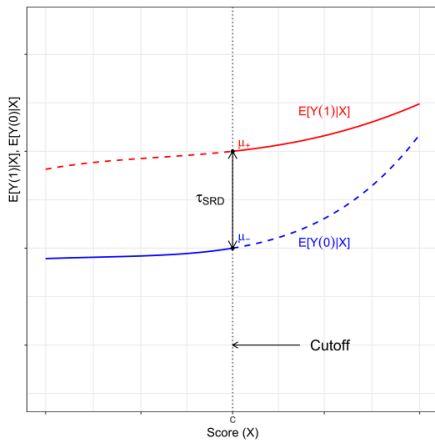
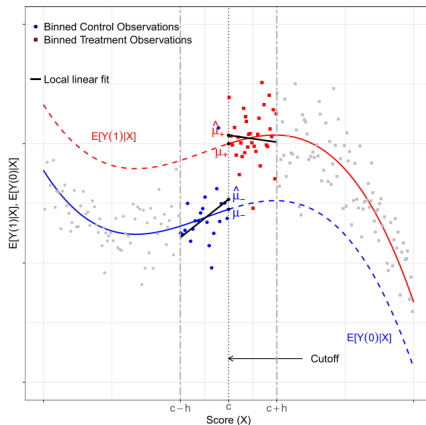


Figure: Local Polynomial Estimation



Local Linear Regression Approach

RD treatment effect parameter τ is defined by

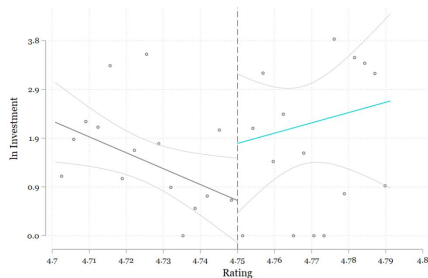
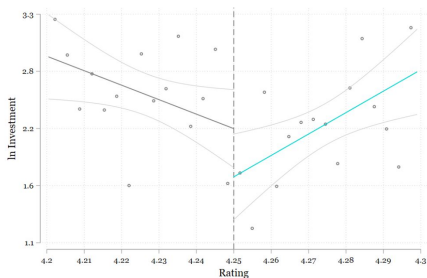
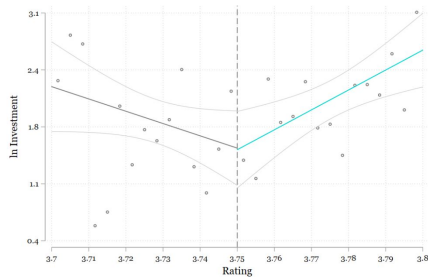
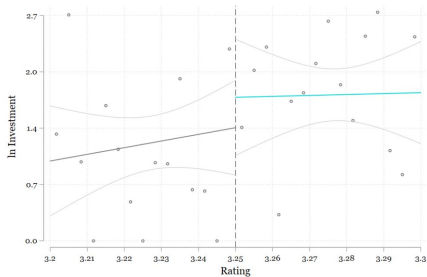
$$\tau = \lim_{x \downarrow c} E[Y_{it} | X_{it} = x] - \lim_{x \uparrow c} E[Y_{it} | X_{it} = x]$$

Empirical model can be written as:

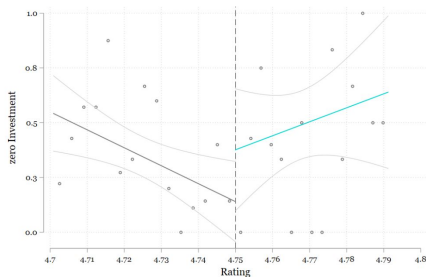
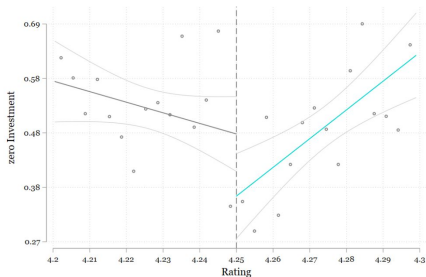
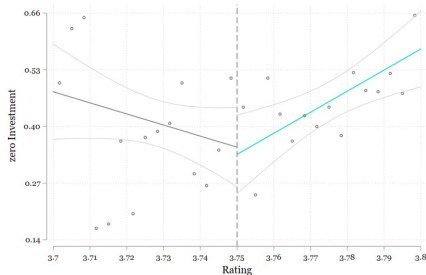
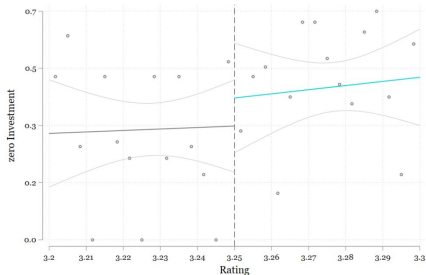
$$Y_{it} = \alpha + \tau \mathbf{1}(X_{it} > c) + \beta_1(X_{it} - c) + \beta_2 \mathbf{1}(X_{it} > c) \times (X_{it} - c) + \epsilon_{it}, \\ \forall X_{it} \in (c - h, c + h)$$

- 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					
	Linear				Quadratic	Cubic
Polynomial						
Bandwidth	\hat{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

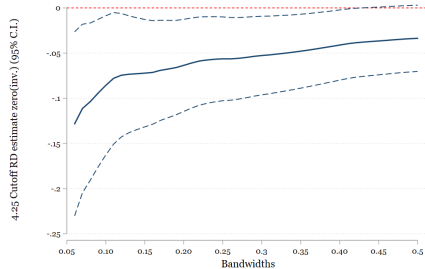
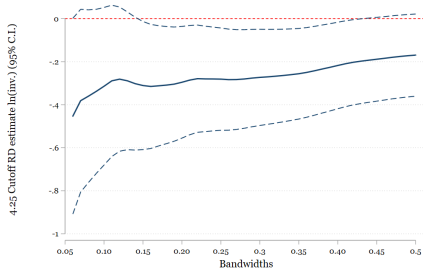
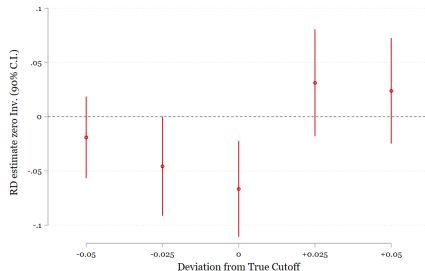
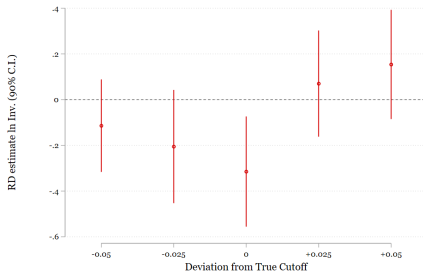
Notes: Notes: Only hotels with more 25 reviews are included. Bandwidths are computed for different order of polynomial at various cutoffs. One common MSE-optimal bandwidth is used for both sides around cutoffs. All specifications use triangular kernel function. Standard errors are robust and clustered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

RD Estimates: Extensive Margin

Outcome	1(Investment > 0)					
	Linear				Quadratic	Cubic
Polynomial						
Bandwidth	\hat{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** (0.126)	0.059* (0.034)	0.071* (0.043)	0.040 (0.028)	0.073* (0.040)	0.073 (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 (0.107)	0.011 (0.030)	0.038 (0.036)	-0.004 (0.025)	0.022 (0.033)	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 (0.093)	-0.054** (0.025)	-0.067* (0.037)	-0.040** (0.019)	-0.067* (0.037)	-0.078* (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 (0.168)	0.037 (0.081)	0.075 (0.082)	0.051 (0.060)	0.078 (0.088)	0.094 (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 (0.174)	0.102 (0.179)	-0.299** (0.129)	0.237 (0.536)
Average Rating	-2.310 (2.582)	-3.048 (2.120)	1.474 (2.381)	20.016 (11.305)
Above Cutoff X Average Rating	6.622* (3.369)	1.512 (2.839)	0.761 (3.418)	-28.383 (18.100)
Lagged log Inv.	0.344*** (0.066)	0.324*** (0.051)	0.422*** (0.059)	0.303 (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 (0.054)	0.035 (0.040)	-0.058** (0.025)	0.121 (0.125)
Average Rating	-0.112 (0.737)	-0.696 (0.443)	0.063 (0.419)	2.076 (2.278)
Above Cutoff X Average Rating	1.108 (0.861)	0.490 (0.665)	0.227 (0.616)	-1.612 (5.139)
Lagged 1(Inv.> 0)	0.066*** (0.014)	0.071*** (0.012)	0.066*** (0.008)	0.036 (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