Differential Impacts of Online Ratings in the Market for Medical Services

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Motivation: Online Reputation and Medical Services

Online ratings and reviews are an increasingly important driver of economic activity and consumer decision-making

- Top Industries: Restaurants, Hotels, Medical Services (Local consumer Review Survey 2020)

Physician services are a credence good, meaning consumers face ex-ante and ex-post uncertainty about quality

- Ex-ante uncertainty – like experience goods, ratings could provide useful information
- Ex-post uncertainty – unclear what information ratings include

Reputation systems could mitigate or exasperate existing disparities in the medical services industry

Studying a platform with building ratings and booking allows us to better understand important mechanisms in this market

Introduction

Research questions

- What is the impact of ratings on demand for physician services?
- Investigate differential impact of ratings depend on other characteristics?

Context

- Primary Care Physicians on ZocDoc.com in 8 Metropolitan Divisions Feb 2016 - April 2017

Data sources

- Physician Information – Profile information (PCPs) collected by scraping ZocDoc
- Patient volume – Imputed from scraping physician schedules

Methodology

- Regression discontinuity design with multiple cumulative cutoffs (RDMCC)

Differential impact - Repeat analysis for economically interesting subgroups

- Physician Gender
- Number of Ratings (Bayesian learning)
- Hospital Affiliation   (other quality signal)

Background – Recent Literature

Impact of Ratings in Healthcare

- Patients are willing to travel further to receive care from hospitals with higher Yelp ratings (McCarthy, Sanbower, and Sánchez Aragón, 2022)
- Positive ratings increase general practitioner enrollment (Brown, Hansman, Keener, and Veiga, 2023)

Differential Impact of Ratings and Quality Signals

- Impact of ratings could be mediated by private information (Brown, et al ,2023)
- Signals of doctor quality reduce 90% of the racial gaps in willingness to pay (Chan, 2022)
- Women surgeons experience a larger drop in referrals after a patient death (Sarsons, 2017)
- Platform mechanics mediate the impact of ratings (Athey, and Kaye, in progress)

Background on ZocDoc.com: An Online Doctor Reservation Platform

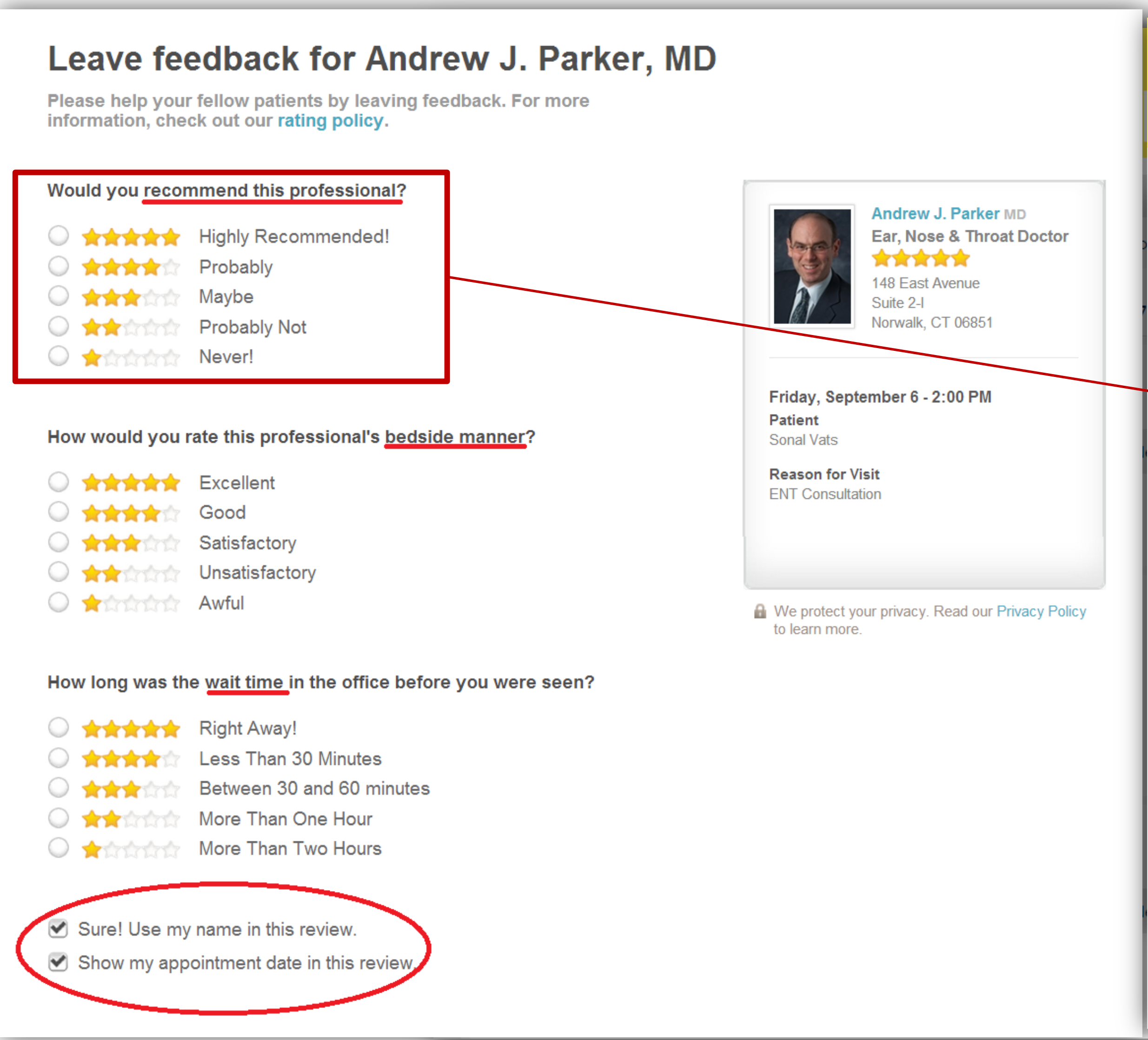
Company timeline:
- 2007: Founded
- 2015: Valued at $1.8 billion

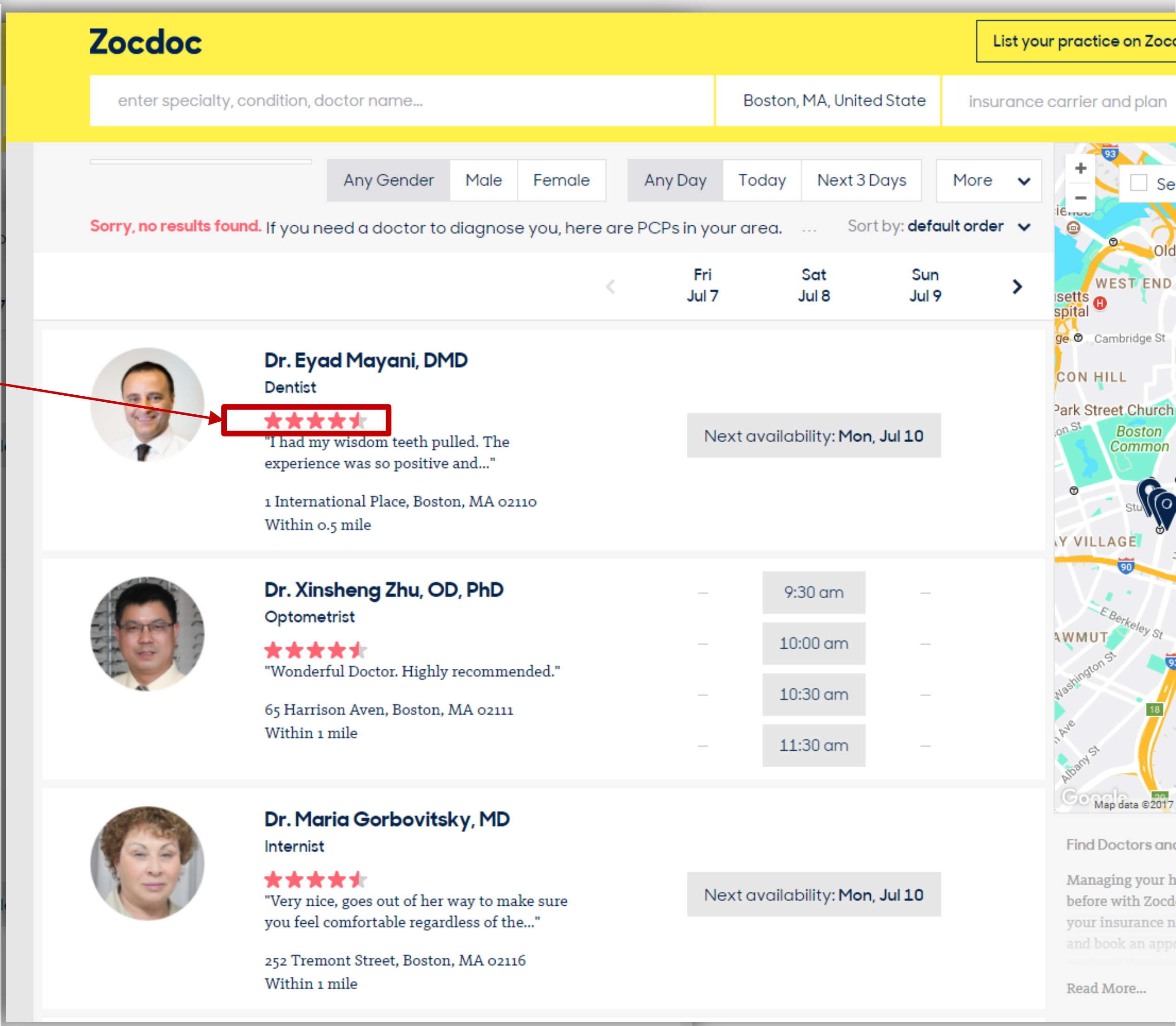
Revenue model charges physicians not patients
- 2015-2018: Physicians subscribe to $300 monthly or $3000 annual contracts
- 2018-2019: Shifted to per-booking fee

Patients can search for physicians by
- insurance, location, specialty etc. and book an appointment

Key features:
- Bundles reviews with appointments
- Verified reviews, less potential for review fraud
- Closed loop review System
- Doctors cannot screen patients

Background on ZocDoc





Preview of Findings

Descriptive Evidence

- Booking likelihood: More likely to be booked
- Booking speed: Booked further in advance

Regression Discontinuity at 5-Stars

- Patient volume via bookings: Approx. twice as many bookings
- Patient volume via vacancies: Approx. half as many vacancies

Differential Impact

- Physician gender: Effect greatest for women physicians
- Number of ratings: Effect increases with number of ratings
- Hospital affiliation: No significant difference

Robustness

- Placebo tests: Effect greatest at true cutoff
- Rating manipulation: Bunching above cutoff

Data

COLLECTION

SAMPLE RESTRICTIONS

Data Collection

Data Collected by Crawling ZocDoc's website

Time Period

- February 25, 2016 – April 17, 2017

Profile photos processed with Microsoft Face API

Region – Coordinates in the following Metropolitan Divisions

Metro Division	*Apts.*	*PCPs*
Boston, MA	86,512	117
Cambridge-Newton-Framingham, MA	71,159	68
Chicago-Naperville-Arlington Heights, IL	795,000	331
Fort Lauderdale-Pompano Beach-Deerfield, FL	184,185	80
New York-Jersey City-White Plains, NY-NJ	3,629,392	1,291
San Francisco-Redwood City-South San Fr., CA	69,384	31
Silver Spring-Frederick-Rockville, MD	232,236	82
Washington-Arlington-Alexandria, DC-VA-MD	774,756	305

Sample Selection

Appointment Sample

- Appointment type: new patient, illness, cross-listed
- Appointments on weekdays between 8am and 6pm
- At least one appointment available three weeks in advance

Physician-week sample

- “Stable” half star rating
  - 90% of observation at this rating
- Remove physicians with deleted reviews
  - More than 4 weeks with a decrease in number of reviews
- At least 8 ratings
- At least one appointment available three weeks in advance

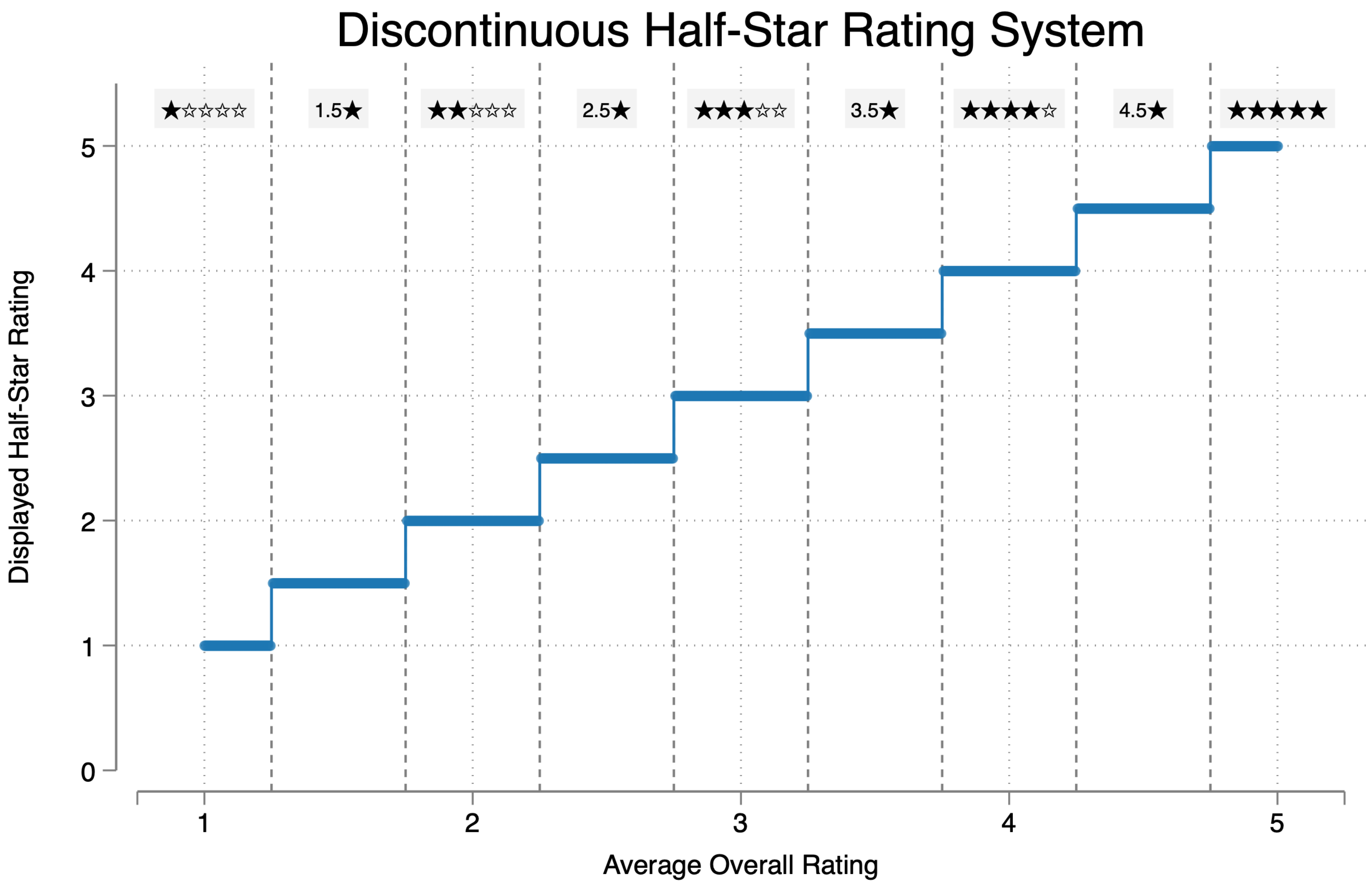
Empirical Strategy

FIRST STAGE: HALF-STAR RATINGS

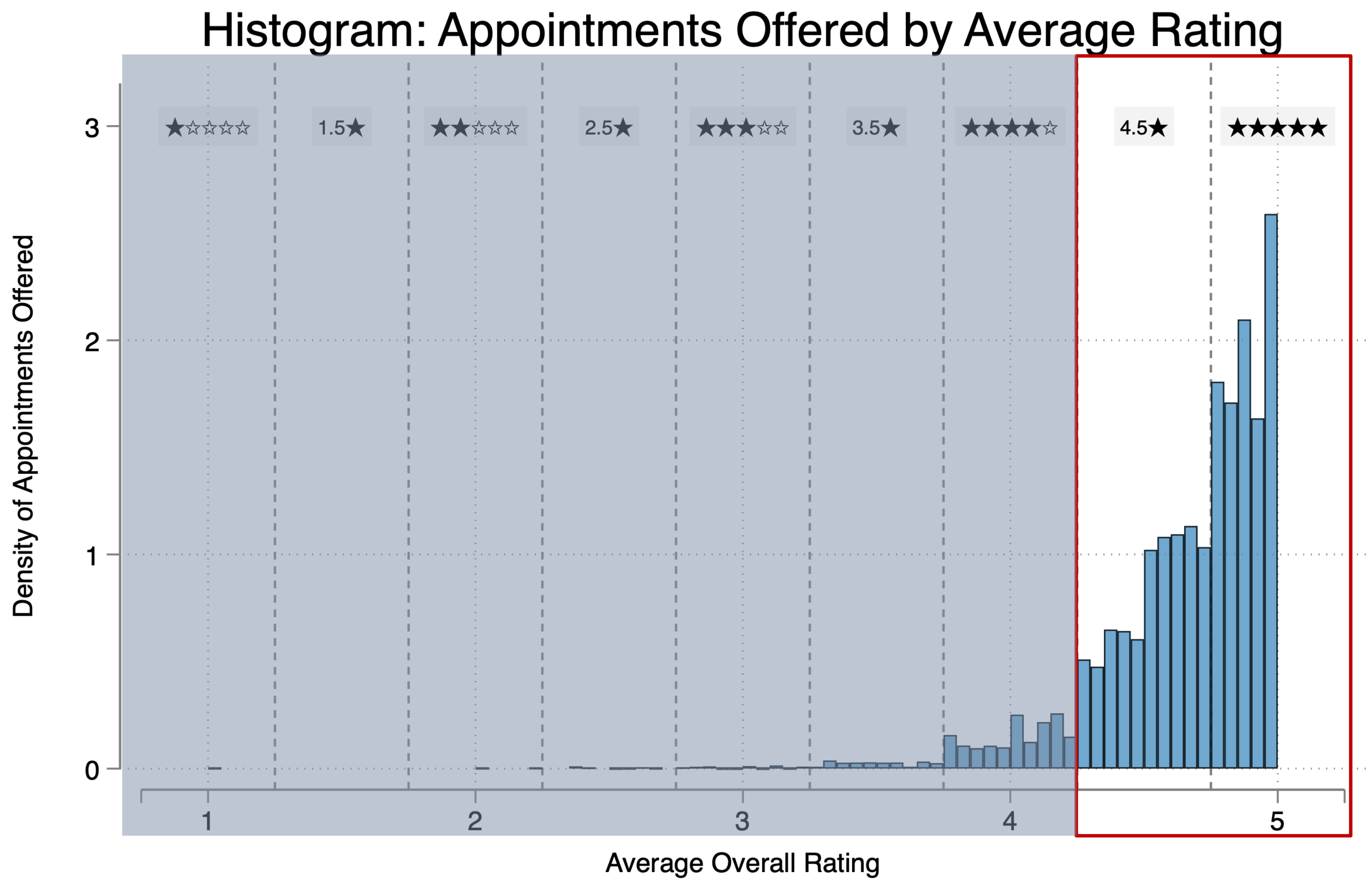
DESCRIPTIVE EVIDENCE

PRIMARY SPECIFICATION

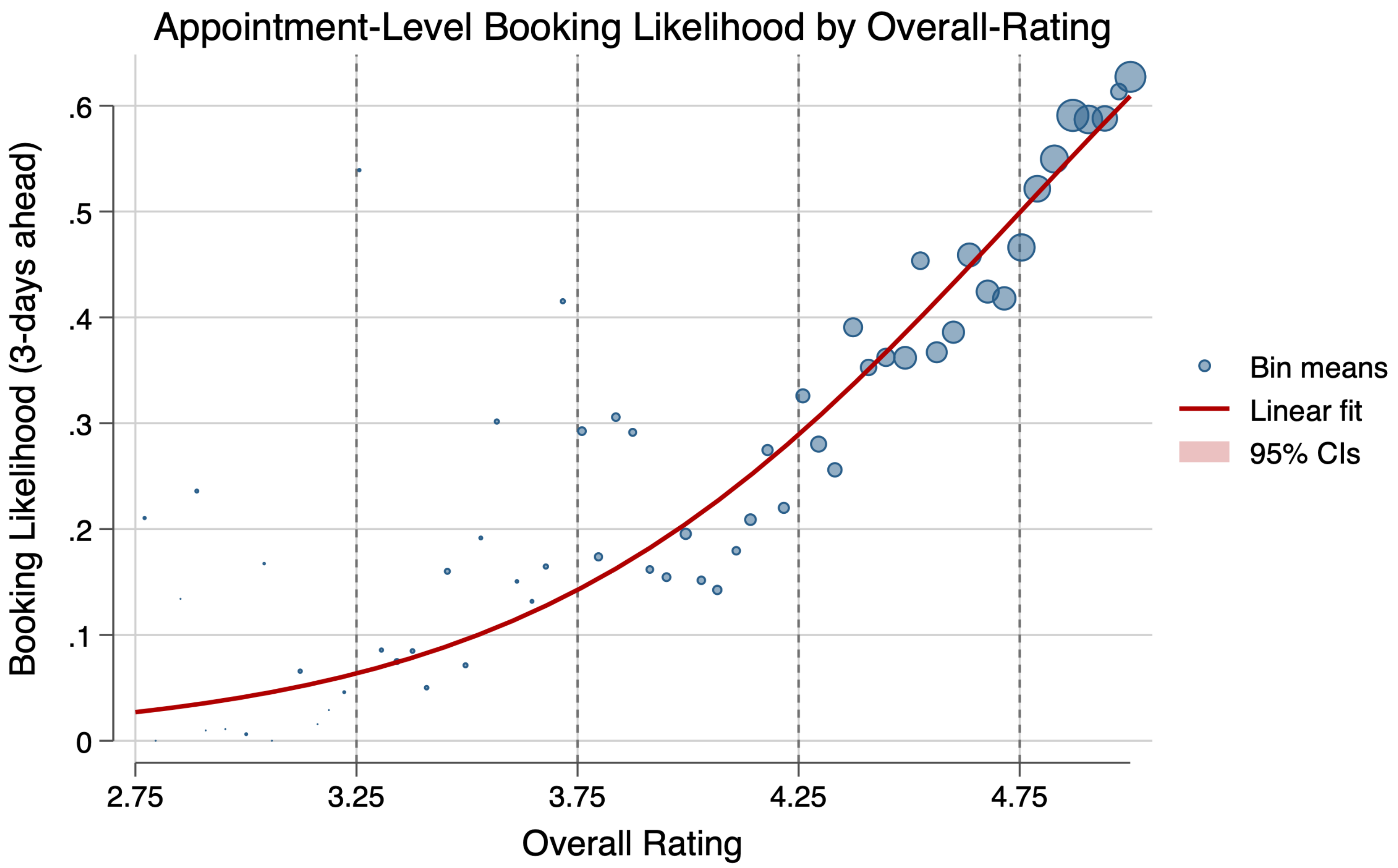
Empirical Strategy:
regression discontinuity w/ multiple cumulative cutoffs



Empirical Strategy



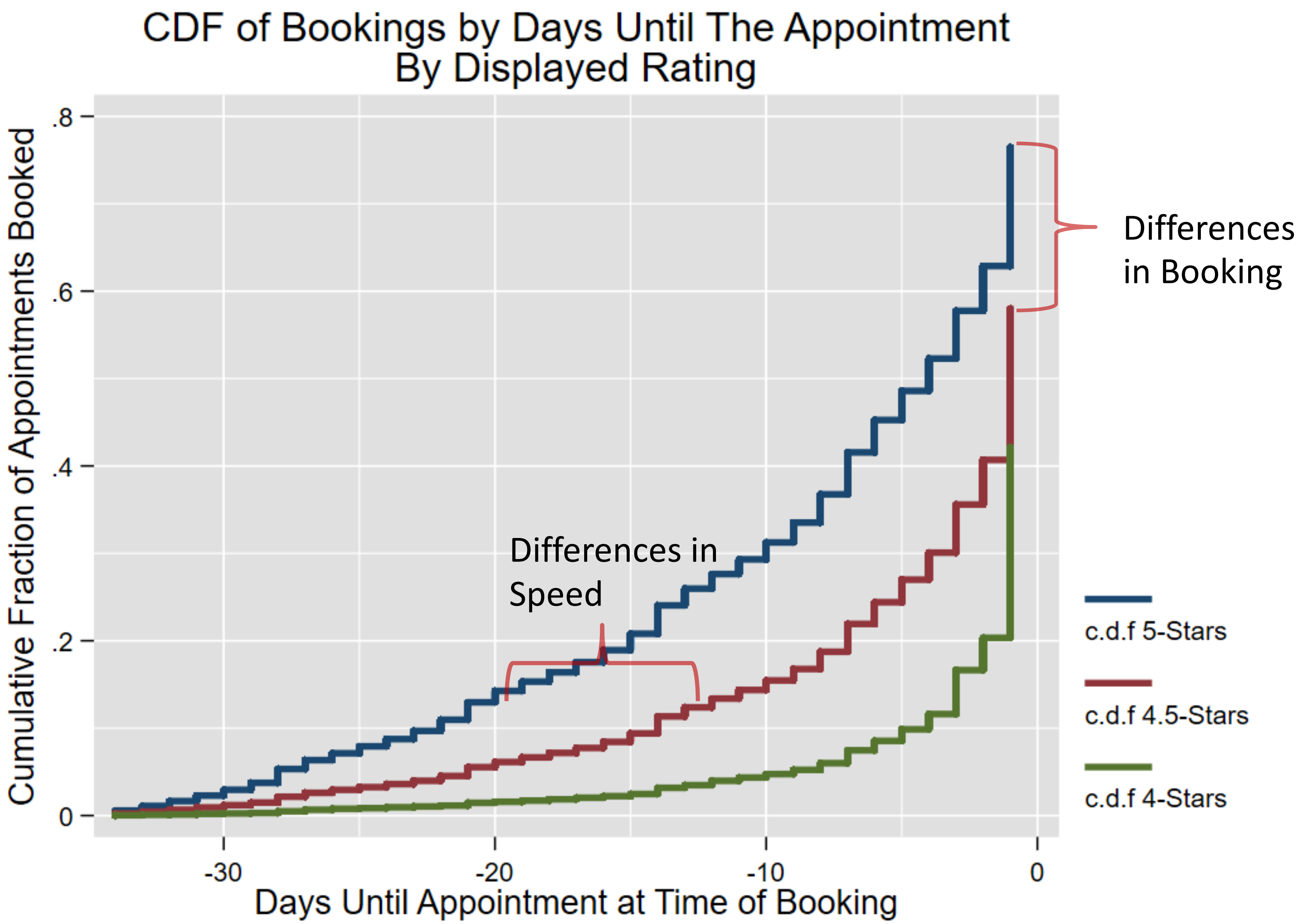
Booking Likelihood by Rating



Sample: 2/24/2016-4/17/2017, primary care, min 8 ratings, with apts offered during business hours
Controls: None

Preliminary Results: Booking by Time (CDF Comparison)

- **The vertical difference:** difference in percent of appointments booked at a given number of days in advice.
- **The horizontal differences:** The difference in how many days in advanced the same percent of appointments were booked.



Empirical Strategy: Primary Specification

Observation level: Physician-week

Dependent variable: Weekly patient volume based

- Inverse Hyperbolic Sign (IHS) of bookings
- IHS vacant appointments (alternative)

Running variable: Average overall rating

Covariates: Market-week, IHS(offered appointments), number of location, appt length and type no. reviews, hospital affiliation

Methods:

- Asymmetric data-driven MSE-optimal bandwidth selectors
- Triangular kernel
- Mass point adjustments
- Bias-corrected RD estimates with robust variance estimator
- Cluster-robust nearest neighbor variance estimation clustered on physician (panel data)

Results

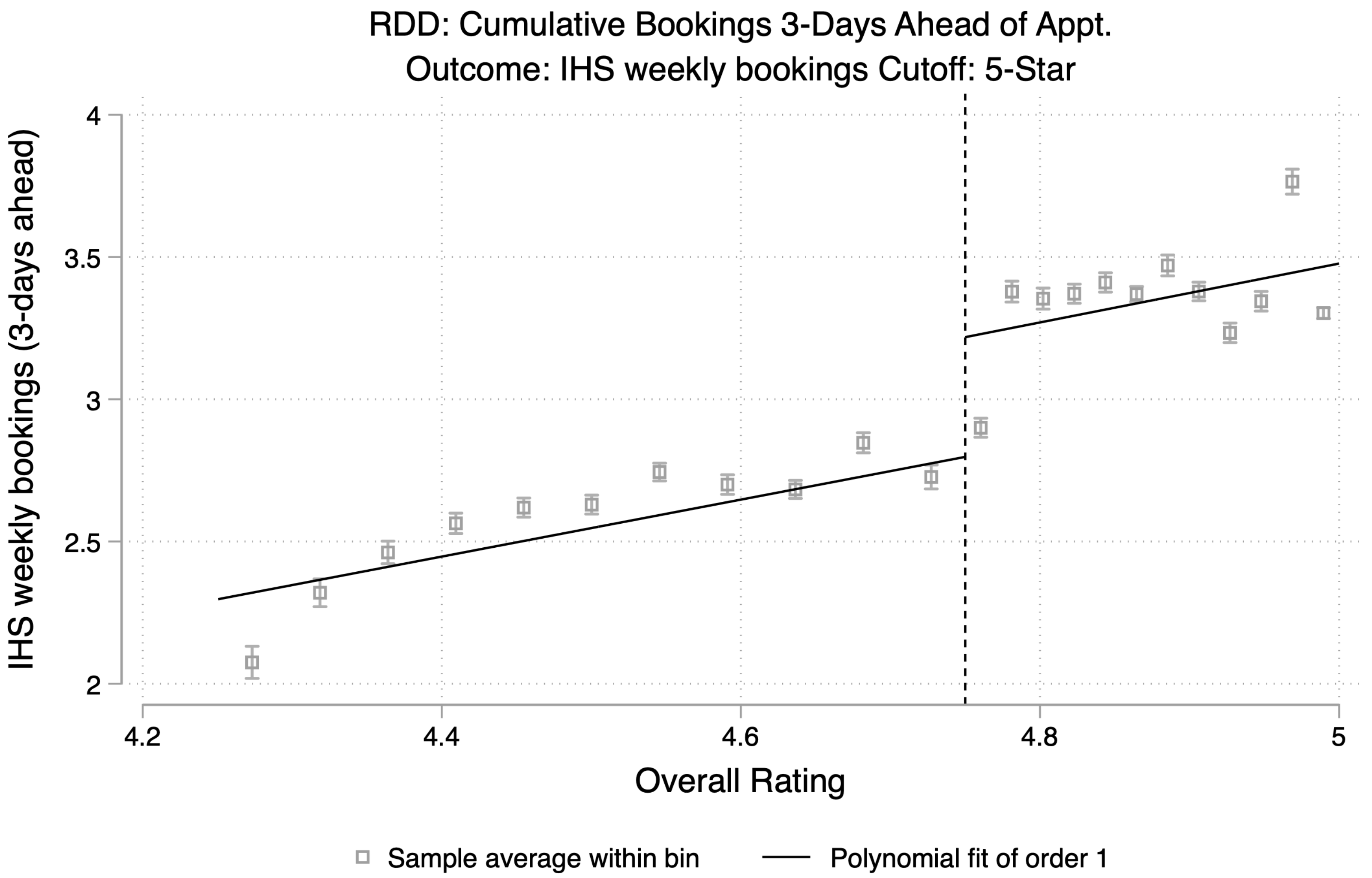
PRIMARY SPECIFICATION

ALTERNATIVE SPECIFICATIONS

DIFFERENTIAL IMPACTS

ROBUSTNESS CHECKS

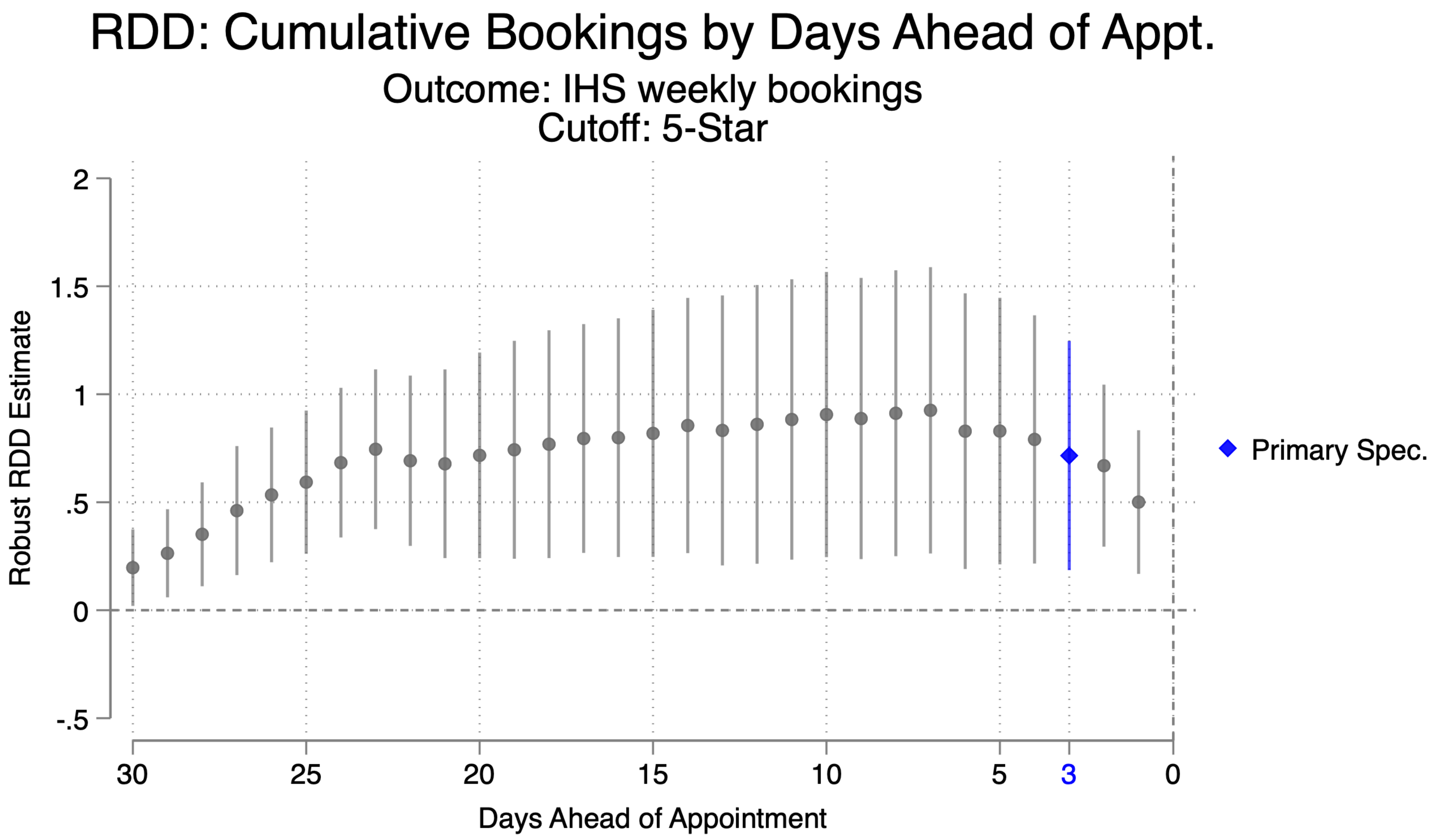
Impact of Ratings on Patient Volume: Approx. Doubling of Bookings



Method	(1) IHS(Weekly Bookings)
Conventional	0.686***
	(0.228)
Bias-corrected	0.716***
	(0.228)
Robust	0.716***
	(0.271)
Observations	54263
Controls	X

Details

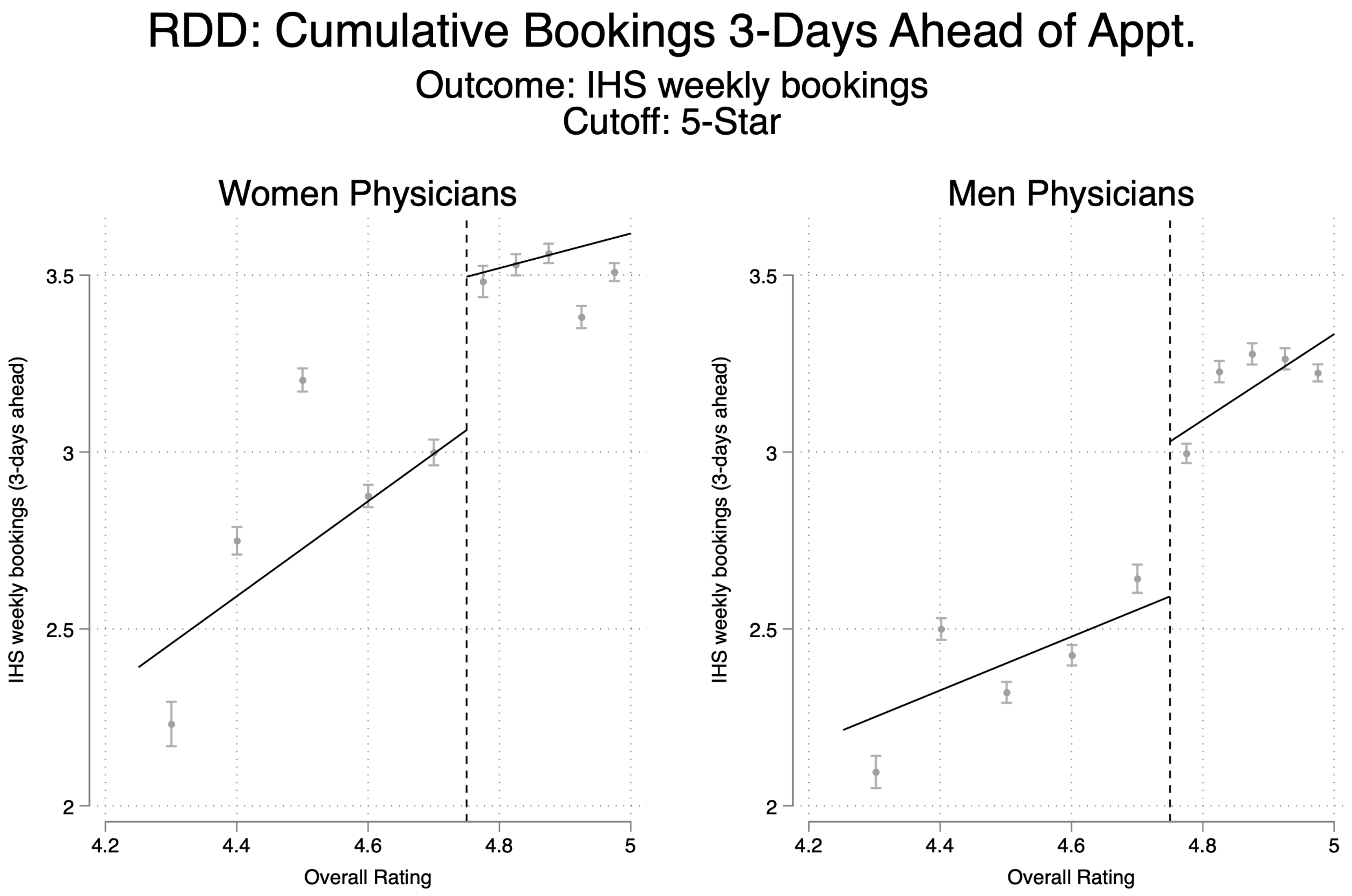
Impact of Ratings on Patient Volume: Approx. Doubling of Bookings



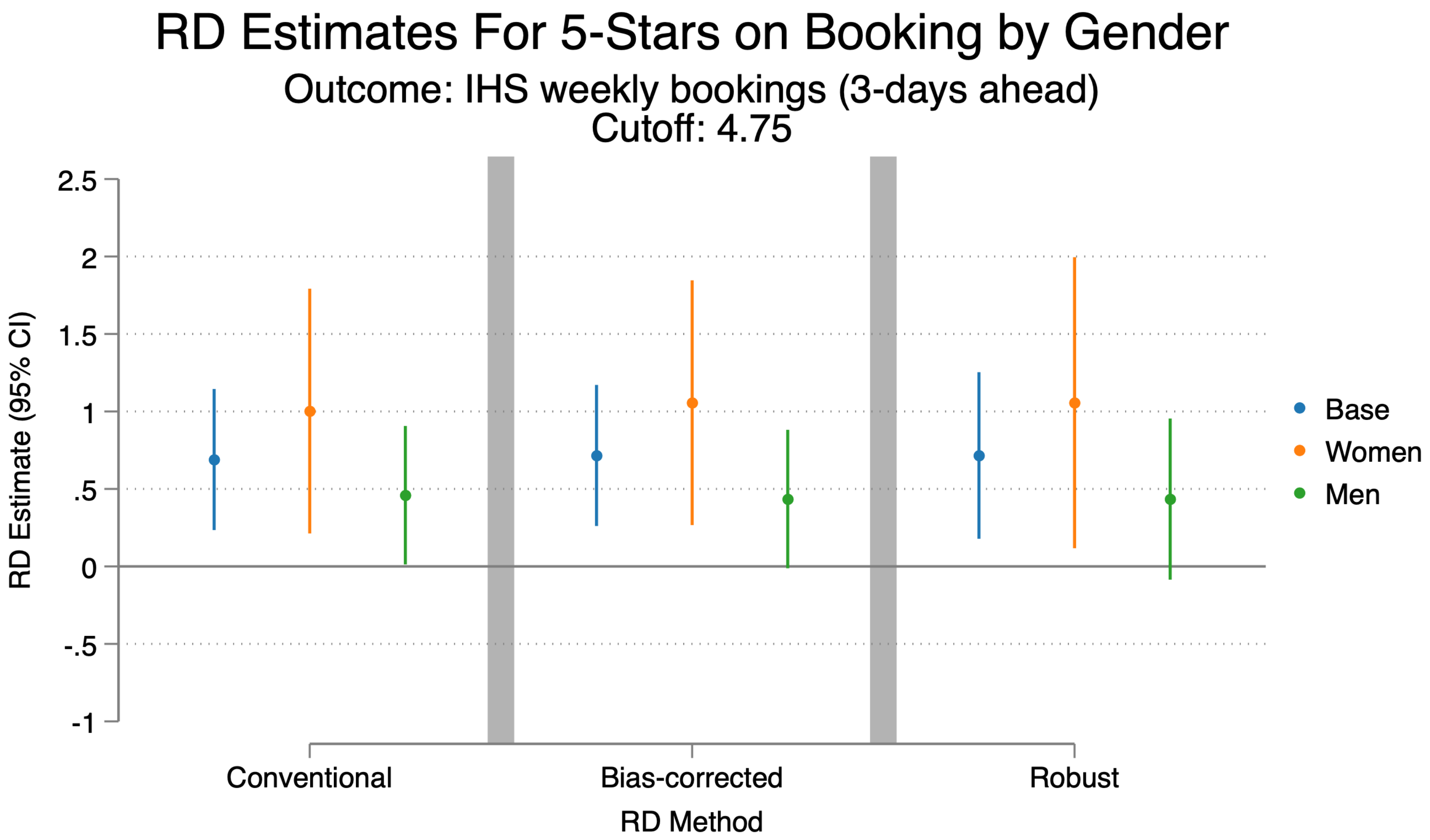
Controls: market-week, no. locations, appt length, appt type, no. reviews, hospital affiliation
Sample: 2/24/2016-4/17/2017, primary care, min 8 ratings, with apts offered during business hours 21 days in advance, stable ratings, excludes profiles with >4 rating removals
Specification: data-driven asymetric bandwidth, triangular kernal, NNcluster on physician

Vacancy Results

RD Plot by Physician Gender: Women Have More Bookings at 4.5 and 5 Stars



Differential Impact of by Gender: Effect Greatest for Women



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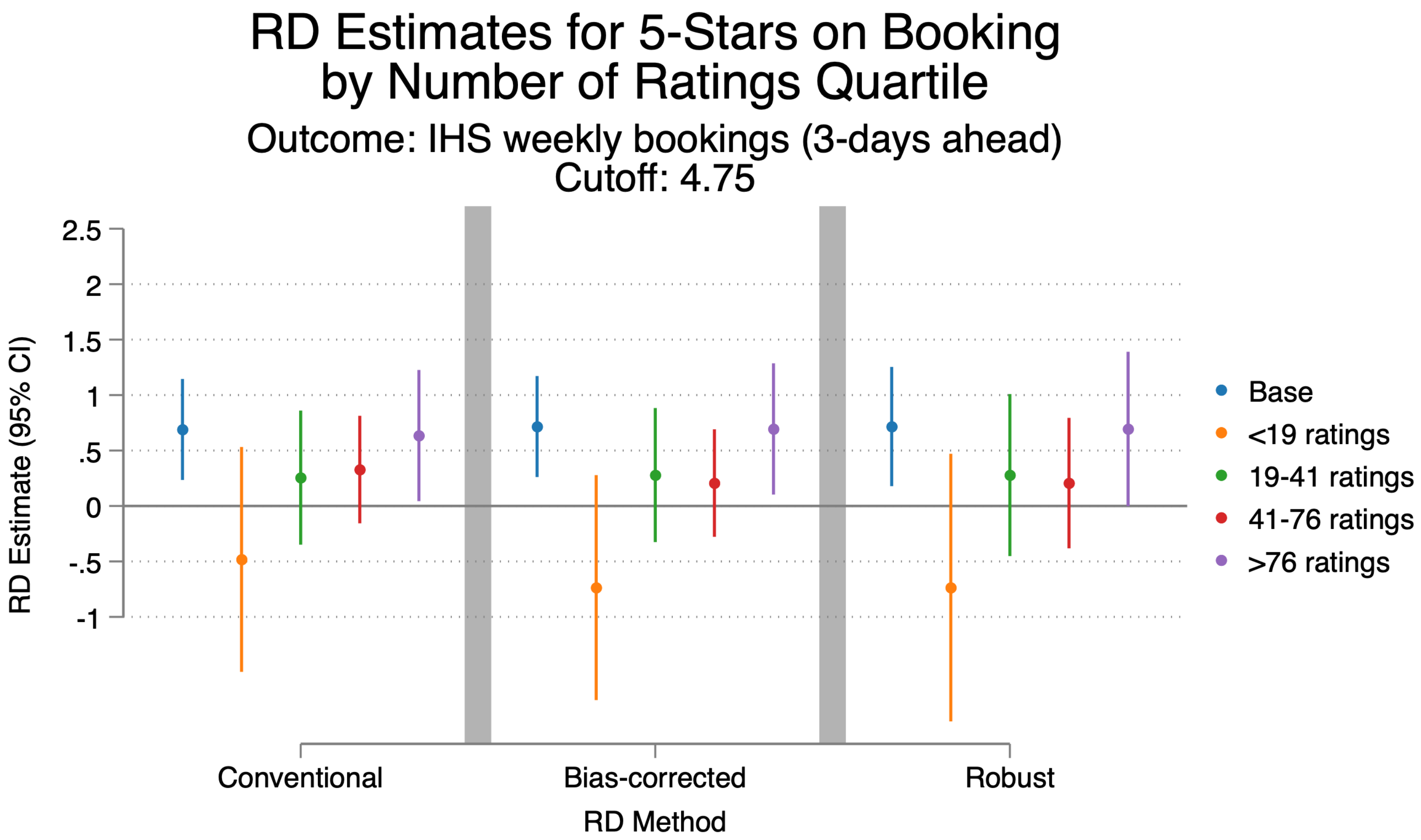
Details

Differential Impact of by Ratings: Effect Increases with No. Ratings



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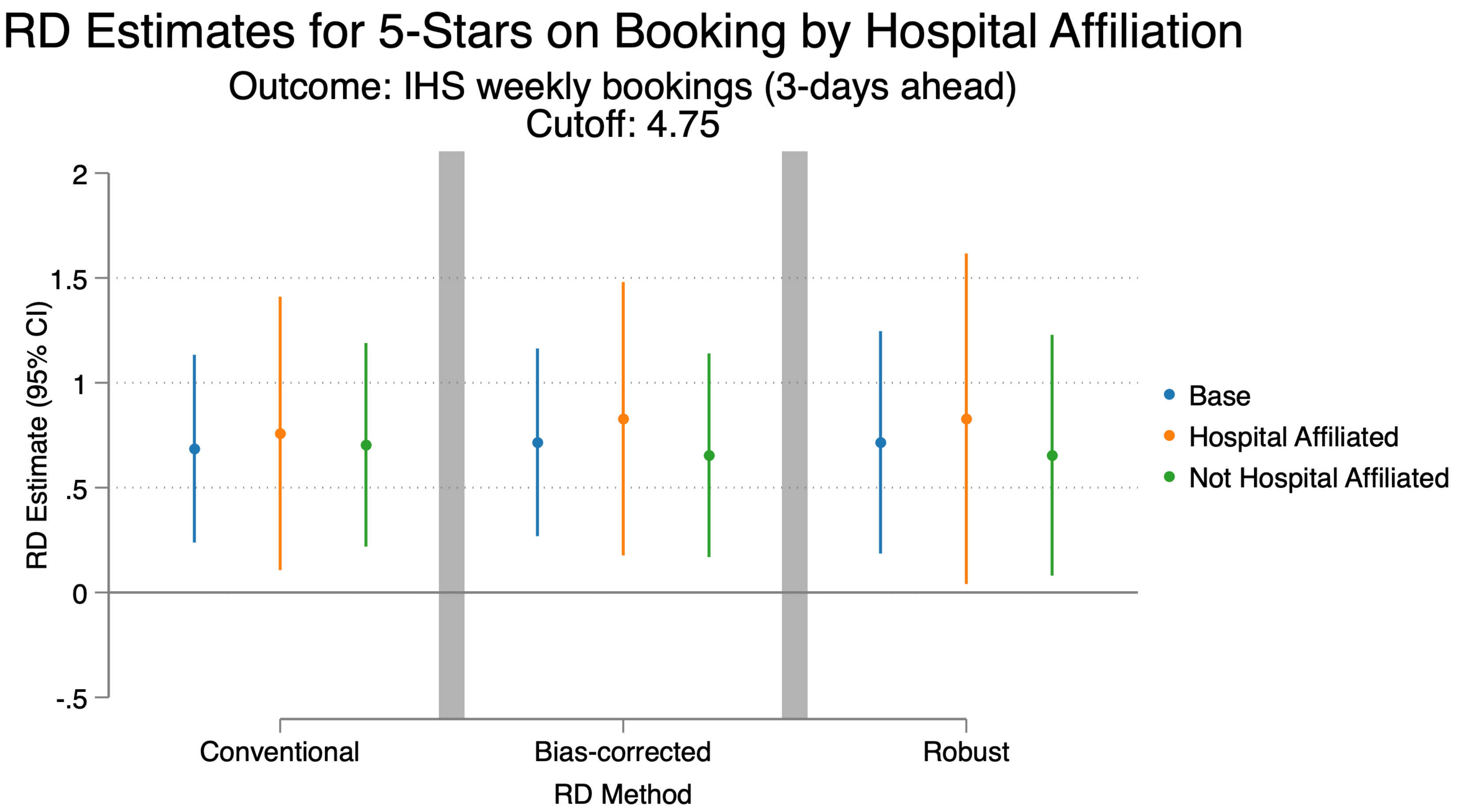
Differential Impact of by Hospital Affiliation: Similar Effects



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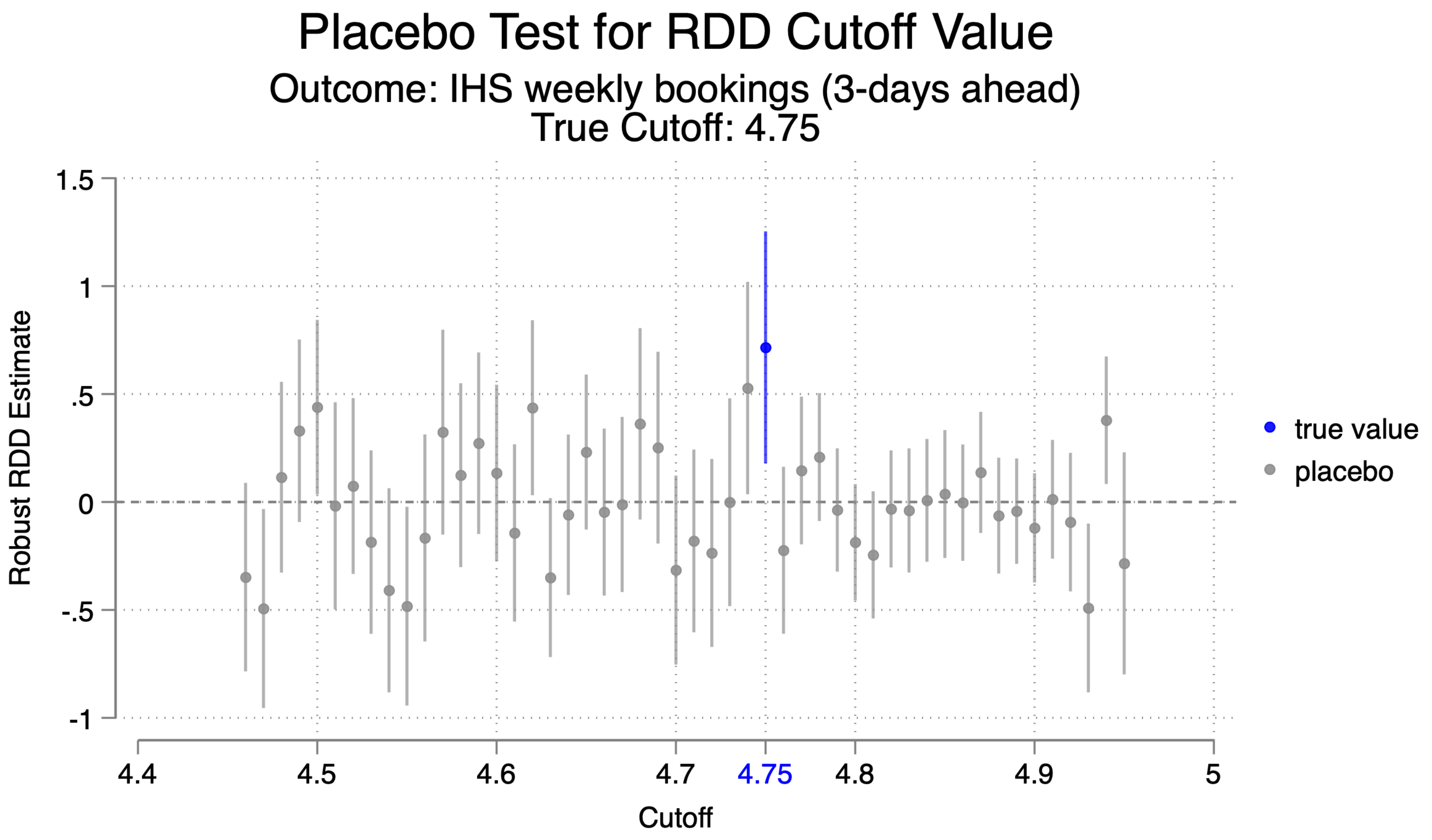
Robustness: Placebo Test of Main Result



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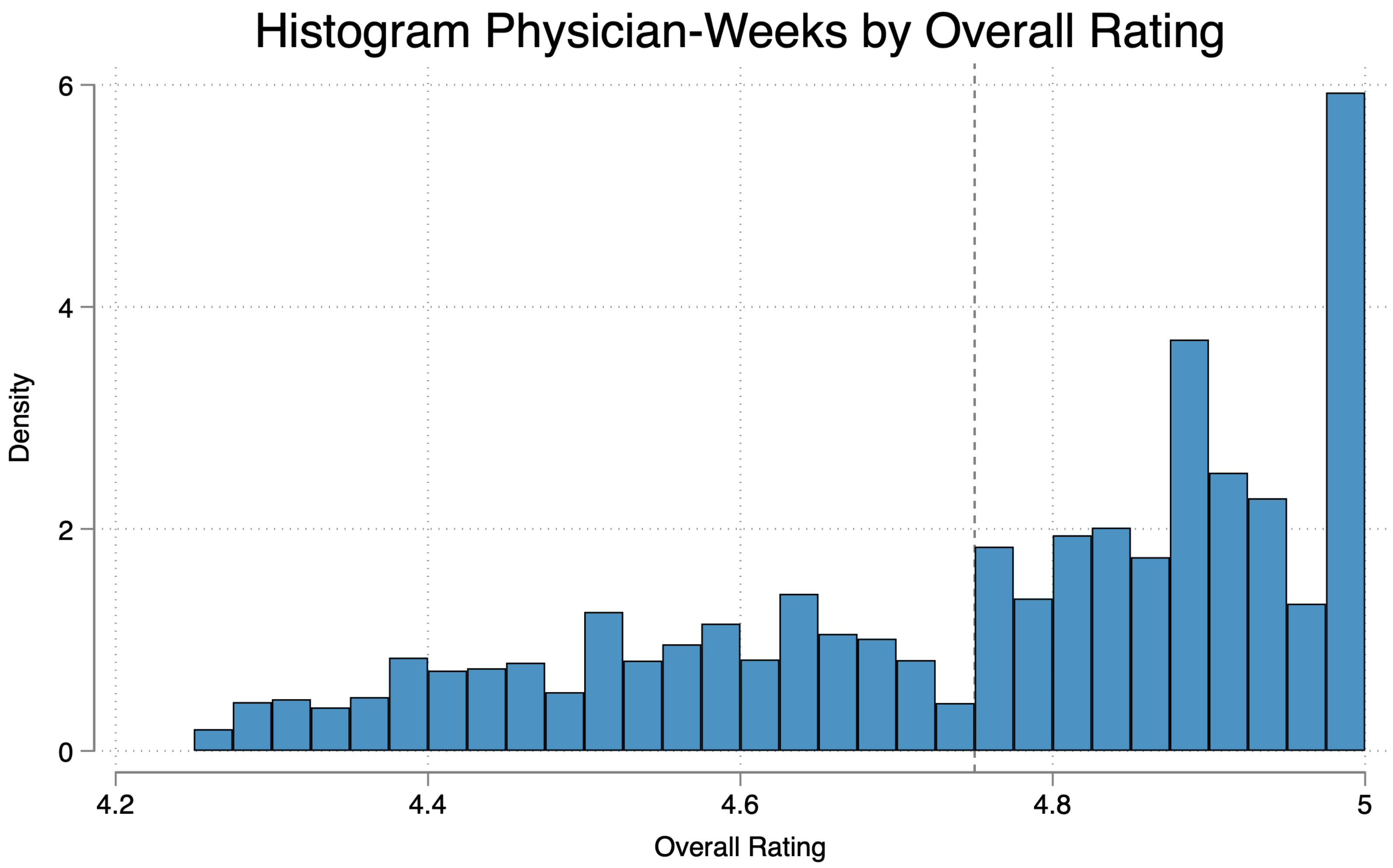
Robustness: Visible Bunching Above Cutoff



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Conclusion

SUMMARY OF RESULTS

DISCUSSION & MECHANISMS

Summary of Findings

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Differential Impact

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Robustness

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Discussion: Potential Mechanisms

Gender: Effect greatest for women physicians

- But not closing a gender gap
- Correlated preferences
  - Ex: Gender, rating, and wait time
- Platform recommendation system

Ratings: Effect increases with number of ratings

- Consistent with Bayesian learning

Hospital Affiliation: Similar Effects

Next Steps

Extend to analysis to other cutoffs

Differential impact by apparent race and age

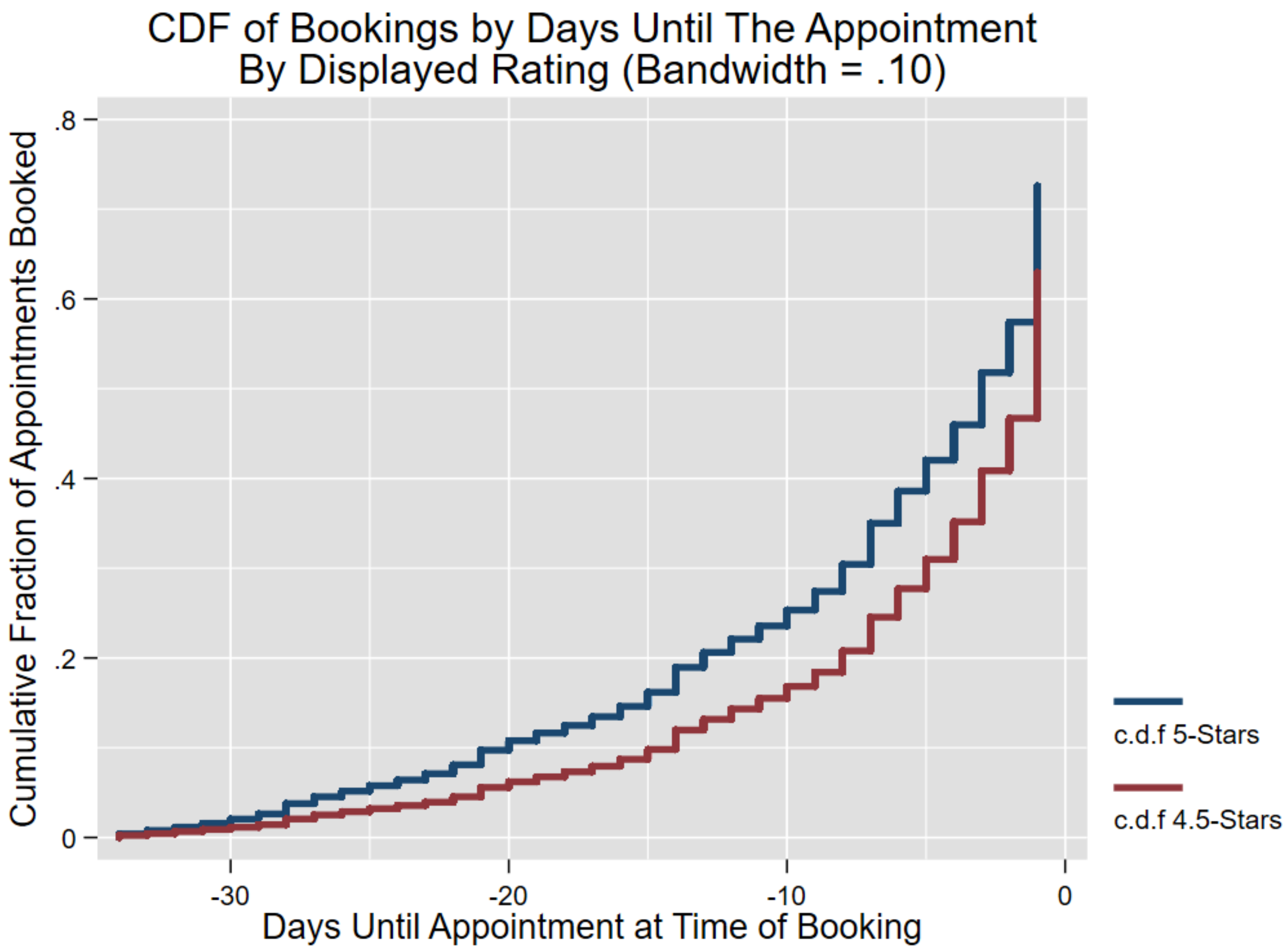
Robustness

- Mass at cutoff
  - “Donut” regression discontinuity
- Covariate balance

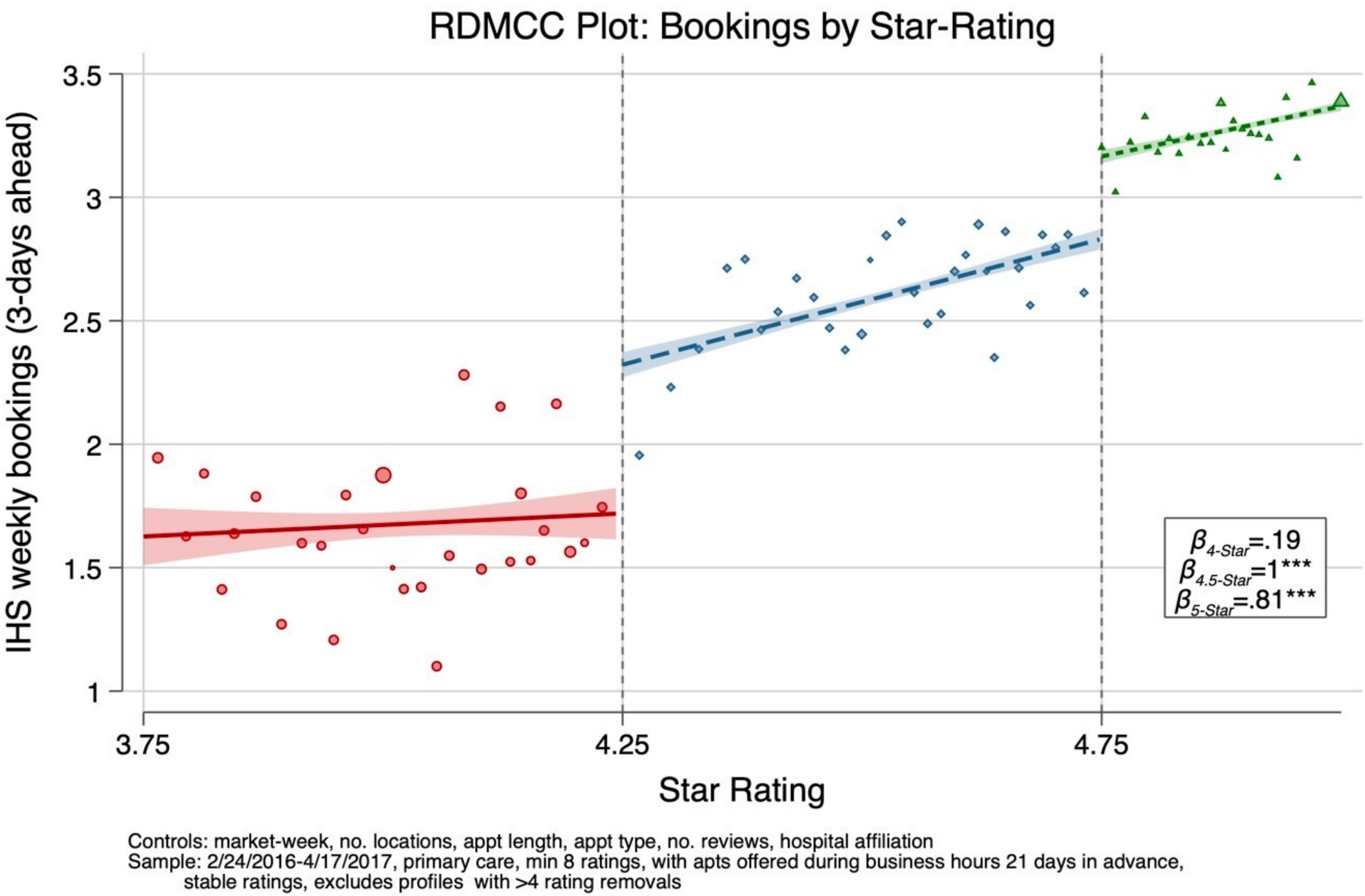
Appendix

Booking by Time (CDF Comparison)

Use a pilot bandwidth of .1 to compare these cdfs of physicians just above and just below the 4.75 threshold to have five stars.

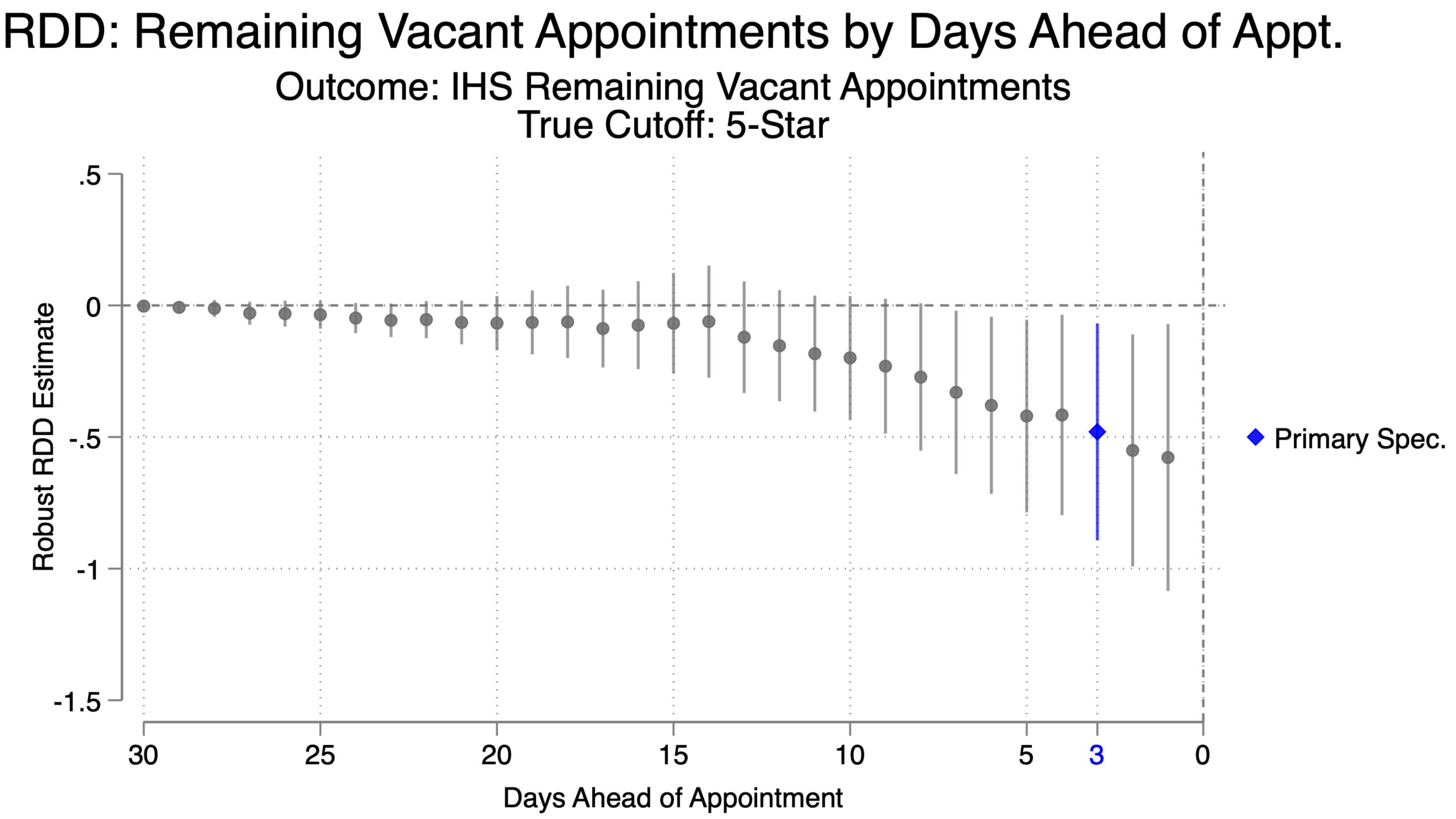


Patient Volume by Star Rating: 4, 4.5, and 5-Stars



5-star Results

Impact of Ratings on Patient Volume: Fewer Vacancies



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Booking Results

Booked Appointments by Page Rank Proxy

We are also interested in platform mechanics. Here, we take advantage of the fact that page rank is a function of availability.

Observation Level: Physician-day

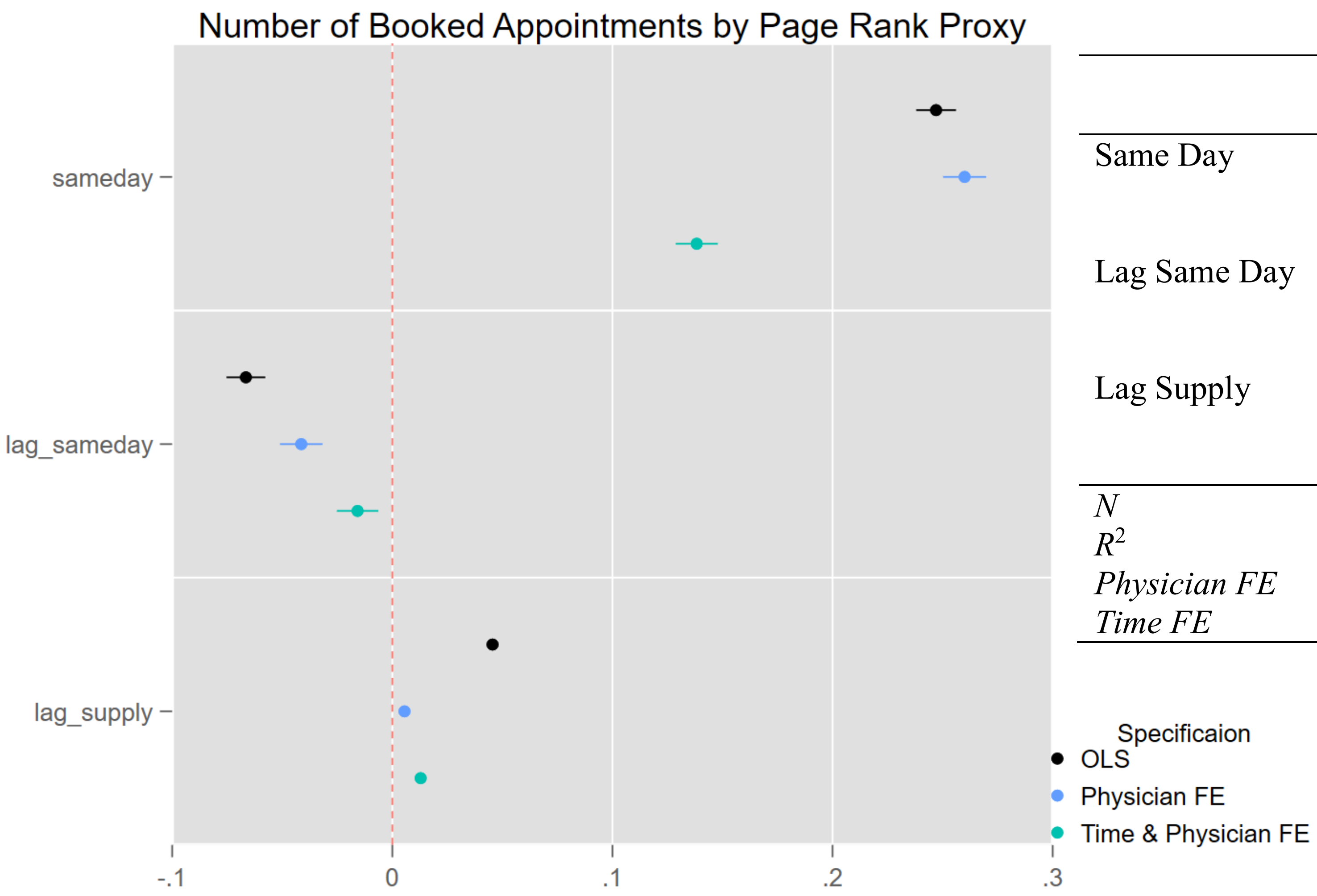
Dependent Variable: Count of appointments booked that day

Variables of Interest: Proxy for page rank with the number of same day appointments available, and the lag of same day appointments available.

Intuition: If page rank has no effect, we might expect these coefficients to be negative. A positive coefficient suggest page rank is indeed important.

Controls: Number of available appointments, physician FE, and time FE.

Booked Appointments by Page Rank Proxy



	(1) booked	(2) booked	(3) booked
Same Day	0.247***	0.260***	0.138***
	(53.49)	(52.12)	(28.31)
Lag Same Day	-0.0665***	-0.0413***	-0.0158**
	(-14.78)	(-8.38)	(-3.28)
Lag Supply	0.0455***	0.00554***	0.0129***
	(45.60)	(5.56)	(11.76)
N	487408	487408	487408
R^2	0.012	0.006	0.186
Physician FE		X	X
Time FE			X