Information and Disparities in Health Care Quality: Evidence from GP Choice in England

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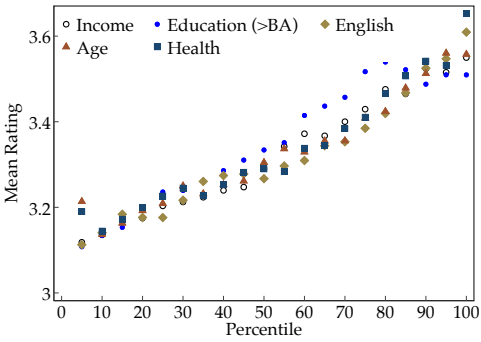
February 2024

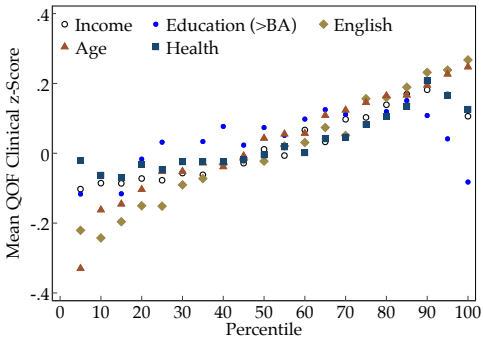
Quality and Choice Heterogeneity in Health Care

- Health care provider quality varies widely and matters for health
  - E.g. Doyle et al. 2019; Hull 2018; Cooper et al. 2022
- Many individuals appear to choose low quality doctors/hospitals even when higher quality options are available
- Given the available options, heterogeneity in choice could be due to
  - Heterogeneous preferences
  - Heterogeneous information
- Policy prescriptions depend on whether information or preferences drive choice
  - Particularly important given propensity to choose high quality providers is correlated with SES (e.g., van Doorslaer et al. 2004; Cookson et al. 2016; Scobie and Morris 2020; AHRQ 2021)

Demographics Correlated with Quality of Chosen GP



a. Star Rating

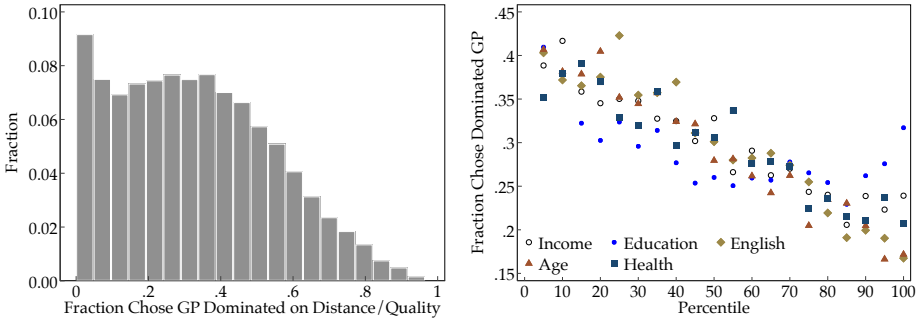


b. Clinical Quality Score (QOF)

- Could be due to differences in information, preferences, or access

Heterogeneity in Choosing GP Dominated on Quality/Distance

Figure: Prob. of Choosing GP Dominated on Distance, Rating and Clinical Quality



- Heterogeneous information? Or heterogeneous preferences over other (potentially unobserved) characteristics?

Dominated on capacity

This Paper: Is Heterogeneity in Choice the Result of Information Gaps?

- We know heterogeneous preferences are key in most markets
- Less emphasis on heterogeneous information
  - Due to, e.g. differences in education, social networks, advertising, or other costs of acquiring info
  - Potentially more difficult for low income individuals to determine which doctors are high quality
- Identification challenge: separating **information** from preferences (& access)
  - If an individual doesn't choose high quality doctor, is it that they don't know, don't care, or can't get there?
  - Need to leverage variation in information

Implications of Information Heterogeneity

Information heterogeneity is key for understanding

1. Strategies for ensuring all patients have high quality health care
   - Systemic change vs. (relatively) low-cost information interventions
   - Is access "enough"?
2. Value of choice in public services (e.g. Gaynor et al. 2016)
   - Changes in choice will have different welfare implications if some individuals are uninformed
3. Welfare effects of quality improvements
   - In presence of information frictions, it may appear that individuals are not sensitive to quality

This Paper

We exploit the responsiveness of demand to a Yelp-like star rating website.

1. Conceptual framework: impacts of public star ratings on demand
   - Intuition: Well informed individuals do not update in response to coarse ratings
2. Reduced form: do public star ratings (differentially) impact GP enrollment?
   - RD approach based on rounding of average reviews
   - Compare how different demographic groups respond around rounding thresholds (e.g., 3.74 vs 3.76)
3. Empirical model of GP Choice: quantify role of information heterogeneity
   - Allow for heterogeneous inertia, information precision and preferences
   - Estimated by indirect inference matching RD moments
   - Counterfactuals equate both information and access by income group
   - Welfare implications of targeted quality improvements, coupled with informational interventions

Preview of Findings

- RD shows sharp response to public star ratings (on average)
  - One half star higher rating increases enrollment growth by $\approx 20\%$
- Impacts driven by low-income neighborhoods
  - High-income enrollment correlates with average rating, but no jump at threshold
  - Consistent results in panel FE strategy (uses rating changes)
- Structural model: meaningful role for information heterogeneity
  - Less precise beliefs for low-income patients
  - Information differences explain **24%** of the income-quality gradient
  - Equating information & access nearly eliminates disparities (but preferences are not a major driver)
  - Information differences reinforce differences in access to care
  - Accounting for information reveals that quality improvements tend to benefit poor individuals the most

Contribution to Literature

- Disparities and information in health care
  - **Heterogeneity in health care quality:** Doyle et al. 2019; Hull 2018; Cooper et al. 2022
  - **Disparities:** Peters et al. 2008; van Doorslaer et al. 2006; Gwatkin et al. 2004; Cookson et al. 2016; Marmot et al. 2007; Balarajan et al. 2011; Devaux 2015; Handel et al. 2021
  - **Patient + equilibrium responses to information about health care quality:** Dranove et al. 2003; Cutler et al. 2004; Pope 2009; Werner et al. 2012; Grabowski & Town 2011; Kolstad 2013
  - **Role of health care expertise:** Bronnenberg et al. 2015; Artmann et al. 2019; Chen et al. 2021
- Impacts of review/scoring systems
  - Lewis & Zervas 2016; Luca 2016; Newberry & Zhou 2019; Reimers & Waldfogel 2021; Farronato et al. 2020; Li, Tadelis, & Zhou 2020, Xin 2020, Mayzlin et al. 2014; Luca & Zervas 2016; Chartock 2021; Kummer et al. 2021; Vatter 2022
- Information, choice, and inequality in other domains (particularly education)
  - Hastings & Weinstein 2008; Kapor et al. 2020; Dynarski & Scott-Clayton 2006; Dynarski et al. 2021; Bettinger et al. 2012; Hastings et al. 2015; Oreopoulos & Ford 2019

Outline

Background and Data

Conceptual Framework

Regression Discontinuity Effect of Star Ratings

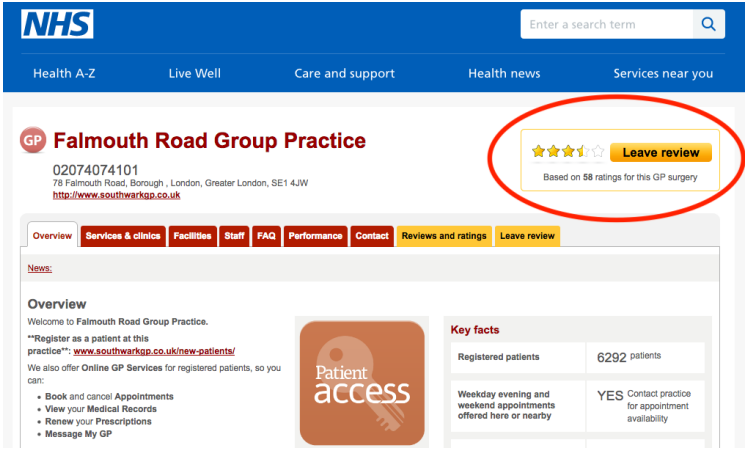
Empirical Model

Conclusion

GP Registration and National Health Service (NHS) Choices Website

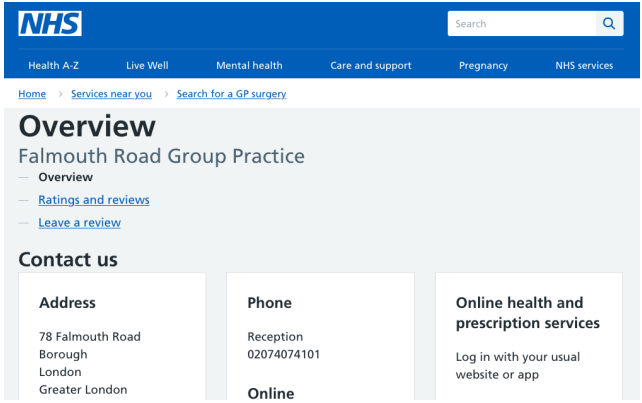
- All individuals in England register with a GP free of charge
  - GPs provide checkups, vaccinations, simple diagnoses, and refer patients to specialists
  - Quality of GPs is thought to be important and NHS monitors quality closely
  - Individuals have legal right to choose any GP (with a few limited exceptions)
- NHS Choices Website (www.nhs.uk)
  - Prior to 2020, "NHS Choices" website provided information to facilitate choice
  - Key component was a star rating based on 2-year moving-average of patient reviews
- NHS took steps to ensure credibility of reviews
  - Concerns about fake reviews (e.g., Mayzlin et al. 2014; Luca and Zervas 2016)
  - NHS collected IP address and email for individuals leaving reviews
  - Moderation process to remove uninformative or potentially fake reviews

NHS Website with Visible Star Rating (before January 2020)



- Star rating was most prominent source of quality information

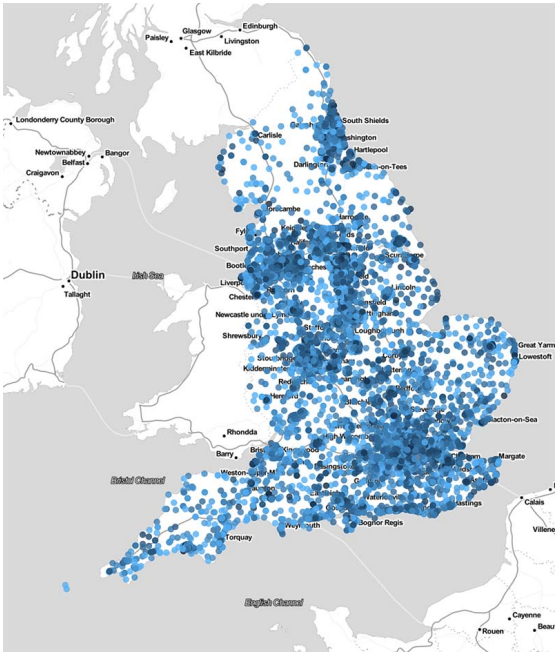
NHS Website with No Star Rating (after January 2020)



- Star rating removed from website in January 2020
- We make limited use of this data because of COVID

Data

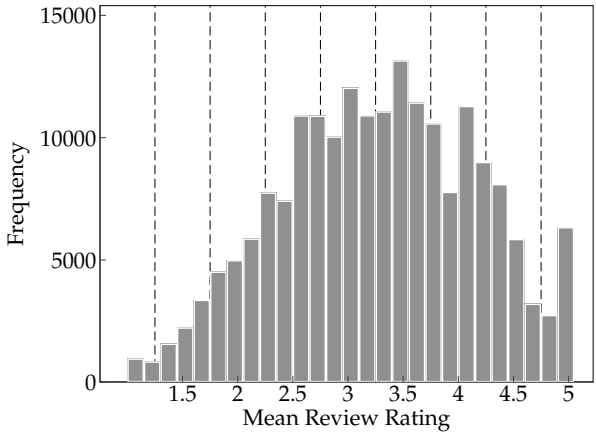
- Reviews for all GPs in England
  - $\sim$400,000 individual reviews for 2013–2022
  - Construct panel of average reviews by GP-quarter (2 year moving average)
- GP enrollment for all individuals in England
  - At GP-quarter-neighborhood level for 2015–2022
  - Merge income, education, health, and other demographics by neighborhood
  - Use geolocation of GPs to get distance to each patient
- Microdata for individuals that switch/change addresses
  - Can examine "movers" that must switch their GP


Edinburgh
Glasgow
Paisley
Livingston
East Kilbride
Londonderry County Borough
Newtownabbey
Bangor
Belfast
Craigavon
Carlisle
South Shields
Hartlepool
Darlington
Dublin
Tallaght
Irish Sea
Southport
Chester
Newcastle under Lyme
Shrewsbury
Lincoln
Great Yarmouth
Lowestoft
Slough
Kidderminster
Rhondda
Barry
Bristol Channel
Margate
Hastings
Calais
Torquay
Weymouth
Bognor Regis
English Channel
Cayenne
Rouen

Summary Statistics

	Period with Star Ratings		Period without Star Ratings	
	Mean	SD	Mean	SD
GP Reviews:				
Individual review	3.17	1.84	3.39	1.70
GP average stars	3.20	1.02	.	.
GP Number of Reviews	86.8	93.4	129.5	162.9
GP Enrollment:				
Total Enrollment (100s)	80.73	50.92	92.07	61.26
LSOA Enrollment (100s)	0.58	1.61	0.54	1.61
Quarterly LSOA Enrollment Change	0.17	2.08	0.09	1.80
Patient Demographics:				
Female	0.50	0.02	0.50	0.09
Age	39.93	4.55	40.32	4.55
LSOA patient Demographics:				
Income score	−0.13	0.10	−0.13	0.10
Education (>BA)	0.27	0.11	0.27	0.11
English	0.88	0.10	0.88	0.10
Health score	−0.01	0.86	−0.02	0.86
Unique GPs	7,640			
Total GP Observations	19,998,172			
Individual Reviews	367,458			

Histogram of Average GP Reviews



Distribution of Individual Reviews

Reviews are Correlated with Other Measures of Quality

			> 100 Reviews	
	Corr	p-value	Corr	p-value
Patient Surveys:				
Easy getting through to GP	0.48	0.000	0.57	0.000
Receptionist was helpful	0.46	0.000	0.52	0.000
Able to get appointment	0.47	0.000	0.57	0.000
GP gave enough time	0.43	0.000	0.51	0.000
GP explained well	0.40	0.000	0.49	0.000
GP involved you	0.41	0.000	0.48	0.000
GP treated with care & concern	0.43	0.000	0.52	0.000
Confidence and trust in GP	0.38	0.000	0.46	0.000
Overall experience good	0.55	0.000	0.61	0.000
Quality & Outcomes Framework:				
Clinical (z-score)	0.20	0.000	0.63	0.000
Overall (z-score)	0.19	0.000	0.59	0.000

- Quality & Outcomes Framework (QOF) score is objective measure of clinical quality
- Average patient reviews positively correlated with QOF score
- Previous work shows NHS reviews are correlated with mortality/infection rate of hospitals (Greaves et al. 2012)
- Evidence that ratings mean the same for individuals of different SES Results

Learning about GP Quality

- Star ratings s_j are public and all individuals have prior for quality r_j:

$$r_j | s_j \sim \mathcal{N}(\mathbb{E}[r_j | s_j], \eta^2)$$

where $\mathbb{E}[r_j | s_j]$ is expected quality given rounded star rating

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- Individual i receives private signal (e.g, friend's recommendation)

$$\tilde{r}_{ij} = r_j + \epsilon_{ij}$$

where $\epsilon_{ij} \sim \mathcal{N}(0, \sigma_i^2)$ and σ_i^2 characterizes the precision of i's information

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where $\epsilon_{ij} \sim \mathcal{N}(0, \sigma_i^2)$ and σ_i^2 characterizes the precision of i's information

- Bayesian updating gives posterior

$$\mathbb{E}[r_j | \tilde{r}_{ij}, s_j] = \alpha_i r_j + (1 - \alpha_i)\mathbb{E}[r_j | s_j] + \alpha_i \epsilon_{ij}, \quad \text{where} \quad \alpha_i = \frac{\eta^2}{\sigma_i^2 + \eta^2}.$$

Preferences over expected quality

- Suppose risk neutral patients care about expected quality

$$\mathbb{E}[u_{ij}] = \beta \mathbb{E}[r_j | \tilde{r}_{ij}, s_j] + \nu_{ij}$$

  where $\nu_{ij} \sim N(0,1)$ is a taste shock/match value

- Plugging in the expected value gives:

$$\mathbb{E}[u_{ij}] = \beta \alpha_i r_j + \beta(1-\alpha_i)\mathbb{E}[r_j | s_j] + \underbrace{\beta \alpha_i \varepsilon_{ij} + \nu_{ij}}_{\text{Composite Error}}$$

  - Choice probability takes probit form
  - Two key parameters: preference for quality (β) and information precision (in α_i)

Model Predictions

1. Imprecise private info (σ_i large, β large):
   - Flat slope + large jump

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1. Imprecise private info (σ_i large, β large):
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2. Precise private info (σ_i small, β large):
   - Steep slope + small jump
3. Low preference for quality (β small):
   - Flat slope + small jump

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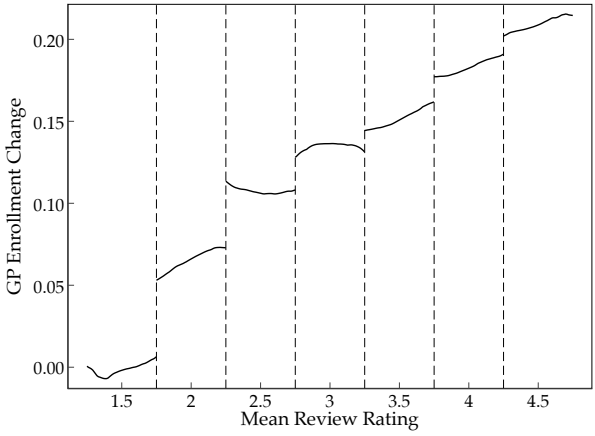
Testing for the Impact of Star Ratings on Demand

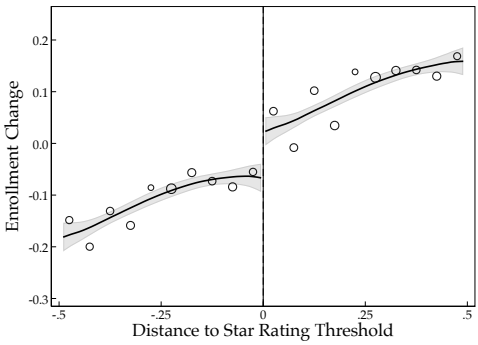
- Regression discontinuity approach: impact of star ratings on enrollment
  - Two GPs may have different star ratings with similar mean reviews (as in Luca 2016)
  - Main outcome: quarterly change in enrollment

GP Enrollment Change and Review Thresholds

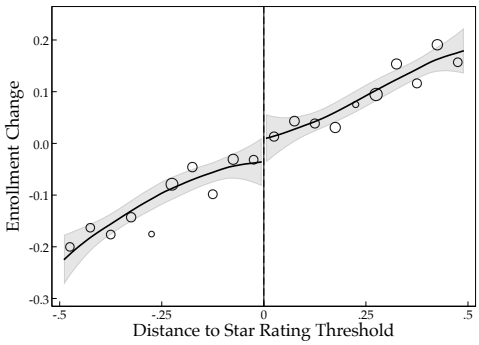


- Local Linear regression within each bin

Patients Learn from Star Ratings



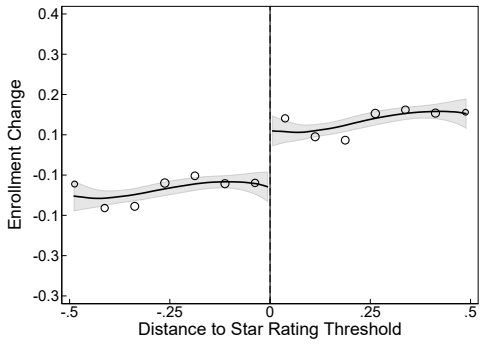
a. **Visible Star Rating**



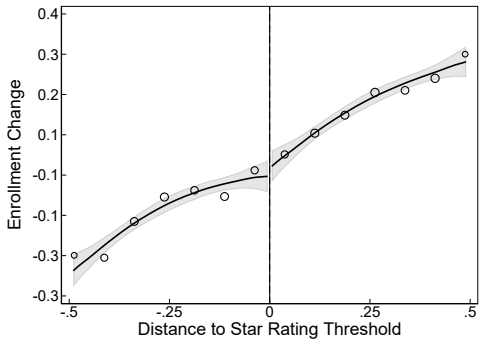
b. **No Star Rating**

- Significant effect at star ratings threshold (no effect once stars removed)

Evidence of information gap between low and high income patients



a. **Low Income**



b. **High Income**

- Flat slope + large jump for low-income $\Rightarrow$ rely heavily on star ratings
- Steep slope + no jump for high income $\Rightarrow$ already informed

Regression Discontinuity by Demographics

	Income	Education	English	Age	Health
Above × Low	0.144***	0.119***	0.120***	0.133***	0.127***
	(0.042)	(0.042)	(0.046)	(0.045)	(0.042)
Above × High	0.015	0.032	0.028	0.016	0.032
	(0.041)	(0.045)	(0.041)	(0.039)	(0.042)
High/Low Diff P-Value	0.009	0.115	0.110	0.025	0.061
Bandwidth	0.25	0.25	0.25	0.25	0.25
N	1,621,745	1,573,713	1,573,713	1,573,713	1,621,745

- Large jump for "low", small jump + steep slope for "high" Charts
- Robust to using period without stars as control Diff-in-RD

RD Results: Robustness

- Implement bandwidth selection procedure and SEs following Calonico et al. (2014) and Cattaneo et al. (2020) Results
  - Significant effect for low-income but no statistically significant effect for high-income
- No evidence of endogenous sorting across the threshold Result
- Other covariates are smooth across the thresholds (including waiting times) Result
- Distribution of ratings is similar in period without visible stars
- Similar effect for movers who must choose GP Result
  - Addresses concern about differential switching
  - Again, effect almost entirely driven by low-income
- Results robust to panel FE strategy that focuses on rating changes Result
- Effects not driven by differences in choice sets or capacity constraints Result
- Effects robust to other outcome variables (enrollment level and growth) Result

Empirical Model of GP Demand with Learning

- Want to quantify importance of information heterogeneity
  - RD indicates presence of an information gap by income
  - No insight into relative importance of access, information, & preferences
- Empirical model
  - Leverage RD to separately identify preference vs. information heterogeneity
  - Account for heterogeneous inertia in provider choice
  - Counterfactuals decompose sources of disparities in health care quality in long run and welfare implications

Empirical Model: Beliefs about Quality

- Following the theoretical framework, individuals have posterior beliefs about quality given by

$$\mathbb{E}[r_{jt}|\tilde{r}_{i\ell jt}, s_{jt}] = \alpha_\ell(r_{jt} + \epsilon_{i\ell jt}) + (1 - \alpha_\ell)\mathbb{E}[r_j|s_j]$$

  where weight on private signal is

$$\alpha_\ell = \frac{\eta^2}{\sigma_\ell^2 + \eta^2}$$

- We allow precision of private signal to vary with (neighborhood-level ℓ) income

$$\frac{1}{\sigma_\ell^2} = \exp[\gamma_0 + \gamma_1 I_\ell]$$

Empirical Model: Demand for GPs

- For individual i in LSOA ℓ, expected utility for choosing GP $j \in \mathcal{J}_{\ell t}$ is:

$$\mathbb{E}[u_{i\ell jt}] = \beta_{1\ell}\left[\alpha_\ell r_j + (1-\alpha_\ell)\mathbb{E}[r_j|s_{jt}]\right] + f(d_{\ell j};\beta_{2\ell}) + \beta_3 X_{jt} + \xi_j + k_\ell \nu_{i\ell jt}$$

  - Preference for quality, $\beta_{1\ell}$, is function of income
  - $f(d_{\ell j};\beta_{2\ell})$ is disutility from distance that may differ by income
  - X_{jt} is a vector of time varying GP characteristics (GP experience, capacity)
  - ξ_j is a fixed effect for GP j (unobserved amenities)
  - $\nu_{i\ell jt}$ is EV1 error capturing both error in beliefs and taste shock
    - Note $Var[\nu_{i\ell jt}] = \sigma^2_{\nu_\ell} = \frac{6}{\pi^2}\beta_1^2\alpha_{\ell t}^2\sigma_\ell^2 + 1$
  - $\mathcal{J}_{\ell t}$ includes GPs within 3Km of LSOA centroid

Inertia

- Only a modest fraction of individuals switch GPs in a given quarter
- The share of individuals that make an active choice as

$$\varphi_{\ell t} = \frac{\exp[\theta X^a_{\ell t}]}{(1 + \exp[\theta X^a_{\ell t}])}$$

  where $X^a_{\ell t}$ includes a constant and income

- GP share within LSOA ℓ at time t is then

$$s_{\ell j t} = \varphi_{\ell t} \frac{\exp\left[\frac{1}{\sigma_{\nu_\ell}(\beta_1,\gamma)}\left(\beta_1\left[\alpha_{\ell t} r_j + (1-\alpha_{\ell t})\mathbb{E}[r_j|s_{jt}]\right] + f(d_{\ell j}, X^d_{\ell t};\beta_2) + \beta_3 X_{jt} + \xi_j\right)\right]}{\sum_{k\in\mathcal{J}_{lt}} \exp\left[\frac{1}{\sigma_{\nu_\ell}(\beta_1,\gamma)}\left(\beta_1\left[\alpha_{\ell t} r_k + (1-\alpha_{\ell t})\mathbb{E}[r_k|s_{kt}]\right] + f(d_{\ell k}, X^d_{\ell t};\beta_2) + \beta_3 X_{kt} + \xi_k\right)\right]} + (1-\varphi_{\ell t}) s_{\ell j, t-1}$$

Estimation

- Estimate parameters that determine preferences, information, and inertia via GMM
- Match four sets of moments
  - Predicted RD estimates to actual RD estimates (by income)
  - Predicted market shares to actual market shares (averaged for each GP-year)
  - Predicted average characteristics to actual characteristics of chosen options
  - Predicted switching rate to actual switching rate (from "movers" data, by income)
- For computational tractability, estimation sample is Greater London (pop 10M)
  - RD results are similar for this sub-sample

Identification

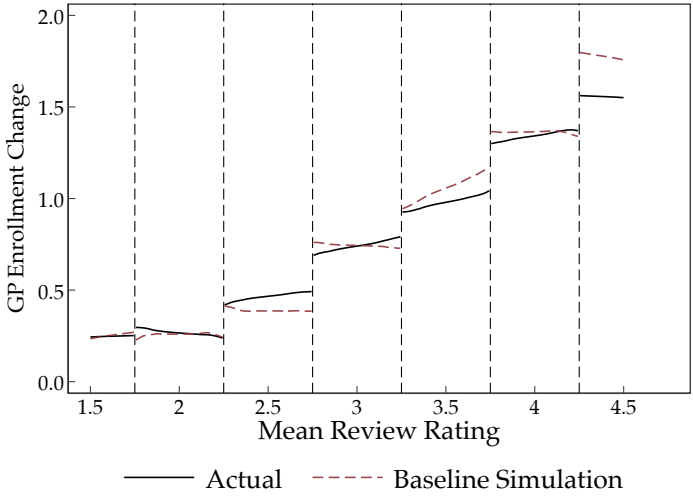
- Key challenge is separating information and preferences
- Extent to which individuals respond at star rating thresholds and when stars change over time identifies private signal precision
  - If individuals respond to stars conditional on r_j, weight α_{ljt} must be low $\rightarrow$ high $\sigma_{\ell t}$
  - If no response to stars conditional on r_j and no slope $\rightarrow$ low β_1
  - RD moments help discipline model estimates of signal precision
- Moments targeting shares help pin down GP fixed effects and preferences for other GP characteristics
- Moments targeting observed switching rates pin down inertia parameters

Demand Estimates

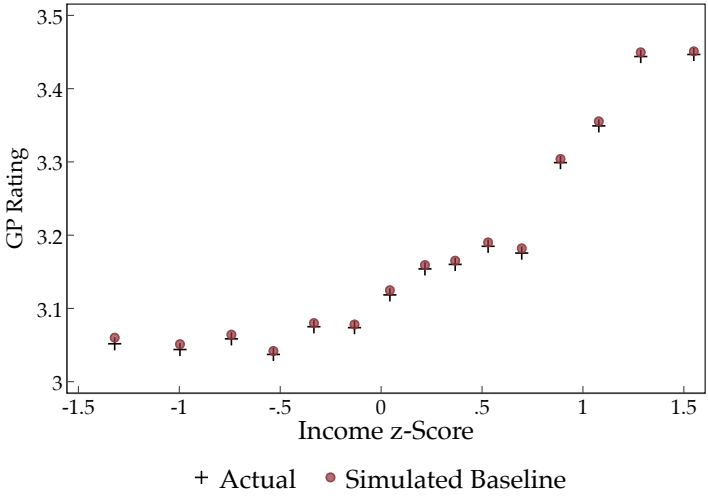
	Estimate	SE
Inertia (θ)		
Constant	−3.406	(0.002)
Income	0.095	(0.002)
Private Signal Precision ($\frac{1}{\sigma_\ell^2}$)		
Constant	4.313	(0.572)
Income	2.214	(0.617)
GP Quality ($\beta_{1\ell}$)		
Constant	0.284	(0.020)
Income	0.011	(0.021)
Distance ($\beta_{2\ell}$)		
Constant	−1.778	(0.028)
Income	0.036	(0.029)
Other GP Characteristics (β_3)		
Mean physician age	0.049	(0.026)
Practitioners per 1000 Patients	0.224	(0.046)
Active choice fraction	0.032	

- Large degree of inertia
- High income more informed
- High income less sensitive to distance
- High income slightly more sensitive to quality
- Evidence of demand for less crowded GPs

Model Fit: GP Enrollment Change and Review Thresholds



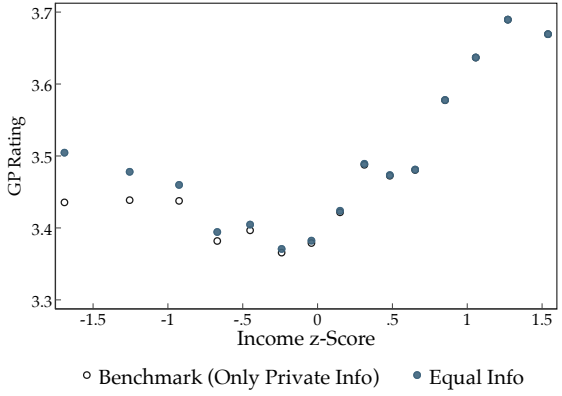
Model Fit: Disparities and Inertia



Counterfactual 1

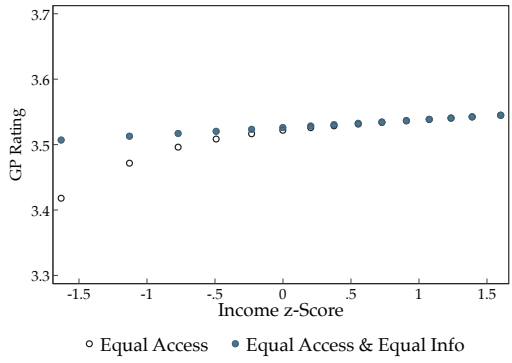
- What is the role of information differences in explaining income-quality gradient?
- Consider benchmark without star rating system (current status quo policy)
- Relative to benchmark, what if all individuals had same information precision?
  - Set $1/\sigma_\ell^2$ equal to precision in top income ventile
  - Focus on long-run (no inertia)

Counterfactual 1



- Correlation between income and ratings would be 24% lower (relative to status quo without star ratings)

Counterfactual 2



- What if individuals also had equal access?
  - Randomly draw quality from empirical distribution
- Equalizing both access and info precision eliminates almost 90% of inequality

Counterfactual summary: Information & Access

Counterfactual	Income-Quality Correlation	Percent Change Relative to No Stars
Benchmark	0.091	
Equal Information	0.069	-24%
Equal Access	0.040	-55%
Equal Information + Equal Access	0.013	-86%
Stars	0.070	-22%
Stars + Equal Access	0.014	-85%

- Information and access are complements
- By removing stars, NHS exacerbated inequality
- Counterfactuals are largely robust to allowing capacity to endogenously adjust

Counterfactual: Increasing Quality

- We consider a counterfactual in which we Improve 25% of GPs by 1-Star
  - welfare in Km (median distance travelled is 1.4Km)

	ΔCS	Low Info ΔCS	High Info ΔCS	$\frac{High}{Low}$
Model with Heterogenous Info				
Quality Increase	0.042	0.043	0.033	0.753
+ Website	0.043	0.047	0.033	0.690
Naive Model Assuming Full Info				
Quality Increase	0.038	0.031	0.034	1.104

- Naive demand model implies largest welfare increase for high-income patients
  - These individuals are estimated to have strongest preferences for quality
- Preferred model implies largest welfare increase for low-income patients
  - These individuals care about quality, but have imprecise information

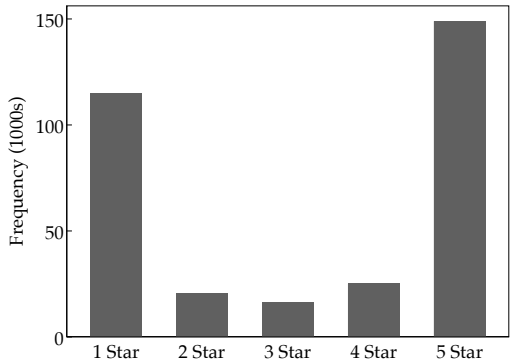
Conclusion

- Likelihood of going to high quality provider is correlated with demographics
- Information differences play a meaningful role in driving heterogeneity in choice
  - Star ratings primarily benefit low-income individuals
- Important interaction between access and information
  - Having high quality options is valuable only to those that know about it
- Welfare effects of increasing choice depend on who has information
- Information heterogeneity also has implications for supply-side

THANK YOU

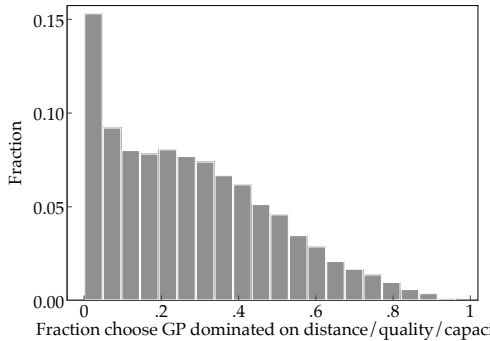
APPENDIX

Histogram of Individual Reviews

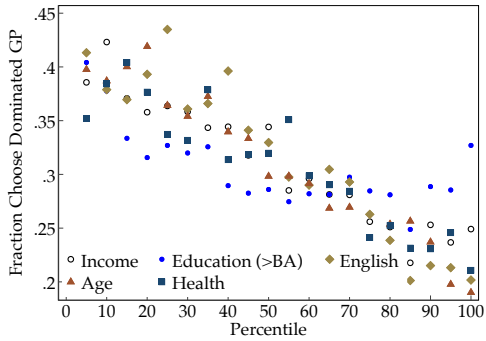


Back

Choose GP Dominated on Distance, Rating, and Capacity



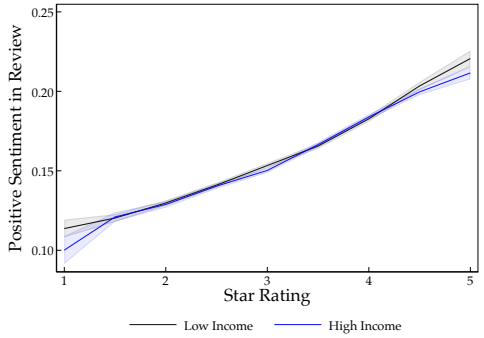
a. Distribution of Fraction Choosing GP Dominated on Distance/Quality/Capacity



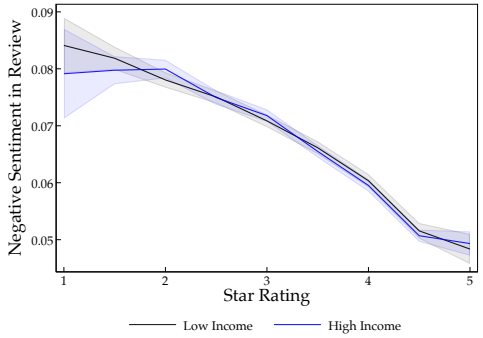
b. Correlation between Choosing Dominated GP and Demographics

Back

Sentiment Analysis of Review Text by GP Patient Income and Rating



a. Frequency of Positive Sentiment

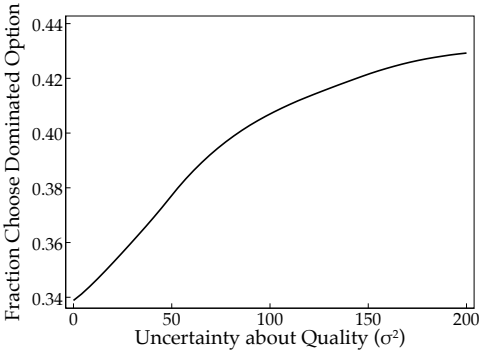


b. Frequency of Negative Sentiment

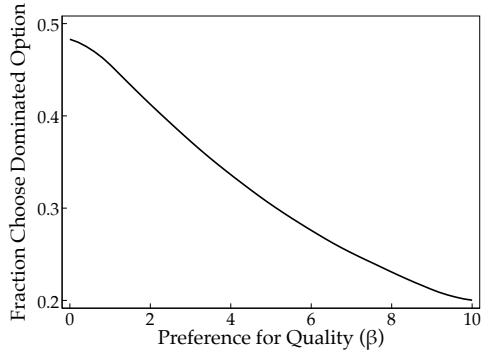
I.e., when low SES individuals give a 2-star review, they seem about as upset as when high SES individuals do

Back

Simulated Probability of Choosing Dominated Option



a. By signal precision



b. By preference for quality

Back

Effects of Star Rating on Enrollment Change

	Visible Star Ratings		No Star Ratings	
	CCT Bandwidth	IK Bandwidth	CCT Bandwidth	IK Bandwidth
Estimate	0.131**	0.073**	0.030	0.031
	(0.058)	(0.034)	(0.105)	(0.061)
Robust CI	[.009 ; .278]	[.019 ; .206]	[-.228 ; .282]	[-.148 ; .24]
Bandwidth	0.13	0.39	0.13	0.30
N	916,822	2,801,989	310,307	716,328

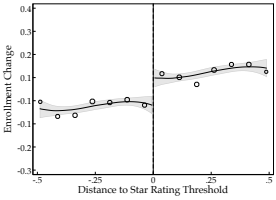
Back

Effects of Star Rating on Enrollment Growth

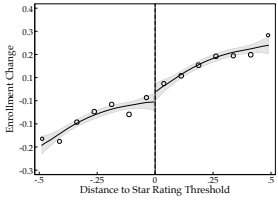
	Visible Star Ratings		No Star Ratings	
	CCT Bandwidth	IK Bandwidth	CCT Bandwidth	IK Bandwidth
Estimate	0.276***	0.204**	0.164	0.084
	(0.100)	(0.088)	(0.233)	(0.146)
Robust CI	[.068 ; .533]	[.09 ; .48]	[-.36 ; .796]	[-.347 ; .773]
Bandwidth	0.12	0.26	0.18	0.28
N	846,362	1,995,500	420,414	688,050

Back

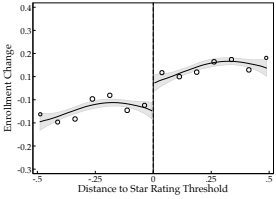
RD Effect: Additional Heterogeneity Analysis



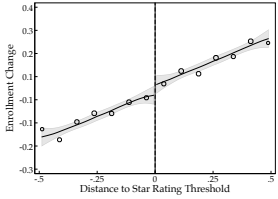
a. Low Education



b. High Education



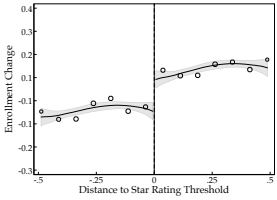
c. Low English



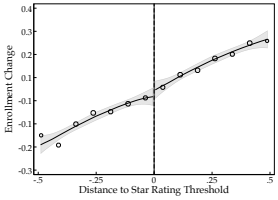
d. High English

Back

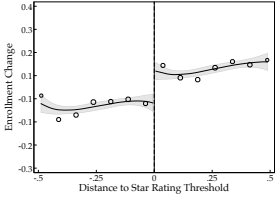
RD Effect: Additional Heterogeneity Analysis



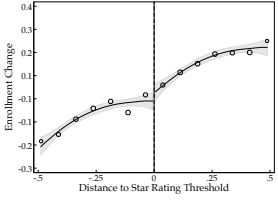
e. Younger



f. Older



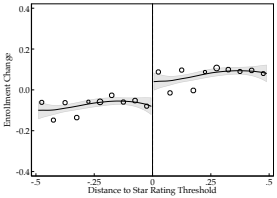
e. Poor Health



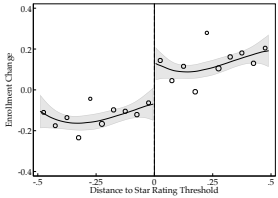
f. Good Health

Back

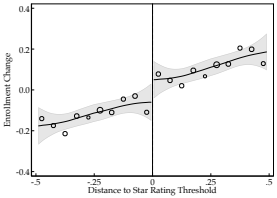
RD Effect by Income and Education



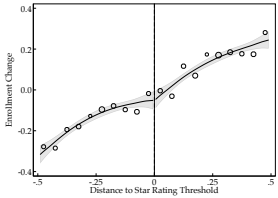
a. Low Income/Low Educ



b. Low Income/High Educ



c. High Income/Low Educ



d. High Income/High Educ

Back

RD Estimates using Period without Stars as Control Group

	Full	RD Effect Heterogeneity				
	Sample	Income	Education	English	Age	Health
Above Threshold × Visible Stars	0.078**					
	(0.034)					
Above × Low × Stars		0.144***	0.119***	0.120***	0.133***	0.127***
		(0.042)	(0.042)	(0.046)	(0.045)	(0.042)
Above × High × Stars		0.015	0.032	0.028	0.016	0.032
		(0.041)	(0.045)	(0.041)	(0.039)	(0.042)
High/Low Diff P-Value		0.009	0.115	0.110	0.025	0.061
Bandwidth	0.25	0.25	0.25	0.25	0.25	0.25
N	2,022,032	1,621,745	1,573,713	1,573,713	1,573,713	1,621,745

Back

Panel Regression Estimates

	(1)	(2)
Stars × 2	0.029***	0.025***
	(0.001)	(0.001)
(Stars×2) × 1(Low Income)		0.008***
		(0.001)
GP FEs	Yes	Yes
Quarter FEs	Yes	Yes
Outcome Mean	0.17	0.17
Adjusted R2	0.011	0.011
Observations	8,475,098	8,475,098

Notes: The unit of observation is the quarterly enrollment change for an LSOA-GP. Sample is period when stars were visible. All specifications control for GP age, age squared, and number of practitioners in the GP practice. Standard errors clustered at the GP level in parentheses.

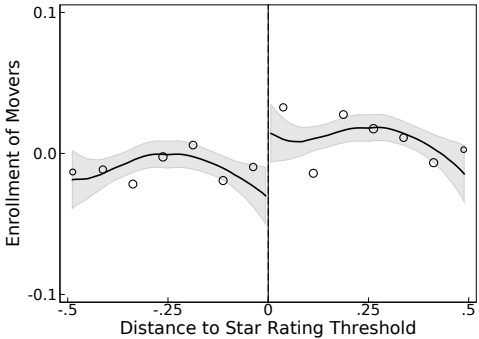
Back

Choices Sets and Capacity Constraints

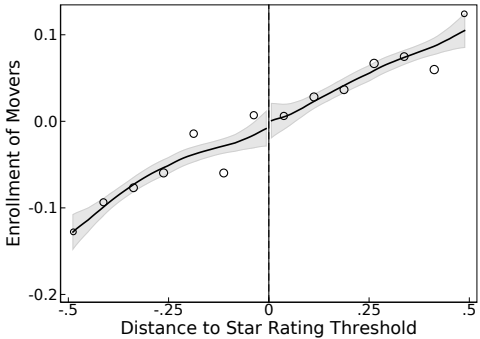
	Similar Choice Set		No GPs with Static Enrollment	
	Low Inc.	High Inc.	Low Inc.	High Inc.
Estimate	0.159**	0.100	0.191***	0.077
	(0.075)	(0.083)	(0.072)	(0.078)
Bandwidth	0.14	0.12	0.15	0.13
N	363,094	285,300	492,612	403,975

Back

Effects For Movers + Alternate Bandwidths



a. Low-Income



b. High-Income

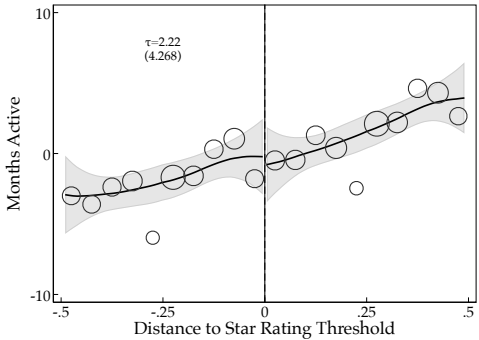
Back

Greater London

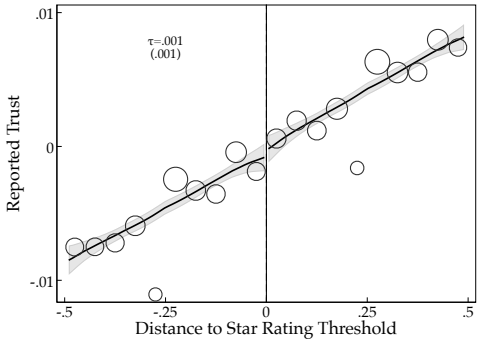
			Visible Star Ratings		Visible Star Ratings London Only	
	Visible Star Ratings	No Star Ratings	Low Income	High Income	Low Income	High Income
Estimate	0.072	0.017	0.113	0.035	0.159	0.047
	(0.028)	(0.049)	(0.035)	(0.034)	(0.064)	(0.063)
Distance from threshold	−0.031	0.099	−0.129	0.065	−0.216	0.039
	(0.056)	(0.097)	(0.069)	(0.068)	(0.129)	(0.127)
Outcome Mean	0.82	0.41	0.87	0.77	0.93	0.90
N	3,421,544	1,116,437	1,698,686	1,722,858	564,239	498,160

Back

Smoothness of Covariates



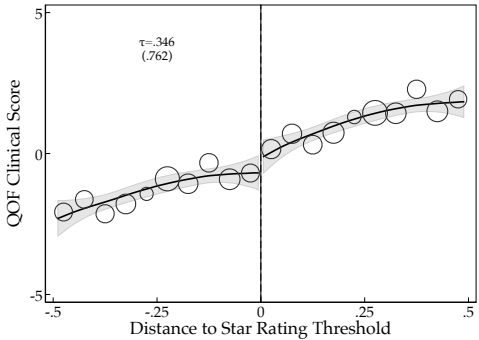
Months Active



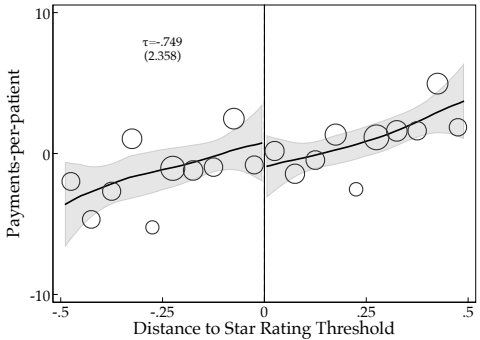
Confidence and Trust (Survey)

Back

Smoothness of Covariates



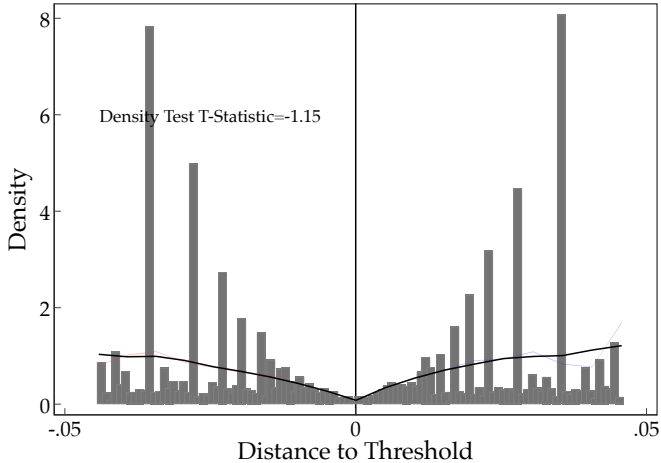
QOF Clinical Score



Payments Per-Patient

Back

Density Tests



Back