Sensitivity Analyses

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Table of contents I

Sensitivity

What is “sensitivity”?

Sensitivity to Model Specification

Should we trust our model?

Estimating all possible regressions

Idea

Example 1

Moore, Powell, and Reeves (2013)

Implementation

Hebbali (2024)

```
library(olsrr)
```

Example 2

```
library(qss)
data(social)

social <- social |> mutate(
  age = 2006 - yearofbirth,
  messages = fct_relevel(messages, "Control")
)

head(social)
```

```
     sex yearofbirth primary2004   messages primary2006 hhs
1   male        1941           0 Civic Duty           0
2 female        1947           0 Civic Duty           0
3   male        1951           0  Hawthorne           1
4 female        1950           0  Hawthorne           1
5 female        1982           0  Hawthorne           1
6   male        1981           0    Control           0
```

Example 2

```
lm_out <- lm(primary2006 ~ messages + sex + age +
               primary2004 + hhsize, data = social)

all_lm_social <- ols_step_all_possible(lm_out)$result
```

Example 2

```
all_lm_social_coefs <- ols_step_all_possible_betas(lm_out)

all_lm_social_coefs
```

```
    model           predictor           beta
1       1         (Intercept)  0.2966383083
2       1 messagesCivic Duty  0.0178993441
3       1  messagesHawthorne  0.0257363121
4       1  messagesNeighbors  0.0813099129
5       2         (Intercept)  0.3059095493
6       2             sexmale  0.0126509479
7       3         (Intercept)  0.1055564253
8       3                 age  0.0041515670
9       4         (Intercept)  0.2508820413
10      4         primary2004  0.1528795252
11      5         (Intercept)  0.3763534949
12      5              hhsize -0.0293482475
13      6         (Intercept)  0.2902800648
```

Example 2

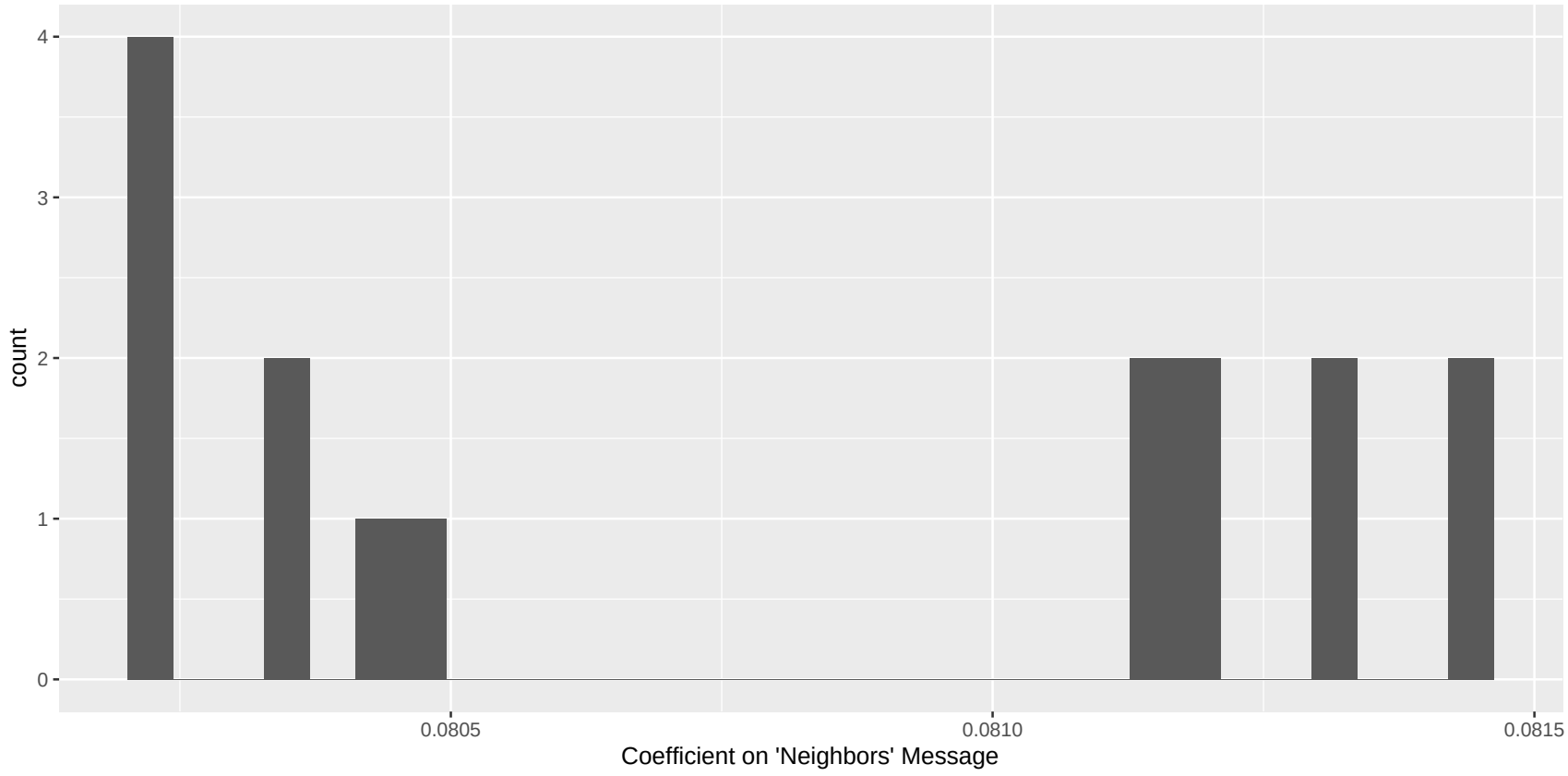

Figure 1: Coefficients from All Possible Regressions

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.08023 0.08032 0.08081 0.08080 0.08122 0.08145
```

Matching as Preprocessing

- minimize effects of model-based adjustment (subclassify, match)

"model-based adjustments ...will give basically the same point estimates"

Matching as Preprocessing

- minimize effects of model-based adjustment (subclassify, match)

"model-based adjustments ...will give basically the same point estimates"

What does this mean?

Ho et al. (2007)

"Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference"

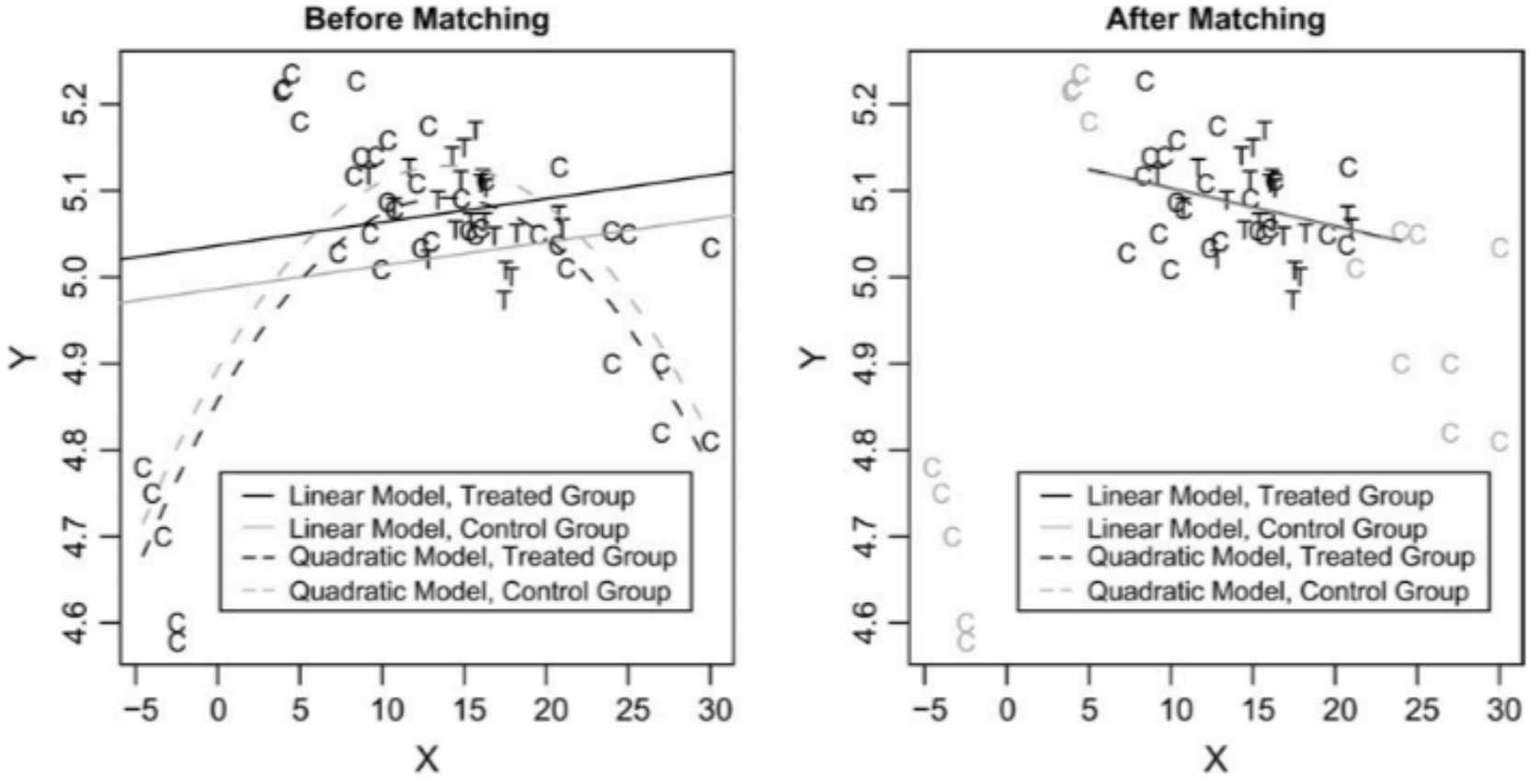

Figure 2: Here

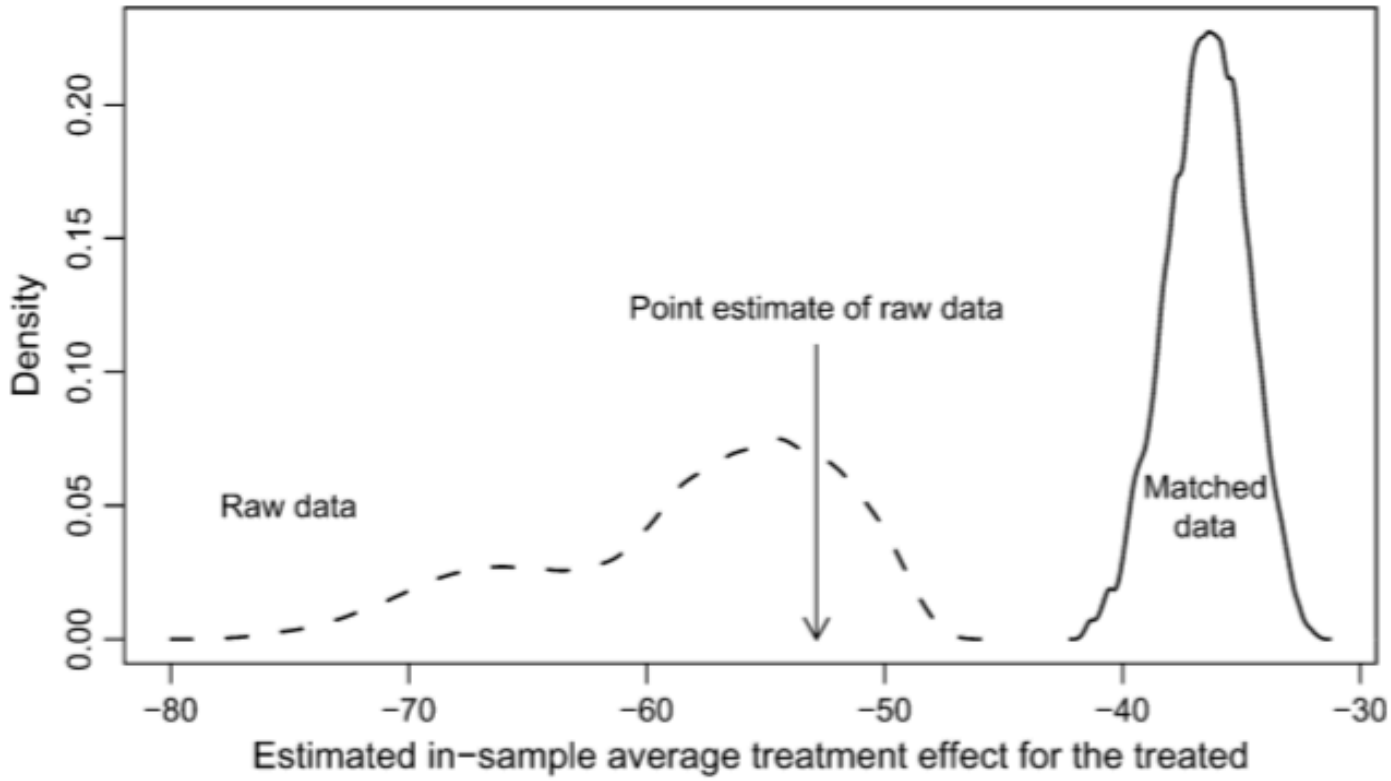

Fig. 2 Kernel density plot (a smoothed histogram) of point estimates of the in-sample ATT of the Democratic Senate majority on FDA drug approval time across 262,143 specifications. The solid line

Figure 3: Here

How to Identify Problem?

Different distributions; non-overlap

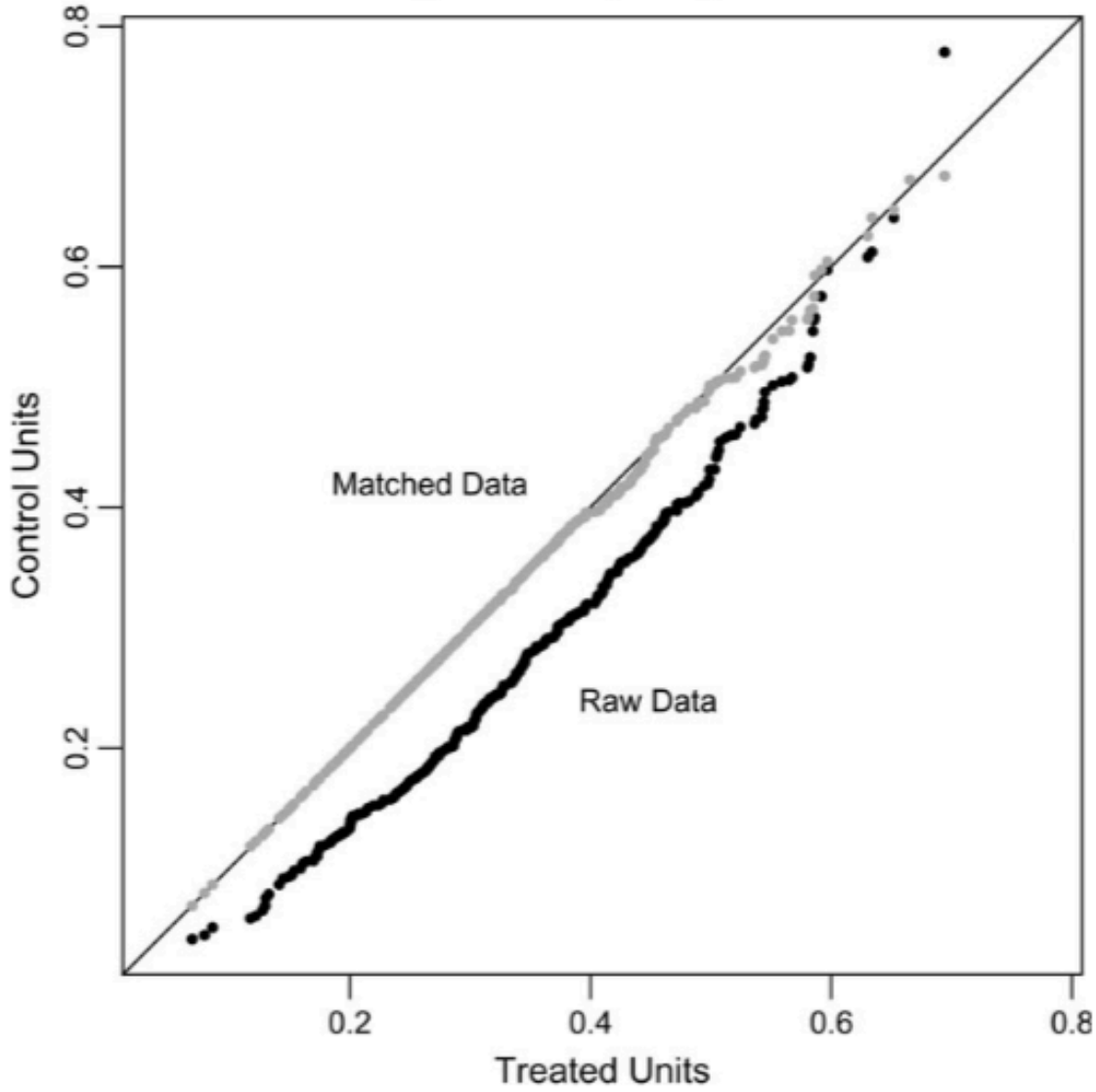

Fig. 3 QQ plot of propensity score for candidate visibility. The black dots represent empirical QQ

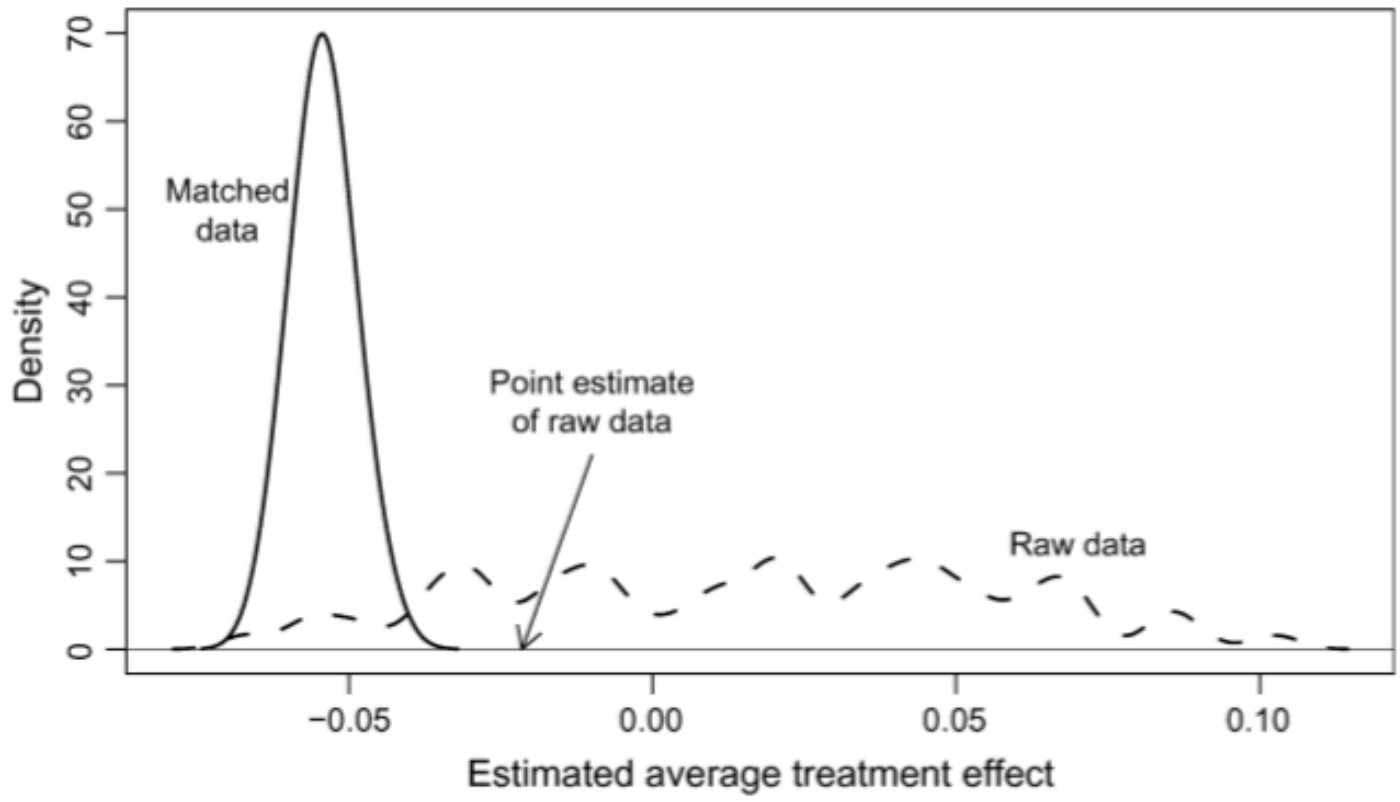

Fig. 4 Kernel density plot of point estimates of the effect of being a less visible male Republican candidate across 63 possible specifications with the Koch data. The dashed line presents estimates for

Figure 5: Here

Paradox of Regression for causal inference?

- If diffs large, regression not enough, very sensitive
- If diffs small, regression won't matter much
- Ho et al. (2007)

Matching as Preprocessing for Dynamic Treatment Regimes

Blackwell and Strezhnev (2022)

Sensitivity to an Unidentifiable Parameter

Mediation Analysis

Sensitivity to an Unobserved Covariates

“Rosenbaum sensitivity” analysis

Thanks!

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References I

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