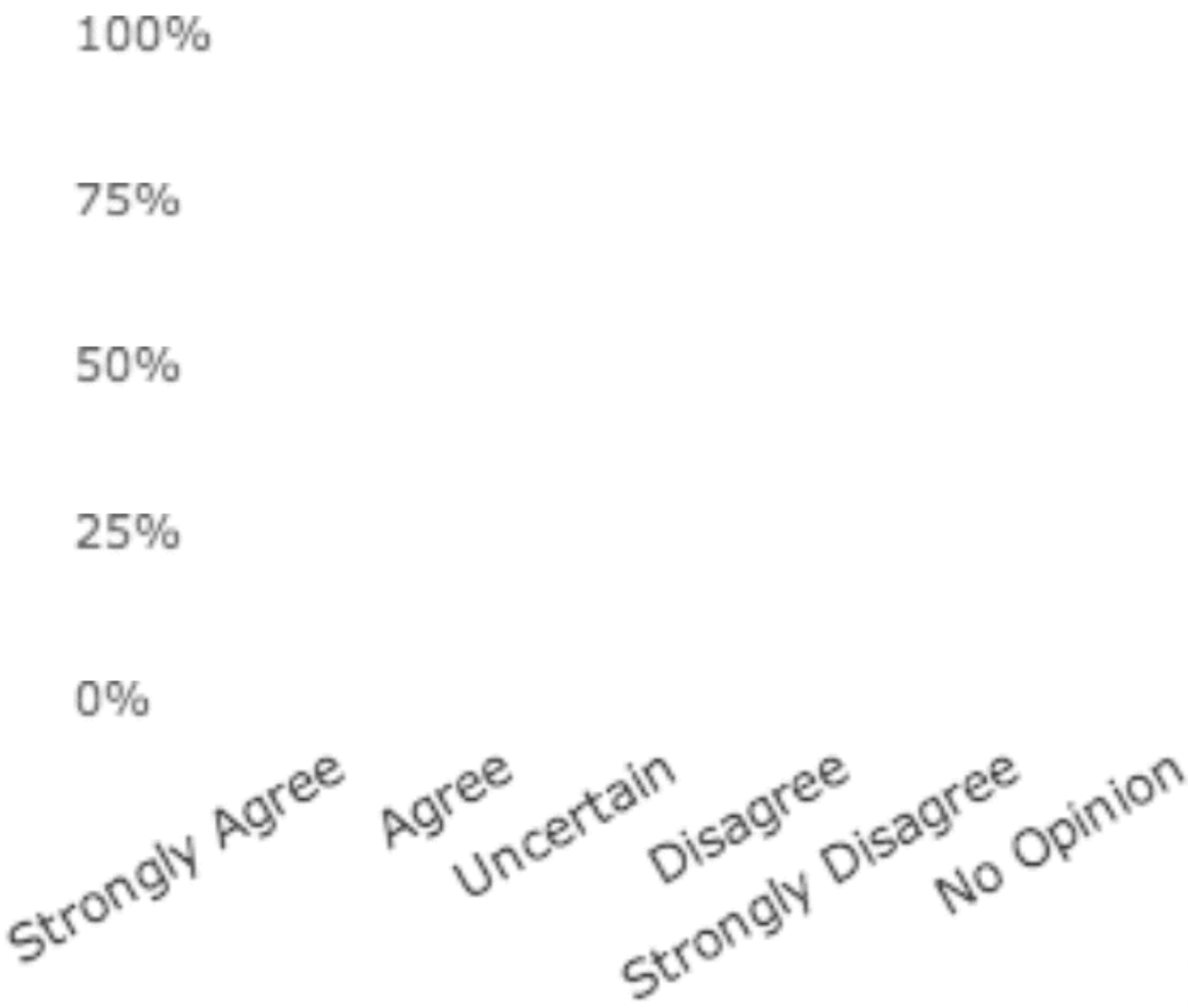
Price Floors and Employer Preferences: Evidence from a Minimum Wage Experiment

John Joseph Horton
NYU Stern School of Business

http://www.john-joseph-horton.com/papers/minimum_wage.pdf

Minimum Wage

Question A: Raising the federal minimum wage to $9 per hour would make it noticeably harder for low-skilled workers to find employment.

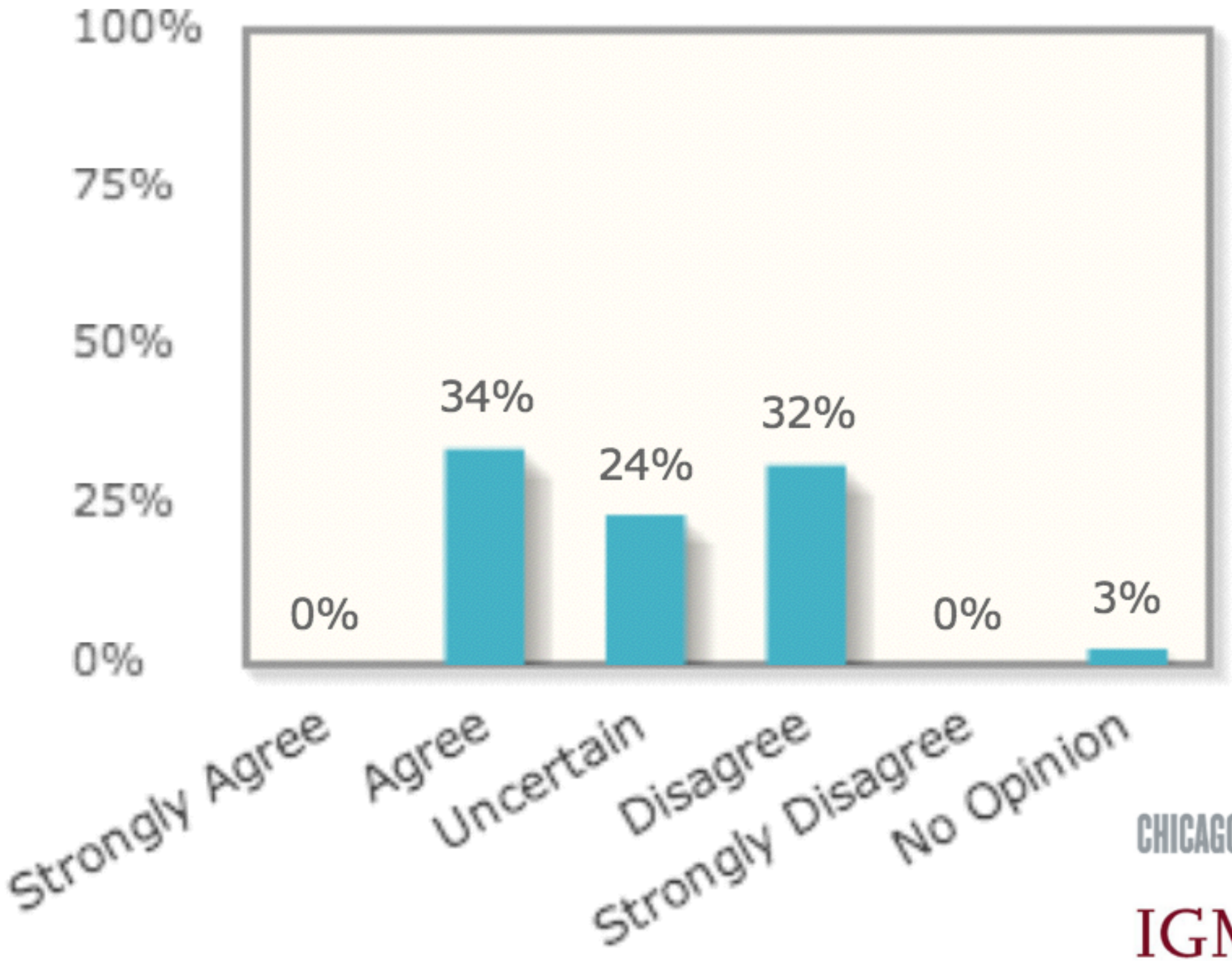


CHICAGO BOOTH

IGM Forum

Minimum Wage

Question A: Raising the federal minimum wage to $9 per hour would make it noticeably harder for low-skilled workers to find employment.



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IGM Forum

State of the "conventional" minimum wage literature

- Much of the evidence is quasi-experimental, from US states changing their minimums:

- Card & Krueger, Card & Katz, Neumark & Wascher, Dube et al., Meer & West, Clemens & Wither and others

Challenges in conventional minimum wage research

- Lack of exogenous variation in minimum wages
- Lack of statistical power
- Measurement issues
  - Many hypothesized “margins of adjustment” are difficult to observe

This paper

- Uses data from a minimum wage experiment—and eventual platform-wide imposition—conducted in an **online labor market**

- Excellent measurement made at a range of minimum wages exogenously imposed for about 160K job openings

Agenda

- Empirical context
- Experimental design
- Experimental results
- Market-wide minimum wage announcement & imposition difference-in-differences results
- Conclusions

Experimental context

Empirical context

- A large online labor market for work that can be done remotely:
  - Computer programming, graphic design, data entry, etc.
- Focus is primarily on hourly contracts, with hours measured precisely by platform-provided software
- An excellent “testing ground" for phenomena that are generally hard to observe in conventional markets cf.
  - E.g., Pallais, Stanton & Thomas, Kerr & Stanton, Horton & Johari, Gilchrist, Luca & Malhotra

1. Employers post openings

Orthopaedic Surgery Research - Statistical Analysis

Indicates an hourly job

Statistical Analysis Posted 13 hours ago

Hourly Job
As needed - Less than 10 hrs/week
Less than 1 month

$$ Intermediate
I am looking for a mix of experience and value

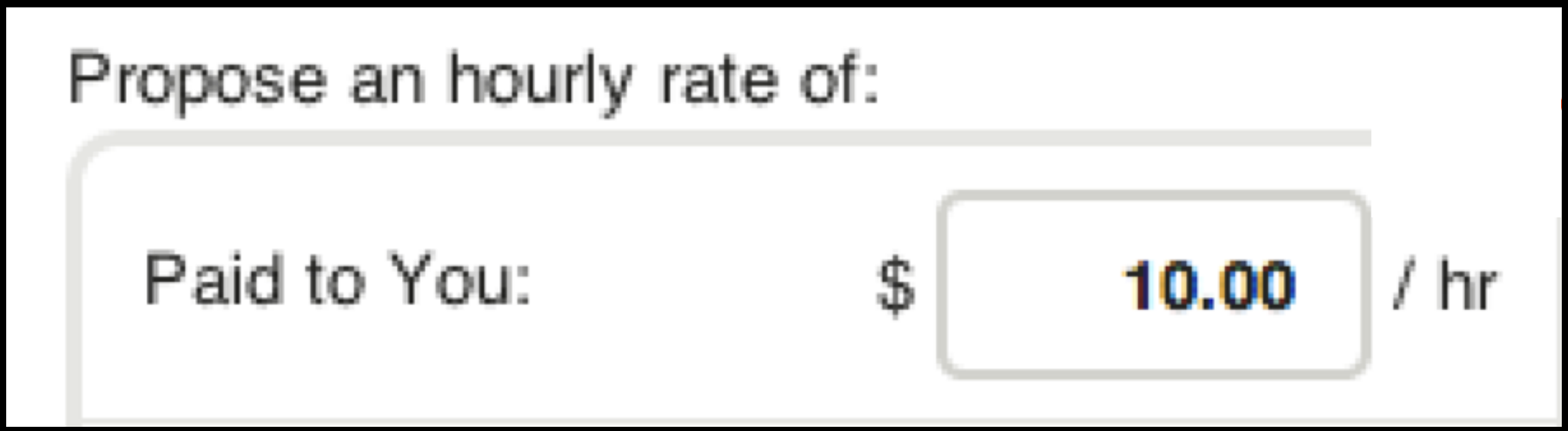
Job Description

I have a data set that needs statistical analysis. It consists of multiple reviewers' (10-20) analyses of patient's x-rays. I need to examine the reviewers' overall agreement on the x-rays and their ability to judge surgical technique from the x-rays.

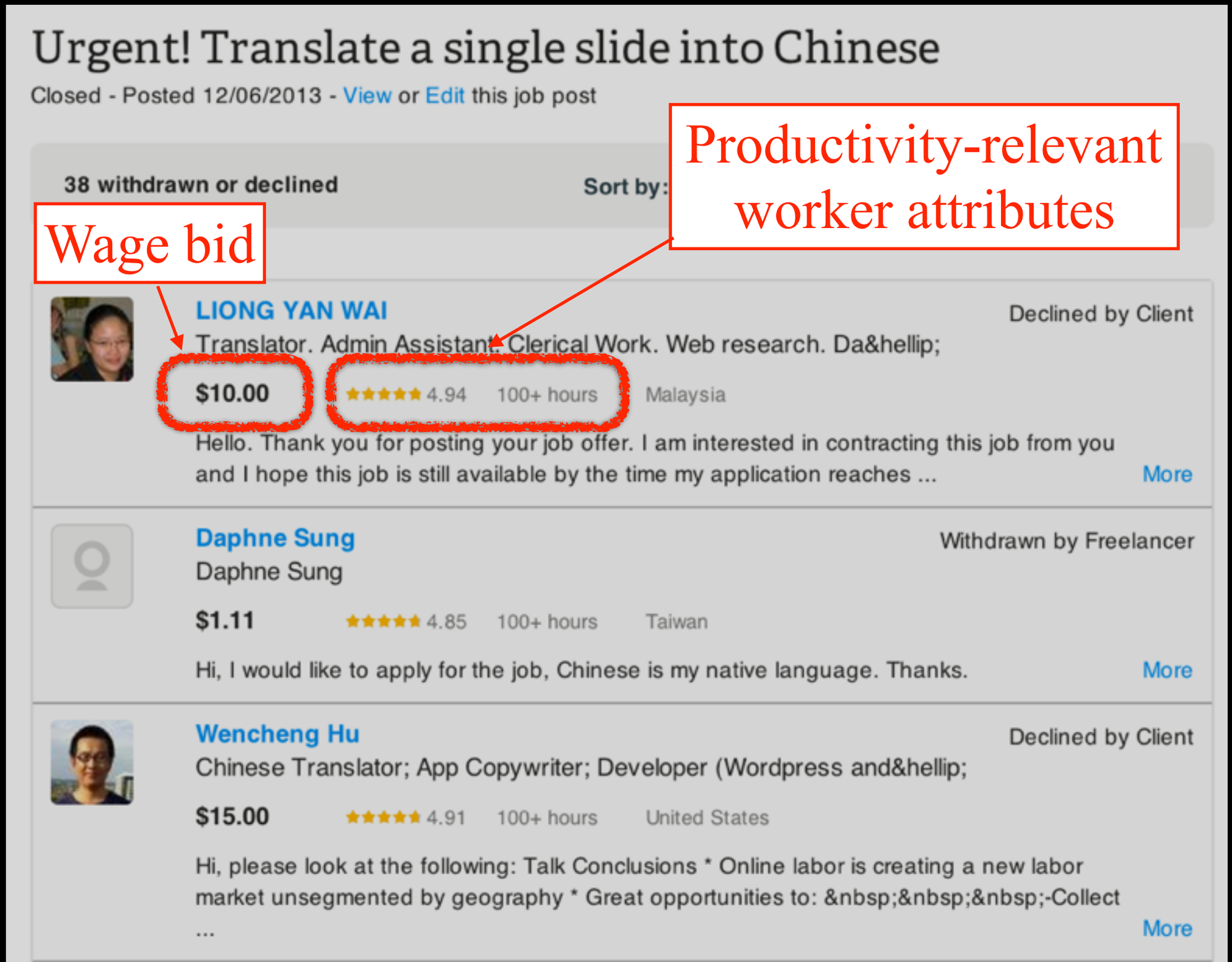
Skills Required

Data Science Scientific Writing Statistics

2. Workers apply & submit wage bids



3. Employers screen applicants



Experimental design

Platform-initiated minimum wage experiment

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- Design goal: Create counter-factual in which job openings get same applicants they would have, but with below-minimum workers bidding up

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  - Control (75% of sample): No minimum
  - Treatment Cells (25%): $2/hour, $3/hour & $4/hour

Platform-initiated minimum wage experiment

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- Randomization was at the level of the employer
  - Control (75% of sample): No minimum
  - Treatment Cells (25%): $2/hour, $3/hour & $4/hour
- The minimum was enforced by not allowing wage bids below the employer's assigned minimum

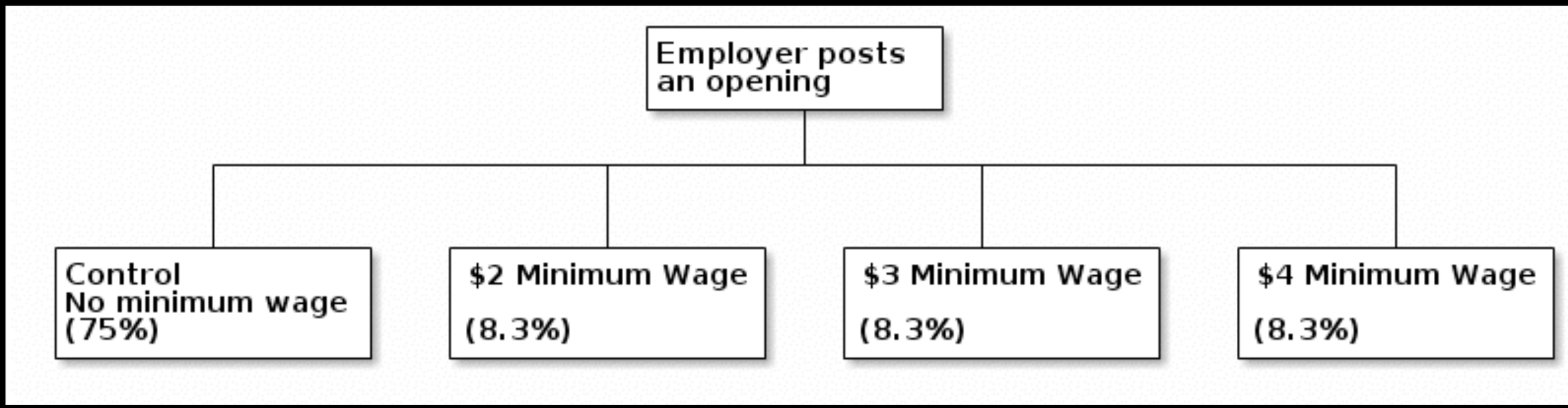
Example Employer View

Control

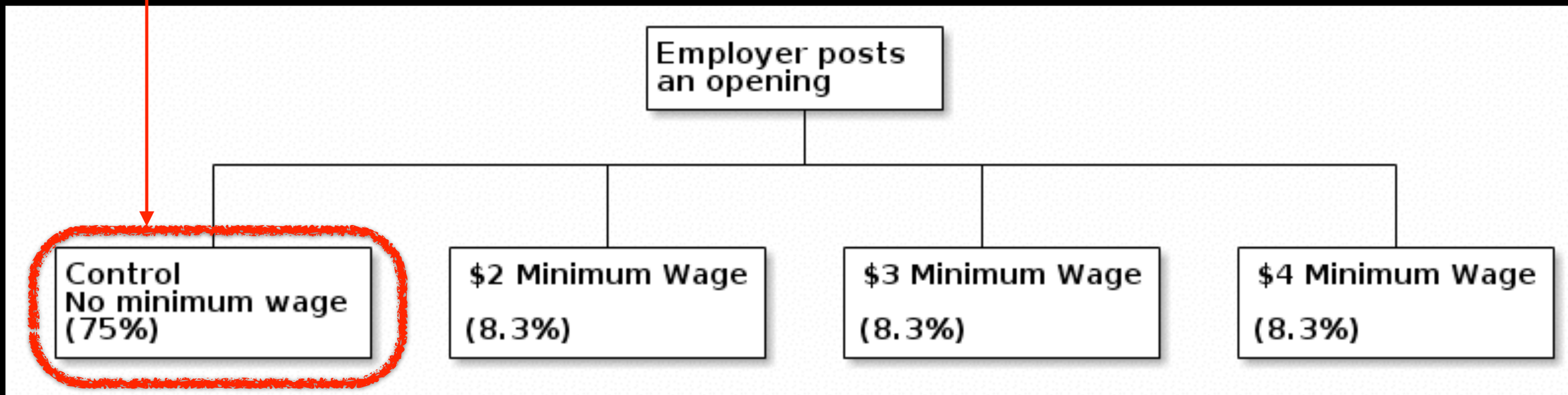


Treatment (MW2)




Employer posts an opening
Control
No minimum wage
(75%)
$2 Minimum Wage
(8.3%)
$3 Minimum Wage
(8.3%)
$4 Minimum Wage
(8.3%)

75% of the sample in the control to avoid SUTA problems



Threats to internal validity

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   No evidence of displacement to other platforms. Prior survey evidence suggests weak online/offline substitutability

Threats to internal validity

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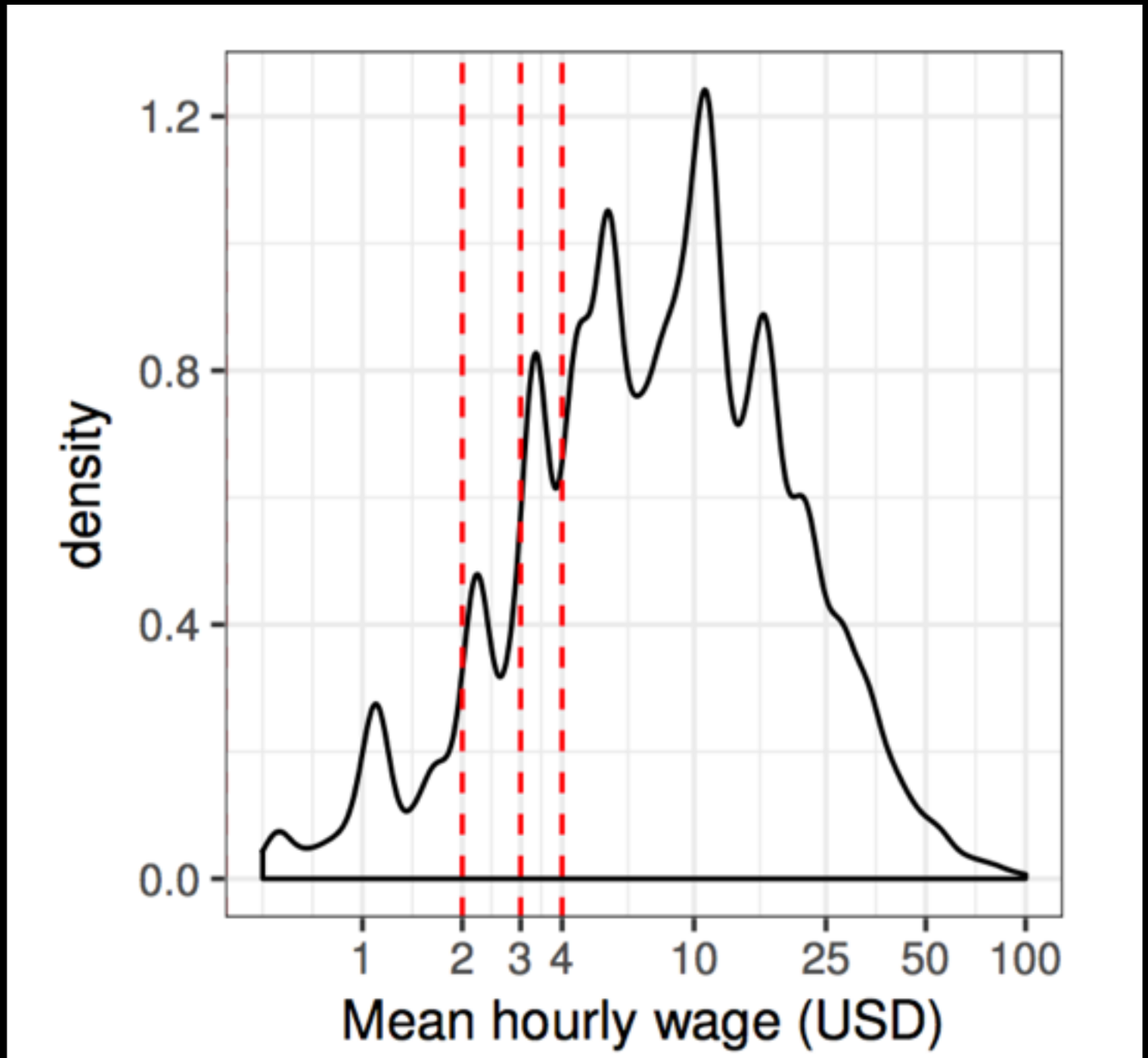
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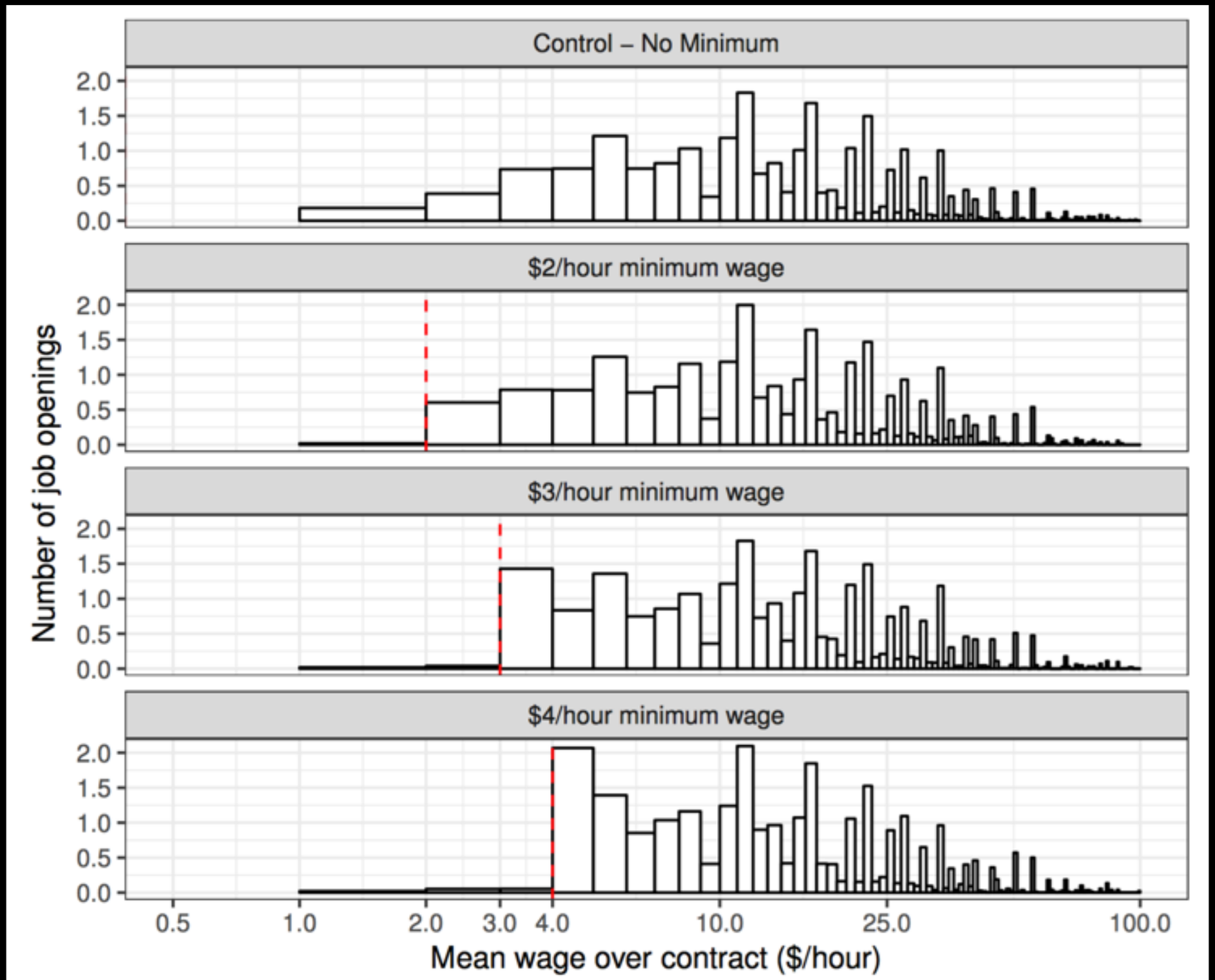
4. Market-moving violations of the SUTVA condition; intentionally small active treatment cells & relatively short duration

Does a $2/hour MW "bite" in this market?

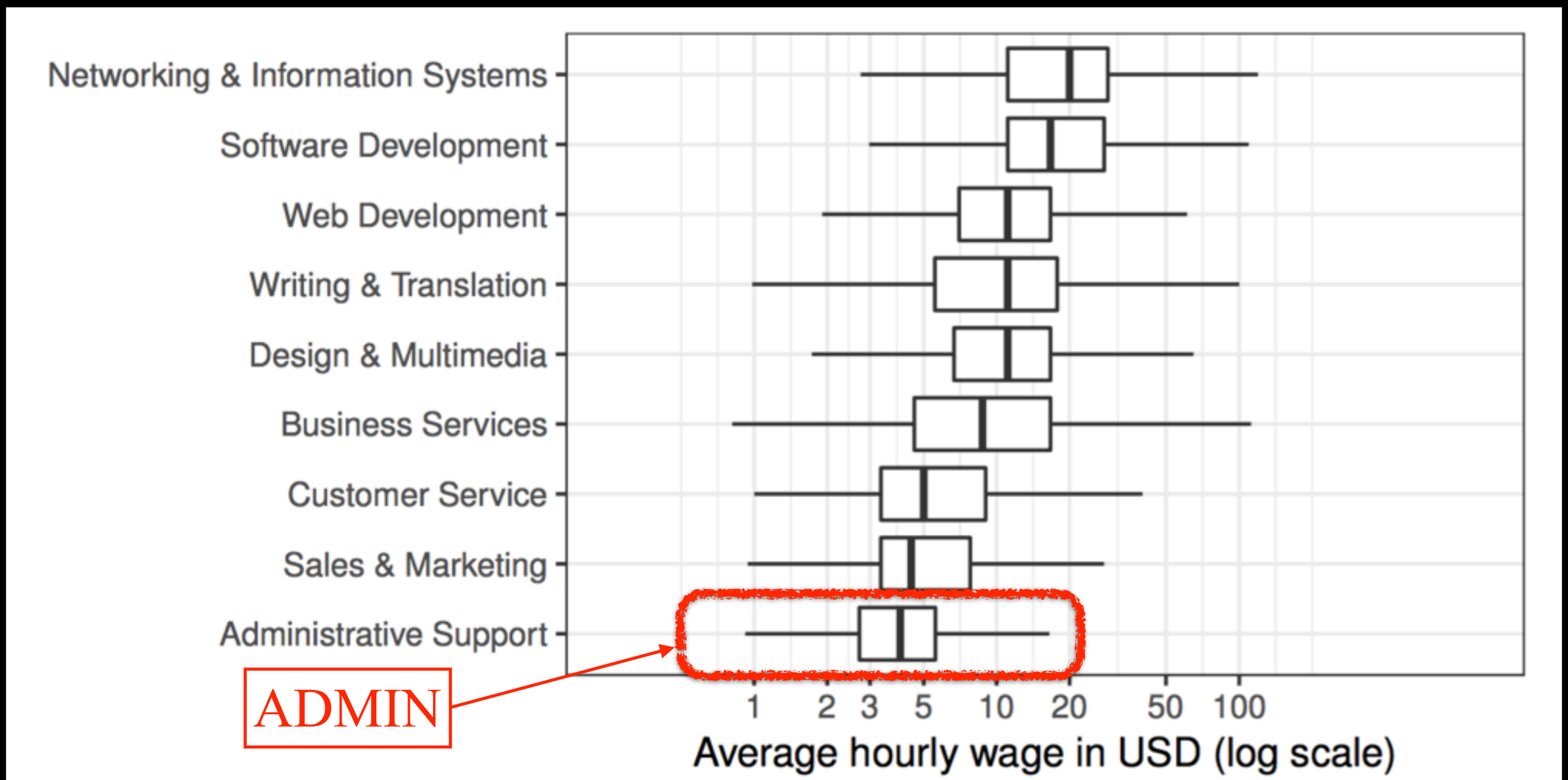


(a) Control cell of ALL

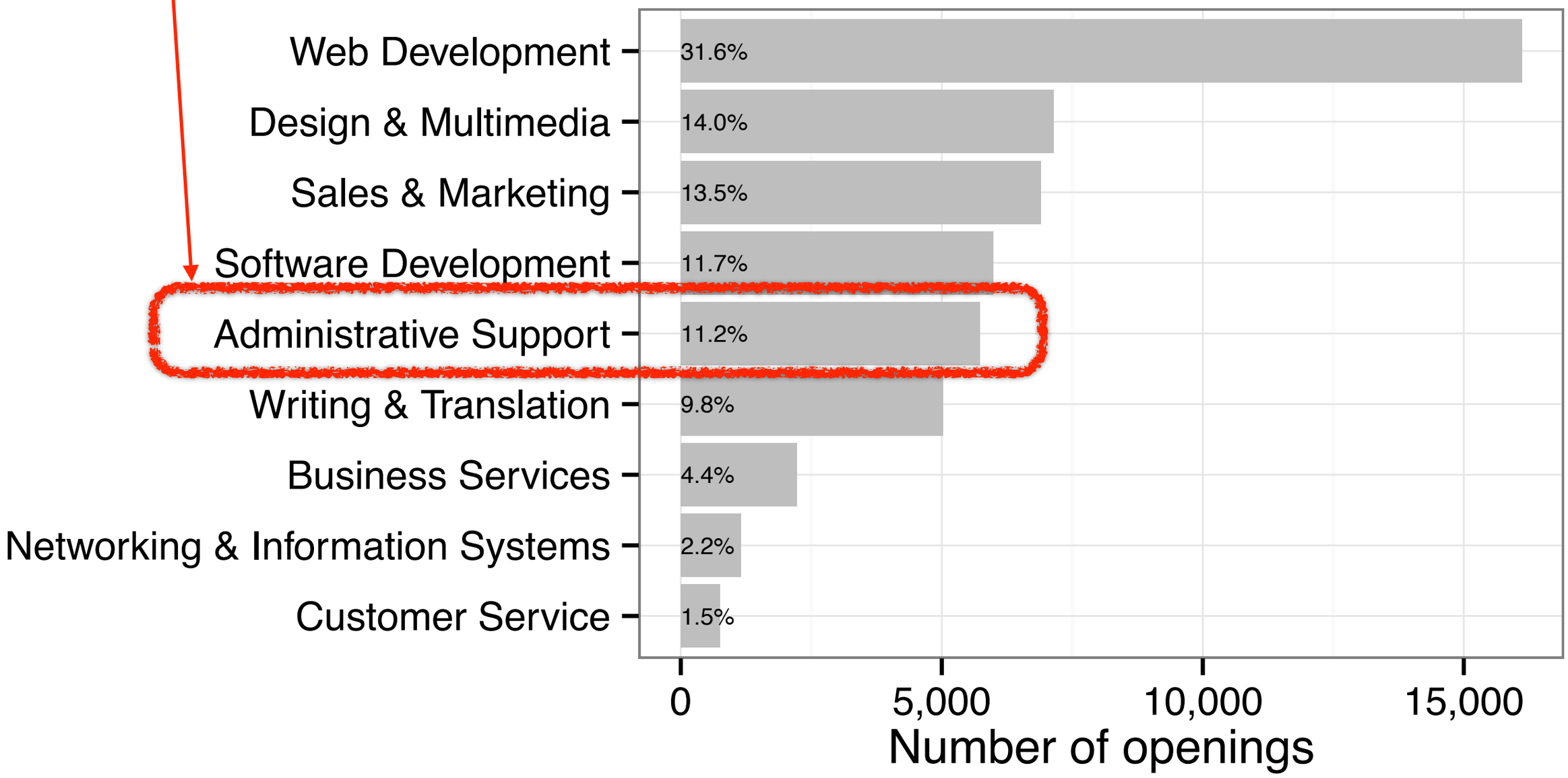
Compliance?


Control – No Minimum
$2/hour minimum wage
$3/hour minimum wage
$4/hour minimum wage
Number of job openings
2.0
1.5
1.0
0.5
0.0
0.5
1.0
2.0
3.0
4.0
10.0
25.0
100.0
Mean wage over contract ($/hour)

Where to look for effects?



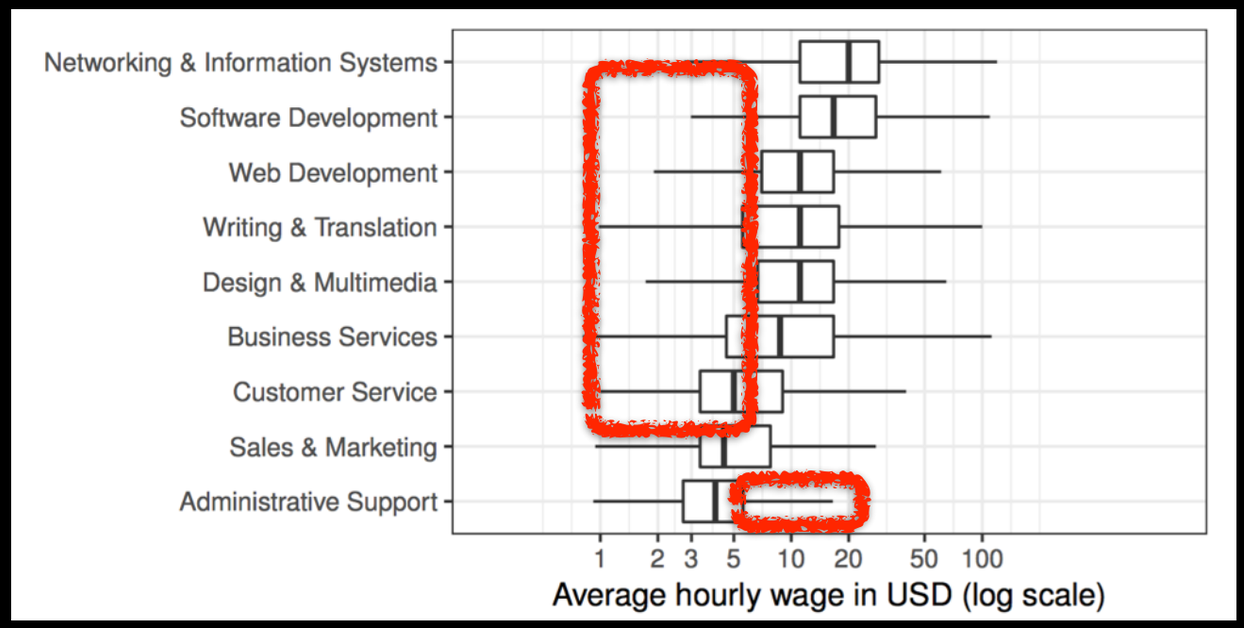
Only about 11% of openings



Using historical platform data to predict low-wage openings

- Not all low-paying openings are in ADMIN and not all ADMIN openings are low-paying

- **Solution**: I fit a predictive model of wages using historical data, then selected openings with low-predicted wages as the **LPW sample.**

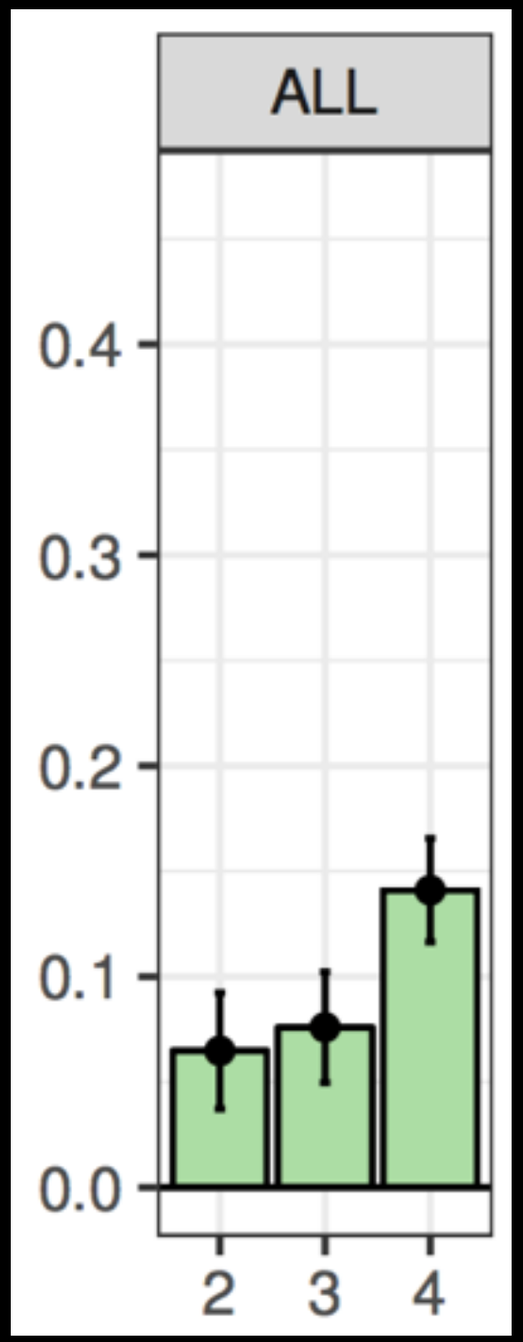


Experimental results

Outcomes

- Price
  - Log wage of hired worker (conditional upon hired)
- Quantities
  - Anyone hired?
  - Hours-worked (conditional upon a hire)
- Attributes of hired workers
  - Past wages, profile rates, past earnings
  - Country of hired workers

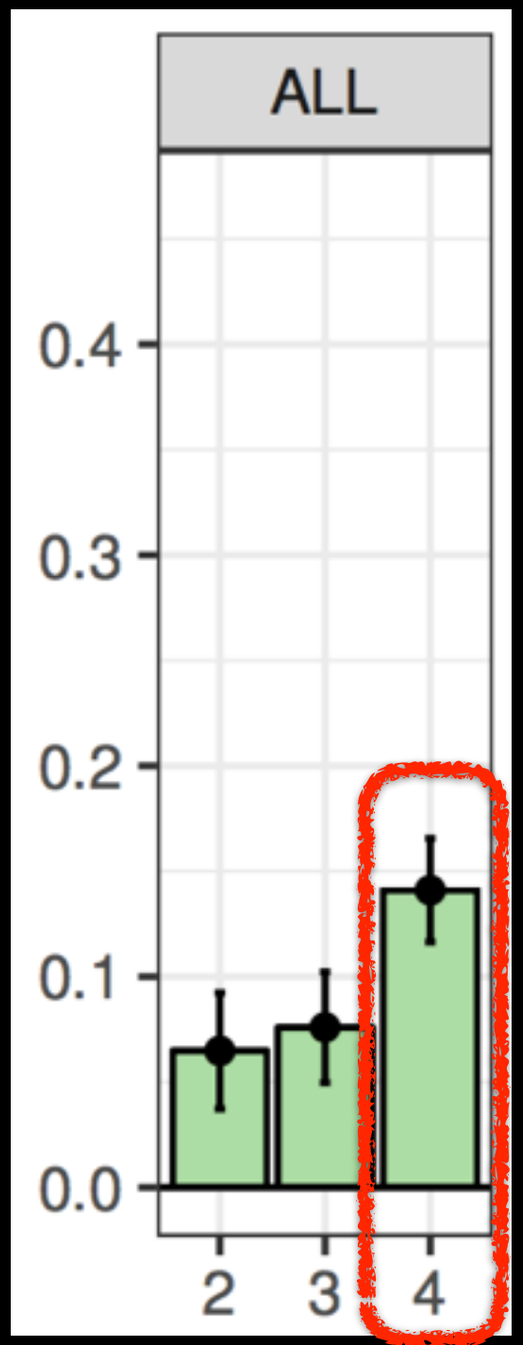
Outcome: Log wage of the hired worker



	ALL
	(1)
Panel A: Group indicators	
MW4	0.141***
	(0.015)
MW3	0.076***
	(0.015)
MW2	0.065***
	(0.015)
Constant	2.107***
	(0.004)
Observations	53,032
R^2	0.002

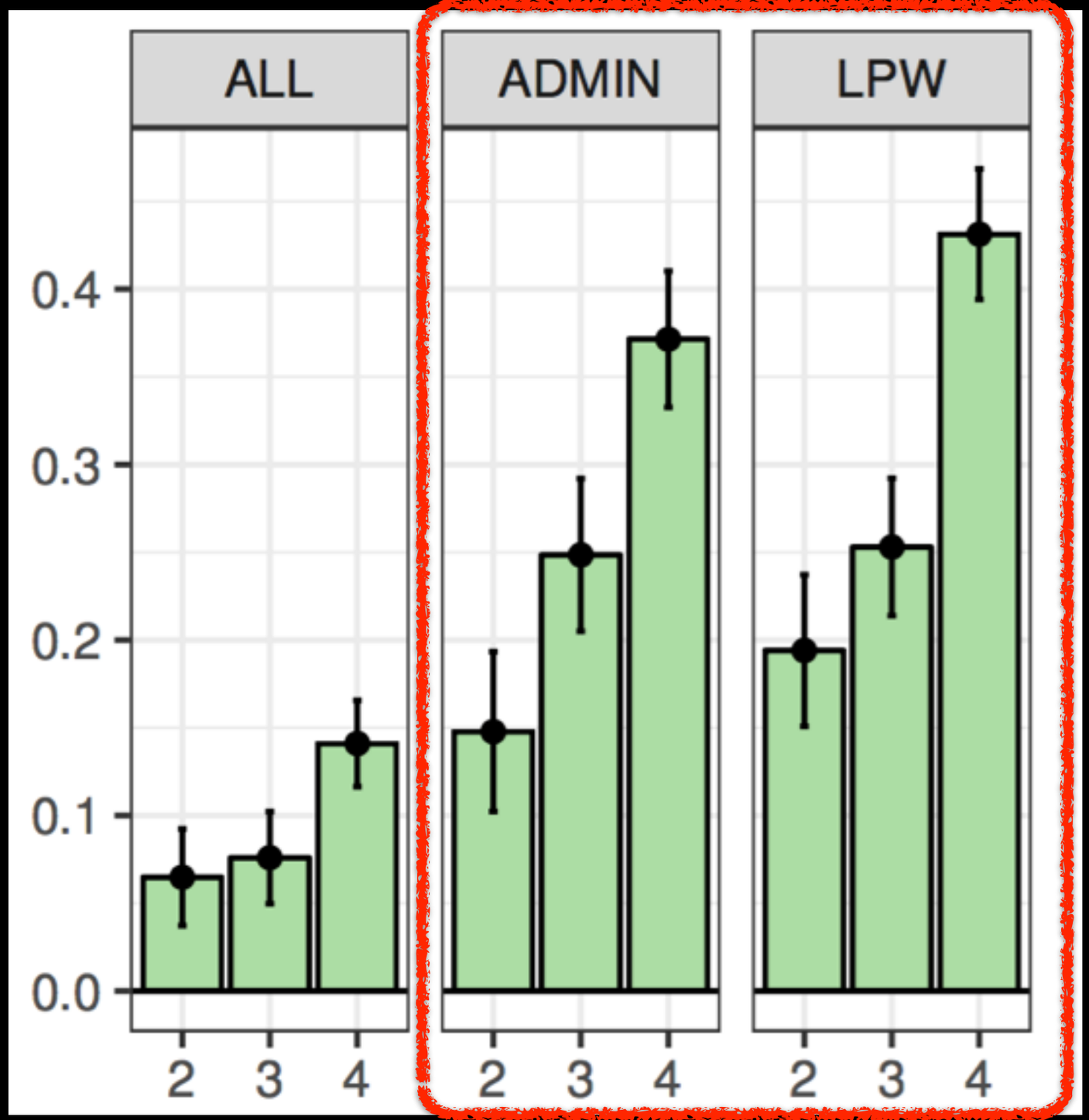
Outcome: Log wage of the hired worker

In MW4, hired worker wages were about 14% higher



	ALL
	(1)
Panel A: Group indicators	
MW4	0.141***
	(0.015)
MW3	0.076***
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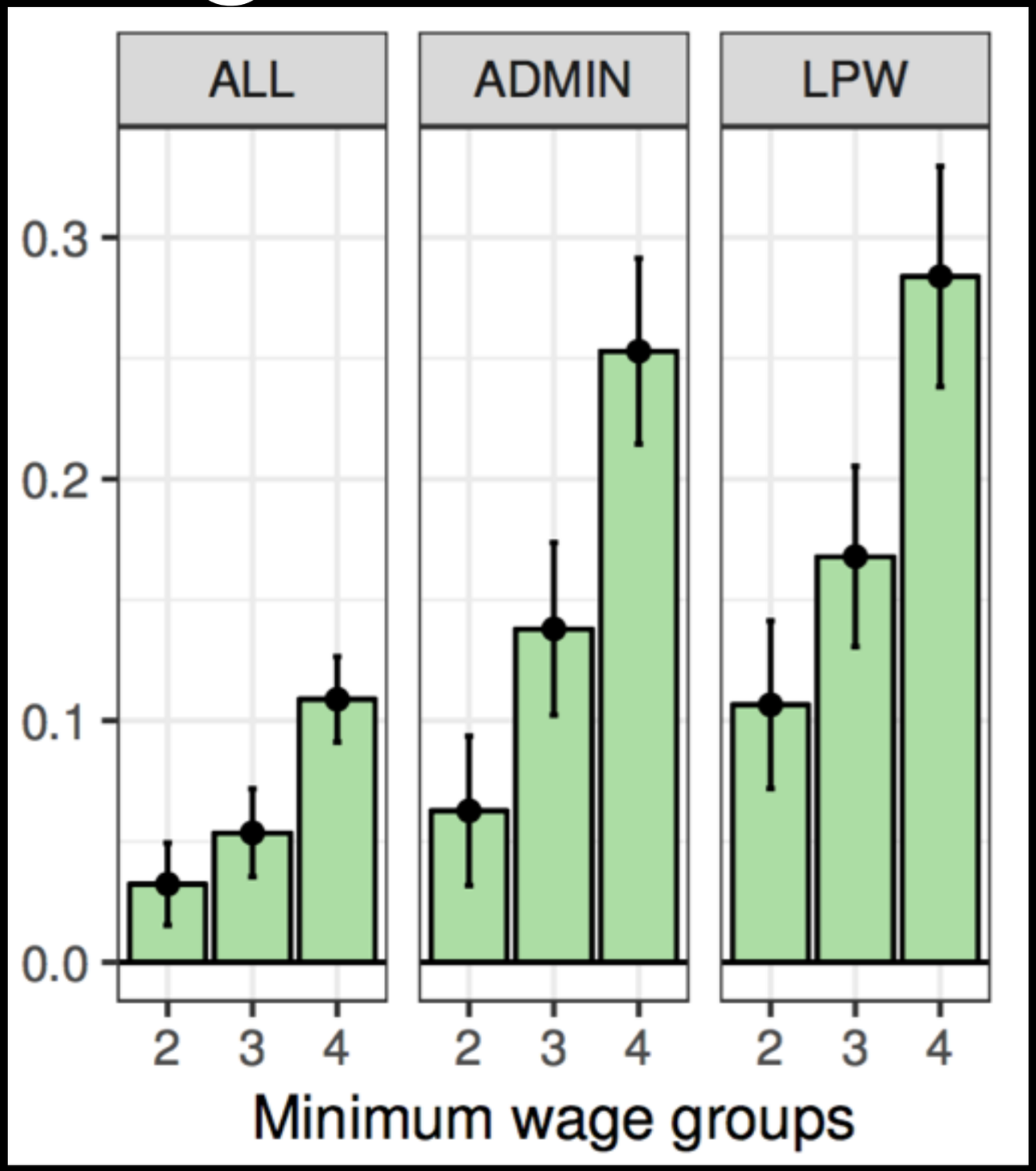
Even stronger wage increases in the sub-populations—around 40% in MW4.

LPW: "Low predicted wage" - predictions from a ML model fit w/ pre-experiment data

Why did wages increase?

- Markup effects—same workers hired, but at a higher wage
- Selection effects—jobs that would have paid low wages went unfilled
- Substitution effects—different (more productive) workers hired

Outcome: "Markup" in the wage bid of the hired worker



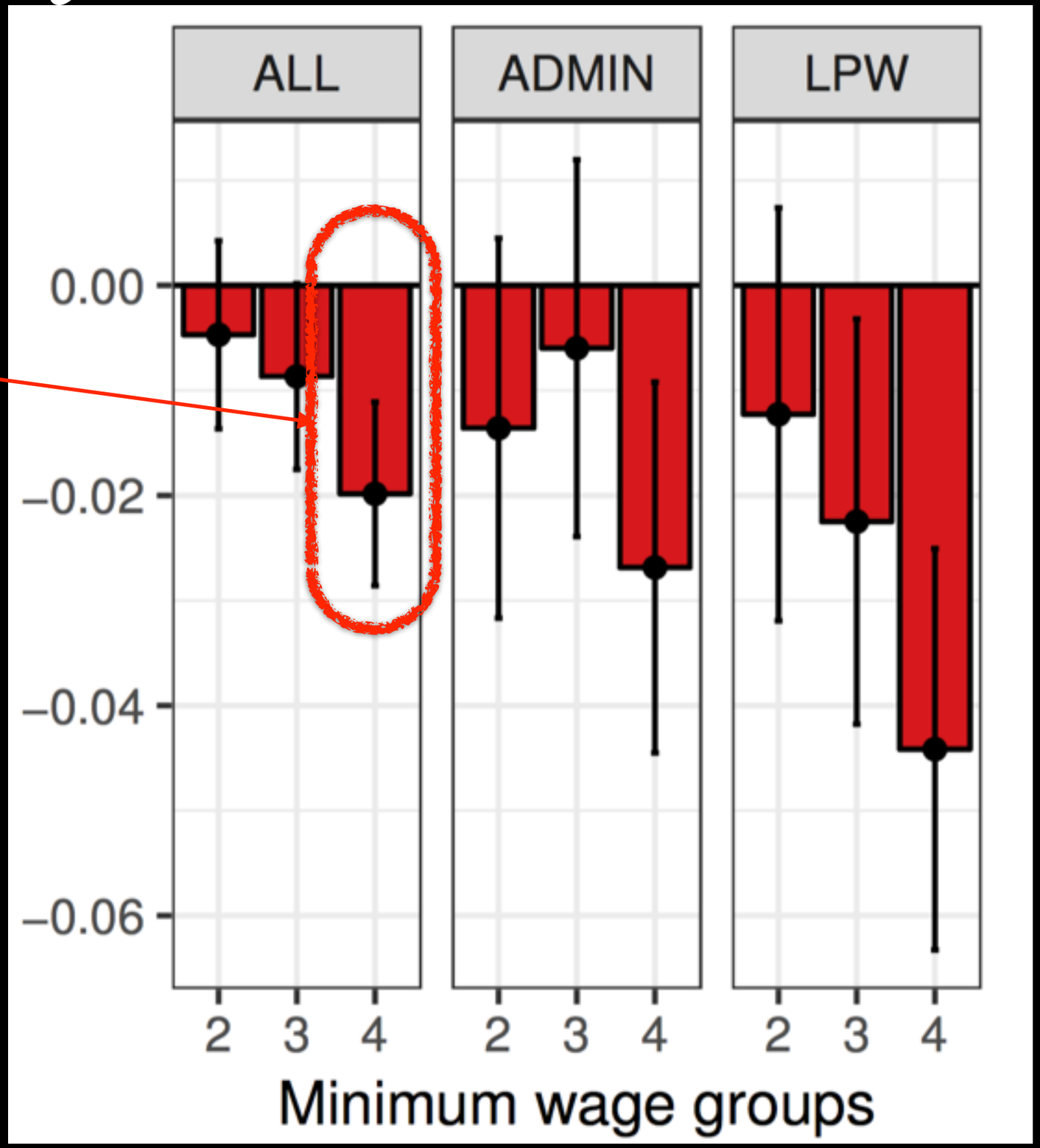
Markup:
Hired worker
wage relative to
their profile rate

Workers
are getting
a higher wage
relative to previous
"market" wage

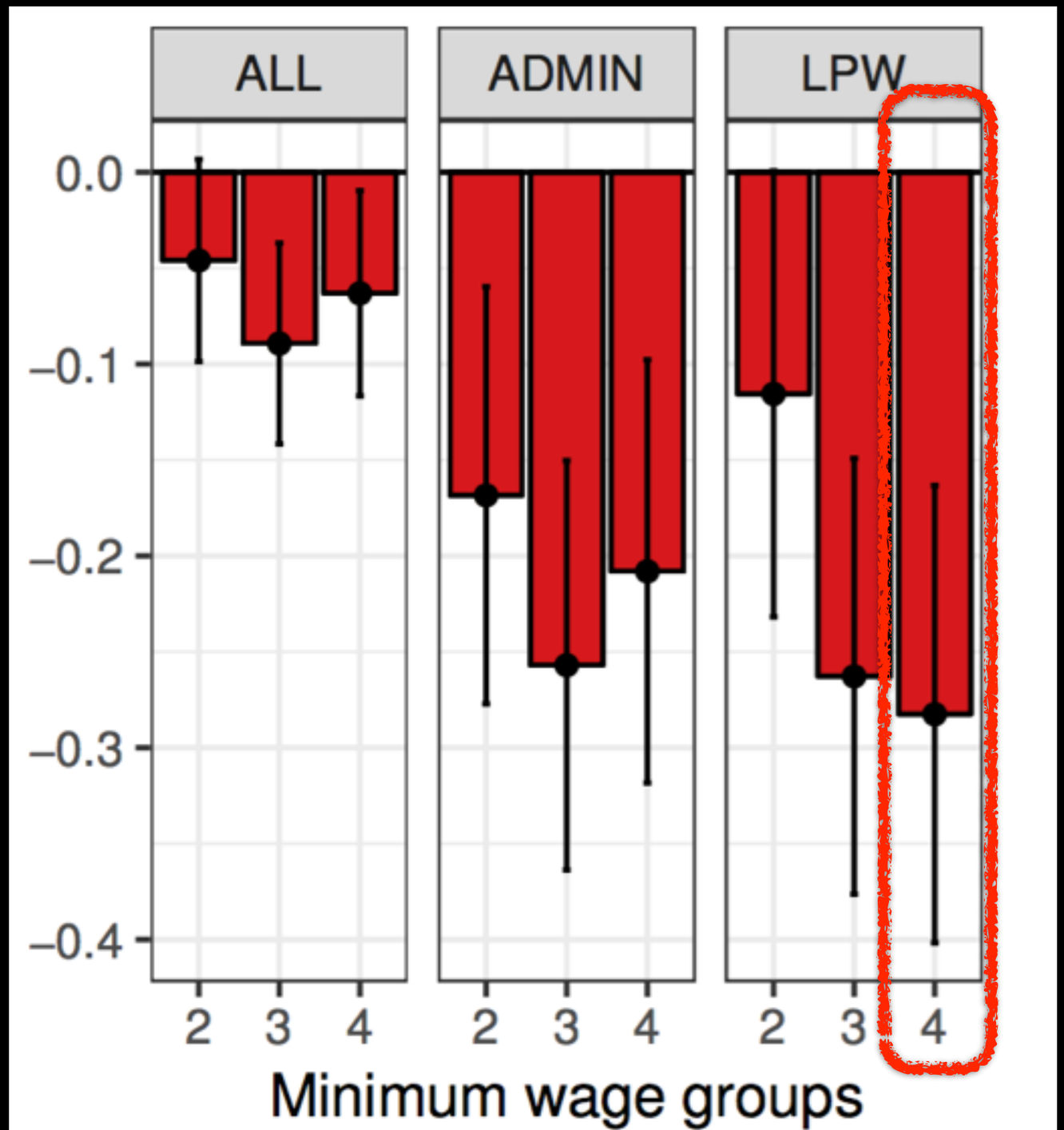
Outcome: Any worker hired?

This is only a 2 percentage point reduction, or about 4%

These are small effects. E.g., ADMIN MW3: 1% decrease for a MW near the median



Outcome: Log hours-worked, conditional upon a hire



Large reductions in hours-worked; e.g., nearly -30% in MW4 in LPW

Why the reduction in hours-worked?

- Endogenous project sizes: Firms reduce the scope of projects when labor costs are higher

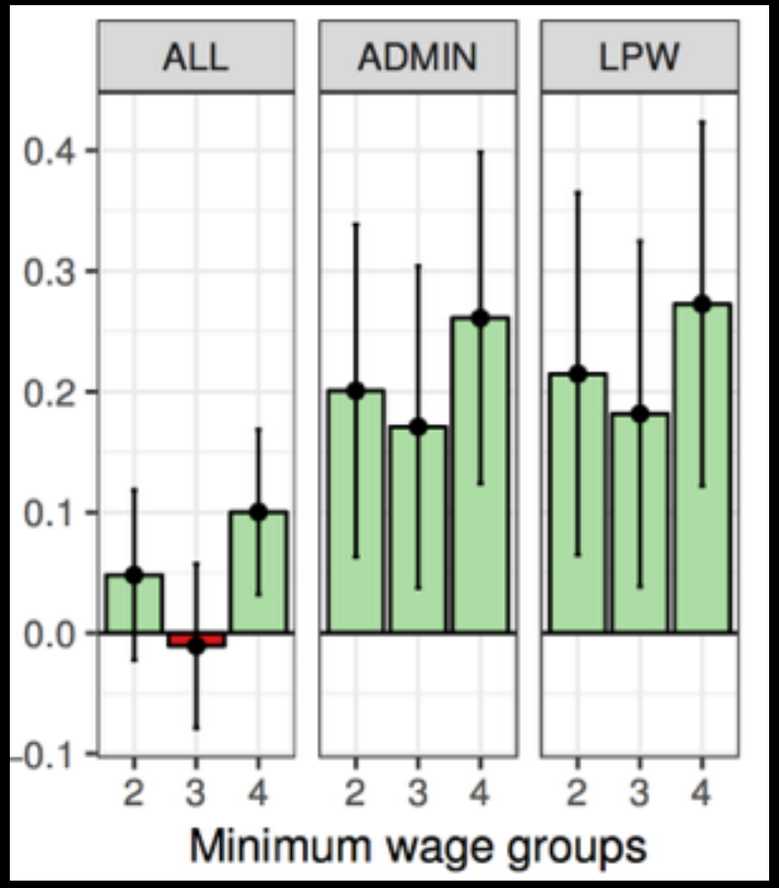
- Efficiency wage: Firms hire same workers, but they are made more efficient and can complete projects more quickly

- Labor-Labor substitution: Firms hire more productive, higher wage workers that can complete projects more quickly

Outcome: the *attributes* of hired worker that are proxies for productivity

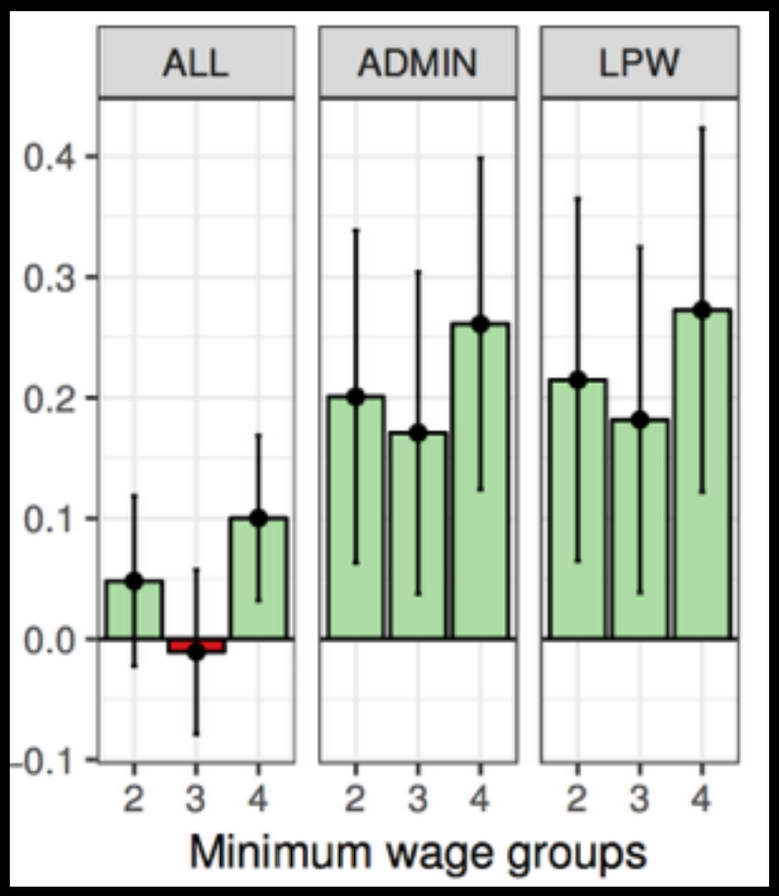
Outcome: the *attributes* of hired worker that are proxies for productivity

Log cumulative
past earnings

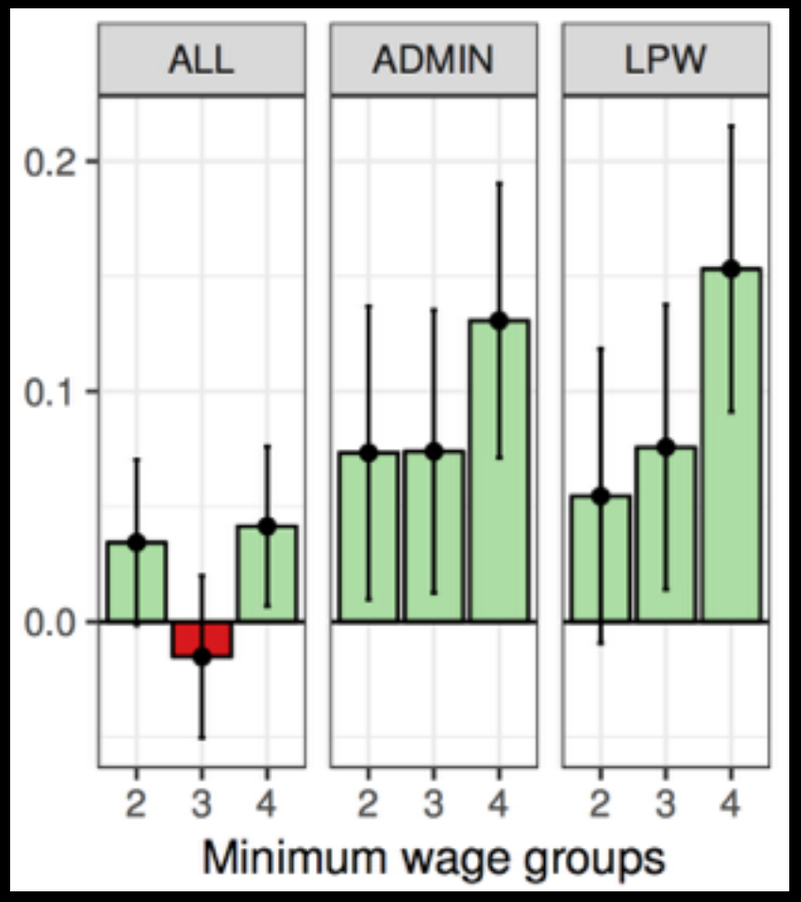


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Log cumulative past earnings

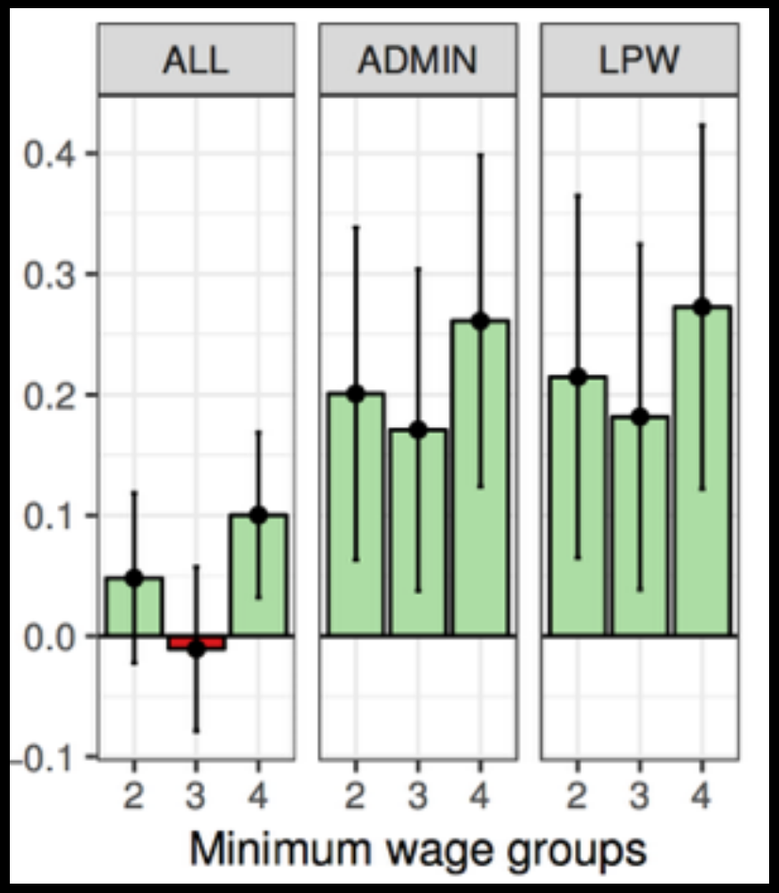


Log average past wage

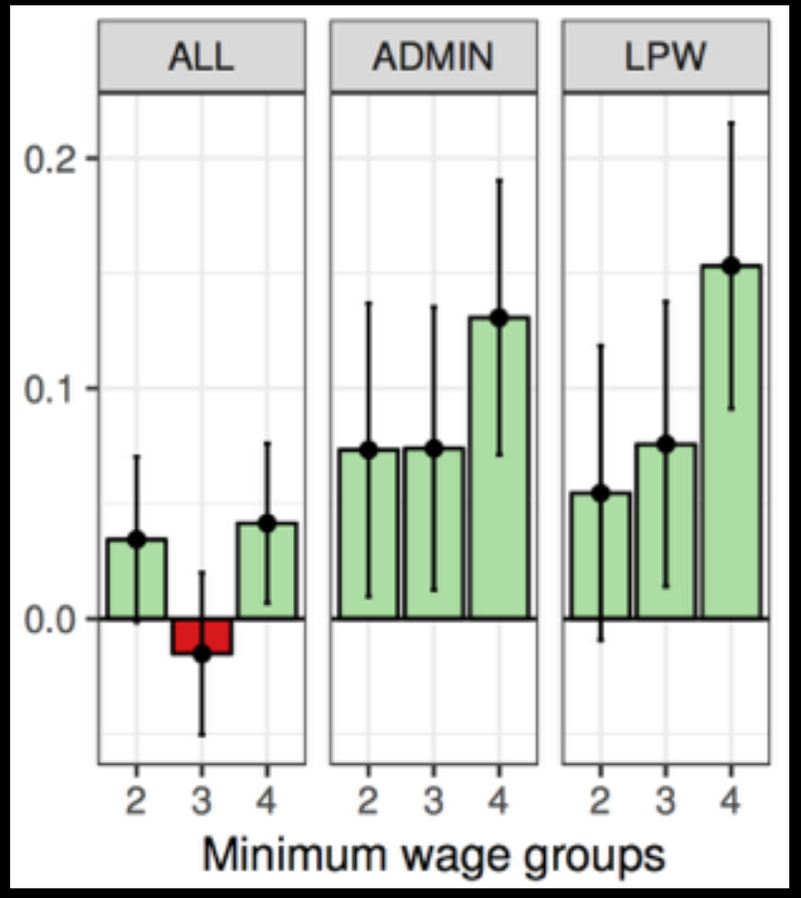


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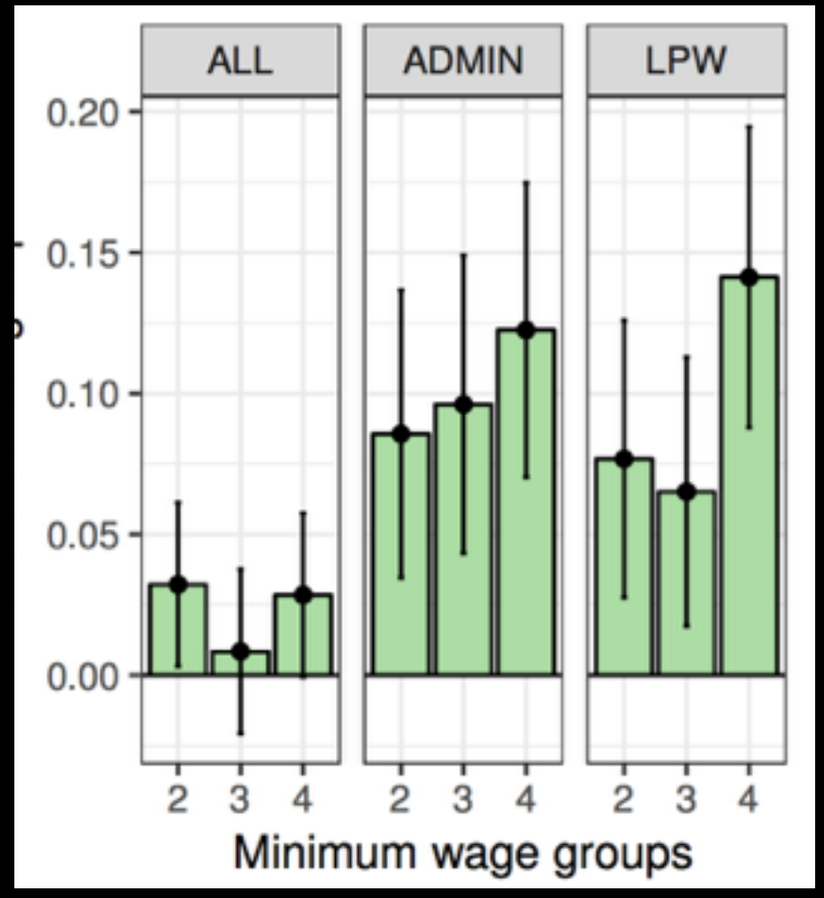
Log cumulative past earnings



Log average past wage



Hired worker profile rate



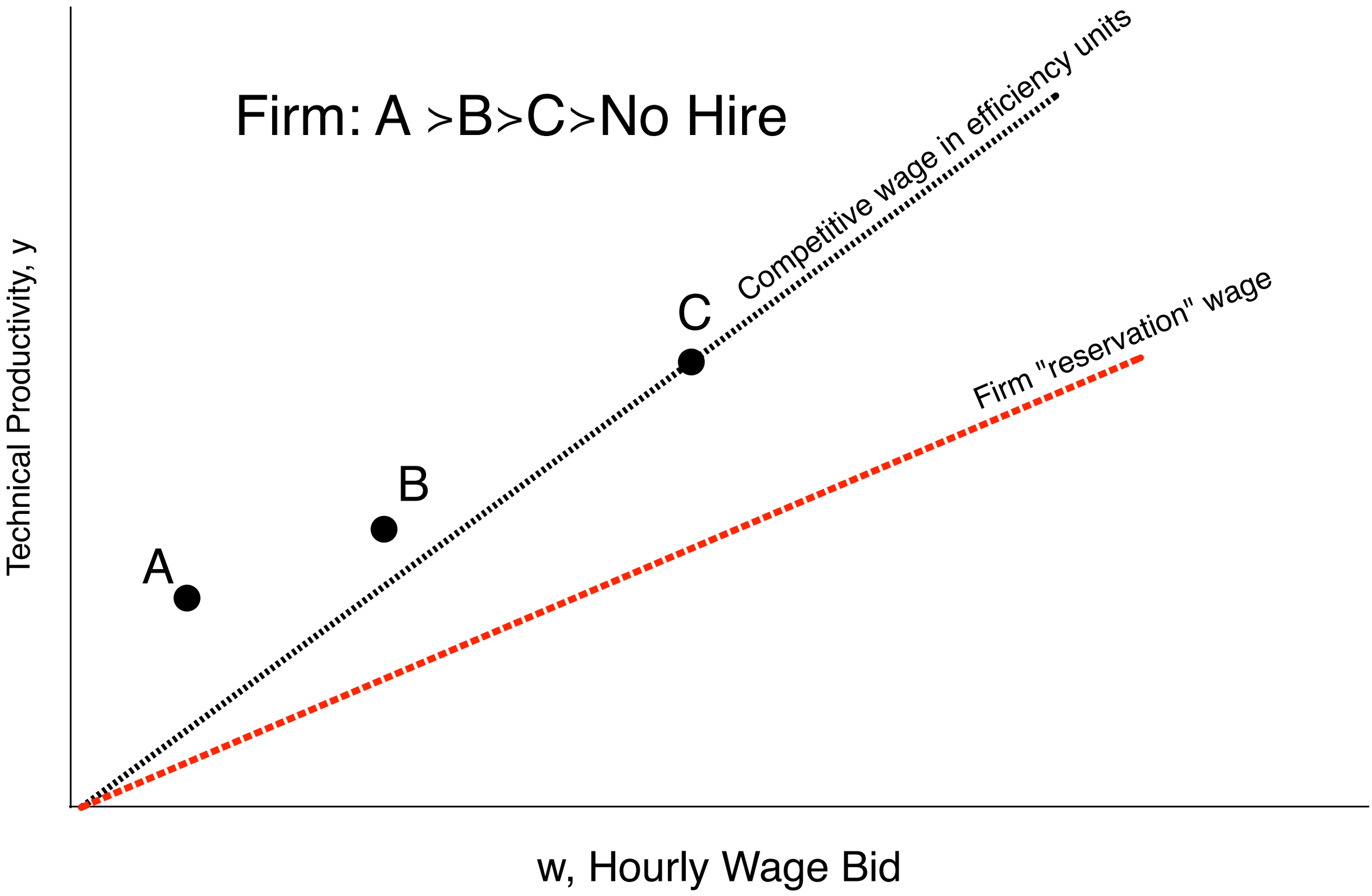
Answers to the questions I posed

- Why did wages increase?
  - Both substitution towards higher wage workers & a markup effects; no evidence of much of selection effect
- Why did hours-worked decrease?
  - In part substitution towards more productive workers; no evidence on endogenous project size reduction or efficiency wage effects

How does substitution "work" here?

- Employers have projects of size **Y**. Workers vary in their technical productivity, **y; j**obs get done in Y/y hours. Workers submit an hourly wage bid, w.
- From a collection of candidates: $\max_{j \in J} \left\{ \underline{u}_i, pY - w_j \frac{Y}{y_j} \right\}$
- What matters to employers is the ratio of the wage to the technical productivity

Firm: A >B>C>No Hire



Firm: B>A>C>No Hire

Competitive wage in efficiency units

Firm "reservation" wage

C

B

A

A'

Minimum Wage

Technical Productivity, y

w, Hourly Wage Bid

Firm: C≻B≻No Hire≻A

Technical Productivity, y

Competitive wage in efficiency units

Firm "reservation" wage

C

B

B'

A

A'

Minimum Wage

w, Hourly Wage Bid

Labor-labor substitution in conventional research

- Not much evidence of it, through some exceptions (e.g., Giuliano 2013), however it is almost always looked for by looking at employment by demographic group:
  - Teenagers, women, African-Americans, and so on
- What if we try to do the same demography-focused analysis to look for substitution?

Labor-labor substitution by hired worker country

	Hired worker from:			
	US	India	Philippines	Bangladesh
	(1)	(2)	(3)	(4)
MW4	0.032***	−0.003	−0.011	−0.025*
	(0.008)	(0.012)	(0.014)	(0.012)
MW3	0.009	0.007	−0.006	−0.016
	(0.008)	(0.012)	(0.014)	(0.012)
MW2	0.003	0.001	0.009	−0.008
	(0.008)	(0.012)	(0.014)	(0.012)
Constant	0.073***	0.187***	0.303***	0.209***
	(0.002)	(0.004)	(0.004)	(0.004)
Observations	14,131	14,131	14,131	14,131
R^2	0.001	0.00003	0.0001	0.0004

Labor-labor substitution by hired worker country

Labor-labor substitution by demographics only detectable at highest wages

	Hired worker from:			
	US	India	Philippines	Bangladesh
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What about in equilibrium?

- The problem: If all firms tried to hire more productive workers, it would bid up their wages

- Equilibrium results might look very different from the experimental results

Platform-wide announcement and imposition

- After the experiment ended, the platform publicly announced and then imposed a $3/hour minimum wage

- DD: I analyze job openings posted job before and just after, using one calendar year prior as a comparison.

- What's nice here: I can compare the experimental estimates to the "equilibrium" estimates

Anyone hired?

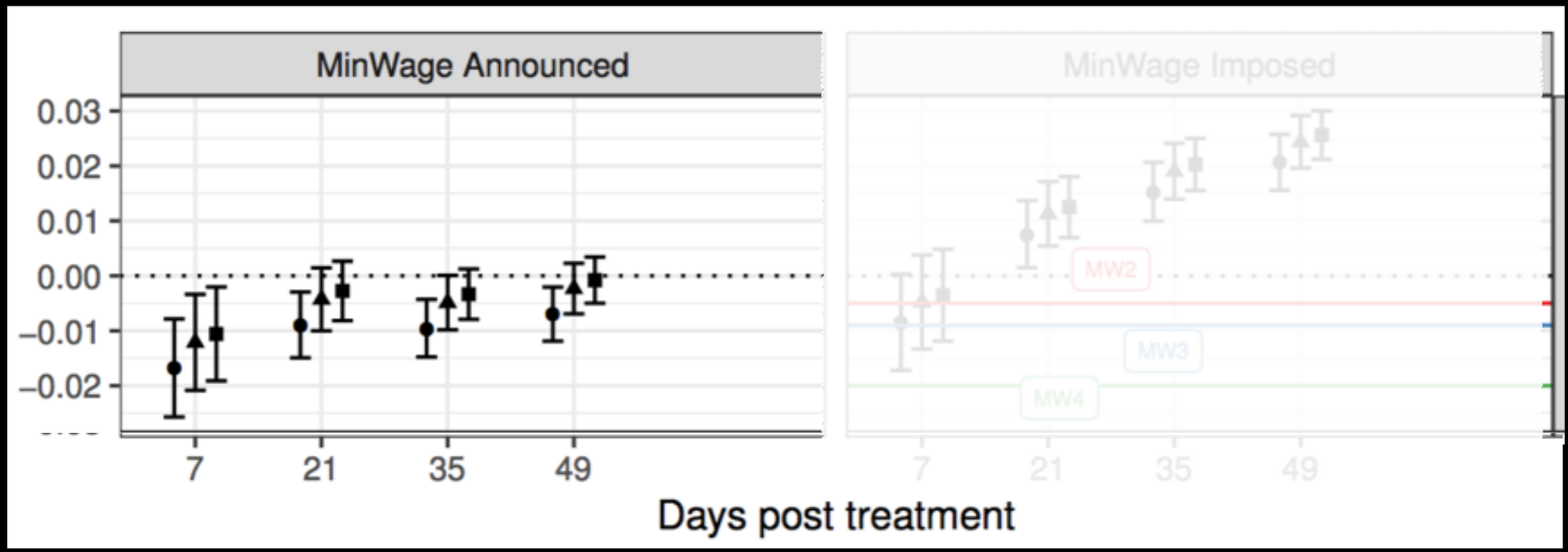
Announcement
(2 weeks before/after)

Imposition
(2 weeks before/after)

	Dependent variable:			
	Anyone hired?			
	Announce (Actual)	Announce (Placebo)	Impose (Actual)	Impose (Placebo)
	(1)	(2)	(3)	(4)
POST	0.0001	0.007	−0.002	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.395***	0.392***	0.382***	0.365***
	(0.003)	(0.003)	(0.003)	(0.003)
R^2	0.00000	0.0001	0.00001	0.00003

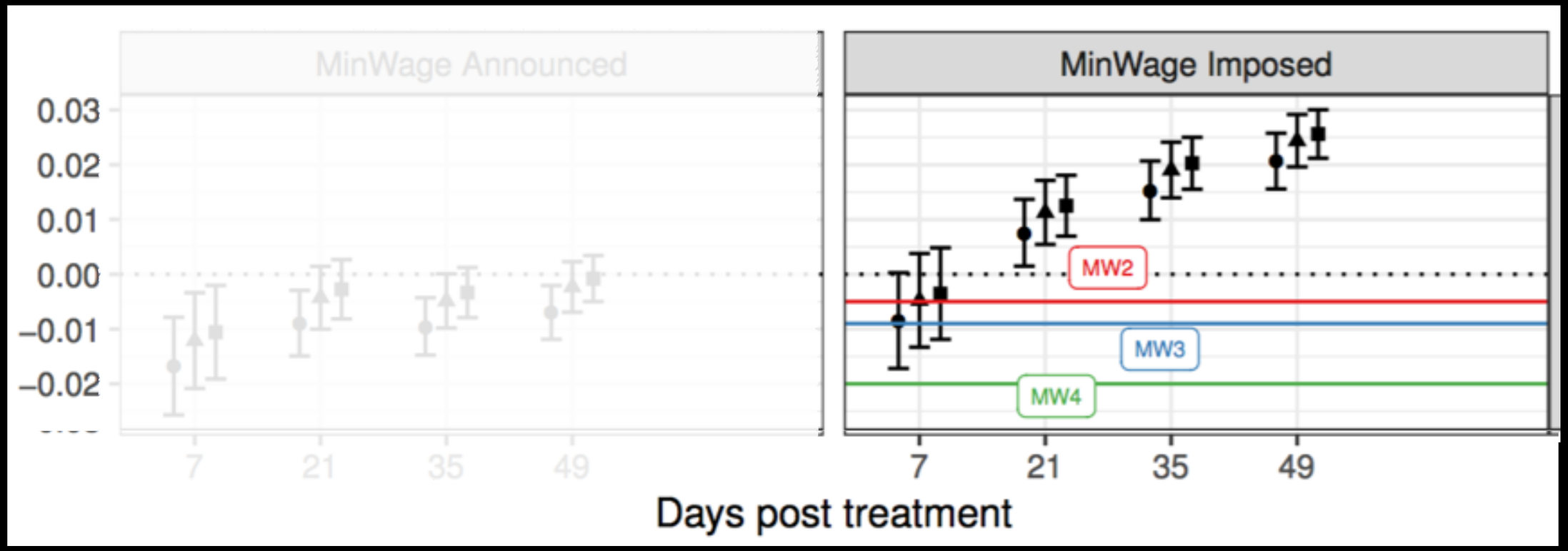
Outcome: Hire made?

$$(Y_{post}^{Actual} - Y_{pre}^{Actual}) - (Y_{post}^{Placebo} - Y_{pre}^{Placebo})$$

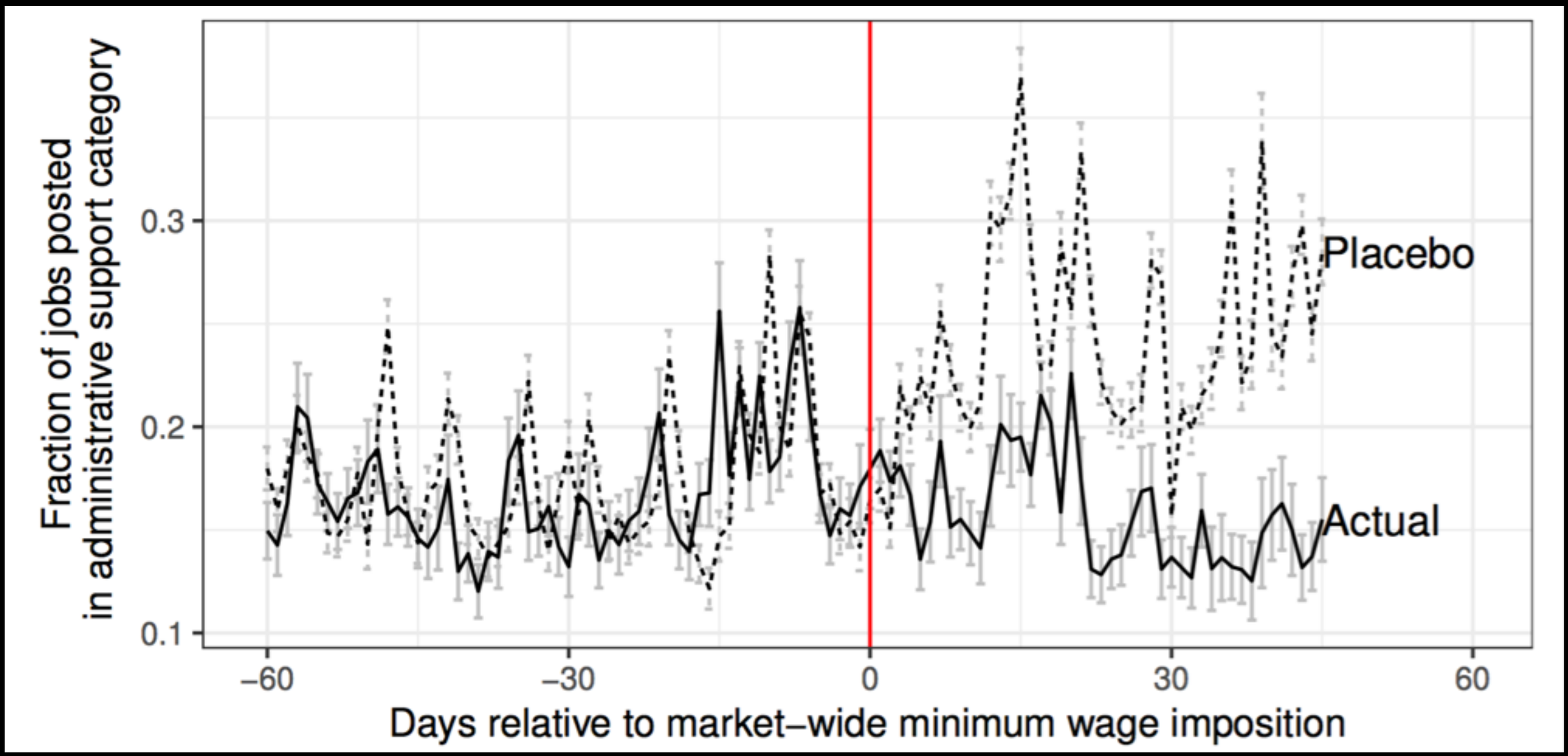


Outcome: Hire made?

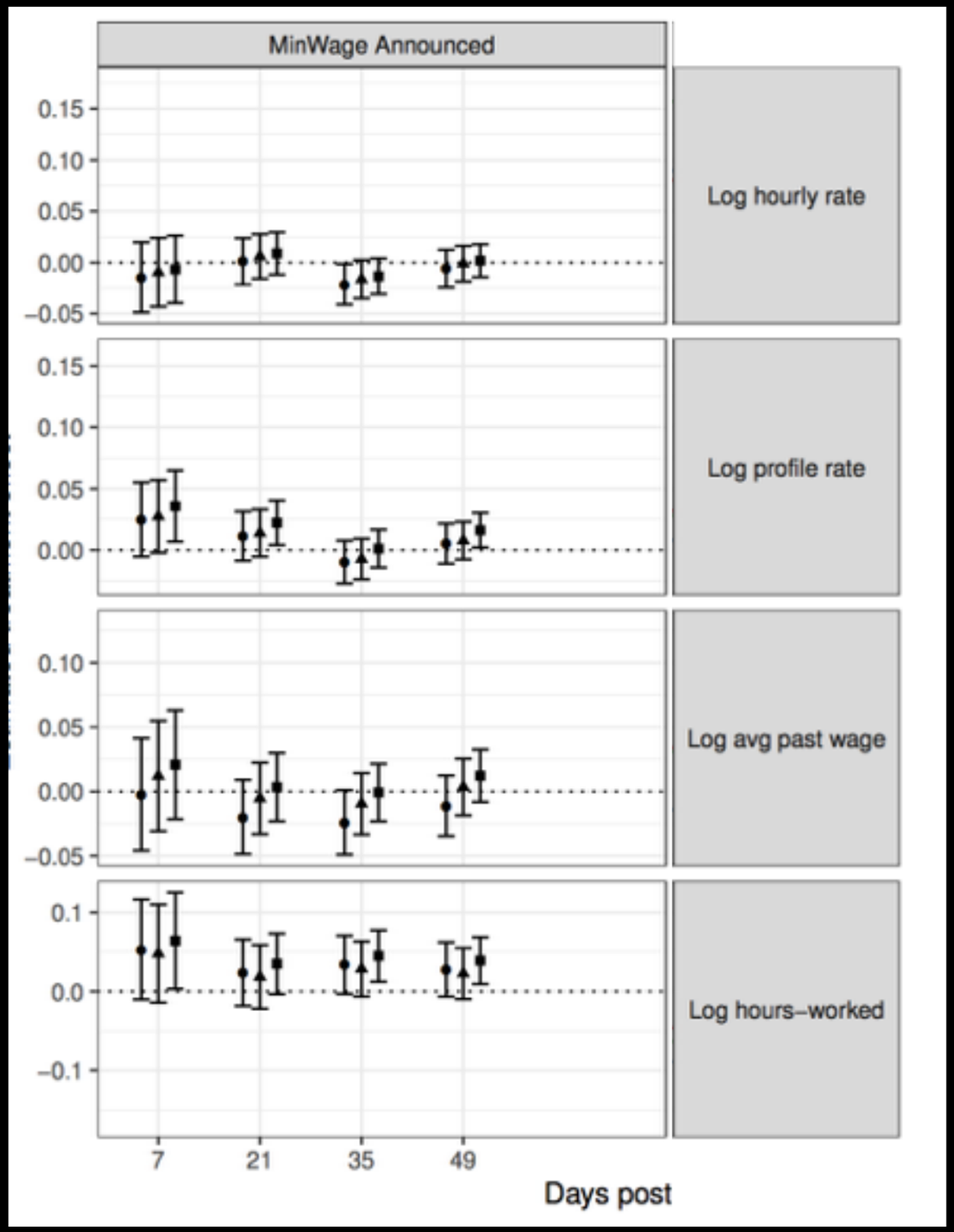
$$(Y_{post}^{Actual} - Y_{pre}^{Actual}) - (Y_{post}^{Placebo} - Y_{pre}^{Placebo})$$



Daily fraction of job openings in administrative category



Effects of MinWage announcement on filled opening outcomes

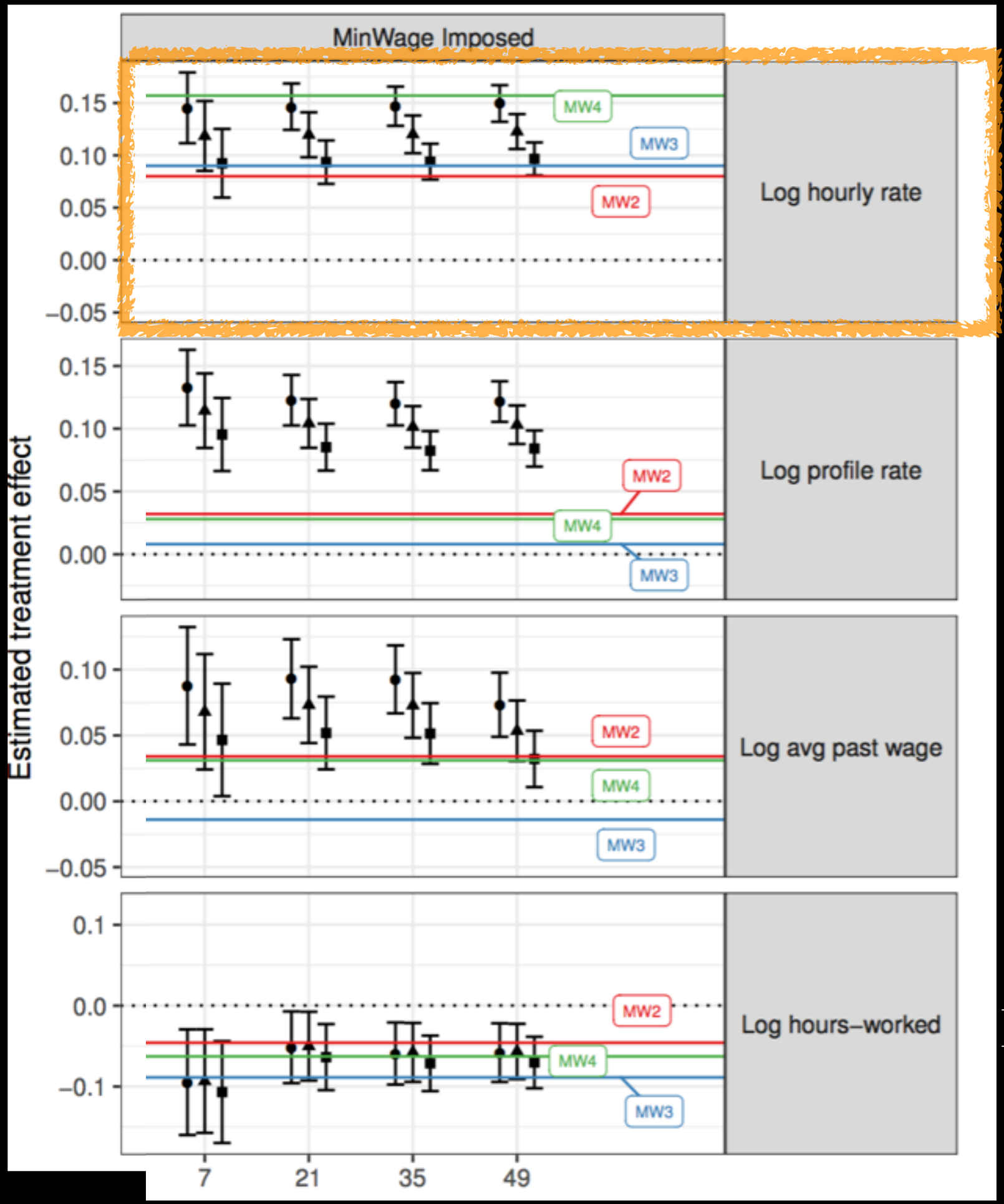


Hired worker wage

Hired worker profile rate

Hired worker past wage

Hours-worked

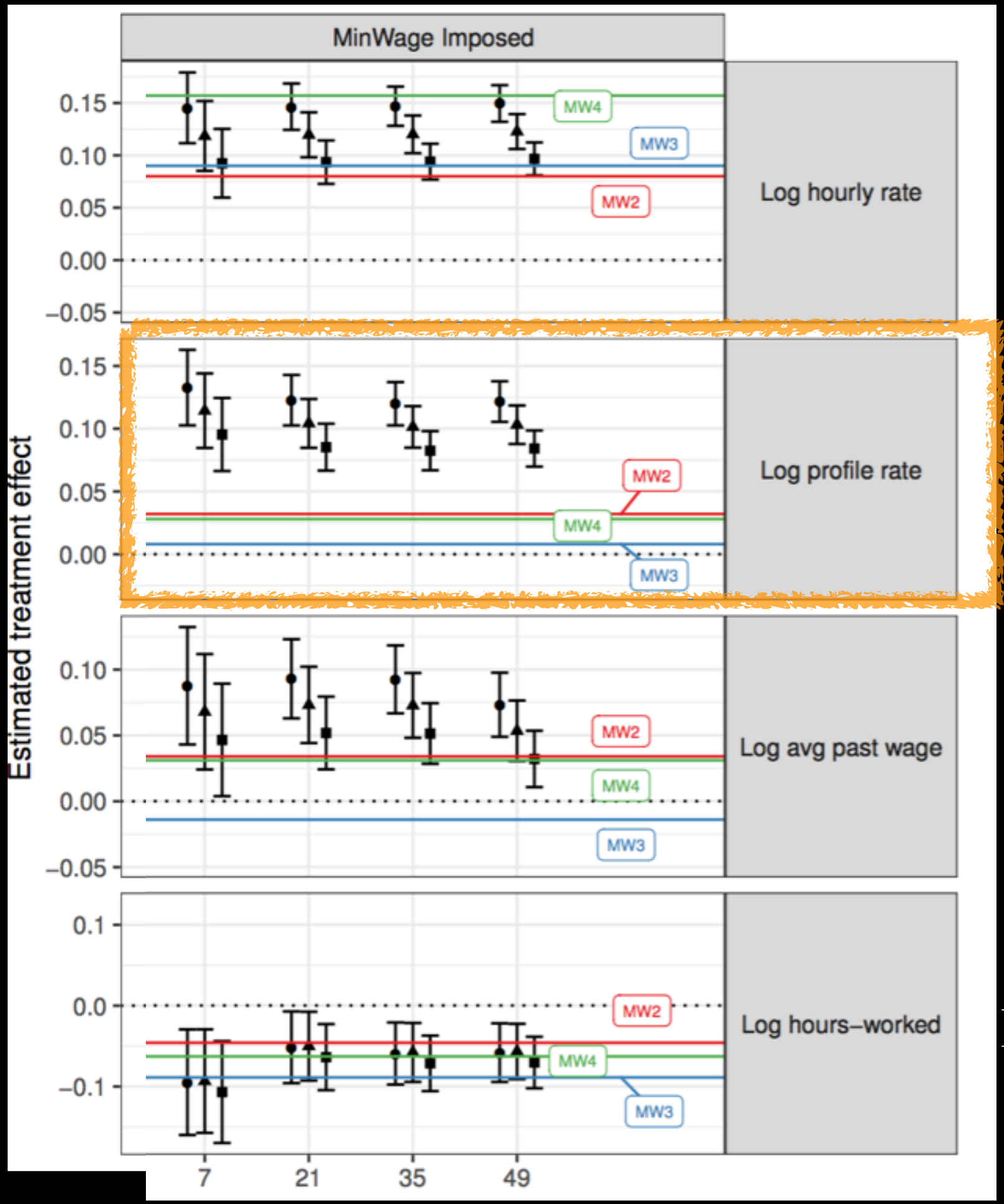


Wage

Profile Rate

Past wage

Hours-worked

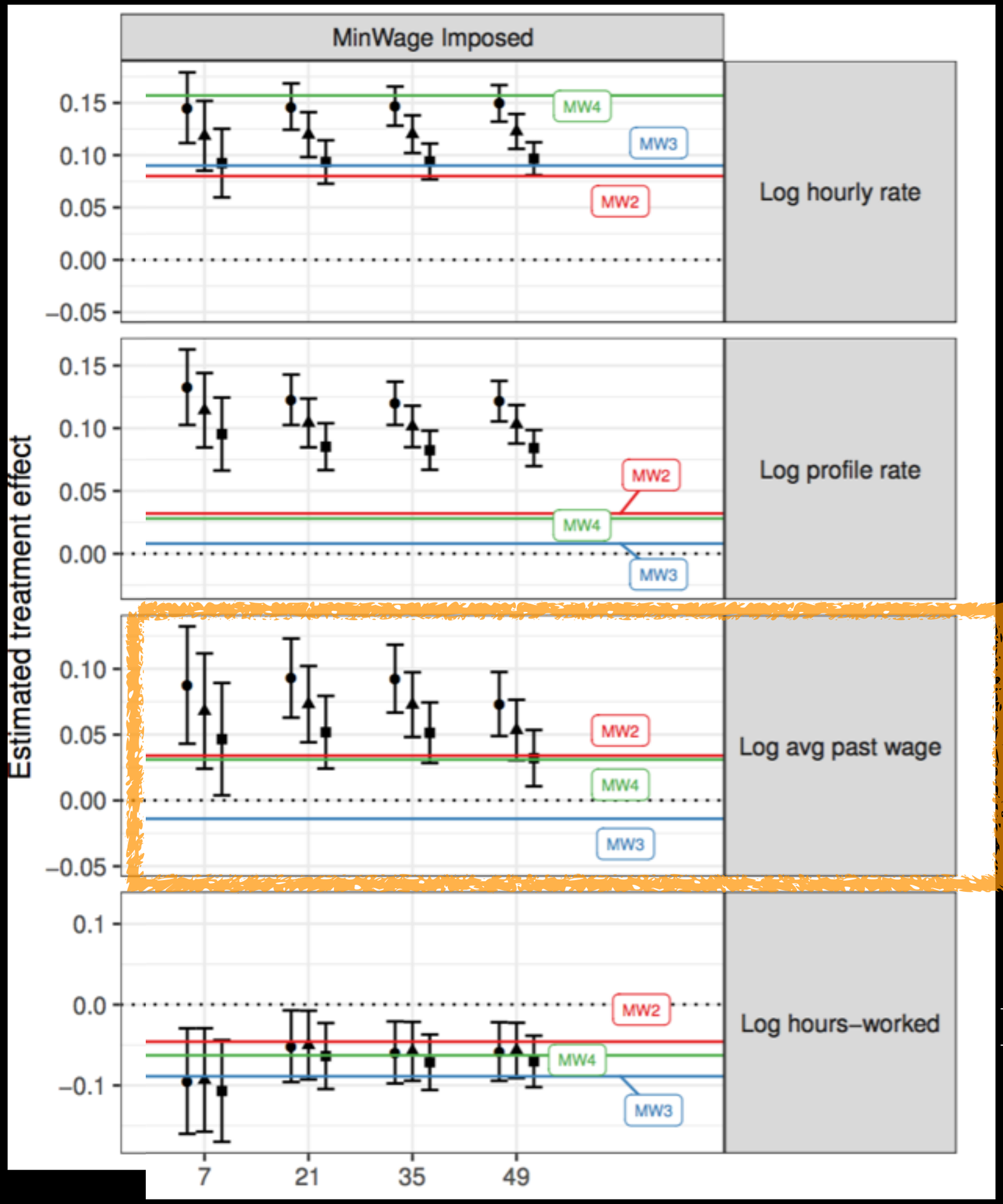


Wage

Profile Rate

Past wage

Hours-worked

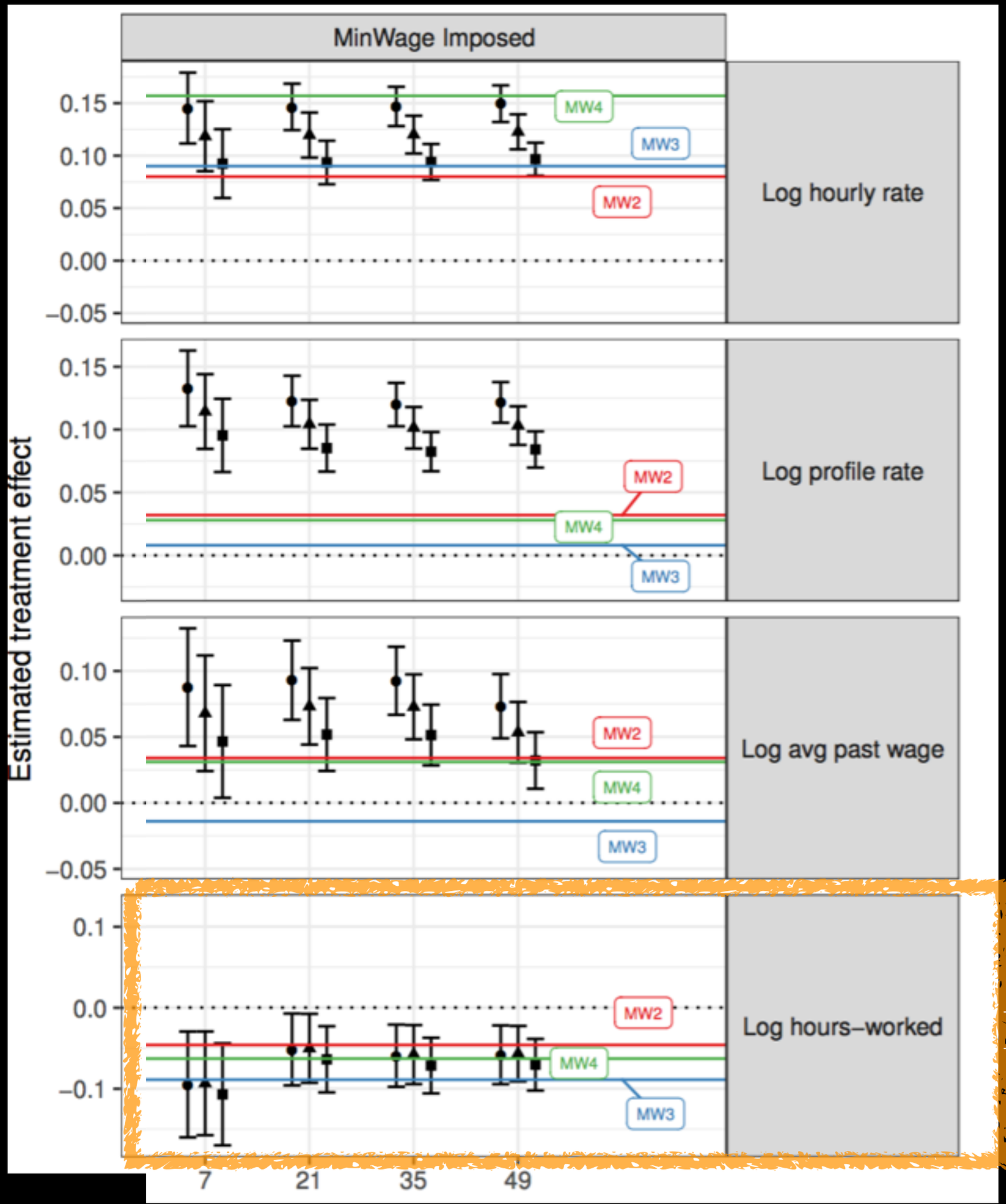


Wage

Profile Rate

Past wage

Hours-worked



Wage

Profile Rate

Past wage

Hours-worked

Effects of imposition of worker bidding and hire rates

Indicator for application after the minimum wage is imposed

Indicators for average pre-period freelancer hourly wage bid

Worker FE

$$y_{ij} = \sum_{k \in K} \beta_k \left(\text{POST}_{ij} \times \text{PREWAGEBAND}_i^k \right) + c_i + \epsilon,$$

Outcome: Applicant's log wage bid

Actual Minimum Wage Imposition Year

Placebo Year (1 year prior)

1.2
0.8
0.4
0.0

Outcome: Applicant hired

Placebo Year (1 year prior)

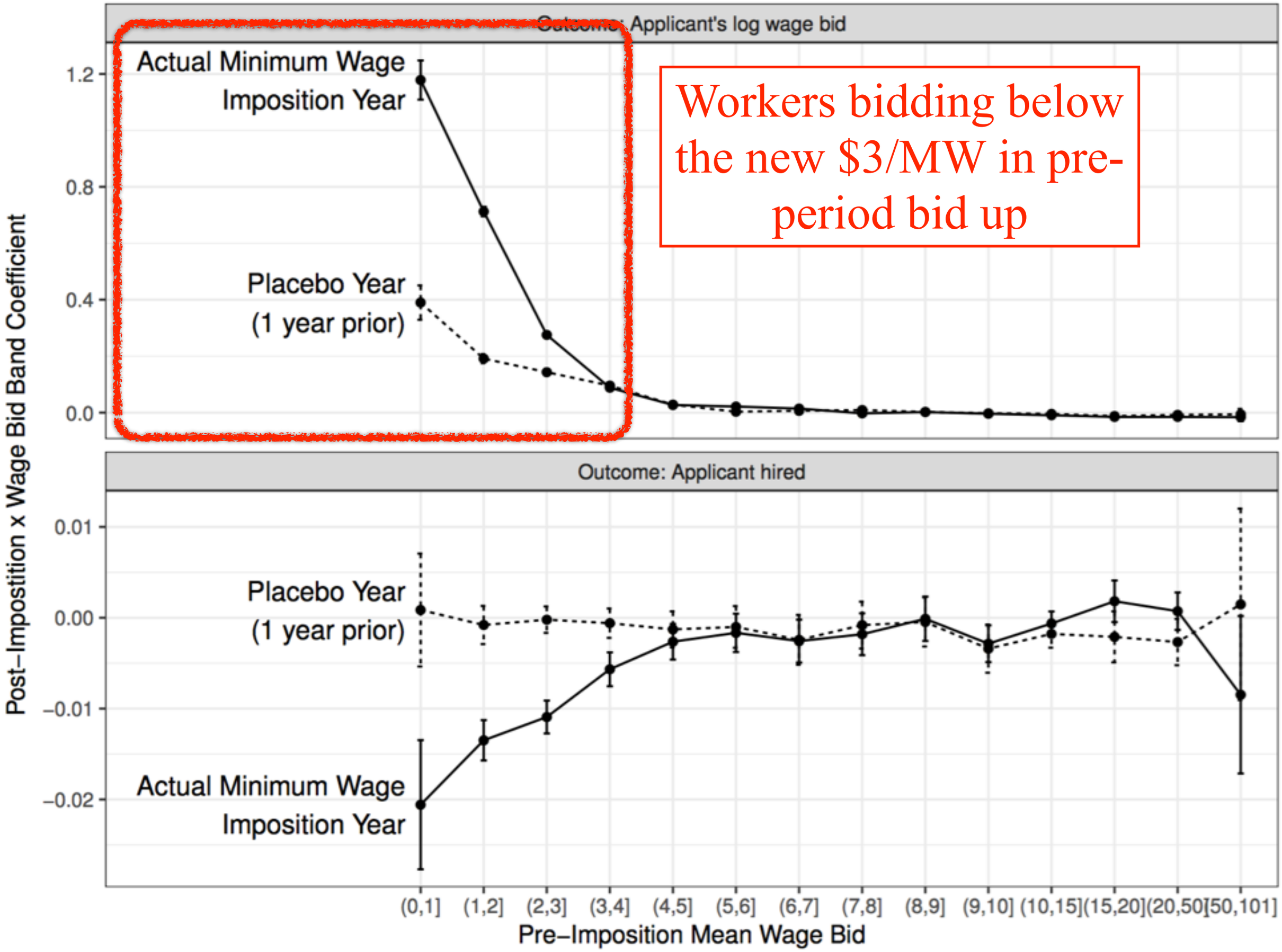
Actual Minimum Wage Imposition Year

0.01
0.00
−0.01
−0.02

Post−Impostition x Wage Bid Band Coefficient

(0,1] (1,2] (2,3] (3,4] (4,5] (5,6] (6,7] (7,8] (8,9] (9,10] (10,15] (15,20] (20,50] [50,101]

Pre−Imposition Mean Wage Bid


Outcome: Applicant's log wage bid
Actual Minimum Wage Imposition Year
Placebo Year (1 year prior)
1.2
0.8
0.4
0.0
Workers bidding below the new $3/MW in pre-period bid up
Outcome: Applicant hired
Post−Impostition x Wage Bid Band Coefficient
0.01
0.00
−0.01
−0.02
Placebo Year (1 year prior)
Actual Minimum Wage Imposition Year
(0,1]
(1,2]
(2,3]
(3,4]
(4,5]
(5,6]
(6,7]
(7,8]
(8,9]
(9,10]
(10,15]
(15,20]
(20,50]
[50,101]
Pre−Imposition Mean Wage Bid

Outcome: Applicant's log wage bid

Actual Minimum Wage Imposition Year

Placebo Year (1 year prior)

1.2
0.8
0.4
0.0

Workers bidding below the new $3/MW in pre-period bid up

Outcome: Applicant hired

Post−Impostition x Wage Bid Band Coefficient

0.01
0.00
−0.01
−0.02

Placebo Year (1 year prior)

Actual Minimum Wage Imposition Year

Same workers had large fall-off win rate

(0,1] (1,2] (2,3] (3,4] (4,5] (5,6] (6,7] (7,8] (8,9] (9,10] (10,15] (15,20] (20,50] (50,101]

Pre−Imposition Mean Wage Bid

Summary of findings

- Prices: Large increase in hourly wages from an imposed minimum
- Quantities:
  - Little reduction in hiring from even *very* high minimum wages
  - Large reductions in hours-worked, even when no reduction in hiring
- Hired worker attributes:
  - Substantial substitution towards more productive workers
    - Evidence that the market-wide minimum wage made it harder for low-wage workers to be hired

Concluding thoughts

- Labor-labor substitution results only detectable because of fine-grained productivity measures
- Plausible that this substitution happens in conventional markets but goes largely undetected because most variation in productivity is *within* demographic groups rather than *between*

Thanks!

- Paper: Price Floors and Employer Preferences: Evidence from a Minimum Wage Experiment

- Author: John J. Horton, NYU Stern School of Business

- Paper: www.john-joseph-horton.com/papers/minimum_wage.pdf