

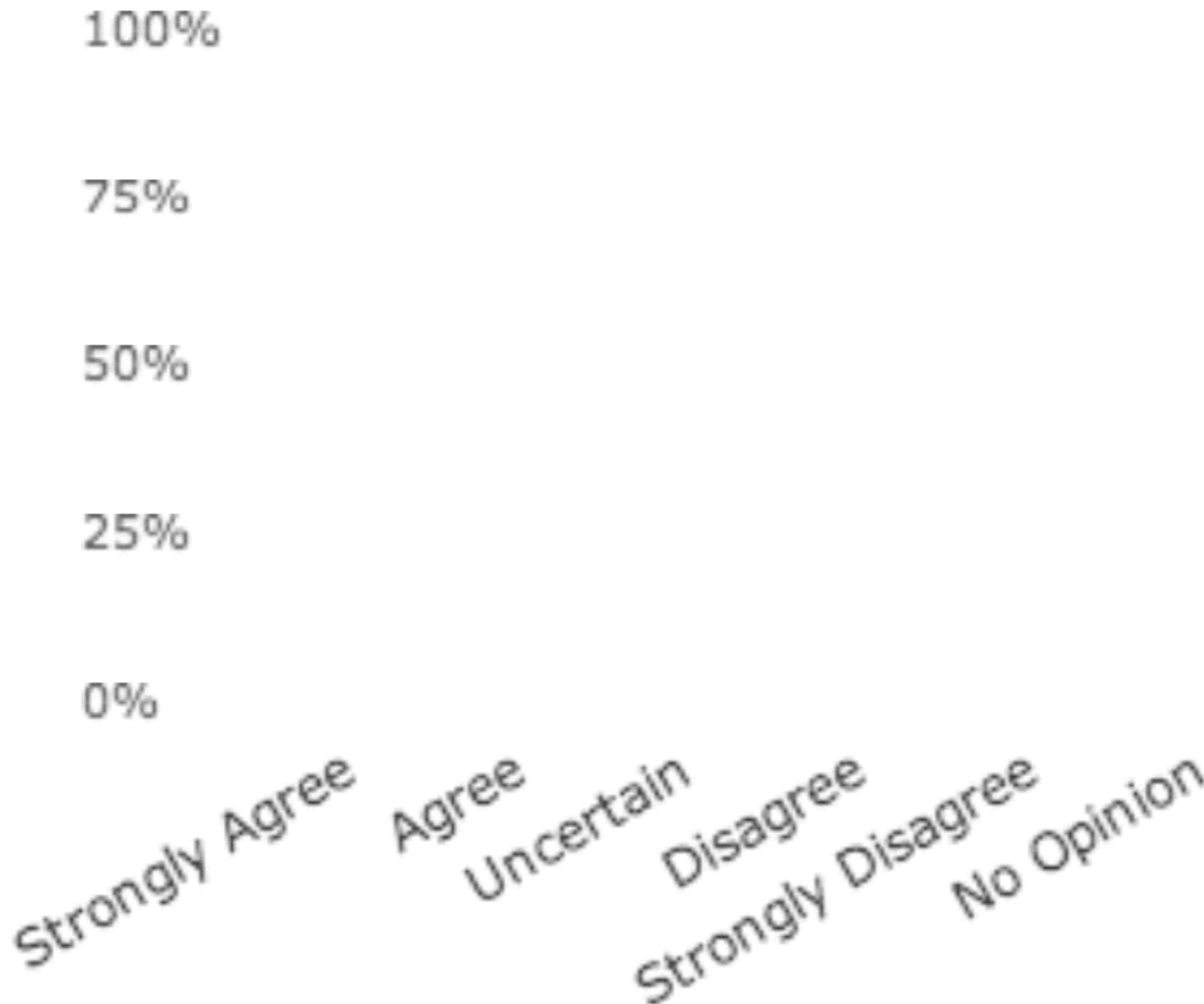
# Price Floors and Employer Preferences: Evidence from a Minimum Wage Experiment

John Joseph Horton  
NYU Stern School of Business

[http://www.john-joseph-horton.com/papers/minimum\\_wage.pdf](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.**

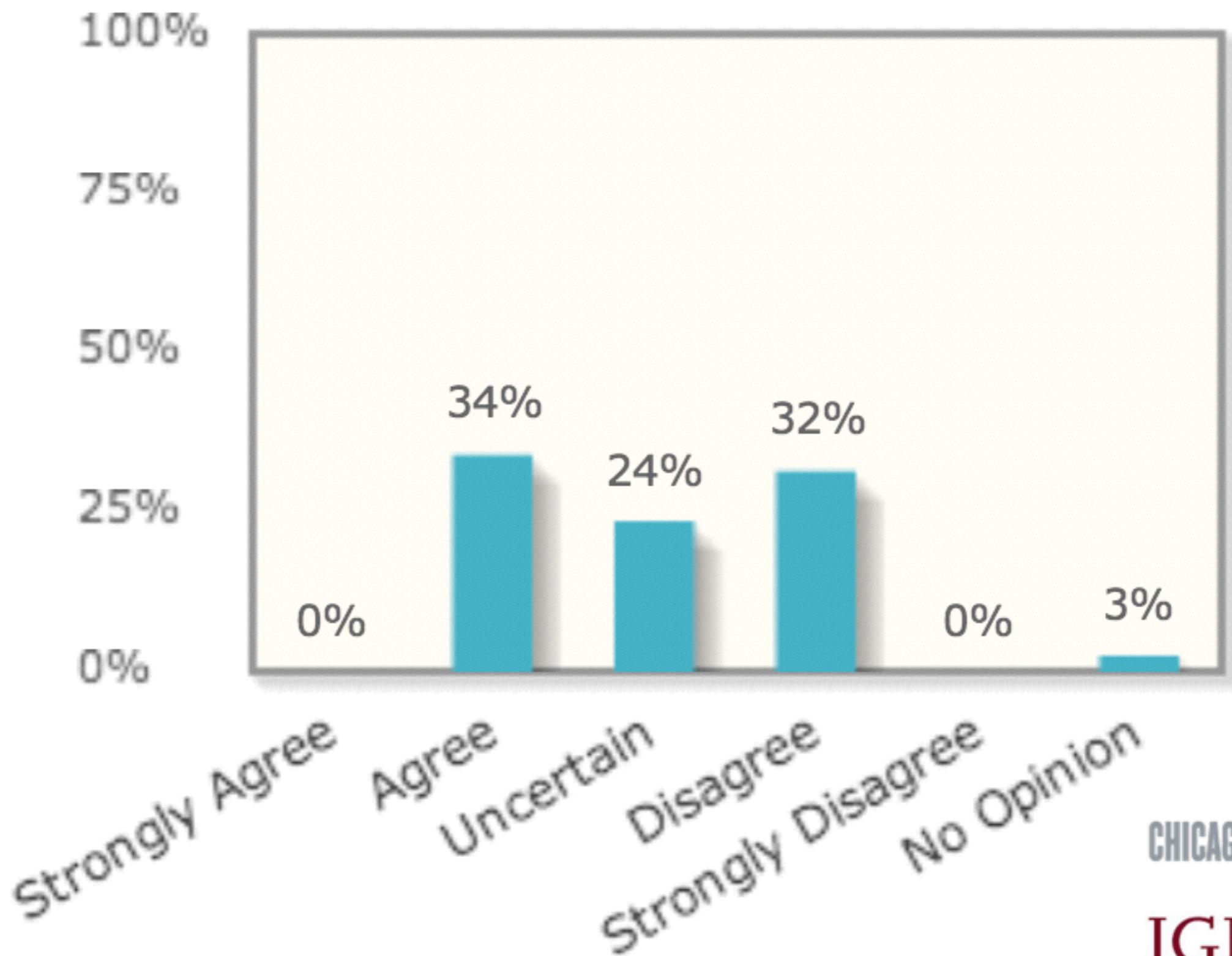


CHICAGO BOOTH

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.**



# 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 event study 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

Statistical Analysis Posted 13 hours ago



**Hourly Job**

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

Indicates an hourly job

**\$\$ 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

Propose an hourly rate of:

Paid to You:

\$

**10.00**

/ hr

# 3. Employers screen applicants

Urgent! Translate a single slide into Chinese  
Closed - Posted 12/06/2013 - [View or Edit](#) this job post

38 withdrawn or declined      Sort by:

**Wage bid**

**LIONG YAN WAI**  
Translator. Admin Assistant. Clerical Work. Web research. Da&hellip;  
**\$10.00**    **★★★★★ 4.94**    100+ hours    Malaysia    Declined by Client

Hello. Thank you for posting your job offer. I am interested in contracting this job from you and I hope this job is still available by the time my application reaches ... [More](#)

---

 **Daphne Sung**  
Daphne Sung  
**\$1.11**    **★★★★★ 4.85**    100+ hours    Taiwan    Withdrawn by Freelancer

Hi, I would like to apply for the job, Chinese is my native language. Thanks. [More](#)

---

 **Wencheng Hu**  
Chinese Translator; App Copywriter; Developer (Wordpress and&hellip;  
**\$15.00**    **★★★★★ 4.91**    100+ hours    United States    Declined by Client

Hi, please look at the following: Talk Conclusions \* Online labor is creating a new labor market unsegmented by geography \* Great opportunities to: &nbsp;&nbsp;&nbsp;-Collect ... [More](#)

# 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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- Randomization was at the level of the employer
  - 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)

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Closed - Posted 12/06/2013 - [View or Edit](#) this job post

38 withdrawn or declined Sort by: Best Match

 LIC Translators \$10.00 Hello and I am a native and I would like to apply for the job, Chinese is my native language. Thanks.	Wage bid: <b>\$1.11</b>	research. Da&hellip; a erested in contracting this job from you application reaches ...	Declined by Client
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**Employer posts  
an opening**

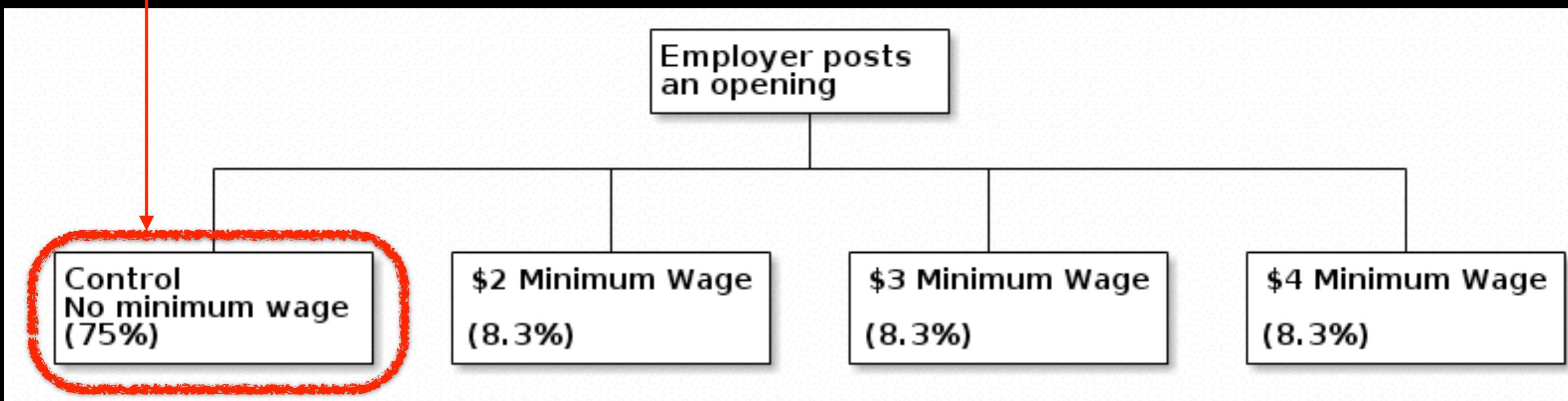
**Control  
No minimum wage  
(75%)**

**\$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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1. Failed randomization: no evidence; openings well-balanced across cells
2. Workers “sort” across openings: logically difficult and no evidence—applicant counts and characteristics well-balanced across cells
3. Firms “sort” across platforms, or are displaced to offline work

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

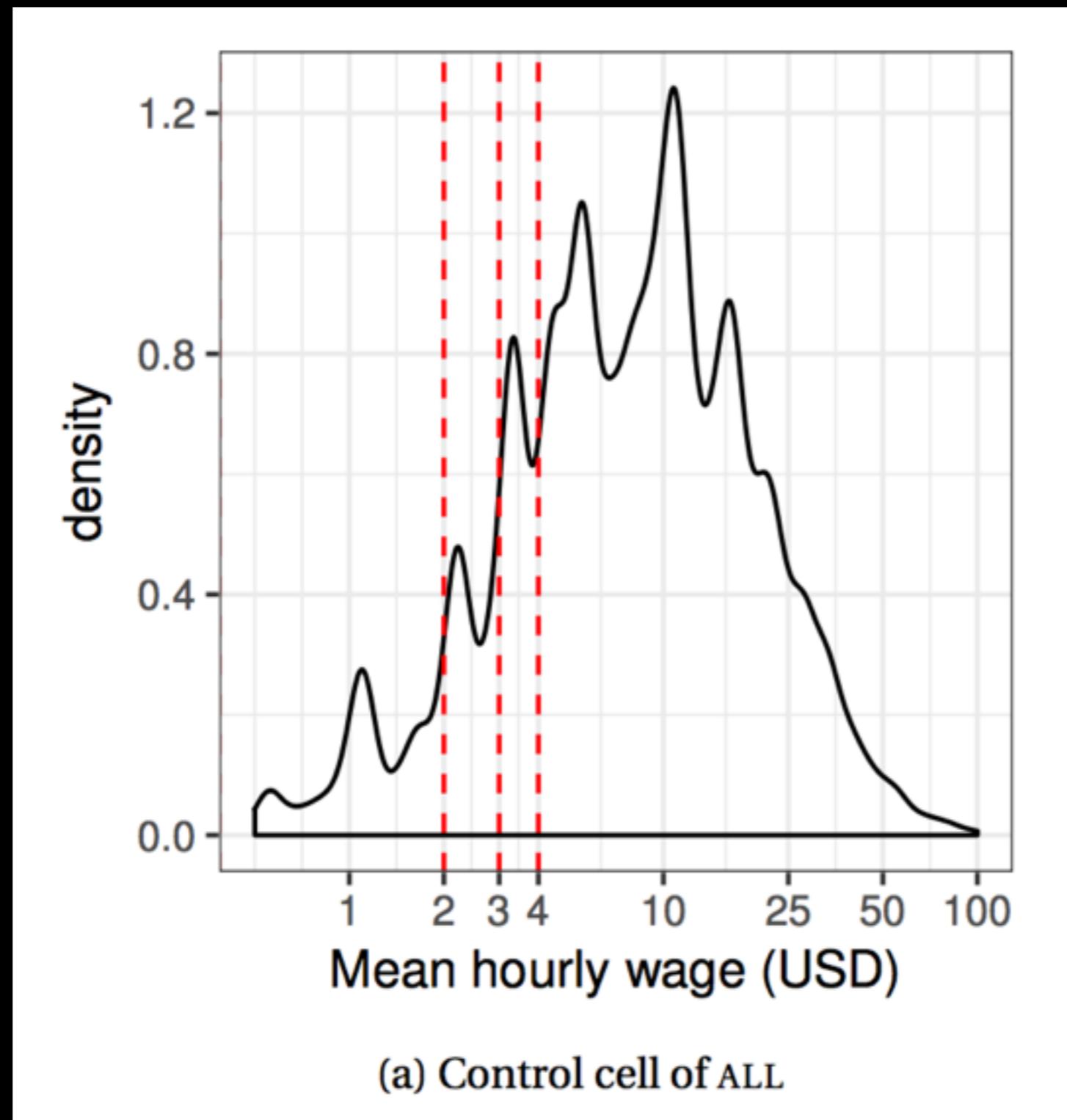
# Threats to internal validity

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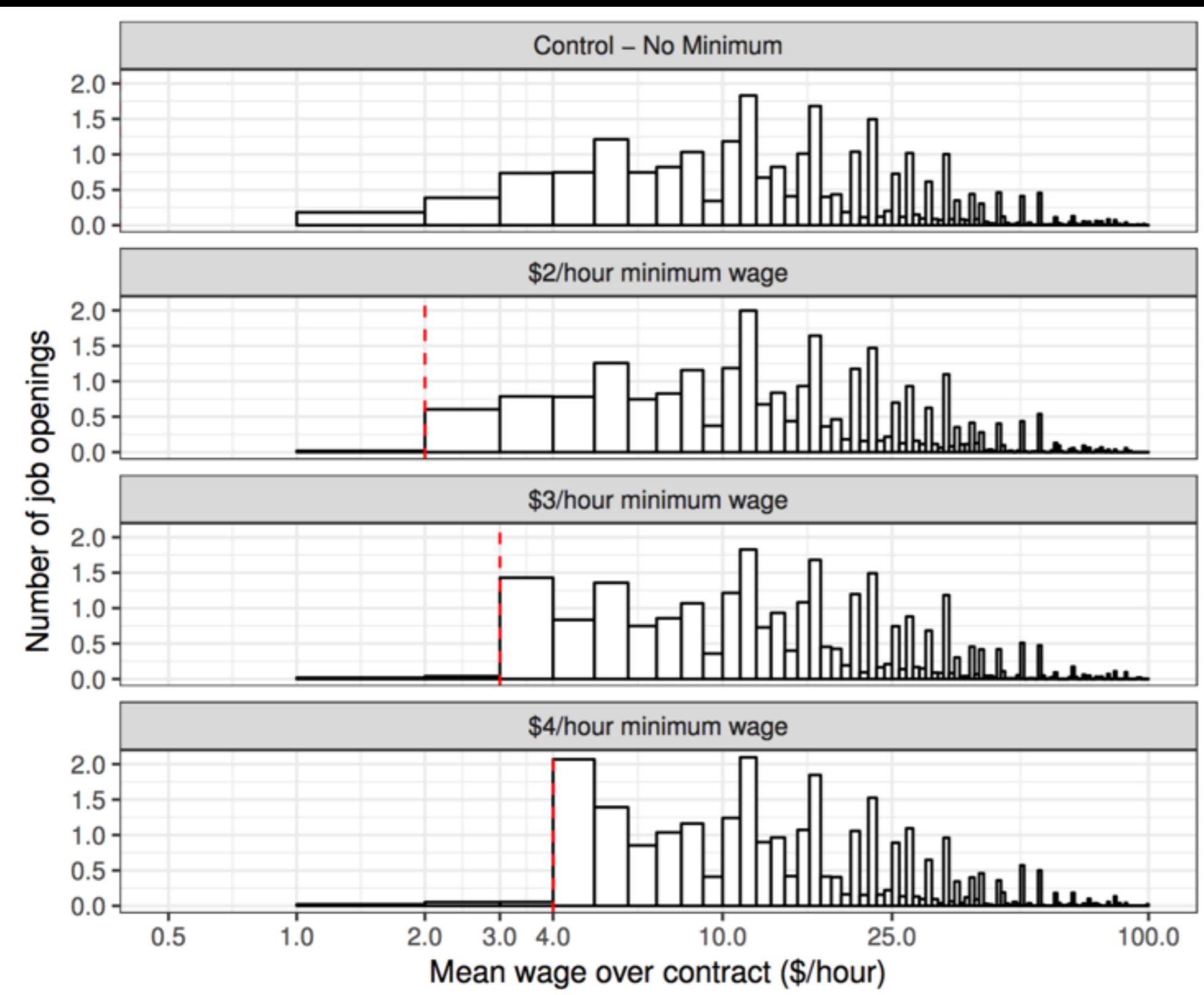
No evidence of displacement to other platforms. Prior survey evidence suggests weak online/offline substitutability

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

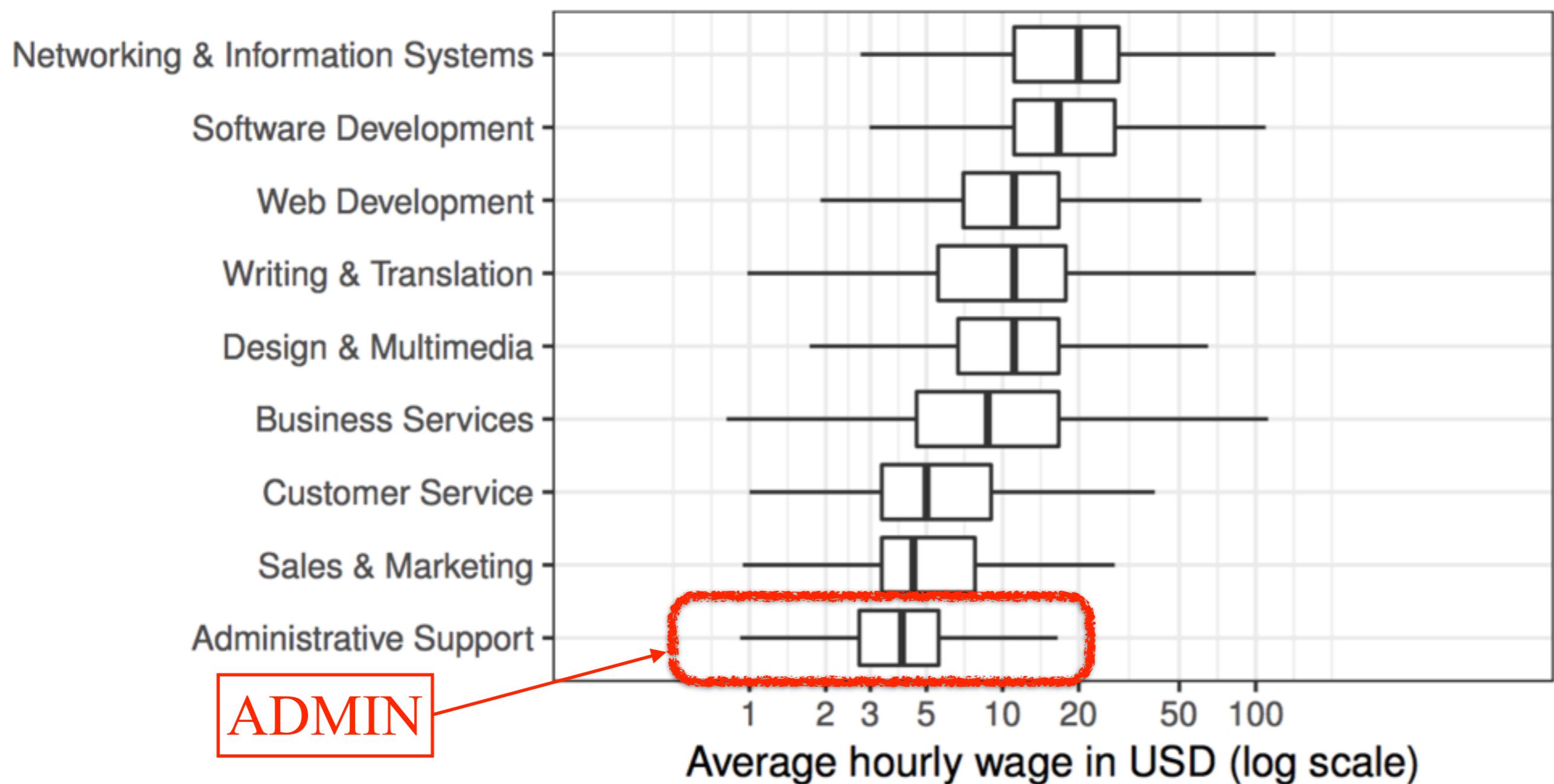
# Does a \$2/hour MW ‘‘bite’’ in this market?



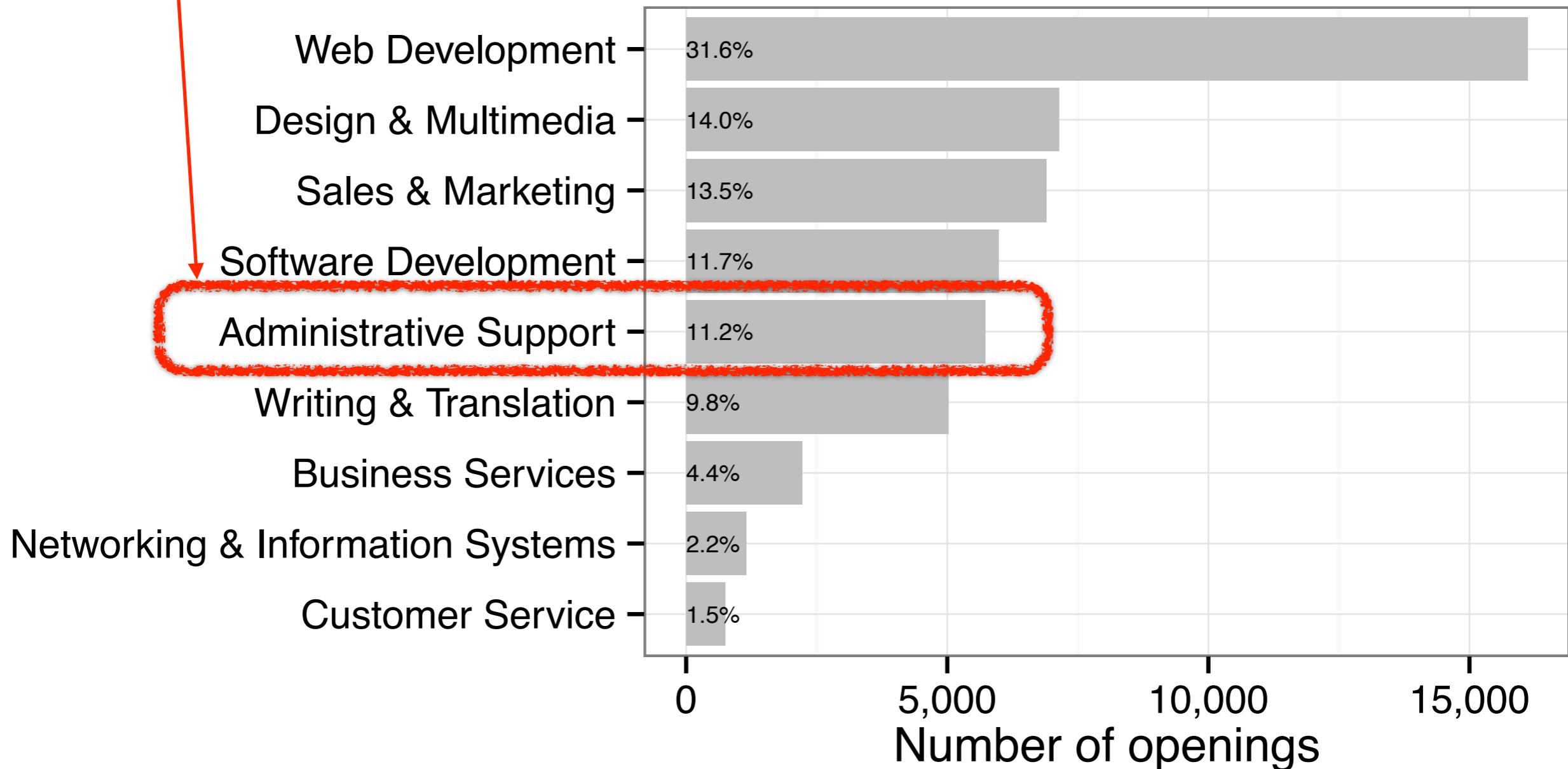
# Compliance?



# Where to look for effects?

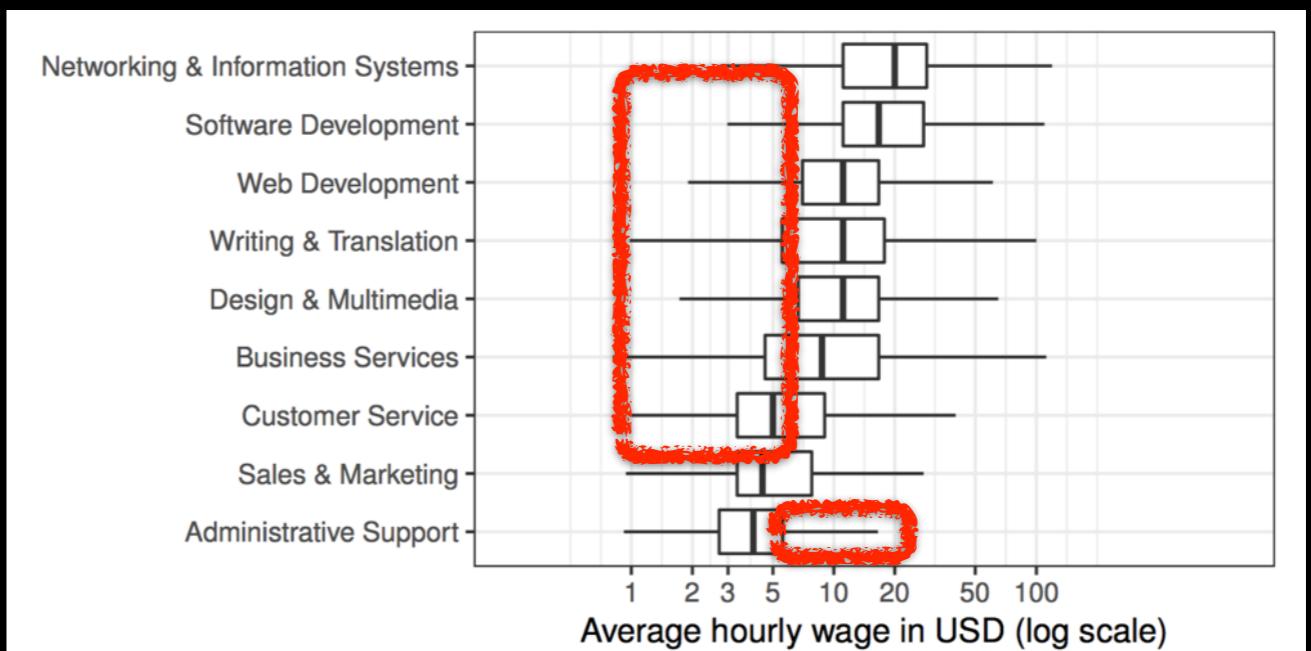


Only about 11%  
of openings



# 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

# Outcomes

- Prices
  - Log wage of hired worker (conditional upon hired)

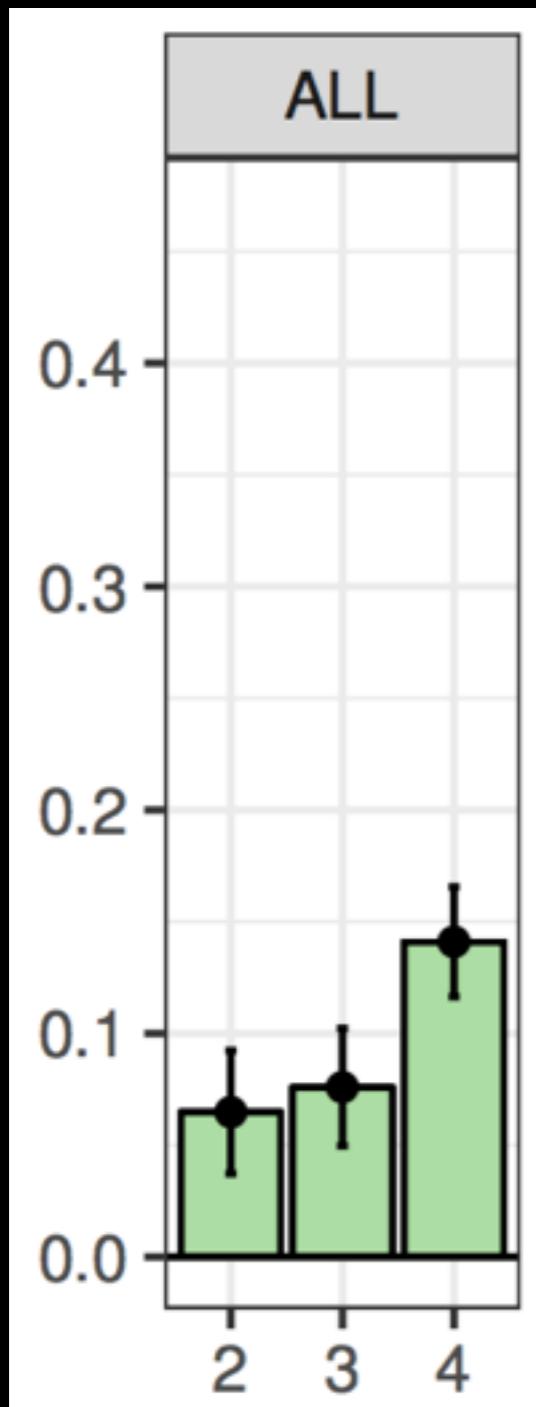
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- Quantities
  - Anyone hired?
  - Hours-worked (conditional upon a hire)

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- Prices
  - 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

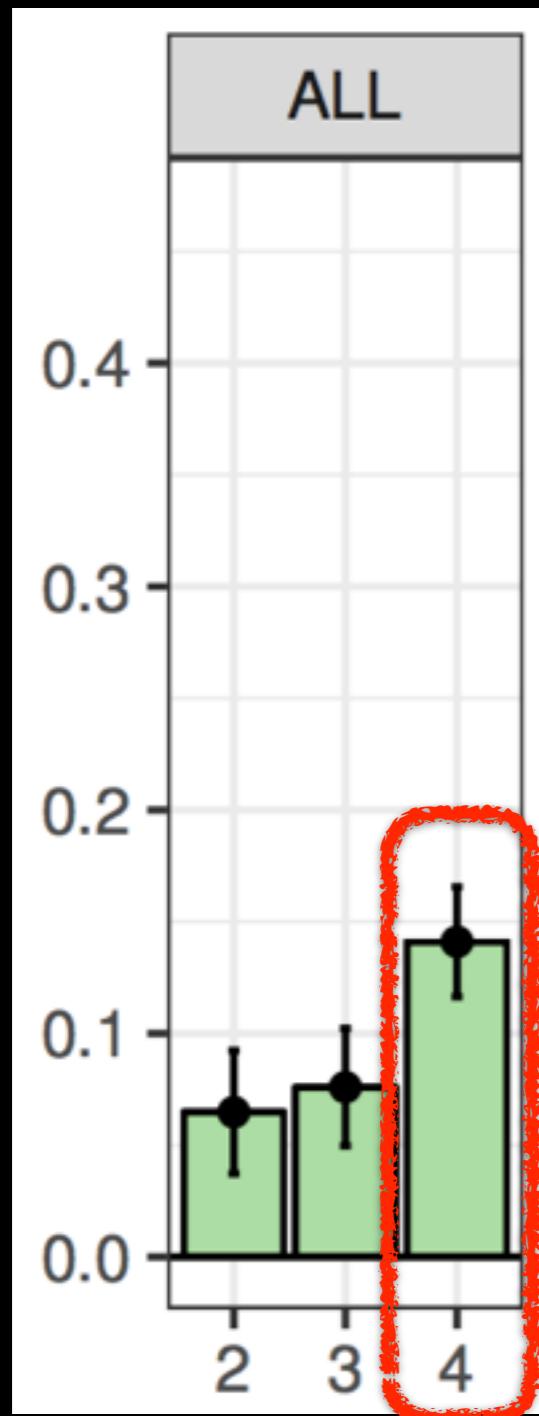


ALL  
(1)

**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 <sup>2</sup>	0.002

# Outcome: Log wage of the hired worker



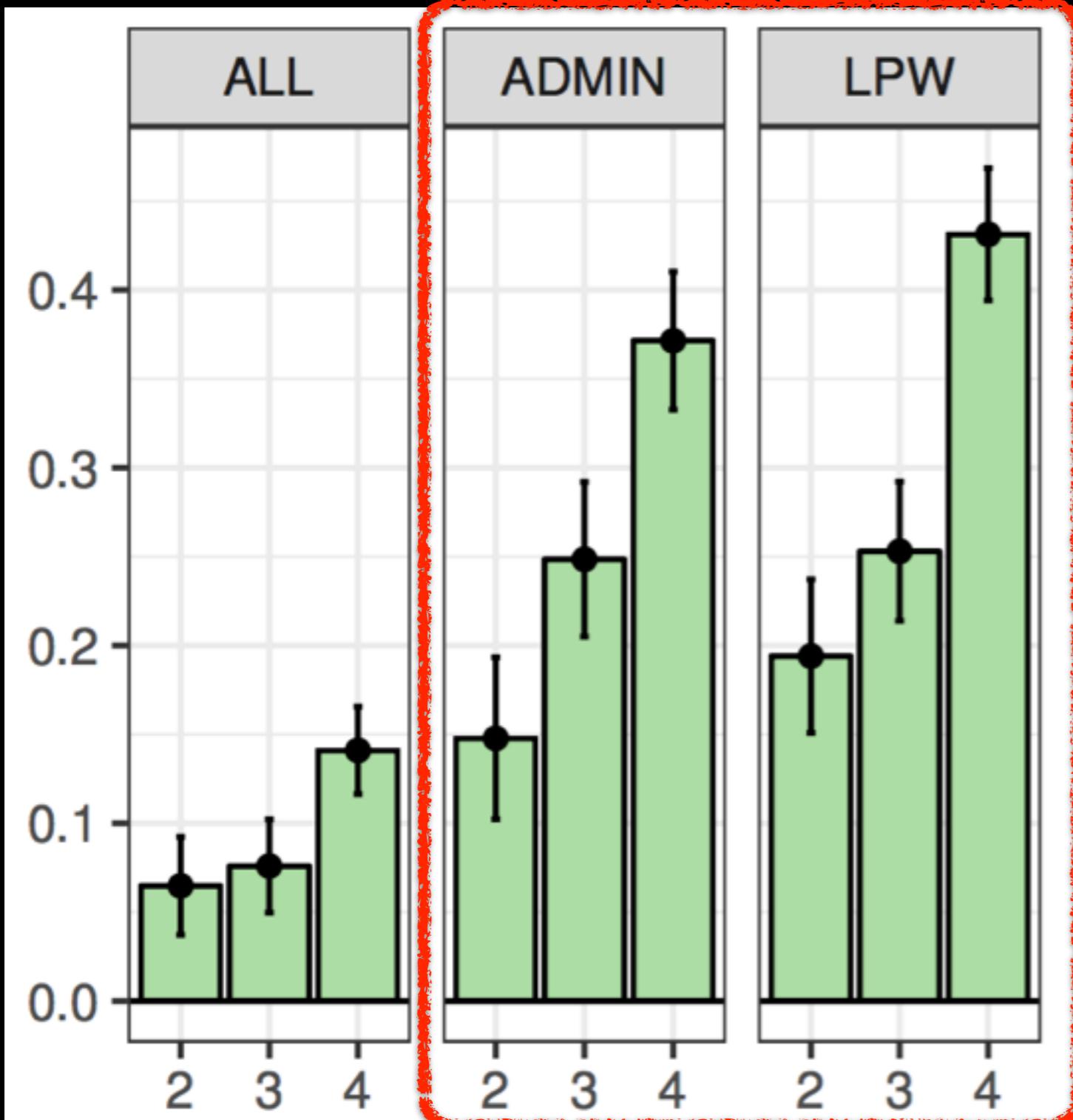
In MW4, hired worker wages were about 14% higher

ALL  
(1)

Panel A: Group indicators

MW4	0.141*** (0.015)
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# Outcome: Log wage of the hired worker



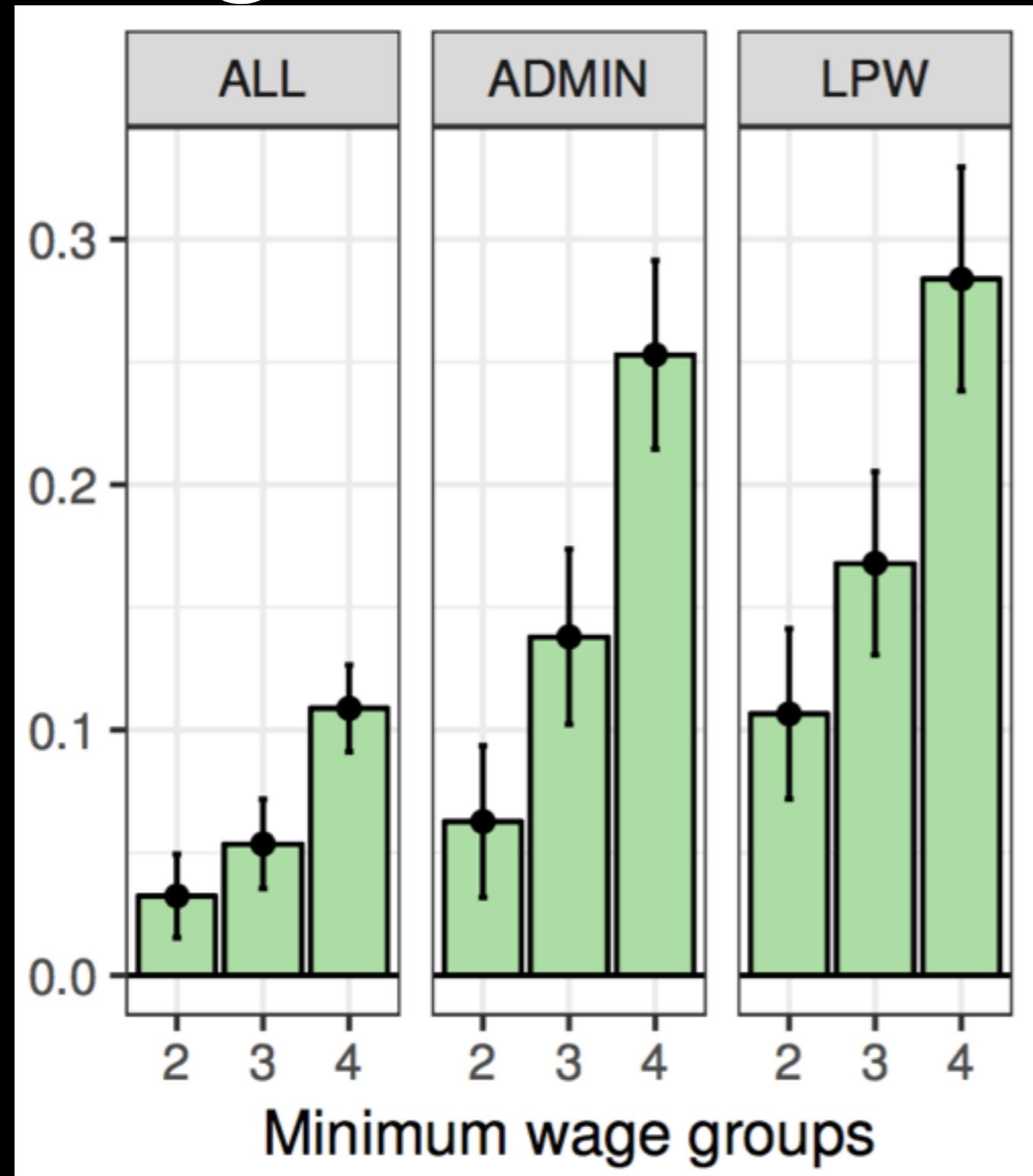
Even stronger wage increases in the sub-populations—around 40% in MW4.

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



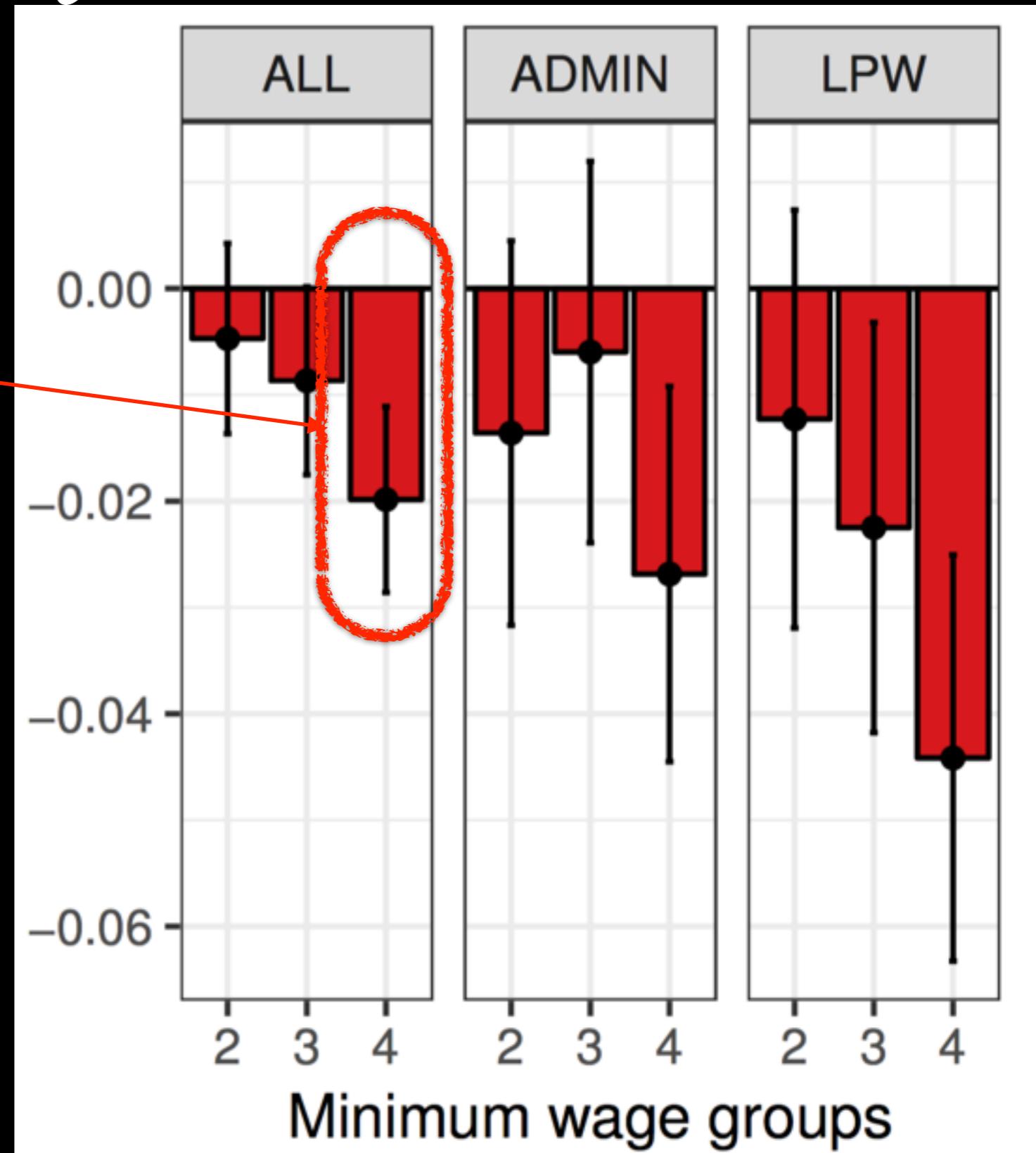
Markup:  
Hired worker  
wage relative to  
their profile rate

Workers  
are getting  
a higher wage  
relative to previous  
“market” wage

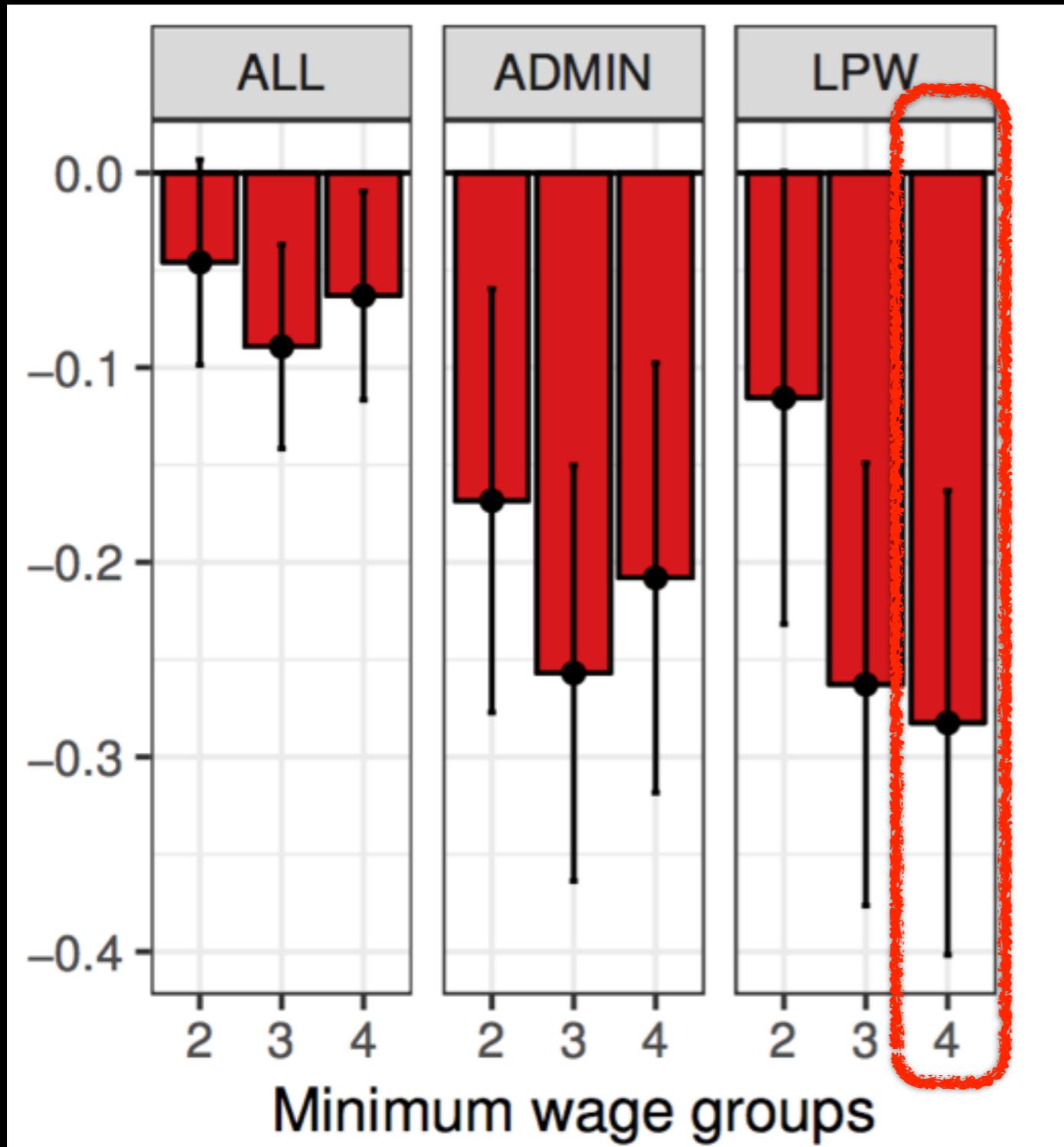
# Outcome: Any worker hired?

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

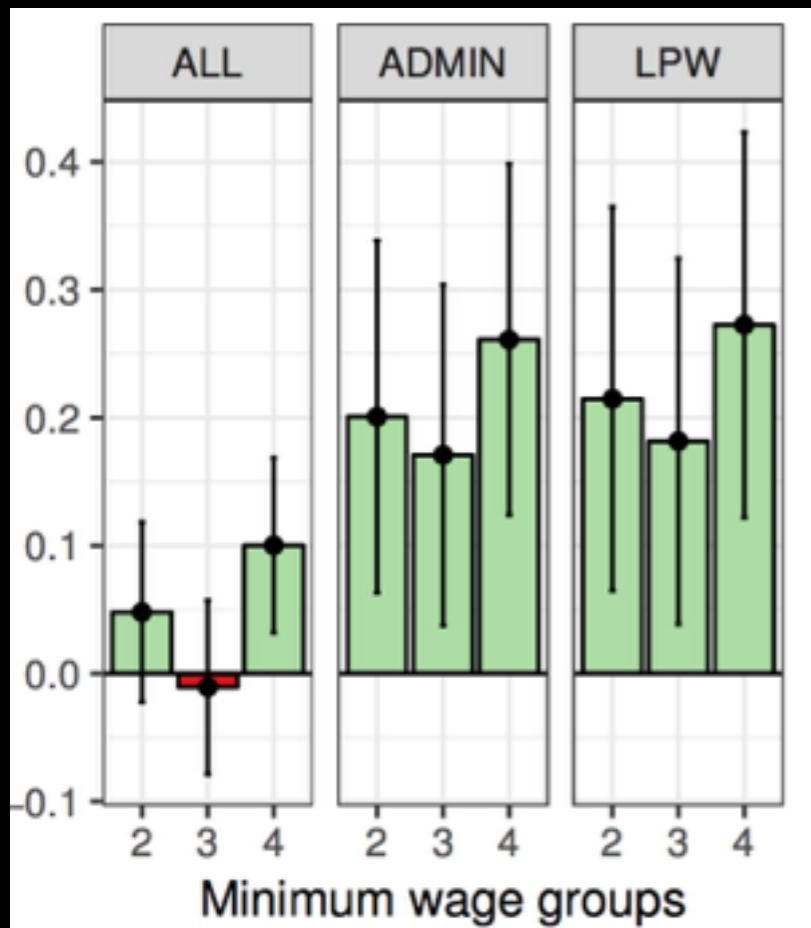
# Why the reduction in hours-worked?

- 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

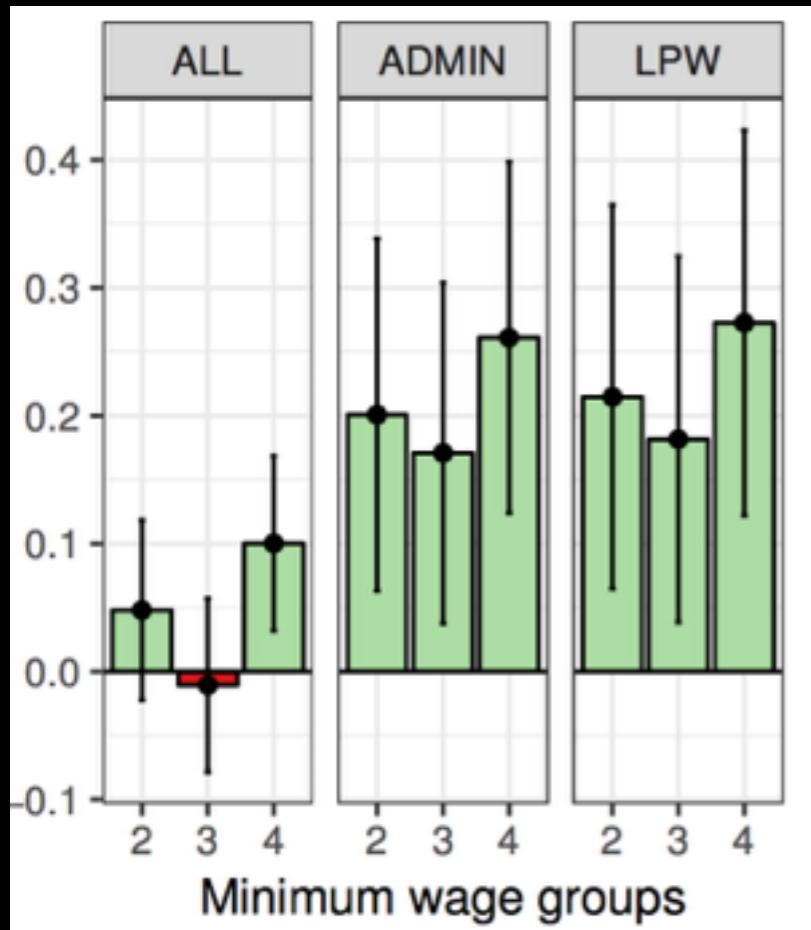
# Outcome: the *attributes* of hired worker that are proxies for productivity

Log cumulative  
past earnings

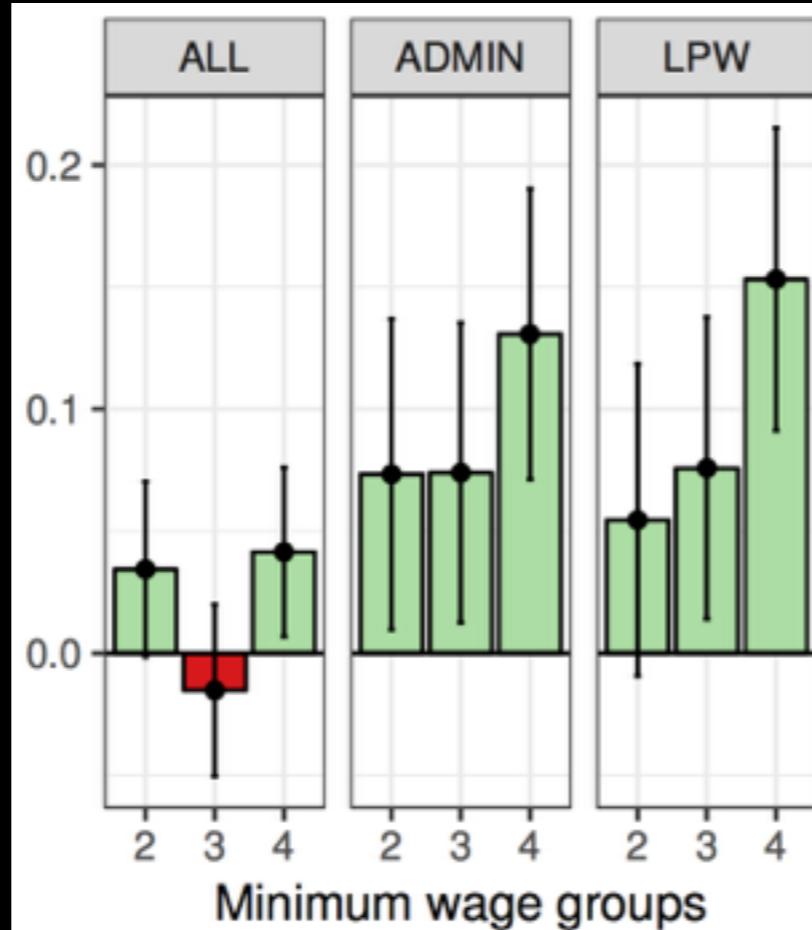


# Outcome: the *attributes* of hired worker that are proxies for productivity

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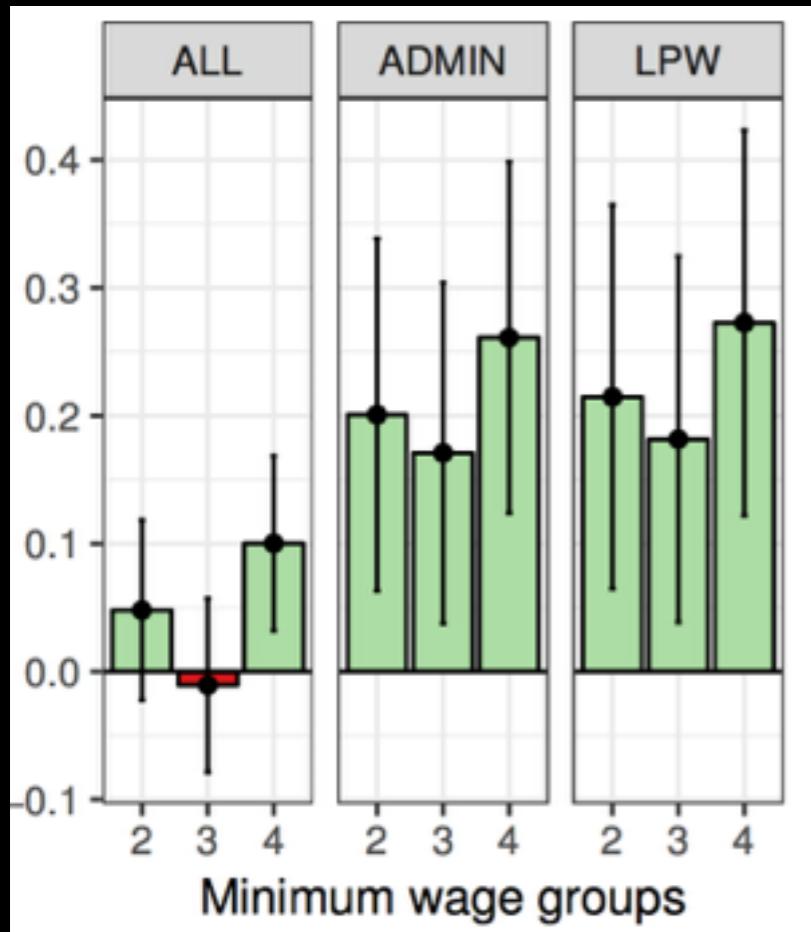


Log average  
past wage

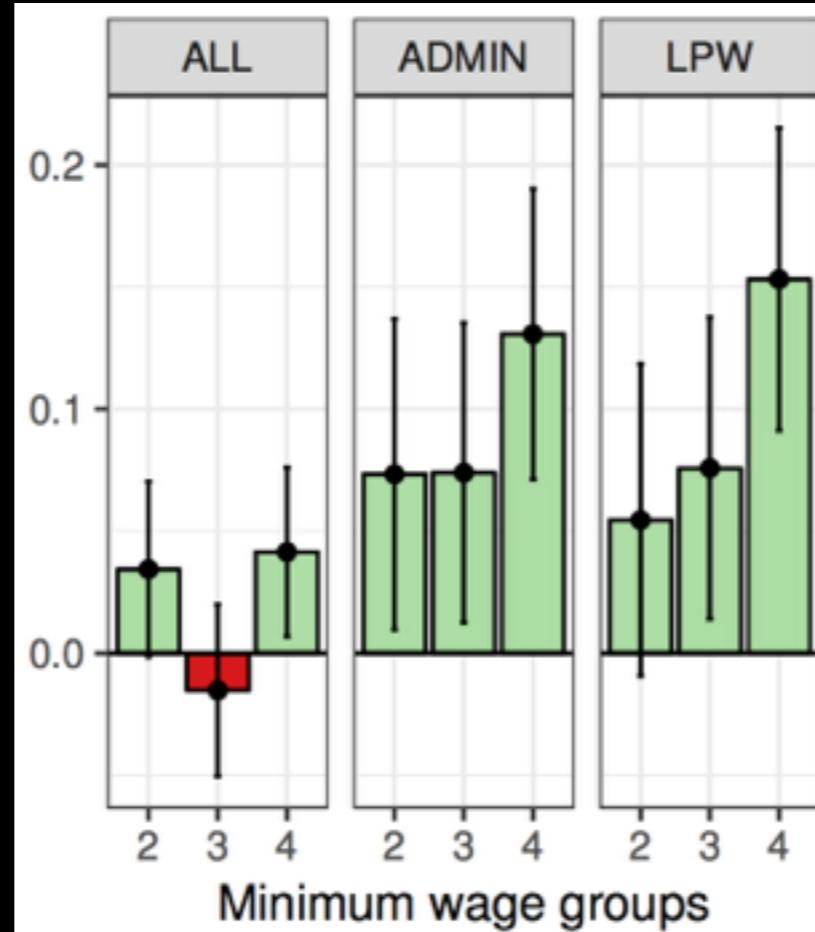


# Outcome: the *attributes* of hired worker that are proxies for productivity

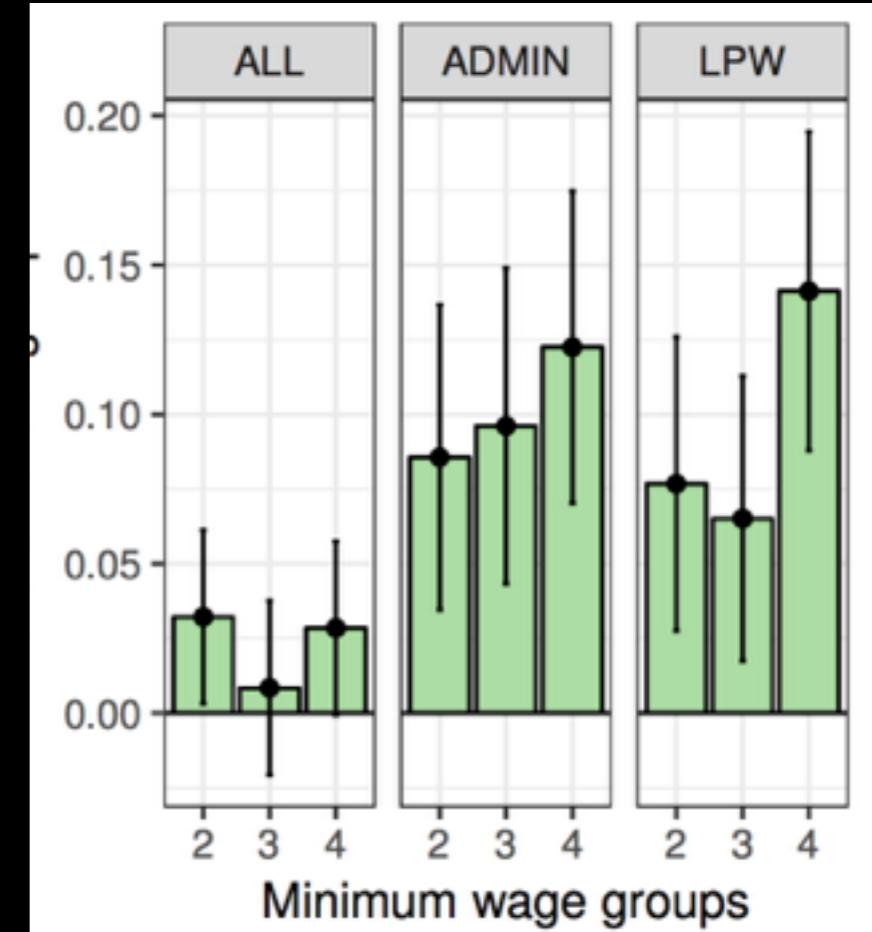
Log cumulative past earnings



Log average past wage



Hired worker profile rate



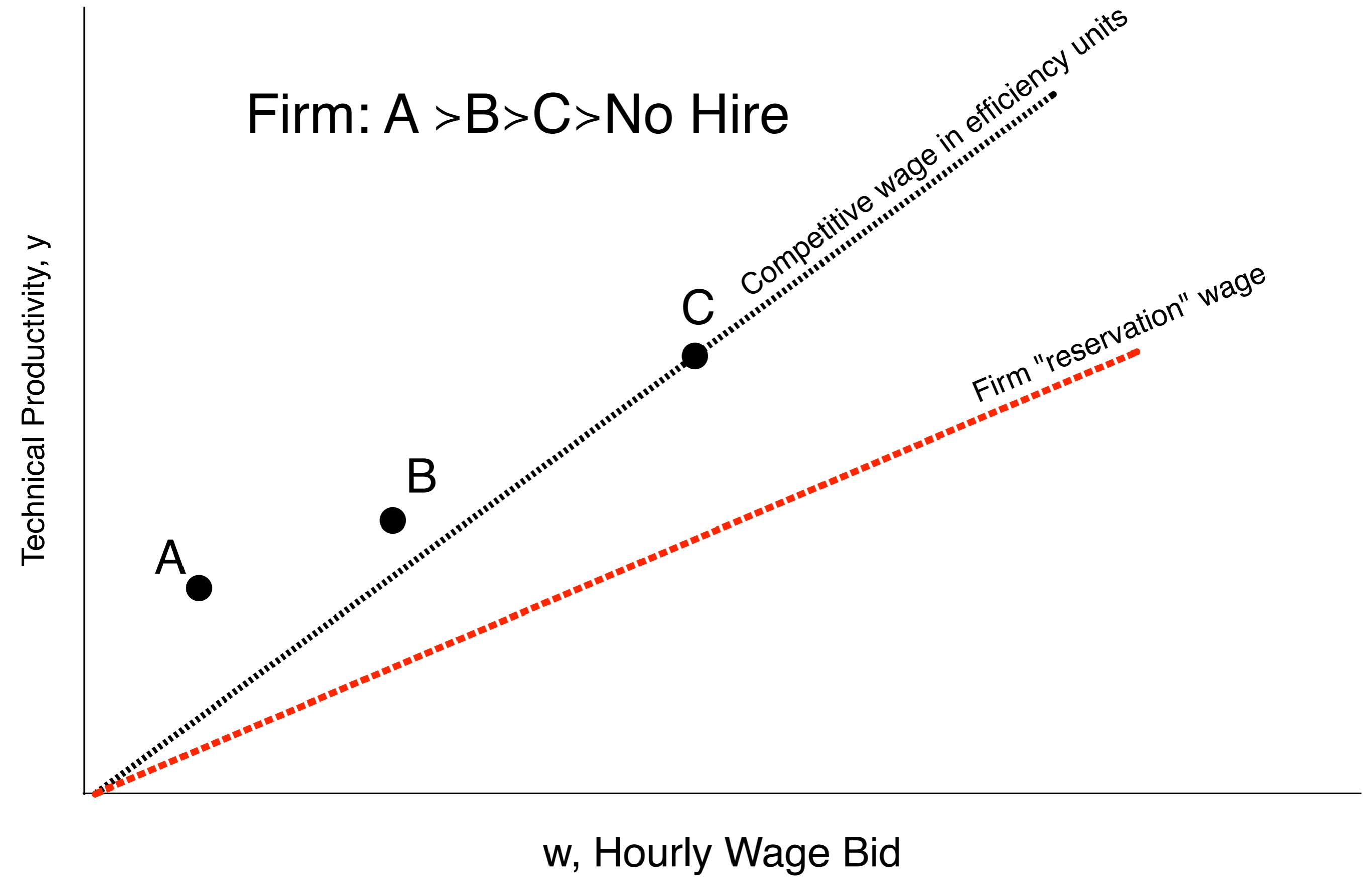
# Answers to the questions I posed

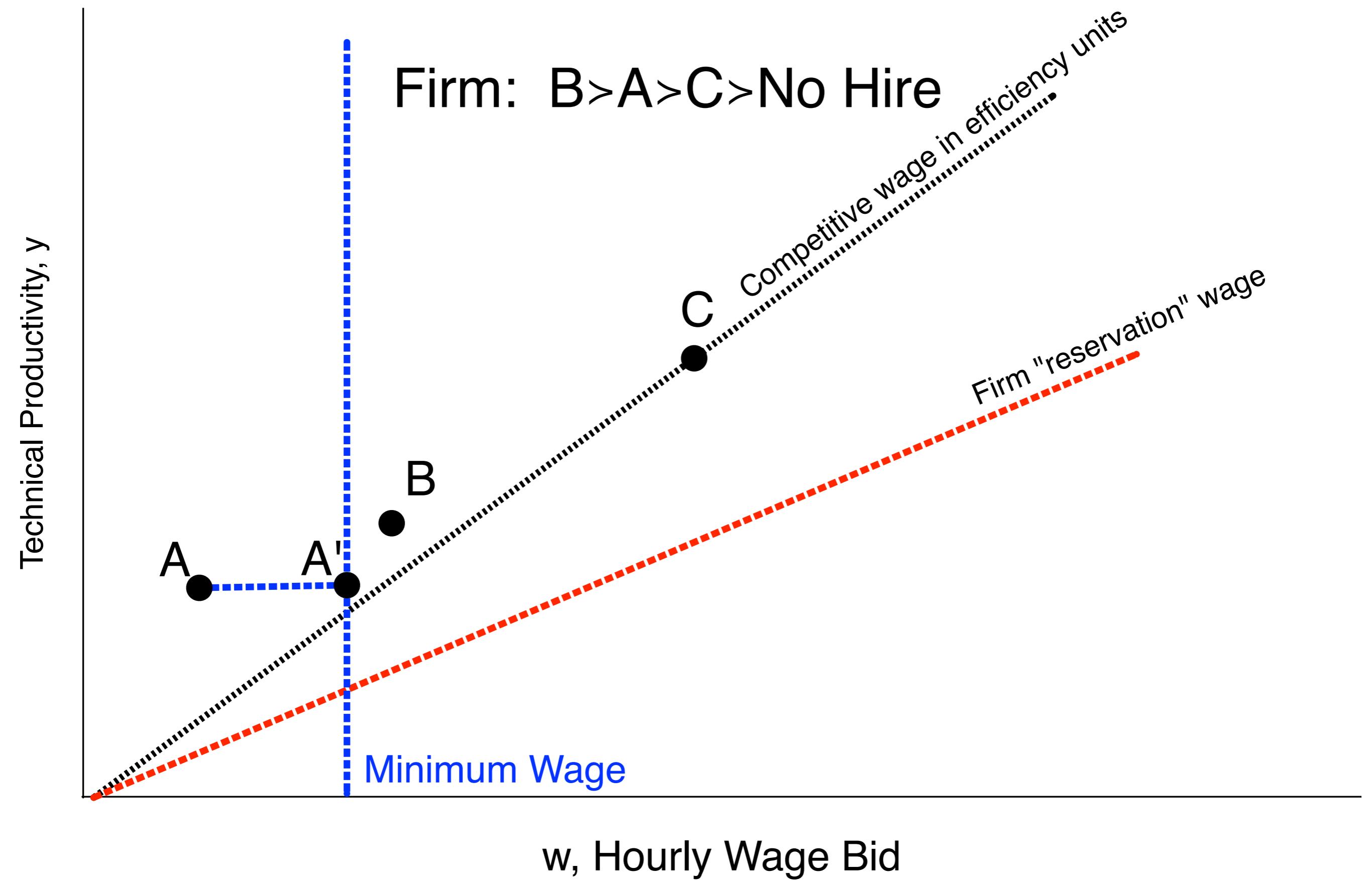
- Why did wages increase?
  - Both substitution towards higher wage workers & a markup effects; no evidence of much of selection effect
- Why did hours-worked decrease?
  - In part substitution towards more productive workers; no evidence on endogenous project size reduction or efficiency wage effects

# How does substitution “work” here?

- Employers have projects of size  $Y$ . Workers vary in their technical productivity,  $y$ ; jobs 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

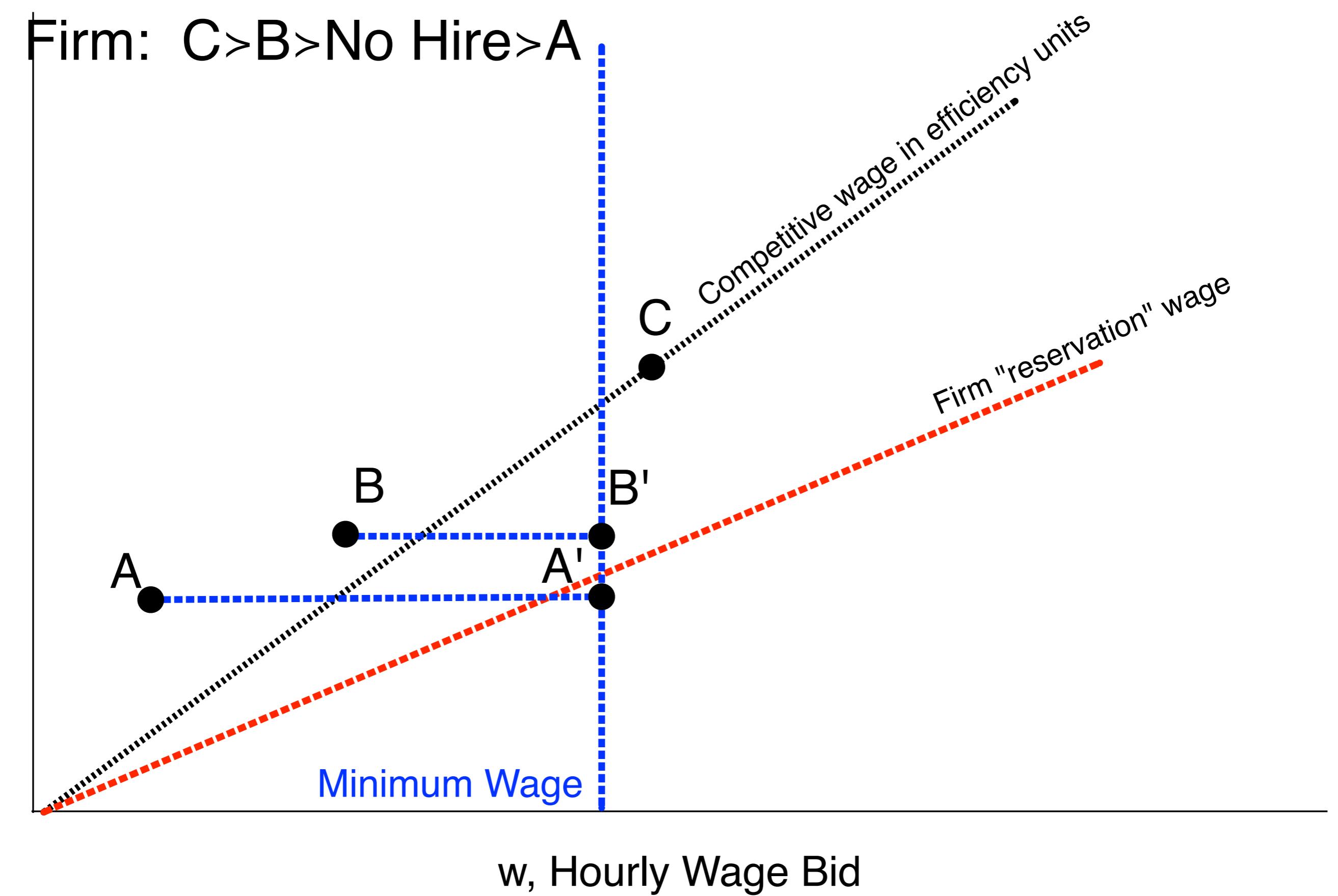
Firm: A >B>C>No Hire





Firm: C>B>No Hire>A

Technical Productivity,  $y$



# 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*** (0.008)	-0.003 (0.012)	-0.011 (0.014)	-0.025* (0.012)
MW3	0.009 (0.008)	0.007 (0.012)	-0.006 (0.014)	-0.016 (0.012)
MW2	0.003 (0.008)	0.001 (0.012)	0.009 (0.014)	-0.008 (0.012)
Constant	0.073*** (0.002)	0.187*** (0.004)	0.303*** (0.004)	0.209*** (0.004)
Observations	14,131	14,131	14,131	14,131
R <sup>2</sup>	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
	(1)	(2)	(3)	(4)
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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)

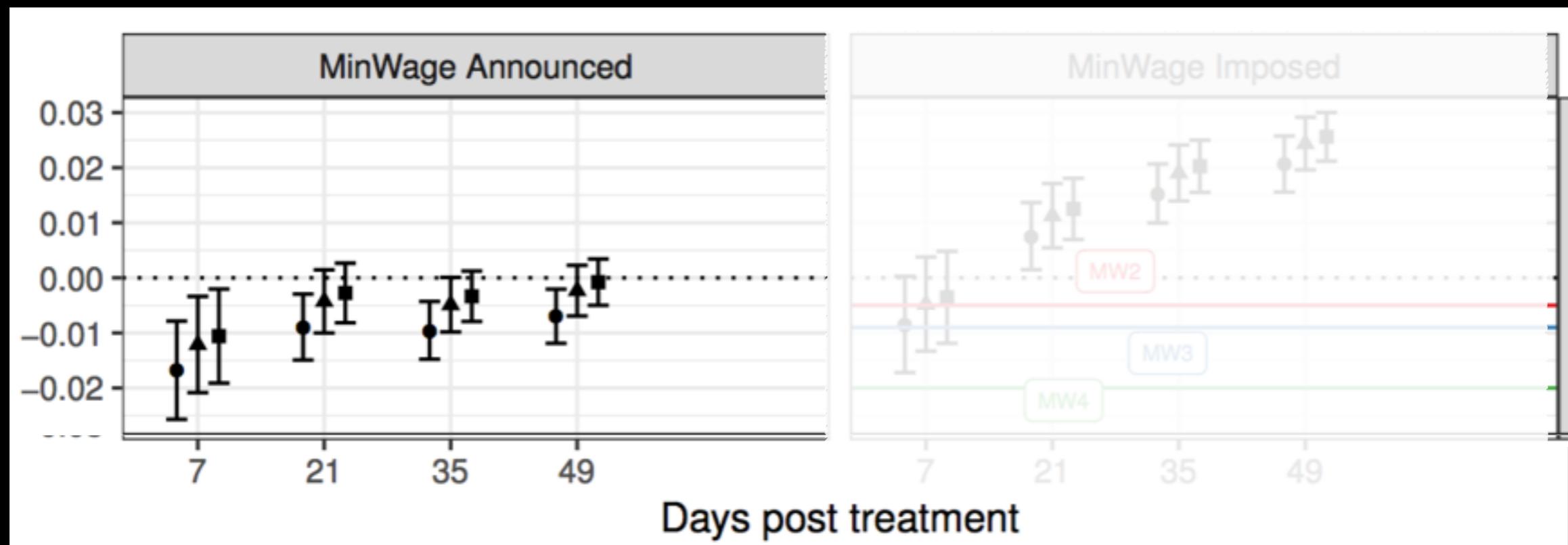
Imposition  
(2 weeks before/after)

*Dependent variable:*

	Announce (Actual)	Announce (Placebo)	Anyone hired?	
	(1)	(2)	Impose (Actual)	Impose (Placebo)
POST	0.0001 (0.004)	0.007 (0.004)	-0.002 (0.004)	0.005 (0.004)
Constant	0.395*** (0.003)	0.392*** (0.003)	0.382*** (0.003)	0.365*** (0.003)
R <sup>2</sup>	0.00000	0.0001	0.00001	0.00003

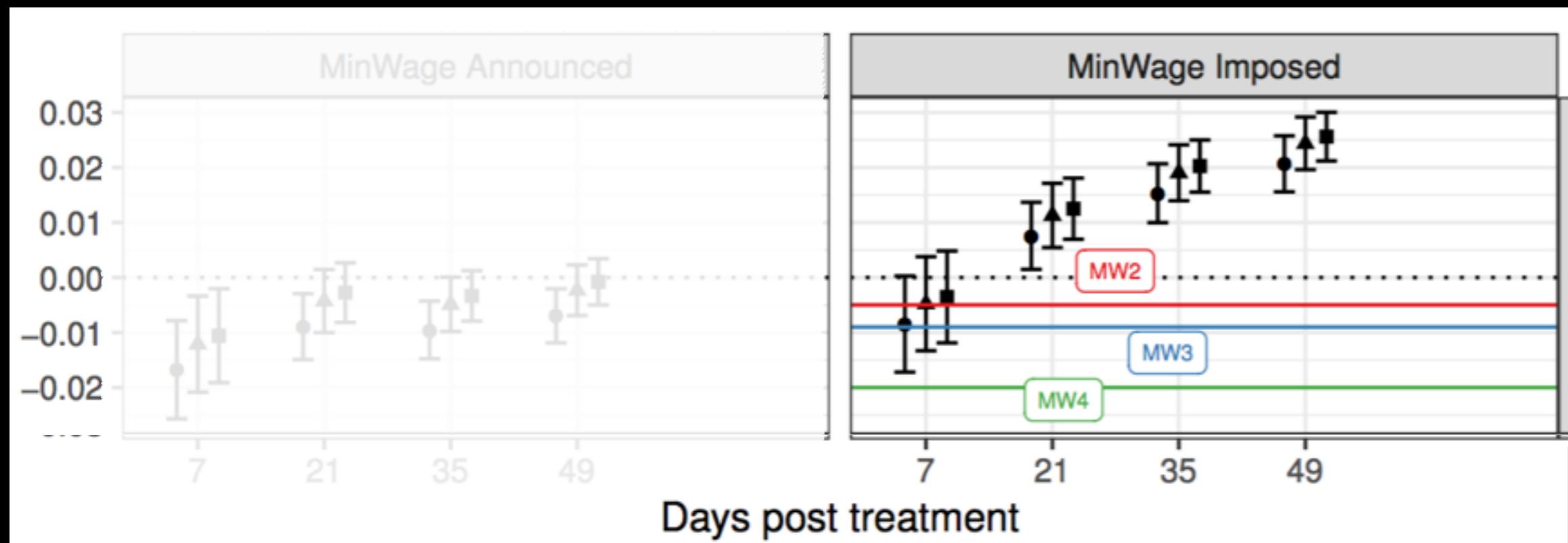
# Outcome: Hire made?

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

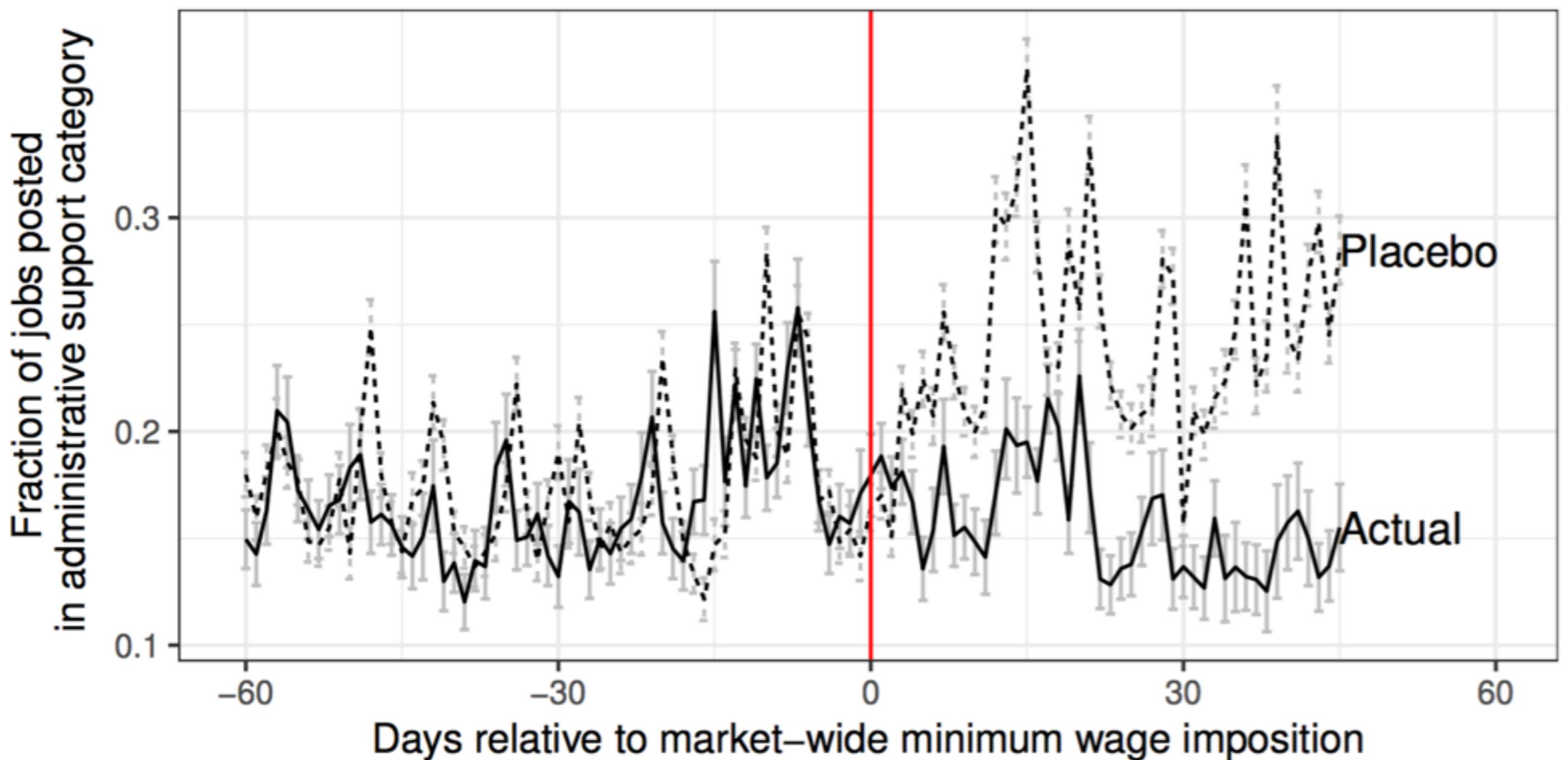


# Outcome: Hire made?

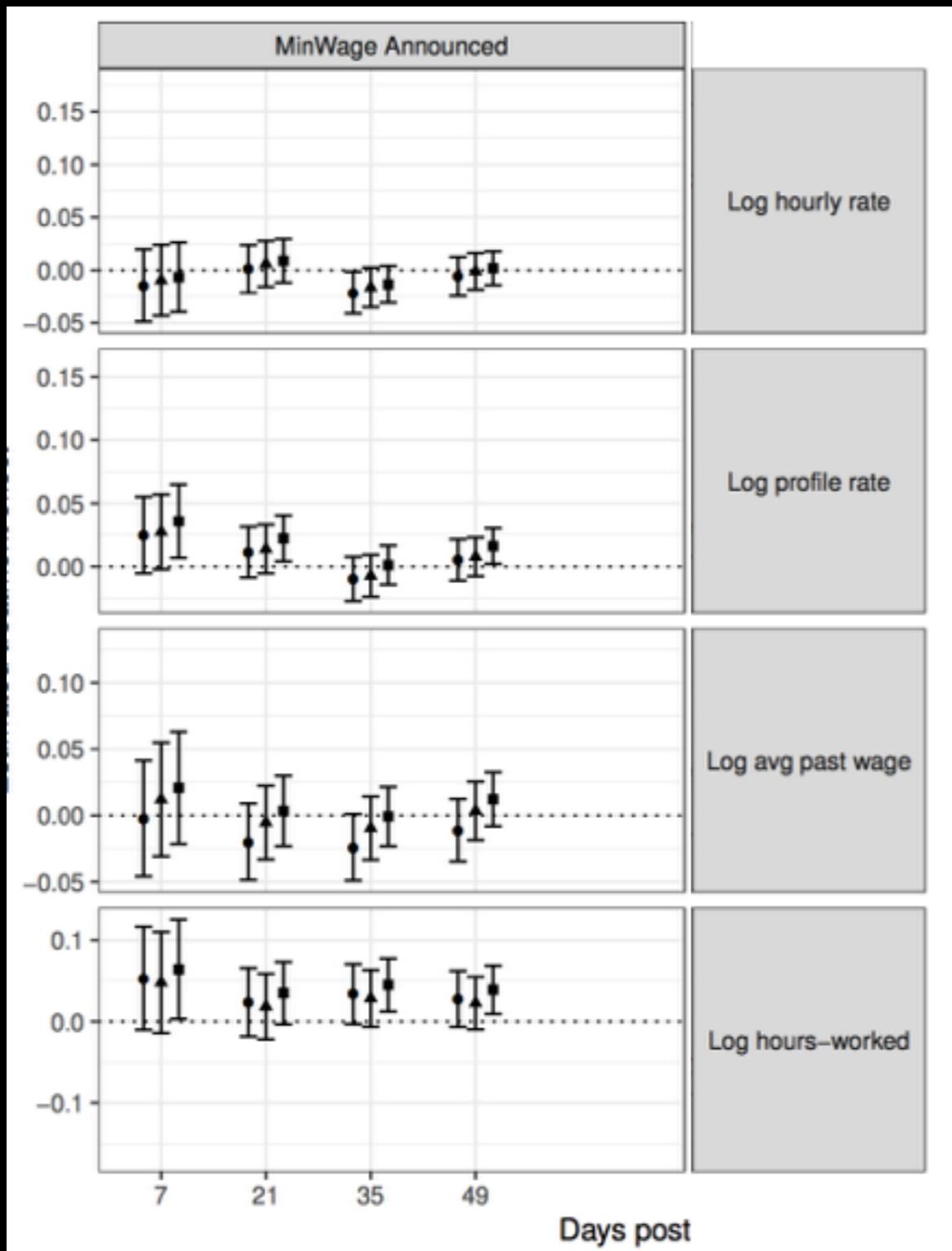
$$(Y_{post}^{Actual} - Y_{pre}^{Actual}) - (Y_{post}^{Placebo} - Y_{pre}^{Placebo})$$



# Daily fraction of job openings in administrative category



# Effects of MinWage announcement on filled opening outcomes

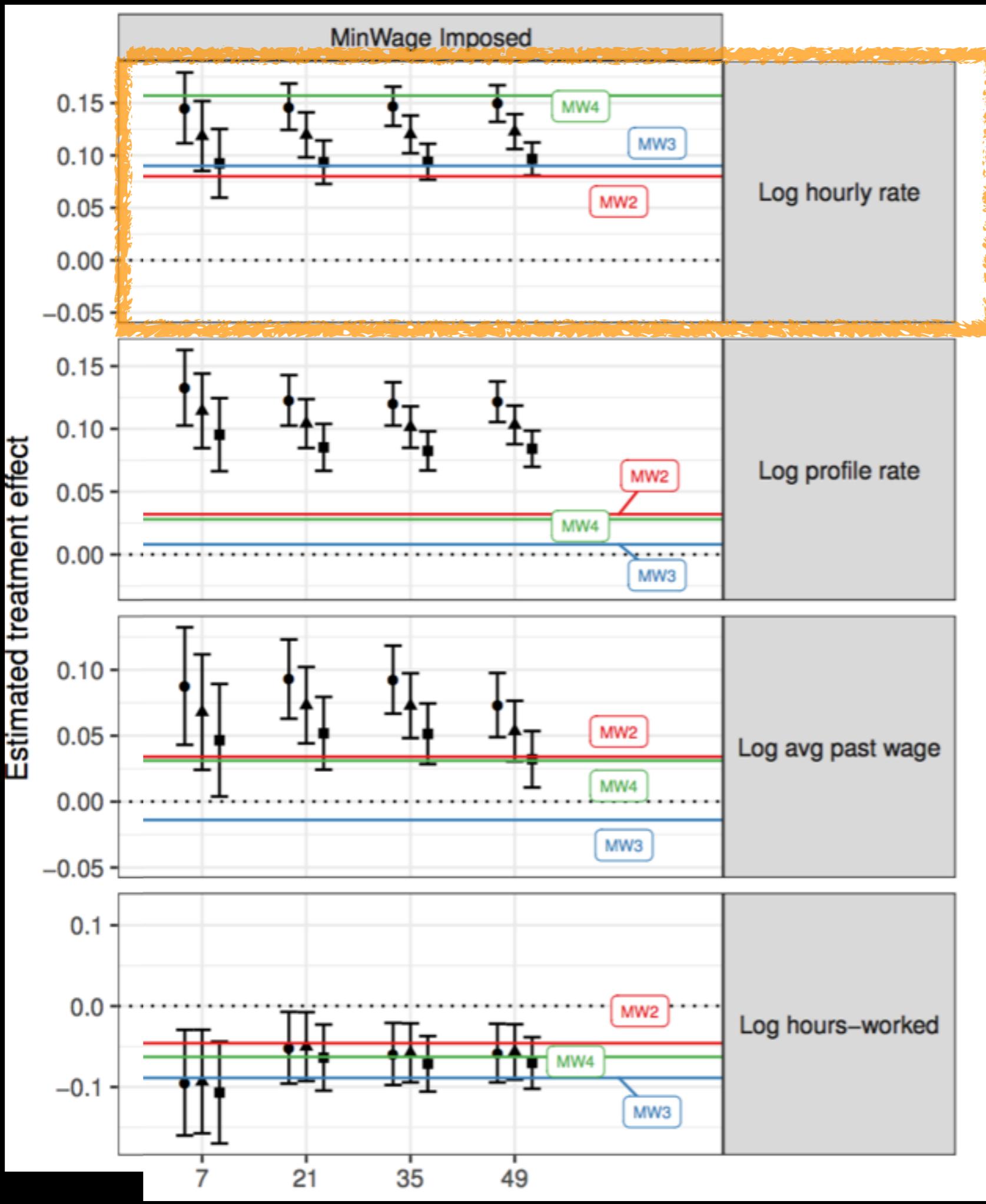


Hired worker wage

Hired worker profile rate

Hired worker past wage

Hours-worked

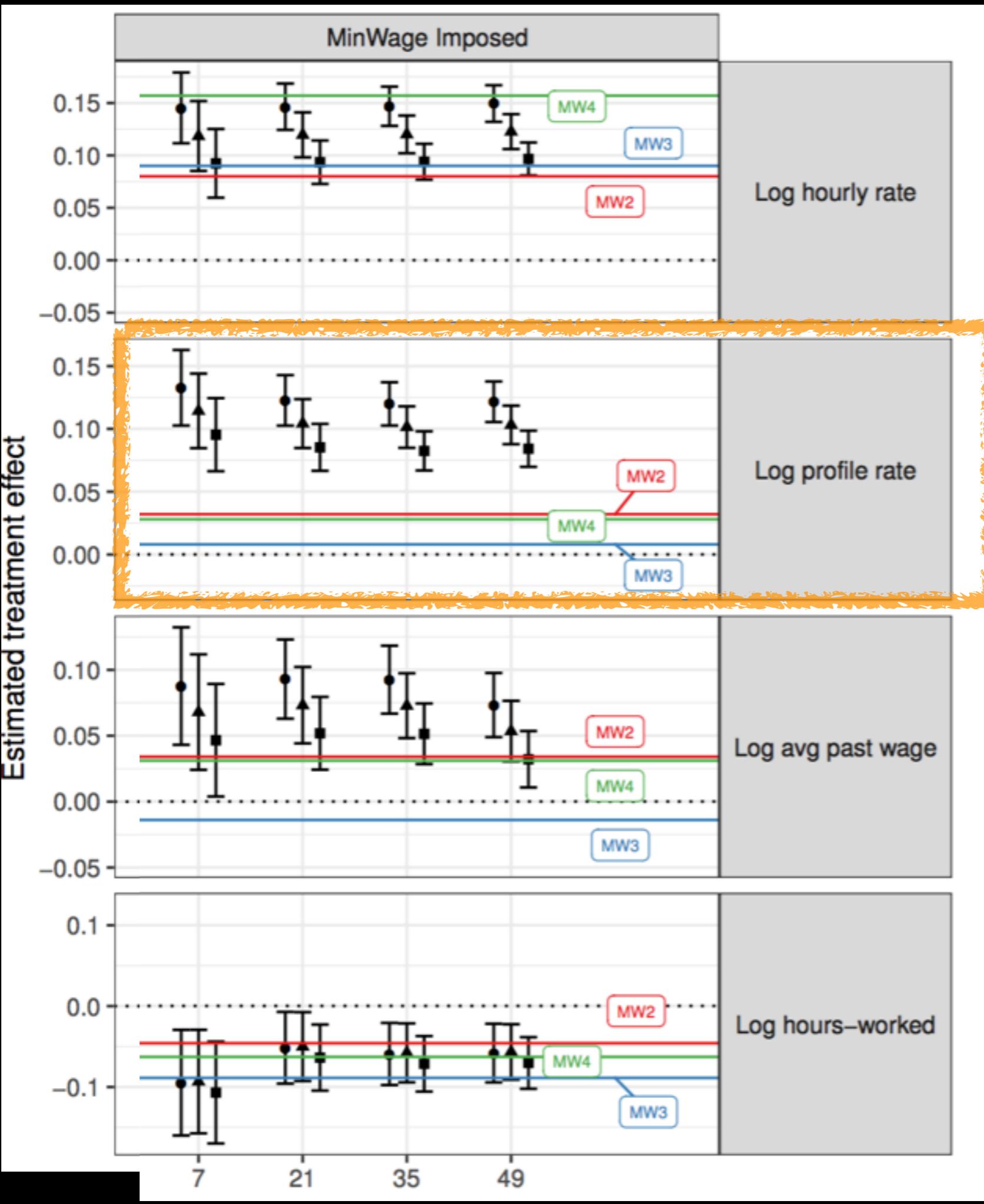


Wage

Profile Rate

Past wage

Hours-worked

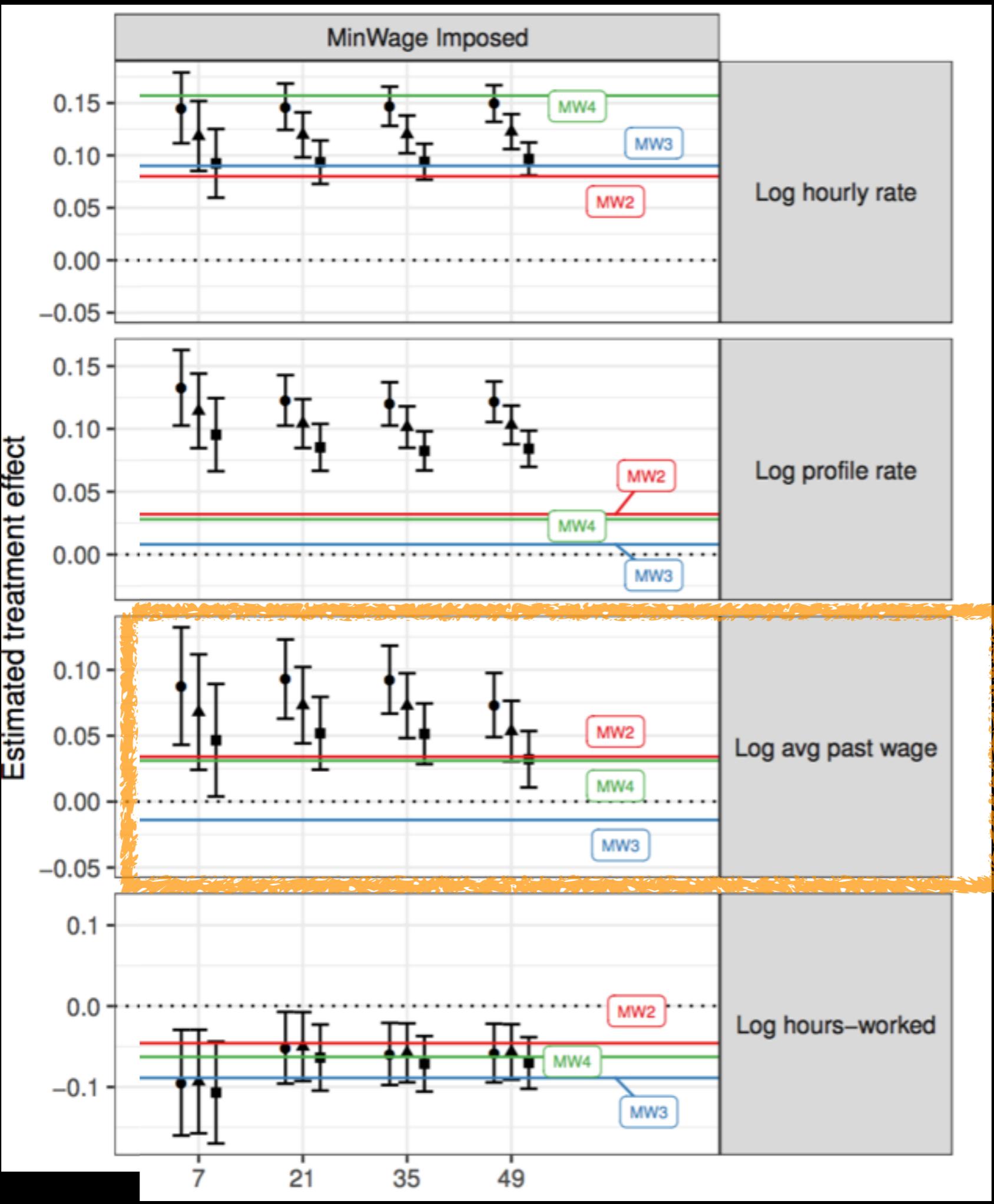


Wage

Profile Rate

Past wage

Hours-worked



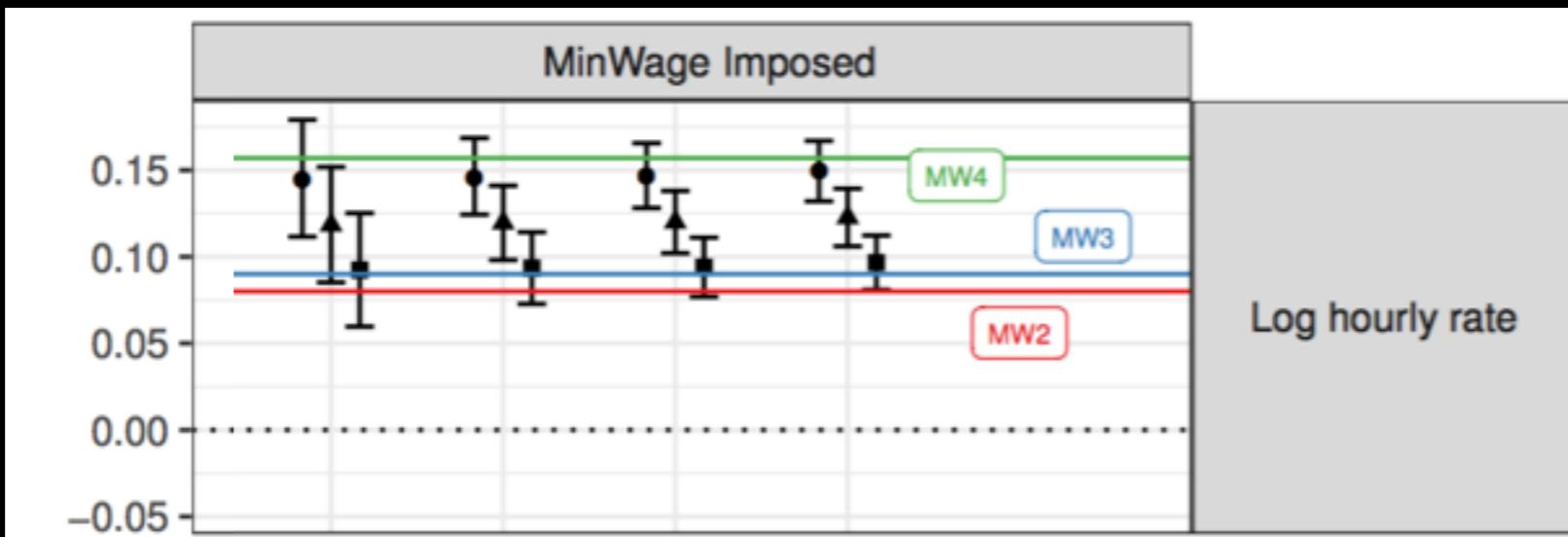
Wage

Profile Rate

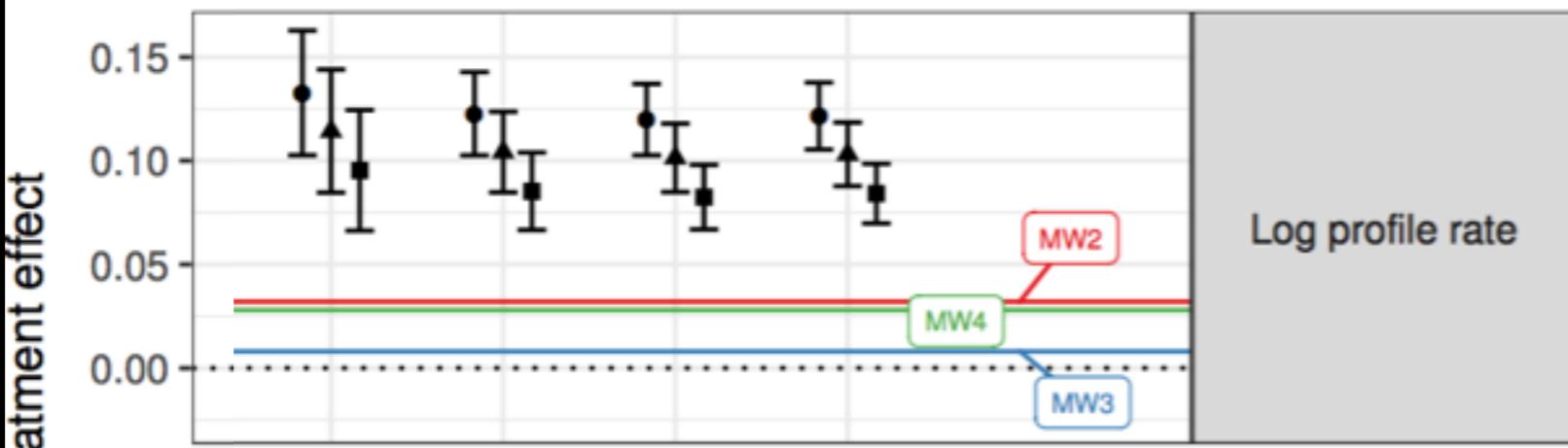
Past wage

Hours-worked

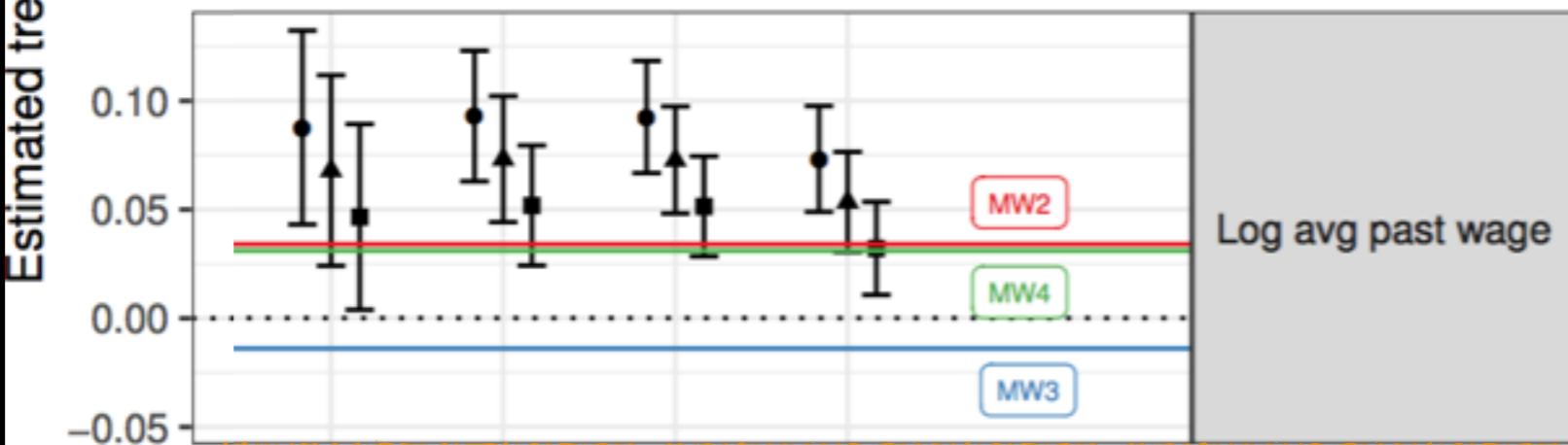
Wage



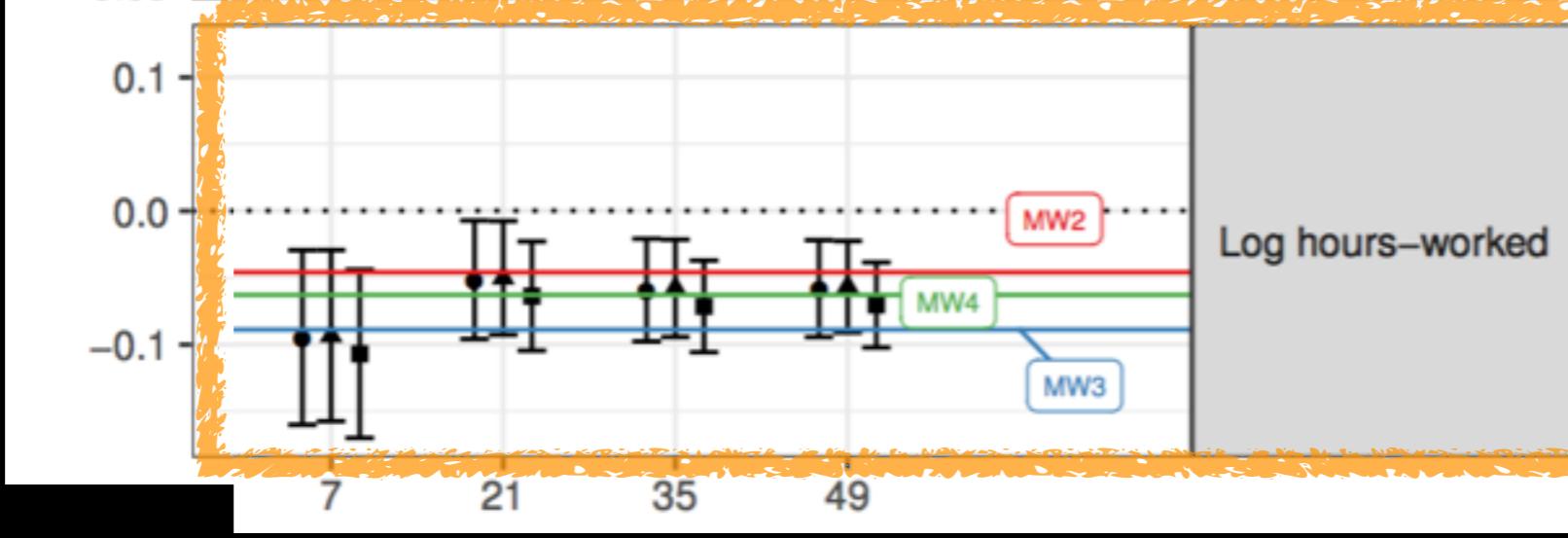
Profile Rate



Past wage



Hours-worked



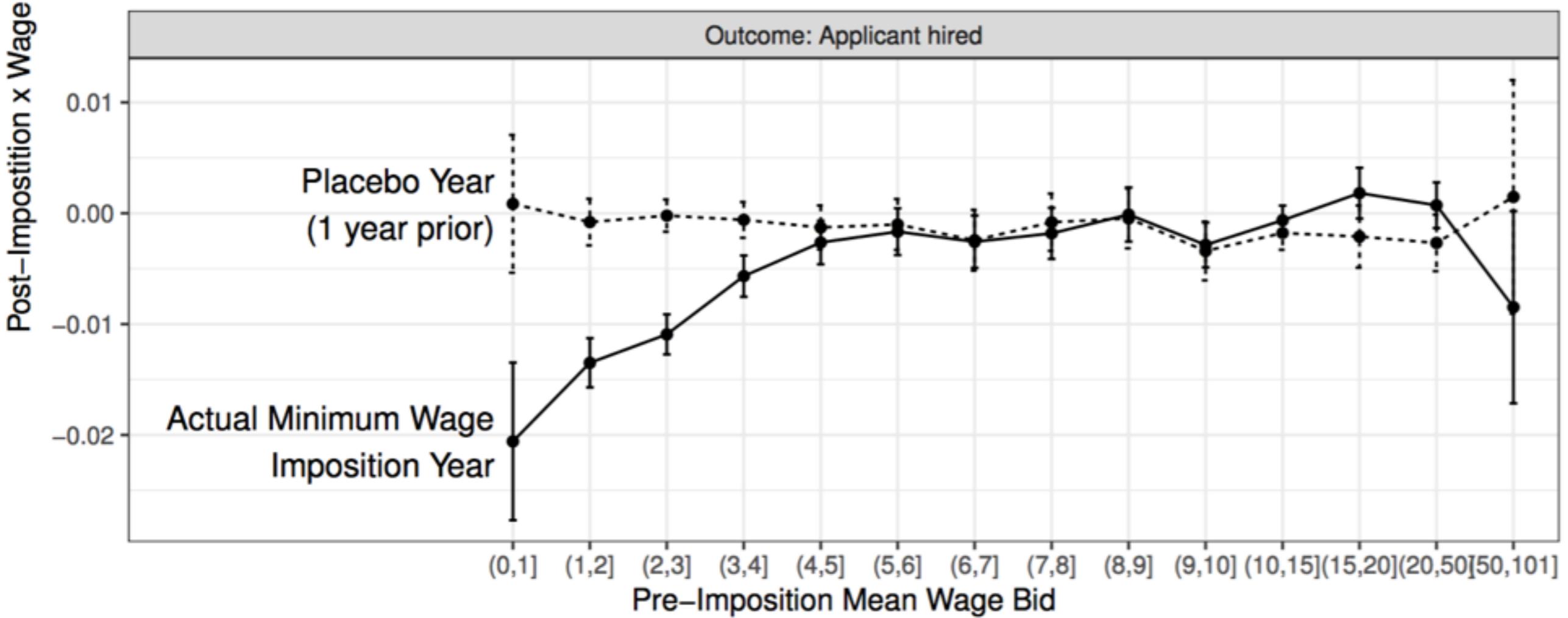
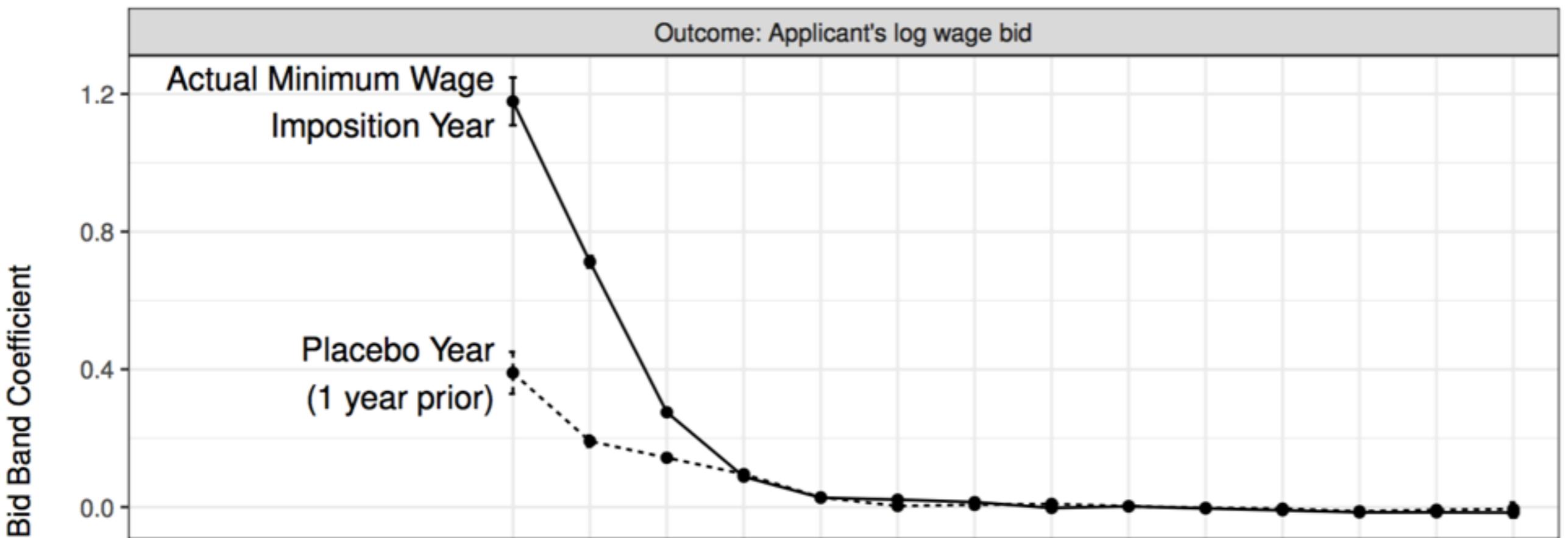
# Effects of imposition of worker bidding and hire rates

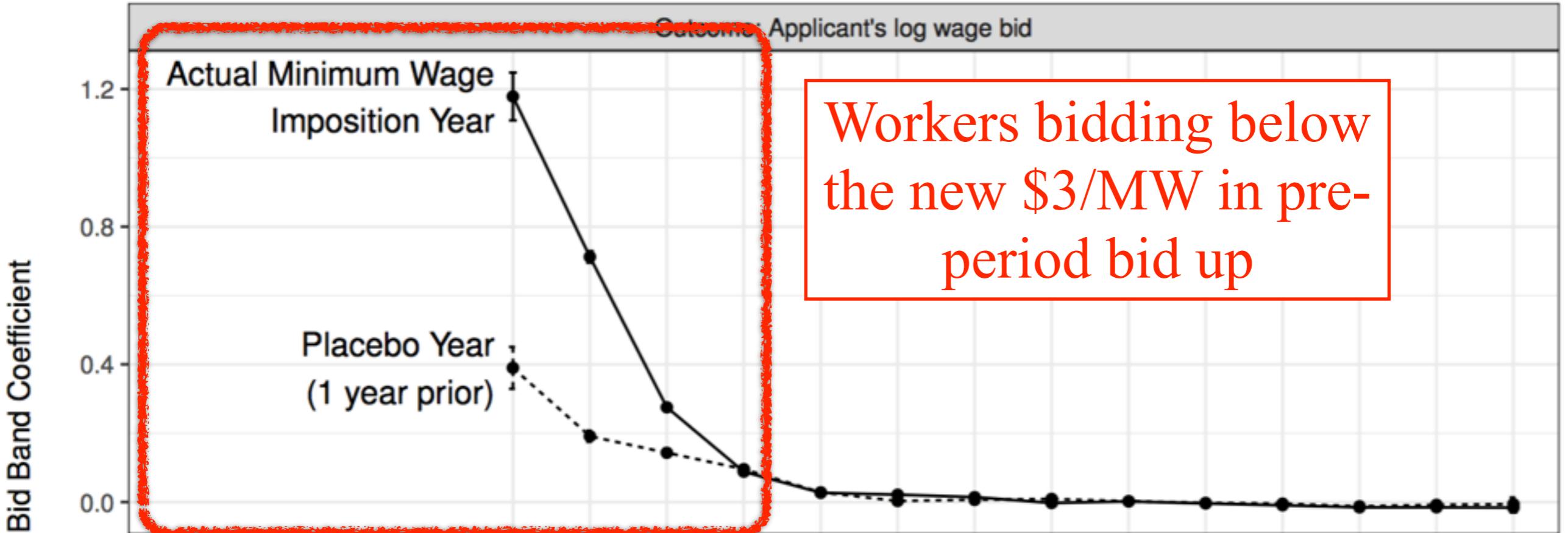
Indicator for application after the minimum wage is imposed

Indicators for average pre-period freelancer hourly wage bid

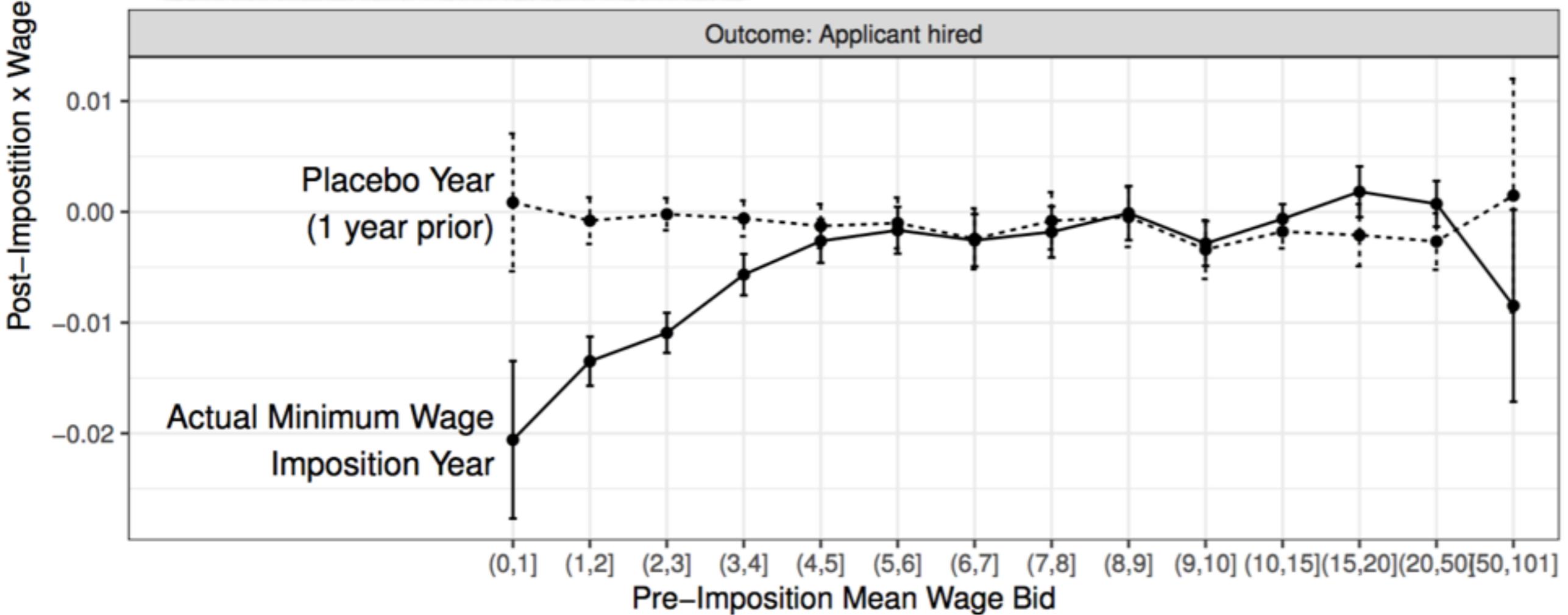
Worker FE

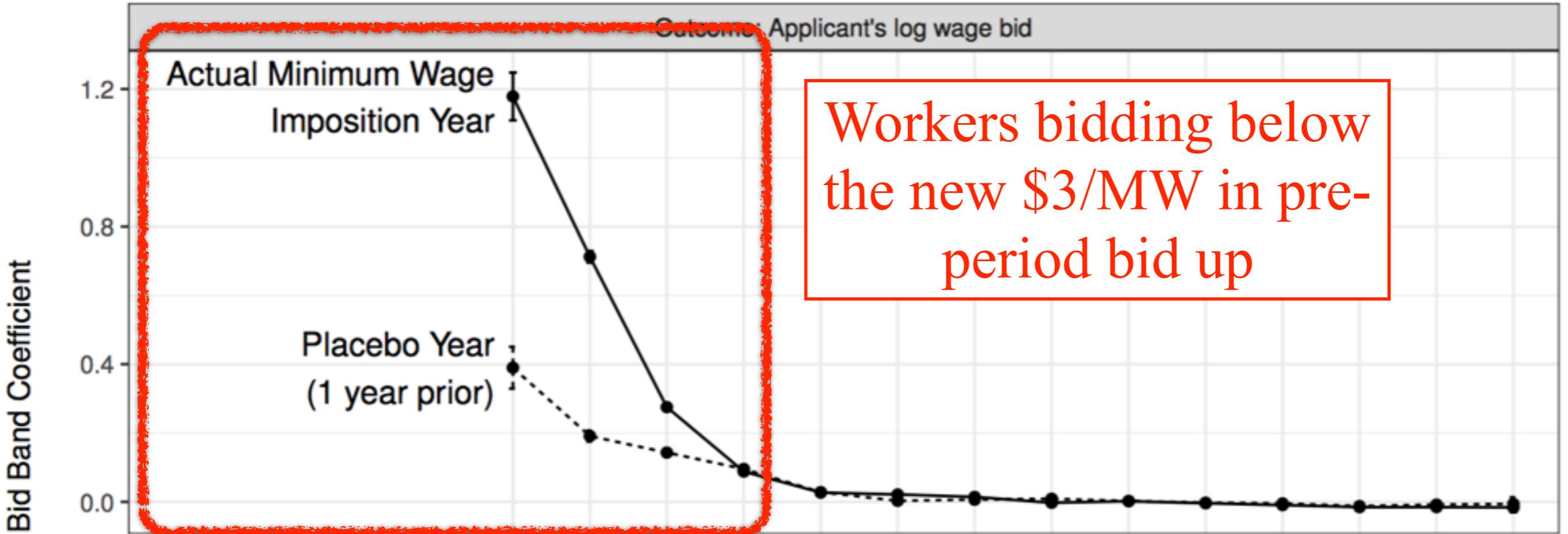
$$y_{ij} = \sum_{k \in K} \beta_k (\text{POST}_{ij} \times \text{PREWAGEBAND}_i^k) + c_i + \epsilon,$$



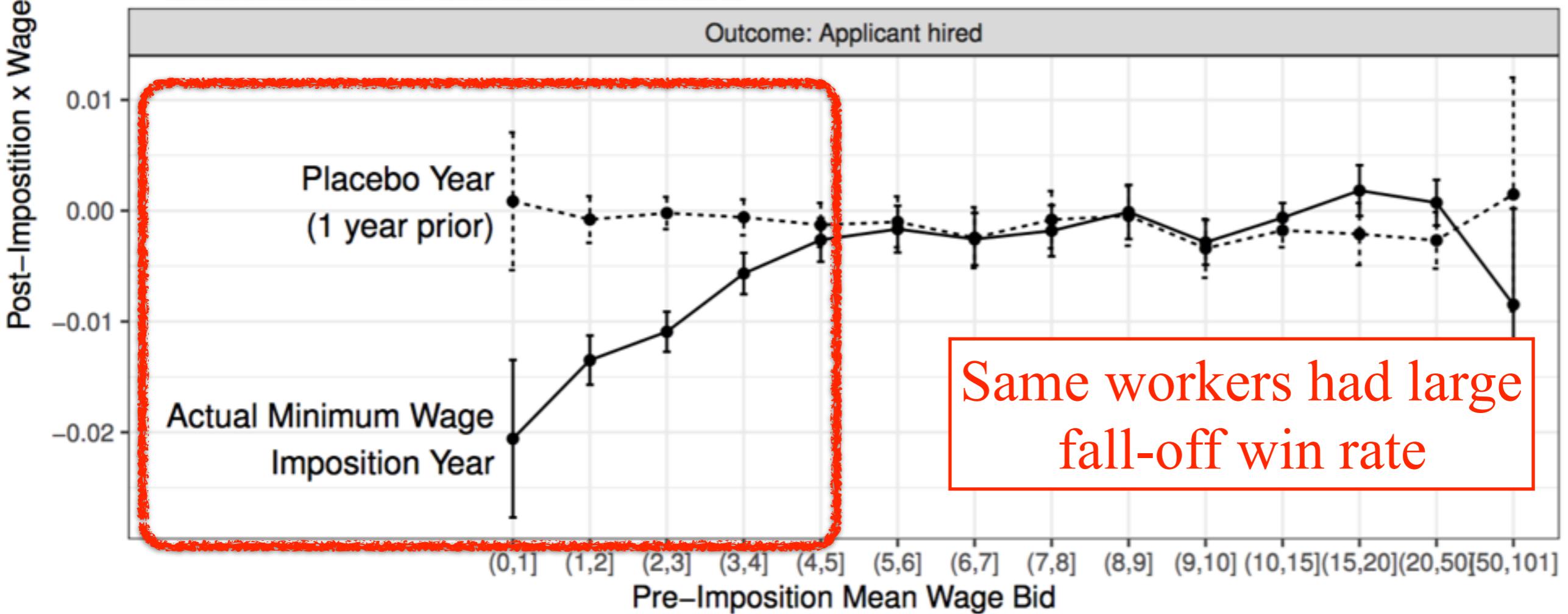


Workers bidding below  
the new \$3/MW in pre-  
period bid up





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



Same workers had large fall-off win rate

# 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](http://www.john-joseph-horton.com/papers/minimum_wage.pdf)