

Productivity Effects of Remote Work

Emma Harrington
University of Virginia

Puzzle

Remote work was rare in seemingly remotable jobs like call-center work & programming before Covid-19

Even though...

- **Strong demand** for WFH from workers (Mas & Pallais, 2017; He et al., 2021; Maestas et al., 2023; Lewandowski et al., 2024)
- **Positive immediate productivity effects** in an RCT in a Chinese travel agency (Bloom et al., 2015)

So were firms making mistakes? Or were other pieces to the puzzling rarity of remote work?

Working Remotely?

Selection, treatment, and the market for remote work

Natalia Emanuel	Emma Harrington
New York Federal Reserve Bank	University of Virginia

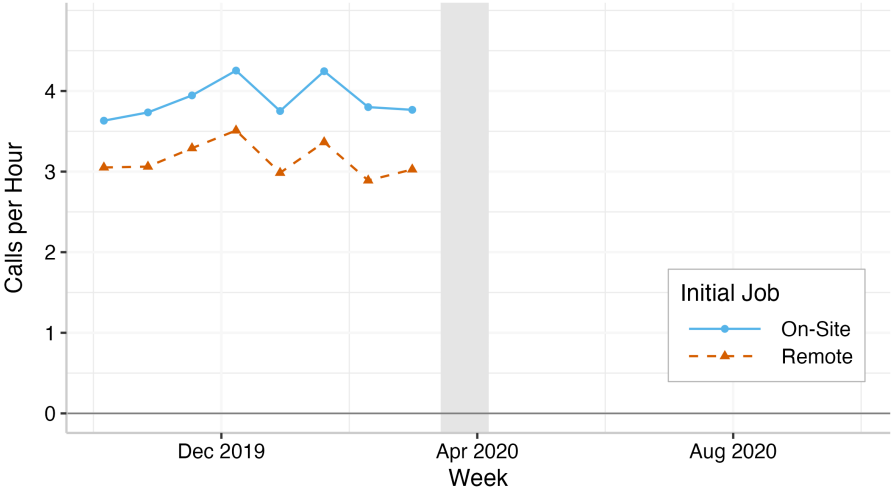
R&R at *AEJ: Applied*

Key features of context

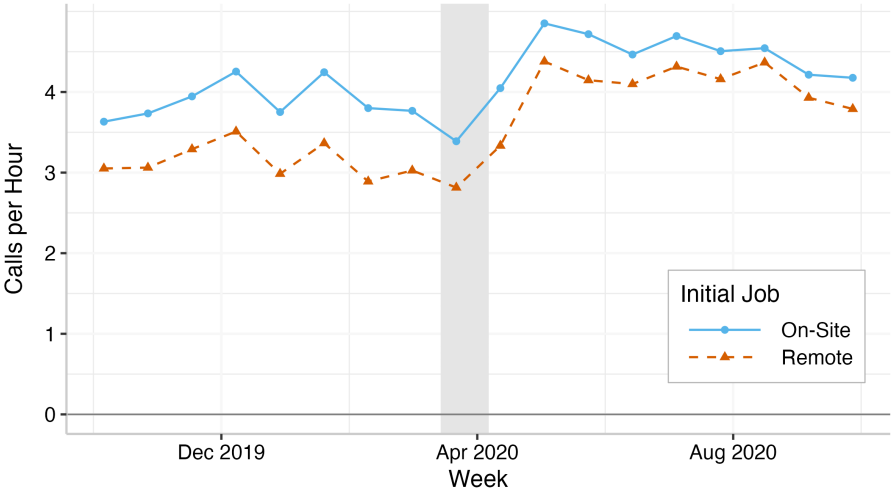
Data on call-centers at a Fortune 500 firm

- Firm hired both remote & on-site workers before Covid-19.
- Randomly routed calls between them

Remote Work and Calls Per Hour



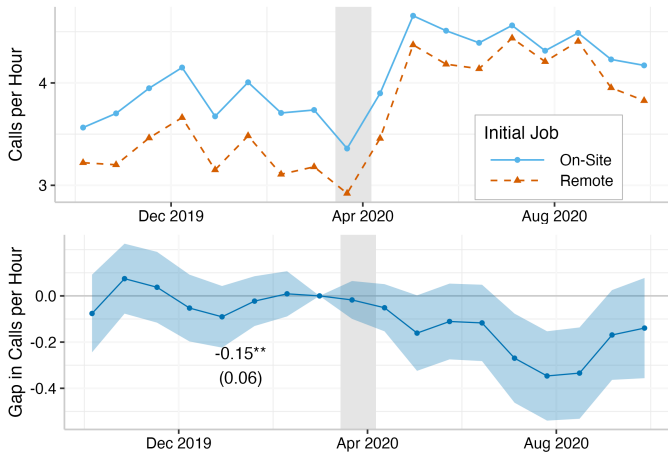
Remote Work and Calls Per Hour



Difference-in-Differences Design

[Details →](#)[Table →](#)[Pre-Covid Design →](#)

$$\text{Calls/Hour}_{i,t} = \beta \text{ Initially On-Site}_i \times \text{Post}_t + \mu_i + \mu_t + X'_{i,t}\kappa + \epsilon_{i,t}$$



Effects on Call Quality & Worker Development

Deterioration in call quality especially for less experienced workers →

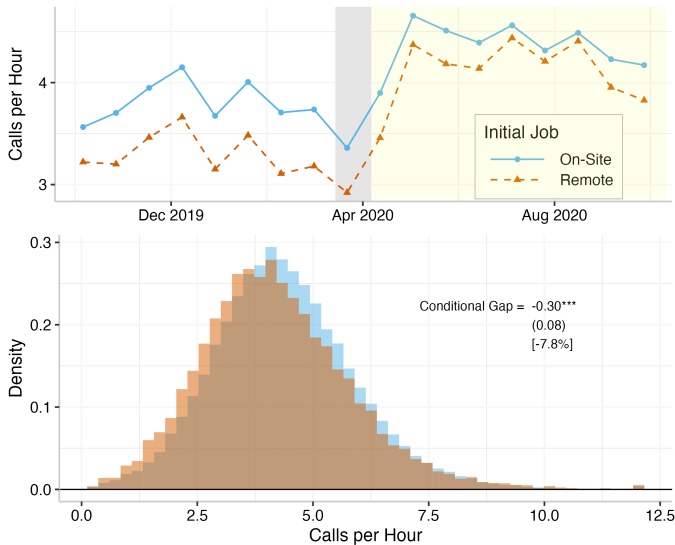
Remote work slows career progression

- Less one-on-one time with managers & in training sessions →
- Half the promotion rates as on-site workers →
- Gaps narrow when offices shut down

Selection into Remote Jobs

[Fade-out in Selection →](#)

[Table →](#)



The Firm's Pro/Con List

Pros of WFH

Cons of WFH

- Reduces productivity by 4%
 - Attracts workers who are 8% less productive
- Total reduction of 12%

The Firm's Pro/Con List

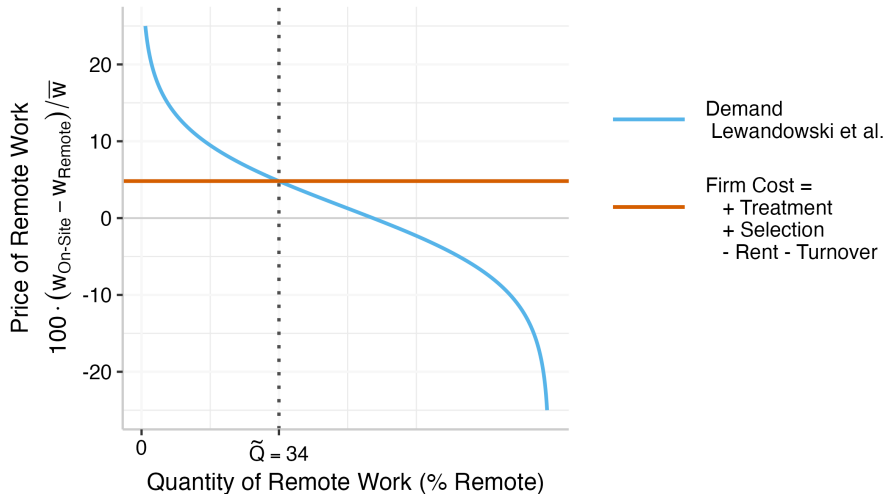
Pros of WFH

- Reduces office rents, worth 6% of labor costs
- Reduces attrition, worth 0.8% of labor costs

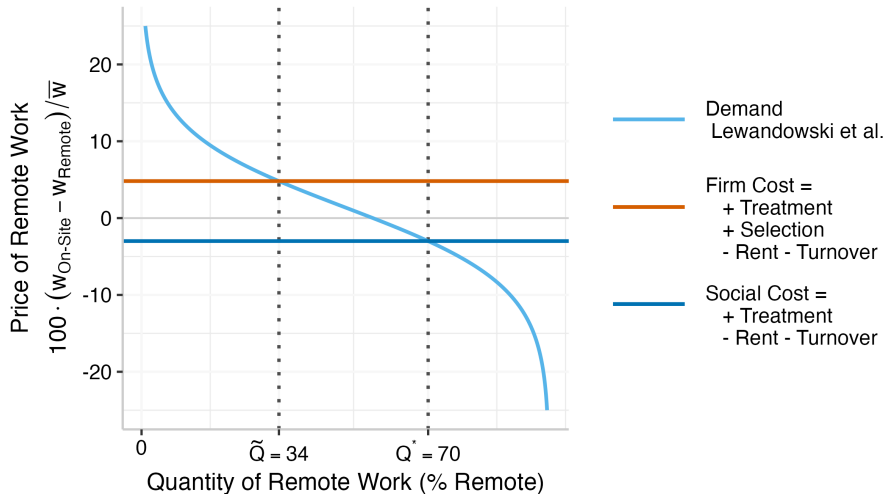
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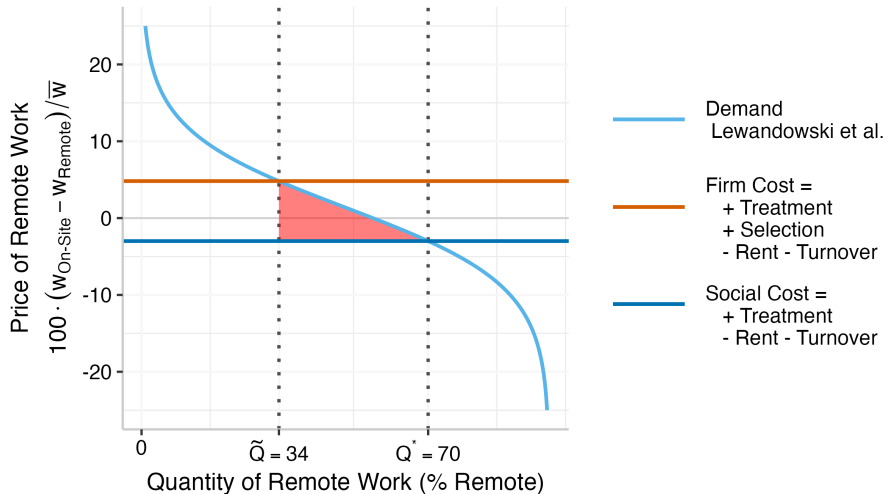
Market Provision of Remote Work



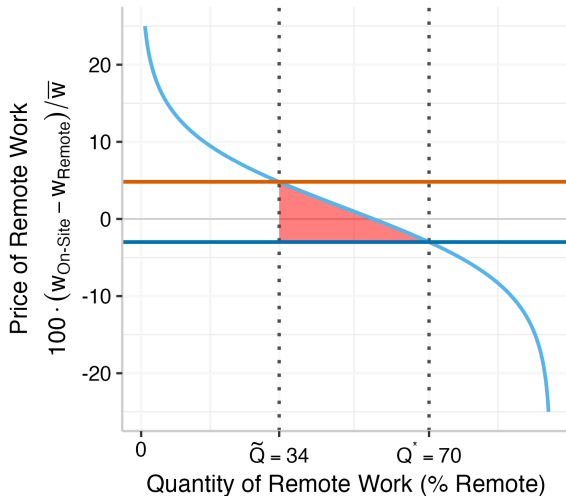
Market Provision of Remote Work



Market Provision of Remote Work



Market Provision of Remote Work



Summary: Remote work's rarity was more due to **adverse selection** than a **negative productivity effect**

The Power of Proximity to Coworkers

Training for Tomorrow or Productivity Today?

Natalia Emanuel
NY Fed

Emma Harrington
University of Virginia

Mandy Pallais
Harvard & NBER

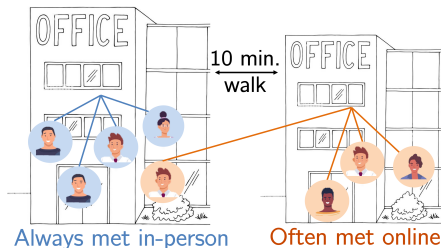
How does remote work affect mentorship & output?

- ▶ Software engineers at a Fortune 500 firm
 - ① Data on mentorship in code reviews & programming output

How does remote work affect mentorship & output?

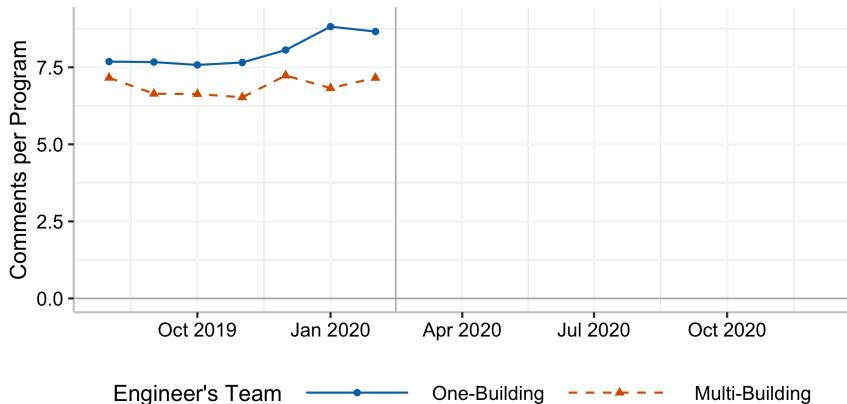
► Software engineers at a Fortune 500 firm

- ① Data on mentorship in code reviews & programming output
- ② Variation in proximity

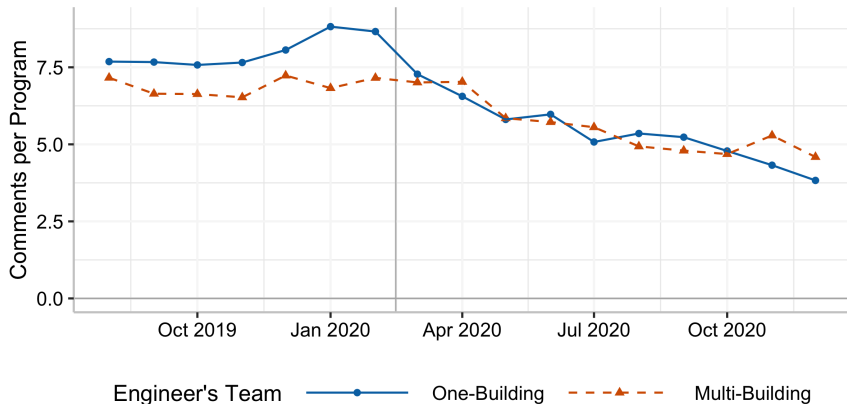


- **Offices open:** Difference in proximity
- **Offices closed:** Differential loss in proximity for previously co-located teams (diff-in-diff)

Proximity to Teammates and Online Feedback

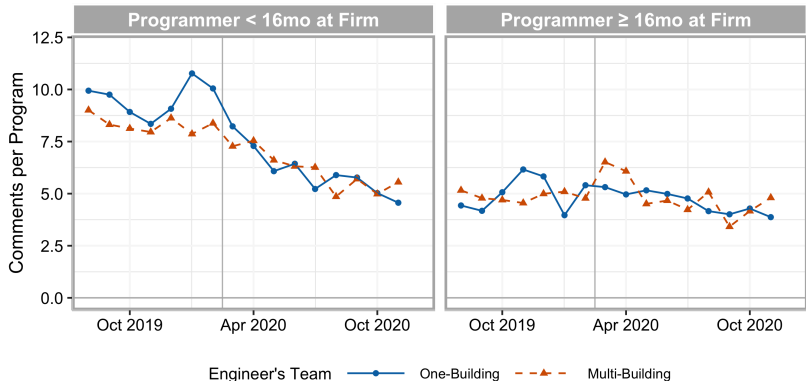


Proximity to Teammates and Online Feedback



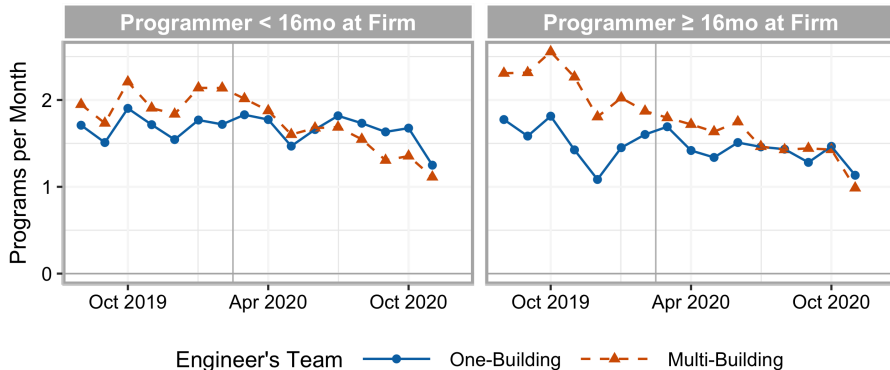
Evidence of Mentorship

Driven by feedback to junior engineers

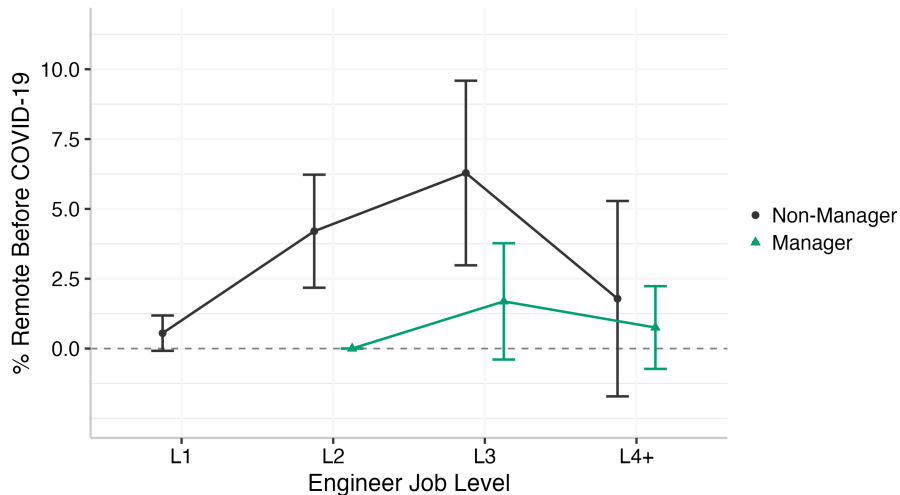


- Also impacts younger engineers with independent effect
- Disproportionately feedback from senior engineers

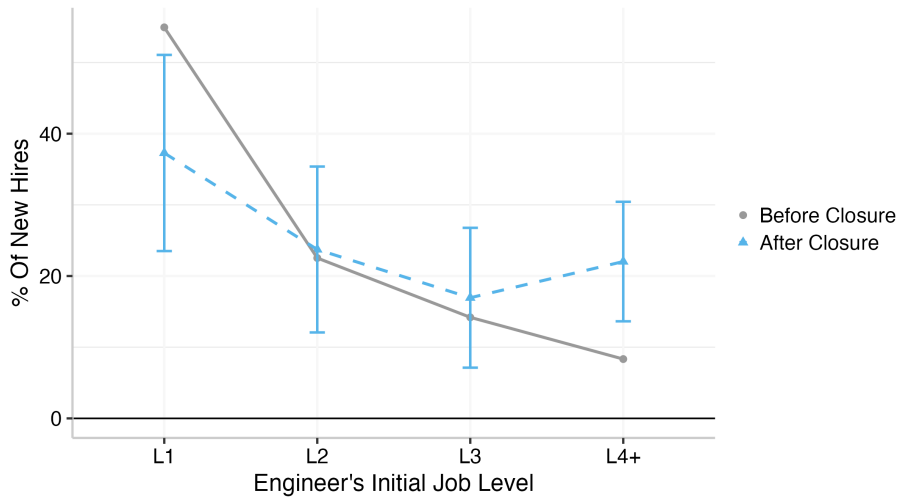
Mentorship has an Opportunity Cost



Firm policies seem to reflect tradeoff



Firm policies seem to reflect tradeoff



Summary of Results

- ① **Proximity increases online feedback for junior engineers**
 - Evidence that it's easier to ask for advice in-person
- ② **Mentorship has an opportunity cost**
 - Proximity reduces programming output, especially of senior engineers
- ③ **The tradeoffs show up in firm policies**
 - Firm required most junior & senior to be on-site pre-COVID and shifted to hiring more experienced workers post-COVID
- ④ **The tradeoffs from proximity are more acute for women** ⇒
 - ↑ junior women's training; ↓ senior women's output

Piecing Together the Puzzle

Immediate productivity effects of remote work unlikely to be key deterrent

- Positive immediate effects for the programmers
- Slightly negative effects in the call-center context
 - But outweighed by other savings

Evidence of longer-term productivity costs in both settings

- Reduced investments in workers' skills & reduced promotion rates

These **longer-term consequences in turn impact selection into remote work**, further compounding costs to the firm and potentially leading to an underprovision of remote work

Thank you!

Feedback welcome in-person or online
emma.k.harrington4@gmail.com

Difference-in-Differences Design

$$\text{Calls/Hour}_{i,t} = \beta \text{Initially On-Site}_i \times \text{Post}_t + \\ \phi \text{Initially On-Site}_i + \rho \text{Post}_t + X'_{i,t} \kappa + \epsilon_{i,t}$$

Observation: worker-day level and clustering by worker

Difference-in-Differences Design

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Observation: worker-day level and clustering by worker

Identifying assumption: remote and on-site workers face similar pandemic shocks

Difference-in-Differences Design

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Observation: worker-day level and clustering by worker

Identifying assumption: remote and on-site workers face similar pandemic shocks

Relax identifying assumptions with controls in $X_{i,t}$

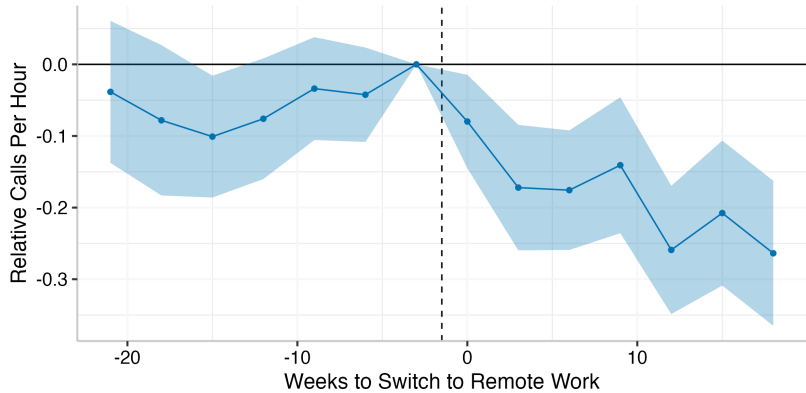
- *Preferred:* call-level x date x time-zone FE, gender x age x post FE, worker FE
- *Additional:* local Covid-19 cases & mother/father x post FE

Remote Work and Calls Per Hour

$$\text{Calls/Hour}_{i,t} = \beta \text{ Initially On-Site}_i \times \text{Post}_t + X'_{i,t}\kappa + \epsilon_{i,t}$$

	Calls per Hour					
	(1)	(2)	(3)	(4)	(5)	(6)
Initially On-Site x Post	-0.19*** (0.07)	-0.14** (0.07)	-0.16* (0.08)	-0.15** (0.06)	-0.15** (0.06)	-0.21*** (0.08)
Initially On-Site	0.39*** (0.06)	0.45*** (0.06)	0.45*** (0.08)			
Post	0.79*** (0.06)					
County Covid Cases/10K					0.02 (0.01)	0.01 (0.02)
Mother x Post						-0.04 (0.06)
Father x Post						-0.14 (0.13)
Pre Dependent Mean On-Site	3.8	3.8	3.8	3.8	3.8	3.8
Initially On-Site x Post in %	-5.1% (1.80)	-3.6% (1.80)	-4.1% (2.20)	-3.9% (1.60)	-3.9% (1.60)	-5.5% (2.00)

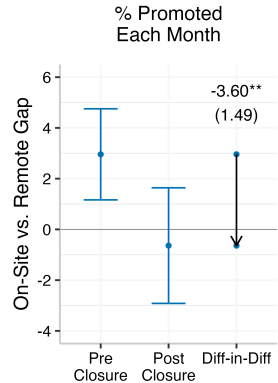
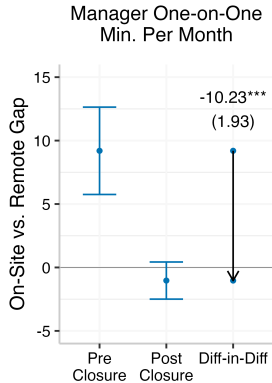
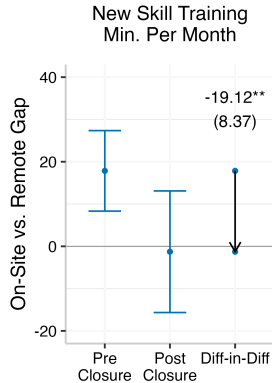
Pre-Covid Design



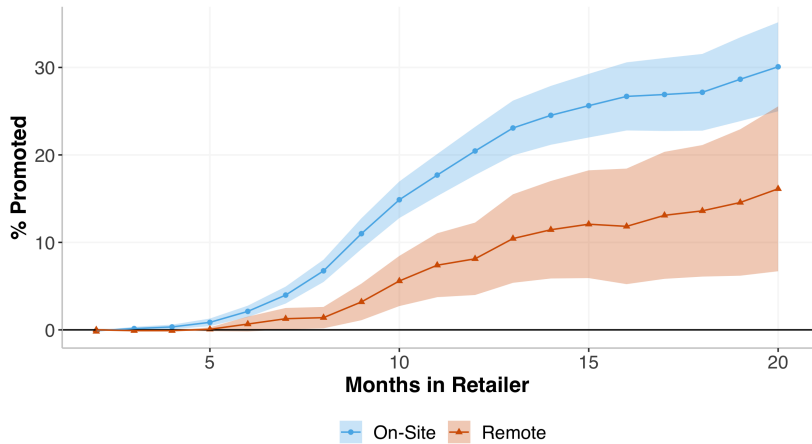
Remote Work and Call Quality

	Decomposition		Call Quality			
	% On Phone	<u>Min.</u> Call	<u>Hold Min.</u> Call	% Call Back (2 Day)	Satisfaction Rating	<u>Call Without Call Back</u> Hour
	(1)	(2)	(3)	(4)	(5)	(6)
Initially On-Site x Post	-1.99*** (0.54)	0.37* (0.22)	0.12** (0.05)	0.40** (0.20)	-0.002 (0.01)	-0.13** (0.05)
R ²	0.63	0.38	0.18	0.13	0.09	0.42
Pre Mean On-Site	74.3	13.2	1.1	15.8	4.9	3.2
Initially On-Site x Post in %	-2.7% (0.7)	2.8% (1.7)	10.6% (4.8)	2.5% (1.3)	-0.03% (0.20)	-4% (1.7)

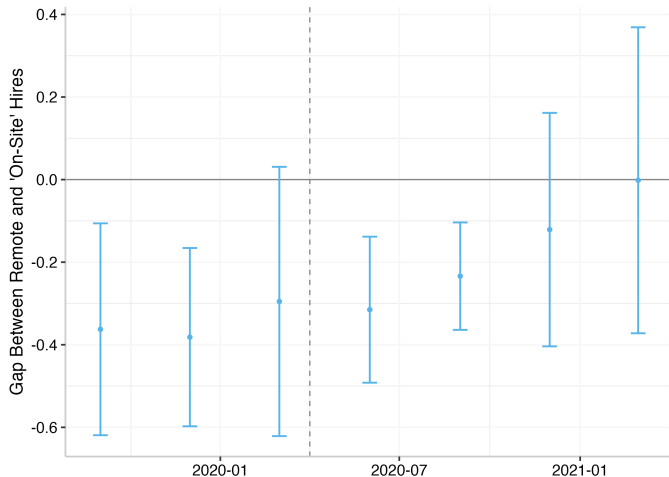
Career Consequences



Career Consequences



Fade-out in Selection

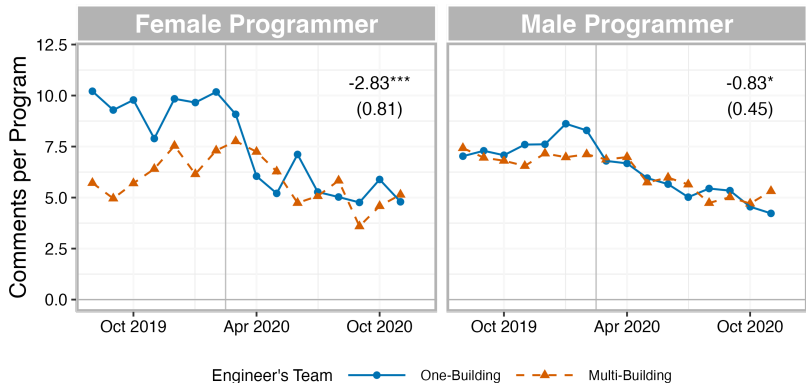


Selection

$$\text{Calls/Hour}_{i,t} = \alpha \text{ Initially On-Site}_i + X'_{i,t} \kappa + u_{i,t}$$

	Calls per Hour						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Initially Remote	-0.20*** (0.07)	-0.31*** (0.07)	-0.30*** (0.08)	-0.30*** (0.08)	-0.24*** (0.09)	-0.27** (0.11)	-0.21 (0.13)
County Covid Cases/10K				0.01 (0.02)	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)
Base Pay					0.06 (0.04)	0.04 (0.04)	0.07 (0.05)
Local Outside Option Pay in MSA						0.03 (0.03)	0.04 (0.03)
Unemployment Rate in MSA						-0.01 (0.02)	-0.004 (0.02)
Mother							0.07 (0.08)
Father							-0.04 (0.15)
Pre Dependent Mean On-Site	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Initially Remote in %	-5.3% (1.9)	-8.2% (1.9)	-7.8% (2.1)	-7.9% (2.1)	-6.4% (2.4)	-7.2% (2.9)	-5.6% (3.5)
Age x Gender FE		✓	✓	✓	✓	✓	✓
Call Queue FE			✓	✓	✓	✓	✓

By Gender



By Gender

