Is Working from Home Here to Stay?
Evidence from Job Posting Data and the COVID-19 Shock

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Outline

Motivation

- **Working from home (WFH) used to be an uncommon work arrangement**
  - ▶ Benefits of WFH: improve work efficiency (Bloom et al., 2015), save time and energy from long commutes, better flexibility and work-life balance, reduce office rental costs...
  - ▶ Potential barriers to WFH adoption: nature of work (Dingel and Neiman, 2020), managerial difficulties, transition costs, uncertainties about the benefits...

- **Jobs have to be done at home given COVID-19 human mobility restrictions**
  - ▶ Widely-adopted restrictions to contain the spread of the coronavirus
  - ▶ A natural experiment offering firms a "compulsory" trial session of WFH

- **Research questions:**
  - ▶ Can some barriers to WFH adoption be overcome by a short-period experience?
  - ▶ Will this short-period but intense WFH experience have a lasting impact?

Preview of This Paper

- **Our paper answers these questions using detailed job posting data in China**
  - ▶ Job postings capture labor demand and reflect future transitions in work arrangements

- **We find that both the number and the share of WFH job postings have increased significantly since the COVID-19 lockdown**
  - ▶ Firm composition change: New firms post half of the total WFH jobs
  - ▶ Within-firm transition: Existing firms also increase their WFH job vacancies
  - ▶ Firms' increased demand for WFH jobs is long-lasting in post-lockdown periods

- **Our DID analysis focuses on the structural change of labor demand toward WFH among existing firms**
  - ▶ We exploit the geographical variation in COVID-19 cases during the lockdown period
  - ▶ Within a firm, the impact is more pronounced in cities hit harder by COVID-19
  - ▶ Firms with less pre-COVID WFH hiring experience more significantly increase their WFH job postings, consistent with the learning hypothesis

The Literature

- **Impact of COVID-19 on WFH**
  - Barriers to WFH: Hall and Khan (2002), Bloom et al. (2013), Bloom et al. (2015)
  - Survey data: Barrero et al.(2021), Bick et al.(2021), Erdsiek (2021)
  - Job posting data: Adrjan et al. (2021) - OECD, Bloom et al. (2022) - around the world
  - Our paper offers empirical evidence from the largest developing country, which implemented strict national lockdown to combat virus

- **WFH and labor market inequality**
  - Gender and racial inequalities: Alon et al.(2020), Angelucci et al. (2020), Bick et al.(2020), Mongey and Weinberg (2020), Yancy (2020), Kawaguchi and Motegi (2021), Deryugina et al. (2021), Albanesi and Kim (2021), Deryugina et al. (2022)
  - Regional and income inequalities: Brynjolfsson et al. (2020), Irlacher and Koch (2021)
  - We examine cross-occupation heterogeneity and find WFH adoption higher among high-wage, high-edu, and non-entry-level jobs

- **Tech and the future of work**
  - Oettinger (2011), Golden et al. (2014), Katz and Krueger (2019)
  - We find that WFH jobs concentrate in new firms and IT industries

Outline

The COVID-19 Shock in China

- **COVID-19 outbreak and nationwide lockdown period:** January - March 2020
  - ▸ In mid-January 2020: outbreak in Wuhan city and quickly spread nationwide
  - ▸ By late January 2020: lockdown policies adopted by local governments across China
  - ▸ By mid-March 2020: under-control, daily confirmed cases drop to single digit
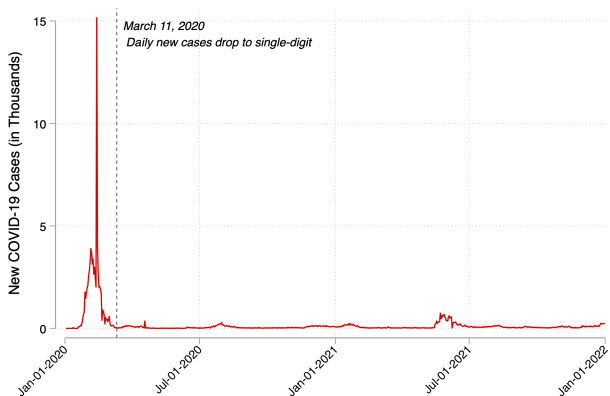
Online job posting data

- Data source
  - Zhaopin.com, one of the largest online job market platforms in China
  - Nearly 4 million online job postings, a roughly 7% random sample of the universe of job postings between December 2017 and June 2021
  - We cannot observe firms' WFH arrangement for existing workers; however, job posting data represent future labor demand

- Job posting information
  - Job entry info: date of the posting, type of the position, occupation code, number of workers to be hired, location, wage range, education requirement, work experience requirement, full job descriptions
  - Posting firm info: firm ID, industry, firm size, firm type

- Occupation-level teleworkability à la Dingel and Neiman (2020)

Sample and Variable Construction

- Sample period: December 2017 - December 2021
  - We exclude the educational service industry, which was overhauled in June 2021 by a government policy banning for-profit cram study sessions
- Step 1: Identify WFH jobs using keyword search in job posting full text
  - WFH keywords: working from/at home, remote working, etc.
- Step 2: Trace back non-WFH job posting history of WFH firms
  - More than 20,000 firms with at least one WFH job posting during the sample period
- key variable: WFH ratio in firms' job postings:

$$WFHRatio_{fct} = \frac{WFH_{fct}}{WFH_{fct} + (nonWFH_{fct}/7\%)} * 100$$

  - $(non)WFH_{fct}$: Number of (non-)WFH jobs posted by firm f in city c in month t
  - Captures the structural change toward WFH in firms' labor demand

Empirical Methodology: Difference-in-Differences Approach

- DID exploiting geographical variation in the COVID-19 shock

$$WFHRatio_{fct} = \alpha + \beta Covid_c \times Post_t + \mathbf{X}_{ct}\eta + \gamma_f + \gamma_c + \gamma_t + \varepsilon_{fct} \qquad (1)$$

- Key variables in the firm-city-month panel:
  - *Covid*: short for $ln(COVIDcases_c)$, log value of accumulated COVID-19 cases in city c as of March 2020;
  - $Post_t = 1$ for months after January 2020 and 0 otherwise
  - $\mathbf{X}_{ct}$ include GDP (log), population (log), and GDP share of the secondary industry
  - γ_f, γ_c, and γ_t are firm, city, and year-month fixed effects, respectively
  - Standard errors are clustered at the city level and presented in the parentheses
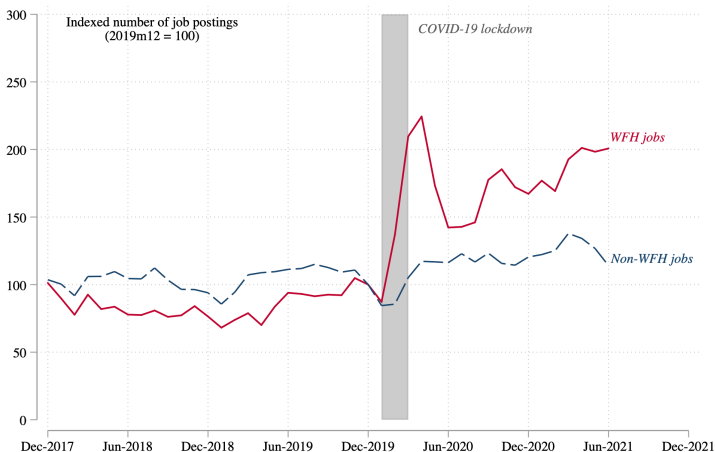
Outline

The Rise of WFH after COVID-19

- A substantial increase in WFH job postings after COVID-19
- Other alternative work arrangement (AWA) jobs are not affected
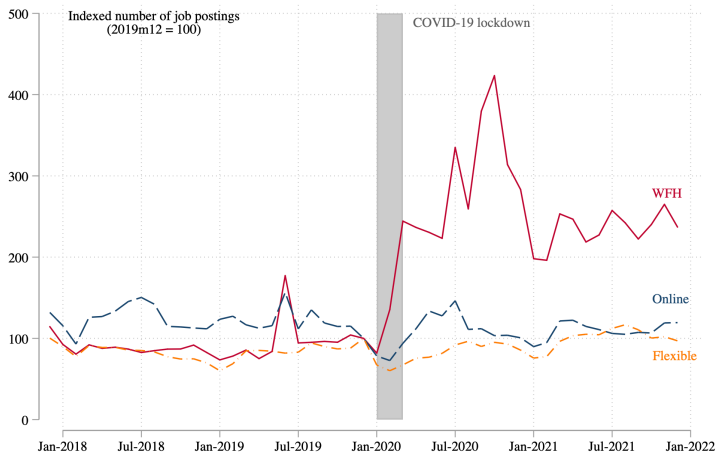
WFH and Non-WFH Job Postings by Same Firms

- The increase in WFH job postings is persistent within the same group of firms

Indexed number of job postings (2019m12 = 100). COVID-19 lockdown. WFH jobs. Non-WFH jobs.
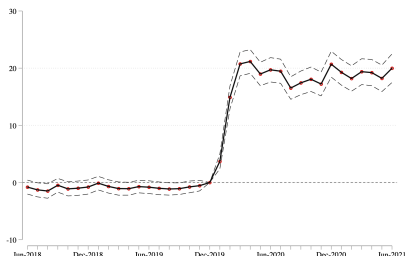
Firm-City-Month-Level DID Regressions

- Within a firm, the WFH job posting ratio is higher after the COVID-19 shock in cities hit harder by the COVID-19 shock
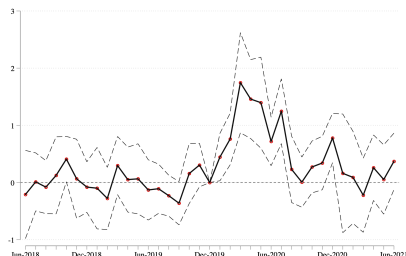
	Full sample		Excl. Hubei		Excl. Hubei and far	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Ratio of WFH Job Postings						
Covid × post	0.727***	0.694***	1.136***	1.085***	1.065***	1.015**
	(0.131)	(0.158)	(0.374)	(0.404)	(0.397)	(0.424)
N	194,242	180,762	189,640	176,285	187,515	174,567
Adj. R^2	0.592	0.589	0.590	0.587	0.588	0.585
Panel B: Number of WFH Job Postings						
Covid × post	0.011***	0.010***	0.018***	0.018***	0.017***	0.017***
	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)	(0.006)
N	194,242	180,762	189,640	176,285	187,515	174,567
Adj. R^2	0.553	0.556	0.553	0.556	0.552	0.555
Panel C: Number of Non-WFH Job Postings						
Covid × post	-0.028***	-0.027***	-0.040***	-0.039***	-0.038***	-0.037***
	(0.005)	(0.005)	(0.009)	(0.010)	(0.010)	(0.010)
N	194,242	180,762	189,640	176,285	187,515	174,567
Adj. R^2	0.584	0.581	0.582	0.579	0.580	0.577
All Panels						
Controls		Y		Y		Y

Pre-Trend Analysis

- The WFH job posting patterns of a firm's city branches are not significantly different prior to the COVID-19 shock, ruling out the possibility that pre-existing firm-city characteristics drive the results

(a) Firm-Month Regression

(b) Firm-City-Month Regression

Placebo Tests with False COVID Shock Months

- No significant results when we change the timing of the treatment

	Y: Ratio of WFH Job Postings, Firm-City-Month Level					
	Full sample		Excl. Hubei		Excl. Hubei and far	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: False COVID-19 Month in January 2019						
Covid $\times$ Post2019m1	-0.007	-0.004	-0.076	-0.083	-0.057	-0.088
	(0.147)	(0.152)	(0.153)	(0.155)	(0.153)	(0.158)
N	158,803	150,435	155,613	147,257	154,300	146,104
Adj. R^2	0.604	0.603	0.603	0.602	0.601	0.600
Panel B: False COVID-19 Month in July 2019						
Covid $\times$ Post2019m7	0.065	0.078	0.055	0.050	0.045	0.027
	(0.118)	(0.129)	(0.143)	(0.150)	(0.146)	(0.153)
N	158,803	150,435	155,613	147,257	154,300	146,104
Adj. R^2	0.604	0.603	0.603	0.602	0.601	0.600
Panels A and B						
Controls		Y		Y		Y
Firm F.E.	Y	Y	Y	Y	Y	Y
City F.E.	Y	Y	Y	Y	Y	Y
Year-Month F.E.	Y	Y	Y	Y	Y	Y

Outline

Learning Hypothesis

- More pronounced impact on firms which already started posting WFH job ads prior to COVID-19, indicating the substitution role of WFH

	Y = Ratio of WFH Job Postings					
	Includ. lockdown period			Exclud. lockdown period		
	(1) Full sample	(2) Ftype = 0	(3) Ftype = 1	(4) Full sample	(5) Ftype = 0	(6) Ftype = 1
Panel A: Pre-COVID WFH Hiring Experience						
WFHratio2019 × post	-0.298***	-0.167***	.	-0.347***	-0.185***	.
	(0.017)	(0.018)	.	(0.022)	(0.021)	.
Firm FE	Y	Y	.	Y	Y	.
Year-Month FE	Y	Y	.	Y	Y	.
N	97,825	61,326	.	89,354	56,459	.
Adj. R^2	0.472	0.486	.	0.475	0.484	.
Panel B: WFH Hiring Experience during Lockdowns						
wfhtrial × post	0.196***	0.211***	0.526***	0.042**	0.097***	0.284***
	(0.014)	(0.015)	(0.030)	(0.017)	(0.018)	(0.035)
Firm F.E.	Y	Y	Y	Y	Y	Y
Year-Month F.E.	Y	Y	Y	Y	Y	Y
N	97,825	61,326	36,499	89,354	56,459	32,895
Adj. R^2	0.471	0.489	0.353	0.470	0.483	0.346

Is WFH a privilege? Heterogeneity Analysis

	Wage		Education		Work Exp.		Teleworkability	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Y = Ratio of WFH job postings with **high** levels								
Covid $\times$ post	0.458***	0.423***	0.588***	0.627***	0.447***	0.404***	0.922***	0.906***
	(0.097)	(0.099)	(0.185)	(0.178)	(0.115)	(0.109)	(0.167)	(0.148)
N	187,515	174,567	187,515	174,567	187,515	174,567	187,515	174,567
Adj. R^2	0.572	0.578	0.595	0.601	0.587	0.589	0.568	0.569
Panel B: Y = Ratio of WFH job postings with **medium** levels								
Covid $\times$ post	0.706***	0.736***	0.527**	0.461*	0.357*	0.354*	0.127	0.150
	(0.205)	(0.213)	(0.235)	(0.238)	(0.197)	(0.214)	(0.385)	(0.380)
N	187,515	174,567	187,515	174,567	187,515	174,567	187,515	174,567
Adj. R^2	0.543	0.541	0.560	0.555	0.545	0.546	0.648	0.648
Panel C: Y = Ratio of WFH job postings offering **low** levels								
Covid $\times$ post	-0.168	-0.122	0.188*	0.171			0.030	-0.029
	(0.232)	(0.232)	(0.106)	(0.131)			(0.099)	(0.125)
N	187,515	174,567	187,515	174,567			187,515	174,567
Adj. R^2	0.576	0.577	0.596	0.599			0.557	0.555
Panels A, B, and C								
Controls		Y		Y		Y		Y
Firm F.E.	Y	Y	Y	Y	Y	Y	Y	Y
City F.E.	Y	Y	Y	Y	Y	Y	Y	Y
Year-Month F.E.	Y	Y	Y	Y	Y	Y	Y	Y

Outline

Takeaways

- **We find a significant, persistent increase in WFH job postings after COVID-19**
  - ▸ New firm entry contributes more than half of the WFH job postings
  - ▸ Existing firms increase their WFH jobs and reduce non-WFH jobs

- **COVID-19 serves as a catalyst for firms to overcome WFH adoption barriers**
  - ▸ Within the same firm, establishments in cities hit harder by COVID experience larger increase in WFH job ratios in the post-lockdown period
  - ▸ The impact on WFH transition in labor demand is more pronounced in firms with lower pre-COVID WFH hiring experience, consistent with the learning hypothesis
  - ▸ the development of the digital economy drives long-term supply of WFH jobs

- **Future research directions and policy implications**
  - ▸ Job applicant data: gender inequality, skill mismatch
  - ▸ Labor market inequality: welfare program for non-WFH, low-income jobs