

# MEASURING THE IMPACT OF REMOTE [KNOWLEDGE] WORK USING BIG DATA

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# THIS IS AN AMBITIOUS PAPER USING NEW/IMPRESSIVE DATA ON:

**Working from home (WFH) based on employee IP addresses**

**Firm tax information (IRS/Treasury)**

**Firm IT usage**

**Mobility and pandemic restrictions (Safegraph, etc.)**

**Employee characteristics (scraped from LinkedIn, etc., & job posting)**

## WITH SOME PROVOCATIVE RESULTS

**30% Increase in “Remote IP” Work-Related Traffic in 2020 (i.e., mobile, residential, VPN)**

- ▶ Validated vs. mobility, restrictions, commute times
- ▶ Larger for firms with more *managers, IT use*

**Sales, Total Income, Costs, Compensation vs. Remote Work:**

- ▶ **Zero/Negative** relation under OLS
- ▶ **Positive** under IV, 1st Stage **Remote Work** ~ **Commuting Times**

**Driven by Small, Tradable Firms, Investment in Managers & IT**

# MY DISCUSSION

## Contribution to the Literature

- ▶ Measurement
- ▶ WFH and individual businesses

What are the Economics?

What is the (Verbal or Explicit) Model?

Data Transparency

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- ▶ **Measurement**
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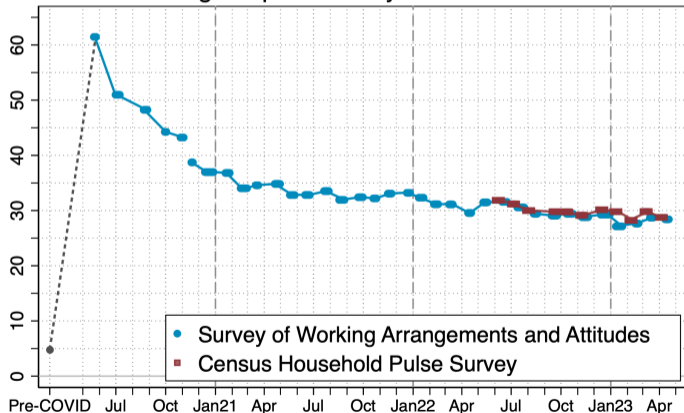
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# MEASURING WFH IS MORE OR LESS SETTLED: BARRERO ET AL. (2021)

Percentage of paid full days worked from home



**Notes:** Data are from the May 2020 to April 2023 SWAA waves and from the Census Household Pulse Survey. We re-weight raw responses to match 2010-2019 CPS pop. by {age × sex × education × earnings} cell.

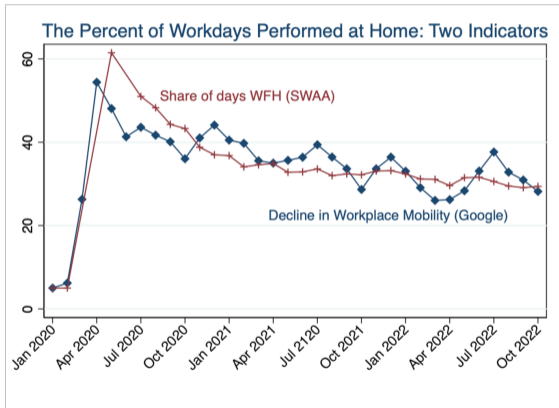
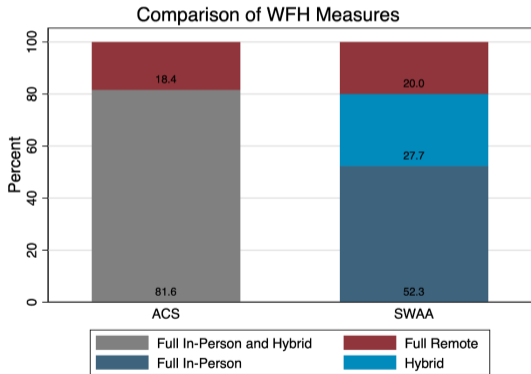
**N = 131,225 (SWAA).**

**N = 364,540 (HHP)**

\*Pre-COVID estimate taken from the 2017-2018 American Time Use Survey

\*The break in the series in November 2020 reflects a change in the survey question.

# SWAA MATCHES ACS, GOOGLE MOBILITY WHEN COMPARING APPLES TO APPLES



**Notes:** Google Workplace Cellphone Mobility Data from <https://www.google.com/covid19/mobility/> measured as the daily deviation of workplace trips from the January 3 to February 6, 2020 average. We report a monthly average of weekdays, baselined at 5% in January 2020 to match pre-pandemic values from ATUS. SWAA is the amount of full paid working days done from home from home minus the pre-pandemic estimate based on the American Time Use Survey as reported in Barrero, Bloom, and Davis (2021).

# MEASURING WFH IN KWAN ET AL. (2023)

## Share of Remote (Mobile, Residential, VPN) Internet Activity Linked to Employees of Firm $i$

- ▶ Number of website visits? Number of sessions? Web time? Data sent/received?
- ▶ What do we want?

## Sensible behavior vs. other WFH predictors

- ▶ How well calibrated in *levels*?

## Less Than Ideal: Data currently ends in **2021**

- ▶ Before WFH settles down
- ▶ Dominated by 2020/2021 gyrations



# WFH & INDIVIDUAL BUSINESSES

## A Lot of Work Out There Measures WFH

- ▶ Barrero, Bloom, & Davis (2021), Brynjolfsson et al. (2023), Kmets, Mondragon, & Wieland (2023)

## Less Work Linking WFH Levels to A Broad Sample of Businesses

- ▶ This is Kwan, Matthies, & Yuskavage's (2023) advantage
- ▶ Impact on firm performance?
- ▶ What characteristics lead firm  $i$  to use more WFH than firm  $j$ ?
- ▶ Role of intangible capital?

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# WFH INCREASES OUTPUT

## CF. BARRY, CAMPELLO, GRAHAM, MA (2022 JFE)

	Receipts				Total Income			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Remote Work	-0.125** (0.058)		-0.103* (0.060)		-0.019 (0.043)		0.000 (0.045)	
$\widehat{RemoteWork}$		2.195*** (0.784)		1.648** (0.797)		1.739*** (0.599)		1.339** (0.608)
F-stat?		347.519		333.222		347.519		333.222
Observations	80,855	79,518	76,675	75,418	80,855	79,518	76,675	75,418
Industry fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
State fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Controls			✓	✓			✓	✓

# WFH INCREASES IT, MANAGERIAL CAPITAL

	$\widehat{RemoteWork}$ (1)	IT upgrade (2)	(3)	$\Delta PctManagerJobPostings$ (4)	(5)
Commute Distance	0.0428*** (0.0012)				
$\widehat{RemoteWork}$		0.0072*** (0.0004)	0.0776*** (0.0065)	0.0194*** (0.0048)	0.1659*** (0.0623)
F-stat?			1285.32		574.24
R <sup>2</sup>	0.36188	0.02508	-0.04116	0.00577	-0.00234
Observations	310,193	313,444	310,193	115,630	114,783
Industry fixed effects	✓	✓	✓	✓	✓
State fixed effects	✓	✓	✓	✓	✓

# WHAT ARE THE ECONOMICS?

## WHAT IS THE MODEL?

### **Justify Your Outcome Variables of Interest Using Economics:**

- ▶ For example, why  $(Receipts_{2021}/Assets_{2019})$ ,  $(TotalIncome_{2021}/Assets_{2019})$ ,  $(Compensation_{2021}/Assets_{2019})$ ,  $(EBITDACosts_{2021}/Assets_{2019})$ ?
- ▶ Why  $ITIndex$ ,  $ihs(\%ManagerJobPostings)$ ?

### **Justify Control Variables, Especially Lagged Dependent Variables:**

- ▶ Industry FEs not a silver bullet. Especially with 2-digit industries
- ▶ Simpler specifications would be easier to interpret

# WHAT ARE THE ECONOMICS? WHAT IS THE MODEL?

## **Need Much More About the IV Strategy**

- ▶ Sources of endogeneity or measurement error?
- ▶ Exclusion restriction? What economics justifies it?

## **Why Do the OLS and IV Results Have Opposite Signs?**

**Sensible Descriptives or DiD Can Be More Informative than an Unconvincing IV**

## SOME MODELS FROM THE LITERATURE

**Residential, IT, Relationship “Potential” Capital Boost  
Economic Resilience During 2020-2021**

Eberly, Haskel, and Mizen (2021)

**More People WFH  $\Rightarrow$  Increased WFH Productivity**

Davis, Ghent, & Gregory (2022) Barrero, Bloom, & Davis (2021)

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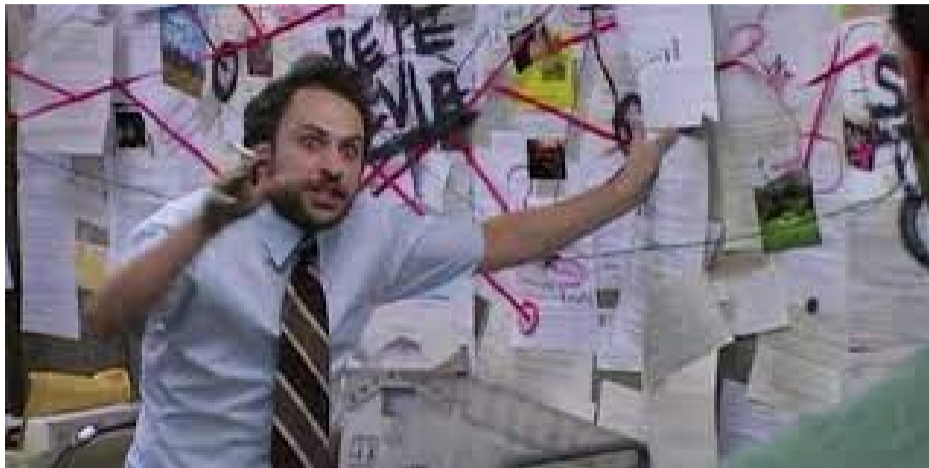
What are the Economics?

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**Data Transparency**



# THE PAPER'S DATA SECTION IN MEMES



# MORE SERIOUSLY, THIS PAPER'S DATA

## At Face Value: Amazing

- ▶ Internet activity  $\Rightarrow$  WFH
- ▶ IRS business/Corporate tax data
- ▶ Web scraped employee characteristics
- ▶ Mobility
- ▶ IT use at the firm level

## MORE, SERIOUSLY THIS PAPER'S DATA

### **In Practice: Somewhat of a Black Box, Difficult for Outside Researchers to Verify**

- ▶ Focus on a few key data sources and their validation?
- ▶ Separate Mimeo about web activity data, or the WFH measurement exercise

### **That Way, Limit The Amount of Validation**

# CONCLUSION

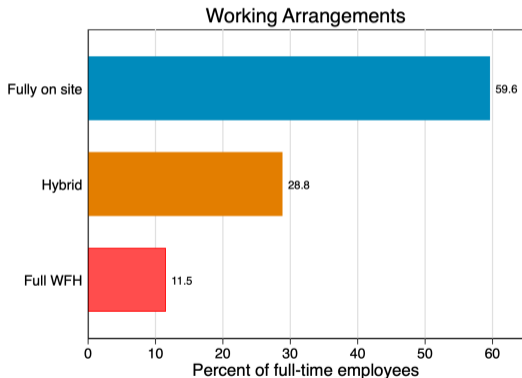
## **A Very Ambitious Paper, Tons of Potential**

- ▶ Amazing data on several fronts
- ▶ Key Advantage: Linking WFH to individual firm outcomes

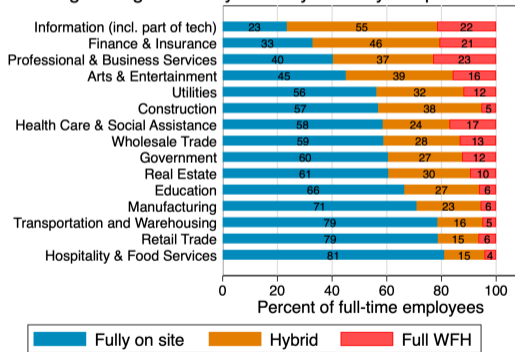
**What is the (Verbal or Explicit) Economic Model?**

**Simplify Data, Analysis, Results**

# UNDER THE HOOD: HYBRID IS THE DOMINANT MODE OF WFH

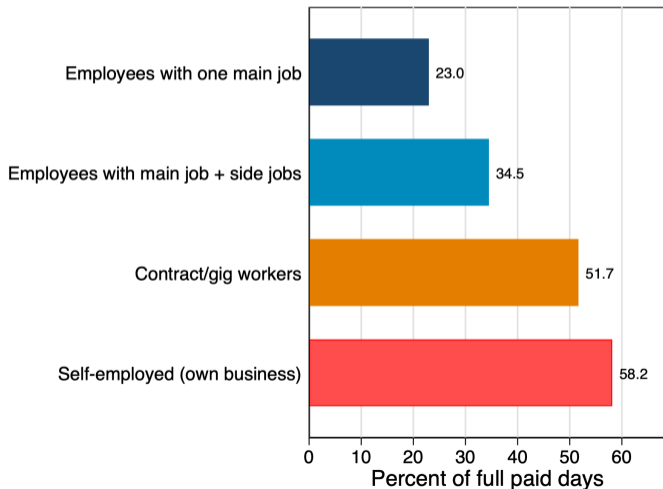


**Working Arrangements by Industry January to April 2023**



**Notes:** Data are from the January to April 2023 SWAA waves and focus on full-time wage and salary employees. We re-weight raw responses to match 2010-2019 CPS pop. by {age × sex × education × earnings} cell. **N = 16,564 (left). N = 16,162 (right)**

# KEEP IN MIND: EMPLOYEES WFH LESS THAN CONTRACTORS, SMALL BUSINESS OWNERS



**Notes:** Data are from the January to April 2023 SWAA waves and from the Census Household Pulse Survey. We re-weight raw responses to match 2010-2019 CPS pop. by {age × sex × education × earnings} cell.

**N = 19,435.**