

Some Economic Implications of COVID-Related Shocks

Steven J. Davis

Based on work with Jose Maria Barrero, Nick Bloom, Stephen Hansen, Brent Meyer, Dingqian Liu, Christian Seminario-Amez, Xuguang Simon Sheng, and Yulia Zhestkova.

The Better Policy Project

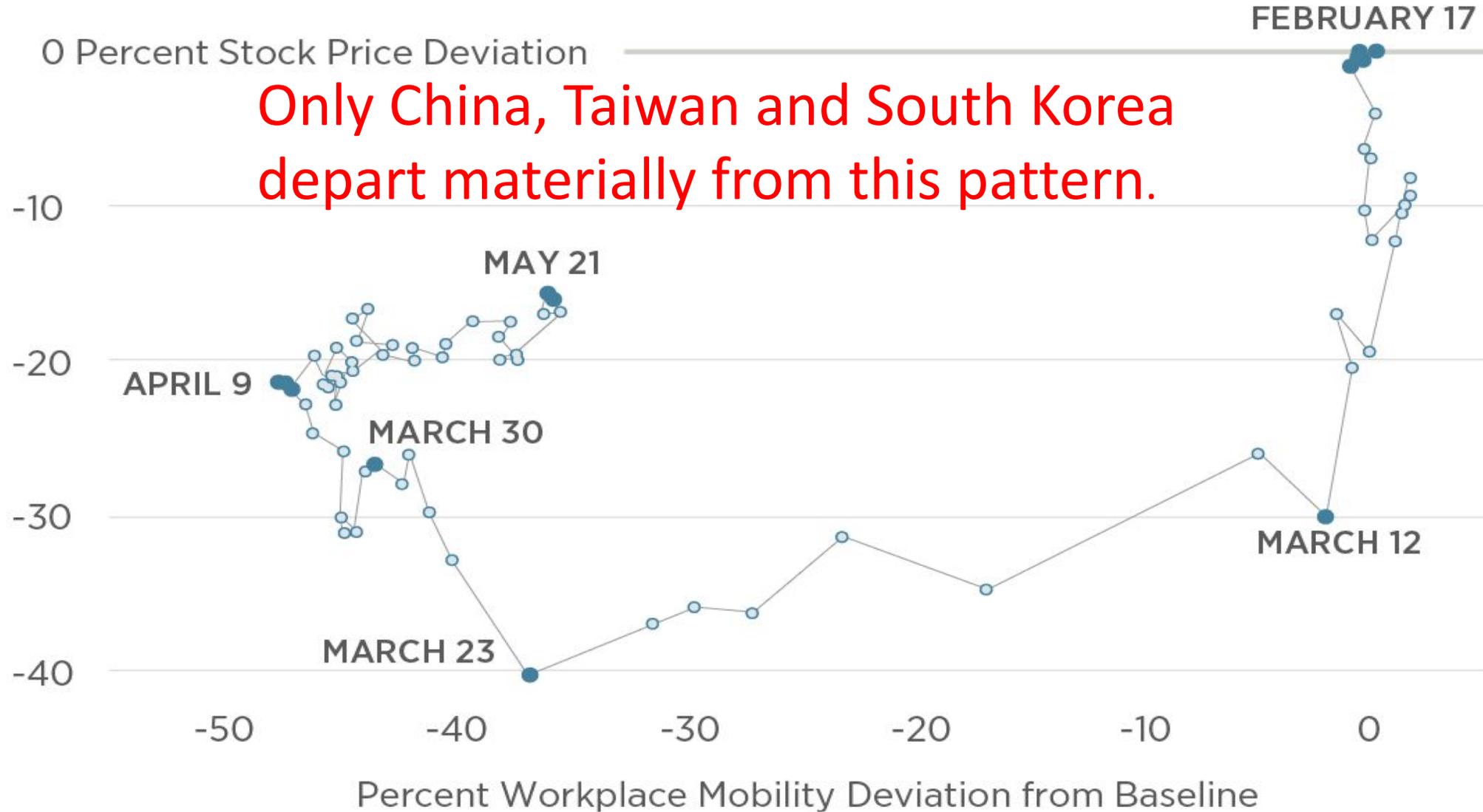
13 January 2021

Davis, Liu and Sheng (2020)

1. Stock prices and workplace mobility trace out clockwise paths in daily data from mid-February to late May 2020.
2. National stock prices foreshadow own-country drops in workplace mobility, conditional on global developments.
3. The stock price drop is many times larger than what a standard asset-pricing model implies.
4. Stricter lockdown policies, both in-country and globally, drove larger declines in national stock prices conditional on pandemic severity, workplace mobility, and income support and debt relief policies.

Time Path of Stock Prices and Workplace Mobility, Market-Cap Weighted Global Averages

31 Countries (excludes China), February 17 - May 21, 2020



A Standard Asset-Pricing Model

Barro (2006) posits an endowment economy with a representative agent who has time-separable, isoelastic preferences over consumption. Log output evolves exogenously as a random walk with drift:

$$\ln(A_{t+1}) = \ln(A_t) + \gamma + u_{t+1} + v_{t+1} \quad (3)$$

where the drift $\gamma \geq 0$, u_{t+1} is i.i.d. normal with mean 0 and variance σ^2 , and v_{t+1} picks up low-probability disaster shocks. Barro shows that the price of a one-period equity claim at t is

$$P_{t1} = A_t e^{-\rho - (\theta-1)\gamma + (1/2)(\theta-1)^2\sigma^2} [e^{-p} + (1 - e^{-p}) \times E\{(1 - b)^{1-\theta}\}] \quad (4)$$

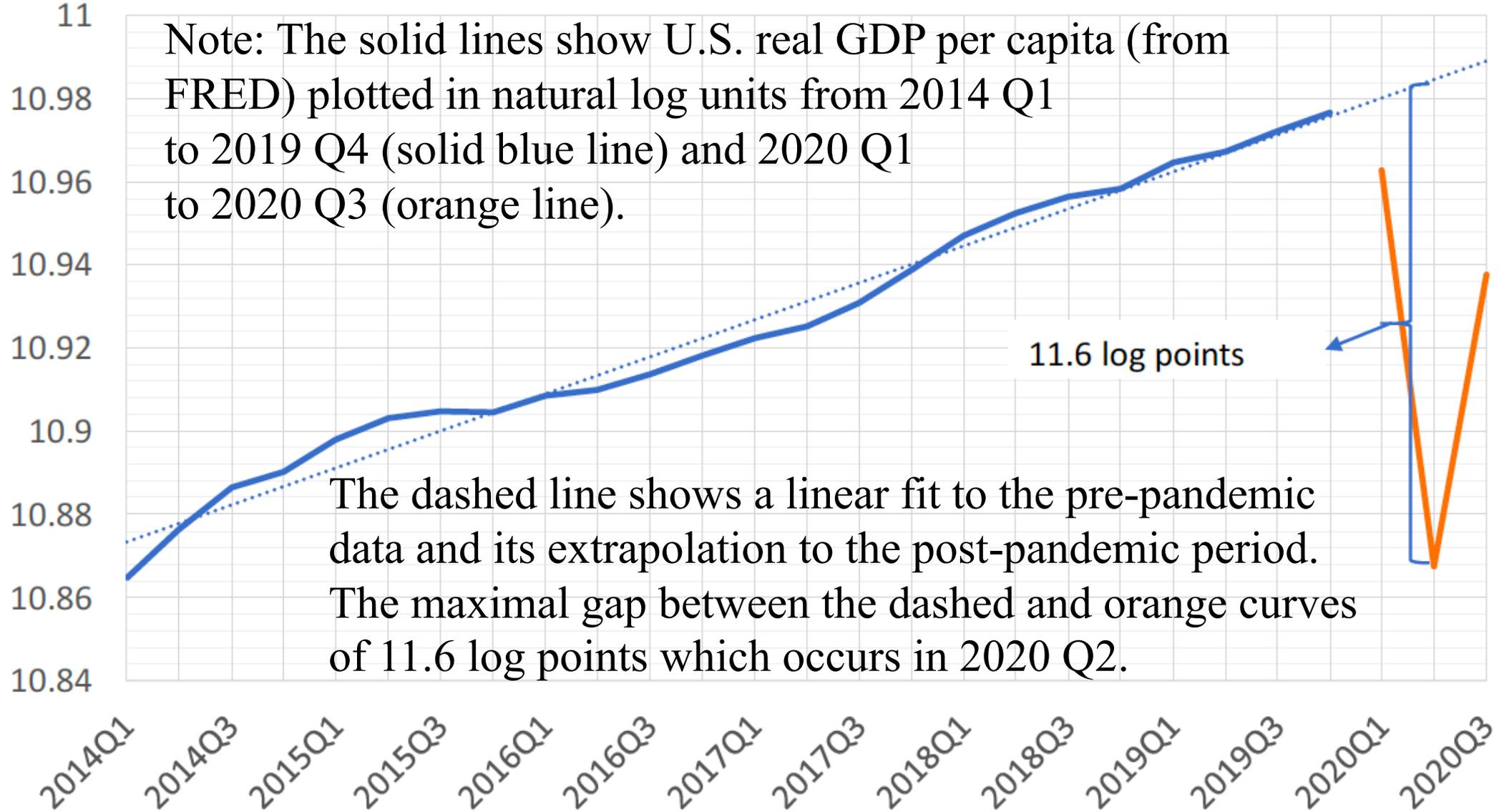
where ρ is the time preference rate, θ is relative risk aversion, σ is the standard deviation of the output growth rate absent disasters, E denotes the expectations operator, p is the disaster probability, and b is the size of the log output drop when disaster strikes. Agents know the parameters.

In taking this model to the data, we interpret 17 February as the last date before disaster strikes and 23 March as the date by which agents fully grasp the gravity of the disaster. Global and U.S. equity prices fell about 40 percent (51 log points) over this 33-day period. Using (3) and (4), the model-implied realized equity return over this period is

$$\ln \left(\frac{P_{\text{after}}}{P_{\text{before}}} \right) = \ln \left(\frac{A_{\text{after}}}{A_{\text{before}}} \right) = \gamma \left(\frac{33}{365} \right) + u_1 - |v_1|, \quad (5)$$

where $|v_1|$ is the realized disaster size, and u_1 is the realized value of the regular shock. For any reasonable values of the annual drift (γ) and the variability of regular shocks (σ), the first two terms on the right side are tiny compared to v_1 . Thus, the model implies that stock prices should fall nearly one-for-one in proportion to disaster size. (Given the stochastic process in (3), the rates of return on one-period and full equity claims are identical.)

Assessing the Size of the COVID Disaster

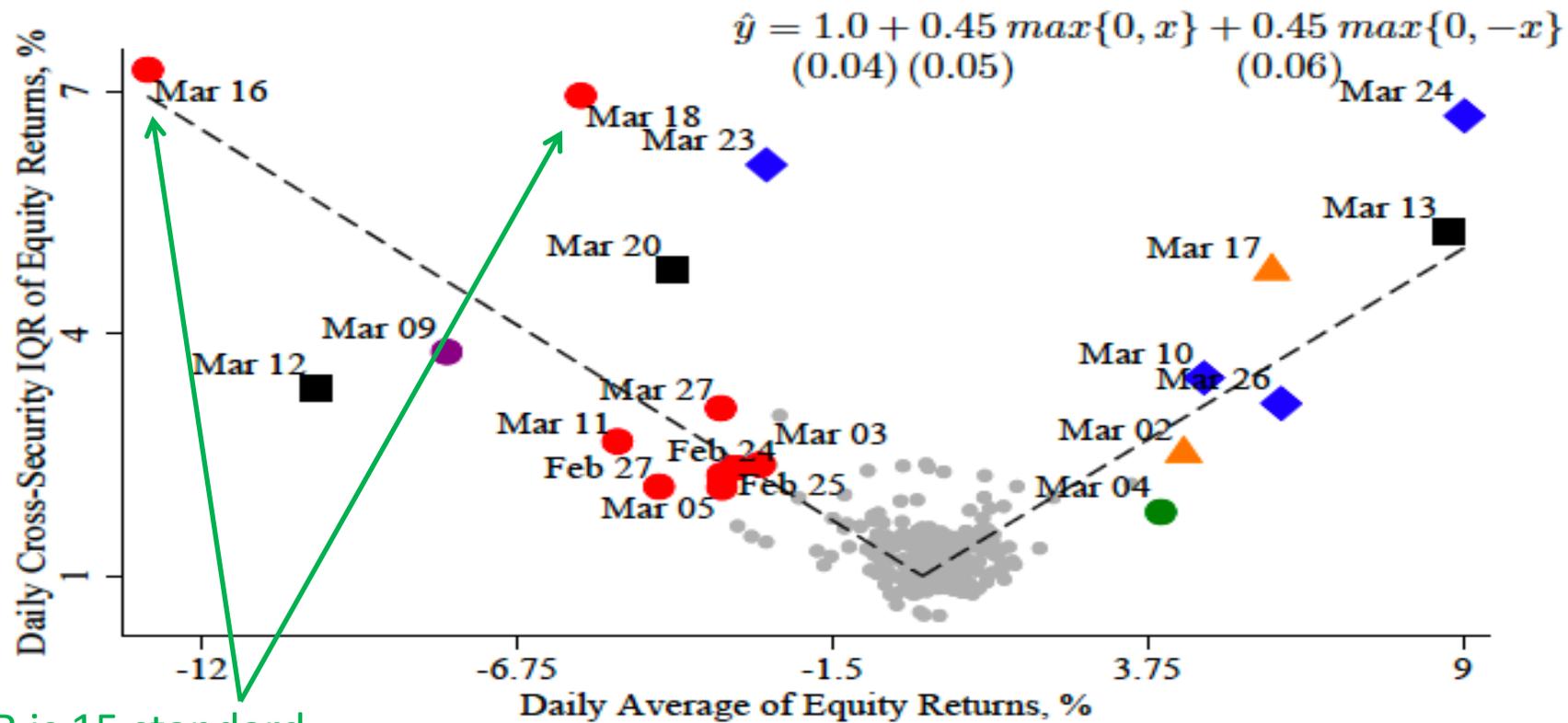


What Accounts for National Stock Price Moves in Early Stages of the Pandemic?

We fit regression models to national data for 34 countries on trading days from 17 February to 21 May 2020 →

In our preferred specification – which includes controls for own-country and global average values of economic activity, pandemic severity, and government income support and debt relief measures – national stock prices are 3.0 percentage points lower when the own-country lockdown stringency index is one st. dev. higher and 4.7 points lower when the global average stringency index is one st. dev. higher. These are separate and statistically significant effects.

Tremendous Dispersion in U.S. Firm-Level Stock Price Reactions to COVID News



IQR is 15 standard deviations greater than average IQR in 2019

- COVID-19 and Economic Fallout
- ◆ Fiscal Policy Stimulus
- Oil Price Crash
- Super Tuesday Aftermath
- All trading days in 2019
- ▲ Monetary Policy Easing
- Unclassified

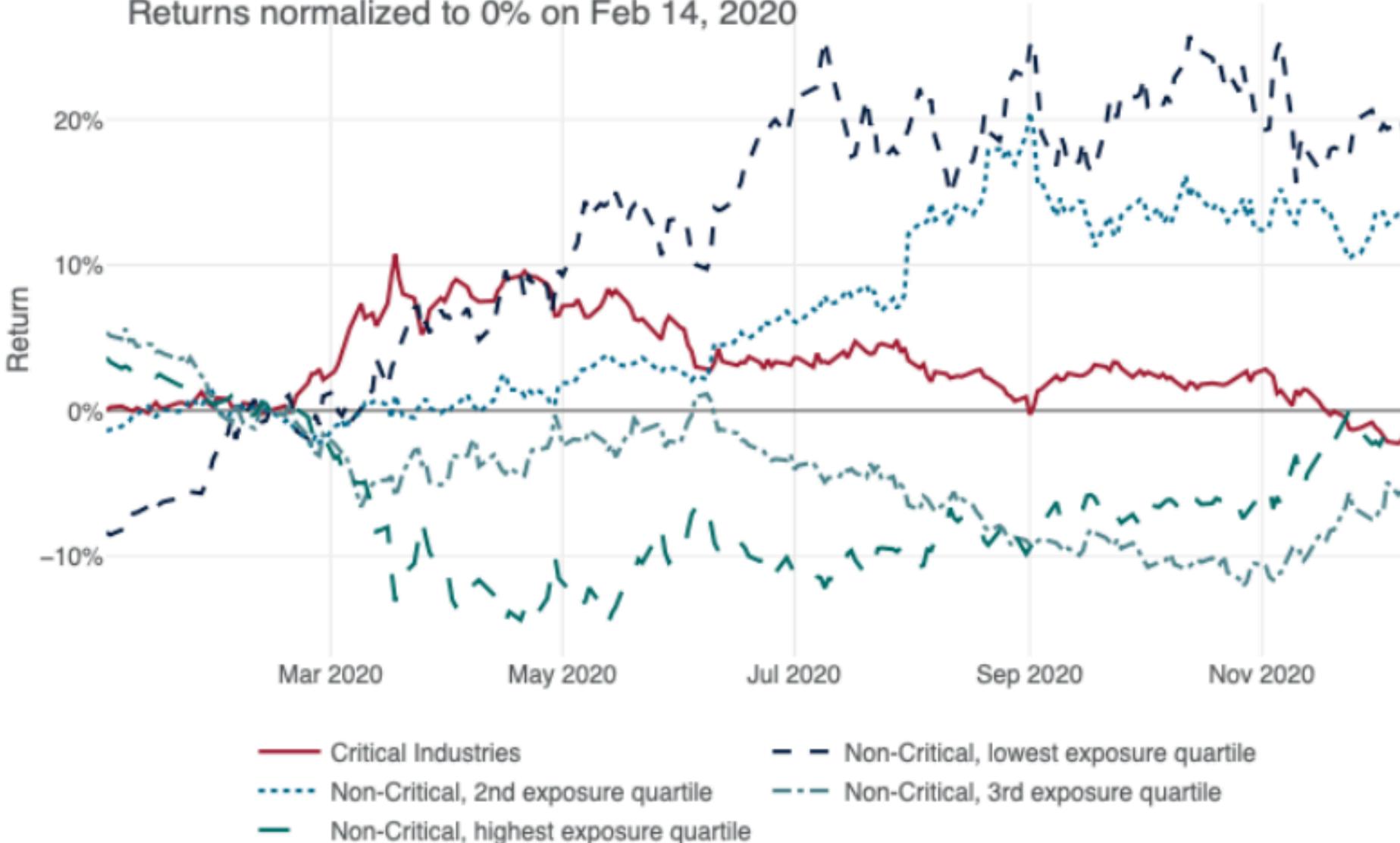
Classifications from Baker et al. (2020)

Reproduced From Davis, Hansen and Seminario-Amez (2020)

Figure 1: Value-Weighted Mean and Cross-Sectional IQR of U.S. Equity Returns, Daily for 2019 and for Large Daily Jumps in 2020

Equity Markets Think the Shift to WFH Is a Big Deal

Cumulative returns relative to the market since Jan 1, 2020
Returns normalized to 0% on Feb 14, 2020

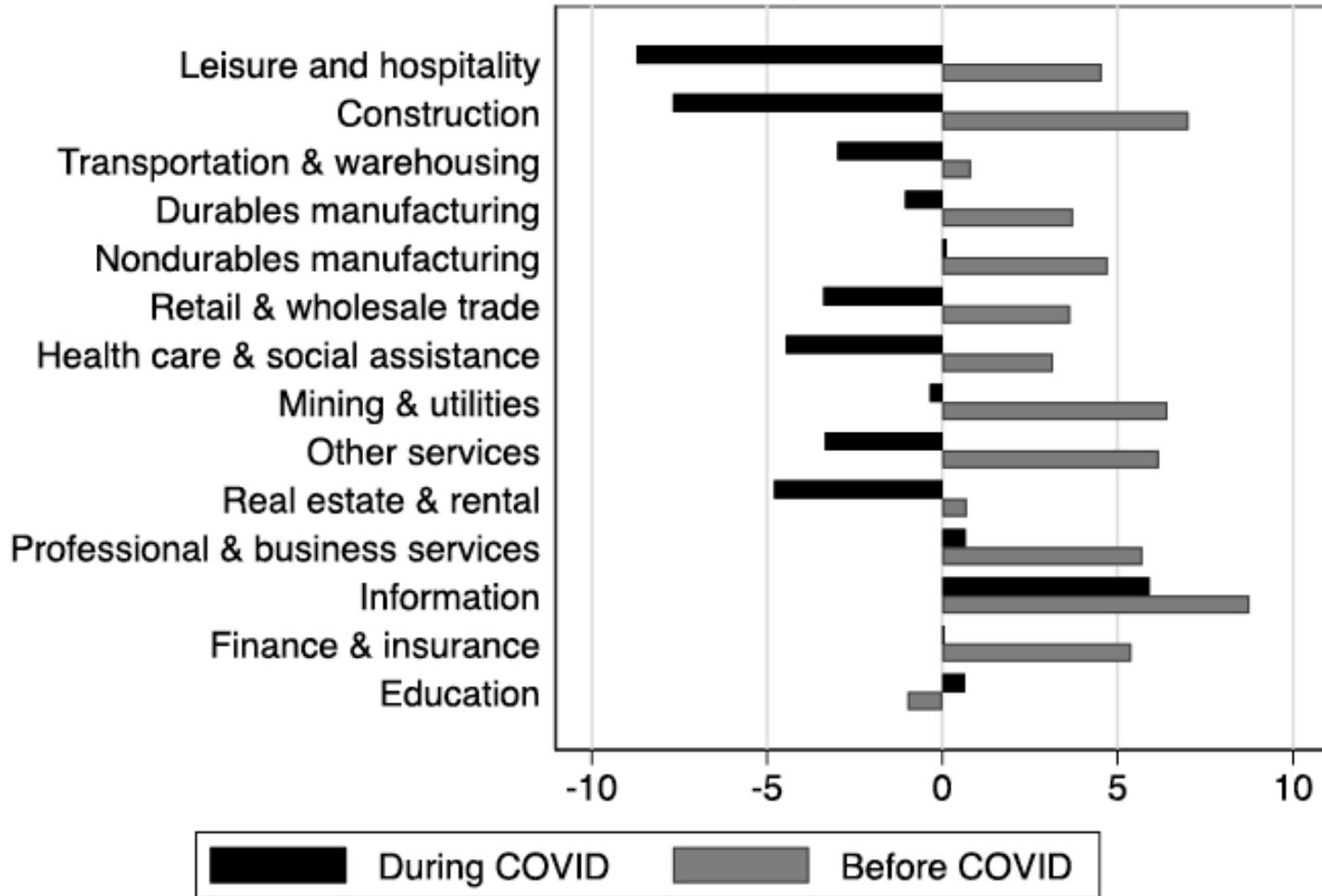


Firms outside “Critical Industries” sorted into quartiles based on the fraction of workers in their industry that can feasibly work from home.

This chart is from <https://sites.google.com/site/lawrencedwscmidt/covid19> and is based on work by Schmidt and Papanikolaou (2020).

So Do Employers, Who See a COVID-Induced Shift in Growth Trends in Favor of Industries with a Greater Share of Jobs Suitable for WFH

Past + Expected Future Employment Growth (%)



Reproduced from Barrero et al. (2021), drawing on data from Altig et al. (2020) and Dingel and Neiman (2020).

U.S. industry groups are sorted by WFH capacity, from lowest to highest. For each industry group, we start with monthly observations on firm-level growth rates in the past 12 months and expected growth rates in the next twelve months. We then aggregate over firms to the industry level separately for the pre-COVID (9/2016–2/2020) and COVID (3/2020–12/2020) periods. Then we plot the average growth rate for each industry in the two periods.

The cross-industry correlation between the realized plus expected employment growth rate and WFH capacity is -0.04 in the pre-COVID period and 0.71 in the COVID period.

COVID-19 Compelled Firms and Workers to Experiment at Scale with Working from Home

“If you’d said three months ago that 90% of our employees will be working from home and the firm would be functioning fine, I’d say that is a test I’m not prepared to take because the downside of being wrong on that is massive.”

– James Gorman, CEO of Morgan Stanley*

*Cited in Cutter (2020)



James Gorman

PHOTO: AL DRAGO/BLOOMBERG NEWS

COVID WFH has generated various challenges



Barrero, Bloom and Davis (2020): Surveying 20,000 US Workers

Seven waves so far (repeated cross sections)

- May: 2,500
- July: 2,500
- August: 5,000
- September: 2,500
- October: 2,500
- November: 2,500
- December: 2,500 – Data not yet incorporated into these slides

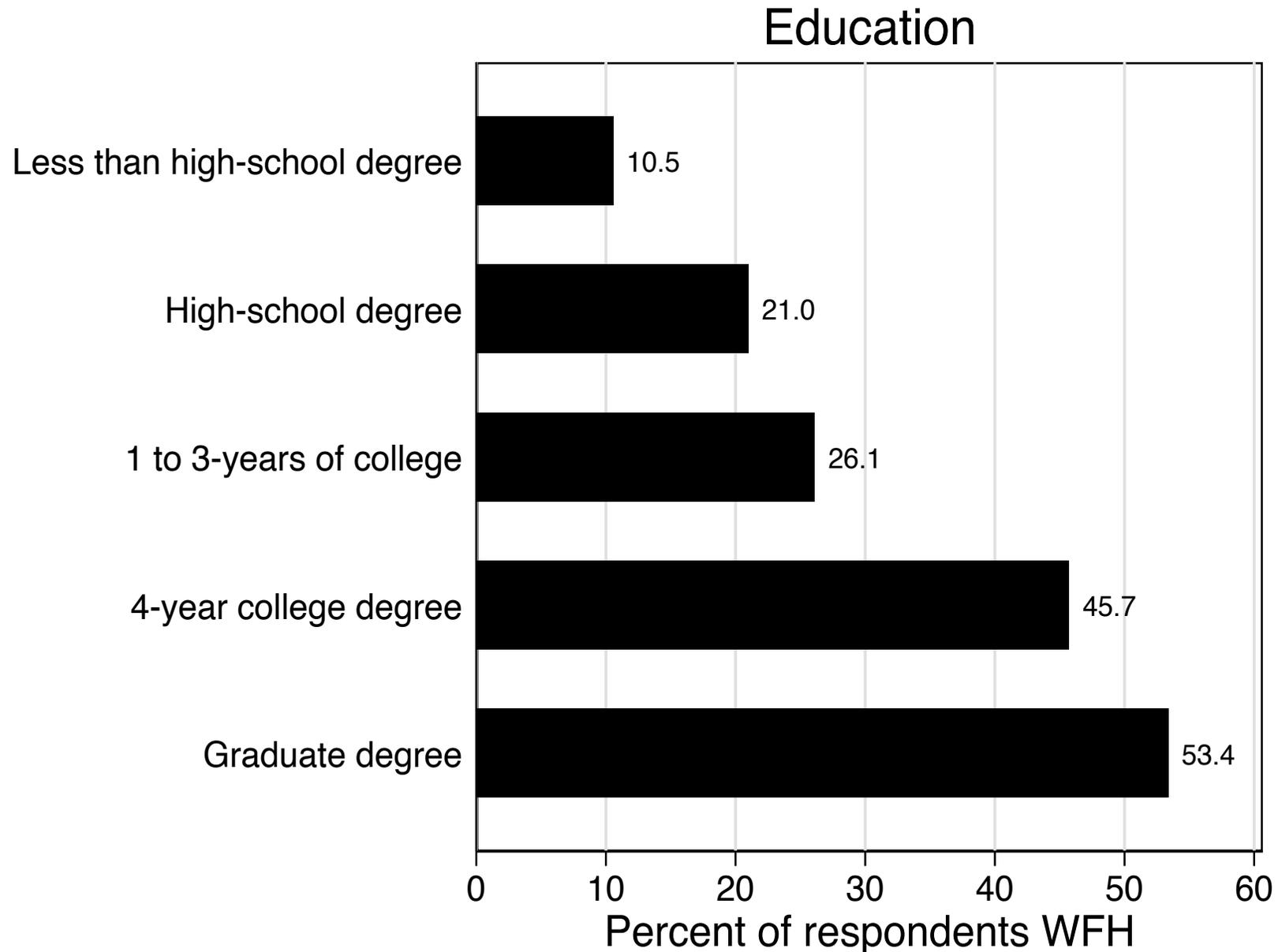
Randomly sample US residents aged 20-64, earning \$20K+ in 2019

- Re-weight to match 2010-2019 CPS by $\{earnings \times industry \times state\}$ cell

Ask about 40 questions on:

- Demographics
- Extent of WFH during COVID and desires/plans after COVID
- Experience, perspectives on WFH etc

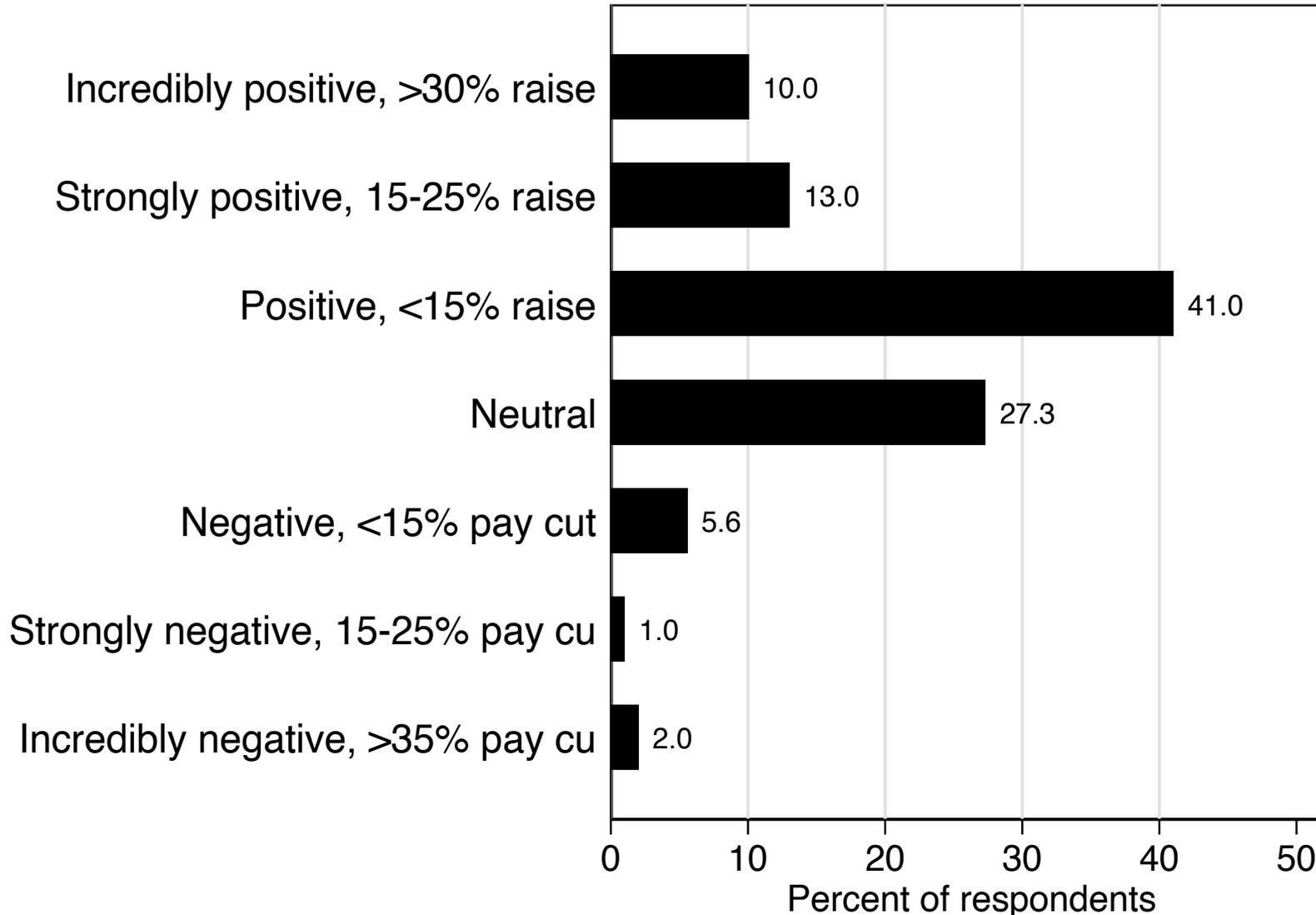
WFH incidence during COVID: Steeply rising with education



Notes: Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

The option to WFH is a valuable perk

Value of the option to WFH 2 - 3 days/wk, % of current pay?



Average value of 8% matches Mas and Pallais (2017, AER)

Notes: Response to a two-part question.

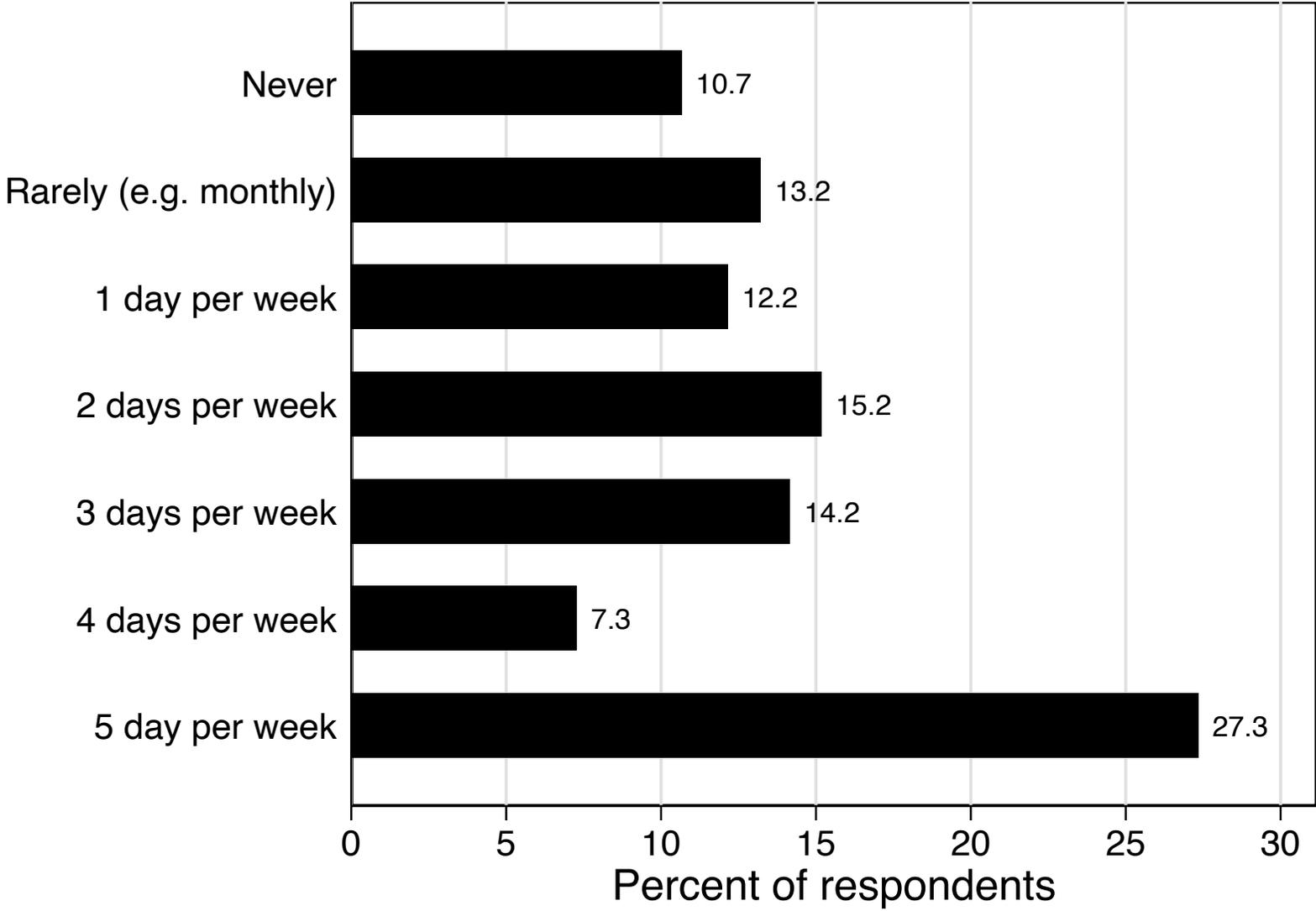
Part 1: **“After COVID, in 2022 and later, how would you feel about working from home 2 or 3 days a week?”**

- Positive: I would view it as a benefit or extra pay
- Neutral
- Negative: I would view it as a cost or a pay cut

Part 2: **“How much of a *pay raise [cut]* (as a percent of your current pay) would you value as much as the option to work from home 2 or 3 days a week?”**

Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Average employee wants about 2 days WFH a week (after COVID)

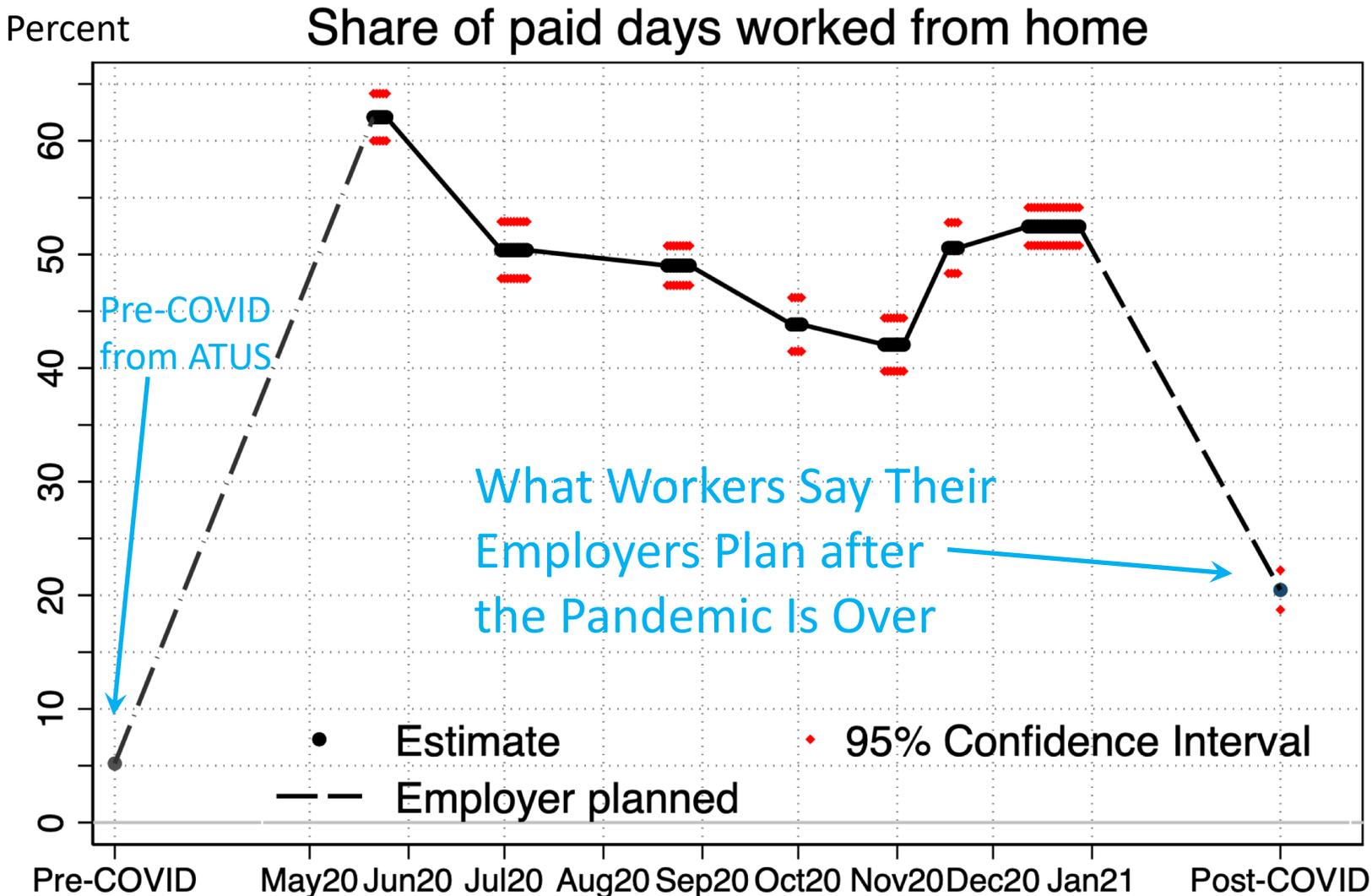


Source: Response to the questions: *“In 2021+ (after COVID) how often would you like to have paid work days at home?”*

Data from a survey of 2,500 US residents aged 20 to 64, earning more than \$20,000 per year in 2019 carried out between May 21-25, by QuestionPro on behalf of Stanford University. Sample reweighted to match the US CPS.

*Sample: Respondents who report being able to WFH or did at some point during COVID

Post-COVID Working Arrangements: Less WFH than Now, But 4-5 Times as Much as Pre-COVID



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

Notes: Data are from an original survey of our design, fielded by QuestionPro and IncQuery in May, July, August, September/October, November, and December 2020, with 5,000 responses in August and 2,500 in other months. We re-weight raw responses to match the share of working-age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Chart reproduced from "[Why Working From Home Will Stick](#)," by Jose Maria Barrero, Nick Bloom and Steven J. Davis.

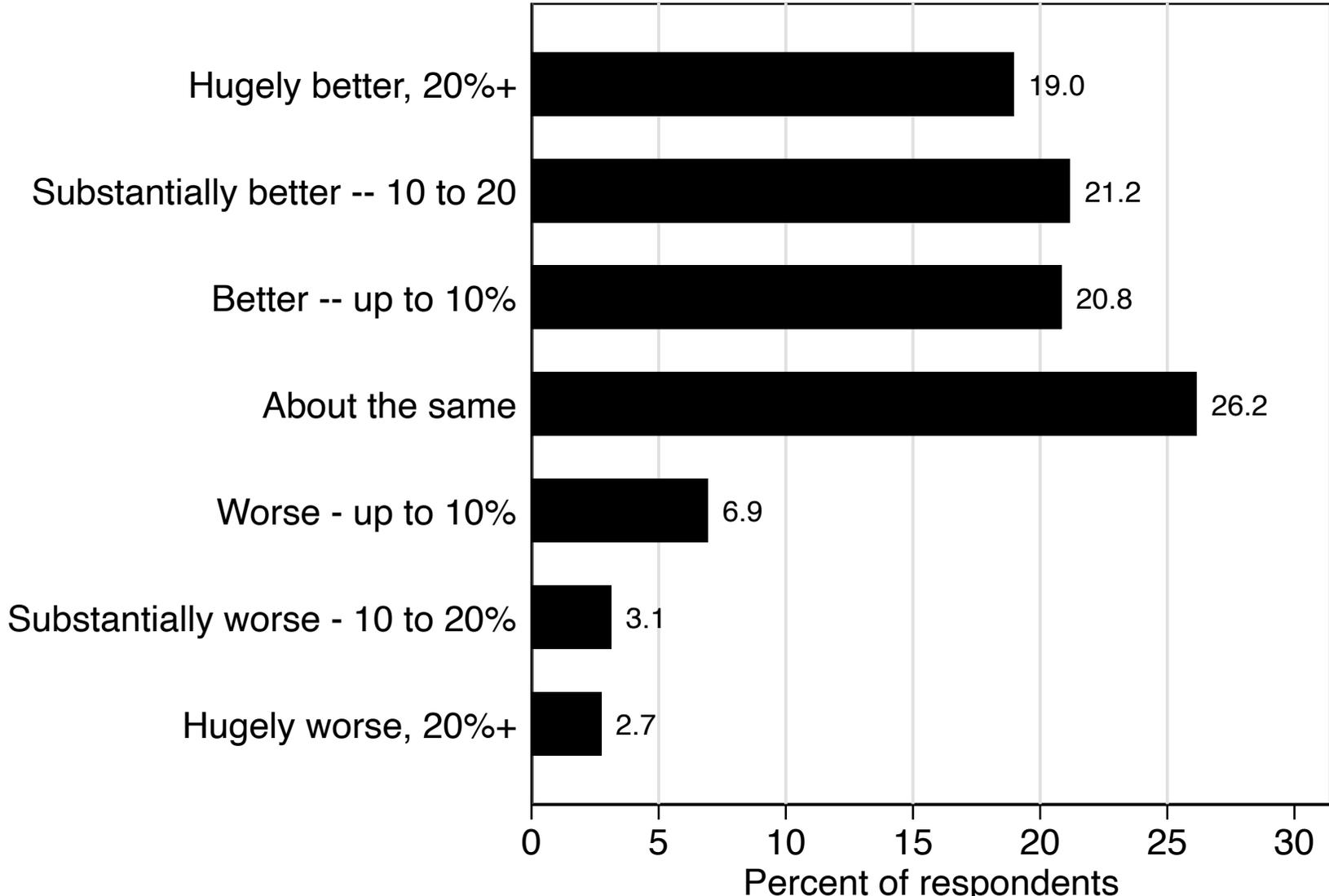
Why WFH Will Stick After COVID

Why WFH Will Stick

1. COVID-induced shift to WFH overcame inertia and coordination challenges.
2. Forced experimentation revealed information that alters the optimal working arrangements for many. (Think about the multi-armed bandit model.)
3. Barrero, Bloom and Davis (2020, BBD) find WFH productivity has exceeded expectations for most people. It has exceeded productivity on business premises for about 40%
4. COVID-19 spurred investments that enable more effective WFH:
 - BBD estimate **at-home investments** to enable WFH during COVID = 1.2% of annual GDP.
 - This figure omits WFH-enabling investments on business premises and in the cloud.
5. BBD survey data show massive drop in stigma associated with WFH.
6. More than one-third of people say they will remain wary of mass transit, crowded elevators, and taxis even after COVID and after a vaccine (BBD survey evidence).
7. COVID knocked down regulations that had blocked virtual service delivery, especially in the healthcare sector.
8. COVID-19 shifted the direction of innovation toward technologies that support WFH, as reflected in the flow of new patent applications (Bloom, Davis, Zhestkova, 2021)
9. Network effects are likely to amplify many of the effects above.

1. Forced Experimentation: WFH exceeded expectations

Relative to expectations, how has WFH turned out?



Compared to your expectations **before COVID (in 2019)** how has working from home turned out for you?

Notes: Data from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Chart reproduced from "[Why Working From Home Will Stick](#)," by Jose Maria Barrero, Nick Bloom and Steven J. Davis.

2. Pandemic-induced investments (mostly sunk) that enable WFH

Investments at home to enable WFH add up to about 1.2% of annual GDP

*How many hours have you invested in learning how to work from home effectively (e.g., learning how to use video-conferencing software) and creating a suitable space to work? **Mean hours: 13.0 (SE = 0.3)***

*How much money have you and your employer invested in equipment or infrastructure to help you work from home effectively -- computers, internet connection, furniture, etc.? **Mean: \$580 (SE = 18)***



2. Pandemic-induced investments (mostly sunk) that enable WFH

☆ **Private fixed investment in information processing equipment and software** (A679RC1Q027SBEA) DOWNLOAD

Observation:
Q3 2020: **5.7** (+ more)
Updated: Oct 29, 2020

Units:
Percent Change,
Seasonally Adjusted Annual Rate

Frequency:
Quarterly

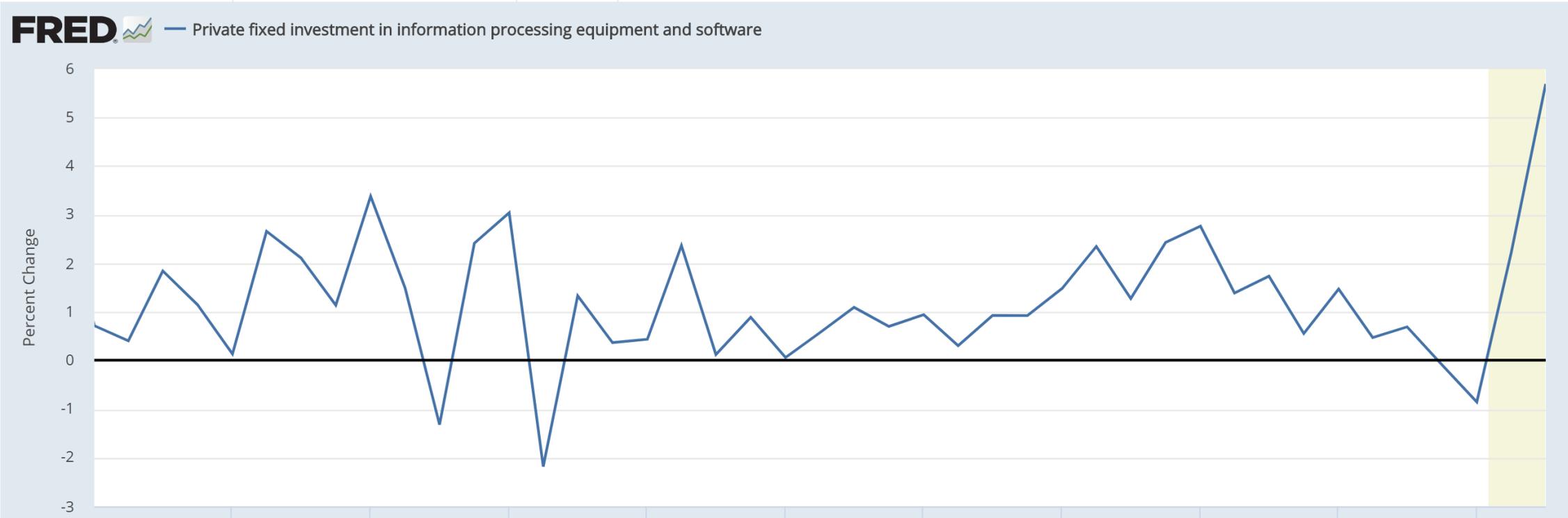
1Y | 5Y | 10Y | Max

2010-01-01

to

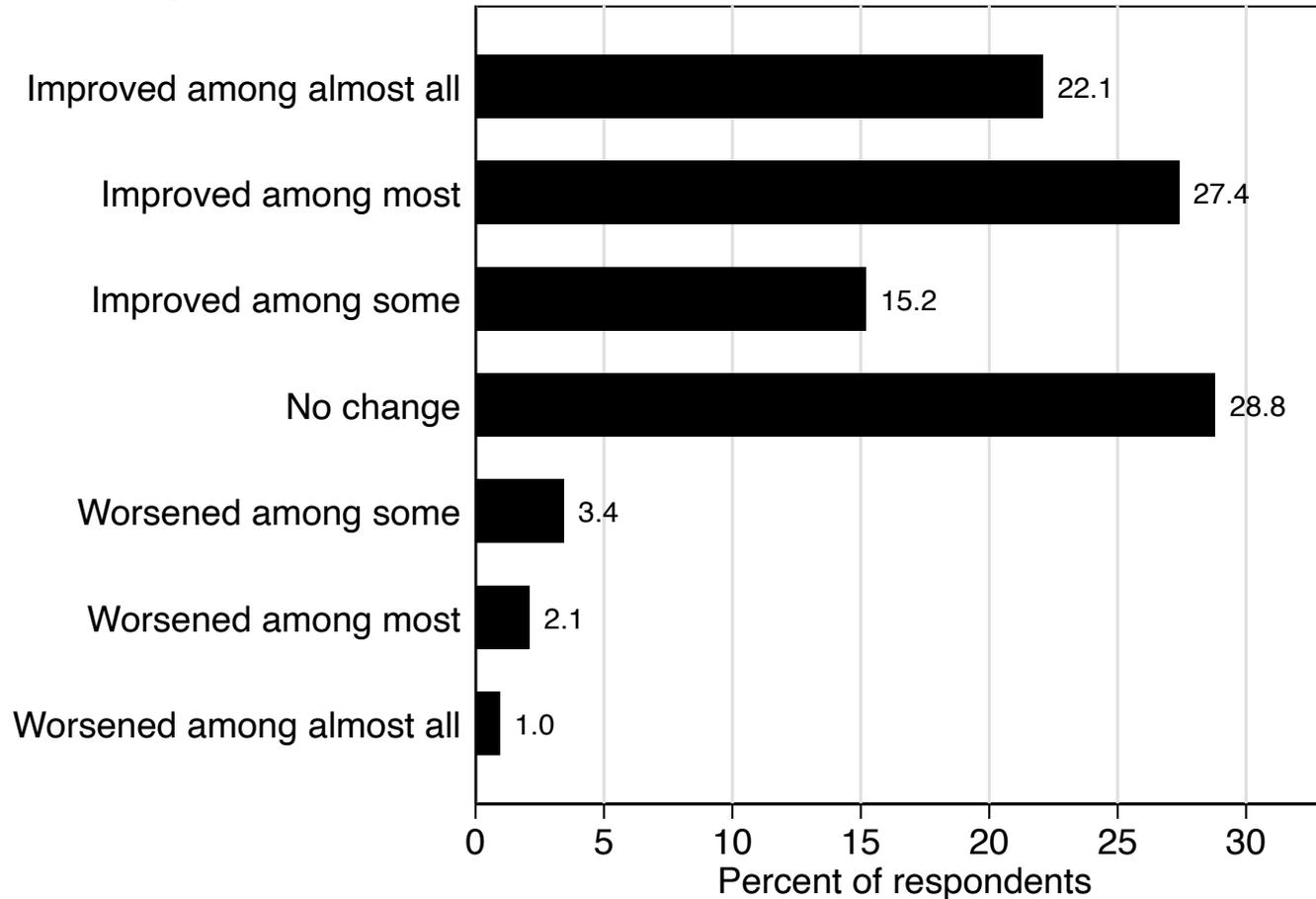
2020-07-01

EDIT GRAPH



3. Under COVID, WFH stigma has greatly diminished

Change in WFH Perceptions Among People You Know



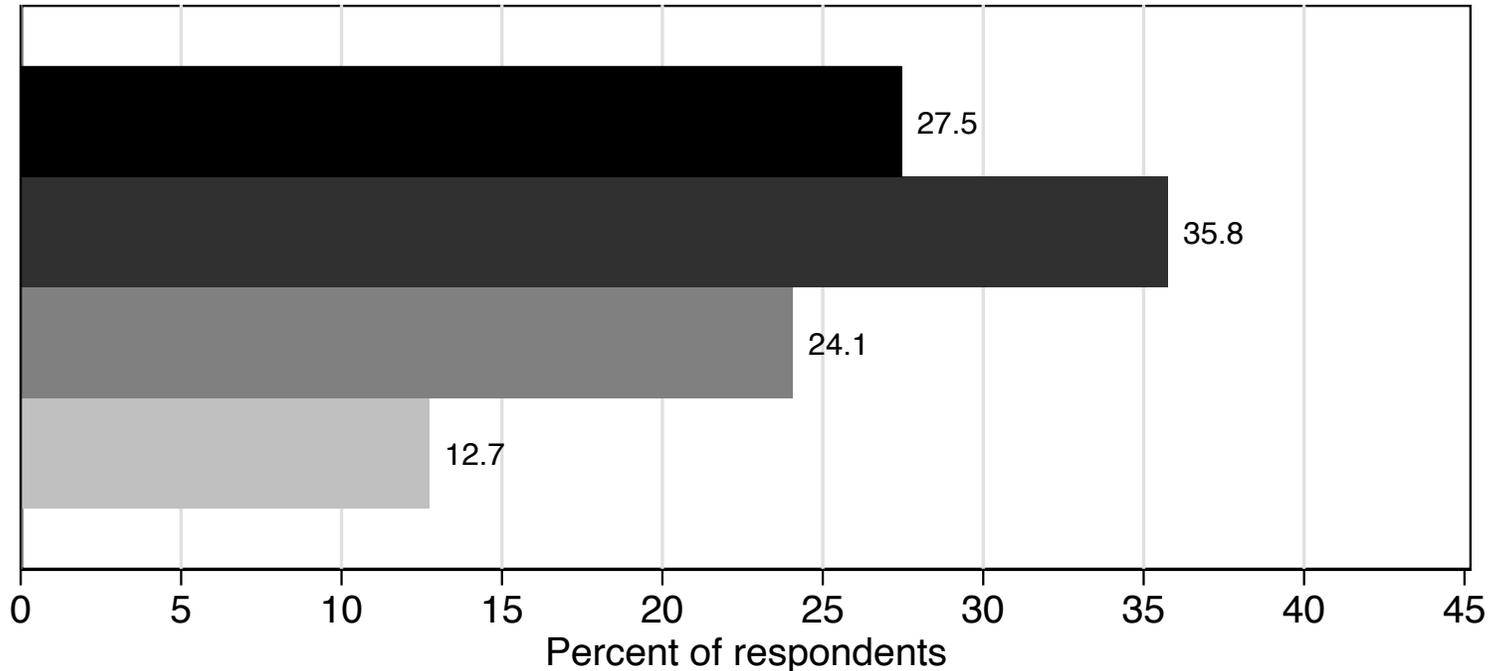
Before COVID-19, "*working from home*" was sometimes seen as "*shirking from home*."

Since the COVID pandemic began, ***how have perceptions about working from home (WFH) changed among people you know?***

Notes: Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

4. Residual Fear of Proximity to Other People

After a vaccine arrives, I would return to pre-COVID activities



- Completely
- Substantially - I'd avoid the subway, crowded elevators
- Partially - I'd avoid eating out, taxis
- Would not - continued social distancing

If a COVID vaccine is discovered and made widely available, which of the following would best fit your views on social distancing?

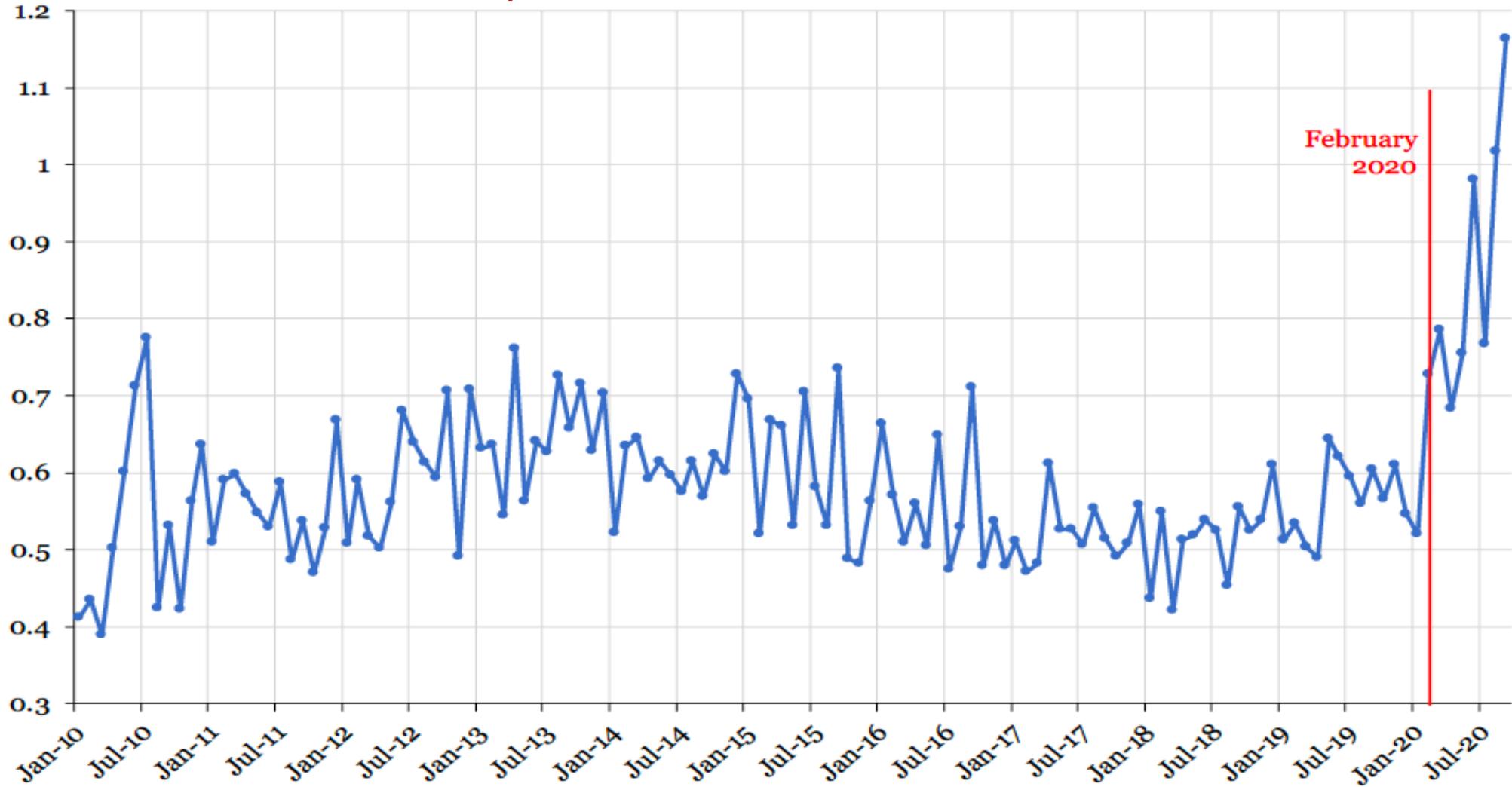
Notes: Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

5. Re-Directed Technical Change: COVID-19 Shifted Patent Applications to Technologies that Support WFH

WFH Patents as % of Patent Applications

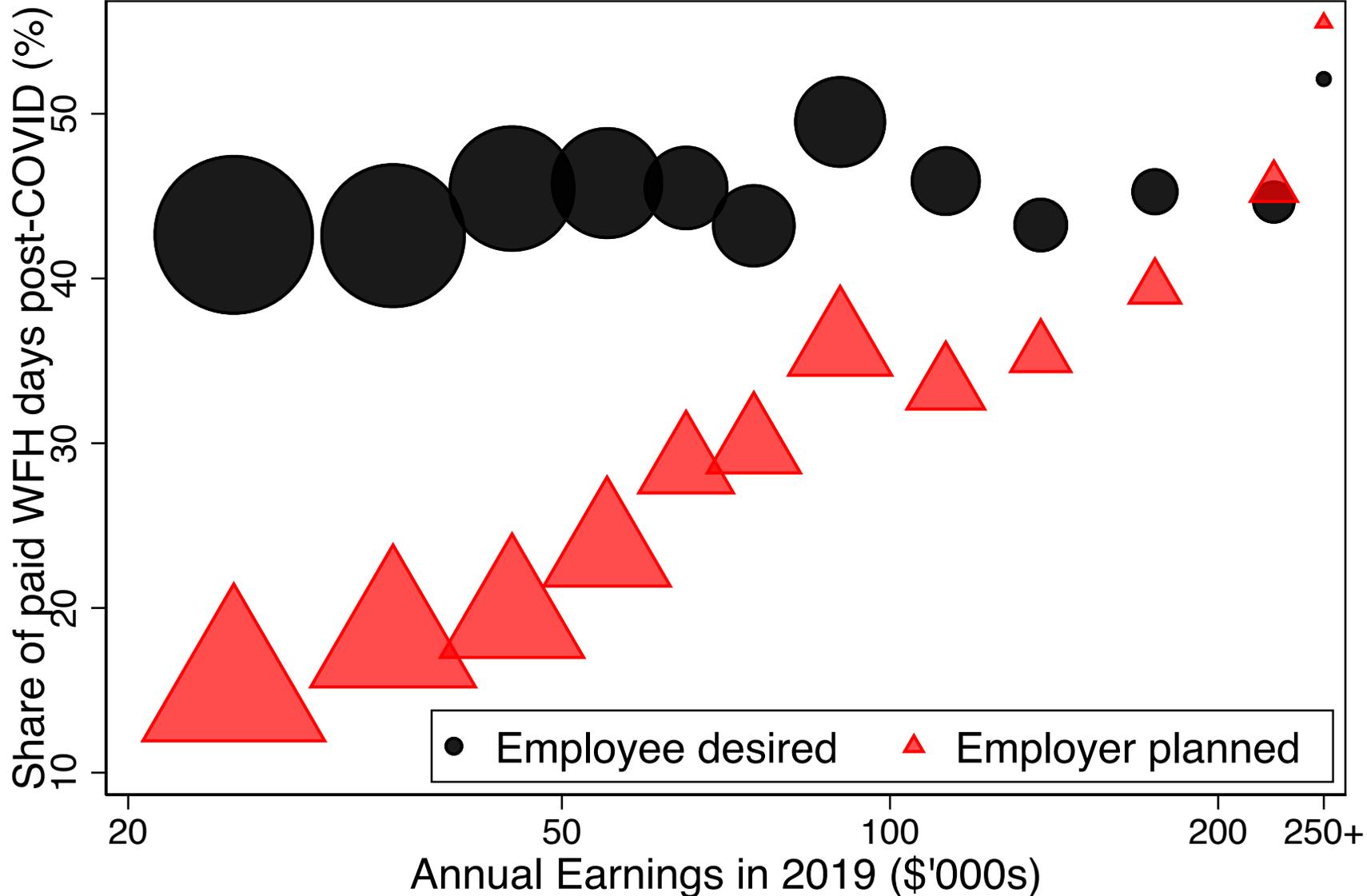
Percent

This chart is reproduced from Bloom, Davis and Zhestkova (2020).



Some Implications

(A) Uneven benefits: higher earners will get to WFH more



Notes: Data are from four survey waves carried out by QuestionPro and IncQuery in May, July, August, and September/October 2020 with 2,500 responses in the first two and the last, plus 5,000 in August. We re-weight raw responses to match the share of working age respondents in the 2010-2019 CPS in each {industry x state x earnings} cell.

Note: Marker size is proportional to the number of respondents per income level.

Sample Survey Questions

6. **After COVID, in 2022 and later**, how often **is your employer planning** for you to work full days at home?

Never

About once or twice per month

1 day per week

2 days per week

3 days per week

4 days per week

5+ days per week

My employer has not discussed this matter with me or announced any plans

I have no employer

«

Auto-fill

Re-randomize

31. Compared to your expectations **before COVID (in 2019)** how has working from home turned out for you?

Hugely better -- I am 20%+ more productive than I expected

Substantially better -- I am 10% to 19% more productive than I expected

Better -- I am 1% to 9% more productive than I expected

About the same

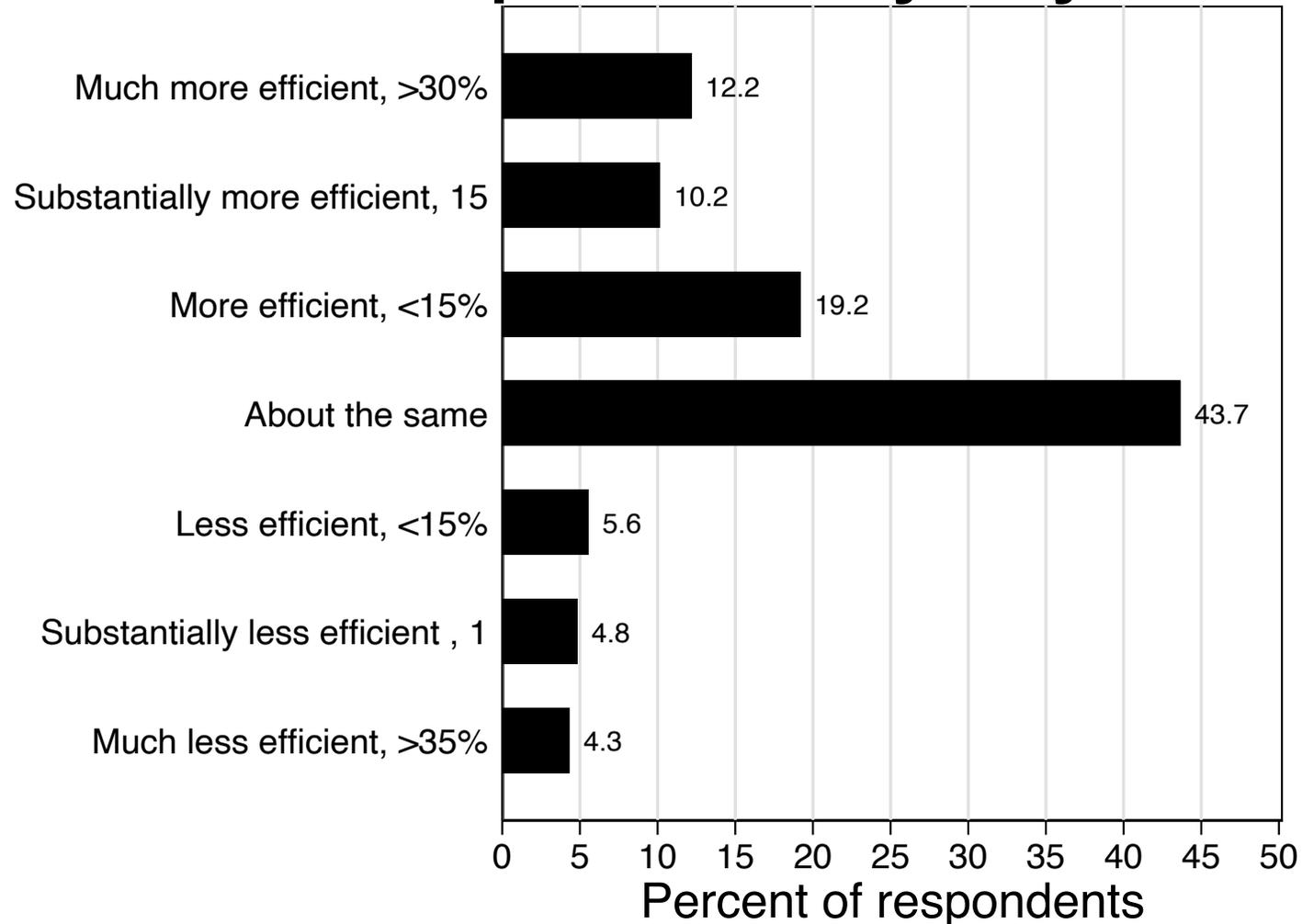
Worse -- I am 1% to 9% less productive than I expected

Substantially worse -- I am 10% to 19% less productive than I expected

Hugely worse -- I am 20%+ less productive than I expected

Continue

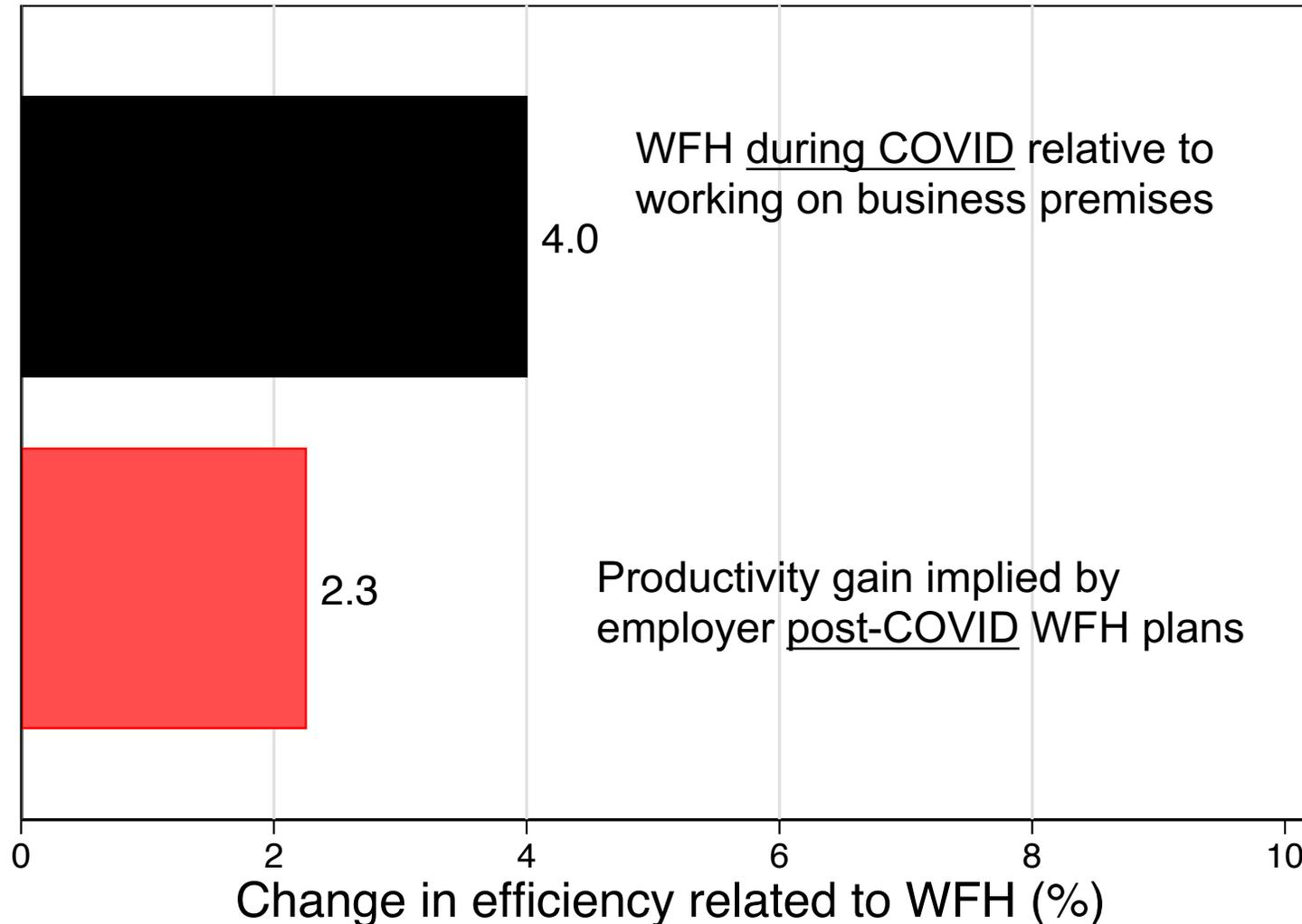
(B) Productivity gains from re-optimizing working arrangements: > 40% of respondents say they are more productive when WFH



How does your efficiency working from home *during the COVID-19 pandemic* compare to your efficiency working on business premises *before the pandemic*?

Notes: From August to October 2020, we surveyed 7,500 Americans aged 20-64 with labor earnings > \$20,000 in 2019. We re-weight raw responses to match the industry-state-earnings shares of working-age persons in the CPS from 2010 to 2019. The right chart also uses responses to questions about employment status (selection), pay levels (for earnings weights) and, for the blue bar, how much their employer plans for them to work from home after the pandemic ends. **Source:** "Working from Home Will Stick" by Jose Maria Barrero, Nick Bloom and Steven J. Davis, October 2020.

(B) Potential Productivity gains – Our results suggest a 2.3% Post-pandemic gain due to re-optimization of working arrangements



Notes: From August to October 2020, we surveyed 7,500 Americans aged 20-64 with labor earnings > \$20,000 in 2019. We re-weight raw responses to match the industry-state-earnings shares of working-age persons in the CPS from 2010 to 2019. This chart uses responses to questions about productivity while working from home relative to business premises, as well as about employment status and ability to work from home (selection), pay levels (for earnings weights) and, for the red and blue bars, how much their employer plans for them to work from home after the pandemic ends.

[Calculations detail](#)

(C) Big savings in commuting time



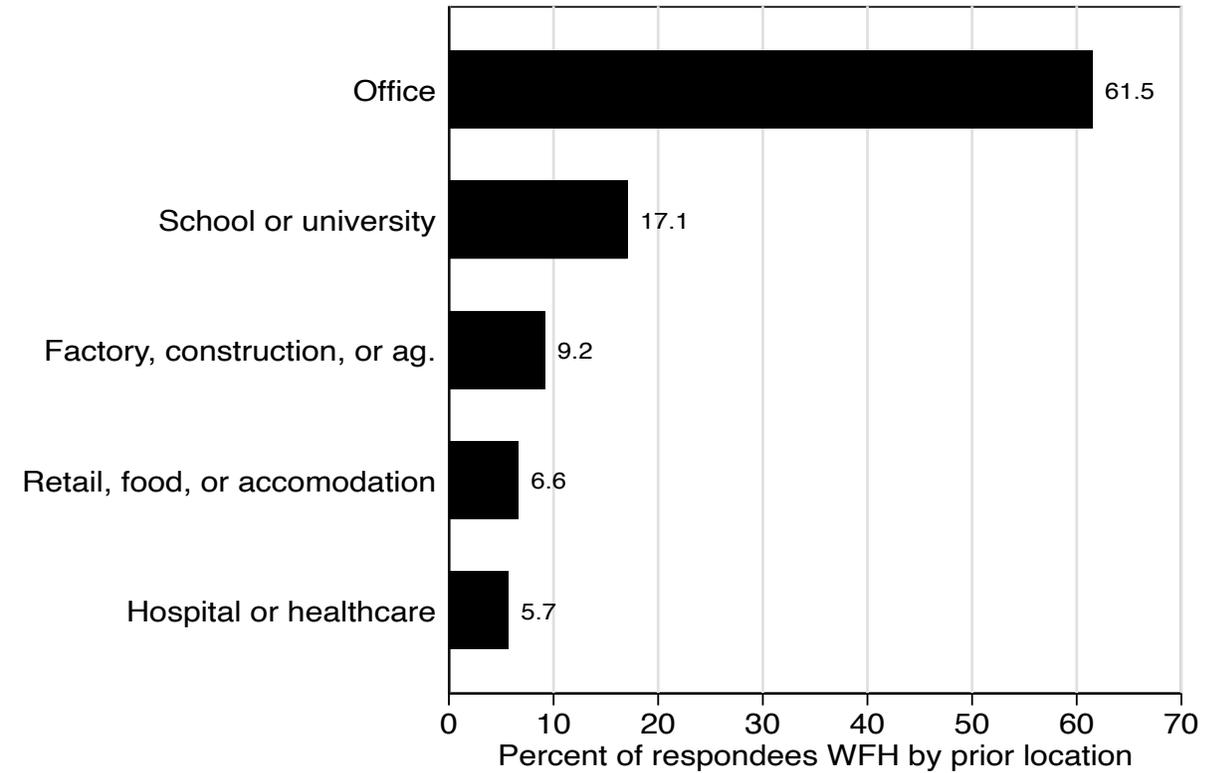
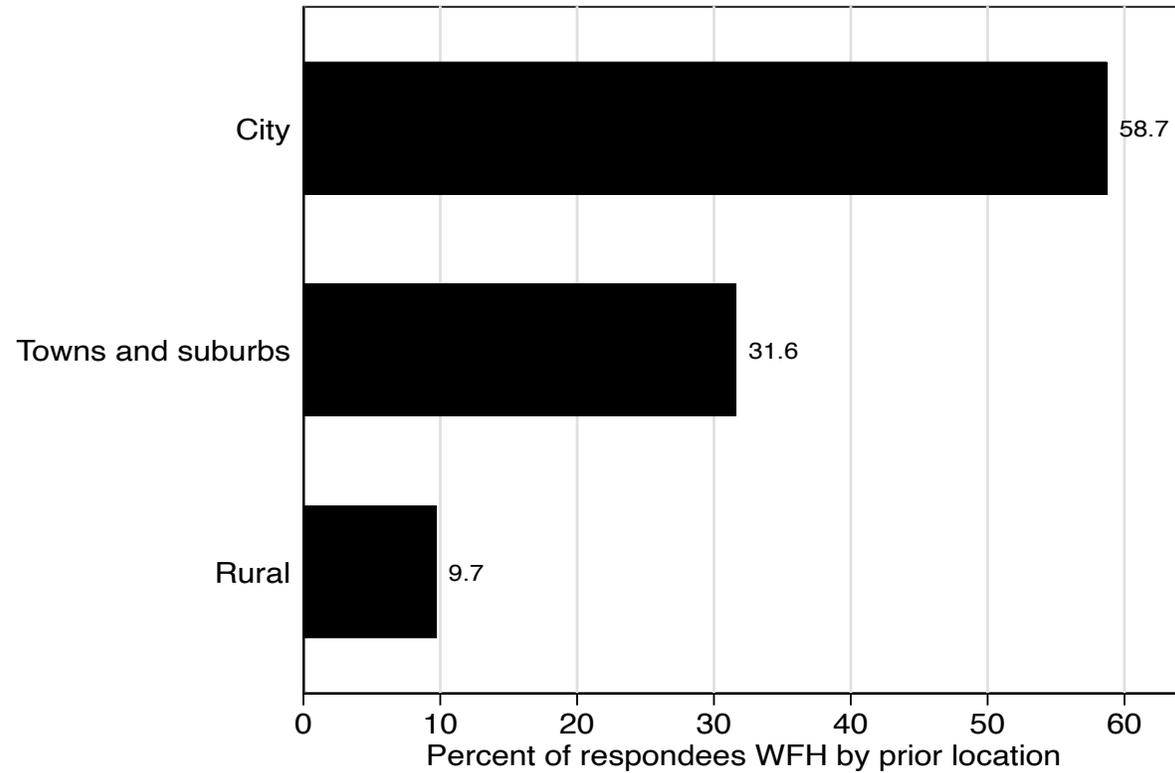
The image shows the top portion of a website. At the top left, there are logos for 'VOX^{EU}' and 'CEPR'. To the right of these logos is the text 'Research-based policy analysis and commentary from leading economists'. Further right are social media icons for Facebook, LinkedIn, and Twitter. Below this is a navigation bar with the following items: 'Columns' (highlighted), 'Covid-19', 'Vox Multimedia', 'Publications', 'Blogs&Reviews', 'People', and 'Debates'. Below the navigation bar is a secondary menu with the following items: 'By Topic', 'By Date', 'By Reads', and 'By Tag'.

60 million fewer commuting hours per day: How Americans use time saved by working from home

Jose Maria Barrero, Nicholas Bloom, Steven Davis 23 September 2020

The COVID-19 pandemic triggered a sudden, massive shift around the world to working from home. While there is great concern how this will affect inequality and how the economy will adjust, the shift has also saved billions of hours of commuting time in the US alone. Drawing on original surveys, this column estimates that the shift to working from home lowers commuting time among Americans by more than 60 million hours per workday. Americans devote about a third of the time savings to their primary jobs and about 60% to other work activities, including household chores and childcare. The allocation of time savings differs substantially by education group and between persons with and without children at home.

(D) Cities: WFH highest amongst employees from city offices



Source: Data from a survey of 2,500 US residents aged 20 to 64, earning more than \$20,000 per year in 2019 carried out between May 21-25 2020, by QuestionPro on behalf of Stanford University. Sample reweighted to match the US CPS.

(D) Cities: for example, 10% worker spending drop in Manhattan

- Manhattan workers plan to WFH **30.7%** of working days post-COVID
- Pre-COVID average weekly expenditure near work by these workers **\$283**
- Pre-COVID **2.3M** people commuted into Manhattan for work per day
- Implies **\$10Bn** less spending per year
- Fall of about **10%** of total spending

[Similar calculation for San Francisco](#)



(D) Cities – office rents also falling in high-rise buildings

Survey evidence shows post-COVID office space demand about flat*

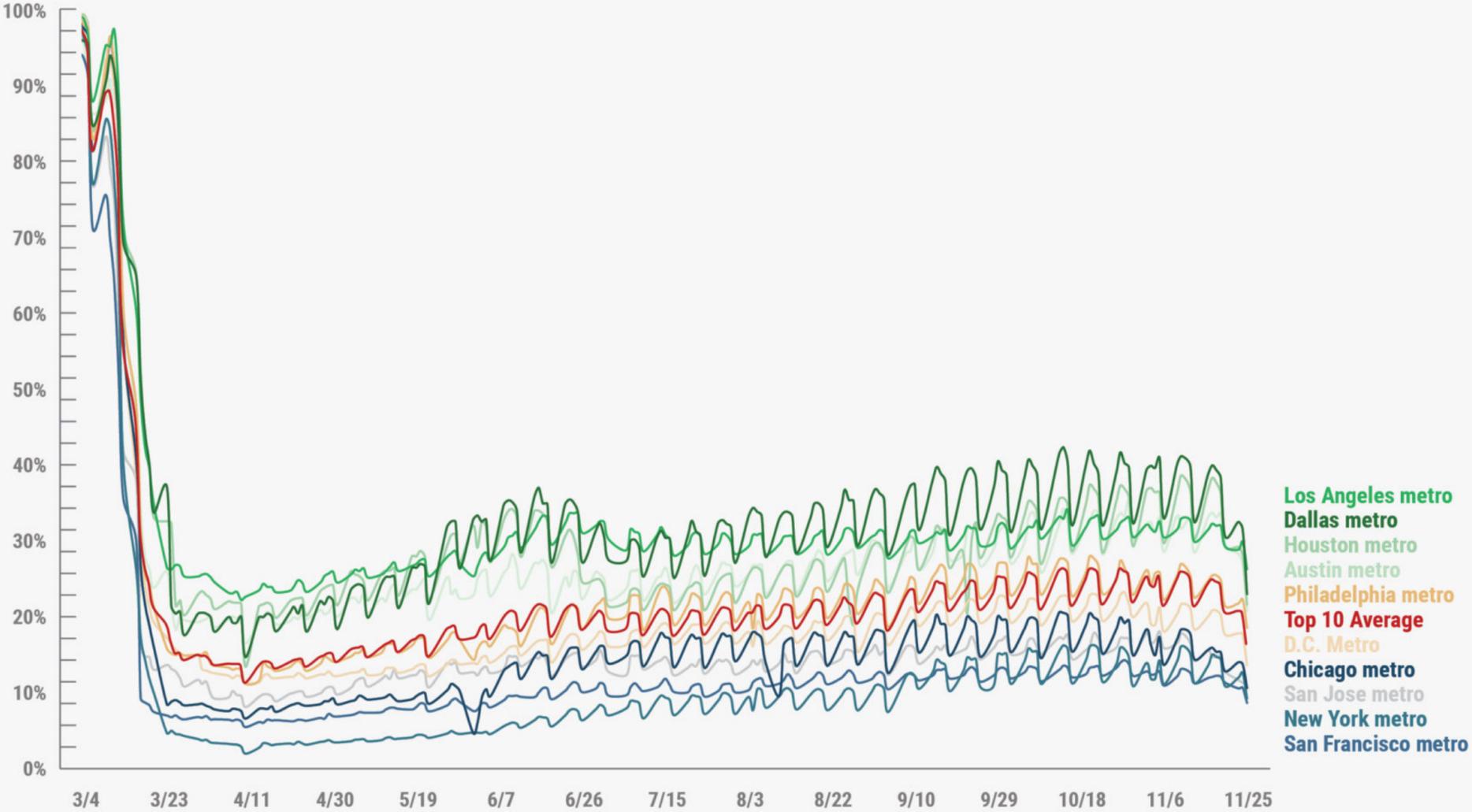
But shift from Skyscrapers to Office Parks



* <https://www.frbatlanta.org/blogs/macroblog>

Since COVID, commercial buildings are semi-deserted in U.S. cities

OCCUPANCY OVER TIME — MARCH 4 TO NOVEMBER 25



Notes: Kastle security index of swipe card access relative to pre-COVID average

<https://www.kastle.com>

Some Conclusions

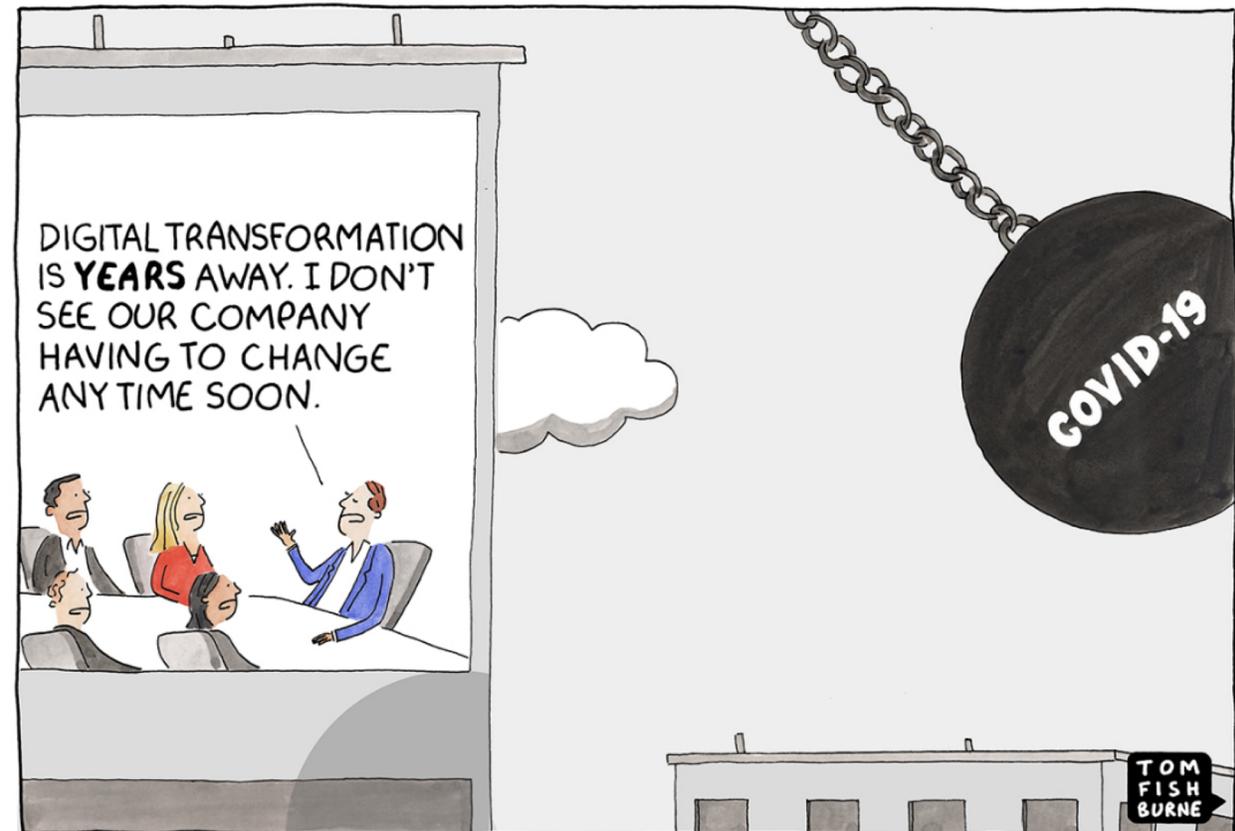
WFH days 5% pre-COVID, 60% during COVID, predicting 23% post-COVID

Mechanisms behind a persistent WFH shift

1. Positive productivity experiences
2. Investments enabling WFH
3. Diminished stigma
4. Lingering concerns over density
5. Re-directed innovation

Big implications for

- Uneven benefits
- Cheaper Cities
- Higher Productivity
- Less Commuting



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