

# On-the-job Leisure and Work from Home: Measuring Productive Hours

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# Introduction

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# Motivation

- Changing work environment
    - Computers: How we work
    - Pandemic: Where we work
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## Goal

- Measure total *productive hours worked*
- Typically, reported usual hours worked:
  - include time spent in leisure on the job (OJL)
  - do not include work from home (WFH)

# What we find

- WFH
  - Has increased
  - Increase started just after Great Recession
  - Is now more productive than work at the office
- OJL has declined slightly

# Data

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# How are we going to measure all of this?

## American Time Use Survey 2003 - 2019

- Interviews CPS respondents 2-5 months after final interview
  - interviewed on one diary day
- Asks people about their activities
  - **what**
  - **when**
  - **how long**
  - **where**
  - **who with**
- Coded into one of 400 categories

**Table 1:** Demographic Summary Statistics: ATUS 2003-2019

Characteristic	Sample Mean	Characteristic	Sample Mean
Female	0.48	White	0.82
Married	0.55	Black	0.11
Age	40.41	Other	0.07
Child	0.43	Government	0.17
High School	0.28	Full Time	0.80
Some College	0.27	Paid Hourly	0.59
Advanced Degree	0.12	One Job	0.87
College	0.22	At Work	0.62
Less than HS	0.10		
Total number of Observations			110,717
Number of people at work on interview day			55,152

*Note: ATUS weights used in all calculations.*

# Key Measures from the ATUS

- If respondent was at work on the diary day
  - *Total time at work*: Sum time at office: work and OJL
  - *OJL*: Sum duration of non-work at work
  - *WFH*: Sum duration of work at home (remote)



**Table 2:** Work and Leisure at Work Summary Statistics: ATUS 2003-2019

	Sample Average
Time at Work ( $h^w$ )	312.71
On-the-job Leisure ( $h^l$ )	
<i>Participation</i>	0.43
<i>Unconditional Min.</i>	19.87
<i>Conditional Min.</i>	46.74
Work from Home ( $h^h$ )	
<i>Participation</i>	0.16
<i>Unconditional Min.</i>	30.92
<i>Conditional Min.</i>	190.84
Productive Work ( $h^p$ )	323.76

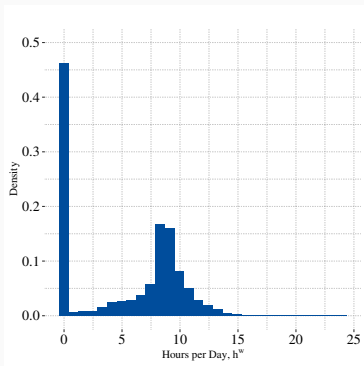
*Note: ATUS weights used in all calculations.*

# Definitions

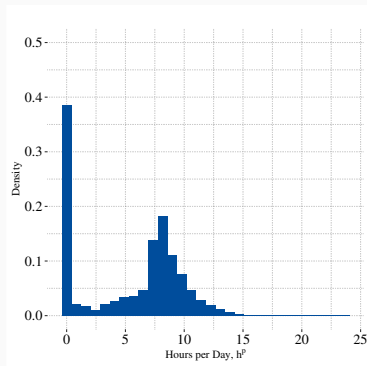
- Hours at the workplace:  $h_{it}^w$
- Hours of OJL at the workplace:  $h_{it}^l$
- Hours of work at home:  $h_{it}^h$
- *Productive hours:*

$$h_{it}^p = h_{it}^w - h_{it}^l + h_{it}^h \quad (1)$$

## Hours at work and Productive hours worked: Full sample



**(a)** Hours at Work



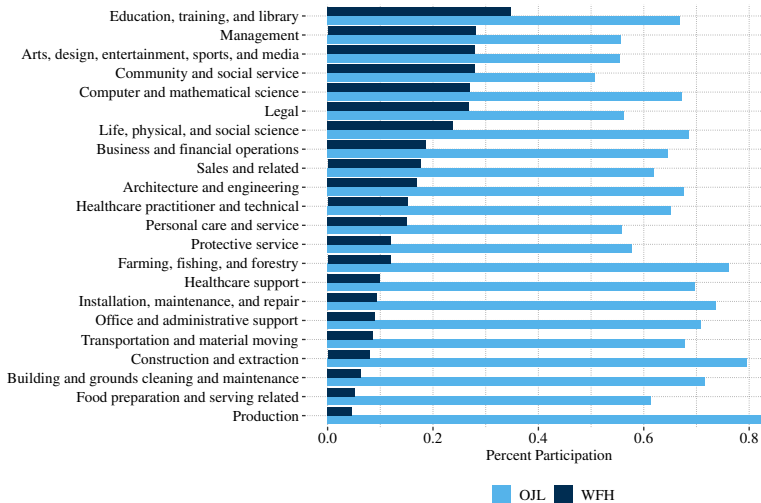
**(b)** Productive Hours Worked

*Note: ATUS weights used in all calculations.*

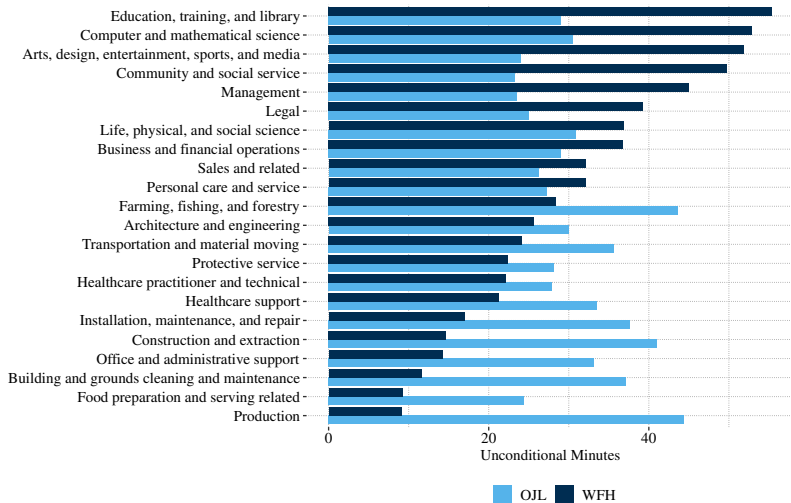
# Variation by Occupation

- Large differences in OJL and WFH by occupation
  - eg. office work vs. production
  - computer intensity, etc.
- Participation
- Minutes

# Percent Participating



# Unconditional Minutes



# Aggregate Hours

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# From Individual to Aggregate Hours

- Aggregate our measure for comparison
  - Current Employment Statistics (CES)
  - Current Population Survey (CPS)
  - Composite BLS series (BLS)
- ATUS sample weights aggregate to quarterly total hours

$$H_t^p = \sum_i h_{it}^p \times wgt_{it}. \quad (2)$$

- Convert to average weekly hours

$$\bar{H}_t^p = \frac{H_t^p}{13 \times E_t}. \quad (3)$$

- $E$  is total employed in our sample

$$E_t = \sum_i \frac{wgt_{it}}{91.5}. \quad (4)$$



# From Individual to Aggregate Hours

- Same for  $\bar{H}^h$ ,  $\bar{H}^l$  and  $\bar{H}^w$ .

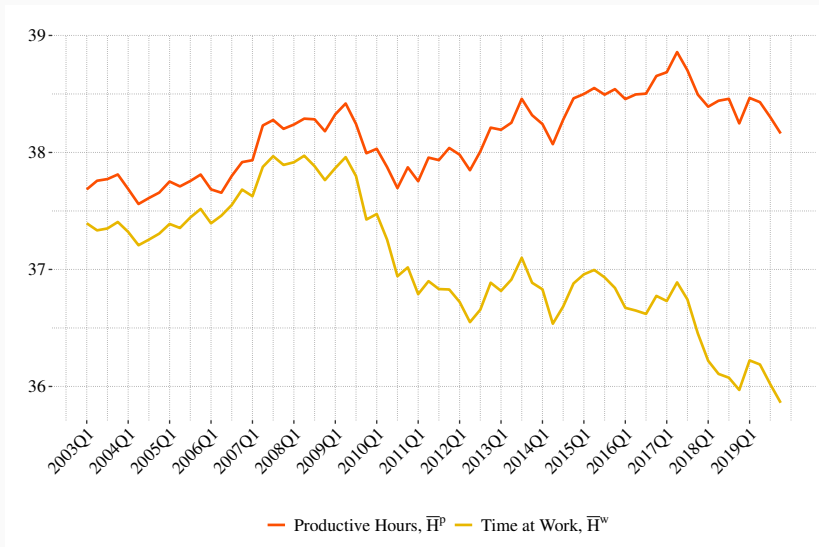
$$\bar{H}_t^h = \frac{\sum_i h_{it}^h \times wgt_{it}}{13 \times E_t} \quad (5)$$

$$\bar{H}_t^l = \frac{\sum_i h_{it}^l \times wgt_{it}}{13 \times E_t} \quad (6)$$

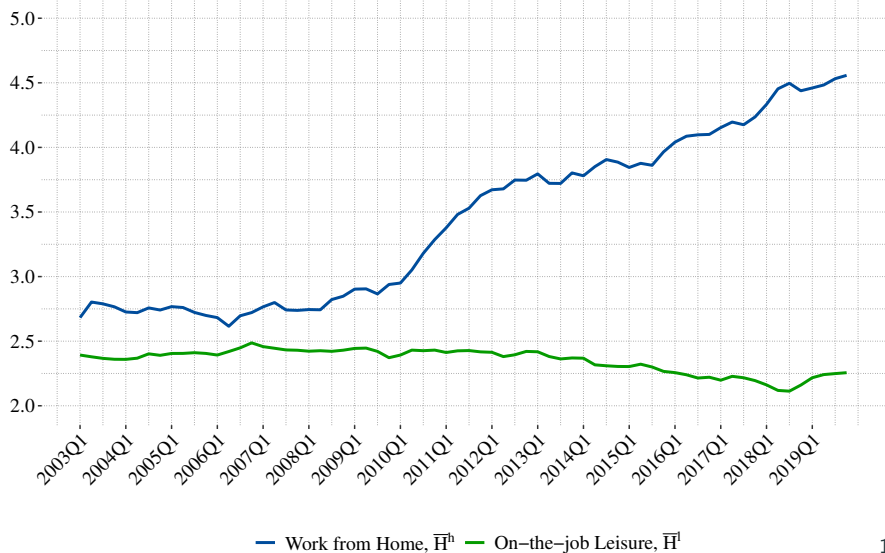
$$\bar{H}_t^w = \frac{\sum_i h_{it}^w \times wgt_{it}}{13 \times E_t} \quad (7)$$

- Smooth with a 12-quarter moving average.

# Productive Hours and Time at Work



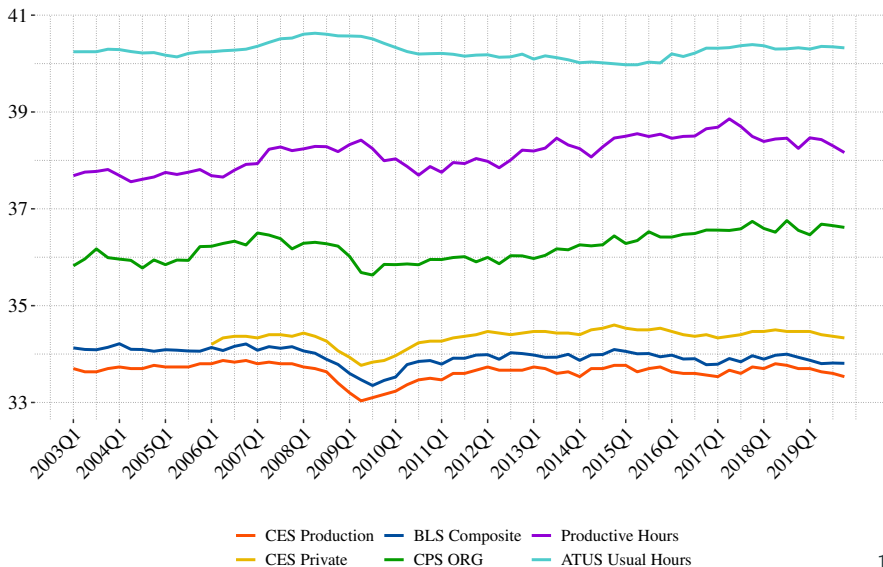
# WFH and OJL



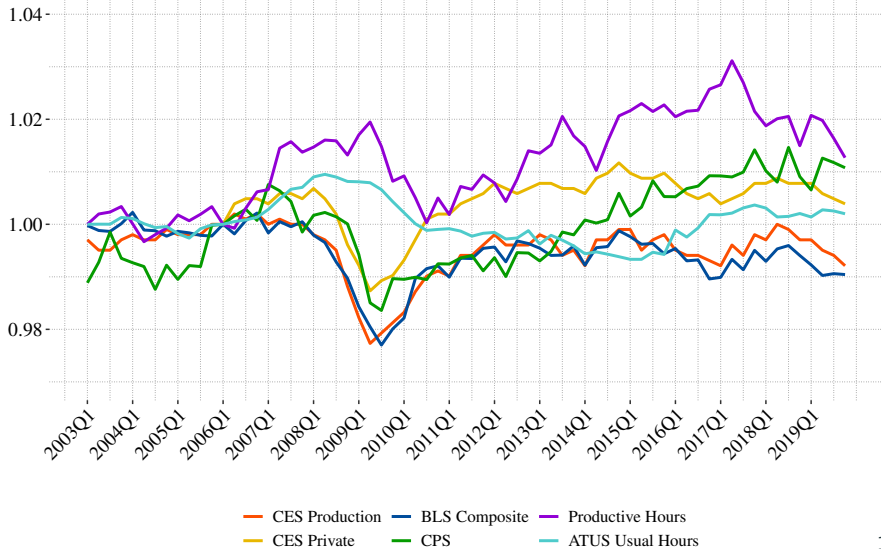
# Comparison to Other Measures

- Well-known large level differences
  - Different sample populations
  - Different hours concept (paid vs. all hours)
  - Frazis and Stewart [2004]
- Sample differences cannot explain trends
- Frazis and Stewart [2010]

# Hours Comparison: Levels



# Hours Comparison: Trends



## So Far...

- Increase in work from home
- Small decrease in on-the-job leisure
- Reporting issue in usual hours?

# Trends

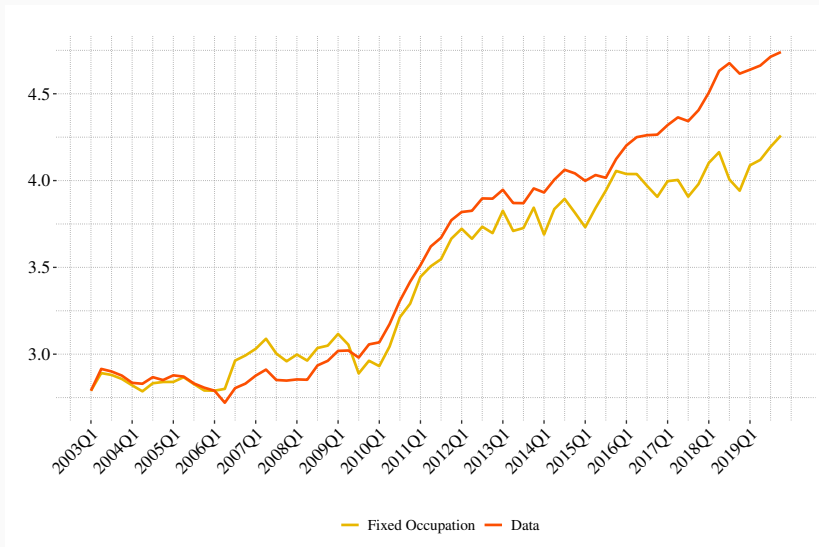
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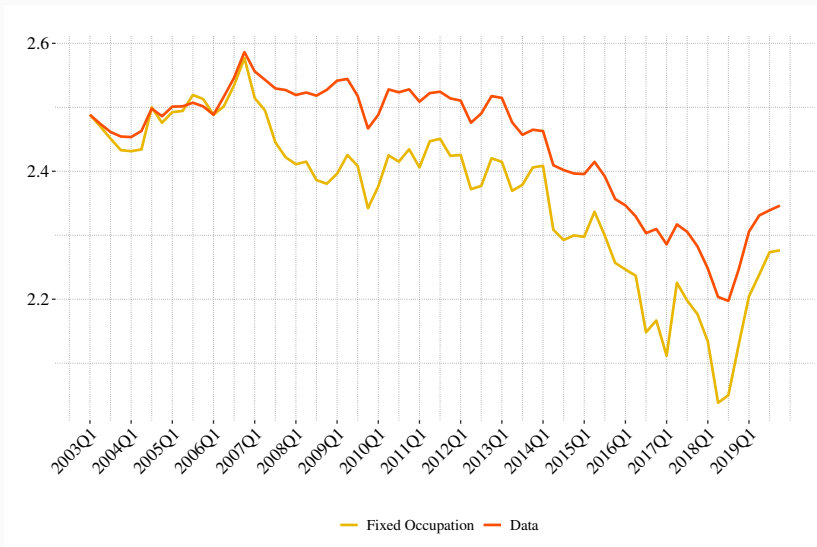
# Accounting for Trend Changes I

- Changing occupational distribution
- Across occupations
  - Fix occupational distribution at 2003 distribution
  - Construct 1,000 bootstrapped samples of OJL and WFH
  - Take means and apply 12 quarter moving average

# WFH: Weekly Hours



# OJL: Weekly Hours



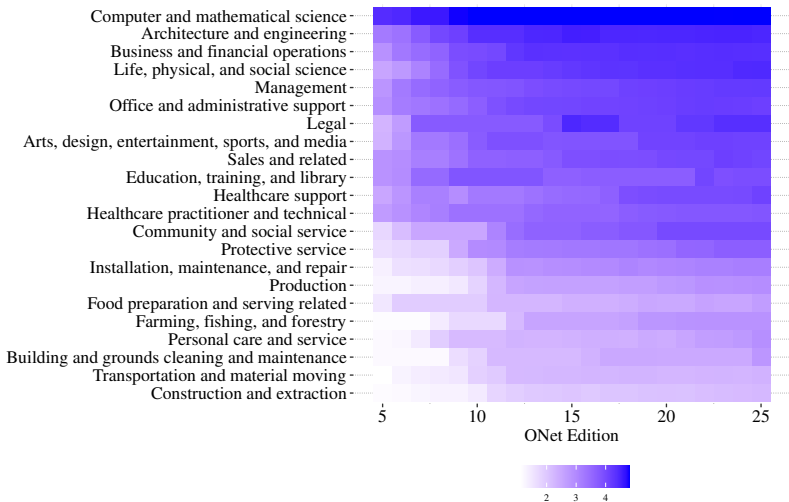
# Accounting for Trend Changes II

- Within occupations
  - Combine ATUS data with O\*NET 2004-2019 (5.0 - 25.0)
  - Worker attributes and job characteristics
  - 1,000 occupations
  - Focus on working with computers
  - How important is working with computers?
    - 1-5, 5 most important
- How do computers affect OJL? WFH?

# Ambiguous effect of computers

- OJL and an increase in computer usage
  - More efficient → more OJL
  - More distractions → more OJL
  - More monitoring → less OJL
- WFH and an increase in computer usage
  - Less work to take home → less WFH
  - Zoom → more WFH
- How important are computers at work?

# Importance of Computers at Work



# Computers, OJL and WFH

- Extensive margin
  - Logit on indicator of participation in OJL
  - Control for worker and job characteristics
  - Estimate the probability of participation in OJL
- Intensive margin
  - Estimate minutes of OJL given OJL

# OJL Estimates

	Probability of OJL		Minutes of OJL		Minutes of OJL w/o eating	
	Across (1)	Within (2)	Across (3)	Within (4)	Across (5)	Within (6)
Interacting with Computers	0.018 (0.036)	-0.327 (0.072)	-0.827 (0.824)	0.641 (1.475)	-0.100 (0.703)	3.047 (1.379)
log(Hours at work)	1.961 (0.053)	2.046 (0.054)	31.256 (1.590)	31.747 (1.599)	11.711 (1.311)	12.407 (1.310)
Female	0.069 (0.031)	0.039 (0.034)	-0.215 (0.624)	-0.104 (0.677)	-0.544 (0.536)	-0.554 (0.602)
Child	-0.011 (0.030)	-0.020 (0.031)	-1.062 (0.588)	-0.834 (0.579)	-0.771 (0.514)	-0.377 (0.506)
Occupation FE		✓		✓		✓
Onet Edition FE	✓		✓		✓	
Month FE	✓	✓	✓	✓	✓	✓
Diary Day FE	✓	✓	✓	✓	✓	✓
Mean Dependent Variable	0.682	0.682	0.087	0.087	0.035	0.035
N	48,824	48,824	32,352	32,352	32,352	32,352



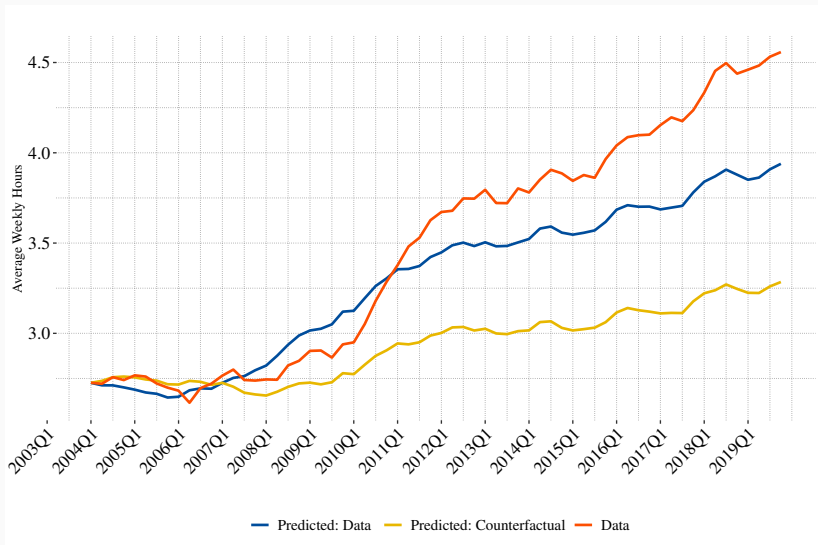
# WFH Estimates

	Probability of WFH		Minutes of WFH	
	Across	Within	Across	Within
Interacting with Computers	-0.054 (0.038)	0.261 (0.066)	-1.478 (5.387)	32.271 (8.975)
At Work	0.633 (0.079)	0.607 (0.078)	-64.277 (9.385)	-63.312 (9.154)
At Work $\times$ log(Hours at work)	-0.928 (0.037)	-0.925 (0.037)	-89.986 (4.370)	-87.978 (4.272)
Female	-0.156 (0.028)	-0.087 (0.030)	-12.130 (3.804)	-7.917 (3.956)
Age	0.011 (0.001)	0.010 (0.001)	0.308 (0.160)	0.340 (0.159)
Married	0.085 (0.028)	0.046 (0.029)	-5.227 (4.064)	-4.829 (3.951)
Occupation FE		✓		✓
Onet Edition FE	✓		✓	
Month FE	✓	✓	✓	✓
Diary Day FE	✓	✓	✓	✓
Mean Dependent Variable	0.163	0.163	191.880	191.880
N	99,403	99,403	16,517	16,517

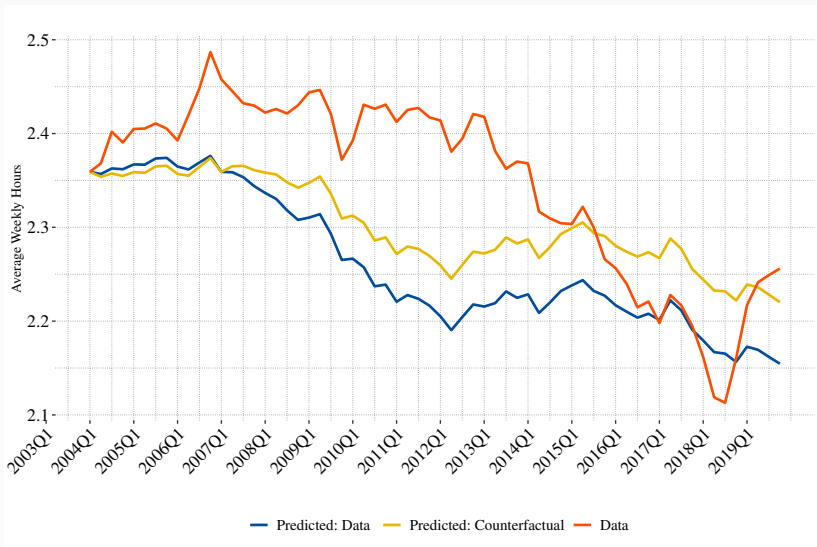
# Computers and Trends in OJL and WFH

- Using “within” estimates predict OJL and WFH
  - Construct aggregate expected minutes
  - Calculate average weekly hours
  - Use 12 quarter moving average smoother
- Do this for
  - Full data set
  - Counterfactual holding fixed computer importance

# WFH: Computer Importance Fixed at 2004 Level



# OJL: Computer Importance Fixed at 2004 Level



# Relative Productivity

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# Productive Time

- Calculate productivity relative to office work
  - Output is generated by

$$Y = K^\alpha L^{1-\alpha} \quad (8)$$

$$L = H_o + A_h H_h + A_l H_l \quad (9)$$

- $A_h$ : productivity of a home relative to office
- $A_l$ : productivity of OJL relative to office
- Assume a competitive firm

# Productivity

- Taking wages as given
- Optimality conditions imply

$$\frac{s_h}{s_o} = A_h \times \frac{H_h}{H_o} \quad (10)$$

$$\frac{s_l}{s_o} = A_l \times \frac{H_l}{H_o} \quad (11)$$

- Where  $s_o$ ,  $s_h$  and  $s_l$  are income shares
- $H$ 's from our constructed hours series

# Productivity

- Share of working time in WFH and OJL

$$\theta_{it}^h = \frac{h_{it}^h}{h_{it}^o + h_{it}^h + h_{it}^l} \quad (12)$$

$$\theta_{it}^l = \frac{h_{it}^l}{h_{it}^o + h_{it}^h + h_{it}^l} \quad (13)$$

- Income shares are now given by

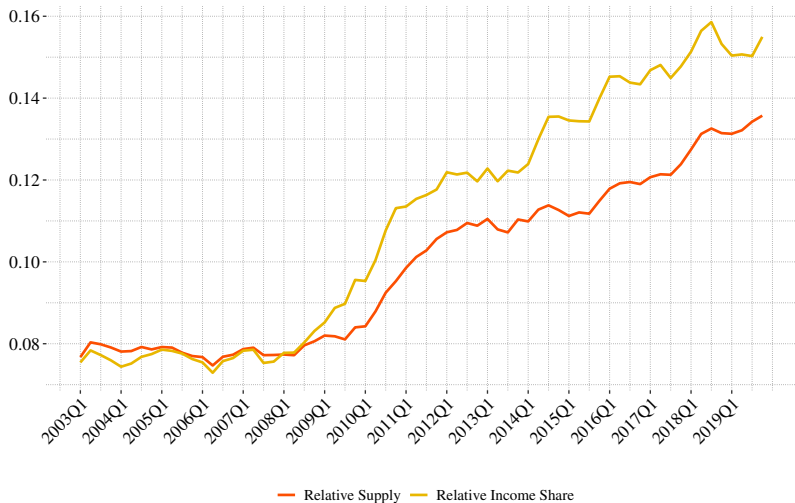
$$s_{it}^h = \sum_i w_{it} \times \theta_{it}^h \times h_{it}^h \times wgt_{it} \quad (14)$$

$$s_{it}^l = \sum_i w_{it} \times \theta_{it}^l \times h_{it}^l \times wgt_{it} \quad (15)$$

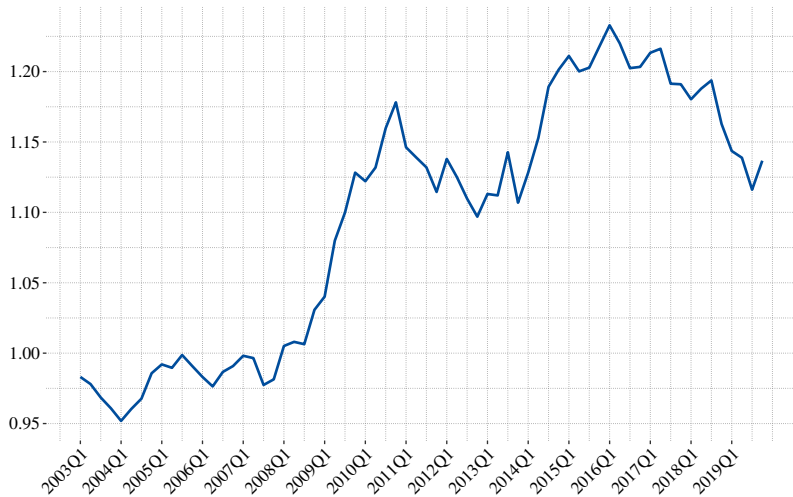
$$s_{it}^o = \sum_i w_{it} \times (1 - \theta_{it}^h - \theta_{it}^l) \times h_{it}^o \times wgt_{it} \quad (16)$$



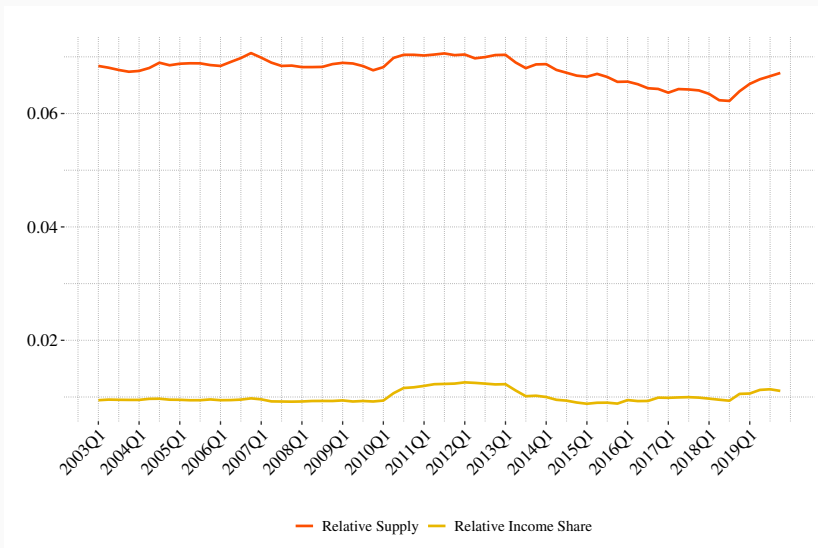
# Relative Supply and Income Share: WFH



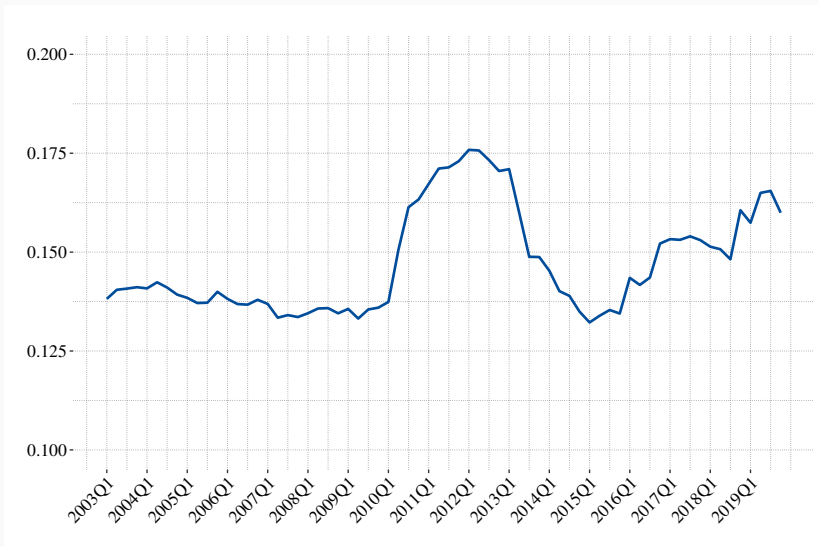
# Relative Productivity: WFH



# Relative Supply and Income Share: OJL



# Relative Productivity: OJL



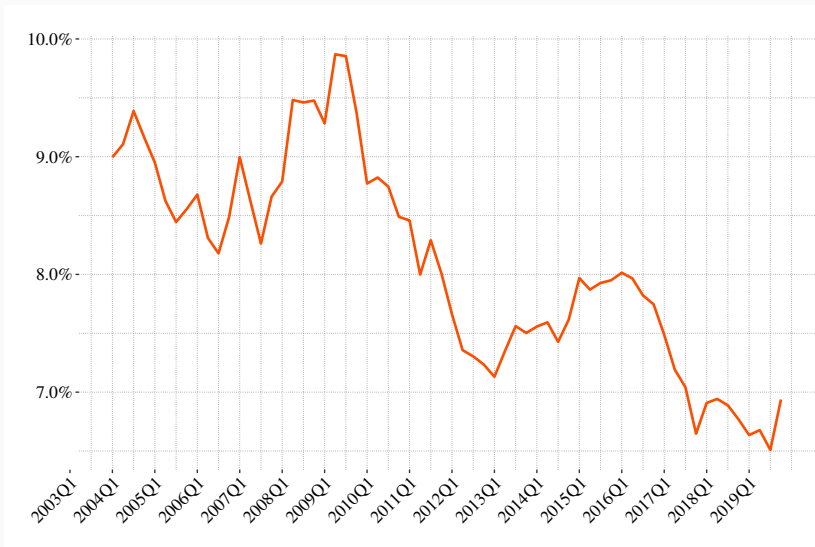
## So Far....

- Time spent WFH has risen
- WFH productivity now higher than at the office
  - One avenue: time spent with children
  - ATUS has child care as a secondary activity
  - Calculate the fraction of time worked while caring for a child

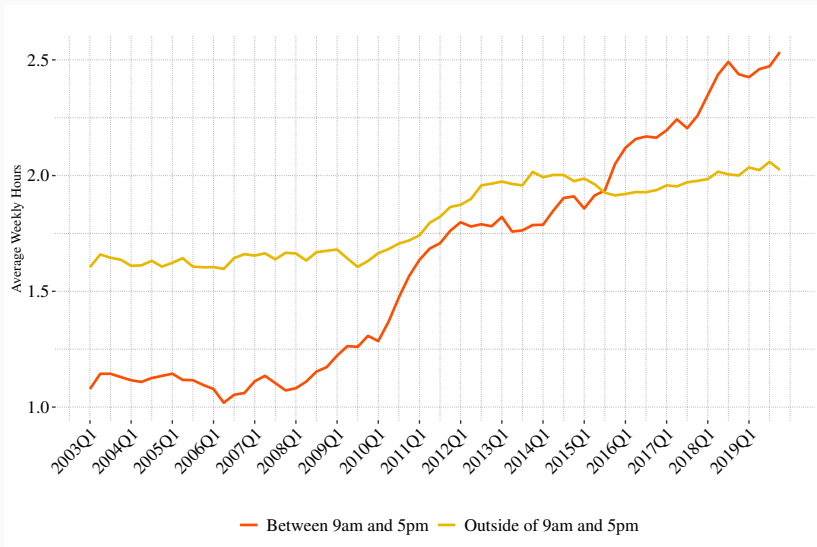
$$\frac{\tilde{H}_t^h}{H_t^h} = \frac{\sum_i \tilde{h}_{it}^h \times wgt_{it}}{\sum_i h_{it}^h \times wgt_{it}}. \quad (17)$$

- Use the 12 quarter smoother

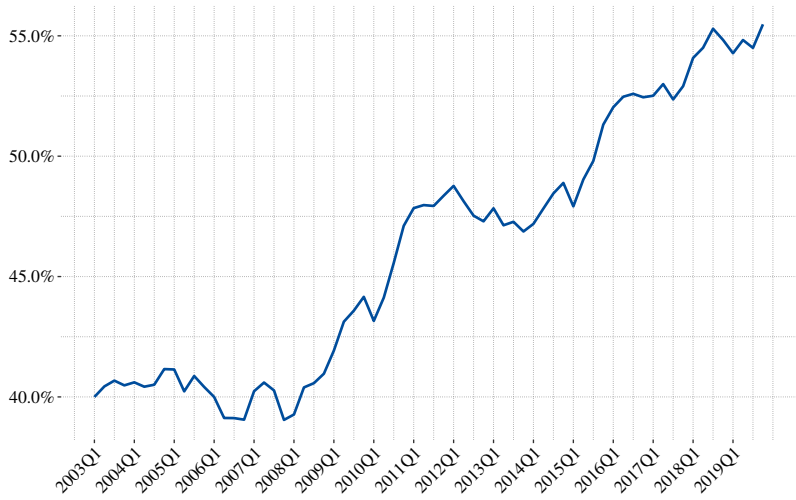
# Percent of Hours WFH while caring for Children



# Hours WFH by time of Day



# Fraction of Time WFH 9-5





# Productivity Estimates

	Relative Productivity of WFH		
	OLS		IV
	(1)	(2)	(3)
WFH 9am-5pm	0.892 (0.246)	1.053 (0.323)	1.471 (0.540)
WFH providing Childcare	-0.557 (0.795)	-1.011 (1.127)	-1.770 (0.721)
Female	-0.657 (0.334)	-0.460 (0.565)	-0.684 (0.347)
Occupation Percentage WFH		✓	✓
First Stage F-stat			8.751
N	64	64	63

# Implication of Productivity Estimates

- 1pp increase in the share of WFH occurring between 9-5 increases relative productivity by 0.015
- 15pp increase  $\implies$  0.22 increase in relative productivity
- 1pp decrease in WFH w/ children  $\implies$  0.05 increase in relative productivity
  - Together they account for roughly the whole increase

# Conclusion

- OJL has not changed much
- Time spent WFH has risen substantially
- WFH productivity now higher than at the office
  - One avenue: time spent with children