

NBER WORKING PAPER SERIES

HOW MANY JOBS CAN BE DONE AT HOME?

Jonathan I. Dingel
Brent Neiman

Working Paper 26948
<http://www.nber.org/papers/w26948>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2020, Revised April 2020

The authors have no financial relationships relevant to this research. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2020 by Jonathan I. Dingel and Brent Neiman. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

How Many Jobs Can be Done at Home?

Jonathan I. Dingel and Brent Neiman

NBER Working Paper No. 26948

April 2020, Revised April 2020

JEL No. D24,J22,J61,O30,R12,R32

ABSTRACT

Evaluating the economic impact of "social distancing" measures taken to arrest the spread of COVID-19 raises a fundamental question about the modern economy: How many jobs can be performed at home? We classify the feasibility of working at home for all occupations and merge this classification with occupational employment counts for the United States. Our classification implies that 37 percent of U.S. jobs can plausibly be performed at home.

Jonathan I. Dingel

Booth School of Business

University of Chicago

5807 South Woodlawn Avenue

Chicago, IL 60637

and NBER

jdingel@chicagobooth.edu

Brent Neiman

University of Chicago

Booth School of Business

5807 South Woodlawn Avenue

Chicago, IL 60637

and NBER

brent.neiman@chicagobooth.edu

A replication package is available at <https://github.com/jdingel/DingelNeiman-workathome/>

How Many Jobs Can be Done at Home?

Jonathan I. Dingel* Brent Neiman†

April 6, 2020‡

1 Introduction

Evaluating the economic impact of “social distancing” measures taken to arrest the spread of COVID-19 raises a number of fundamental questions about the modern economy: How many jobs can be performed at home? What share of total wages are paid to such jobs? How does the scope for working from home vary across cities or industries?

To answer these questions, we classify the feasibility of working at home for all occupations and merge this classification with occupational employment counts for the United States. Our feasibility measure is based on responses to two Occupational Information Network (O*NET) [surveys](#) covering “work context” and “generalized work activities.” For example, if answers to those surveys reveal that an occupation requires daily “work outdoors” or that “operating vehicles, mechanized devices, or equipment” is very important to that occupation’s performance, we determine that the occupation cannot be performed from home.¹ We merge this classification of O*NET occupations with information from the U.S. Bureau of Labor Statistics (BLS) on the prevalence of each occupation in the aggregate as well as in particular metropolitan statistical areas and 2-digit NAICS industries.

2 Results

Our classification implies that 37 percent of U.S. jobs can plausibly be performed at home. We obtain our estimate by identifying job characteristics that clearly rule out the possibility of working entirely from home, neglecting many characteristics that would make working from

*University of Chicago, Booth School of Business, NBER, and CEPR; jdingel@chicagobooth.edu.

†University of Chicago, Booth School of Business, NBER, and CEPR; brent.neiman@chicagobooth.edu.

‡Originally published on March 27, 2020. This version updates our numbers by correcting a coding error that was helpfully brought to our attention by Megan Fasules, to whom we are grateful. The correction raised our estimate of the share of U.S. jobs that can be done at home from 34 to 37 percent and raised our estimate of the share of the wage bill represented by these jobs from 44 to 46 percent. Similarly, the correction increased these shares for nearly all geographies and industries by a few percentage points.

¹See the Appendix for a more detailed description of our classification based on O*NET survey responses. Using our [replication package](#), researchers can modify this classification scheme to produce results based on their own assessment of the plausibility of working at home for each type of job.

home difficult.² Our estimate is therefore an upper bound on what might be feasible and greatly exceeds the share of jobs that in fact have been performed entirely at home in recent years. According to the 2018 American Time Use Survey, less than a quarter of all full-time workers work at all from home on an average day, and even those workers typically spend well less than half of their working hours at home. Workers in occupations that can be performed at home typically earn more. If we assume all occupations involve the same number of hours of work, the 37 percent of U.S. jobs that can plausibly be performed at home account for 46 percent of all wages.

Table 1: Share of jobs that can be done from home, by metropolitan area

	Unweighted	Weighted by wage
<i>Top five</i>		
San Jose-Sunnyvale-Santa Clara, CA	0.51	0.66
Washington-Arlington-Alexandria, DC-VA-MD-WV	0.50	0.64
Durham-Chapel Hill, NC	0.46	0.57
Austin-Round Rock, TX	0.46	0.58
San Francisco-Oakland-Hayward, CA	0.45	0.58
<i>Bottom five</i>		
Grand Rapids-Wyoming, MI	0.29	0.37
Lancaster, PA	0.29	0.36
Bakersfield, CA	0.29	0.36
Stockton-Lodi, CA	0.29	0.33
Cape Coral-Fort Myers, FL	0.28	0.34

There is significant variation in this percentage across cities and industries. Table 1 reports the top five and bottom five metropolitan statistical areas (from among the 100 largest, by employment) in terms of the share of jobs that could be done from home. More than 45 percent of jobs in San Francisco, San Jose, and Washington, DC could be performed at home, whereas this is the case for 30 percent or less of the jobs in Fort Myers, Grand Rapids, and Las Vegas. Figure 1 depicts the geographic distribution of our unweighted measure of the share of jobs that can be done at home across metropolitan areas. As shown in Table 2, whereas most jobs in finance, corporate management, and professional and scientific services could plausibly be performed at home, very few jobs in agriculture, hotels and restaurants, or retail could be. The full results for all [metropolitan areas](#) and [industries](#), together with our [classifications of occupations](#), are available at <https://github.com/jdingel/DingelNeiman-workathome>.

As an alternative to our baseline classification, we each manually assigned values of 0, 0.5, or 1 to each 5-digit SOC code based on introspection. Averaging our two judgments resulted

²For example, our classification codes 98 percent of 8.8 million teachers as able to work from home, which seems sensible given the large number of schools currently employing remote learning. Re-coding these teaching jobs as unable to be performed from home would, in the aggregate, reduce our estimate of the share of jobs that can be performed at home by about six percentage points.

Figure 1: Share of jobs that can be done from home

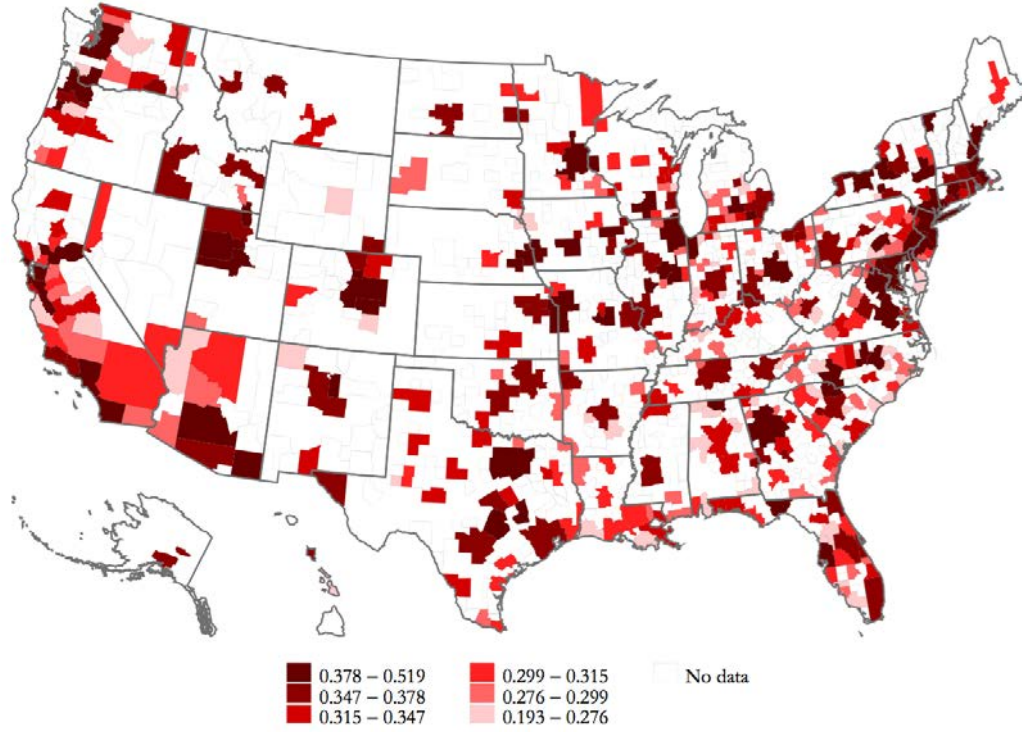


Table 2: Share of jobs that can be done from home, by industry

	Unweighted	Weighted by wage
<i>Top five</i>		
Educational Services	0.83	0.71
Professional, Scientific, and Technical Services	0.80	0.86
Management of Companies and Enterprises	0.79	0.86
Finance and Insurance	0.76	0.85
Information	0.72	0.80
<i>Bottom five</i>		
Transportation and Warehousing	0.19	0.25
Construction	0.19	0.22
Retail Trade	0.14	0.22
Agriculture, Forestry, Fishing and Hunting	0.08	0.13
Accommodation and Food Services	0.04	0.07

in values of 0, 0.25, 0.5, 0.75, and 1.³ Using this alternative measure, we find the following: Approximately 32 percent of all U.S. jobs, accounting for 42 percent of overall wages, can be performed almost entirely at home.

The city- and industry-level results generated by this alternative classification, which are included in our [replication package](#), are very similar to those presented in Table 1, Table 2, and Figure 1. Table 3 reports the share of jobs that can be performed at home by major group of occupation for both measures. The reported shares are generally quite similar across the two methods.

Table 3: Share of jobs that can be performed at home, by occupation’s major group

	Occupation	O*NET-derived baseline	Manual alternative
15	Computer and Mathematical Occupations	1.00	1.00
25	Education, Training, and Library Occupations	0.98	0.85
23	Legal Occupations	0.97	0.84
13	Business and Financial Operations Occupations	0.88	0.92
11	Management Occupations	0.87	0.84
27	Arts, Design, Entertainment, Sports, and Media Occupations	0.76	0.57
43	Office and Administrative Support Occupations	0.65	0.51
17	Architecture and Engineering Occupations	0.61	0.88
19	Life, Physical, and Social Science Occupations	0.54	0.36
21	Community and Social Service Occupations	0.37	0.50
41	Sales and Related Occupations	0.28	0.21
39	Personal Care and Service Occupations	0.26	0.00
33	Protective Service Occupations	0.06	0.00
29	Healthcare Practitioners and Technical Occupations	0.05	0.06
53	Transportation and Material Moving Occupations	0.03	0.00
31	Healthcare Support Occupations	0.02	0.00
45	Farming, Fishing, and Forestry Occupations	0.01	0.00
51	Production Occupations	0.01	0.00
49	Installation, Maintenance, and Repair Occupations	0.01	0.00
47	Construction and Extraction Occupations	0.00	0.00
35	Food Preparation and Serving Related Occupations	0.00	0.00
37	Building and Grounds Cleaning and Maintenance Occupations	0.00	0.00

For a small set of occupations, however, the two methodologies do reach opposite conclusions. Appendix Table A.1 reports the 5-digit occupation codes for which the two measures differ by 0.8 or more.⁴ Our baseline classification based on O*NET survey responses says that fundraisers, for example, cannot work from home, whereas our manual classification says that they can. Our baseline classification codes mail clerks as able to work from home, whereas the manual classification says that they cannot.

³Our two assessments about whether an occupation could be done at home or not agreed in about 85 percent of the cases, and our disagreements were only rarely greater than 0.5.

⁴Since the O*NET-derived measure is defined for 6-digit occupations, this measure is not necessarily 0 or 1 at the 5-digit level. We aggregate 6-digit occupations weighting by employment counts.

3 Related Literature

Our coding of occupational characteristics to determine how flexibly certain jobs can be re-located has clear roots in the exercise in Blinder (2009) that assessed the “offshorability” of jobs. While our approach is similar, we cannot simply use Blinder’s index because the feasibility of working from home is quite distinct from offshorability. For example, Blinder and Krueger (2013) write, “we know that all textile manufacturing jobs in the United States are offshorable.” Textile manufacturing jobs, of course, cannot be performed at home using current production technologies.

Our work also relates to Mas and Pallais (2020), who offer a detailed and helpful overview of the prevalence, features, and demand for alternative working arrangements, including the ability to work from home. Citing the Quality of Worklife Survey and the Understanding American Study, they report that less than 13 percent of full- and part-time jobs have a formal “work-from-home” arrangement, even though twice that amount work often from home. According to Mas and Pallais, the “median worker reports that only 6 percent of their job could be feasibly done from home,” but plenty of jobs, including those in “computer and mathematical” and “business and financial operations” can do a majority of their work from home. We note that, in the context of the response to COVID-19, there is an important distinction between being able to do most and all of one’s work at home.

Finally, a recently released paper by the United Kingdom Office for National Statistics (2020) reports that while 27 percent of the U.K. workforce said they’ve previously worked from home, only about 5 percent said they mainly work from home. Whether people have actually worked from home differs conceptually from the focal question of this note, which is whether these people could feasibly work from home.

4 Conclusion

Due to COVID-19, many employees are unable to travel to work. Identifying which jobs cannot be performed from home may be useful as policymakers try to target social insurance payments to those that most need them. Likewise, the share of jobs that could be performed at home is an important input to predicting the economy’s performance during this or subsequent periods of social distancing. We note, however, that it is not straightforward to use these values to estimate the share of output that would be produced under stringent stay-at-home policies. An individual worker’s productivity may differ considerably when working at home rather than her usual workplace. More importantly, there are likely important complementarities between jobs that can be performed at home and those that cannot. Incorporating our measures together

with these richer considerations is a fruitful avenue for future research.

References

- Blinder, Alan. 2009. “How Many US Jobs Might be Offshorable?” *World Economics*, 10(2): 41–78.
- Blinder, Alan S., and Alan B. Krueger. 2013. “Alternative Measures of Offshorability: A Survey Approach.” *Journal of Labor Economics*, 31(S1): 97–128.
- Mas, Alexandre, and Amanda Pallais. 2020. “Alternative Work Arrangements.” *Annual Review of Economics*.
- United Kingdom Office for National Statistics. 2020. “Coronavirus and homeworking in the UK labour market: 2019.” *Working Paper*.

APPENDIX FOR “HOW MANY JOBS CAN BE DONE AT HOME?”

Jonathan Dingel Brent Neiman

Our baseline results use the responses to two O*NET surveys to designate any given occupation, based on the standard occupational classification (SOC) code, as able or unable to be performed at home. We then merge this information with BLS data on the number and wages of workers in each SOC in the country as a whole as well as in metropolitan areas and industries.

If any of the following conditions in the “[Work Context](#)” survey responses are true, we code the occupation as one that cannot be performed at home:

- Average respondent says they use email less than once per month (Q4)
- Majority of respondents say they work outdoors every day (Q17)
- Average respondent says they deal with violent people at least once a week (Q14)
- Average respondent says they spent majority of time wearing common or specialized protective or safety equipment (Q43)
- Average respondent says they spent majority of time walking or running (Q37)
- Average respondent says they are exposed to minor burns, cuts, bites, or stings at least once a week (Q33)
- Average respondent says they are exposed to diseases or infection at least once a week (Q29)

If any of the following conditions in the “[Generalized Work Activities](#)” survey responses are true, we code the occupation as one that cannot be performed at home:

- Performing General Physical Activities is very important (Q16A)
- Handling and Moving Objects is very important (Q17A)
- Controlling Machines and Processes [not computers nor vehicles] is very important (Q18A)
- Operating Vehicles, Mechanized Devices, or Equipment is very important (Q20A)
- Performing for or Working Directly with the Public is very important (Q32A)
- Repairing and Maintaining Mechanical Equipment is very important (Q22A)
- Repairing and Maintaining Electronic Equipment is very important (Q23A)
- Inspecting Equipment, Structures, or Materials is very important (Q4A)

Table A.1: Occupations for which survey-derived and alternative measures differ considerably

Occupation		O*NET-derived baseline	Manual alternative
13-1130	Fundraisers	0.00	1
13-2080	Tax Examiners, Collectors and Preparers, and Revenue Agents	0.00	1
19-3050	Urban and Regional Planners	0.00	1
41-3040	Travel Agents	0.00	1
43-2020	Telephone Operators	0.00	1
43-4180	Reservation and Transportation Ticket Agents and Travel Clerks	0.00	1
13-2070	Credit Counselors and Loan Officers	0.10	1
17-3020	Engineering Technicians, Except Drafters	0.17	1
39-3010	Gaming Services Workers	0.85	0
25-2050	Special Education Teachers	0.92	0
27-2020	Athletes, Coaches, Umpires, and Related Workers	0.93	0
25-2010	Preschool and Kindergarten Teachers	1.00	0
25-4020	Librarians	1.00	0
25-4030	Library Technicians	1.00	0
27-4020	Photographers	1.00	0
33-9020	Private Detectives and Investigators	1.00	0
39-3030	Ushers, Lobby Attendants, and Ticket Takers	1.00	0
39-9010	Childcare Workers	1.00	0
39-9040	Residential Advisors	1.00	0
43-1010	First-Line Supervisors of Office and Administrative Support Workers	1.00	0
43-5020	Couriers and Messengers	1.00	0
43-9050	Mail Clerks and Mail Machine Operators, Except Postal Service	1.00	0
43-9070	Office Machine Operators, Except Computer	1.00	0