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Technical appendix

I. Data and sample geographies

This analysis is based on 2012-2016 five-year American Community Survey (ACS) Public Use Microdata Samples.

There are currently 383 metro areas in the United States. Because we are using ACS microdata, we construct these metro areas using Public Use Microdata Areas (PUMAs). A PUMA is assigned to a metropolitan area if at least half of its decennial census population falls within that metro area. Eight metro areas are excluded from the analysis because there are no PUMAs with populations that are at least 50% within the metro area. Those metros are:

- Carson City, Nev.
- Corvallis, Ore.
- Danville, Ill.
- Grants Pass, Ore.
- Jonesboro, Ark.
- Lewiston, Idaho-Wash.
- Midland, Mich.
- Weirton-Steubenville, W.Va.-Ohio

In addition to these eight metro areas, we also exclude Twin Falls, Idaho because it became a designated metropolitan area after 2016, the final year considered in our data, and Enid, Okla. because it became a designated a metro area midway through our study period. This leaves 373 metros in our final analysis.

Observations in nine PUMAs are dropped because a majority of the population in those PUMAs does not reside in a single metro, but more than 50% of the PUMA's population resides in any metro. For example, 92% of the population in West Virginia's "Berkeley, Jefferson, Mineral, Hampshire & Morgan Counties" PUMA resides within a metro area. That metropolitan population is split between four metro areas: Cumberland,

MD-WV (12%), Hagerstown-Martinsburg, MD-WV (46%), Washington-Arlington-Alexandria, DC-VA-MD-WV (23.5%), and Winchester, VA-WV (10.5%). Because more than 50% of the PUMA is not within any one of these metro areas, it cannot be included with that metro area, but also cannot be included with the non-metropolitan area of West Virginia because, combined, more than 50% resides in those four metro areas.

II. Sample population

To identify those we define as "workers," we began by considering civilian, non-institutionalized 18- to 64-year-olds currently in the labor force (employed and unemployed) who worked at some point over the previous year. While most low-wage worker analyses consider those who are working at the time of the survey, rather than at any point over the year, we took the more inclusive approach based on the documented instability of low-wage work.[1] Of those who worked at some point over the previous year, under 4% are currently unemployed and about 91% are currently employed.[2] From this sample, we exclude a number of different groups in order to better focus on our population of interest:

- **"Traditional" students, defined as students who worked fewer than 14 weeks over the previous year, students living in dormitories, and high school students living at home.** Work patterns of traditional students differ from the general working population, and excluding students who worked fewer than 14 weeks removes students who are likely seasonal workers. We also subtract all graduate and professional students, who may be "on the right track" to mid- or high-wage employment.

- **Self-employed workers, defined as anyone reporting that they earned self-employment income over the previous year or that they are currently self-employed.** We are

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APPENDIX TABLE A1. **Summary of subgroups in the labor force, but excluded from the sample of workers**

	Some students*		Self-employed		Work w/o pay in family business or farm		Data outliers**	
	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted
Total	5,875,144	306,108	15,772,538	804,436	226,352	12,261	8,344,998	409,496
Employment characteristics								
Median annual earnings	$8,870.65	$7,267.19	$34,259.61	$35,487.06	$9,814.48	$9,507.78	$25,189.70	$25,344.72
Mean annual earnings	$25,510.99	$23,965.44	$60,705.98	$63,059.81	$22,474.79	$22,235.22	$67,936.91	$71,528.36
Median hourly earnings	$13.25	$12.29	$4.20	$6.11	$8.90	$8.66	$16.56	$17.29
Mean hourly earnings	$20.18	$19.50	$18.76	$19.99	$18.05	$18.41	$27.84	$28.47
Worked full time/year-round	32.8%	30.0%	62.3%	62.4%	41.3%	41.6%	54.2%	54.1%
Currently employed	91.2%	91.3%	96.7%	96.8%	87.2%	86.8%	95.6%	95.6%
Weeks worked last year								
50 to 52 weeks	46.8%	45.0%	76.9%	76.6%	60.2%	59.5%	71.9%	71.2%
48 to 49 weeks	2.0%	2.2%	2.8%	3.1%	2.0%	2.1%	3.0%	3.3%
40 to 47 weeks	7.0%	8.0%	6.7%	7.0%	6.1%	6.2%	7.3%	7.8%
27 to 39 weeks	8.1%	9.6%	5.9%	5.8%	7.4%	7.7%	6.9%	6.9%
14 to 26 weeks	7.6%	9.1%	3.7%	3.6%	6.8%	6.7%	4.6%	4.5%
Fewer than 14 weeks	28.5%	26.1%	3.9%	3.9%	17.6%	17.8%	6.1%	6.3%
Age								
18-24	52.0%	56.2%	4.0%	3.7%	16.3%	15.7%	4.4%	4.1%
25-34	26.4%	23.0%	15.6%	13.6%	18.5%	16.3%	15.7%	13.4%
35-44	11.5%	10.5%	23.8%	22.0%	19.7%	17.8%	23.8%	21.7%
45-54	7.1%	7.1%	30.2%	30.7%	24.3%	25.6%	29.9%	30.3%
55-64	3.0%	3.2%	26.4%	30.0%	21.2%	24.5%	26.3%	30.4%
Gender								
Male	43.9%	43.2%	62.5%	62.2%	49.8%	48.9%	60.7%	60.4%
Female	56.1%	56.8%	37.5%	37.8%	50.2%	51.1%	39.3%	39.6%
Race/ethnicity								
White	61.3%	64.8%	71.6%	76.4%	64.0%	69.0%	67.1%	72.6%
Black	13.8%	11.8%	6.3%	4.9%	7.4%	6.1%	6.7%	5.4%
Latino or Hispanic	13.3%	12.0%	14.3%	11.2%	16.2%	13.6%	18.4%	14.5%
Asian American	7.9%	7.7%	5.7%	5.3%	9.1%	8.2%	5.6%	5.3%
All other races	3.7%	3.8%	2.2%	2.1%	3.3%	3.0%	2.2%	2.2%
Education level								
Less than a high school diploma	9.9%	8.4%	9.5%	8.5%	14.4%	13.6%	13.3%	11.9%
High school diploma or equivalent	9.8%	10.6%	22.9%	22.5%	28.3%	28.6%	26.8%	26.5%
Some college	26.2%	31.6%	21.3%	21.3%	25.3%	25.0%	21.3%	21.4%
Associate degree	3.7%	3.6%	7.8%	8.1%	8.3%	8.6%	7.3%	7.6%
Bachelor's degree or more	50.4%	45.9%	38.4%	39.5%	23.8%	24.2%	31.4%	32.6%
Family characteristics								
Married	24.3%	23.8%	64.3%	68.2%	53.9%	57.4%	60.8%	65.0%
Single parent	4.6%	3.8%	6.1%	5.1%	5.0%	4.6%	7.0%	5.8%
Has a child	17.3%	16.0%	36.9%	36.2%	28.9%	28.8%	35.9%	35.2%
Below 100% of federal poverty line	26.9%	33.7%	10.0%	9.3%	20.3%	20.3%	14.3%	13.5%
Below 200% of federal poverty line	40.4%	46.1%	24.6%	23.0%	38.6%	38.3%	32.3%	30.6%
Receives safety net assistance	14.1%	12.9%	13.9%	12.7%	22.0%	21.3%	18.1%	16.7%
Other characteristics								
Enrolled in school	100.0%	100.0%	4.6%	4.5%	11.0%	11.1%	4.3%	4.3%
Has a disability	4.3%	4.6%	5.5%	5.7%	9.8%	10.1%	6.2%	6.5%
Speaks English less than 'very well'	3.9%	3.7%	10.8%	8.9%	13.7%	12.1%	14.1%	11.6%
Foreign-born	12.8%	11.7%	19.9%	16.7%	21.7%	19.0%	23.5%	19.5%
Veteran	3.3%	2.9%	4.6%	4.8%	3.1%	3.6%	4.4%	4.7%

Notes: Dollar values are adjusted to 2016 real dollars using the ACS-provided adjust variable
* Excluded students are students living in dorms, high school students living with parents, graduate/professional students, and students who worked fewer than 14 weeks over the previous year.
** Data outliers are defined as those who report: (1) More than 98 work hours duing a typical week, (2) Wages equivalent to less than $.94 per hour in 2016 dollars, or (3) Wages equivalent to more than 187.38 per hour in 2016 dollars.   Source: Brookings analysis of 2012-2016 American Community Survey 5-year Public Use Microdata Samples

specifically interested in wage and salary workers in this analysis. Self-employment differs from wage work and includes returns to capital in addition to returns to labor, and it is not possible to distinguish between the two using ACS data.

- **Those who worked without pay in a family business or farm.** By definition, the primary job of these workers is unpaid, so they do not earn wages or salary at their primary job, making them inappropriate for inclusion in this analysis.

- **Weekly work-hour outliers.** The ACS sets an upper limit on its usual hours worked per week variable at 99 hours. Anyone who reports usually working more than 98 hours per week is shown as working 99 hours. Because we rely upon this variable to calculate hourly wages, we exclude anyone who worked more than 98 hours per week.

- **Hourly wage outliers.** We exclude hourly wage outliers by dropping those who earn less than $0.94 per hour or more than $187.38 per hour in 2016 dollars.[3]

After excluding these populations, we are left with 5,610,286 observations (unweighted).

III. Identifying low-wage workers

Calculating hourly wages

While the American Community Survey provides more robust demographic information representative at smaller levels of geography than other data sources, its wage data are less robust and specific. The ACS does not provide hourly wage data, so it must be calculated based on three variables: annual earnings from wages, usual hours worked per week over the previous year, and number of weeks worked over the previous year.

The number of weeks worked variable is categorical, and in order to estimate the number of hours worked across the year, must be converted to a continuous variable.[4] We do so by assigning the value of the midpoint to each interval. For example, those who ACS says worked 50 to 52 weeks over the previous year are treated as if they worked 51 weeks.[5] Annual earnings from wages are then divided by the product of usual hours worked and weeks worked over the previous year to determine the estimated hourly wage.

Setting national low-wage threshold

A single agreed-upon definition of low wages does not exist. In this analysis, we define low-wage as hourly wages below 2/3 the median hourly wage for men working full time/year-round. Two-thirds median wages is a commonly used threshold in low-wage literature.[6] We prefer this measure to others that rely on the poverty line because we are interested in identifying those that work for low wages regardless of current poverty status, since poverty status is affected by family size and the presence of other earners in the family or household. We also prefer this measure to definitions using wage quintiles because we do not want to dictate the share of workers who are low-wage, which is inherent in such a strategy.

We use the 2/3 median wage for men because

APPENDIX TABLE A2

Unadjusted national hourly low-wage thresholds, 2/3 median wages for men working full time, year-round

Year	Threshold
2016	$16.21
2015	$16.01
2014	$15.62
2013	$15.42
2012	$15.22

Source: Based on U.S. Census Bureau, American Community Survey 1-year estimates (2012-2016), Table S2002.

gender pay inequality is well-established and we want to limit its effect on our definition of low-wage.[7] While a less common strategy, we are not the first to do so.[8]

Adjusting low-wage threshold for cost of living differences

To better calibrate our low-wage threshold to the local cost of living, we adjust the national low-wage thresholds using the Bureau of Economic Analysis's Regional Price Parities (RPPs), a weighted average of the price level of goods and services for the average consumer in a given geographic region. RPPs are available for individual metropolitan areas and state non-metropolitan areas. We use the RPPs for "all items" for each year. We calculate low-wage thresholds for each year of our data (2012-2016) in each metropolitan area and non-metropolitan state by multiplying the national threshold by RPP/100.

Low-wage workers

To identify those workers who are low-wage, we compare hourly wages for each observation in the data to the low-wage threshold for the observation's geographic area and survey year. All observations with hourly wages below that year and geography's threshold are considered low-wage and included in our low-wage worker sample. All dollar values in the report and associated documentation are adjusted to 2016 dollars using the ACS-provided income and earnings adjustment factor, unless otherwise stated.

IV. Analytic strategy

We group low-wage workers together based on three primary variables: age, education level, and enrollment status. While other variables affect employment—such as caring for children, disability status, race/ethnicity, and limited English proficiency—our goal was to create a typology of low-wage workers composed of mutually exclusive categories. Informed by our previous cluster analyses of out-of-work individuals[9], and after reviewing cross-tabulations of low-wage workers by numerous demographic characteristics, we judged that age and education variables were the simplest and most comprehensive assessment of employment prospects and interest in further education and training. To provide more depth to our profile of low-wage workers, and show other factors shaping people's employment outlook, we also provide demographic data on each group of low-wage workers.

Appendix A. Endnotes

1. See, for example, David Cooper, Lawrence Mishel, and Ben Zipperer, "Bold Increases in the Minimum Wage should be Evaluated for the Benefits of Raising Low-Wage Workers' Total Earnings" (Washington: EPI, 2018); Jacquelyn Anderson and others, "A New Approach to Low-Wage Workers and Employers: Launching the Work Advancement and Support Center Demonstration" (New York: MDRC, 2006); Emsi and Careerbuilder, "The Pulse of U.S. Hiring Activity: Labor Market Churn by Occupation & Metro" (Moscow, Idaho: Emsi, 2014).

2. These data are the share of unweighted observations.

3. Following the methodology of the Economic Policy Institute's State of Working America, we define outliers are those earning below $0.50 or above $100 per hour in 1989 dollars. Please refer to https://www.epi.org/data/methodology/.

4. The weeks worked categories are: (1) 50-52 weeks, (2) 48-49 weeks, (3) 40-47 weeks, (4) 27-39 weeks, (5) 14-26 weeks, (6) 13 weeks or less.

5. We validated this strategy by using Current Population Survey (March supplement) data. Using the CPS continuous weeks worked variable, we calculated the average weeks worked for low-wage workers according to the intervals used in the ACS. We found the average weeks worked for low-wage workers in the CPS were not meaningfully different from the interval midpoints.

6. For example, OECD, "Wage Levels" available at https://data.oecd.org/earnwage/wage-levels.htm (2018); UC Berkeley, "Low-Wage Work in California" available at http://laborcenter.berkeley.edu/low-wage-work-in-california/#; and Claus Schnabel, "Low-Wage Employment," IZA World of Labor available at https://wol.iza.org/uploads/articles/276/pdfs/low-wage-employment.pdf?v=1 (July 2016).

7. Francine D. Blau and Lawrence M. Kahn, "The Gender Wage Gap: Extent, Trends, and Explanations." Working Paper 21913 (National Bureau of Economic Research, 2016); Philip Broyles, "The Gender Pay Gap of STEM Professions in the United States," *International Journal of Sociology and Social Policy* 29 (5/6) (2009): 214–226; Anthony P. Carnevale, Nicole Smith, and Artem Gulish, "Women Can't Win: Despite Making Educational Gains and Pursuing High-Wage Majors, Women Still Earn Less than Men" (Washington: Georgetown University Center on Education and the Workforce, 2018).

8. See Heather Boushey and others, "Understanding Low-Wage Work in the United States" (Washington: Center for Economic and Policy Research, 2007); Jennifer E. Swanberg, Elizabeth Watson, and Meridith Eastman, "Scheduling Challenges among Workers in Low-Wage Hourly Jobs: Similarities and Differences among Workers in Standard- and Nonstandard-Hour Jobs," *Community, Work & Family* 17(4): 409–435.

9. Martha Ross and Natalie Holmes, "Meet the Millions of Young Adults Who are Out of Work" (Washington: Brookings, 2019); Martha Ross and Natalie Holmes, "Meet the Out of Work" (Washington: Brookings, 2017).