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ABSTRACT

The U.S. Low-Wage Structure: A McWage Comparison*

Thanks to standardized work protocol and technology of McDonald's restaurants, the hourly wage of McDonald's Basic Crew enables wage comparisons under near-identical skill inputs and hedonic job conditions. McWages capture labor costs in entry-level jobs, while the Big Macs (earned) Per Hour (BMPH) index measures corresponding purchasing power of wages. We document large and growing geographical wage differences in standardized jobs using data covering most U.S. counties during 2016-2023. Before the Covid-19 pandemic, there was no BMPH growth where minimum wages stayed constant, but the pandemic wage increase, which diminished the importance of minimum wages, was stronger in these areas.

JEL Classification: J31
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1. Introduction

We provide a highly consistent, credible measure of differences in low-skilled wage rates across U.S. local labor markets. We collect a wage rate in a *standardized job* available across the entire U.S. and the price of an *identical product*, enabling us to form a simple real wage measure. Standardized jobs do not differ across place or time in their human capital use (skill input) or in hedonic work conditions. Retail and hospitality industries provide such jobs for low-skilled workers in large grocery, apparel, and fast-food chains that operate in virtually all local labor markets. As of 2018, 24% of U.S. employment was in occupations requiring no formal educational credential for entry; the three most common, with about 4 million workers each, were retail sales, food preparation and serving, and cashiers (U.S. Bureau of Labor Statistics, 2019). These jobs are accessible to workers of all education levels, who can be considered omnipresent and homogenous 'laborers' of developed economies.[1]

McDonald's Basic Crew employees belong to and plausibly represent this large group. Crucially, the McDonald's global guarantee of standardized, sanitized food production implies that the restaurants use the same 'fixed-coefficient' production technology and that their workers follow the same detailed operation protocol. Thanks to this standardization, one can measure wage rates of workers supplying near-identical skill inputs using near-identical technology (having the same physical productivity) under near-identical hedonic job conditions. In this paper, we focus on McDonald's Basic Crew to contribute to measurement of local-area wage rates. We provide a well-defined quantification of cross-area differences in the prices of an identical factor of production—the standardized amount of human capital corresponding to an hour of work by Basic Crew workers in McDonald's restaurants. We collect 2016 to 2023 wage rates from 70 to 80% of U.S. McDonald's restaurants, covering U.S. counties with 97% of the U.S. population.

Our data collection effort is designed to avoid difficulties in cross-area comparisons present in existing analyses. It is generally accepted that there are large geographical gaps in economic opportunities for low-skilled workers in the U.S., and a growing literature explores the sources of these differences (Autor et al., 2016; Acemoglu and Restrepo, 2020, Card et al., 2023). A key conceptual question underlying much of this research is the earnings effect of worker mobility: What would a given worker earn in another location? Location premiums can stem from working

[1] There is a long tradition of analyzing the pay of laborers in less developed countries (e.g., Jeong, 2002).

in a different job (for a different employer), or can correspond to an earnings gap within a job. Wage surveys allow comparison of the wages of workers with similar productive characteristics, such as education and occupation. However, such comparisons across locations, time, and economic circumstances (e.g., Amior and Manning, 2018; Albouy, et al., 2019) can be confounded by variation in human capital quality and effort within education type, and by variation in tasks and hedonic job conditions within occupations. Similarly, research that relies on workers moving across locations to estimate various types of location wage premia (e.g., Glaeser and Maré, 2001; Card et al., 2023) faces the challenge of avoiding selection biases and of controlling for hedonic job conditions. A well-defined measure of geographic gaps in locally available wages would compare a real consumption wage rate for workers supplying fixed skill (human capital) inputs under identical hedonic job conditions. To the extent that standardized jobs are available across locations, they enable such measurement.[2] While there could be cross-area differences in effort of McDonald's Basic Crew, the detailed nature of the operation protocol combined with the high level of worker turnover in these jobs[3] minimizes these issues relative to other available wage comparisons. Our measurements thus provide a natural benchmark for wage comparisons that incorporate selective mobility, upskilling, and worker-firm match quality.

Our primary goal is to provide simple, credible measures of wage rates that can be compared across varied economic circumstances. The key advantage of the McDonald's Basic Crew job is that it is both more widely available and more standardized than any alternative.[4] Furthermore, it allows us to deal with the fact that only limited information is available on U.S. local labor market price differences, which makes cross-market comparisons of the purchasing power of wage rates difficult. Here, we measure not only nominal wages, which we refer to as 'McWages', but also real wages of workers supplying identical skill inputs. We capture the purchasing power of McWages using the price of a standardized product—the Big Mac sandwich.[5] In addition to basic wage rates expressed in U.S. dollars, we thus also collect data on the price of a Big Mac in each surveyed restaurant. The Big Mac is a standardized hamburger, and the price of

[2] Administrative data allow one to observe wage rates of workers by occupation for specific employers, but confidentiality conditions imply that findings are aggregated across many employers (e.g., Yagan, 2019). This makes it difficult to focus on jobs with fixed hedonic conditions, technology, and skill inputs.
[3] McDonald's annual employee turnover rate is typically more than 100% (see Appendix B.3).
[4] McDonald's is the largest fast-food chain in the U.S. (world-wide) with about 13,500 (40,000) restaurants.
[5] Handbury and Weinstein (2015) stress the use of identical products to measure geographical price gaps.

Big Macs has been used in cross-country research as an easily-obtained measure of purchasing power parity (PPP) based on a standardized consumption 'basket'.[6] We use these data for the same purpose across local labor markets, and we also express McWage rates in purchasing power using Regional Price Parities (RPPs) for counties and Metropolitan Statistical Areas (MSAs).[7] We thus measure hourly wage rates in U.S. dollars, in consumption PPP dollars, and in units of "Big Macs", i.e., in Big Macs per Hour (BMPH). Though the BMPH index is clearly limited in that it is based on a single price with no information on purchase quantities, it is based on the price of a standardized product coincident with the timing and precise geographic location of wage data collection, while MSA RPPs are typically available only with a significant delay.

To the extent that McWages represent pay conditions for the large group of 'laborers' working in omnipresent entry-level jobs across the U.S., our survey allows us to consistently assess the evolution of wages in near-identical jobs before, during, and after the Covid-19 pandemic. We thus provide a previously unavailable view of geographical differences in nominal and real wage rates. We assess the changing importance of minimum wage legislation for McWage growth, and present a new measure of the minimum wage 'bite' based on a consistent cross-area comparison.

Annual growth in McWages was at or below 5% between 2016 and 2020, consistent with growth at the tenth percentile of the earning distribution based on the Current Population Survey. In 2021, McWages grew rapidly by 17%, leading to a 14% rise in the BMPH index, which had grown at only a 1% annual rate between 2016 and 2019. In 2023, the BMPH index remained at about its 2021 level. We document large and growing geographical differences in the real wage rates of workers performing near-identical tasks across U.S. labor markets: Looking across the 11,365 restaurants in our 2016 data, we find that 5% of U.S. McDonald's pay was under 1.58 BMPH, and 5% was over 2.34, i.e., almost 50% more in real terms. The corresponding 95/5 percentile gap in 2016 based on county BMPH means (or medians) across the 2,255 U.S. counties with a McDonald's is similar, at 41%. This county-level gap grew to 67% by 2021, then stabilized at 61%, suggesting limited and declining labor market integration of low-skilled workers.

Differences in minimum wages across locations are not the primary reason for rising geographical differentiation, despite a strong link between pre-pandemic McWage growth and minimum wage increases. In the roughly half of restaurants in local labor markets that did not

[6] Ong (2003) and Clements et al. (2012) show the value of the Big Mac Index in predicting exchange rates.
[7] The U.S. Bureau of Economic Analysis publishes RPPs; the 2016 county RPPs are experimental.

experience minimum wage increases during 2016-2023, there was essentially no growth in BMPH up to 2020, while nominal McWages grew twice as fast where minimum wages rose. This picture changed dramatically in 2021, the one year in which McWages and BMPH grew rapidly across the U.S., as this one-off increase was stronger in locations that had no minimum wage hikes. As a result, the average annual growth rate of McWages and of the BMPH index during 2016-2023 is only slightly lower in areas that experienced no minimum wage increase, compared to areas where minimum wage increases were enacted, irrespective of whether the wage hikes were state-level or local (city/county).[8] The importance of minimum wages for McWage growth declined in 2021, as the share of restaurants paying the local effective minimum wage (the maximum of the federal, the state, and the city or county minimum wage) declined from 45% in 2016 to 36% in 2020, and then dropped to 16% in 2021. The federal minimum wage became nearly irrelevant: In 2016, 16% of U.S. McDonald's paid the $7.25 federal minimum wage; by 2023, this share is only 0.2%.

We provide a simple first-step assessment of whether geographic disparity in McWages would grow in absence of minimum wages. We extend the results of Ashenfelter and Jurajda (2022) to find no effect of minimum wages on McDonald's restaurant exit and entry. This allows us to estimate *latent* McWages at the state level that would be observed in the absence of minimum wage legislation. (Taking minimum wage spillovers into account does not affect our conclusions based on these estimates.) Based on latent McWages, we again find growing geographic disparity.

Our novel wage measurement allows us to express the 'bite' of minimum wages relative to these latent McWages, a policy-relevant magnitude that is consistently defined across locations.[9] Excluding observations with local minimum wage ordinances, we estimate that in the absence of federal and state minimum wage legislation, McDonald's workers would have earned 1.8 BMPH in 2016, which is 7% below the observed level. By 2023, real wages in these comparable entry-level jobs were only 2% higher thanks to minimum wages.

Mean latent McWages also allow us to ask whether increases in minimum wages occur where latent McWages are growing. This is important for the interpretation of minimum-wage pass-through effects and for the degree to which minimum wage hikes are independent of local wage growth. We find that, between 2016 and 2020, if not for the federal minimum wage, there would have been approximately a one-to-one cross-state relationship between state minimum wage

[8] Appendix A, Table A.1 provides descriptive statistics on the U.S.-wide evolution of McWages.
[9] Minimum wages affect the composition of low-skilled employment, while McWages keep tasks constant.

levels and the state mean of the latent McWage distributions, as increases in latent McWages correspond one-for-one to increases in state minimum wage levels. Hence, during 2016-2020, there is limited variation in the 'bite' of state minimum wages across states. This also suggests that some of the wage increases occurring when minimum wages are increasing would have occurred even in the absence of minimum wage hikes, which affects the interpretation of standard minimum-wage pass-through effects. Since the large 2021 increase in McWages, however, latent McWage increases have no longer been tied to minimum wage increases, as minimum wages in most states do not keep pace with rising wage levels, leading to declining minimum wage 'bite'.

2. McWages as a Conceptual Real Wage Measure

To provide their implied warranty of food safety, McDonald's restaurants apply a highly standardized technology and work protocols for employee work. Ingredients are delivered to the restaurants and stored in coolers and freezers. These ingredients are handled using a mechanized food preparation system with equipment that differs little from place to place. Because the technology of production at McDonald's is fixed, the restaurants do not adjust their technology to reflect the price or available skills of local labor.[10] Although the skills necessary to handle supplier contracts or to select and manage employees may differ across restaurants, basic food preparation work in each restaurant is highly standardized, as operations are monitored using s 600-page Operations and Training Manual that covers every aspect of food preparation.[11] McDonald's Basic Crew workers thus have near-identical physical productivity across locations. However, they are not necessarily paid the same wage rate. In the absence of monopsony power, McDonald's restaurants would treat the prevailing local labor *market* wage rate as the price of labor, and McWages would thus reflect the local productivity of workers supplying a unit of skill.

During our study period, new technology was introduced that allows customers to order at self-ordering touch-screen kiosks or on-line. Kiosk introduction could be related to local demand and it could affect sales and employment, which we do not observe. Do kiosks affect McWage

[10] Parsley and Wei (2007) and Aaronson et al. (2018) assume a Leontief production function in McDonald's.
[11] See, e.g., Royle (2000, pp. 45-59) for details of the unification of McDonald's workers. About 90% of all employees at McDonald's are Basic Crew workers paid hourly. Employees typically start working at a food preparation station, and are rotated through various stations and eventually to the sales counter.

geographic comparisons? In Appendix C, we extend the analysis of Ashenfelter and Jurajda (2022) to include data up to 2023. We again find that the presence of touch-screen ordering is not related to McWages.[12] This is consistent with McDonald's being a price taker in terms of McWages.

With no monopsony and with perfect worker mobility across industries within a local labor market, McWages will be predominantly determined outside of the food industry – in the tradable sector. A representative profit-maximizing firm producing tradable output hires workers to the point where the value of an additional worker's marginal product is equal to it. The familiar relation $p \times mp = w$, where p is output price of tradables and mp is the marginal product of labor in tradables, implies that w/p is a measure of the marginal product of labor when firms are maximizing profits and labor and product markets are competitive. In particular, when prices of tradables do not vary across local labor markets, relative wages (corresponding to a fixed skill input) correspond to relative differences in productivity (of workers supplying that skill level).

If wage rates differ from place to place and tradable goods prices are the same, then the prices of non-tradable goods will also differ from place to place, because local wage rates (set in the tradable sector) indicate the cost of a factor of production that is used in producing non-tradable goods. The simplest version of this phenomenon, known as the Balassa-Samuelson effect, is based on the equality of wage rates between workers in the tradable and non-tradable sectors within a labor market. We deflate McWages using local Big Mac prices, which corresponds to a fixed 'consumption basket' with both tradable and non-tradable goods and rents (Parsley and Wei, 2007).[13] Consider a product produced according to a Cobb-Douglas production function from a combination of tradable goods and local labor that is paid wage w_i in location i. The cost of producing such a good will be $p_{ni} = w_i^a p^{1-a}$, where p_{ni} is the price of the quasi-tradable good, p is the (constant across places) price of tradable goods, and $0 < a < 1$. A real wage defined as $w_i/p_{ni} = (w_i/p)^{1-a}$ is then a purchasing-power-parity price adjusted wage rate, which will show a smaller gap between high and low wage labor markets than would a wage rate measured in tradable prices. It is natural to think of the w_i/p_{ni} index as being closely related to worker welfare, as represented by a constant-utility real wage index based on a conventional consumer-worker utility maximization setup. The

[12] The exception is 2023, when McWages in the remaining (geographically dispersed) 7% of McDonald's without self-ordering kiosks were 2% lower. App ordering is near-universally available and affects workers similarly to self-ordering through kiosks; we thus assume that it does not affect our cross-area comparisons.
[13] We also deflate by RPPs, which include tradable and non-tradable goods, as well as rents and services.

welfare interpretation of such an index is not affected by product market monopoly or labor market monopsony. Approximating the effect of prices on such an index raises all the usual problems of index number base levels and purchasing power parity measurement (Deaton 2010).

3. McWage Survey

From 2016 to 2023, there were about 13,500 to 14,000 McDonald's restaurants in the U.S., and annual restaurant market entry and exit rates were low.[14] In a typical year, over 80% of restaurants are free-standing (not part of a larger structure such as a Walmart) and about 10% are company owned (not franchised).[15] Our survey was carried out through phone interviews from July to September of 2016-2023. The 2016 survey collected geo-coded data from 11,365 restaurants, corresponding to an 80% response rate, i.e., covering 80% of all U.S. McDonald's restaurants. The 2016 survey covers all U.S. states plus Washington, D.C., which we count as a state because it has about as many McDonald's as Vermont or North Dakota. The survey covers almost all (381) Metropolitan Statistical Areas (MSAs) and 2,255 counties (72% of all U.S. counties). McDonald's are more likely to be found in populous locations; the counties covered by our 2016 data house over 97% of the U.S. population. The share of restaurants covered by the survey declines to 69% in 2023, but the survey consistently covers at least 90% of U.S. counties with a McDonald's, and 83% of the data comes from MSAs in every year of the survey. The differences between average values of McWages and of Big Mac prices across the balanced and the unbalanced panel of 2016 and 2023 observations are all well within 1% of each other.

The survey instrument (provided in Appendix E) asks about the starting hourly wage rate for regular day shift entry-level crew members 18 or older who finished initial training. An important aspect of our data is that we collect gross wages, without adjustments for taxes or fringe benefits. The Earned Income Tax Credit (EITC) plays an important role in low-skilled workers' net pay, and state EITC levels differ (Allegretto et al., 2013). We do not collect information on the family (or tax) status of the Basic Crew workforce. To construct purchasing power adjustments coincident with the timing of the wage information, we also collect the price of a Big Mac in each

[14] Exit rates were about 1% until 2019, 3% in 2020, and well under 1% since, while entry rates have remained well under 1% since 2016, according to data compiled by AggData, a market research company.
[15] We use data on 2018 ownership of McDonald's restaurants from FRANdata, a market research company.

restaurant as part of the survey. We ask about the price of the sandwich (not the combo meal) including sales tax and excluding temporary promotions.[16] Finally, we ask whether the respondent is a manager or a basic crew member, and whether there is touch-screen ordering in the restaurant.

Measurement error in hourly wage rates in standard survey data is much larger than for annual earnings, so hourly wage rates are rarely used in research.[17] We provide two assessments of the extent of measurement error in McWages. First, we conduct repeat interviews within a month of the first interview for a random sample of surveyed restaurants. We focus on the repeat interviews answered by a different respondent (using first name information), assume uncorrelated classical measurement error, and arrive at reliability ratios of about 0.9 in each year of our survey. Second, we collect data on Starbucks wages and prices, because Starbucks jobs are also highly homogenous across areas. Our McDonald's and Starbucks data overlap in 1,520 zip codes, across which both types of wage data reproduce highly similar geographical differences.[18]

4. McWages: Geography and Evolution

The key descriptive statistics based on our 2016 survey appear in the top panel of Table 1.[19] Under the reliability ratio derived in Appendix B, the true standard deviation of 2016 McWages is 0.91. The 5-95 percentile ranges of the hourly McWage rate and of the Big Mac price are not materially affected by weighting using (ZIP code level) population. The 5-95 McWage range implies a 45% gap in the costs of an identical unit of labor across restaurants; the corresponding gap is 38% at the county level. Moving from the bottom to the top U.S. state, McWages increase by 39%. Next, the 5-95 percentile range of the BMPH index implies within-U.S. real-wage gaps of

[16] Where the Big Mac price is reported before sales taxes, we apply the average city-level combined rate from https://www.salestaxhandbook.com/ and http://www.salestaxstates.com/.
[17] Bound, et al. (1994) report reliability ratios of 40% for earnings per hour measured in the PSID. Lemieux (2006) provides similar evidence for the Current Population Survey. Bound, et al. (2001) survey this work.
[18] Appendix B.1 provides details of the data collection efforts and calculations. Future research is need to assess the importance of controlling for job tasks for measurement of geographical wage gaps. Regressing the Card et al. (2023) Commuting Zone (CZ) location premia on the 2016 demeaned *ln(McWage)* across 639 CZs gives an R^2 of 0.1. The corresponding slope of 0.3 is robust to controlling for the CZ size, fraction of highly educated and unemployment rates, and to using only CZs with at least 10 McWages.
[19] Not surprisingly, McWages are higher in labor markets with higher shares of college educated workers and greater population density (Appendix Table C.1). Because restaurant characteristics explain very little of the variation in McWages and Big Mac prices (see Appendix C and Ashenfelter and Jurajda, 2022), the geographical wage gaps we report below are not materially affected by controlling for these characteristics.

nearly 50%. The BMPH range based on county means is similarly high. At the state level, the min-max BMPH comparison implies a 33% gap.[20] Next, we express 2016 McWages in Regional Price Parity (RPP) dollars, using both the MSA RPPs and county RPPs. Big Mac prices co-vary strongly but imperfectly with RPPs at both levels of aggregation.[21] As a result, the 5-95 percentile range in Table 1 based on county or MSA RPP McWages signals a somewhat smaller gap, at 42%. The county-level 5-95 range in county RPP McWages implies a 39% real wage gap. We conclude that, irrespective of the price level we use, there are large geographical differences within the U.S. in the real wage rates of workers performing near-identical tasks. These findings are consistent with research highlighting the importance of moving costs for non-college graduates (e.g., Ransom, 2022) and research that relates various local-labor-market productivity shocks with wage rates (e.g., Acemoglu and Restrepo, 2020; Amior and Manning, 2018; Autor et al., 2016; Dao et al., 2017) to imply that the within-U.S. labor supply is only partially elastic.

Between 2016 and 2023, nominal McWages grew annually by about 6% on average, to $13.15 (see bottom panel of Table 1), while the BMPH index grew by 3% on average annually, reaching 2.34 in 2023. These wage growth measures are consistent with available national statistics.[22] Aggregate statistics, however, hide qualitatively different developments in U.S. regions where minimum wages were rising during 2016-2023 versus the rest of the U.S. In roughly half of our panel of restaurants located in labor markets that did not experience minimum wage increases during 2016-2023, there was essentially no growth in BMPH (see Appendix Table A.1) between 2016 and 2020. This picture changed dramatically in 2021, when U.S.-wide McWages and BMPH grew rapidly, by 17% and 14%, respectively (Figure 1); this one-off growth spike is substantially stronger in locations with no minimum wage hikes.[23] About 40 percent of U.S. McWages are

[20] Maine, Kansas, and Louisiana had the lowest BMPH in 2016. Outside of Washington, D.C., the highest 2016 BMPH was in Oregon and Minnesota.

[21] The correlation of 2016 county RPPs with Big Mac prices is 0.31 and rises to 0.55 when based on counties with more than five McDonald's. Appendix Figure B.1 depicts the latter relationship.

[22] There was 6% average annual growth between the third quarter of 2016 and 2022 in McWages and in the usual weekly nominal earnings of full-time workers aged 25 and up who are at the tenth percentile of the earning distribution based on the Current Population Survey (CPS); the average CPI inflation rate during this period was about 3%. The 2016-2022 average annual growth in constant-dollar 10th-percentile compensation costs of employers was 2%, based on the National Compensation Survey (NCS).

[23] The local strength of the pandemic had little effect on McWages. In Ashenfelter and Jurajda (2022), we find a precisely estimated zero effect of pandemic operations restrictions on prices or wages, even when instrumenting for operation restrictions using county Covid-19 deaths through Sep 2020. Forsythe et al. (2022) show that the 2022 labor market was extremely tight, and suggest workers' preferences are changing.

earned in locations that experienced no minimum wage increases during our entire sample frame. Within these locations, nominal McWages (BMPH) grew by 48% (19%) between 2016 and 2023, only somewhat below the 55% (22%) growth in areas that experienced at least one state minimum wage hike during 2016-2023. Locations with a city/county minimum wage ordinance experienced a 59% (25%) McWage (BMPH) growth between 2023 and 2016. The importance of minimum wages for McWage growth thus declined in 2021, thanks to the one-off pandemic increase in McWages, which occurred in the absence of minimum wage hikes in much of the U.S.

Nevertheless, geographical differences in wages in standardized jobs grew dramatically between 2016 and 2023. The gap between the 95th and 5th percentiles of McWages (BMPH) grew from 45% (48%) in 2016 to 78% (70%) in 2022 and then declined to 65% (66%) in 2023.[24] Looking across the more than two thousand counties with McDonald's restaurants, the 5-95 range of county average McWages (BMPH) grew from 40% (41%) in 2016 to 69% (61%) in 2023. The min-max range across US states (excluding Washington, D.C.) in McWages (BMPH) increased from 39% (33%) in 2016 to 68% (54%) in 2023.[25] Our data suggest the U.S. labor market is becoming less integrated for low-skilled workers in omnipresent standardized jobs.

5. McWages and Minimum Wages

Traditionally, the pay level at McDonald's has been strongly affected by minimum wage legislation, as the restaurant industry is the most intensive employer of U.S. minimum wage workers (U.S. Bureau of Labor Statistics, 2016). Of the 11,365 2016 McWages we analyze, 45% are at the effective local minimum wage.[26] Figure 2 shows the state-level relationship between the minimum wage and the share of McWages censored at the state minimum wage. The difference between the top (2016) and the bottom (2023) graph in Figure 2 illustrates the decline in the degree to which minimum wage levels are binding for McWages. While the federal minimum wage of $7.25 was binding in several states in 2016, almost no restaurants are paying $7.25 by 2023. In Mississippi, the share of restaurants paying the federal minimum wage declined from 68% to 1%.

[24] Using the 2022 MSA RPPs, the 2023 95/5 percentile ratio of RPP McWages is 1.6, up from 1.4 in 2016.
[25] Appendix Figure D.1 plots the 2016-2023 state-level growth in McWages and BMPH.
[26] Minimum wage data come from the Department of Labor and the Berkeley Labor Center. We assume it takes two months to fully implement a minimum wage increase.

How low would U.S. McWages be if not for federal and state minimum wage legislation? We provide an approximate answer to this question by estimating latent McWage means from the censored McWage distributions. Specifically, we estimate constants in state-specific *ln(McWage)* Tobit specifications.[27] Excluding observations with local minimum wage ordinances, we first estimate the mean of the U.S. latent McWage distribution that would have been observed in 2016 in the absence of minimum wages at $7.90, a value that translates to a BMPH index 7% below the observed level. By 2023, the US-wide gap between observed and latent BMPH, the ratio of the latent McWage and the Big Mac price mean, shrinks to 2%. Similarly, the gap between latent and observed average McWages drops from 6% in 2016 to 2% in 2023.

Next, we construct latent McWage (and latent BMPH) measures at the state level, and again find growing geographic disparity across local labor markets.[28] In 2016, Mississippi had the lowest state average McWage, at $7.47, and the lowest *latent* McWage mean, at $6.68, which would be paid if 68% of McDonald's restaurants in Mississippi did not pay the federal minimum wage level in 2016. Oregon's and Washington state's latent McWage was about 45% above that of Mississippi in 2016. By 2023, this gap had grown. Mississippi still has the lowest latent McWage ($9.7), while the highest latent McWage, in Washington State ($16) is 65% higher. The state latent McWage 75/25 percentile gap grows steadily in every year of our survey until 2022. Within-U.S. differences in wage rates in standardized jobs, that would be paid in the absence of minimum wage legislation, are growing, and are a fundamental reason for the rising dispersion in observed wages.

Our latent McWage measure allows us to explore the structure and 'bite' of state minimum wages. Figure 3 displays the state values of *ln(latent McWage)* in 2016 and in 2023 against state values of *ln(state minimum wage)*. In 2016, Mississippi is the state most constrained by the federal minimum wage in setting its state-specific minimum wage. In terms of the ratio of state minimum wages to latent McWages, however, Mississippi is similar to California, which had one of the

[27] To check the robustness of our estimates, we first apply the generalized gamma distribution (Cabral and Mata, 2003). This results in estimates of state latent means that are very close to those based on the normality assumption (Appendix Fig. D.2). Second, we estimate latent medians in states with over 50% censoring without relying on distributional assumptions: We match each heavily censored state to one less censored state, based on the longest inter-percentile range observed in the heavily censored state. The matched median predictions and the Tobit means are nearly identical, with a cross-state correlation of 0.98 (Appendix Tab D.1). Third, in Appendix Figure D.3, we estimate alternative Tobit latent McWages based on censoring at 1.1 times the state minimum wage. The correlation of these estimates with our preferred estimates is 0.98, suggesting that our simple Tobit latent McWages are robust to minimum wage spillovers.
[28] Appendix Table D.2 provides the estimated state latent McWages for 2016 and 2023.

highest minimum wages in 2016, but also features a high latent McWage. The 'bite' of state minimum wages based on the ratio of the minimum wage to latent average McWage signals a different state structure of the minimum wage 'bite' relative to measures based on low-skilled wages from the American Community Survey (see Appendix Figure D.4). Our 'bite' measure is declining between 2016 and 2023 in most states, thanks in large part to the pandemic wage growth, and remains stable in only a handful of states with large minimum wage increases.[29]

How strong is the link between minimum wages and state latent McWages? The 2016 cross-state comparison in the top graph of Figure 2 implies a slope of 1.04 (estimated using the Tobit model due to censoring at the federal minimum wage level). We estimate a slope that is statistically indistinguishable from 1 in every year up to 2020. However, it begins to increase in 2021, and by 2023, the cross-state slope has roughly doubled relative to its level in 2016. This occurs while the underlying (Tobit) relationship between *changes* in *ln(latent McWage)* and *changes* in *ln(state minimum wage)* undergoes a transformation between 2016 to 2019, and 2020 to 2023 (Appendix Figure D.5). In the first of the two four-year periods, minimum wages were rising in tandem with rising latent McWages (we cannot reject that the slope is equal to 1 at the 5% level of statistical significance). After 2020, there is no relationship between changes in latent McWages and changes in state minimum wages. During 2016-2023, latent McWage growth in the half of U.S. states that were below the state median of latent McWages as of 2016 is similar (within 15%) to that in states above the median, and the higher 2023 slope in Figure 3 is not due to a stronger relationship between minimum wage growth and latent McWage growth in high-wage states. Our evidence thus suggests that in states with higher initial latent McWages, minimum wages have fallen behind pandemic latent McWage growth relatively less than in low-wage states. Our pre-pandemic evidence is consistent with the notion that minimum-wage pass-through can partly correspond to states setting minimum wages in line with concurrently rising wage levels. Overall, our findings are related to the large literature studying the relationship of minimum wages and lower-tail wage inequality, which points to the political economy of minimum wage increases as a potentially important factor (e.g., McCall, 2000; Autor, et al., 2008; Autor, et al., 2016).

[29] For example, in California, the post-pandemic 'bite' of minimum wages expressed in latent McWages declined, but Wiltshire et al. (2023, Figure 2) report a stable minimum wage 'bite' for restaurant workers. What could drive such differences? While minimum wages likely affect the composition of low-skilled employment, the skill content of McWages is constant. It is also known that a simple index of the 'bite' of the minimum wage may be negatively correlated with the wages of affected workers (Card, et al., 1994).

6. Conclusions

In this paper, we provide a simple, credible measure of wage rates for near-identical jobs in U.S. local labor markets facing varying economic conditions. Comparing wages is complicated by the fact that even within an occupation, tasks vary substantially. We collect data on wage rates in a highly standardized job that is available across the entire U.S. Our evidence is based on a single job, that of McDonald's Basic Crew, which is the price paid for the high consistency of McWages over time and space. Nevertheless, McDonald's employees belong to and plausibly represent a large group of workers in omnipresent entry-level jobs requiring comparable skills.

Our results imply two key conclusions. First, there are clearly considerable differences between wage rates measured in U.S. dollars and wage rates adjusted to reflect the purchasing power of workers performing essentially identical tasks in different regions of the U.S. labor market. Differences in real wages of about 50% for workers supplying a fixed skill input are not consistent with the notion that the U.S. labor market is highly integrated for low-skilled workers. Moreover, these differences have been growing rapidly over recent years, even as tight post-pandemic labor markets support low-wage growth within the 'unexpected compression' of the wage distribution (Autor et al., 2023). Our results highlight the importance of controlling for tasks in cross-area wage comparisons. They are consistent with the recent decline in the geographic mobility of U.S. workers (Dao et al., 2017), and suggest that models of local-area economic development in which organizational and structural differences account for differences in income levels are of considerable importance. Future research should also explore links between geographic McWage gaps and proxies for monopsony, such as local labor market concentration (Azar et al., in press).

Second, we extend the literature studying the effects of minimum wages on U.S. earnings inequality. We find that the Covid-19 pandemic resulted in a sharp break in the importance of minimum wages for low-skilled wage growth, as captured by McWages. Prior to the pandemic, cross-state wage differences were strongly related to minimum wages, as state minimum wage levels were rising in tandem with the state-specific latent McWage means. As a result, prior to the pandemic, real wages of McDonald's workers were growing only in the roughly half of U.S. states that were raising state minimum wages. The pandemic-induced wage spike of 2021 nearly

eliminated these geographic minimum-wage-related differences in wage growth between 2016 and 2023, and led to near-irrelevance of the federal minimum wage. Finally, our estimates offer a new, consistent measure of the 'bite' of state minimum wages, one that suggests limited cross-state variation in the minimum wage 'bite' prior to the pandemic, and a declining 'bite' in most states since the pandemic.

References

Aaronson, D., French, E., Sorkin, I., and T. To (2018) "Industry Dynamics and the Minimum Wage: A Putty-Clay Approach," *International Economic Review*, 59: 51–84.

Acemoglu, D., and P. Restrepo (2020) "Robots and Jobs: Evidence from U.S. Labor Markets," Journal of Political Economy, 128(6): 2188–2244.

Albouy, David, Chernoff, Alex, Lutz, Chandler, and Casey Warman (2019) "Local Labor Markets in Canada and the United States," *Journal of Labor Economics*, 37(S2): S533-–S594.

Allegretto, S., Doussard, M., Graham-Squire, D., Jacobs, K., Thompson, D., and J. Thompson (2013) "The public cost of low-wage jobs in the fast food industry," Labor Center, UC Berkeley.

Amior, Michael, and Alan Manning (2018) "The Persistence of Local Joblessness," American Economic Review, 108(7): 1942—1970.

Ashenfelter, Orley, and Štěpán Jurajda (2022) "Minimum Wages, Wages, and Price Pass-Through: The Case of McDonald's Restaurants", *Journal of Labor Economics,* 40(S1): S179-S201.

Autor, D., Dube, A., and A. McGrew (2023) "The Unexpected Compression: Competition at Work in the Low Wage Labor Market," NBER Working paper No. 31010.

Autor, D., Katz, L., and M. Kearney (2008) "Trends in U.S. Wage Inequality: Revising the Revisionists," *Review of Economics and Statistics*, 90(2), 300–323.

Autor, D., Manning, A., and C. Smith (2016) "The Contribution of the Minimum Wage to U.S. Wage Inequality over Three Decades: A Reassessment," *American Economic Journal: Applied Economics*, 8(1), 58–99.

Azar, José, Huet-Vaughn, Emiliano, Marinescu, Ioana, and Till von Wachter (in press) "Minimum Wage Employment Effects and Labor Market Concentration," *Review of Economic Studies*

Bound, J., Brown, C., Duncan, G.J., and W.L. Rodgers (1994) "Evidence on the Validity of Cross-Sectional and Longitudinal Labor Market Data," *Journal of Labor Economics*, 12(3): 345-368.

Bound, J., Brown, C., and N. Mathiowetz (2001) "Measurement Error in Survey Data," *Handbook of Econometrics*, Vol. 5: 3705–3843.

Cabral L.M.B., and J. Mata (2003) "On the Evolution of the Firm Size Distribution: Facts and Theory," *American Economic Review* 93(4): 1075-1090.

Card, D., Katz L., and A. Krueger (1994) "Comment on David Neumark and William Wascher, "Employment Effects of Minimum and Subminimum Wages: Panel Data on State Minimum Wage Laws," *ILR Review*, 47(3): 487-497.

Card, D., and A. Krueger (1994) "Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania," *American Economic Review* 84(4): 772-93.

Card, D., Rothstein, J., and M. Yi (2023) "Location, Location, Location," NBER Working Paper No. 31587

Clements, K. W., Lan, Y., and S.P. Seah (2012) "The Big Mac Index Two Decades on: an Evaluation of Burgernomics," *International Journal of Finance & Economics*, 17(1): 31–60.

Dao, M., Furceri, D., and P. Loungani (2017) "Regional Labor Market Adjustment in the United States: Trend and Cycle," *Review of Economics and Statistics*, 99(2): 243–257.

Deaton, Angus (2010) "Price Indexes, Inequality, and the Measurement of World Poverty," *American Economic Review,* 100(1): 5-34.

Forsythe E., Kahn L., Lange F., and D. Wiczer (2022) "Where have all the workers gone? Recalls, retirements, and reallocation in the covid recovery," *Labour Economics*, 78:102251.

Glaeser, Edward, and David Maré (2001) "Cities and skills," *Journal of Labor Economics,* 19(2): 316–342.

Handbury, J., and D.E. Weinstein (2015) "Goods Prices and Availability in Cities," *Review of Economic Studies*, 82(1): 258-296.

Jeong, B. (2002) "Measurement of Human Capital Input across Countries: New Method and Results," *Journal of Development Economics,* 67 (2), pp. 333-349.

Lemieux, T. (2006) "Increasing Residual Wage Inequality: Composition Effects, Noisy Data, or Rising Demand for Skill?" *American Economic Review*, 96(3): 461-498.

McCall, L. (2000) "Explaining levels of within-group wage inequality in U.S. labor markets," *Demography*, 37(4): 415–430.

Ong, L.L. (2003) *The Big Mac Index: Applications of Purchasing Power Parity*. Palgrave Macmillan.

Parsley, D. C., and S.-J. Wei (2007) "A Prism into the PPP Puzzles: The Micro-Foundations of Big Mac Real Exchange Rates," *The Economic Journal*, 117(523), 1336–1356.

Ransom, T. (2022) "Labor Market Frictions and Moving Costs of the Employed and Unemployed*," Journal of Human Resources*, 57: S137-S166.

Royle, T. (2000) *Working for McDonald's in Europe: the Unequal Struggle*. London; New York: Routledge.

U.S. Bureau of Labor Statistics (2016) Occupational employment and wages, May 2015.

U.S. Bureau of Labor Statistics (2019) Occupational employment and wages, May 2018.

Yagan, D. (2019) "Employment Hysteresis from the Great Recession," *Journal of Political Economy* 127(5): 2505-2558.

Wiltshire, J.C., C. McPherson and M. Reich. (2023) "Minimum Wage Effects and Monopsony Explanations". IRLE Working Paper No. 105-23.

Tables and Figures

Tab. 1: Basic Descriptive Indicators, 2016 and 2023

	Mean	Median	S.D.	P5	P95
			2016		
$ McWage	8.53	8.25	1.04	7.25	10.5
$ BigMac price	4.46	4.42	0.45	3.79	5.26
BMPH	1.92	1.91	0.24	1.58	2.34
MSA RPP$ McWage	8.80	8.72	0.97	7.37	10.5
County RPP$ McWage	8.87	8.82	0.98	7.38	10.5
			2023		
$ McWage	13.15	13	2.19	10	16.5
$ BigMac price	5.64	5.55	0.66	4.75	6.84
BMPH	2.34	2.34	0.36	1.77	2.94

Note: RPPs not yet available for 2023.

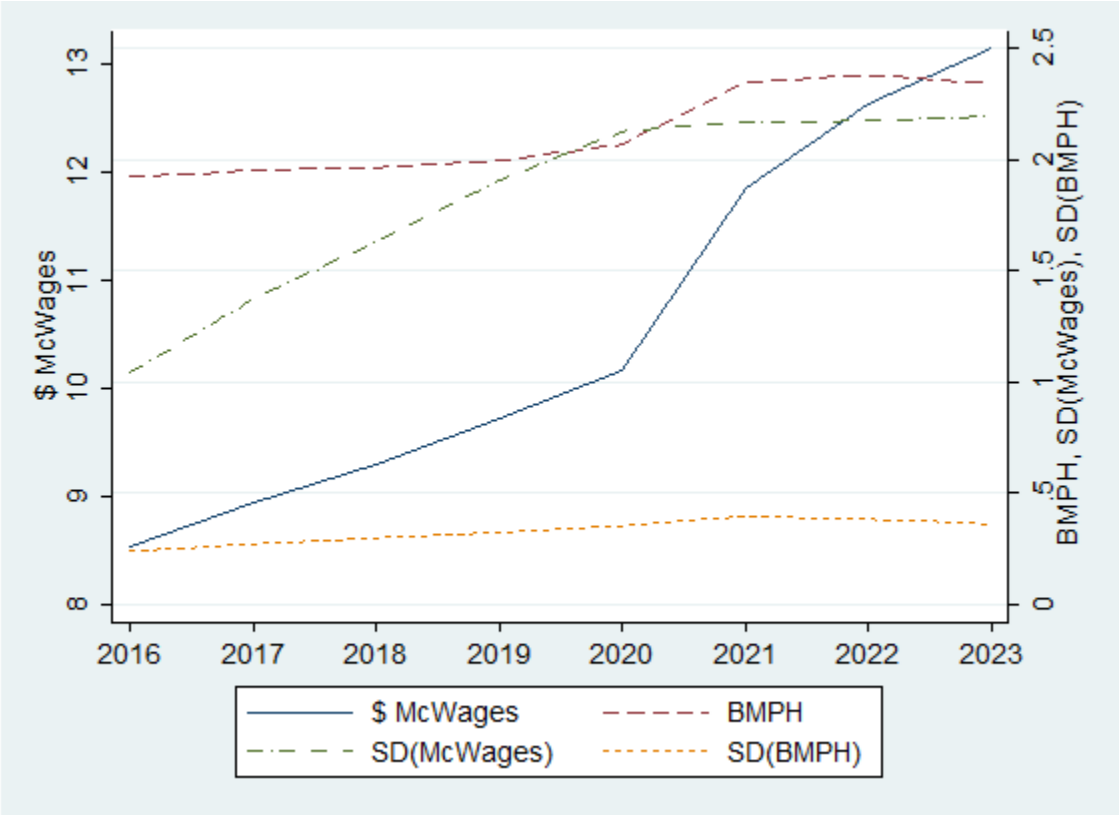

Fig. 1: The Evolution of $McWages, Big Macs per Hour (BMPH), and of their Dispersion (S.D.)

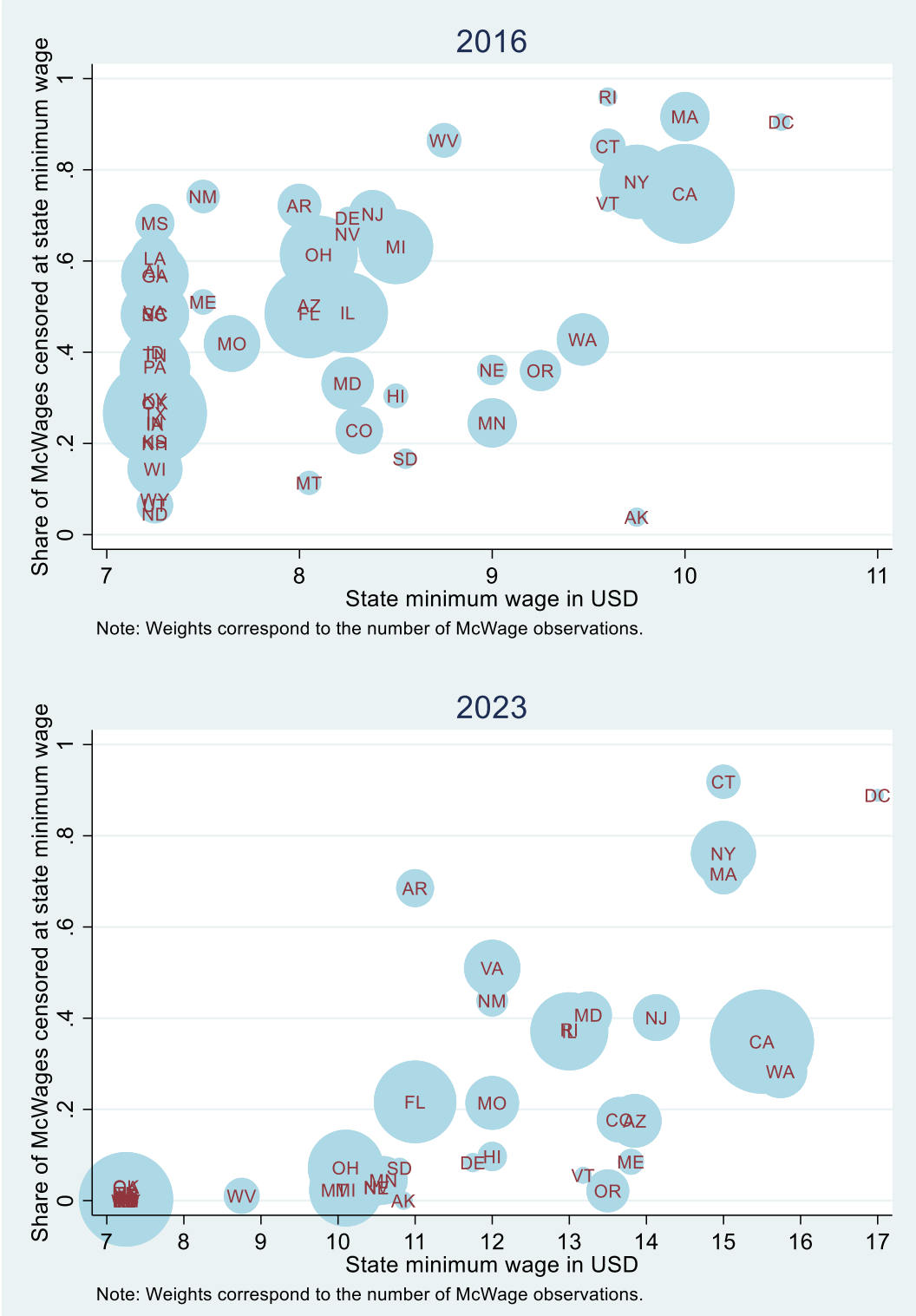

Fig. 2: The Extent of McWage Censoring at State Minimum Wage Level, 2016, 2023

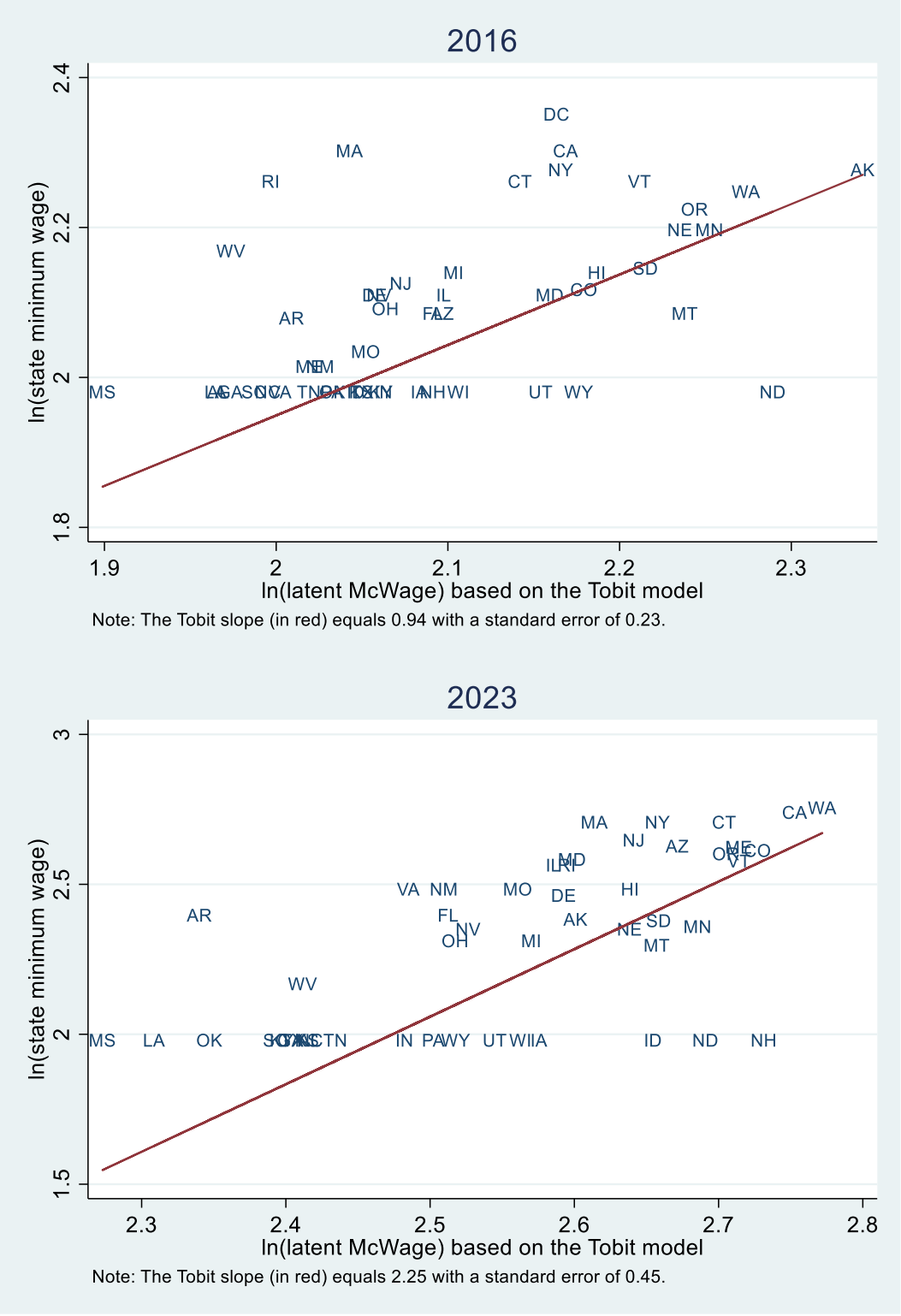

Fig. 3: State Minimum Wage Levels and Latent McWages

Note: Only states with more than 10 McDonald's; no data from locations with city/county minimum wage ordinances.

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APPENDIX A: Additional Descriptive Statistics at the National Level

Table A.1: Evolution of McWages and Big Mac Prices , 2016-2023

USA-wide Evolution

	Levels					Avg .annual growth rates			Annual Growth Rates		
year	$McWage	% McWages	$BMPrice	BMPH	No of obs.	$McWage	$BMPrice	BMPH	$McWage	$BMPrice	BMPH
		at Min. Wage									
2016	8.53	46%	4.46	1.92	11,365						
2017	8.94	42%	4.60	1.95	10,873	5%	3%	1%	5%	3%	1%
2018	9.30	39%	4.75	1.96	10,407	4%	3%	1%	4%	3%	1%
2019	9.72	38%	4.88	1.99	10,003	4%	3%	1%	4%	3%	1%
2020	10.17	36%	4.91	2.07	9,713	4%	2%	2%	5%	1%	4%
2021	11.85	16%	5.07	2.35	9,466	7%	3%	4%	17%	3%	14%
2022	12.63	16%	5.33	2.38	9,058	7%	3%	4%	7%	5%	1%
2023	13.15	18%	5.64	2.34	9,200	6%	3%	3%	4%	6%	-2%

Locations with no minimum wage increases during 2016-2023 (states where the federal minimum wage of $7.25 is applicable and WV)

	Levels					Avg .annual growth rates			Annual Growth Rates		
year	$McWage	% McWages	$BMPrice	BMPH	No of obs.	$McWage	$BMPrice	BMPH	$McWage	$BMPrice	BMPH
		at Min. Wage									
2016	7.83	38%	4.31	1.83	5,075						
2017	7.96	31%	4.41	1.82	4,648	2%	2%	-1%	2%	2%	-1%
2018	8.17	25%	4.54	1.81	4,420	2%	3%	-1%	3%	3%	-1%
2019	8.38	20%	4.64	1.82	4,180	2%	2%	0%	2%	2%	0%
2020	8.62	15%	4.66	1.86	4,071	2%	2%	0%	3%	0%	2%
2021	10.35	3%	4.79	2.17	3,641	6%	2%	4%	20%	3%	17%
2022	11.11	1%	5.04	2.22	3,445	6%	3%	3%	7%	5%	2%
2023	11.55	1%	5.32	2.18	3,510	6%	3%	3%	4%	6%	-2%

Locations with state minimum wage increases at some point during 2016-2023, but no local (city/county) minimum wages

	Levels					Avg .annual growth rates			Annual Growth Rates		
year	$McWage	% McWages	$BMPrice	BMPH	No of obs.	$McWage	$BMPrice	BMPH	$McWage	$BMPrice	BMPH
		at Min. Wage									
2016	8.97	54%	4.53	1.99	5,442						
2017	9.46	53%	4.70	2.02	5,304	5%	4%	2%	5%	4%	2%
2018	9.86	51%	4.85	2.04	5,089	5%	3%	1%	4%	3%	1%
2019	10.37	52%	4.99	2.08	5,014	5%	3%	2%	5%	3%	2%
2020	10.97	52%	5.04	2.18	4,879	5%	3%	2%	6%	1%	5%
2021	12.54	23%	5.18	2.44	5,040	7%	3%	4%	14%	3%	12%
2022	13.34	23%	5.47	2.46	4,889	7%	3%	4%	6%	5%	1%
2023	13.92	29%	5.78	2.42	4,970	6%	4%	3%	4%	6%	-1%

Locations with local (city/county) minimum wages in place at some point during 2016-2023

	Levels					Avg .annual growth rates			Annual Growth Rates		
year	$McWage	% McWages	$BMPrice	BMPH	No of obs.	$McWage	$BMPrice	BMPH	$McWage	$BMPrice	BMPH
		at Min. Wage									
2016	9.87	41%	4.81	2.06	848						
2017	10.93	35%	5.00	2.20	921	11%	4%	7%	11%	4%	7%
2018	11.75	41%	5.19	2.28	898	9%	4%	5%	7%	4%	4%
2019	12.59	43%	5.38	2.35	809	8%	4%	4%	7%	4%	3%
2020	13.32	46%	5.47	2.45	763	8%	3%	4%	6%	2%	4%
2021	14.35	35%	5.60	2.58	785	8%	3%	5%	8%	2%	5%
2022	15.13	35%	5.83	2.62	724	7%	3%	4%	5%	4%	1%
2023	15.66	36%	6.12	2.58	720	7%	3%	3%	3%	5%	-2%

APPENDIX B: Data Reliability

B1. McWage Measurement Error

Repeat interviews

To assess the extent of noise in our wage rate measure in 2016, we collected 438 repeat interviews within a month of the first interview for a random sample of the surveyed restaurants. Only 17% of the 2016 re-interviews were answered by the same person, based on the respondent's first name. The mean (absolute) wage difference between the two interviews is \$0.24 and this gap drops to \$0.11 for re-interviews in which the respondent was the same person. As a first approximation, we assume that, for the 83% of re-interviews that were answered by different crew members, the two wage measures are affected by classical uncorrelated measurement errors: $w^{*}=w+e^{*}$ and $w^{**}=w+e^{**}$. The sample covariance of the two measures equals 1.058 (with a standard deviation of 0.07). Under the assumed zero co-variance of measurement errors, the statistic $\text{Cov}(w^{*}, w^{**}) / \text{SD}(w^{*})\text{SD}(w^{**})$ converges to $\text{Var}(w) / [\text{Var}(w)+\text{Var}(e^{*})]$, i.e., to the reliability ratio.[30] When evaluated using re-interviews that were not answered by the same respondent, this statistic equals 0.87 for both \$McWages and their logs.[31] In the 2017 survey, we collected 663 repeat interviews, two thirds of which were answered by different respondents based on their first names, with a resulting \$McWage reliability ratio of 0.88. We subsequently collected large sets of repeat interviews (the largest was 1,722 strong in 2019), of which over 70% were answered by a different respondent based on the first name provided; the resulting reliability ratio was 0.92 to 0.95, suggesting little measurement error.[32]

Starbucks wages

Another way of assessing the validity of our measurement strategy based on McWages is to consider the geographical differences implied by McWages in comparison to those implied by another fast-food chain. For this purpose, we additionally collected a Starbucks wage and price survey in 2017. Unlike McDonald's, Starbucks owns and operates most of its stores. Another difference is that about 40% of Starbucks locations in the U.S. correspond to licensing arrangements, where a store is operated inside a grocery store, a mall, an airport, or a university. Because employees in these licensed stores face less uniform compensation packages and potentially varying hedonic job conditions, we exclude the licensed stores from our Starbucks survey. This eliminates over 5 thousand of the 13,612 U.S. Starbucks locations in 2017. We only collect data from Starbucks stores that are located in the 5-digit zip code areas from which we have 2016 McDonald's data. This further reduces the target population of Starbucks locations to 5,726 stand-alone stores in 3,274 zip code areas in 849 counties.[33] Starbucks stores are harder to reach using a telephone survey than are McDonald's. It is harder to predict off-peak hours, and, when contacted, Starbucks

[30] Some of what we count as measurement error in McWages could correspond to actual wage movement, although the distribution of the difference between the two reported wage rates is almost perfectly symmetric around zero.
[31] The ratio equals 0.95 when evaluated on the sample of re-interviewed restaurants where the respondent was the same person, which implies a small variance of the individual-specific error component of 0.09.
[32] Relying on the assumption of classical measurement error with uncorrelated errors and collecting 1,415 (1,722) [1,190] {1,156} |955| repeat interviews in 2018 (2019) [2020] {2021} |2023|, of which 79% (71%) [76%] {97%} |73%| are answered by a different respondent based on their first names; the reliability ratios are 0.93 (0.94) [0.95] {0.93} |0.93|. In 2022, we could not collect the respondent names; the 2022 reliability ratio based on 500 re-interviews is 0.92.
[33] U.S. Starbucks locations are more geographically concentrated than McDonald's stores; Starbucks stores can be found in only 1,100 highly populous counties, while McDonald's are found in 2,250 counties.

employees are more likely to refuse to answer our survey than McDonald's workers. We obtained wage and price measures from only 40% of the Starbucks stores in our target population, such that our 2017 McDonald's and Starbucks data overlap in 1,520 zip codes, where we observe 2,664 McWages and 2,013 Starbucks wage rates. The median (mean) McWage in these zip codes is $9 ($9.32), while the comparable Starbucks median (mean) is $10 ($10.07), implying an 11% (8%) wage differential for basic crew across these two types of highly standardized restaurants. The coefficient of variation is identical (at 0.15) for $McWages and Starbucks wages within the 1,520 zip codes where the two measures overlap. Finally, regressing the zip-level *ln(McWage)* median on the corresponding Starbucks wage measure results in an R^2 of 0.5 with a slope coefficient of 0.78. When we use only zip codes where we observe at least two McWages and at least two Starbucks wage rates, the slope increases to 0.9 and the R^2 is 0.6. Similarly, the Spearman rank correlation of 0.78 over zip codes with at least two observations of each measure confirm that the two wage measures are reflecting a common pattern of geographic differences in wage rates.[34]

B.2 Big Mac Prices vs. RPPs

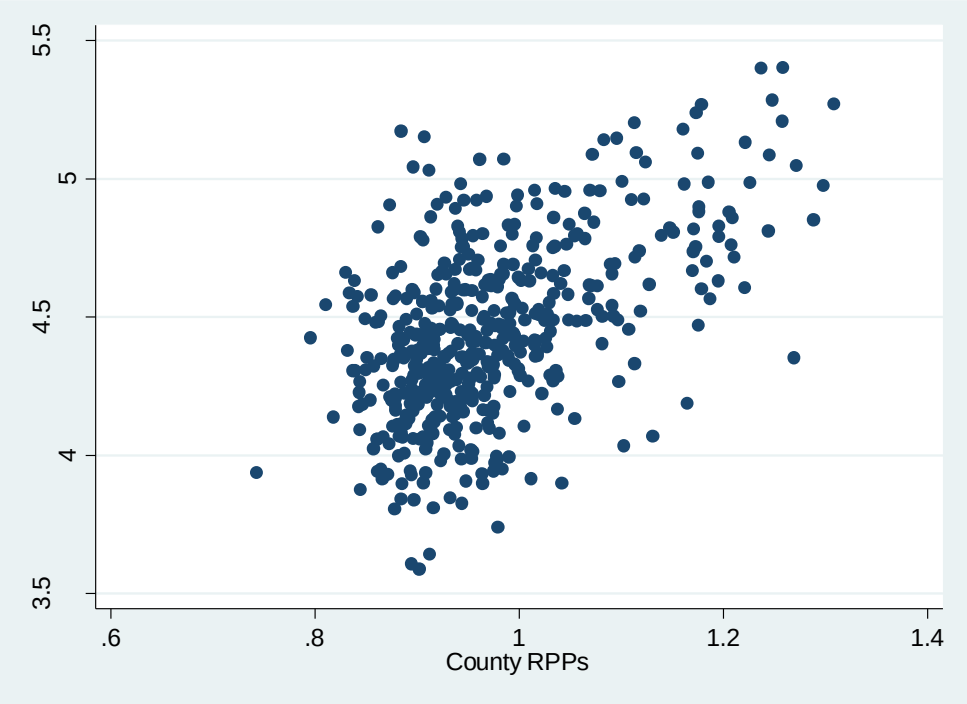

Fig. B.1 Big Mac Prices and RPPs, County Level, 2016
Note: The 2016 county RPPs are experimental. Only counties with more than 5 McDonald's shown.

B.3 McDonald's employee turnover rates

"We have a 100% turnover rate worldwide – if we can hold on to just 10 per cent, that's amazing for us." https://www.hrreporter.com/focus-areas/automation-ai/how-mcdonalds-is-supersizing-engagement/370071
"McDonald's has an annual turnover rate of over 130%." https://www.zippia.com/advice/mcdonalds-statistics/

[34] When we contrast the (medians of the) two measures across the 541 counties where we observe both wage rates, we obtain practically the same results. In particular, using the 284 counties where we have at least two observations of both wage measures, the regression slope is 0.92, statistically indistinguishable from unity. Aggregating across counties as opposed to zip codes may lower measurement error. On the other hand, it lowers comparability due to growing geographic differences between McDonald's and Starbucks stores.

APPENDIX C: Additional Regression Analysis

C.1 McWages and Touch-Screen Ordering and Local-Area Predictors

Tab C.1: Explaining ln(McWage) using Restaurant and Local-Area Characteristics, Tobit model

Year	2016	2017	2018	2019	2020	2021	2022	2023
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Restaurant has touch-screen ordering	--	0.014	0.005	-0.003	0.002	0.002	0.004	**0.018**
		(0.010)	(0.009)	(0.009)	(0.008)	(0.005)	(0.009)	(0.009)
Share of college educated	**0.335**	**0.45**	**0.472**	**0.498**	**0.504**	**0.444**	**0.466**	**0.483**
	(0.050)	(0.077)	(0.075)	(0.082)	(0.076)	(0.059)	(0.053)	(0.060)
Population density per sq. mile/1000	**0.004**	**0.007**	**0.008**	**0.008**	**0.009**	**0.004**	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Tobit Sigma	0.14	0.16	0.18	0.19	0.2	0.19	0.18	0.17
N	11,365	10,873	10,408	10,003	9,713	9,466	9,058	9,200

Note: Standard errors in parentheses are based on clustering of residuals at the state level. The Tobit model allows for censoring at effective local minimum wage levels. Bolded coefficients are statistically significant at the 5% level. The share of restaurants with touch-screen ordering increased from 20% to 93% between 2017 and 2023. The additional (not shown) restaurant-level controls (as in Table 1 in Ashenfelter and Jurajda, 2022) are restaurant ownership (franchise or company-owned), location on a highway, and indicators for a free-standing restaurant and for manager answering the survey.

Data Sources for county-level controls:
Population: US Census Bureau. Population Estimates. County Population Totals.
https://www.census.gov/programs-surveys/popest/data/tables.html Retrieved 26.04.2024
Land area: US Census Bureau. US Counties 2011. Land Area.
https://www.census.gov/library/publications/2011/compendia/usa-counties-2011.html#LND Retrieved on 26.04.2024
Educational Attainment: US Census Bureau. ACS 5-Year Estimates Subject Table. Educational Attainment (S1501).
https://data.census.gov/table/ACSST5Y2022.S1501?t=Educational%20Attainment&g=010XX00US$0500000
Retrieved on 28.04.2024

C.2 Minimum Wages and McDonald's Entry and Exit

Tab C.2 Minimum Wage (MW) and McDonald's Entry/Exit, 2010-23

Outcome variable [mean]	Exit [0.01]	Entry [0.01]
	(1)	(2)
ln(MW)	0.002	0.002
	(0.005)	(0.004)
MW Variation Level	State	
Observation Level	Restaurants	
Fixed Effects	County and Year	
N	165,186	164,890

Note: Std. errors in parentheses based on clustering at the state level. Only data from locations with no local (county or city) minimum wage ordinances, as in column (1)/(5) of Tab. 6 in Ashenfelter & Jurajda (2022).

APPENDIX D: Additional State-level Statistics

D.1 State-level averages of $McWages and Big Macs per Hour (BMPH): 2023 versus 2016

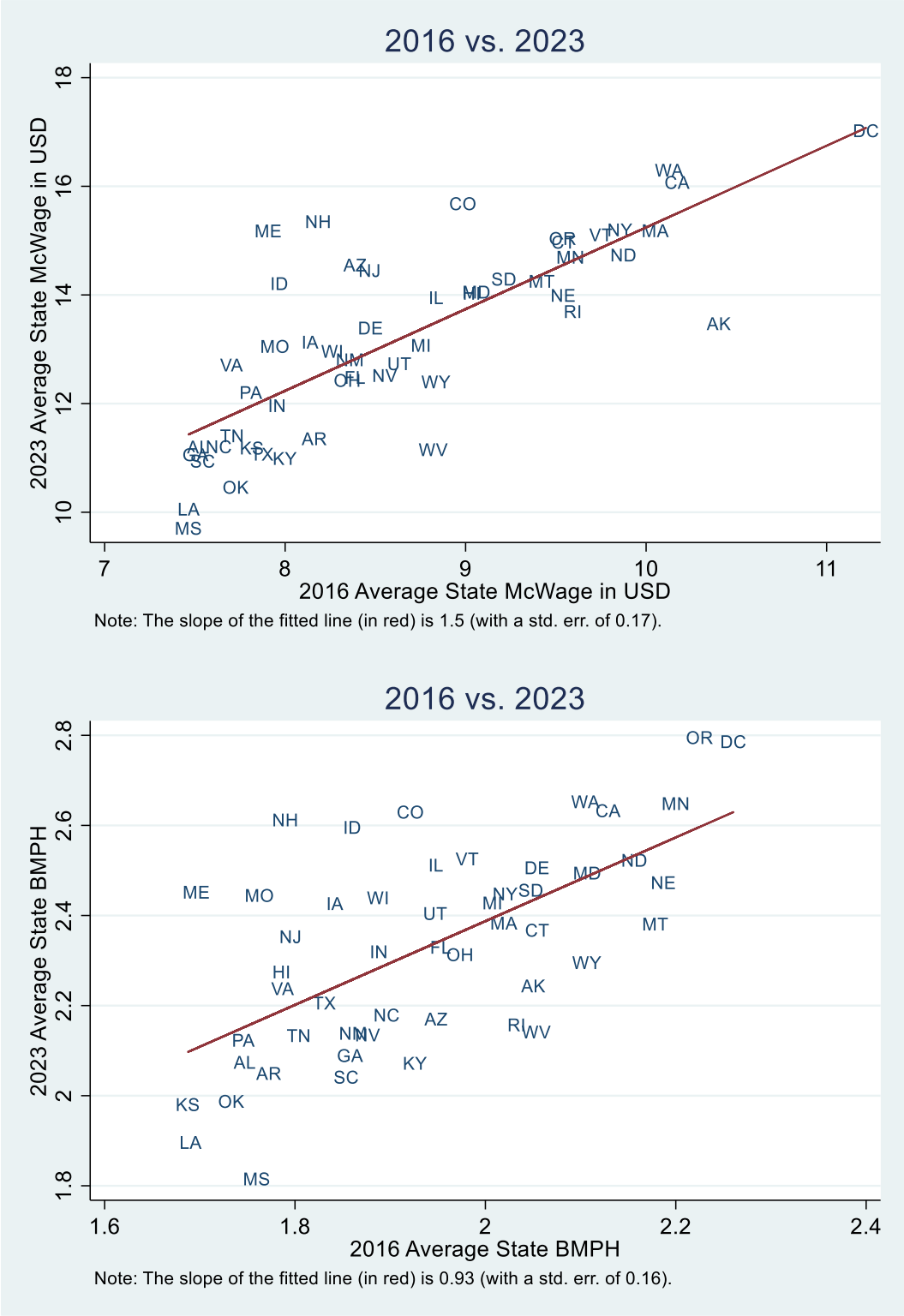

Fig. D. 1: State-level averages of $McWages and Big Macs per Hour (BMPH): 2023 versus 2016

D.2 Estimating Latent McWage Means

Tab D.1 2016 McWages at State Level

State	Tobit Latent $McWage Mean/Median (1)	N (2)	State $ Min. Wage (3)	% Censored (4)	ln(McWage) Mean (5)	SD (6)	Median (7)	P33 (8)	Tobit ln(latent McWage) (9)	Matching Median Predictio (11)
AK	10.40	26	9.75	4%	2.34	0.04	2.35	2.30	2.34	
ND	9.87	22	7.25	5%	2.29	0.10	2.30	2.30	2.29	
UT	8.62	108	7.25	6%	2.15	0.08	2.14	2.15	2.15	
WY	8.81	26	7.25	8%	2.17	0.10	2.18	2.14	2.18	
MT	9.37	44	8.05	11%	2.24	0.10	2.24	2.17	2.24	
WI	8.22	257	7.25	14%	2.11	0.08	2.11	2.08	2.11	
SD	9.16	30	8.55	17%	2.22	0.06	2.20	2.17	2.22	
NH	8.10	40	7.25	20%	2.10	0.10	2.08	2.02	2.09	
KS	7.76	127	7.25	20%	2.05	0.06	2.05	2.02	2.05	
IA	8.03	140	7.25	24%	2.19	0.08	2.20	2.14	2.08	
MN	9.51	184	9	24%	2.09	0.09	2.08	2.05	2.25	
IN	7.87	306	7.25	25%	2.07	0.07	2.08	2.02	2.06	
CO	8.84	163	8.31	26%	2.26	0.05	2.25	2.25	2.18	
TX	7.77	954	7.25	27%	2.06	0.07	2.06	2.05	2.05	
OK	7.63	166	7.25	29%	2.42	0.06	2.44	2.44	2.03	
MD	8.67	160	8.25	29%	2.04	0.06	2.05	2.05	2.16	
KY	7.85	226	7.25	30%	2.08	0.09	2.08	2.05	2.06	
HI	8.91	46	8.5	30%	2.20	0.06	2.20	2.17	2.19	
NE	9.35	72	9	36%	2.20	0.10	2.17	2.17	2.24	
OR	9.43	120	9.25	37%	2.25	0.06	2.27		2.24	
PA	7.63	432	7.25	37%	2.25	0.07	2.30		2.03	
WA	9.71	202	9.47	39%	2.05	0.07	2.05		2.27	
TN	7.53	287	7.25	39%	2.31	0.09	2.30		2.02	
ID	7.74	55	7.25	40%	2.04	0.06	2.01		2.05	
MO	7.78	272	7.65	42%	2.07	0.08	2.08		2.05	
AZ	8.14	175	8.05	46%	2.07	0.05	2.08		2.10	
NC	7.35	402	7.25	48%	2.03	0.07	2.00		2.00	
SC	7.29	182	7.25	48%	2.02	0.06	1.99		1.99	
FL	8.10	695	8.05	48%	2.12	0.06	2.10		2.09	
VA	7.41	350	7.25	49%	2.17	0.09	2.13		2.00	
NM	7.58	44	7.5	49%	2.04	0.07	1.99		2.03	
ME	7.53	45	7.5	49%	2.07	0.06	2.05		2.02	
GA	7.19	391	7.25	57%	2.01	0.05			1.97	1.89
IL	8.15	389	8.25	58%	2.17	0.01			2.10	2.13
AL	7.14	192	7.25	58%	2.02	0.06			1.97	1.95
LA	7.13	193	7.25	61%	2.01	0.04			1.96	1.96
OH	7.88	526	8.1	61%	2.12	0.06			2.07	2.10
MI	8.19	483	8.5	63%	2.17	0.06			2.10	2.15
NV	7.85	91	8.25	66%	2.14	0.07			2.06	2.04
MS	6.68	123	7.25	68%	2.01	0.08			1.90	1.86
DE	7.83	36	8.25	69%	2.14	0.05			2.06	2.03
NJ	7.95	192	8.38	70%	2.14	0.04			2.07	2.06
AR	7.46	158	8	72%	2.10	0.05			2.01	1.99
VT	9.13	22	9.6	73%	2.28	0.03			2.21	2.24
NY	8.72	344	9.75	76%	2.29	0.06			2.16	2.18
CA	8.75	572	10	85%	2.32	0.05			2.17	2.22
CT	8.52	101	9.6	85%	2.26	0.04			2.14	2.24
WV	7.20	96	8.75	86%	2.18	0.04			1.97	
MA	7.71	204	10	92%	2.31	0.05			2.04	
RI	7.37	25	9.6	96%	2.26	0.02			2.02	

In Table D.1 above, we estimate the state latent McWage medians in states with over 50% censoring (i.e., where medians are censored) without relying on distributional assumptions. (We exclude data from locations with city/county minimum wage ordinances.) We match each heavily censored state to one less censored state based on the longest inter-percentile range (starting with the 90th percentile) observed in the heavily censored state. For example, when estimating the median in a state, where the lowest observed uncensored percentile is P60, we calculate the P90-P60 range and find a state (where the median is not censored) with the nearest value of this range. (We have also matched to multiple states, matched on multiple inter-decile ranges summarized using the Kolmogorov-Smirnov D-statistic, and used the 95th rather than the 90th percentile as the highest point of the inter-percentile range. In all cases, we obtain highly similar results.) We then use this matched state to predict the latent median in the heavily censored state. We obtain similar results in other years.

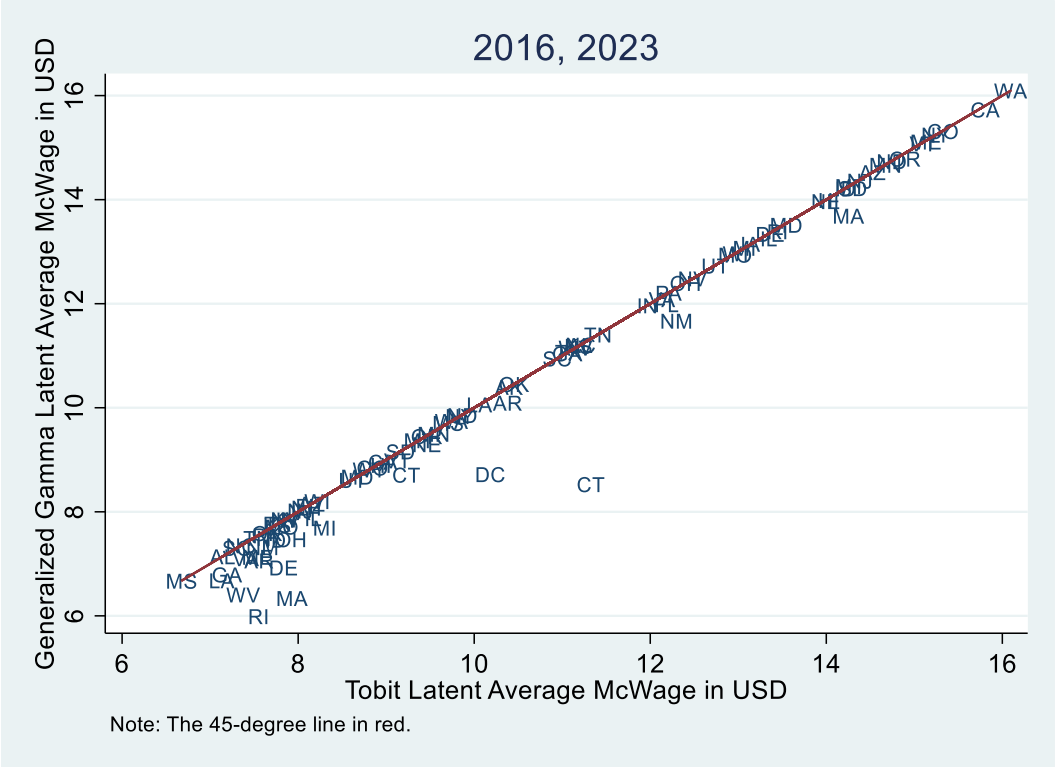

Fig. D.2: Latent McWage means based on the Normal distribution vs. the Generalized Gamma distribution
Note: State-year data from 2016 and 2023.

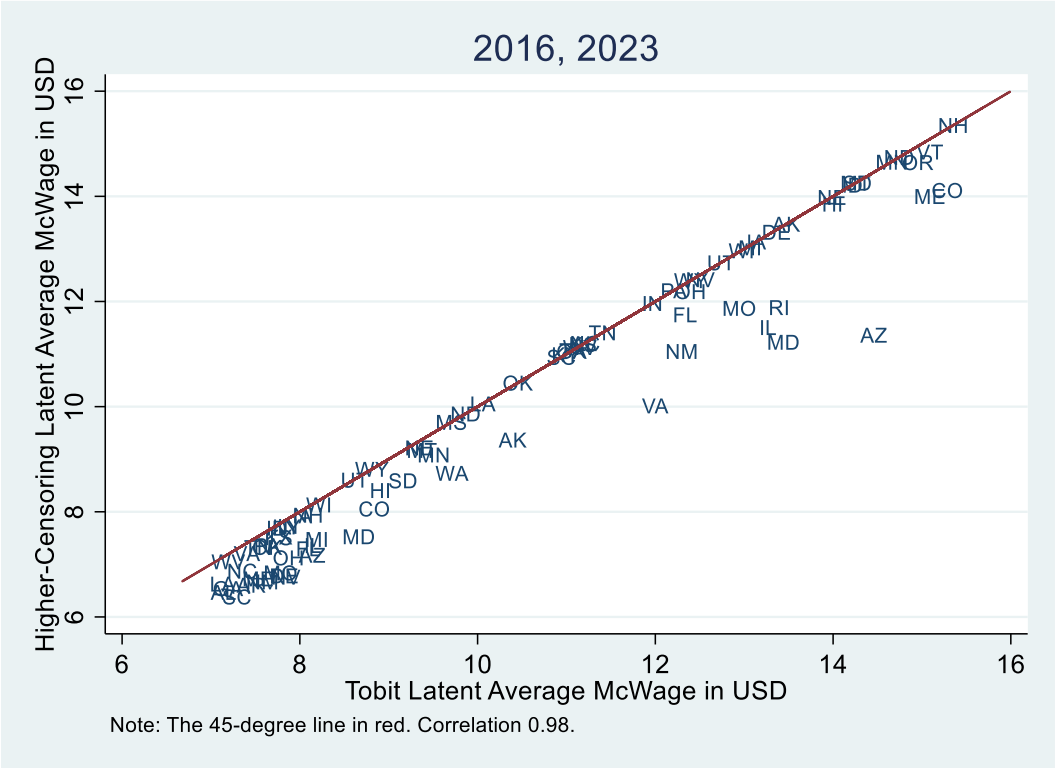

Fig. D.3: Latent McWage means based on the Normal distribution with censoring at actual state minimum wage (horizontal axis) vs. with censoring at 1.1 of the state minimum wage (vertical axis)

Note: State-year data from 2016 and 2023 where censoring at 1.1 of the state minimum wage is below 90%. On average, the state-specific degree of censoring, i.e., the share of McWages at or below the minimum wage, doubles under the alternative 10%-higher Y-axis minimum wages relative to that under the actual state minimum wage value.

D.3 State Mean McWages and Big Mac Prices, and Tobit-Based Latent McWages, 2016, 2023

Tab D.2 State $McWages, $Big Mac Prices, and $Latent McWages

Year	2016			2023		
State	McWage	Latent McW	Bmprice	McWage	Latent McW	Bmprice
AK	10.40	10.40	5.08	13.48	13.48	6.08
AL	7.52	7.14	4.33	11.21	11.20	5.38
AR	8.16	7.46	4.63	11.36	10.38	5.59
AZ	8.42	8.14	4.39	14.53	14.46	6.71
CA	10.06	8.75	4.79	15.89	15.69	6.12
CO	8.97	8.84	4.67	15.41	15.29	5.96
CT	9.54	8.52	4.68	14.98	14.94	6.38
DC	11.22	10.18	4.99	17.03	16.49	6.17
DE	8.47	7.83	4.14	13.40	13.37	5.38
FL	8.39	8.10	4.32	12.49	12.34	5.39
GA	7.50	7.19	4.06	11.06	11.06	5.31
HI	9.03	8.91	5.11	14.03	13.99	6.23
IA	8.14	8.03	4.45	13.14	13.14	5.44
ID	7.97	7.74	4.29	14.21	14.22	5.49
IL	8.53	8.15	4.47	13.64	13.27	5.51
IN	7.96	7.87	4.24	11.97	11.97	5.19
KS	7.82	7.76	4.65	11.19	11.19	5.66
KY	8.00	7.85	4.18	10.99	10.99	5.34
LA	7.47	7.13	4.44	10.06	10.06	5.30
MA	10.05	7.71	4.99	15.19	13.65	6.41
MD	8.79	8.67	4.23	13.73	13.44	5.64
ME	7.89	7.53	4.70	15.13	15.09	6.20
MI	8.75	8.19	4.39	13.08	13.07	5.42
MN	9.59	9.51	4.39	14.66	14.67	5.60
MO	7.94	7.78	4.53	13.06	12.95	5.35
MS	7.47	6.68	4.26	9.71	9.71	5.39
MT	9.42	9.37	4.35	14.26	14.26	6.01
NC	7.63	7.35	4.07	11.21	11.21	5.15
ND	9.88	9.87	4.58	14.74	14.75	5.84
NE	9.54	9.35	4.38	14.00	13.99	5.70
NH	8.18	8.10	4.62	15.35	15.35	5.89
NJ	8.47	7.95	4.74	14.45	14.03	6.18
NM	7.92	7.58	4.58	12.77	12.30	6.01
NV	8.55	7.85	4.60	12.52	12.51	5.92
NY	9.81	8.72	4.81	15.24	14.26	6.13
OH	8.35	7.88	4.25	12.43	12.40	5.40
OK	7.73	7.63	4.51	10.46	10.45	5.33
OR	9.55	9.43	4.27	14.96	14.96	5.47
PA	7.81	7.63	4.50	12.21	12.21	5.77
RI	9.59	7.37	4.75	13.70	13.39	6.38
SC	7.54	7.29	4.11	10.95	10.95	5.37
SD	9.21	9.16	4.53	14.30	14.28	5.87
TN	7.71	7.53	4.30	11.41	11.41	5.35
TX	7.87	7.77	4.33	11.07	11.07	5.04
UT	8.63	8.62	4.46	12.74	12.74	5.30
VA	7.70	7.41	4.33	12.71	12.00	5.71
VT	9.75	9.13	4.95	15.11	15.09	6.00
WA	9.94	9.71	4.78	16.20	15.99	6.18
WI	8.26	8.22	4.39	12.97	12.97	5.34
WV	8.82	7.20	4.34	11.16	11.15	5.24
WY	8.84	8.81	4.21	12.40	12.40	5.48

D.4: Alternative Measures of the State-Minimum-Wage 'Bite'

We extract the hourly pay of employees with a regular high school diploma or less from the American Community Survey (ACS), and the ACS hourly earnings in food preparation and serving occupations. Next, we contrast alternative measures of minimum wage 'bite' in 2016. The R^2 of the regression of the state minimum wage/latent-McWage ratio on the ACS-based ratio for food occupations is 0.1. The corresponding R^2 based on the ACS data for all workers with a high school diploma or less is also low, at 0.2.

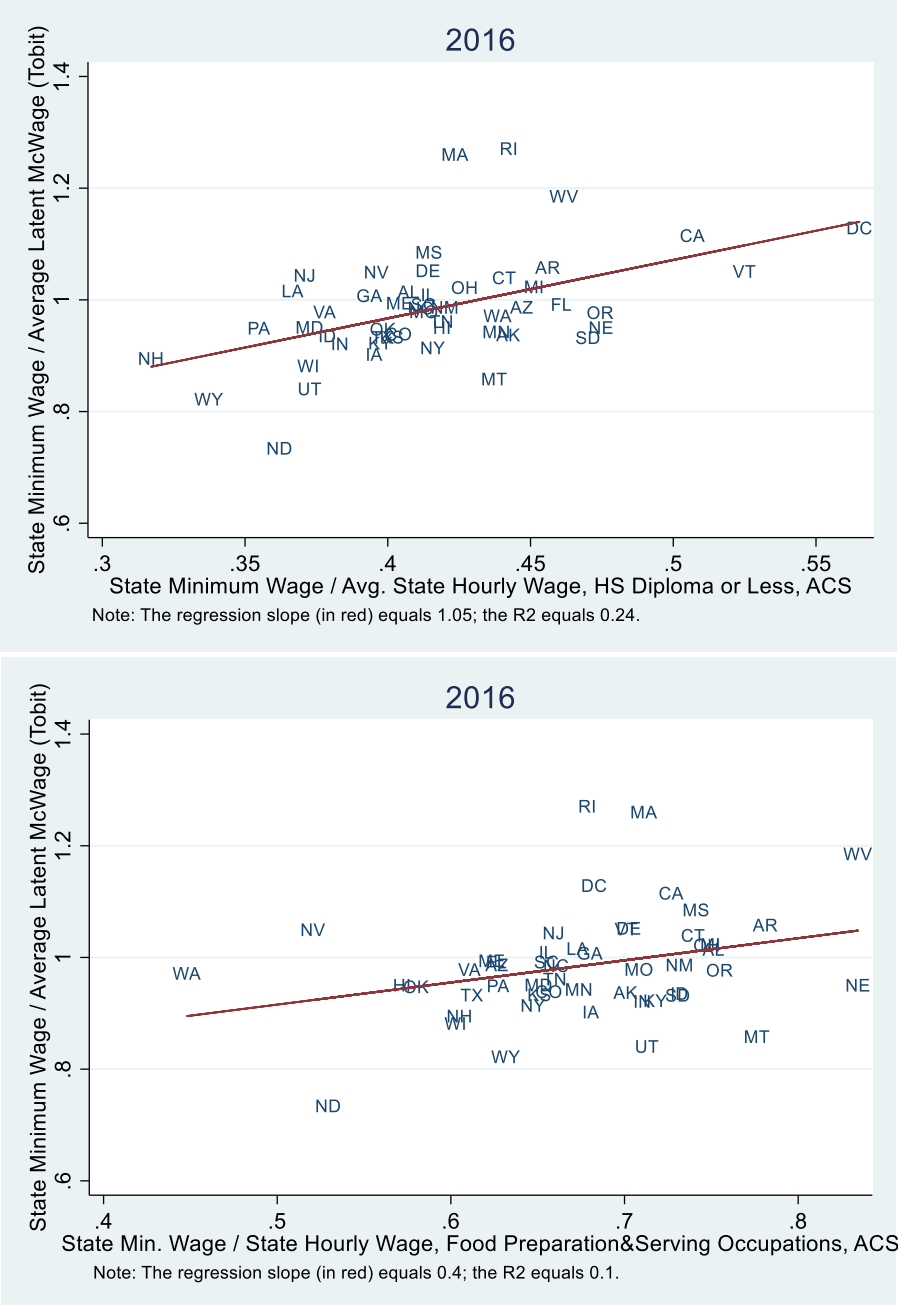

Fig. D.4: The 'Bite' of State Minimum Wages against Latent McWage Means (Tobit model) vs. against the Average Hourly Earnings of workers with HS diploma or less or of workers in Food Preparation and Serving Occupations, ACS. ACS data from https://data.census.gov/; occupational wages based on ACS IPUMS: Ruggles, Flood, Sobek, Brockman, Cooper, Richards, and Schouweiler. IPUMS ersion 13.0.

D.5 Changes in State Latent McWages and Minimum Wage Levels

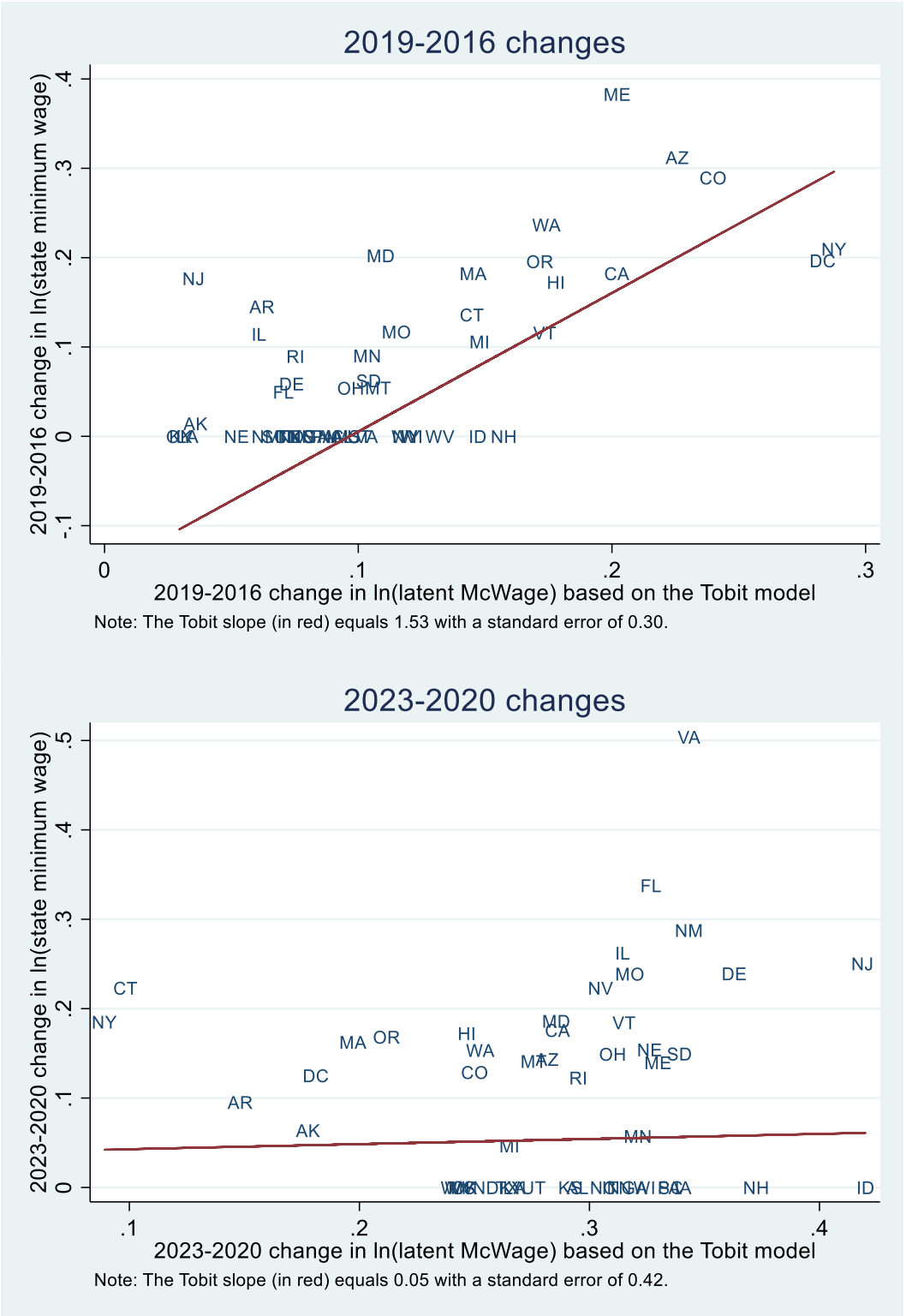

Fig. D.5: Changes in State Latent McWages and Minimum Wage Levels

APPENDIX E: Telephone Survey Instrument

McDonald's Survey 2016

INTRODUCTION

1. Hello, my name is {INTERVIEWER NAME}. I'm interested in the entry-level wage rate at your outlet. Could you answer this or direct me to someone who could? [IF R ASKS WHO IS CALLING, GO to 1a.]

01 willing to continue
02 refusal
03 call back <at specific time>
04 call back <no specific time>
05 no answer
06 busy
07 answering machine, residential or other business – TERMINATE
08 answering machine, McDonalds
09 disconnected number
10 language barrier (not Spanish or English)
11 residential number - TERMINATE
12 fax machine

1.a I am calling from {survey company}. We are conducting a survey on behalf of Princeton University on globalized products such as take away coffee and burgers. Neither your name nor your location will be printed/published, all responses will be completely anonymous, and your participation is of course voluntary. I only have two quick questions.

[IF R INDICATES THAT IT IS NOT A GOOD TIME:] Is there a day and time that would be more convenient for you? [SCHEDULE CALLBACK APPOINTMENT.]

[IF R DOES NOT KNOW THE ENTRY LEVEL WAGE RATE:]

1.b Could you direct me to someone who knows the wage rate? [IF YES, START AT INTRODUCTION 1.0. IF NOT, END THE INTERVIEW AND CODE AS REFU.S.AL.]

[IF R IS READY TO ANSWER THE QUESTION, ASK Q.2:]

2. What is your starting hourly rate for the regular day shift for entry-level crew members 18 or older who finished initial training? [INTERVIEWER CLARIFY IF NECESSARY: "AT YOUR LOCATION, NOT INCLUDING NIGHT SHIFT, OVERTIME, WEEKEND OR HOLIDAY PAY". INTERVIEWER: RECORD BASE PAY ONLY]

$_____[RECORD DOLLARS AND CENTS]

3. And what is the price of the Big Mac sandwich by itself at your outlet? I don't mean the combo meal.

$_____[RECORD DOLLARS AND CENTS]

Is this the before-sales-tax price?

1 YES
2 NO
9 Don't know/refused

[IF THE ANWER IS BELOW $3.50:] Is there a temporary price promotion in place?

1 YES
2 NO
9 Don't know/refused

[IF THE ANSWER IS YES:] And what is the regular price of the Big Mac?

$_____[RECORD DOLLARS AND CENTS]

4. [IF BOTH QUESTIONS ARE ANSWERED:] What is your position at your outlet?

1 Manager [ANY RESTAURANT MANAGERIAL POSITION]
2 Crew Member
9 Don't know/refused

5. Finally, is your restaurant a franchise or company-owned?

1 Franchise
2 Company-owned
9 Don't know/refused

Thank you very much...

Frequently Asked Questions and Sample Responses
1. Why are you doing this study? See 1a.
2. Who is funding this study? Princeton University. Should you wish to contact the Principal Investigator, Prof. Orley Ashenfelter of Princeton University, he can be reached at 609-258-4040 or at c6789@princeton.edu. Should you wish to contact the Institutional Review Board of Princeton University, call 609-258-1194 or email irb@princeton.edu .
3. How are the results of this study going to be used? The results will be used only for research purposes. They help compare prices and wage rates across locations in a comparable fashion.
4. How was I selected for this study? We randomly selected McDonald's outlets.
5. Do I have to do this? Your participation is completely voluntary. The survey consists of three quick questions and should not take more than a minute of your time.
6. How long will this take? The survey consists of only two quick questions and is expected to take about a minute.
7. What do I get for participating? We are not offering any payment. This survey is very quick.