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Abstract: We use the detailed microdata of the Occupational Employment and Wage Statistics (OEWS) mapped onto near-universe data on civilian employment in the United States to estimate employer concentration by occupation for nearly all workers in the United States, in all sectors, all occupations, and all geographic areas, from 2003 to 2018. Major findings include (1) concentration is a characteristic of small labor markets, whether defined by area or by occupation; (2) patterns of concentrated employment are different from patterns of employment in very large employers, with overlap largely in the public sector; (3) the public sector and the hospital industry play very prominent roles in concentrated employment; (4) more concentrated labor markets are associated with slightly lower wages, but only within the private sector; (5) there is enormous variation between occupations in concentration levels, concentration trends, and wage associations with concentration.

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Introduction-

“There’s one new fact which I found very surprising when I first thought about it and then it started to make more sense as I thought about it some more, and that is that the number of potential employers, for many occupations and many local labor markets is quite small....for a typical occupation, there aren’t as many employers as you might think, at least locally....” – David Card, AEA 2022 Presidential Address, “Who Sets Your Wage?”¹

Decreasing competition among employers has been suggested as a cause of lagging labor market compensation in the recovery from the Great Recession. Economists have documented the concentration of job postings and of employment by industry in local areas. However, labor markets are better defined by occupation and geographic area than by industry and geographic area. We bring near-universal data on current employment by occupation and geographic area in the United States to the study of labor market concentration to document concentration in employment ‘stocks’ rather than the concentration of employment ‘flows’ that other authors have studied with job postings data.

We also study the extent of overlap between employers in concentrated local labor markets—some of them explicit monopsonists or oligopsonists—and the set of very large national employers. This matters for understanding the nature of concentrated employment. Other research has shown that “Superstar firms” increasingly dominate employment and production in particular industries at the national level, and these same employers and industries have declining labor shares in output. If concentrated employers are part of very large nationwide firms, then labor market concentration and the rise of superstar firms may be different aspects of a common phenomenon. However, if concentrated employers are not part of large nationwide firms, but instead are simply local employers in small labor markets, then labor market concentration and the rise of superstar firms are more likely to be different phenomena.

In this paper, we use the microdata of BLS’ Occupational Employment and Wage Statistics (OEWS) survey, merged with the Quarterly Census of Employment and Wages (QCEW) to calculate the extent of employer concentration, explicit oligopsony, and employment by very large employers for each occupation in each local area of the United States—for the private sector only and for all employment. We compare our measures of concentration with others found in the rapidly expanding literature on this topic. We examine patterns and trends in concentration by occupation, area type, and industry, and map out the associations between concentration and employment in very large employers and between employment concentration and wages. We show the extent to which these patterns, trends, and wage associations with concentration can be explained by the characteristics of occupations. Finally, we give examples to illustrate some of the varying patterns we observe.

Literature Review

A search for explanations for slow U.S. wage growth in the expansion of the 2010s, just as more employer data became available, sparked a rapidly growing literature examining the relationship between dominant employers and worker compensation in the U.S. An influential report from the Council of Economic Advisers (CEA 2016) connected evidence on declining competition among employers with wage growth that lagged behind productivity gains. This report pointed to evidence of

¹ Remarks transcribed from <https://www.aeaweb.org/conference/2022/livecasts/aea-awards>, 1:02:55

product market concentration and reduced entry of new firms as evidence that markets had become more conducive to monopsony power in labor markets.

A rapidly expanding literature has shown the importance of employer monopsony power in certain labor markets. Benmelech et al (2022) show that employer concentration at the county-industry level has been growing in the manufacturing sector, with a negative impact on wages, even after controlling for employer productivity, labor market size, and firm-by-year fixed effects. This relationship between employer concentration and wages in the manufacturing sector is growing over time and reduces the link between productivity growth and wage growth. Rinz (2022), Lipsius (2018), and Hershbein, Macaluso, and Yeh (2019) find similar relationships between employer concentration and wages to Benmelech et al across all sectors, although both these papers find employer concentration at the local level—in sectors other than manufacturing—has been declining over time. Rinz (2020) explains that this decline has happened as nationwide employers enter an increasing number of local markets. Similarly, Azar et al (2022) use online job posting data for 26 occupations to show a negative relationship between employer concentration at the occupation-commuting zone level and posted wages for new hires, and Sojourner and Qiu (2022) find a negative relationship between employer concentration and both wages and employment-based health insurance coverage. Azar et al (2020) show a strong relationship between employer concentration and the elasticity of job applications to variation in posted wages in the same market, concluding that as many as 80% of workers are in markets with substantial monopsony power. Schubert, Stansbury, and Taska (2020) show that the relationship between employer concentration in job postings and wages is driven by occupations and local geographic areas in which workers have the fewest outside options. Berger, Herkenhoff, and Mongey (2022) develop a detailed oligopsony model of the labor market, showing which measures of labor market power best capture the extent of competition in the labor market and that much of the measured correlation between employer monopsony power and wages is an artifact of market size. Jarosch, Nimczik, and Sorkin (2020) develop another, search-based model of the labor market in which there are fewer outside options for workers when firms are large, leading to a similar empirical measure of labor market concentration.

A complementary literature has demonstrated the growing importance of large firms in labor markets. Autor et al (2017) document that “superstar firms” are gaining market share in many sectors, and industries where concentration rises most have the fastest falling labor share of output, due to the rapid expansion of these superstar firms. Song et al (2019) show the importance of megafirms (defined as those with 10,000 or more employees) to changes in the wage distribution from 1978 to 2013. In earlier years, these “megafirms” had compressed wages compared with smaller firms (with higher earnings for workers in the bottom half of the wage distribution), but that wage compression disappeared over time.

Overall, this literature finds that there are many labor markets—especially in areas with small population—in which explicit oligopsony power is substantial. This literature has also shown a negative relationship between the oligopsony power of employers in a market and the wages of workers in that market. However, none of these authors have had the data to study concentration in employment in labor markets defined by occupation rather than by industry²; those examining labor markets defined by occupation have generally studied concentration in job postings, not in employment.

² Sojourner and Qiu (2022) use measures of employer concentration by occupation, but they have no direct measures of employment by occupation and infer these from industry distributions.

Data Construction

For its unparalleled information on the occupation and wage distributions of hundreds of thousands of employers, we rely on the microdata of the Occupational Employment and Wage Statistics (OEWS). The OEWS program surveys roughly 200,000 establishments each May and November. OEWS respondents report employment counts by detailed occupation and coarse wage bands. The sampling frame for this survey is the Quarterly Census of Employment and Wages (QCEW) which records quarterly employment levels for each establishment in the US that reports to state-level Unemployment Insurance departments.³ The sample design of the OEWS uses employment and wages collected from 1.2 million establishments over a 3-year period to create estimates of employment and wages for individual occupations at detailed levels of industry and geography.

Since we are expressly interested in employment concentration at the local labor market level, we need a full accounting of employment by employer for each labor market, not a measure based only on the respondents of the OEWS survey. We therefore combine responses to the OEWS sample with the QCEW. We adapt the method of Dey, Piccone, and Miller (DPM) to map three years of OEWS microdata onto the full set of establishments in the QCEW in May for each of 2003, 2006, 2009, 2012, 2015, and 2018. The QCEW provides key determinants of the occupational staffing pattern and wages: detailed industry, geographic area, and very importantly, the level of employment. The DPM method imputes the occupational and wage distributions of non-responding establishments in the OEWS—whether or not they were included in the OEWS sample—using the occupation-specific information provided by OEWS respondents.

Our version of the DPM method predicts the occupation-specific labor market outcomes for each non-responding unit using the report of the single closest responding unit. The only firm identifier available in these data is the Employer tax Identification Number (EIN). In our version of the method, closeness is defined first and foremost by EIN and detailed industry. Specifically, we attempt first to find a responding unit that uses the same EIN to report its employment to the Unemployment Insurance System and is in the same detailed industry and is of a similar size as the non-responding establishment in question. If we cannot locate a responding establishment with the same EIN and industry, we then search for a responding establishment in the same detailed industry and ownership classification,⁴ of similar size, located nearby to the non-responding unit. The end result of the DPM approach is a near-census⁵ of employers that includes employment levels and wages by detailed occupation.⁶

For each market, defined by geography and occupation, we estimate the concentration of employers. Geographically, we define markets using Metropolitan Statistical Areas (MSA), as well as the balance of

³ For more information on the coverage of the QCEW, see <https://www.bls.gov/cew/cewbultn17.htm>

⁴ Ownership classifications are federal government, state government, local government, and private ownership.

⁵ We exclude single-employee establishments in Services for the Elderly and Persons with Disabilities (NAICS 624140), because the unemployment insurance system—and thus the QCEW—expanded to cover many more of these establishments over this period, and so they are not comparable over time. In 2003, the typical such establishment employed a mental health counselor, while in 2018, it employed a home health aide.

⁶ Federal and State Government employment is included in the OEWS data by occupation, wage level, and county of employment, but it is generally not split out into individual establishments. Local government employment in education, hospitals, and casinos is estimated for individual establishments (using the same methods as private sector employment); other local government employment is estimated at the county level.

state divisions of rural areas within each state used to draw the OEWS sample.⁷ We also make numerous small adjustments and aggregations of occupation and industry definitions to make these consistent from 2001⁸ (as part of the 2003 estimate) to 2019 (as part of the 2018 estimate). More substantially, we aggregate all detailed occupations that the O*Net database describes as having either *no entry requirements* (the 32 large occupations in Job Zone One), or *some preparation needed* (the 278 occupations in Job Zone Two) into groups broader than individual occupations.⁹ We define an employer as a collection of establishments within a market that share a common EIN in the QCEW data. Summary measures of the number of markets, and the distribution of occupations, industries, and geographic area types can be found in Table 1. There are 1,374,204 occupation x year x area markets in our data, with an average of 583 employees in 104 establishments and 89 Employer tax Identification Numbers per market.

We recognize the limitations of these data: there is ample evidence that EINs are not perfect measures of employers in these data. Very large firms may use multiple EINs for their establishments in reporting their employment and wages to state unemployment insurance systems, the data that are then assembled into the QCEW data, and there is no straightforward way to link together all the EINS used by these firms without a tremendous amount of manual review. Thus, we may somewhat understate employer power whenever different EINs in the same geographic area are part of a common firm. Further discussion of firm-EIN issues can be found in Handwerker and Mason (2013).

Following Azar et al and Qiu & Sojourner but guided by the theoretical foundation of Berger et al,¹⁰ we calculate a Herfindahl-Hirschman Index (HHI) of payroll by employer for each occupation in each geographic area. We define the set of employers as Ω and the measure of occupation-area labor market concentration as

$$HHI_{jg} = \sum_{e \in \Omega} (s_{ejg})^2$$

Where Y_{ejg} denotes wages of employer e in occupation j and geographic area g and $s_{ejg} = \frac{Y_{ejg}}{\sum_{e \in \Omega} Y_{ejg}}$ is the share of total wages paid in occupation j and geographic area g by employer e .

⁷ The counties used in defining each nonmetropolitan area are listed at https://www.bls.gov/oes/current/msa_def.htm. We use these subdivisions of rural areas rather than the Commuting Zones used by Azar et al for two reasons. First, these subdivisions of rural areas are used by the OEWS program in drawing the OEWS sample, and so the sample sizes and sample distribution will be more uniform across rural areas if we use these subdivisions. Second, Foote, Kutzbach, and Vilhuber (2021) document that the boundaries of commuting zones in rural areas are estimated with a great deal of sensitivity to errors in the underlying data on worker commutes.

⁸ There was no May OEWS survey in 2002, and so we use some data OEWS from 2001 in our estimates for 2003.

⁹ Specifically, we aggregate the occupations in O*Net Job Zone One by major occupational group (2-digit SOC), further aggregate the occupations within major occupational groups 31 through 39 into one group, and the occupations within major occupational groups 45 through 53 into another group. We aggregate the occupations in O*Net Job Zone Two by major occupational group, except for those in SOC 11-27, which we do not aggregate at all, and we aggregate occupations in major occupational groups 39 and 53 by minor occupational group (3-digit SOC). We include occupation 23-2093 (Title Examiners) with those in the major occupational group 43.

¹⁰ Berger et al show that when employer concentration affects both wages and employment levels, the HHI of payroll better measures employer concentration than the HHI of employment

This expands on the 26 occupations of Azar et al (2022) and the 200 occupations of Azar et al (2020). It also differs substantially from both Azar et al papers in estimating this measure for current payroll (the “stock” of employment), rather than for new job postings (the “flow” of new employment). It differs from Qui & Sojourner in estimating this measure directly from the occupational composition of employers rather than inferring occupational composition from their industries, as well as in estimating this measure for payroll, rather than for employment.

As shown in Table 2, the average value of this measure across all years is 0.0584 (0.0400 within the private sector). To compare results in our data to those found by other authors, we also calculate employment (rather than payroll) versions of this measure. In our data, for the 26 occupations of Azar et al (2022), the employment-weighted level of the employment HHI measure in the private sector is 0.0331, compared with the 0.3157 calculated on an annual basis in Azar et al (2020). Azar et al (2022) note on page 9 that estimates (such as ours) based on employed workers should be lower than the concentration measures they estimate for vacancies, because only a subset of employers in a market hire during any given time period. Across all occupations, we estimate an employment-weighted level of employer power HHI_{jg} of 0.0547 (0.0380 within the private sector), which is lower than the 0.1638, weighted by employment in Azar et al (2020) and similar in magnitude to the 0.066 of Qui and Sojourner. Note that the average level of this variable in Azar et al (2022) for only 26 occupations is lower than the level Azar et al (2020) calculate for 200 occupations, and this is also true for our estimates overall (though not within the private sector).

Department of Justice guidelines for reviewing mergers in product markets consider markets “highly concentrated” when they have an HHI value of .25 or above. In our data, 6% of employment is in labor markets with concentration levels of .25 or higher (using the payroll HHI measure). Such highly concentrated labor markets employ just over 3% of private sector workers, but nearly 20% of public-sector workers, and so more than half of highly concentrated employment (54%) is in the public sector.

Following Benmelech et al. (2020) as well as Rinz (2020) and Lipsius (2018), we calculate a Herfindahl-Hirschman Index of payroll or of employment by employer within each industry for each geographic area. As shown in Table 2, the average value of the employment version of this concentration measure within industries other than public administration (but including government-operated establishments in health and education industries) is 0.1431 in 2003 and 0.1378 in 2015, close to the values of about 0.148 in 2003 and about 0.147 in 2015 in Rinz (Figure 1b). Like both Rinz and Lipsius (2018), we see that concentration by these measures is generally decreasing from 2003 to 2018 but increasing between 2006 and 2009. Within the manufacturing sector, the average value of this measure of concentration across all years in our data is 0.3095, compared with the 0.481 of Benmelech et al (2020) for 1978-2016,¹¹ and does not have a clear time trend.

For some of our analyses, it is useful to classify employers by whether they are local oligopsonists. We classify employers in this way only in labor markets (defined as an occupation within a local geography) that have at least 100 workers. Table 1 shows that these labor markets are larger than other markets—with an average of 289 establishments and 1,668 employees—but they have similar wages, and a similar distribution of employment by occupation, industry, and geography to the overall distribution of

¹¹ Note that we define geographic areas by MSA, while both Rinz and Benmelech et al use Commuting Zones. All comparisons define industry by 4-digit NAICS.

employment, and include much of employment even in rural locations. For each large-enough market, we rank employers from largest to smallest by their share of the total payroll in the market, square these payroll shares, and classify the largest employers in each market, whose summed squared payroll shares reach the product-market anti-trust threshold of 0.15 as “local oligopsonists.”¹² For example, if there is one large employer in a labor market, employing workers who make up half the payroll in that market, we classify this employer—and only this employer—as the local monopsonist in this labor market. If there are two large employers in a labor market who each employ workers making up 35.4% of the payroll in that market, we classify these two employers—and only these two employers—as the local oligopsonists in this market.

We compare these local oligopsonists and their employees with the employers and employees in “megafirms.” For this purpose, we borrow the definition of Song et al (2019) and define megafirms as EINs with employment of 10,000 or more employees in the United States, regardless of the occupations or geographic areas in which these employees work. We also count government employers with 10,000 or more employees as “megafirms.” Table 2 shows the fraction of employment in such “megafirms” increases monotonically from 19.7% in 2003 (15.9% within the private sector) to 21.4% in 2018 (18.4% within the private sector). Since large firms may use many EINs in reporting their payroll data to state UI systems that are the underlying source of our EIN data, it is unsurprising that we find a smaller fraction of employment in megafirms than Song et al find in tax return data (in 2013, they found 23% of private sector employment in such megafirms).

Oligopsony is a characteristic of Small Markets

High levels of employer concentration in areas with lower population were noted by Rinz and by Azar et al. In Figure 1, we plot the average employer concentration of industries in a geographic area and the average employer concentration of occupations in the same area, with one dot for each geographic area. This figure shows the very high correlation of average employer concentration for geographic areas, whether labor markets are measured as industries within geographic areas or as occupations within the same geographic areas (the weighted correlation coefficient of the two averaged measures at the area level is 0.956 overall and 0.897 within the private sector only). The size of the dots in this figure corresponds to the overall employment in each area, and the smaller dots (smaller areas) have higher average values of employer concentration, whether this concentration is measured within industries or within occupations within areas.

Patterns for megafirm employment are very different. To compare the percentage of employment in megafirms with employment concentration, we use the discrete classification of employers as “local oligopsonists” or not within occupations and areas of at least 100 workers. In figure 2, we plot the fraction of such large market employment in each area that is in megafirms and within local oligopsonists against the total large market employment of the area. This figure shows that the fraction of employment in local oligopsonists is declining with the overall employment level of the area—but the fraction of employment in megafirms has little relationship with employment size. We confirm this with simple regressions of the fraction of large market employment in either local oligopsonists or megafirms on the large market employment of the area and its square and find R^2 values of 0.347 for local oligopsonists and 0.177 for megafirms.

¹² We count a maximum of 5 employers per market, each with at least 10% of payroll, as “local oligopsonists.”

Similarly, the size of an occupation matters much more for the fraction of employment in local oligopsonists than for the fraction of employment in megafirms. Figure 3 shows that the greater the total employment in an occupation, the smaller the share of people in that occupation employed by a local oligopsonist. Simple regressions of the fraction of large market employment in either local oligopsonists or megafirms on the large market employment of the occupation and its square yield R^2 values of 0.264 for local oligopsonists and 0.033 for megafirms.

Using the microdata underlying these figures, we can examine which variables are most strongly associated with megafirm and local oligopsonist employment. We use linear probability regressions of being employed by a megafirm or a local oligopsonist (in one's own occupation) and examine how much of this variation can be explained by occupations, geographic locations, and industries. Table 3 shows that occupation has a particularly strong role in explaining oligopsonist employment, while industry has an even stronger role in explaining megafirm employment. Overall, the combination of areas, occupations, and industries can explain 34% of variation in local oligopsony employment and 35% of variation in megafirm employment. Despite the strong relationship between occupation or area size and HHI levels at the occupation or area level shown in figures 2 and 3, only 9.4% of overall variation in oligopsonist employment and 4.9% of variation in megafirm employment is explained by the sizes (and sizes squared) of areas, occupations, and industries.

Less variation in employment by megafirms or oligopsonists can be explained by occupation, industry, and geographic areas within the private sector. Within the private sector, the combination of areas, occupations, and industries can explain 26% of variation in local oligopsony employment and 27% of variation in megafirm employment. The smaller amount of variation explained within the private sector is consistent with employers in the occupations, industries (education, health care, and general government services), and geographic areas that have more government employment being more likely to be either local oligopsonists or megafirm employers. We expand on this in the next section.

Oligopsonists tend to be Small Employers, Governments, or Hospitals

Employers are often local oligopsonists for some occupations without being local oligopsonists for all the occupations they employ. For example, a rural hospital may be a local oligopsonist for some medical specialty occupations, without being a local oligopsonist for janitors. We classify employers in labor markets with at least 100 people in an occupation and area by whether they are part of megafirms and also by how much of their employment is in occupations for which they are a local oligopsonist. We use 5 bins to classify the extent of local oligopsonist employment: none, 0-10%, 10% - 25%, 25% - 50%, or more than 50%. For each of these 10 groups of employers (2 megafirm bins x 5 oligopsonist bins) in 2018, Table 4 shows the number of employers, the number of their employees in large labor markets, the mean wage of these employees, the industries with the most employment, and (for the first and last oligopsonist bins) the occupations with the most employment.

As shown in Table 4, 99.7% of employers, employing 67% of all employees, were neither megafirms nor had any oligopsony power in any occupation or area in 2018. However, there were 734 very large employers as well as 17,993 smaller employers that were local oligopsonists for at least some of their workers, and these local oligopsonist employers had more than 43 million employees (across all their labor markets). The 734 megafirm employers that are local oligopsonists in at least one labor market include the federal government, all state governments, and 138 large local governments (26% of

employers), while the 17,993 smaller employers that are local oligopsonists in at least one labor market include 5,066 local governments (28% of employers).

Not only do governments make up a disproportionate share of employers that are local oligopsonists, but government employees also make up a disproportionate share of the employees of local oligopsonists. As shown in Table 4, public sector employees make up almost 7.9 million of the 25.1 million employees of megafirms that are local oligopsonists (32% of employees), and 5.5 million of the 18.2 million employees of smaller firms that are local oligopsonists (30% of employees). As the fraction of employees for whom employers are local oligopsonists increases, the fraction of employees in the public sector increases: among the employers that are local oligopsonists for more than half their employees, public sector employees make up 1.3 million of the 1.7 million megafirm employees (76%) and 1.5 million of the 2.6 million employees of smaller employers (58%). The overlap of megafirm and oligopsonist employment is disproportionately composed of public sector employment.

The most common occupations vary by the extent of local oligopsony. For employers that are never local oligopsonists, the most commonly employed occupations are Office and Administrative Support Occupations (major occupation group 43) involving some preparation, Service occupations (major occupation group 31 to 39) involving little or no preparation, Food Preparation and Service Occupations (major occupation group 35) requiring some preparation, and Sales and Related Occupations (major occupation group 41) requiring some preparation. The group of occupations most commonly employed shifts as the extent of local oligopsony increases to include more healthcare, policy, and education occupations, such as Registered Nurses (29-1141), Police and Sheriff's Patrol Officers (33-3051), Elementary School Teachers, Except Special Education (25-2021), and Secondary School Teachers, Except Special Education (25-2031). These occupations are generally associated with public-sector employment.

The most common industries of establishments also vary by the extent of local oligopsony. The QCEW microdata do not identify the specific industry for establishments of the Federal Government, but state and local government establishments are often classified in education or healthcare industries. Elementary and Secondary Schools (6111) is one of the most common industries of employment for non-megafirms at all levels of local oligopsony. For employers that are never local oligopsonists, the other most common industries of employment are Restaurants and Other Eating Places (7225), Employment services (5613), Grocery Stores (4451, among very large employers only), General Merchandise Stores (4523, among very large employers only), and Building Equipment Contractors (2382, among smaller employers only). As the amount of employment in local oligopsony increases, the most common industries include such industries as General Medical and Surgical Hospitals (6221), Depository Credit Intermediation (5221), Wired and Wireless Telecommunications Carriers (5173), Colleges, Universities, and Professional Schools (6111), State government not classified in education or health (9992), Local government not classified in education or health (9993), Federal Government (9991), Postal Service (4911), and Junior Colleges (6112). Many of these are the industries of public-sector employment. Moreover, among employers with 25-50% or 50% or more employment in local oligopsony, all the most common industries of employment are industries of public sector employment.

General Medical and Surgical Hospitals (6221) are one of the top three most common industries of employment for each group of employers of less than 10,000 people that have some level of local oligopsony power. This is the industry studied by Prager and Schmitt (2021), who found that mergers

reduced wage growth for employees in markets with the largest resulting increases in concentration (having the highest quartile of merger-related increases in HHI values). The relationship between labor market concentration and wages is among the reasons that economists are increasingly concerned about labor market concentration, and so we turn next to this relationship.

Concentrated Labor Markets are Associated with Lower Wages (in the private sector)—but only when including employer fixed effects

As shown in Table 4, employers who are not local oligopsonists in any of their labor markets pay LOWER wages on average than employers who are sometimes or always local oligopsonists. This pattern holds among both megafirms and smaller employers, and among both public and private sector megafirms (it does not hold among smaller public sector employers). Much of this pattern of differences in unconditional wages is simply driven by occupation. Smaller occupations are more likely to be found in local oligopsonists than larger occupations (see figure 3), and smaller occupations tend to require more specialized preparation and have higher wages than large occupations. Thus, we turn to regression analysis to control for occupation and other observable characteristics in more careful study of the relationship between concentration and wages.

As Miller et. al. (a large group of former chief economists from the Federal Trade Commission and the Department of Justice Anti-trust division) explain, regressions of price (or wage) on HHI do not establish that greater concentration increases prices (or wages). Both HHI and wages are determined endogenously by supply and demand forces in specific labor markets, such as local demand for labor in individual labor markets. Previous authors have used a variety of strategies to examine the relationship between concentration and wages in the presence of this endogeneity. Several authors have attempted to solve this endogeneity problem of estimating the causal impact of concentration on wages by using leave-one-area-out instruments for the average concentration of a market (industry x area for Rinz (2020), occupation x area for Azar et al (2022) and Qiu and Sojourner (2022). This instrument has minimal variation across areas for each occupation (or industry, in the case of Rinz), using the occupation (or industry, in the case of Rinz) composition of an area as a proxy for its employment concentration. We are particularly interested in how the relationship between concentration and wages varies between occupations, and so this instrument is not well suited for our purposes. Arnold (2019) examines only changes in concentration due to mergers, while Schubert et al (2021) examine only changes in concentration due to the expansions and contractions of multi-location employers.

In contrast, our focus is less on estimating the causal portion of the relationship between concentration and wages, and more on describing this relationship across all labor markets in the US, including the government sector, in industries with few mergers, and in industries with few multi-location employers. Without restricting our focus to any subset of markets, we can control for the size of the labor market by geographic area and occupation, we can control for individual industries, geographic areas, and occupations, and we can also incorporate employer fixed effects within each geographic area. These employer by area fixed effects capture time-invariant differences in productivity or cost structures between employers, leaving the regression coefficients to describe how wages change over time as local labor market concentration changes. This mitigates some of the endogeneity between HHI and wages.

Table 5 shows coefficients β from regressions $\ln(\text{Wage}_{ijt}) = \beta \ln(\text{HHI}_{ijt}) + \gamma X_{ijt} + \varepsilon_{ijt}$ for the employees in occupation i and employer j at time period t (the “linear specification”). Panel A of this Table shows

these regression results across all employers, while Panel B shows separate results for the private-sector only. In column (1), we can see that without any additional control variables X , the relationship between HHI and wages is positive and extremely significant. Adding controls for occupation and area size and year, in column (2), replacing these with occupation and area fixed effects in column (3), adding industry fixed effects in column (4), replacing occupation and area fixed effects with occupation $\times$ area fixed effects in column (5), and replacing area and industry fixed effects with employer within area fixed effects in column (6) all decrease the magnitude of this relationship, while increasing the amount of wage variation explained. After including the employer within area fixed effects in column (6), the relationship between wages and concentration is negative, but only within the private sector. The coefficient is small (about -0.0025),¹³ but with a standard error of less than 0.00005, it is very statistically significant.

Studies of the impact of mergers on wages, particularly Arnold (2019), show much larger negative impacts of these mergers on wages in already highly-concentrated labor markets. Thus, we also show separate coefficients β_0 , β_1 , and β_2 from the piecewise-linear specification $\ln(\text{Wage}_{ijt}) = \beta_0 \ln(\text{HHI}_{ijt}) + \beta_1 \ln(\text{HHI}_{ijt}/0.15) * I(\text{HHI} > 0.15) + \beta_2 \ln(\text{HHI}_{ijt}/0.25) * I(\text{HHI} > 0.25) + \gamma X_{ijt} + \epsilon_{ijt}$. In this specification, we allow the slope of the relationship between $\ln(\text{wage})$ and $\ln(\text{HHI})$ to differ above and below HHI values of 0.15 and 0.25, with a slope of β_0 for HHI values below 0.15, $\beta_0 + \beta_1$ for HHI values between 0.15 and 0.25, and $\beta_0 + \beta_1 + \beta_2$ for HHI values above 0.25. These coefficient estimates show that when we include employer within area fixed effects in column (6), the relationship between $\ln(\text{wages})$ and $\ln(\text{HHI})$ is negative overall for HHI values less than 0.15. Within the private sector, the relationship between $\ln(\text{wages})$ and $\ln(\text{HHI})$ is negative for HHI values less than 0.15 (with a coefficient of -0.0029) and even more negative for HHI values between 0.15 and 0.25 (with a coefficient of -0.0029 + -0.0119 = -0.0148), but positive for HHI values above 0.25.

Below, we show how this relationship between concentration levels and wages varies among occupations.

There is huge variation in concentration levels between Occupations

In this section, we show how average levels of employer concentration vary between occupations. Figure 2 shows that much of this variation is simply due to occupation size. The greater the nation-wide employment level of an occupation, the less the employer concentration in that occupation. This echoes the geographic relationship between employer concentration and area employment previously documented by Rinz (2022) and Azar et al (2020).

Nonetheless, Figure 4 shows that even among very large occupations, there is still considerable variation in average employer concentration levels. General Managers, Sales Representatives, and Bookkeeping Clerks have average HHI levels that average below 0.01, while Teacher Assistants, Team Assemblers, and Elementary School Teachers have average HHI levels above 0.10. Postal service occupations¹⁴ (perhaps

¹³ These results are very similar in magnitude to those of Qiu and Sojourner, Table 2

¹⁴ There are 10 occupations for which we assume the few respondents in the private sector were erroneous. These are: Legislators (11-1031), Postmasters and Mail Superintendents (11-9131), Tax Examiners, Collectors, and Revenue Agents (13-2081), Administrative Law Judges, Adjudicators, and Hearing Officers (23-1021), Judges, Magistrate Judges, and Magistrates (23-1023), First-line Supervisors/Managers of Police and Detectives (33-1012),

unsurprisingly) have among the highest average HHI levels (above 0.93), Air Traffic Controllers have average HHI levels of 0.92, graduate teaching assistants have average HHI levels of 0.82, and many scientific occupations also have high average HHI levels.

To move beyond lists of occupations, we regress HHI levels by year on various occupation characteristics, such as overall wage levels for each occupation. This is different from the regressions of wage on concentration in the previous section because we are not examining the relationship between wages and market concentration, but rather whether higher or lower wage occupations tend to be more or less concentrated overall. Motivated by the results in Figure 1 showing that HHI levels are higher in areas with smaller populations, we add to the regression the percentage of jobs in each occupation by area size, using the area size categories found in Table 1. Motivated by the results in Table 4 showing that governments, hospitals, and educational institutions are common occupations among oligopsonists, we add to the regression the percentage of jobs in each occupation that are in local governments, state governments, and the federal government as well as the percentage of jobs in that occupation within hospitals, educational institutions, and manufacturing plants. We also add the percentage of jobs in each occupation that are in employers that report 10,000 employees or more under the same Employer tax ID number (“megafirms”). We weight these regressions by the size of each occupation, and so we are not able to include occupation size as a regressor.

The results of these regressions are in Table 6. These variables explain 70% of the variation between occupations in average concentration levels overall. Overall, the largest and most significant coefficients in the regression are for the percentage of jobs in the occupation in state governments (0.556), the federal government (0.491), and local government (0.079). These government employment percentage variables alone can explain 58% of the overall variation in HHI levels between occupations. The percentage of jobs in “megafirm” also has a large and very significant coefficient (0.161), and it alone can explain 13% of the overall variation in HHI levels between occupations. The set of variables describing the geographic distribution of occupations do not have statistically significant coefficients individually or jointly when we examine concentration in all sectors. The percentage of jobs in an occupation that are in the hospital, education, or manufacturing industries are associated with greater concentration levels, and all these coefficients are statistically significant. The number of unique (EIN) employers employing the occupation is associated with higher concentration levels, almost exactly offset by a negative coefficient on the number of establishments employing the occupation. Since there is some mechanical relationship between the number of employers for an occupation and its concentration, we also show specification (2) in Table 6 in which we do not include these variables, showing that their omission somewhat reduces the overall explanatory power of the regression, but has little impact on the magnitudes and statistical significance of the other coefficients.

There are some differences between the regressions of HHI levels in all sectors and the regressions of HHI levels within the private sector only. We do not include the percentage of employment for each occupation in government jobs in the private sector regressions, and the overall explanatory power of the remaining variables to explain variation in HHI among the private sector occupations is lower—only 39%, compared with 70% overall. Within the private sector, the set of coefficients on the geographic distribution of jobs in each occupation is jointly significant, and they alone can explain about 10% of the

Bailiffs (33-3011), Detectives and Criminal Investigators (33-3021), Fish and Game Wardens (33-3031), and Police and Sheriff’s Patrol Officers (33-3051)

overall variation in HHI levels between occupations in the private sector. Private sector occupations with larger amounts of employment in areas with 500,000 to 1,000,000 jobs (“large” areas) have statistically significantly lower concentration levels than other occupations. Occupations with more employment in private-sector educational institutions and privately-owned hospitals have higher concentration levels than other occupations in the private sector.

Heterogeneity by occupation in Employer Concentration trends

Overall, the average employer concentration level of occupation-area markets declined slightly over this period, but patterns diverged greatly by occupation. Of the 485 aggregated occupations in our data, 193 occupations, representing 40% of employment, show increased concentration on average.¹⁵ Within the private sector (with 475 aggregated occupations), 201 occupations, representing 45% of employment, show increased concentration. As examples, Figure 4 displays selected large occupations with very different trends in average HHI levels over time. These different trends are likely driven by differing forces—employer consolidations, changes in market size, changes in employer organization—in different labor markets. We give brief case studies of three occupations later in the paper.

To investigate whether trends in concentration at the occupation level can be explained by measured characteristics of occupations, we first estimate a linear time trend for each occupation with a regression of estimated concentration levels in each occupation in each year on the number of years since 2005. Then, we perform simple regressions of these time trends on occupational characteristics and the time trends in these occupational characteristics. The set of occupational characteristics used in these regressions is the same as in Table 6, with the addition of average HHI levels as well as linear time trends for these characteristics. Results of these regressions are in Table 7.

These occupational characteristics can explain 63% of the variation in concentration trends between occupations overall, and 33% of the variation in concentration trends for private sector workers. Again, government employment variables have the largest and most significant coefficients, and these government variables can together explain 36% of the variation in concentration trends. Growing percentages of employment in “megafirm” employers of 10,000 people or more is also quite important in explaining increases in concentration over time, with this variable alone explaining 36% of the variation in concentration trends between occupations overall. Occupations with growing wages tend to have increasing concentration over time, but the coefficient on this variable is very small. Occupations with more employment in hospitals tend to have declining concentration, but the coefficient on this variable is small. The geographic variables are jointly significant but have little power to explain overall variation in concentration trends. Occupations with a growing percentage of employment in areas with 100,000 to 500,000 jobs or with more than 1,000,000 jobs have declining concentration. Increases in the number of unique employers (EIN) for an occupation are associated with decreasing concentration, nearly offset by the impact of increases in the number of establishments for an occupation but removing these variables from the regression in specification (2) has little impact on the regression or the amount of total variation in concentration trends explained.

¹⁵ Large occupations with the greatest increases in concentration are Medical Transcriptionists, Detectives and Criminal Investigators, Travel Agents, Family Medicine Physicians, Structural Metal Fabricators and Fitters, Career/Technical Education Teachers, Sales Representatives for Technical and Scientific products, Loan Officers, Healthcare Support Occupations requiring some preparation, and Loan Interviewers and Clerks.

Overall, these occupational characteristics explain much less of the variation in concentration trends in the private sector (32%) than within all sectors (63%), because so much of the overall variation in concentration trends is explained by public sector employment. However, of the remaining occupational characteristics, those that significantly explain trends in occupational concentration overall explain occupational concentration trends within the private sector, with generally similar coefficient signs, magnitudes, and significance levels.

Heterogeneity by occupation in the wage impact of Employer Concentration

Among the central motivations for the existing literature on employer concentration in the labor market has been the potential impact of employer concentration on wages. This literature has focused on the overall impact of employer concentration on wages, generally using instrumental variables approaches to avoid confounding the true relationship between concentration and wages with local demand shocks. To our knowledge, the only paper before us that examines heterogeneity among occupations in the impact of employer concentration on wages has been Schubert, Stansbury, and Taska, who focus on the permeability of labor markets.

In this section, we take the wage regressions of Table 5, column (5), replacing the employer concentration variables with interactions between employer concentration and individual occupations. The resulting coefficients are occupation-specific estimates of the impact of employer concentration on wages. We then use the same measures of occupation characteristics as in Tables 6 and 7 to examine patterns in these occupation-specific wage coefficient interactions.

The consensus of the literature is that overall, employer concentration is associated with lower wages for workers. We replicate this negative overall relationship (for the private sector only) when we include employer within area fixed effects in OLS wage regressions but find a great deal of variation in this relationship between occupations. Using the linear specification between $\ln(\text{wages})$ and $\ln(\text{HHI})$, of the 485 aggregated occupations in our data, 232 occupations, representing 63% of employment, show positive wage relationships with concentration overall. Even within the private sector, 212 occupations, representing 48% of employment, show positive wage relationships with concentration.

The regressions shown in Table 8 show that we can explain 38% of this variation between occupations in linear concentration/wage relationships overall, and 43% of this variation within the private sector. For these regressions, the role of government employment is quite small, explaining only 3% of variation in this wage relationship between occupations. Meanwhile, there are large roles for “megafirm” employment and the geographic distribution of employment in explaining this variation. The “megafirm” level and trend variables alone can explain 10% of the variation in the linear concentration/wage relationships between occupations as well as 19% of this variation within the private sector. Occupations with higher levels of megafirm employment have significantly larger relationships between wages and HHI. Meanwhile, geographic distribution level and trend variables alone can explain 13% of the variation in the linear concentration/wage relationship between occupations as well as 17% of this variation within the private sector. Occupations with growing fractions of their employment in medium-sized (total employment of 100,000 to 500,000) or very large areas (total employment of 1 million or more) have significantly larger relationships between wages and HHI.

The regressions in columns (1) and (2) of Table 8 show that there are significant differences in the relationship between linear concentration and wages for occupations with different average concentration levels. Thus, in columns (3) and (4), we turn to examining the relationship between concentration and wages for concentration levels above 0.25 ($\beta_0 + \beta_1 + \beta_2$) in the piecewise linear regression specification. We drop aggregated occupations from these regressions if there are fewer than 10,000 people working in markets with concentration levels above 0.25, and so the number of observations included in regressions (3) and (4) is considerably lower than the number of observations in columns (1) and (2). Of the 440 remaining aggregated occupations, 271, representing 55% of highly concentrated employment, show positive wage relationships with concentration at this very high level of concentration. Within the private sector, there are 373 occupations with at least 10,000 people at high levels of concentration and of these occupations, 215, representing 49% of highly concentrated private sector employment, show positive wage relationships with concentration.

We can explain 38% of the variation between occupations in highly concentrated concentration/wage relationships in all sectors, and 45% of this variation within the private sector. There is again no role for government in explaining the variation in this wage relationship between occupations. The geographic distribution of employment does play a role in explaining this variation, with geographic distribution level and trend variables alone explaining 10% of the variation in highly concentrated concentration/wage relationships between occupations as well as 16% of this variation within the private sector. Occupations with less employment in small-sized areas (non-rural areas with total employment of less than 100,000) or very large areas (total employment of 1 million or more) have significantly larger relationships between wages and HHI at high levels of concentration. Occupations with higher average wage levels also tend to have more positive relationships between concentration and wages at high concentration levels, although this (very significant) coefficient is small in magnitude.

The patterns of results in this section do not lend themselves to any one explanation for the variation between occupations in the relationship between concentration and wages, either overall or at high levels of concentration. Thus, we turn next to examples illustrating what is happening in various occupations.

Examples

In this section, we describe the patterns of concentration, employment, wages, and the relationship between concentration and wages for three different occupations. We chose these three occupations to illustrate (1) and (2) different relationships between concentration and wages and (3) how concentration can change over time when an occupation is in decline. Although much of this paper describes the prominent role of government employment in employment concentration, in this section we chose three occupations employed predominantly in the private sector.

(1) A large occupation with a positive relationship between concentration and wages

Pharmacists (SOC 29-1051) are an example of a large occupation with a positive relationship between employer concentration and wages. This occupation is described in the Standard Occupational Classification system as, “Dispense drugs prescribed by physicians and other health practitioners and provide information to patients about medications and their use. May advise physicians and other health practitioners on the selection, dosage, interactions, and side effects of medications.” Goldin and Katz (2016) describe how this technological change transformed this occupation from one in which

independent (mostly male) pharmacy owners worked long hours to one in which modern pharmacists predominantly work for large hospitals or pharmacy chains and there is little wage penalty for part-time work.

Pharmacists saw little trend in their employer or payroll concentration, which bounced between .055 and .085 between 2003 and 2018 (shown in Figure 4). Meanwhile, employment in this occupation grew steadily from about 220,000 jobs in 2003 to about 320,000 jobs in 2018, with similar rates of growth in the public and the private sectors (92% of Pharmacists were employed in the private sector throughout this period). The number of employers (identified by EIN) of Pharmacists held steady at about 25,000 throughout the period, but the number of establishments (locations) with at least one Pharmacist grew remarkably, from about 57,500 in 2003 to about 82,500 in 2018.

During this period, average nominal wages for Pharmacists rose from about \$39 per hour to about \$59 per hour, which was much faster than inflation from 2003 to 2009, and essentially kept pace with inflation from 2009 to 2019, resulting in a Real wage increase of about \$6 per hour for the whole period. The relationship between local labor market concentration and wages was positive (with a coefficient of 0.048). This may be because the labor market for pharmacists shares the same inelastic demand as the labor market for physicians. Gottlieb et al (2020) document that physician earnings are significantly larger in rural areas, which have a greater concentration of Medicare revenues per physician. They suggest two explanations for why highly trained medical professionals earn more in less populous areas. Their first explanation is that physicians value the amenities associated with more populous places, leading them to demand higher wages to live in rural areas. Their second explanation is that medical providers in rural areas have a great deal of market power, relative to their employers.

(2) A large occupation with a negative relationship between concentration and wages

Registered Nurses (SOC 29-1141) are an example of a large occupation with a negative relationship between employer concentration and wages. This occupation is described in the Standard Occupational Classification system as, “Assess patient health problems and needs, develop and implement nursing care plans, and maintain medical records. Administer nursing care to ill, injured, convalescent, or disabled patients. May advise patients on health maintenance and disease prevention or provide case management. Licensing or registration required.”

Overall, there was a very small increase in employer and payroll concentration from about .095 in 2003 to about 0.10 in 2009, with little change since then. This is a rapidly growing occupation, with employment increasing from 2.3 million in 2003 to 3.2 million in 2018. The number of private-sector employers of nurses (identified by EIN) grew from about 95,000 in 2003 to about 111,000 in 2018, with little change in the number of public sector employers of nurses, but the number of locations employing at least one nurse grew by several thousand in both the public and private sectors. The fraction of Nurses employed in the private sector grew slightly from 82% to 84% during this period.

During this period, average nominal wages for Registered Nurses grew from about \$25 per hour in 2003 to about \$38 per hour in 2018, more than keeping up with inflation, with a Real wage growth of about \$3 per hour for the period. The relationship between local labor market concentration and wages was negative (with a coefficient of -0.016 overall, and -0.020 in the private sector). It is not obvious why the relationship between concentration and wages should be so different for nurses than it is for pharmacists, as both require specialized training and are heavily employed by the demand-inelastic

healthcare sector. Together with Pharmacists (above), Nurses are the occupation for which Prager and Schmitt (2021) find reduced wage growth following hospital mergers that lead to large increases in concentration.

(3) Increasing concentration associated with decreased domestic demand

Tool and Die Makers (SOC 51-4111) are an example of an occupation with increasing concentration associated with decreased domestic demand. This occupation is described in the Standard Occupational Classification system as, “Analyze specifications, lay out metal stock, set up and operate machine tools, and fit and assemble parts to make and repair dies, cutting tools, jigs, fixtures, gauges, and machinists' hand tools.” Tool and Die Makers saw their employer concentration increase steadily from 0.093 in 2003 to 0.129 in 2018, while payroll concentration increased from 0.111 in 2003 to 0.141 in 2018 (shown in Figure 4). This happened because employment in this occupation fell from about 100,000 jobs in 2003 to about 70,000 jobs in 2018, with nearly all the job loss within manufacturing establishments. More than 99% of jobs in this occupation are in the private sector. The number of employers (identified by EIN) of Tool and Die Makers fell from about 14,600 in 2003 to about 9,500 in 2018, and the number of establishments (plants) with at least one Tool or Die Maker fell from about 17,000 in 2003 to about 11,000 in 2018.

During this period, average nominal wages for Tool and Die Makers rose steadily from about \$20 per hour to about \$25 per hour, not enough to make up for inflation, and real wages fell by about \$2 per hour. The relationship between local labor market concentration and wages was negative (with a coefficient of -0.007) but falling real wages in this occupation can be attributed much more to falling demand for Tool and Die Makers in domestic manufacturing plants than to the growing concentration of employment among their employers; rather, both the falling real wages and the growing concentration of employment in this occupation should be attributed to the same falling demand for this occupation.

Conclusion

Using new methods to map the detailed occupation and wage distribution microdata of the Occupational Employment and Wage Statistics onto the employment histories of nearly every establishment in the United States, this paper examines patterns of employment concentration for local labor markets by occupation from 2003 through 2018. In contrast with other papers in this literature, our work examines concentration in employment ‘stocks,’ rather than the employment ‘flows’ measured by job openings.

Our work highlights the prominent role of public sector employers in concentrated labor markets, particularly among “megafirm” employers of 10,000 people or more. 54% of the workers in highly concentrated markets—those with payroll-HHIs of .25 or greater—are public employees. 58% of variation in average concentration levels between occupations can be explained by differences in public sector employment between occupations. Examining employers by the fraction of their employees for which they are a local oligopsonist, we see the role of the public sector generally increases as the extent of employment concentration increases. For employers that are local oligopsonists for at least half their employees, 28% of employers are in the public sector, and 65% of their employees are government employees. The most common industries for such more-than-half oligopsonist employers are K-12 education, hospitals, colleges and universities, and miscellaneous other local government functions.

We also find that employer concentration is clearly associated with smaller, thinner, labor markets. This is different from employment in “megafirms,” which is associated more strongly with employers in particular industries. Geographic areas with less employment in general and smaller occupations have higher levels of concentration. Since smaller occupations tend to be occupations requiring a greater amount of specialized training, their workers also tend to be more highly paid, leading to an unconditional association between higher levels of employment concentration and higher wages. However, in regression specifications that include occupation and employer fixed effects, we find a small negative relationship between employment concentration and wages for private-sector employers.

Last, our work highlights the enormous heterogeneity of occupations in their levels and trends in employment concentration, as well as in the wage impacts of this employer concentration. Employment concentration in the United States is not one story, but many.

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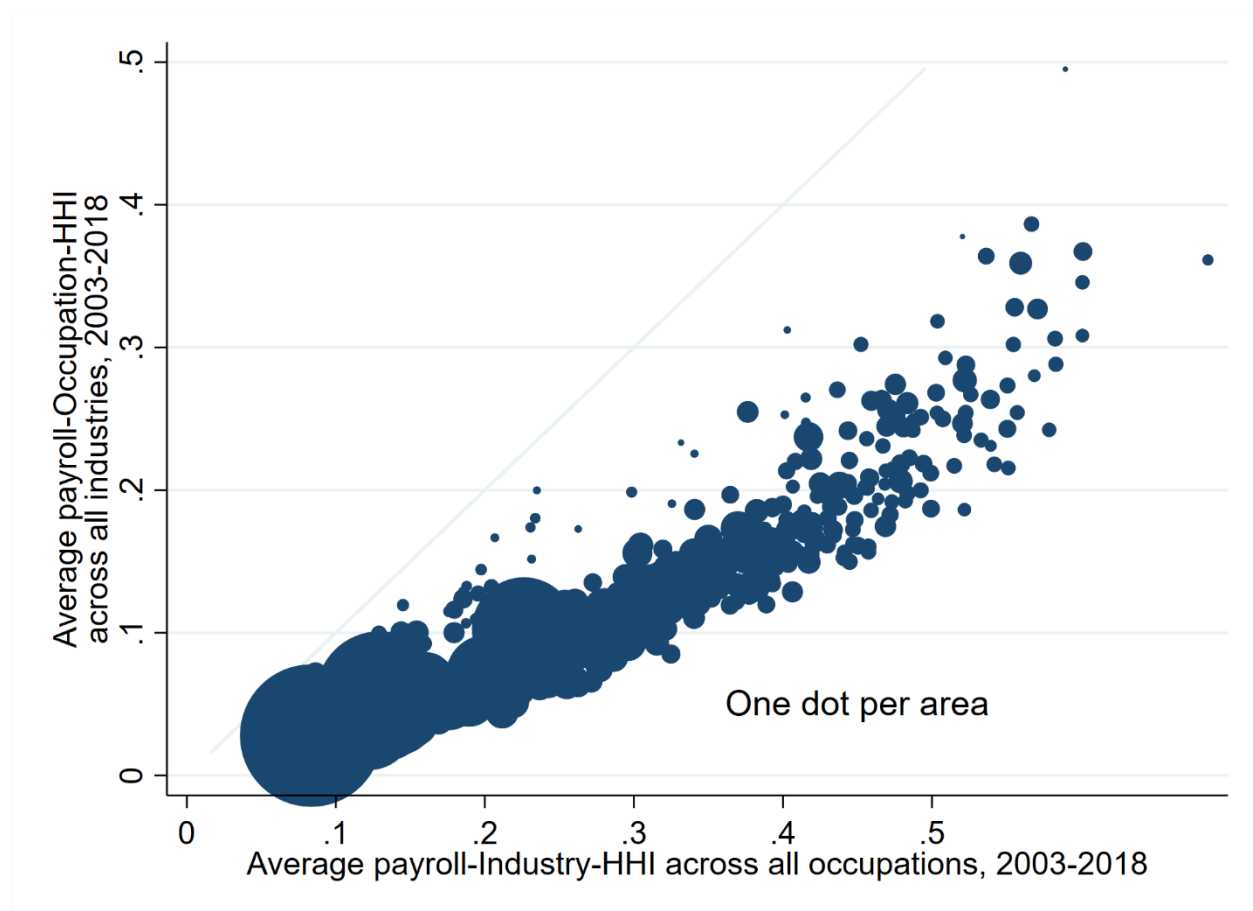
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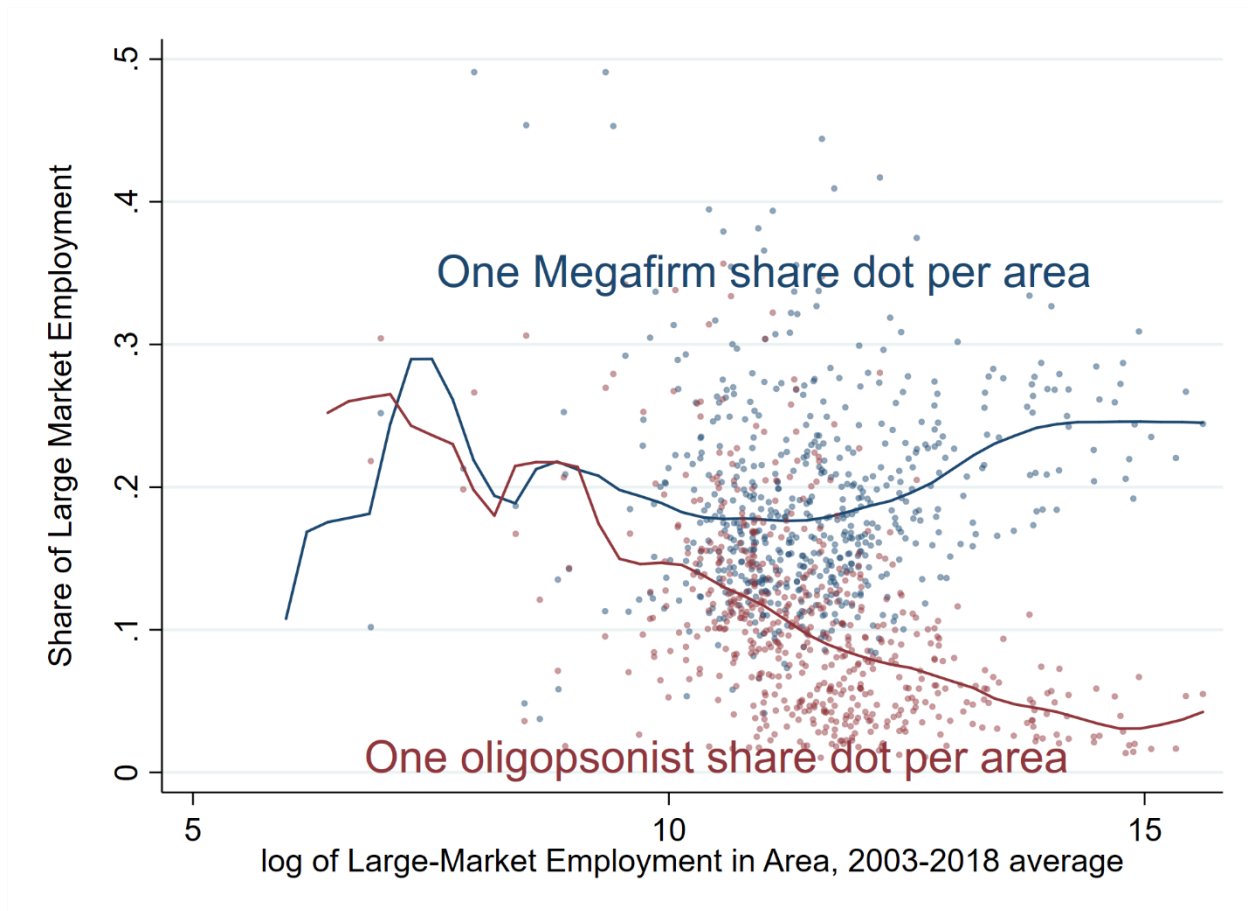
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Figure 1: Comparison of Labor Market Concentration measured for the same geographic areas within Industries or Within Occupations, 2003-2018 average



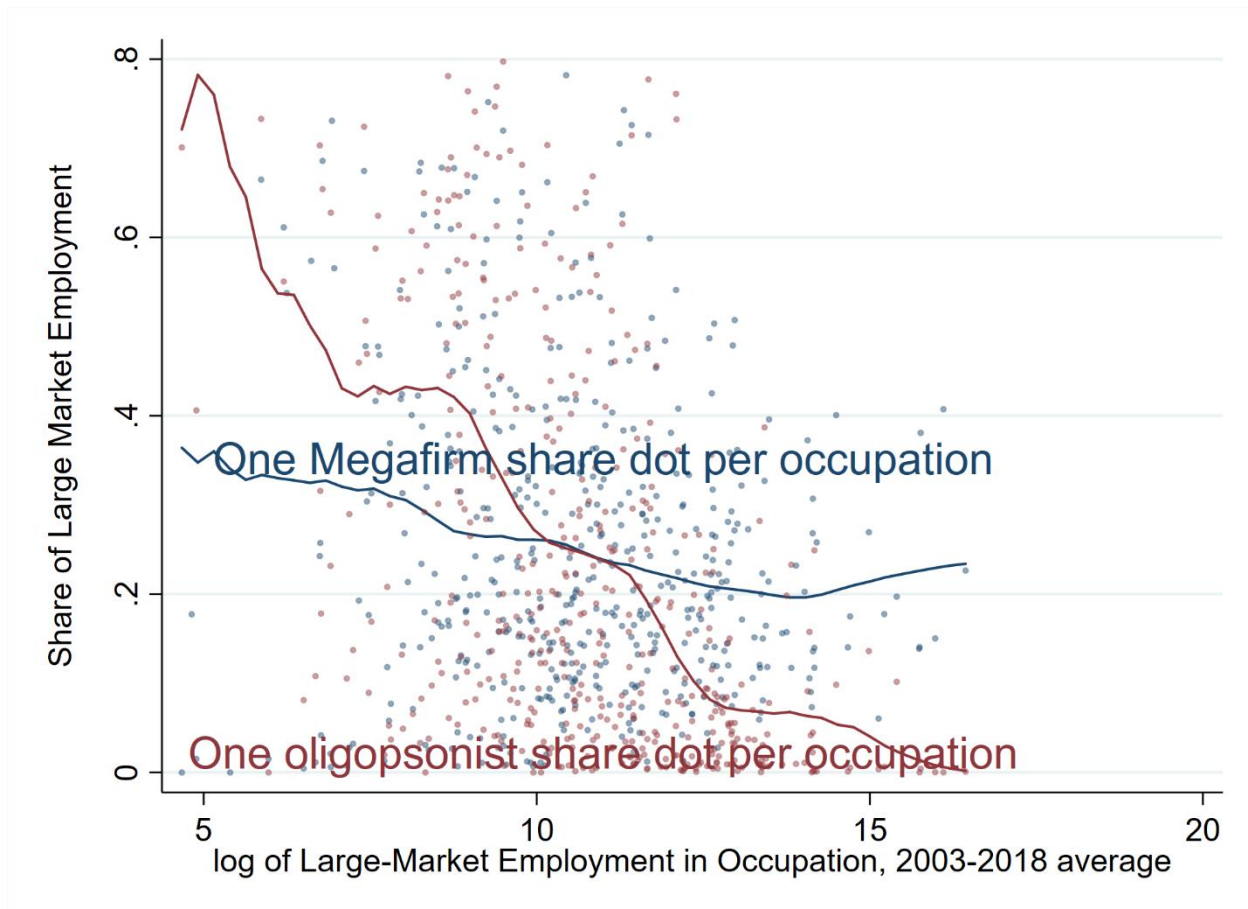
Notes: Employer Concentration is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each four-digit industry or within each six-digit occupation for each geographic area (MSA or balance of state area). It is calculated for all sectors (A similar chart for the private sector only is available in Appendix A). Each dot in this figure is an employment-weighted average of concentration across all occupations or all areas for a geographic area, with dot size corresponding to average employment. Occupations with no entry requirements or few entry requirements are aggregated. The data is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Data for single-employee establishments in industry 624120 is excluded.

Figure 2: Share of Employment in Megafirms or Local oligopsonists by Area



Notes: Each dot in this figure is an employment-weighted average of the share of employment in megafirms or in oligopsonists for a geographic area across all occupations, then a simple average across all years. Each line is an lpoly. Occupations with no entry requirements or few entry requirements are aggregated. The data is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Data for single-employee establishments in industry 624120 is excluded.

Figure 3: Share of Employment in Megafirms or Local oligopsonists by Occupation

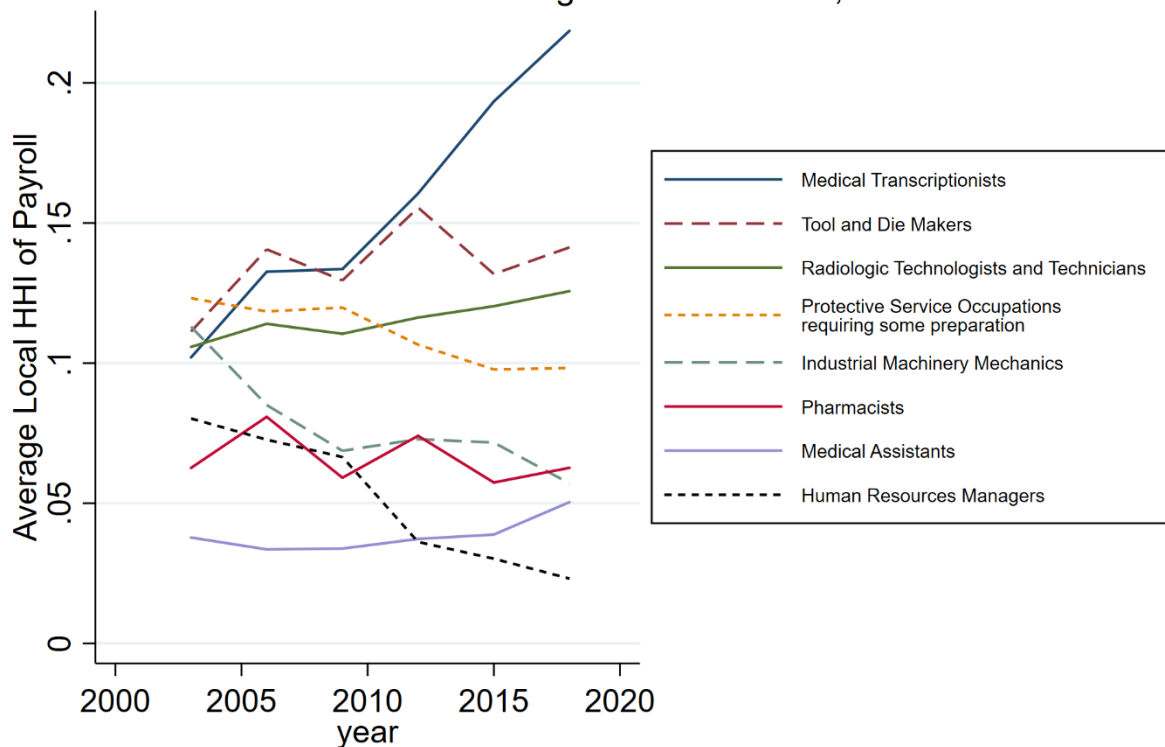


Notes: Each dot in this figure is an employment-weighted average of the share of employment in megafirms or in local oligopsonists for an occupation across all geographic areas, then a simple average across all years. Each line is a loess. Occupations with no entry requirements or few entry requirements are aggregated. The data is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Data for single-employee establishments in industry 624120 is excluded.

Figure 4: Trends in Employer Concentration for Selected Large Occupations

Employment Concentration of Selected Large Occupations

Actual time trends averaged over all areas, All sectors



Notes: Employer Concentration is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area). Each line in this figure is an employment-weighted average of concentration across all geographic areas. Occupations with no entry requirements or few entry requirements are aggregated. The data is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Data for single-employee establishments in industry 624120 is excluded.

Table 1: Summary Measures

Counts and Averages	All markets		Markets with 100+ workers	
	All industries	All occupations	All industries	All occupations
All sectors				
Number of area-occupation-year markets	1,374,204		465,779	
Number of area-industry-year markets		800,018		453,370
Average number of establishments per market	104	53	289	91
Average number of EINs per market	89	46	247	78
Average establishments per EIN, within markets	1.17	1.20	1.25	1.31
Average employment per market	583	1,002	1,668	1,743
Average employment per EIN, within markets	7.86	74.62	13.68	124.11
Average real (2018\$) mean wage	\$24.06	\$24.06	\$23.85	\$24.11
Private-sector only (for industry statistics excludes public administration industry, but includes public schools and hospitals)				
Number of area-occupation-year markets	1,212,707		371,710	
Number of area-industry-year markets		776,125		438,279
Average number of establishments per market	109	55	334	93
Average number of EINs per market	95	47	290	80
Average establishments per EIN, within markets	1.09	1.16	1.16	1.26
Average employment per market	555	963	1,753	1,679
Average employment per EIN, within markets	5.44	42.36	8.78	67.48
Average real (2018\$) mean wage	\$23.49	\$23.90	\$23.27	\$23.76
Distributions, all sectors	All markets		Markets with 100+ workers	
	% of employment	% of markets	% of employment	% of markets
Occupational Distribution				
Entry level service	5.9%	0.3%	6.1%	0.7%
Entry level blue collar	1.1%	0.3%	1.1%	0.7%
Management, business, science, and arts	30.7%	66.6%	29.4%	57.4%
Service	14.4%	10.1%	14.6%	12.4%
Sales and office	25.3%	7.1%	25.9%	11.0%
Natural resources, construction, and maint.	8.0%	9.4%	8.0%	11.0%
Production, transportation, and material mov	14.6%	6.4%	14.9%	6.8%
Industry Distribution				
Goods producing	15.4%	29.2%	15.2%	25.6%
Service producing	84.6%	70.8%	84.8%	74.4%
Geographic Distribution (occupation-area markets)				
MSA with employment greater than 1m	43.4%	5.7%	44.6%	13.9%
MSA with employment between 500k and 1m	12.9%	4.8%	13.1%	9.5%
MSA with employment between 100k and 500k	21.7%	26.4%	21.6%	33.0%
MSA with employment less than 100k	8.7%	34.3%	7.8%	20.2%
Rural areas	13.3%	28.9%	12.8%	23.5%

Notes: Employer Concentration is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each 6-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations with no entry requirements or few entry requirements are aggregated. The data is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Observations are at employer x occupation x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded.

Table 2: Average levels of labor market concentration measures by year

	2003	2006	2009	2012	2015	2018	Average
A: Concentration of Local Area x Occupation Markets							
Average HHI of payrolls for all occupations							
All sectors	0.0602	0.0573	0.0603	0.0590	0.0568	0.0571	0.0584
Private sector only	0.0399	0.0388	0.0404	0.0404	0.0394	0.0412	0.0400
Average HHI of employment for all occupations							
All sectors	0.0557	0.0533	0.0565	0.0553	0.0534	0.0542	0.0547
Private sector only	0.0374	0.0364	0.0384	0.0384	0.0375	0.0397	0.0380
Average HHI of employment for the 26 occupations used in Azar et al (2022) "Labor Market Concentration"							
All sectors	0.0387	0.0380	0.0406	0.0310	0.0304	0.0294	0.0349
Private sector only	0.0370	0.0367	0.0390	0.0288	0.0283	0.0274	0.0331
B: Concentration of Local Area x Industry Markets							
Average HHI of payrolls for all industries							
All sectors	0.1845	0.1782	0.1822	0.1789	0.1730	0.1708	0.1777
No public administration	0.1482	0.1485	0.1499	0.1473	0.1434	0.1425	0.1465
Average HHI of employment for all industries							
All sectors	0.1793	0.1734	0.1775	0.1735	0.1674	0.1667	0.1727
No public administration	0.1431	0.1438	0.1454	0.1420	0.1378	0.1386	0.1417
Average HHI of employment for manufacturing sector industries only							
Private sector only	0.3050	0.3045	0.3135	0.3143	0.3119	0.3097	0.3095
C: Employment in Employer Tax ID Numbers with 10,000 or more workers ("megafirms")							
Fraction of employment in "megafirms" in all markets							
All sectors	0.1987	0.1999	0.2049	0.2058	0.2094	0.2192	0.2066
Private sector only	0.1596	0.1629	0.1666	0.1708	0.1765	0.1893	0.1712
Fraction of employment in "megafirms" in occupation x areas with 100 or more employees							
All sectors	0.1996	0.2009	0.2059	0.2068	0.2103	0.2203	0.2076
Private sector only	0.1622	0.1656	0.1695	0.1737	0.1794	0.1921	0.1743

Notes: Employer Concentration is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations are defined at the -6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated (except for comparison to the 26 occupations of Azar et al (2022)). Industries are defined at the 4-digit NAICS level. Employer Concentration data comes from the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Observations are at the employer x occupation x year level, or at the employer x industry x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded for consistency over time.

Table 3: Predictors of local oligopsony or “megafirm” status of employers in large markets

	Oligopsonist	Megafirm
A: All observations—Regression R ² values		
Occupation fixed effects alone	.268	.079
Area fixed effects alone	.038	.018
Industry fixed effects alone	.150	.336
Occupation x Area fixed effects	.311	.092
Occupation x Industry fixed effects	.305	.341
Area x Industry fixed effects	.183	.349
Occupation x Industry x Area fixed effects	.343	.354
Occupation, Industry, and Area sizes and sizes squared	.094	.049
Observations	134,122,297	134,122,297
B: Private sector employers only—Regression R ² values		
Occupation fixed effects alone	.204	.080
Area fixed effects alone	.032	.013
Industry fixed effects alone	.081	.249
Occupation x Area fixed effects	.242	.092
Occupation x Industry fixed effects	.220	.256
Area x Industry fixed effects	.114	.260
Occupation x Industry x Area fixed effects	.256	.266
Occupation, Industry, and Area sizes and sizes squared	.046	.037
Observations	124,887,598	124,887,598

Notes: These are R² values from linear probability regressions of local oligopsonist or megafirm status of an occupation within an establishment, at the establishment x occupation x year level, weighted by employment. This sample includes only occupation x area combinations with at least 100 employees.

Employer Concentration is measured as above using the microdata of the OEWS and QCEW programs in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Public sector employment is used in determining whether private-sector employers are local oligopsonists in both “all observations” and “private sector only” regressions. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Industries are defined at the 4-digit NAICS level. Areas are defined at the MSA level, with areas outside MSAs aggregated to the within-state level of sampling and publication used by the OEWS program.

Within these markets, we rank employers from largest to smallest by their share of the total payroll in the market, square these payroll shares, and classify the largest employers in each market (up to 5 employers who each employ at least 10% of the market), whose summed squared payroll shares reach the product-market anti-trust threshold of 0.15 as “local oligopsonists.”

Table 4: Counts and Characteristics of Employees and Employers by Megafirm Status and fraction of employment in local oligopsony, May 2018:

	Megafirms			Not megafirms		
	Total	Governments	Private sector	Total	Governments	Private sector
No employees in local oligopsony						
Number of EINs	264	11	253	5,190,668	76,589	5,114,079
Employment	5,437,877	182,381	5,255,496	91,790,017	7,208,506	84,581,511
Mean wage	\$18.44	\$26.14	\$18.18	\$23.27	\$24.68	\$23.15
Largest industries	Restaurants and Other Eating Places (7225)		Restaurants and Other Eating Places (7225)			
	Grocery Stores (4451)		Elementary and Secondary Schools (6111)			
	General Merchandise Stores, including Warehouse Clubs and Supercenters (4523)		Employment Services (5613)			
	Employment Services (5613)		Building Equipment Contractors (2382)			
Largest occupations	Sales and Related Occupations requiring some preparation (41-AJ22)		Office and Administrative Support Occupations requiring some preparation (43-AJ22)			
	Material Moving Workers requiring some preparation (53-7J22)		Service Occupations requiring little or no preparation (30-AJ21)			
	Food Preparation and Service Occupations requiring some preparation (35-AJ22)		Food Preparation and Service Occupations requiring some preparation (35-AJ22)			
	Service Occupations requiring little or no preparation (30-AJ21)		Sales and Related Occupations requiring some preparation (41-AJ22)			
	Office and Administrative Support Occupations requiring some preparation (43-AJ22)		Production Occupations requiring some preparation (51-AJ22)			
Between 0% and 10% of employment in local oligopsony						
Number of EINs	404	23	381	4,847	954	3,893
Employment	13,818,435	413,060	13,405,375	8,721,209	1,297,861	7,423,348
Mean wage	\$23.93	\$33.14	\$23.64	\$28.87	\$25.51	\$29.46
Largest industries	General Merchandise Stores, including Warehouse Clubs and Supercenters (4523)		General Medical and Surgical Hospitals (6221)			
	Grocery Stores (4451)		Elementary and Secondary Schools (6111)			
	Building Material and Supplies Dealers (4441)		Management of Companies and Enterprises (5511)			
	Depository Credit Intermediation (5221)		Employment Services (5613)			
Between 10% and 25% of employment in local oligopsony						
Number of EINs	119	33	86	4,281	1,319	2,962
Employment	2,908,605	822,711	2,085,894	3,519,078	1,032,389	2,486,689
Mean wage	\$34.59	\$30.67	\$36.14	\$28.98	\$24.55	\$30.82
Largest industries	General Medical and Surgical Hospitals (6221)		Elementary and Secondary Schools (6111)			
	State Government (other than education or health)(9992)		Colleges, Universities, and Professional Schools (6113)			
	Colleges, Universities, and Professional Schools (6113)		General Medical and Surgical Hospitals (6221)			
	Wired and Wireless Telecommunications Carriers (5173)		Local Government (other than education or health) (9993)			
Between 25% and 50% of employment in local oligopsony						
Number of EINs	142	86	56	4,381	1,565	2,816
Employment	6,694,603	5,395,899	1,298,704	3,397,085	1,668,374	1,728,711
Mean wage	\$33.84	\$33.05	\$37.11	\$27.36	\$24.65	\$29.97
Largest industries	Federal Government (9991)		Colleges, Universities, and Professional Schools (6113)			
	State Government (other than education or health) (9992)		Elementary and Secondary Schools (6111)			
	Colleges, Universities, and Professional Schools (6113)		General Medical and Surgical Hospitals (6221)			
	Postal Service (4911)		Local Government (other than education or health) (9993)			

Table 4, continued

	<u>Megafirms</u>			<u>Not megafirms</u>		
	Total	Governments	Private sector	Total	Governments	Private sector
Greater than 50% of employment in local oligopsony						
Number of EINs	69	48	21	4,484	1,228	3,256
Employment	1,703,674	1,287,161	416,513	2,578,515	1,498,981	1,079,534
Mean wage	\$31.71	\$28.96	\$40.22	\$25.79	\$23.37	\$29.16
Largest industries	Elementary and Secondary Schools (6111)			Elementary and Secondary Schools (6111)		
	Colleges, Universities, and Professional Schools (6113)			General Medical and Surgical Hospitals (6221)		
	Local Government (other than education or health) (9993)			Colleges, Universities, and Professional Schools (6113)		
	General Medical and Surgical Hospitals (6221)			Junior Colleges (6112)		
Largest occupations	Healthcare Support Occupations requiring some preparation (31-AJ22)			Elementary School Teachers, Except Special Education (25-2021)		
	Office and Administrative Support Occupations requiring some preparation (43-AJ22)			Registered Nurses (29-1141)		
	Elementary School Teachers, Except Special Education (25-2021)			Office and Administrative Support Occupations requiring some preparation (43-AJ22)		
	Teaching Assistants, Except Postsecondary (25-9045)			Teaching Assistants, Except Postsecondary (25-9045)		
	Secondary School Teachers, Except Special Education (25-2031)			Secondary School Teachers, Except Special and Career/Technical Education (25-2031)		

Notes: Employer Concentration is measured as above using the microdata of the OEWS and QCEW programs in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Public sector employment is used in determining whether private-sector employers are local oligopsonists in both “all observations” and “private sector only” regressions. This sample includes only occupation x area combinations with at least 100 employees. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Industries are defined at the 4-digit NAICS level. Areas are defined at the MSA level, with areas outside MSAs aggregated to the within-state level of sampling and publication used by the OEWS program. Within each occupation x area market, we rank employers from largest to smallest by their share of the total payroll in the market, square these payroll shares, and classify the largest employers in each market (up to 5 employers who each employ at least 10% of the market), whose summed squared payroll shares reach the product-market anti-trust threshold of 0.15 as “local oligopsonists.” Megafirms are defined as EINs with at least 10,000 employees across all occupations in all markets. This table classifies all employers who employ people in large markets by the fraction of their employment for which they are a “local oligopsonist.” We do not show the most common occupations for employers with more than 0 but less than 50% of their employment in local oligopsony because the most common occupations for these employers are often not the occupations for which they are local oligopsonists.

Table 5: Relationship between (natural log) concentration and (natural log) wages

	(1)	(2)	(3)	(4)	(5)	(6)
A: All sectors						
Ln(HHI) – linear specification	0.0734 (0.0000)	0.0405 (0.0000)	0.0198 (0.0000)	0.0087 (0.0000)	0.0118 (0.0001)	0.0007 (0.0000)
R ²	0.031	0.212	0.621	0.663	0.677	0.723
Ln(HHI) – piecewise linear specification	0.0597 (0.0000)	0.0341 (0.0000)	0.0165 (0.0000)	0.0071 (0.0000)	0.0074 (0.0001)	-0.0012 (0.0000)
Ln(HHI)-ln(0.15)*I(HHI ≥0.15)	0.3397 (0.0008)	0.0564 (0.0007)	-0.0115 (0.0005)	-0.0206 (0.0005)	0.0209 (0.0006)	0.0015 (0.0005)
Ln(HHI)-ln(0.25)*I(HHI ≥0.25)	0.1732 (0.0003)	0.0889 (0.0002)	0.0512 (0.0002)	0.0286 (0.0002)	0.0677 (0.0003)	0.0311 (0.0002)
R ²	0.033	0.213	0.622	0.663	0.677	0.723
Observations	247.2m	247.2m	247.2m	247.2m	247.2m	247.2m
B: Private sector only						
Ln(HHI) – linear specification	0.0601 (0.0000)	0.0304 (0.0000)	0.0129 (0.0000)	0.0061 (0.0000)	0.0098 (0.0001)	-0.0025 (0.0000)
R ²	0.017	0.217	0.631	0.669	0.680	0.731
Ln(HHI) – piecewise linear specification	0.0467 (0.0000)	0.0252 (0.0000)	0.0123 (0.0000)	0.0058 (0.0000)	0.0071 (0.0001)	-0.0029 (0.0000)
Ln(HHI)-ln(0.15)*I(HHI ≥0.15)	0.4710 (0.0009)	0.0938 (0.0008)	-0.0242 (0.0006)	-0.0263 (0.0006)	0.0162 (0.0007)	-0.0106 (0.0006)
Ln(HHI)-ln(0.25)*I(HHI ≥0.25)	0.2491 (0.0004)	0.1081 (0.0003)	0.0207 (0.0003)	0.0147 (0.0003)	0.0549 (0.0004)	0.0138 (0.0003)
R ²	0.020	0.217	0.631	0.669	0.680	0.731
Observations	224.8m	224.8m	224.8m	224.8m	224.8m	224.8m
Occupation size * Year		X				
Area size * Year		X				
Occupation * Year Fixed Effects			X	X		X
Area * Year Fixed Effects			X	X		
Industry * Year Fixed Effects				X	X	
Occupation * Area Fixed Effects					X	
Employer within area Fixed Effects						X

Notes: These are coefficients β from regressions $\ln Wage_{ijt} = \beta \ln HHI_{ijt} + \gamma X_{ijt} + \epsilon_{ijt}$ or $\ln Wage_{ijt} = \beta_0 \ln HHI_{ijt} + \beta_1 (\ln HHI_{ijt} - \ln(0.15)) * I(HHI_{ijt} \geq 0.15) + \beta_2 (\ln HHI_{ijt} - \ln(0.25)) * I(HHI_{ijt} \geq 0.25) + \gamma X_{ijt} + \epsilon_{ijt}$, where X varies between specifications as noted. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Employers are defined based on the tax id-numbers (EINs) used in reporting payroll to the Unemployment Insurance system. Observations are at the employer x occupation x wage interval x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded for consistency over time.

Table 6: Correlates between Employer Concentration **levels** and Occupation Characteristics

	All sectors	All sectors	Prvt sector	Prvt sector
Wage_level	0.000	0.001**	0.000	0.000*
Employing_EIN_count_(millions)	0.120		0.317***	
Employing_Estab_count_(millions)	-0.124*		-0.262***	
Local_gov_employ_pct	0.079***	0.109***		
State_gov_employ_pct	0.556***	0.639***		
Fed_gov_employ_pct	0.491***	0.421***		
Hospital_employ_pct	0.050*	0.078**	0.131***	0.163***
Education_employ_pct	0.051**	0.041*	0.217***	0.225***
Manufacturing_employ_pct	0.034*	0.057***	0.020	0.046**
Megafirm_employ_pct	0.161***	0.109***	0.195***	0.077**
Small_metro_employ_pct	0.706	0.755	-0.410	-0.580
Medium_metro_employ_pct	-0.148	-0.348	0.373	0.236
Large_metro_employ_pct	-0.045	-0.160	-0.589**	-0.603**
Very_large_metro_employ_pct	0.080	0.061	0.073	0.056
Constant	-0.060	-0.032	0.008	0.050
R-squared	0.700	0.623	0.391	0.294
N	485	485	475	475

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Average_Employer_Concentration}_o = \alpha + \text{occupation_characteristics}_o + \varepsilon_o$, with observations at the occupation level, weighted by occupation size. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018, and is then averaged across years and geographic areas for each occupation. Occupations are defined at the -6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. The data used is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Employers are defined based on the tax id-numbers (EINs) used in reporting payroll to the Unemployment Insurance system. Occupational characteristics, such as the percentage of each occupation employed in hospitals, are calculated separately for “all sectors” and for the “private sector only.”

Table 7: Correlates between Employer Concentration **trends** and Occupation Characteristics

	All sectors	All sectors	Prvt sector	Prvt sector
Average_HHI_level	-0.0018	-0.0034***	-0.0012	-0.0028**
Employment_trend	0.0056*	0.0081***	0.0042	0.0049***
Wage_level	-0.0000	-0.0000	-0.0000	-0.0000
Wage_trend	0.0009**	0.0009*	0.0009**	0.0010**
Employing_EIN_count_(millions)	-0.0001		-0.0001	
EIN_count_trend	-0.1997***		-0.2428***	
Employing_Estab_count_(millions)	-0.0004		-0.0005	
Establishment_count_trend	0.1561***		0.1604***	
Local_gov_employ_pct	0.0005	0.0003		
State_gov_employ_pct	0.0019	0.0021		
Fed_gov_employ_pct	0.0069***	0.0075***		
Government_emp_pct_trend	0.3319***	0.3325***		
Hospital_employ_pct	-0.0032***	-0.0026***	-0.0031***	-0.0027***
Hospital_emp_pct_trend	-0.0541	-0.1314**	0.0453	-0.0091
Education_employ_pct	0.0005	0.0007	-0.0012	-0.0012
Education_emp_pct_trend	-0.1502**	-0.0921	0.0340	0.0599
Manufacturing_emp_pct	0.0009*	0.0008	0.0008*	0.0007
Manuf_emp_pct_trend	0.0753*	0.0975**	0.0818**	0.1022**
Megafirm_employ_pct	-0.0050***	-0.0042***	-0.0045***	-0.0036***
Megafirm_emp_pct_trend	0.3352***	0.3201***	0.2686***	0.2752***
Small_metro_employ_pct	0.0009	-0.0070	-0.0001	-0.0064
Small_metro_emp_pct_trend	0.2126	-0.1627	0.0401	-0.3120*
Medium_metro_employ_pct	0.0028	0.0046	-0.0011	0.0005
Medium_metro_emp_pct_trend	-0.0548	-0.2227**	0.0559	-0.1301
Large_metro_employ_pct	0.0172**	0.0057	0.0205***	0.0083
Large_metro_emp_pct_trend	0.1163	-0.0348	0.0203	-0.1414
Very_large_metro_employ_pct	-0.0014	-0.0032	-0.0031	-0.0048
Very_large_metro_emp_pct_trend	-0.1821**	-0.3334***	-0.1392*	-0.2849***
Constant	-0.0008	0.0018	-0.0002	0.0023
R-squared	0.629	0.591	0.365	0.307
N	485	485	475	475

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Employer_Concentration_Trend}_o = \alpha + \text{occupation_characteristics}_o + \varepsilon_o$, with observations at the occupation level, weighted by occupation size. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018, and is then averaged across years and geographic areas for each occupation. Occupations are defined at the -6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. The data used is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Employers are defined based on the tax id-numbers (EINs) used in reporting payroll to the Unemployment Insurance system. Occupational characteristics, such as the percentage of each occupation employed in hospitals, are calculated separately for “all sectors” and for the “private sector only.” Time trends are estimated using linear regressions of values of each variable on the year of observation.

Table 8: Correlates between **estimates of the wage impact** of Employer Concentration (incorporating establishment fixed effects) and Occupation Characteristics

	All sectors	Prvt sector	All - high	Prvt - high
Average_HHI_level	0.043**	0.048**	-0.274	-0.235
HHI_trend	0.780	0.127	-15.285*	-8.178
Employment_trend	-0.018	0.038	-0.175	0.254
Wage_level	-0.000***	-0.000	0.004***	0.003**
Wage_trend	0.001	-0.005	-0.123*	-0.213***
Employing_EIN_count_(millions)	-0.003	-0.027	2.453***	2.932***
EIN_count_trend	-1.415*	-1.538**	-1.128	-16.472*
Employing_Estab_count_(millions)	-0.001	0.017	-1.849***	-2.246***
Establishment_count_trend	0.960*	0.812*	8.367	12.163**
Local_gov_employ_pct	-0.005		-0.060	
State_gov_employ_pct	-0.009		0.314	
Fed_gov_employ_pct	-0.081**		0.200	
Government_emp_pct_trend	-1.226*		-4.170	
Hospital_employ_pct	-0.010	-0.012	-0.233*	-0.095
Hospital_emp_pct_trend	1.059	1.270*	0.372	-5.743
Education_employ_pct	0.015*	0.016*	0.083	0.023
Education_emp_pct_trend	-0.074	-1.319	-14.382	6.902
Manufacturing_emp_pct	0.015*	0.012*	-0.008	-0.008
Manuf_emp_pct_trend	-0.507	-0.891*	-19.623***	-19.756***
Megafirm_employ_pct	0.070***	0.048***	-0.069	0.156
Megafirm_emp_pct_trend	0.123	0.441	22.686***	15.616***
Small_metro_employ_pct	0.109	0.226	-2.912*	-5.458***
Small_metro_emp_pct_trend	4.845*	2.414	40.615	23.885
Medium_metro_employ_pct	-0.113	-0.168*	-1.302	-0.472
Medium_metro_emp_pct_trend	3.857**	3.189**	14.456	16.140
Large_metro_employ_pct	0.038	0.063	-0.450	-0.392
Large_metro_emp_pct_trend	1.026	2.152	12.657	21.546
Very_large_metro_employ_pct	-0.034	-0.040	-1.490***	-1.799***
Very_large_metro_emp_pct_trend	2.540**	1.792*	21.607*	18.420*
Constant	0.020	0.021	1.195***	1.353**
R-squared	0.383	0.426	0.375	0.447
N	477	446	440	373

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Wage_coefficient}_o = \alpha + \text{occupation_characteristics}_o + \epsilon_o$, with observations at the occupation level, weighted by occupation sizes. The wage coefficients on the left side of regressions (1) and (2) come from using occupation-level interactions in place of overall employer concentration levels in the linear regression shown in column (6) of Table (5); wage coefficients on the left side of regressions (3) and (4) come from the coefficients for HHI levels above 0.25 in the piece-wise linear regressions shown in column (6) of Table (5).

Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Aggregated occupations with employment of less than 10,000 people, or with employment of less than 10,000 people in markets with concentration levels of 0.25 or higher, are dropped. Occupational characteristics, such as the percentage of each occupation employed in hospitals, are calculated separately for “all sectors” and for the “private sector only.” Time trends are estimated using linear regressions of values of each variable on the year of observation.

Appendix 1: Wage regressions in large markets only

Table 5b: Relationship between (natural log) concentration and (natural log) wages in large markets only

	(1)	(2)	(3)	(4)	(5)	(6)
All sectors						
Ln(HHI) – linear specification	0.0707 (0.0000)	0.0402 (0.0000)	0.0201 (0.0000)	0.0089 (0.0000)	0.0110 (0.0001)	0.0007 (0.0000)
R ²	0.027	0.213	0.623	0.665	0.678	0.725
Private sector only						
Ln(HHI) – linear specification	0.0560 (0.0000)	0.0307 (0.0000)	0.0137 (0.0000)	0.0066 (0.0000)	0.0091 (0.0001)	-0.0025 (0.0000)
R ²	0.014	0.218	0.632	0.670	0.681	0.732
Ln(HHI) – piecewise linear specification	0.0418 (0.0000)	0.0244 (0.0000)	0.0127 (0.0000)	0.0060 (0.0000)	0.0069 (0.0001)	-0.0029 (0.0000)
Ln(HHI)-ln(0.15)*I(HHI ≥0.15)	0.5655 (0.0010)	0.1512 (0.0009)	-0.0123 (0.0007)	-0.0175 (0.0006)	0.0183 (0.0008)	-0.0119 (0.0006)
Ln(HHI)-ln(0.25)*I(HHI ≥0.25)	0.3300 (0.0005)	0.1585 (0.0004)	0.0327 (0.0003)	0.0246 (0.0003)	0.0673 (0.0006)	0.0151 (0.0003)
R ²	0.017	0.219	0.632	0.670	0.681	0.732
Observations	215.6m	215.6m	215.6m	215.6m	215.6m	215.6m
Occupation size * Year		X				
Area size * Year		X				
Occupation * Year Fixed Effects			X	X		X
Area * Year Fixed Effects			X	X		
Industry * Year Fixed Effects				X	X	
Occupation * Area Fixed Effects					X	
Employer within area Fixed Effects						X

Notes: These are coefficients β from regressions $\ln Wage_{ijt} = \beta \ln HHI_{ijt} + \gamma X_{ijt} + \varepsilon_{ijt}$, where X varies between specifications as noted. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Observations are at the employer x occupation x wage interval x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded for consistency over time. Only markets with at least 100 observations per occupation x area are included in this Appendix Table.

Table 8b: Correlates between **estimates of the wage impact** of Employer Concentration (incorporating establishment fixed effects) and Occupation Characteristics in large markets only

Regressions of the relationship between HHI and wage levels IN LARGE MARKETS ONLY

	All sectors	Prvt sector	All - high	Prvt - high
Average_HHI_level	0.060**	0.052***	-0.337	-0.288
HHI_trend	0.460	-0.206	-20.100*	-10.693
Employment_trend	0.003	0.045	-0.129	0.640
Wage_level	-0.000***	-0.000**	0.004**	0.004*
Wage_trend	0.002	0.001	-0.104	-0.234**
Employing_EIN_count_(millions)	-0.024	-0.040	2.797***	3.448***
EIN_count_trend	-1.568*	-1.455*	5.823	-16.758
Employing_Estab_count_(millions)	0.015	0.027	-2.091***	-2.614***
Establishment_count_trend	0.959	0.765*	7.372	12.253*
Local_gov_employ_pct	-0.011		-0.050	
State_gov_employ_pct	-0.021		0.393	
Fed_gov_employ_pct	-0.022		0.199	
Government_emp_pct_trend	-1.139		-2.955	
Hospital_employ_pct	-0.006	-0.011	-0.233	-0.078
Hospital_emp_pct_trend	0.818	0.878	2.098	-8.658
Education_employ_pct	0.021**	0.020*	0.106	0.048
Education_emp_pct_trend	-0.042	-1.569	-17.441	7.093
Manufacturing_emp_pct	0.015*	0.014**	0.006	0.033
Manuf_emp_pct_trend	-0.490	-0.943*	-23.043***	-21.828***
Megafirm_employ_pct	0.057**	0.043**	-0.036	0.192
Megafirm_emp_pct_trend	0.225	0.533	27.915***	19.278**
Small_metro_employ_pct	0.050	0.295	-3.767	-6.956**
Small_metro_emp_pct_trend	5.869*	2.625	41.336	24.508
Medium_metro_employ_pct	-0.208*	-0.216**	-1.989*	-0.640
Medium_metro_emp_pct_trend	5.106***	2.988*	14.365	16.043
Large_metro_employ_pct	-0.026	0.051	-1.403	-1.125
Large_metro_emp_pct_trend	0.478	0.811	12.122	26.013
Very_large_metro_employ_pct	-0.071	-0.032	-2.001***	-2.169***
Very_large_metro_emp_pct_trend	3.289**	1.422	23.543	21.334
Constant	0.067	0.022	1.721***	1.728**
R-squared	0.334	0.414	0.400	0.467
N	452	420	327	255

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Wage_coefficient}_o = \alpha + \text{occupation_characteristics}_o + \epsilon_o$, with observations at the occupation level, weighted by occupation sizes. The wage coefficients on the left side of regressions (1) and (2) come from using occupation-level interactions in place of overall employer concentration levels in the linear regression shown in column (6) of Table (5); wage coefficients on the left side of regressions (3) and (4) come from the coefficients for HHI levels above 0.25 in the piece-wise linear regressions shown in column (6) of Table (5).

Only markets with at least 100 observations per occupation x area are included in this Appendix Table. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Aggregated occupations with employment of less than 10,000 people, or with employment of less than 10,000 people in markets with concentration levels of 0.25 or higher, are dropped. Occupational characteristics, such as the percentage of each occupation employed

in hospitals, are calculated separately for “all sectors” and for the “private sector only.” Time trends are estimated using linear regressions of values of each variable on the year of observation.

Appendix 2: Results in States with data available to outside researchers

The QCEW is a Federal-State cooperative program. These data are owned by the states, and different states have different laws and regulations regarding making their data available to outside researchers through the BLS Restricted Data Access Program. As of April 2022, the list of states for which QCEW data is available to outside researchers is AL, AZ, AR, CA, CT, DE, DC, GA, IN, IA, KS, ME, MD, MN, MO, NV, NJ, NM, ND, OK, SC, SD, TN, TX, UT, VA, WV, and WI. In this Appendix, we show the results of our analyses, limiting data to these states only. These (and not the main results in the paper) are the results that outside researchers approved to access BLS data should be able to replicate (until this list of states changes, which it generally does every year).

Table 1a: Summary Measures for States with data available to outside researchers

Counts and Averages	All markets		Markets with 100+ workers	
	All industries	All occupations	All industries	All occupations
All sectors				
Number of area-occupation-year markets	761,338		253,948	
Number of area-industry-year markets		442,452		249,836
Average number of establishments per market	102	52	289	88
Average number of EINs per market	87	44	245	74
Average establishments per EIN, within markets	1.18	1.21	1.26	1.33
Average employment per market	576	992	1,674	1,731
Average employment per EIN, within markets	7.98	78.11	14.07	130.54
Average real (2018\$) mean wage	\$24.03	\$24.03	\$23.83	\$24.08
Private-sector only (for industry statistics excludes public administration industry, but includes public schools and hospitals)				
Number of area-occupation-year markets	668,350		201,613	
Number of area-industry-year markets		429,240		241,596
Average number of establishments per market	107	53	334	90
Average number of EINs per market	93	45	288	77
Average establishments per EIN, within markets	1.09	1.17	1.15	1.27
Average employment per market	548	951	1,758	1,664
Average employment per EIN, within markets	5.40	42.87	8.73	68.42
Average real (2018\$) mean wage	\$23.42	\$23.62	\$23.20	\$23.67
Distributions, all sectors	All markets		Markets with 100+ workers	
	% of employment	% of markets	% of employment	% of markets
Occupational Distribution				
Entry level service	5.9%	0.3%	6.1%	0.7%
Entry level blue collar	1.2%	0.3%	1.3%	0.7%
Management, business, science, and arts	30.7%	66.6%	29.4%	57.0%
Service	14.1%	10.2%	14.2%	12.4%
Sales and office	25.2%	7.1%	25.8%	11.1%
Natural resources, construction, and maint.	8.1%	9.4%	8.1%	11.2%
Production, transportation, and material mov	14.8%	6.3%	15.2%	6.9%
Industry Distribution				
Goods producing	15.9%	29.3%	15.8%	26.0%
Service producing	84.1%	70.7%	84.2%	74.0%
Geographic Distribution (occupation-area markets)				
MSA with employment greater than 1m	41.7%	5.3%	43.0%	13.1%
MSA with employment between 500k and 1m	15.3%	5.5%	15.7%	11.3%
MSA with employment between 100k and 500k	20.0%	24.8%	19.8%	30.4%
MSA with employment less than 100k	9.7%	36.3%	8.7%	22.1%
Rural areas	13.2%	28.1%	12.7%	23.1%

Notes: Employer Concentration is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each 6-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations with no entry requirements or few entry requirements are aggregated. The data is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Observations are at employer x occupation x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded.

Table 2a: Average levels of labor market concentration measures by year, for States with data available to outside researchers

	2003	2006	2009	2012	2015	2018	Average
A: Concentration of Local Area x Occupation Markets							
Average HHI of payrolls for all occupations							
All sectors	0.0610	0.0580	0.0616	0.0598	0.0576	0.0584	0.0594
Private sector only	0.0398	0.0384	0.0405	0.0408	0.0399	0.0425	0.0404
Average HHI of employment for all occupations							
All sectors	0.0567	0.0542	0.0578	0.0563	0.0545	0.0560	0.0559
Private sector only	0.0376	0.0362	0.0387	0.0389	0.0381	0.0414	0.0385
Average HHI of employment for the 26 occupations used in Azar et al (2020) "Labor Market Concentration"							
All sectors	0.0416	0.0392	0.0417	0.0318	0.0311	0.0298	0.0361
Private sector only	0.0394	0.0378	0.0404	0.0296	0.0287	0.0277	0.0341
B: Concentration of Local Area x Industry Markets							
Average HHI of payrolls for all industries							
All sectors	0.1888	0.1823	0.1864	0.1828	0.1763	0.1741	0.1815
No public administration	0.1498	0.1504	0.1519	0.1489	0.1444	0.1439	0.1481
Average HHI of employment for all industries							
All sectors	0.1840	0.1777	0.1820	0.1778	0.1712	0.1709	0.1770
No public administration	0.1453	0.1459	0.1476	0.1439	0.1393	0.1409	0.1437
Average HHI of employment for manufacturing sector industries only							
Private sector only	0.3114	0.3107	0.3181	0.3203	0.3187	0.3178	0.3159
C: Employment in Employer Tax ID Numbers with 10,000 or more workers ("megafirms")							
Fraction of employment in "megafirms" in all markets							
All sectors	0.1730	0.1740	0.1813	0.1814	0.1849	0.1973	0.1820
Private sector only	0.1272	0.1299	0.1353	0.1397	0.1460	0.1626	0.1401
Fraction of employment in "megafirms" in occupation x areas with 100 or more employees							
All sectors	0.1734	0.1745	0.1819	0.1818	0.1854	0.1982	0.1825
Private sector only	0.1295	0.1322	0.1379	0.1422	0.1485	0.1653	0.1426

Notes: Employer Concentration is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations are defined at the -6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated (except for comparison to the 26 occupations of Azar et al (2022)). Industries are defined at the 4-digit NAICS level. Employer Concentration data comes from the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Observations are at the employer x occupation x year level, or at the employer x industry x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded for consistency over time.

Table 3a: Predictors of local oligopsony or “megafirm” status of employers in large markets, for States with data available to outside researchers

	Oligopsonist	Megafirm
A: All observations—Regression R ² values		
Occupation fixed effects alone	.273	.084
Area fixed effects alone	.039	.017
Industry fixed effects alone	.158	.383
Occupation x Area fixed effects	.316	.096
Occupation x Industry fixed effects	.315	.388
Area x Industry fixed effects	.191	.394
Occupation x Industry x Area fixed effects	.354	.398
Occupation, Industry, and Area sizes and sizes squared	.096	.058
Observations	72,852,897	72,852,897
B: Private sector employers only—Regression R ² values		
Occupation fixed effects alone	.203	.076
Area fixed effects alone	.030	.010
Industry fixed effects alone	.081	.270
Occupation x Area fixed effects	.239	.084
Occupation x Industry fixed effects	.219	.277
Area x Industry fixed effects	.112	.278
Occupation x Industry x Area fixed effects	.254	.285
Occupation, Industry, and Area sizes and sizes squared	.045	.040
Observations	67,627,001	67,627,001

Notes: These are R² values from linear probability regressions of local oligopsonist or megafirm status of an occupation within an establishment, at the establishment x occupation x year level, weighted by employment. This sample includes only occupation x area combinations with at least 100 employees.

Employer Concentration is measured as above using the microdata of the OEWS and QCEW programs in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Public sector employment is used in determining whether private-sector employers are local oligopsonists in both “all observations” and “private sector only” regressions. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Industries are defined at the 4-digit NAICS level. Areas are defined at the MSA level, with areas outside MSAs aggregated to the within-state level of sampling and publication used by the OEWS program.

Within these markets, we rank employers from largest to smallest by their share of the total payroll in the market, square these payroll shares, and classify the largest employers in each market (up to 5 employers who each employ at least 10% of the market), whose summed squared payroll shares reach the product-market anti-trust threshold of 0.15 as “local oligopsonists.”

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Table 4a, continued

		<u>Megafirms</u>		<u>Not megafirms</u>	
		Total	Private sector	Total	Private sector
		Governments		Governments	
Between 25% and 50% of employment in local oligopsony					
Number of EINs		142	86	4,381	1,565
Employment		6,694,603	5,395,899	3,397,085	1,668,374
Mean wage		\$33.84	\$33.05	\$27.36	\$24.65
Largest industries					
	Federal Government (9991)			Colleges, Universities, and Professional Schools (6113)	
	State Government (other than education or health) (9992)			Elementary and Secondary Schools (6111)	
	Colleges, Universities, and Professional Schools (6113)			General Medical and Surgical Hospitals (6221)	
	Postal Service (4911)			Justice, Public Order, and Safety Activities (9211)	
Largest occupations					
	Office and Administrative Support Occupations requiring some preparation (43-AJ22)			Office and Administrative Support Occupations requiring some preparation (43-AJ22)	
	Protective Service Occupations requiring some preparation (33-AJ22)			Registered Nurses (29-1141)	
	Project Management Specialists and Business Operations Specialists, All Other (13-1198)			Police and Sheriff's Patrol Officers (33-3051)	
	Registered Nurses (29-1141)			Production Occupations requiring some preparation (51-AJ22)	
	Police and Sheriff's Patrol Officers (33-3051)			Protective Service Occupations requiring some preparation (33-AJ22)	
Greater than 50% of employment in local oligopsony					
Number of EINs		69	48	4,484	1,228
Employment		1,703,674	1,287,161	2,578,515	1,498,981
Mean wage		\$31.71	\$28.96	\$25.79	\$23.37
Largest industries					
	Elementary and Secondary Schools (6111)			Elementary and Secondary Schools (6111)	
	Colleges, Universities, and Professional Schools (6113)			General Medical and Surgical Hospitals (6221)	
	Local Government (other than education or health) (9993)			Colleges, Universities, and Professional Schools (6113)	
	General Medical and Surgical Hospitals (6221)			Junior Colleges (6112)	
Largest occupations					
	Office and Administrative Support Occupations requiring some preparation (43-AJ22)			Elementary School Teachers, Except Special Education (25-2021)	
	Elementary School Teachers, Except Special Education (25-2021)			Registered Nurses (29-1141)	
	Teaching Assistants, Except Postsecondary (25-9045)			Office and Administrative Support Occupations requiring some preparation (43-AJ22)	
	Secondary School Teachers, Except Special Education (25-2031)			Teaching Assistants, Except Postsecondary (25-9045)	
	Registered Nurses (29-1141)			Secondary School Teachers, Except Special and Career/Technical Education (25-2031)	

Notes: Employer Concentration is measured as above using the microdata of the OEWS and QCEW programs in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Public sector employment is used in determining whether private-sector employers are local oligopsonists in both “all observations” and “private sector only” regressions. This sample includes only occupation x area combinations with at least 100 employees. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Industries are defined at the 4-digit NAICS level. Areas are defined at the MSA level, with areas outside MSAs aggregated to the within-state level of sampling and publication used by the OEWS program. Within each occupation x area market, we rank employers from largest to smallest by their share of the total payroll in the market, square these payroll shares, and classify the largest employers in each market (up to 5 employers who each employ at least 10% of the market), whose summed squared payroll shares reach the product-market anti-trust threshold of 0.15 as “local oligopsonists.” Megafirms are defined as EINs with at least 10,000 employees across all occupations in all markets. This table classifies all employers who employ people in large markets by the fraction of their employment for which they are a “local oligopsonist.”

Table 5a: Relationship between (natural log) concentration and (natural log) wages, for states with data available to outside researchers

	(1)	(2)	(3)	(4)	(5)	(6)
A: All sectors						
Ln(HHI) – linear specification	0.0736 (0.0002)	0.0404 (0.0000)	0.0220 (0.0000)	0.0105 (0.0000)	0.0112 (0.0001)	0.0019 (0.0001)
R ²	0.031	0.210	0.628	0.671	0.684	0.730
Ln(HHI) – piecewise linear specification	0.0592 (0.0000)	0.0337 (0.0000)	0.0193 (0.0001)	0.0096 (0.0001)	0.0067 (0.0001)	0.0004 (0.0001)
Ln(HHI)-ln(0.15)*I(HHI ≥0.15)	0.3371 (0.0010)	0.0542 (0.0009)	-0.0299 (0.0007)	-0.0421 (0.0006)	0.0163 (0.0008)	-0.0100 (0.0006)
Ln(HHI)-ln(0.25)*I(HHI ≥0.25)	0.1831 (0.0003)	0.0947 (0.0003)	0.0474 (0.0003)	0.0217 (0.0002)	0.0707 (0.0005)	0.0269 (0.0003)
R ²	0.033	0.211	0.628	0.671	0.684	0.730
Observations	134.1m	134.1m	134.1m	134.1m	134.1m	134.1m
B: Private sector only						
Ln(HHI) – linear specification	0.0593 (0.0002)	0.0283 (0.0000)	0.0147 (0.0001)	0.0082 (0.0001)	0.0099 (0.0001)	-0.0009 (0.0001)
R ²	0.016	0.214	0.636	0.675	0.686	0.736
Ln(HHI) – piecewise linear specification	0.0456 (0.0000)	0.0231 (0.0000)	0.0148 (0.0001)	0.0086 (0.0001)	0.0071 (0.0001)	-0.0011 (0.0001)
Ln(HHI)-ln(0.15)*I(HHI ≥0.15)	0.4596 (0.0013)	0.0733 (0.0012)	-0.0477 (0.0008)	-0.0530 (0.0008)	0.0105 (0.0010)	-0.0205 (0.0008)
Ln(HHI)-ln(0.25)*I(HHI ≥0.25)	0.2628 (0.0005)	0.1131 (0.0005)	0.0109 (0.0004)	0.0031 (0.0003)	0.0571 (0.0006)	0.0089 (0.0004)
R ²	0.019	0.215	0.636	0.675	0.686	0.736
Observations	121.6m	121.6m	121.6m	121.6m	121.6m	121.6m
Occupation size * Year		X				
Area size * Year		X				
Occupation * Year Fixed Effects			X	X		X
Area * Year Fixed Effects			X	X		
Industry * Year Fixed Effects				X	X	
Occupation * Area Fixed Effects					X	
Employer within area Fixed Effects						X

Notes: These are coefficients β from regressions $\ln Wage_{ijt} = \beta \ln HHI_{ijt} + \gamma X_{ijt} + \varepsilon_{ijt}$ or $\ln Wage_{ijt} = \beta_0 \ln HHI_{ijt} + \beta_1 (\ln HHI_{ijt} - \ln(0.15)) * I(HHI_{ijt} \geq 0.15) + \beta_2 (\ln HHI_{ijt} - \ln(0.25)) * I(HHI_{ijt} \geq 0.25) + \gamma X_{ijt} + \varepsilon_{ijt}$, where X varies between specifications as noted. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018. Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Employers are defined based on the tax id-numbers (EINs) used in reporting payroll to the Unemployment Insurance system. Observations are at the employer x

occupation x wage interval x year level, weighted by employment in each cell. Data for single-employee establishments in industry 624120 is excluded for consistency over time.

Table 6a: Correlates between Employer Concentration **levels** and Occupation Characteristics, for states with data available to outside researchers

	All sectors	All sectors	Prvt sector	Prvt sector
Wage_level	0.000	0.001**	0.000	0.000
Employing_EIN_count_(millions)	0.031		0.262*	
Employing_Estab_count_(millions)	-0.092		-0.247**	
Local_gov_employ_pct	0.061**	0.090***		
State_gov_employ_pct	0.594***	0.653***		
Fed_gov_employ_pct	0.511***	0.431***		
Hospital_employ_pct	0.049*	0.078**	0.179***	0.210***
Education_employ_pct	0.049*	0.042*	0.234***	0.244***
Manufacturing_employ_pct	0.030	0.048**	0.028	0.050***
Mega_firm_employ_pct	0.145***	0.119***	0.160***	0.087**
Small_metro_employ_pct	-0.178	-0.296	-1.243***	-1.429***
Medium_metro_employ_pct	0.127	0.057	0.353*	0.354*
Large_metro_employ_pct	-0.161	-0.324	-0.382**	-0.432**
Very_large_metro_employ_pct	-0.059	-0.085	-0.148	-0.146
Constant	0.049	0.072	0.190*	0.193*
R-squared	0.708	0.629	0.394	0.314
N	485	485	475	475

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Average_Employer_Concentration}_o = \alpha + \text{occupation_characteristics}_o + \varepsilon_o$, with observations at the occupation level, weighted by occupation size. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018, and is then averaged across years and geographic areas for each occupation. Occupations are defined at the -6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. The data used is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Employers are defined based on the tax id-numbers (EINs) used in reporting payroll to the Unemployment Insurance system. Occupational characteristics, such as the percentage of each occupation employed in hospitals, are calculated separately for “all sectors” and for the “private sector only.”

Table 7a: Correlates between Employer Concentration **trends** and Occupation Characteristics, for states with data available to outside researchers

	All sectors	All sectors	Prvt sector	Prvt sector
Average_HHI_level	-0.0010	-0.0025*	-0.0016	-0.0029*
Employment_trend	0.0054	0.0109***	0.0071	0.0067**
Wage_level	0.0000	-0.0000	0.0000	-0.0000
Wage_trend	0.0009*	0.0012**	0.0007	0.0010**
Employing_EIN_count_(millions)	-0.0007		0.0013	
EIN_count_trend	-0.3435***		-0.4268***	
Employing_Estab_count_(millions)	0.0001		-0.0015	
Establishment_count_trend	0.2386***		0.2426***	
Local_gov_employ_pct	0.0002	-0.0002		
State_gov_employ_pct	0.0012	0.0011		
Fed_gov_employ_pct	0.0069***	0.0063***		
Government_emp_pct_trend	0.3143***	0.3249***		
Hospital_employ_pct	-0.0029***	-0.0029***	-0.0024**	-0.0026**
Hospital_emp_pct_trend	-0.1497**	-0.2552***	0.0064	-0.0506
Education_employ_pct	0.0006	0.0009	-0.0014*	-0.0014*
Education_emp_pct_trend	-0.1776**	-0.1413*	-0.0685	-0.0201
Manufacturing_emp_pct	0.0006	0.0003	0.0005	0.0002
Manuf_emp_pct_trend	0.0335	0.0723	0.0431	0.0799*
Mega_firm_employ_pct	-0.0052***	-0.0034***	-0.0035**	-0.0016*
Mega_firm_emp_pct_trend	0.3293***	0.3184***	0.1943***	0.1931***
Small_metro_employ_pct	0.0084	0.0056	0.0009	0.0030
Small_metro_emp_pct_trend	0.1672	-0.3001*	-0.2222	-0.8066***
Medium_metro_employ_pct	-0.0013	-0.0010	-0.0048	-0.0026
Medium_metro_emp_pct_trend	0.0094	-0.3190***	0.1394	-0.2068**
Large_metro_employ_pct	0.0106*	0.0050	0.0106**	0.0057
Large_metro_emp_pct_trend	0.0626	-0.1763*	0.0200	-0.2454***
Very_large_metro_employ_pct	0.0010	-0.0023	-0.0013	-0.0028
Very_large_metro_emp_pct_trend	-0.1782**	-0.4476***	-0.1647*	-0.4506***
Constant	-0.0017	0.0008	-0.0001	0.0007
R-squared	0.607	0.565	0.393	0.318
N	485	485	475	475

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Employer_Concentration_Trend}_o = \alpha + \text{occupation_characteristics}_o + \epsilon_o$, with observations at the occupation level, weighted by occupation size. Employer Concentration (HHI) is measured using a Herfindahl-Hirschman Index (HHI) of payroll by employer within each six-digit occupation for each geographic area (MSA or balance of state area) in each year of 2003, 2006, 2009, 2012, 2015, and 2018, and is then averaged across years and geographic

areas for each occupation. Occupations are defined at the -6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. The data used is the microdata of the Occupational Employment and Wage Statistics, mapped to the full employment data of the Quarterly Census of Employment and Wages in the United States in these years. Employers are defined based on the tax id-numbers (EINs) used in reporting payroll to the Unemployment Insurance system.

Occupational characteristics, such as the percentage of each occupation employed in hospitals, are calculated separately for “all sectors” and for the “private sector only.” Time trends are estimated using linear regressions of values of each variable on the year of observation.

Table 8a: Correlates between **estimates of the wage impact** of Employer Concentration (incorporating establishment fixed effects) and Occupation Characteristics, for States with data available to outside researchers

	All sectors	Prvt sector	All - high	Prvt - high
Average_HHI_level	0.038*	0.045**	-0.071	-0.352
HHI_trend	0.603	-0.094	-12.589*	-12.889
Employment_trend	0.054	0.200***	7.274***	9.840***
Wage_level	-0.001***	-0.000*	0.002*	0.006***
Wage_trend	0.001	-0.008	-0.078	-0.219**
Employing_EIN_count_(millions)	0.170**	0.129*	6.876***	8.872***
EIN_count_trend	-1.443	-2.296**	-33.225**	-47.068***
Employing_Estab_count_(millions)	-0.127**	-0.099*	-4.970***	-6.649***
Establishment_count_trend	1.111*	1.059*	-0.517	5.133
Local_gov_employ_pct	-0.011		-0.067	
State_gov_employ_pct	-0.077***		0.001	
Fed_gov_employ_pct	-0.139***		0.280	
Government_emp_pct_trend	-1.227*		-0.694	
Hospital_employ_pct	-0.030**	-0.035**	-0.554***	-0.617***
Hospital_emp_pct_trend	2.159**	1.974**	-16.574*	-17.755*
Education_employ_pct	0.017**	0.010	0.033	0.085
Education_emp_pct_trend	0.376	-0.835	-28.199***	-9.113
Manufacturing_emp_pct	0.007	0.002	-0.068	-0.010
Manuf_emp_pct_trend	-0.349	-0.557	15.077*	13.824*
Megafirm_employ_pct	0.110***	0.085***	-0.227	-0.151
Megafirm_emp_pct_trend	0.484	0.567	7.348	4.728
Small_metro_employ_pct	0.281*	0.276*	0.185	-1.470
Small_metro_emp_pct_trend	0.153	1.666	23.167	34.874
Medium_metro_employ_pct	-0.074	-0.163**	-1.065	-0.931
Medium_metro_emp_pct_trend	0.371	1.555	-9.815	2.863
Large_metro_employ_pct	0.046	0.026	-0.672	-1.240
Large_metro_emp_pct_trend	0.039	1.659	-9.294	15.170
Very_large_metro_employ_pct	-0.011	-0.064	-0.865*	-1.461**
Very_large_metro_emp_pct_trend	0.407	1.299	5.232	24.346*
Constant	-0.014	0.026	0.707*	1.121*
R-squared	0.433	0.514	0.299	0.347
N	470	425	374	282

* p<0.05, ** p<0.01, *** p<0.001

Notes: This is a table of regressions of the form: $\text{Wage_coefficient}_o = \alpha + \text{occupation_characteristics}_o + \varepsilon_o$, with observations at the occupation level, weighted by occupation sizes. The wage coefficients on the left side of regressions (1) and (2) come from using occupation-level interactions in place of overall

employer concentration levels in the linear regression shown in column (6) of Table (5); wage coefficients on the left side of regressions (3) and (4) come from the coefficients for HHI levels above 0.25 in the piece-wise linear regressions shown in column (6) of Table (5).

Occupations are defined at the 6-digit SOC level, although occupations with no entry requirements or few entry requirements are aggregated. Aggregated occupations with employment of less than 10,000 people, or with employment of less than 10,000 people in markets with concentration levels of 0.25 or higher, are dropped. Occupational characteristics, such as the percentage of each occupation employed in hospitals, are calculated separately for “all sectors” and for the “private sector only.” Time trends are estimated using linear regressions of values of each variable on the year of observation.