Labor Market Concentration*

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Abstract

A product market is concentrated when a few firms dominate the market. Similarly, a labor market is concentrated when a few firms dominate hiring in the market. Using data from the leading employment website CareerBuilder.com, we calculate labor market concentration for over 8,000 geographic-occupational labor markets in the US. Based on the DOJ-FTC horizontal merger guidelines, the average market is highly concentrated. Using a panel IV regression, we show that going from the 25th percentile to the 75th percentile in concentration is associated with a 17% decline in posted wages, suggesting that concentration increases labor market power.

Keywords: Monopsony, Oligopsony, Labor Markets, Competition Policy

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1 Introduction

There is growing concern about growing market concentration and its potential effects on the economy, including increases in markups (De Loecker and Eeckhout, 2017) and the decline in the labor share (Autor et al., 2017; Barkai, 2016). Concerns about a lack of competition in the labor market have also reached the policy debate (CEA, 2016). While interest in monopsony has grown in recent years (Ashenfelter, Farber and Ransom, 2010; Manning, 2011), firms' ability to pay workers less than their marginal productivity is not generally taken into account in antitrust practice. Antitrust enforcement is mainly concerned with consumer welfare, and hence the impacts of a lack of competition on product prices, not wages. Antitrust regulators pay little attention to labor market power despite the labor economics literature finding that firms can have substantial market power in the labor market (Staiger, Spetz and Phibbs, 2010; Falch, 2010; Ransom and Sims, 2010; Matsudaira, 2013). But this empirical work has generally focused on particular labor markets. Therefore it is not clear how widespread labor market power truly is, and how much it affects wages.

In this paper, we approach this question by directly quantifying the level of labor market concentration across a wide range of occupations and for almost every commuting zone in the US. In a nutshell, we find that labor market concentration in the average market is high, and higher concentration is associated with significantly lower posted wages. Given high concentration, mergers have the potential to significantly increase *labor* market power. This type of analysis could be used by antitrust agencies to assess whether mergers can create anti-competitive effects in labor markets.

We measure labor market concentration using traditional measures such as the Herfindahl-Hirschman Index (HHI), which have the advantage that they can be compared with the thresholds in the antitrust agencies' horizontal merger guidelines (FTC/DOJ, 2010). The same thresholds apply to seller and buyer power, as the horizontal merger guidelines state that "To evaluate whether a merger is likely to enhance market power on the buying side of the market, the

Agencies employ essentially the framework described above for evaluating whether a merger is likely to enhance market power on the selling side of the market." The buying side of the market refers to inputs markets, including the labor market. Therefore, a merger can be said to enhance market power if it results in a high level of concentration in specific labor markets.

To calculate market shares in geographic and occupational labor markets, we use data from CareerBuilder.com, the largest online job board in the United States, matching millions of workers and firms. We calculate vacancy shares and HHIs of market concentration for over 8,000 labor markets, defined by a combination of occupation at the SOC-6 level and commuting zone. The occupations we cover include the most frequent occupations among CareerBuilder vacancies, plus the top occupations in manufacturing and construction. We show that, on average, labor markets are highly concentrated: the average HHI is 3,157, which is above the 2,500 threshold for high concentration according to the Department of Justice / Federal Trade Commission horizontal merger guidelines. Concentration varies by occupation and city, with larger cities being less concentrated.

We document a negative correlation between labor market concentration and average posted wages in that market. We then run both OLS and instrumental variables (IV) regressions of posted wages on concentration at the market level (HHI), using quarterly panel data ranging from 2010 to 2013. Our instrument for the IV specification is the average concentration in other geographic markets for the same occupation in a given quarter. This instrument uses variation in market concentration that is driven by national-level changes in occupational hiring over time, and not by potentially endogenous changes in occupational hiring within a particular local market.

The OLS and IV results are qualitatively similar, but quantitatively the instrumented estimates are much larger. In the baseline IV specification, the elasticity of the real wage with respect to the HHI is -0.127, while in the baseline OLS specification the elasticity is -0.038. Going from the 25th to the 75th level of concentration decreases posted wages by 17% in the baseline IV specification, and by 5% in the baseline OLS specifications.

One might be concerned that the impact of concentration on posted wages is endogeneous due to the relationship between the number of vacancies and concentration. The sign of the bias could be positive or negative: a decrease in labor demand can lower wages and the number of firms hiring in the market, leading to higher concentration; a decrease in labor supply can increase wages, and lower the number of firms hiring, also leading to higher concentration. To alleviate this concern, we control for labor market tightness, defined as vacancies/applications (Davis and Marinescu, 2017). We find that the negative effect of concentration on wages is essentially unchanged. Overall, our results are consistent with labor market concentration creating labor market power, and hence putting downward pressure on wages.

We perform a number of additional robustness checks. Most importantly, Marinescu and Wolthoff (2016) show that posted wages are largely explained by job titles. Therefore, it is important to control for heterogeneity by job title to get an estimate of the impact of concentration on wages for a given job type. When we control for job titles, the effect of concentration on wages is still highly significant and negative but smaller, suggesting that concentration may change the composition of jobs toward lower paying jobs. We also use alternative measures of labor market concentration, such as the inverse of the number of hiring firms, or market concentration as measured by the number of applications: these alternative measures also yield a negative and highly significant impact of labor market concentration on posted wages.

This paper provides for the first time to our knowledge a measure of labor market concentration for many of the largest labor markets in the US. Our measure of concentration is distinct from the industry concentration measures used by Autor et al. (2017) and Barkai (2016): it is based on concentration in the labor market rather than concentration in the product market. Our contribution is therefore complementary: while they show that product market concentration is associated with a lower labor share, we show that labor market concentration is associated with lower posted wages.

The monopsony literature in labor economics approaches the issue of market power through questions such as the impact of the minimum wage and unionization. This literature focuses

on the elasticity of labor supply to the individual firm, as opposed to market concentration[1]. In such models, employers trade off wages with their employees' quit rates. If workers have a high supply elasticity, then firms pay them more to get them to stay. The literature generally finds low elasticities of labor supply: this is evidence for firm-level monopsony power to reduce wages below the marginal product of labor.

Our approach is complementary to this literature, but with a different mechanism at play. We measure market-level concentration in local and occupational labor markets. Buyer-side market power is a plausible alternative mechanism for empirical findings from the aforementioned labor literature, such as the small effect of minimum wage increases on employment. In our framework, firms pay higher wages if the labor market is unconcentrated and workers can expect abundant job offers.

The remainder of the paper is organized as follows. Section 2 describes the data, and our measure of labor market concentration. Section 3 analyzes the relationship between labor market concentration and posted wages. Section 4 performs robustness tests and addresses remaining limitations. Finally, section 5 concludes.

2 Measuring labor market concentration

2.1 Data

We use proprietary data from CareerBuilder, which is the largest online job board in the United States. The site received approximately 11 million unique job seeker visits in January 2011. Job seekers can use the site for free, while firms seeking to hire workers must pay a fee of several hundred dollars to post a job opening for one month. The total number of vacancies on CareerBuilder.com represents 35% of the total number of vacancies in the US in January 2011 as counted in the Job Openings and Labor Turnover Survey. The dataset used here was first

[1] An older literature has explored the impact of labor market concentration on wages. However, this literature is mostly limited to teachers' and nurses' markets and uses cross-sectional identification, as discussed in Boal and Ransom (1997).

used in Davis and Marinescu (2017). Occupations were selected based on counts of jobs posted between 2009 and 2012 on CareerBuilder: at the broad SOC level, i.e. SOC-5 digits, the 13 most frequent occupations were selected. We also added the three most frequent occupations in manufacturing and construction (17-2110, 47-1010, 51-1010). The full list of SOC-6 occupations is as follows:

- 11-3011 Administrative services managers
- 13-2011 Accountants and Auditors
- 13-2051 Financial Analysts
- 13-2052 Personal financial advisers
- 13-2053 Insurance Underwriters
- 13-2061 Financial Examiners
- 15-1041 Computer support specialists
- 17-2111 Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
- 17-2112 Industrial engineers
- 29-1111 Registered nurses
- 41-4011 Sales representatives, wholesale & manufacturing, technical & scientific products
- 41-9041 Telemarketers
- 43-3031 Bookkeeping, accounting, and auditing clerks
- 43-4051 Customer service representatives
- 43-6011 Executive secretaries and administrative assistants

- 43-6012 Legal Secretaries
- 43-6013 Medical secretaries
- 43-6014 Secretaries and Administrative Assistants, Except Legal, Medical, and Executive
- 47-1011 First-Line Supervisors of Construction Trades and Extraction Workers
- 49-3041 Farm equipment mechanics
- 49-3042 Mobile Heavy Equipment Mechanics, Except Engines
- 49-3043 Rail Car Repairers
- 51-1011 First-line supervisors/managers of production and operating workers
- 53-3031 Driver/sales workers
- 53-3032 Truck drivers, heavy and tractor-trailer
- 53-3033 Light Truck or Delivery Services Drivers

Our data includes, for each vacancy, the number of applicants. This allows us to calculate labor market tightness at the occupation by local labor market level as (number of vacancies)/(number of applications).

Only about 20% of the CareerBuilder vacancies post salary information. The posted wage is converted into an annual salary if it is hourly. The posted wage is defined as the middle of the range if the vacancy posts a range rather than a single value. We estimate posted wages for a given market and year-quarter as the simple average of the posted wage in the wage-posting vacancies.[2]

[2]Appendix Figure A.1 shows the distribution of log real wages across markets and year-quarters. The distribution is bi-modal and there are a small number of outliers on the left and the right sides of the distribution.

2.2 Measure of labor market concentration

Job vacancies are strongly differentiated by location as well as occupation. For example, Marinescu and Rathelot (2017) show that applications to a job decline rapidly with distance, although most applications are still outside the applicant's zip code. It is therefore key to define labor markets geographically to obtain meaningful measures of market concentration.

For our baseline analysis, we use commuting zones (CZs) to define geographic labor markets, and 6-digit SOC codes to define markets by occupational category. Commuting zones are geographic area definitions based on clusters of counties that were developed by the United States Department of Agriculture (USDA) using data from the 2000 Census on commuting patterns across counties to capture local economies and local labor markets in a way that is more economically meaningful than county boundaries. According to the USDA documentation, "commuting zones were developed without regard to a minimum population threshold and are intended to be a spatial measure of the local labor market." Marinescu and Rathelot (2017) also show that 81% of applications on CareerBuilder.com are within the commuting zone. As an example, for our baseline analysis we treat "Accountants and Auditors" in the commuting zone around Kansas City as a labor market. We also conducted robustness checks using single counties for our market definition instead of commuting zones.

We do our analysis at the quarterly level, since the median duration of unemployment is about 10 weeks in 2016 BLS (2017). We consider for our market share calculations all vacancies or applications that occur within a given quarter, including vacancies with missing wages.

We keep an unbalanced panel of 61,017 CZ-occupation-year-quarter observations, covering the period 2010Q1-2013Q4, 681 commuting zones, and 26 SOC 6-digit occupations. These markets all include at least one vacancy with a posted wage.

Our baseline measure of market power in a labor market is the Herfindahl-Hirschman Index (HHI) calculated based on the share of vacancies of all the firms that post vacancies in that market. The HHI is widely used as a measure of market concentration in the industrial

organization literature and in antitrust practice. An advantage of this measure of market concentration is that there are guidelines for what represents a high level of market concentration. The DOJ/FTC guidelines: an HHI above 1500 is "moderately concentrated", and above 2500 is "highly concentrated". Also, a merger that increases the HHI by more than 200 points, leading to a highly concentrated market is "presumed likely to increase market power".

While these measures and thresholds are generally used to evaluate market concentration in product markets, the antitrust agency guidelines state that "[t]o evaluate whether a merger is likely to enhance market power on the buying side of the market, the Agencies employ essentially the framework describe above for evaluating whether a merger is likely to enhance market power on the selling side of the market." This implies that adverse effects of mergers on the inputs market, including the labor market, are part of the legal framework for evaluating mergers.

The formula for the HHI in market m and year-quarter t is

$$\text{HHI}_{m,t} = \sum_{j=1}^{J} s_{j,m,t}^2 \tag{2.1}$$

where $s_{j,m}$ is the market share of firm j in market m. For the HHI based on vacancies, the market share of a firm in a given market and year-quarter is defined as the sum of vacancies posted in CareerBuilder by a given firm in a given market and year-quarter divided by total vacancies posted in the website in that market and year-quarter. We treat all vacancies posted by a recruiting / staffing firm as belonging to the same firm, since we cannot observe which firm the recruiting / staffing firm is hiring for.

In addition to calculating HHIs for each labor market based on shares of vacancies, we also calculated HHIs based on shares of applications (Expressions of Interest, i.e. clicking on the button "Apply now"). For the HHI based on applications, we define the market share of a firm in a given market and year-quarter as the sum of applications through the website to a given firm in a given market and year-quarter divided by the total number of applications to all firms

in that market and year-quarter.

We calculate labor market concentration using posted vacancies and applications to those vacancies. Concentration could also be computed using observed employment (albeit not with this dataset). The concentration of employment is almost certainly lower than the concentration of vacancies–only a subset of the firms in a given labor market (defined by geography and occupation) will be hiring at any given time. But our measure of concentration based on vacancies is more relevant for active job seekers, especially in light of evidence of lengthening job tenures, which implies that a given position will remain filled for longer (Hyatt and Spletzer, 2016). Moreover, our results about the effect of concentration on wages are estimated from variation in concentration over time within a labor market, and in our robustness checks we aggregate vacancy postings over time, which reduces observed concentration levels–toward what we would probably observe if concentration were computed from firm-level employment.

Table 1 shows summary statistics of the main variables used in our analysis. The average real wage was 41,547 USD (in 2009 dollars). The average market in our sample had 20 firms, 83 vacancies, 441,156 searches, and 3,612 applications. The average HHI based on vacancies was 3,157. The average HHI based on applications was somewhat higher: 3,480, reflecting the fact that not all vacancies received the same level of interest from job seekers.

Table 1 also shows that the average HHI calculated using shorter time periods than the quarter is higher, and the HHI using longer time periods is lower but still highly concentrated. The population-weighted quarterly HHI is lower and moderately concentrated. As would be expected, county-level HHIs are higher than CZ-level HHIs, and state-level HHIs are lower than CZ-level HHIs. With the exception of a state-level definition of the labor market, all alternative definitions still show moderate to high concentration.

Figure 1 shows a map of all the commuting zones in the United States color-coded by the average HHI, based on vacancy shares. Commuting zones around large cities tend to have lower levels of labor market concentration than smaller cities or rural areas. This suggests a new explanation for the city-wage premium (Yankow, 2006; Baum-Snow and Pavan, 2012):

cities, and especially large cities, tend to have less concentrated labor markets than rural areas.[3]

Appendix Figure A.2 shows the distribution of the HHIs based on vacancies and of the HHI based on applications in our sample. Under both definitions for market shares, the median market is moderately concentrated, while the average market is highly concentrated.

Appendix Figure A.3 shows the average HHI, based on vacancy shares, by 6-digit SOC occupation. The occupations that are least concentrated on average are "Customer service representatives", "Sales representatives, wholesale and manufacturing, technical and scientific products", and "Registered nurses", each with an average HHI of around 2,000. The occupations that are most concentrated on average are "Farm equipment mechanics", "Rail car repairers", and "Light truck or delivery services drivers", each with an average HHI well above 5,000 (which is the level of concentration of a symmetric duopsony market).

In summary, we find that reasonably defined local labor markets are highly concentrated on average. A limitation of our analysis is that we only use vacancies posted on the CareerBuilder website.[4] Given that CareerBuilder is the largest job-posting website in the United States, the high level of concentration was somewhat surprising to us, especially given that many economists' prior seems to be that labor market monopsony power, if it exists at all, is due primarily to search frictions Boal and Ransom (1997). Our findings can, however, be consistent with the search frictions story, in the sense that if we consider a longer time period the market is less concentrated (Table 1). Also, while the CareerBuilder website does not contain all vacancies, it is likely that, for job seekers who use it, the site is a main source of information on the labor market.

[3] Manning (2010) shows evidence on plant size that is consistent with lower monopsony power in cities.

[4] This is less of an issue for interpreting the within-market variation over time in concentration, which is the basis for the regression analysis in the following section.

3 Labor market concentration and wages

Figure 2 shows a binned scatter plot of the log real wage and log HHI based on vacancies. The two variables are strongly correlated and the association is close to log-linear. Appendix Figure A.4 shows a similar relationship between the real wage and market concentration obtains when using the log HHI based on applications instead of the log HHI based on vacancies.

This negative correlation between market concentration and real wages is consistent with standard oligopsony theory, which predicts that firms in more concentrated labor markets should be able to pay workers wages below their marginal product. Of course, we cannot infer a causal relationship from this correlation alone. It could be driven, for example, by the fact that larger cities tend to have both a higher number of firms and higher wages, perhaps due to a higher cost of living. To address this issue, we conduct panel regressions that control for commuting zone by occupation effects, and identify the effect purely from variation in concentration and wages over time within a given commuting zone-occupation pair.

3.1 Empirical specification: OLS and IV

Our baseline specification is the following:

$$\log(w_{m,t}) = \beta \cdot \text{HHI}_{m,t} + \gamma \cdot X_{m,t} + \alpha_t + \nu_m + \varepsilon_{m,t}, \tag{3.1}$$

where $\log(w)$ is the log real wage in market m in year-quarter t, $\text{HHI}_{m,t}$ is the corresponding HHI, $X_{m,t}$ is a set of controls, and α_t and δ_m are year-quarter and market (commuting zone-occupation) fixed effects and $\epsilon_{m,t}$ is an error term.

For each definition of the HHI, we run a first specification without any controls $X_{m,t}$, and then a specification controlling for log tightness (defined as the number of vacancies divided by the number of applications in a labor market) in the commuting zone and occupation for a given year-quarter. We then run a third specification controlling for year-quarter by com-

muting zone and year-quarter by SOC fixed effects, to control for *any* possible changes in the characteristics of the commuting zone or the occupation over time. We cluster standard errors at the commuting zone-occupation level.

The HHI is potentially endogenous, because market shares, and especially application shares, are likely to be affected by the wages of the different job vacancies. In addition, the number of firms posting vacancies in a labor market is itself endogenous. While we control for commuting zone-time fixed effects, which would rule out that the estimated effects could be driven by local economic conditions or demographic changes over time, there is still the possibility that they could be driven by changes in labor demand or labor supply at the level of the occupation-commuting zone pair. (Our control for local labor market tightness, which is a time-varying measure of labor demand & supply at the occupation-commuting zone level, already limits this concern).

To further address this issue, we instrument the HHI with the average of $\log(1/N)$ in other commuting zones for the same occupation and time period (where N refers to the number of firms in the market). That is, for each commuting zone-occupation-time period combination, we calculate the average of $\log(1/N)$ for the same occupation for every other commuting zone. We use $\log(1/N)$ instead of HHI as the instrument because it is less likely to be endogenous, as it does not depend on market shares. This provides us with variation in market concentration that is driven by national-level changes in the occupation, and not by changes in the occupation in that particular local market. For example, if the demand for customer service representatives falls in the Chicago area, this could both decrease wages and increase concentration, since fewer firms would likely be recruiting. In a different scenario, if the number of customer representatives looking for jobs declines, this falling supply could both increase wages and decrease the number of vacancies, hence decrease concentration. By instrumenting with the number of firms posting vacancies for customer service representatives in other areas, we rule out a direct effect of labor demand or labor supply in Chicago on the HHI.

This type of instrumental variables strategy is commonly used in industrial organization to

address the endogeneity of prices in a local product market. For example, Nevo (2001) uses prices in other geographic markets to instrument for city-level prices of various products in the ready-to-eat cereal industry. Outcomes in other geographic units have also been used as instruments in Autor, Dorn and Hanson (2013), who instrument for growth in US imports from China using Chinese imports in other high-income countries.

The main threat to identification is that labor demand shocks could be correlated across areas. For example, a national level decline in the demand for customer service representatives would likely increase concentration and decrease wages in most labor markets. Therefore, the instrument protects us against a spurious correlation between concentration and outcomes that is due to local changes in labor demand, but not against national-level changes in labor demand (for an occupation relative to other occupations) that influence both concentration and other labor market outcomes.

3.2 Regression results

We find that higher labor market concentration is associated with significantly lower real wages. Table 2 Panel A shows the results from the baseline wage regressions. In the first regression, using vacancy-share HHIs and without controls, we find that a one log point increase in the HHI is associated with a decline in wages of about 0.035 log points. Specifications (2) and (3) show that controlling for log tightness and does not substantially change the result. We consider specification (3) to be the baseline for OLS results since it is the most saturated.

Specifications (4) to (6) show analogous results but based on the instrumental variables estimation strategy. The estimated effect is still negative but much larger in absolute value. The IV estimate may be higher because it corrects the endogeneity bias from market-level labor supply and demand effects, and possibly also corrects for measurement error. A one log point increase in the HHI is associated with a decline in wages of about 0.14 log points. This implies that an increase in HHI of 200 in a market with an HHI of 2000 (moderately concentrated), which is a decline of 10 log points, is associated with a decline in wages of about 1.4%. Going from the

25th percentile of market concentration to the 75th percentile of market concentration is associated with a decline in wages of 5% using specification (3), and of 17% using specification (6), our baseline specification for the IV.[5]

3.3 Controlling for job titles

Marinescu and Wolthoff (2016) showed that job titles are an important predictor of wages and are informative about the type of job and required skills beyond a pure wage-signalling effect. We are thus interested in studying to what extent market concentration affects wages through job titles and to what extent it has a direct effect beyond the effect that can be explained by job titles. For this purpose, we conducted regressions at the individual vacancy level controlling for job title fixed effects (based on strings capturing the first three words in the vacancy's job title).

The results are shown in Table 2 Panel B. The first three specifications show results using the same controls as in the market-level baseline regressions, and find similar results. The fourth specification controls for commuting-zone times job-title fixed effects. The effect has a negative sign and is statistically significant, but the magnitude is about half of the effect without job title fixed effects. This mitigation of the effect is present in both the OLS and the IV specifications. This indicates that the effect of an increase in market concentration on wages is expressed both directly through lower wages conditional on a job title, as well as by increasing the likelihood of posting lower-wage job titles.

[5]The corresponding effects using the 25th and 75th percentiles of the residuals from a regression of log HHI on market and CZ-year-quarter fixed effects are 2% using specification (3) and 6% using specification (6).

4 Robustness checks

4.1 Interaction with city size

We tested whether the negative effect of market concentration on wages is driven by small or large cities, or whether it holds across the whole range of city sizes in our sample. For this purpose, we ran a specification interacting the vacancy HHI in a market with a 5th-order polynomial in the percentile of the population of that market's commuting zone, which we instrument using a 5th-order polynomial in the mean of log(1/N) for the same occupation in other CZs.

The estimated effect of market concentration as a function of commuting zone population percentile is shown in Figure 3, together with 95% confidence bands. The effect is negative and significant over the range of population going from the 10th to the 90th percentile, and it it is higher (in absolute value) for smaller markets than larger markets.

4.2 Alternative concentration measures

As a robustness check, we estimated panel IV regressions similar to our baseline specification from Table 2, column 6, but using log 1/N as the measure of market concentration. The results are similar to the baseline, and shown in Appendix Table A.1, specification (1).

We also estimated regressions using log HHI based on share of applications as the measure of concentration, again with similar results. The results are in Appendix Table A.1, specification (2). These results show that our results are robust to using a range of standard measures of market concentration, and therefore not driven by a particular choice of measure.

4.3 Alternative market definitions

We chose to use commuting zones as a market definition because they were designed to capture meaningful geographic labor markets based on commuting patterns across counties.

However, the correct geographic definition for labor market competition for hiring is still an open question. We decided to test the sensitivity of our results by using an alternative definition based on counties, and running panel IV specifications analogous to our baseline.

The results are shown in Appendix Table A.1, specification (3). The estimated coefficient is similar to those in the baseline, indicating that our results are robust to other plausible geographic labor market definitions.

4.4 Excluding monopsony (HHI=1) markets

The histogram in Appendix Figure A.2 shows that many markets in the sample only have one firm hiring. We checked that our estimates are not sensitive to excluding these markets by running additional regressions that do exactly that. The results from the panel IV specification are reported in Appendix Table A.1, specification (4), which show that the magnitude and significance of the estimated effect is similar to the analogous specification in the baseline.

4.5 Purely cross-sectional specification

Our baseline specification identifies the effect of market concentration on wages purely from variation within a market over time. One may also be interested in identification from cross-sectional variation. We implemented a specification based on the entire 2010-2013 period. We included CZ fixed effects and 6-digit SOC fixed effects, so that our estimates are not driven by variation in average wages across cities, or in average wages across occupations. Similar to the baseline, we instrument the log HHI using the log 1/N, except that we use the number of firms for the entire period. The impact of concentration on posted wages is still negative and significant in this cross-sectional data (Appendix Table A.1, specification (5)). Furthermore, we find that the impact of concentration on prevailing wages measured from the BLS occupational employment statistics is also negative and significant (specification (6)). This alleviates the concern that our results are driven by the less than fully representative nature of our data.

4.6 Controlling for fraction of vacancies posting wages

An important limitation of the dataset is that only a fraction of the vacancies on CareerBuilder post wages. To address this issue, we ran a panel IV specification controlling for the fraction of vacancies in each market that post wages. Appendix Table A.1, specification (7) shows the results. We find that this variable has a positive effect on wages, but does not meaningfully affect the coefficient on log HHI.

4.7 Controlling for tightness based on searches instead of applications

Another concern is that the tightness measure could be endogenous with respect to wages: high-wage vacancies get more applications, so this lowers the tightness measure. As an alternative measure of tightness, we use the log of the ratio of total vacancies in the market to total searches in the market. Searches should not be affected by posted wages, so this can address the endogeneity concern. Appendix Table A.1, specification (8) shows the results from the corresponding panel IV specification, which are similar to those in the baseline specification.

4.8 Remaining limitations

Our analysis accounts for a number of biases in the estimation of the relationship between labor market concentration and posted wages. However, it is important to acknowledge that national level changes in labor demand or supply by occupation could affect both concentration and real wages.

Only 20% of vacancies post wages, and we are therefore not measuring all wages in a given occupation by commuting zone market. However, Marinescu and Wolthoff (2016) show that the distribution of posted wages on CareerBuilder is very similar to the distribution of wages for employed workers in the Current Population Survey. Therefore, posted wages are typical of wages overall in the labor market.

Our data contains the most frequent occupations by number of vacancies on CareerBuilder.com,

and a number of manufacturing occupations. Therefore, our results, while fairly general, do not necessarily apply to the whole US labor market.

More broadly, our data comes from a single website, CareerBuilder.com. While this is the largest US website, and contains overall about a third of US vacancies, it does not contain all vacancies in the occupations that are in our sample. This could lead us to overestimate labor market concentration. At the same time, CareerBuilder vacancies are the relevant ones for job seekers that use it as their primary website for job search.

5 Discussion and conclusion

Labor economists are increasingly questioning the assumption of almost-perfectly-competitive labor markets (Card et al., 2016), although that research has not yet thoroughly addressed policy implications for antitrust.[6]

And yet, the idea that monopsony power can harm efficiency dates to the origins of American antitrust policy. One of the reasons Senator John Sherman gave for legislating against monopoly was that "[i]t commands the price of labor without fear of strikes, for in its field it allows no competitors." (Congressional Record 2457, 1890) The horizontal merger guidelines recognize that the same framework can be applied to market power on the part of buyers as well as sellers, although there have been few merger challenges premised on monopsony theories of harm, and none in which the labor market is where the monopsony power is being challenged. Antitrust agencies have recently brought to court conduct cases regarding labor market monopsony in which they found evidence of overt written agreements not to compete for workers (DOJ, 2007, 2010). However, much disagreement remains over whether antitrust regulators should consider labor market power more broadly, for example as a factor in merger analysis.

[6] An exception is Ashenfelter and Krueger (2017), who study the prevalence of anti-competitive no-poaching language in franchising contracts. The FTC has jurisdiction over those contracts, though they have never enforced against restrictive labor provisions.

In this paper, we contribute to this growing debate by calculating measures of market concentration in local labor markets for the most frequent occupations on the leading employment website CareerBuilder.com. We have shown that concentration is high, and increasing concentration is associated with lower wages. Our results suggest that the anti-competitive effects of concentration on the labor market could be important. The type of analysis we provide could be used to incorporate labor market concentration concerns as a factor in antitrust analysis.

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Table 1. Summary statistics. This table shows summary statistics for our sample consisting of commuting zone-occupational code (6-digit SOC) labor markets over the period 2010Q1–2013Q4.

	Mean	Std. Dev.	Min	Max	Obs.
Real Wage	41547.36	36216.76	4.71	5504385	61017
Vacancies	82.95	224.39	1	17928	61017
Applications	3612.96	14416.02	0	528289	61017
Searches	441156.09	1385720.05	0	78808601	61017
Log Tightness	-2.9	1.36	-7.64	4.48	60200
Number of Firms	20.03	35.78	1	571	61017
HHI (Vacancies, CZ Quarterly) - Baseline	3157.02	2923.92	66.04	10000	61017
HHI (Applications, CZ Quarterly)	3480.17	3061.03	0	10000	61017
HHI (Vacancies, CZ Monthly)	3251.69	3004.4	74.23	10000	132461
HHI (Vacancies, CZ Semesterly)	3090.29	2872.86	58.57	10000	38503
HHI (Vacancies, CZ Yearly)	2970.47	2780.11	51.91	10000	24060
HHI (Vacancies, CZ Whole Period)	2541.6	2498.51	54.76	10000	8979
HHI (Applications, CZ Monthly)	3790.37	3132.18	0	10000	132461
HHI (Applications, CZ Semesterly)	3315.38	3017.08	0	10000	38503
HHI (Applications, CZ Yearly)	3120	2900.47	0	10000	24060
HHI (Applications, CZ Whole Period)	2722.97	2653.19	0	10000	8979
HHI (Vacancies, CZ Quarterly, Population-Weighted)	1690.74	1942.09	66.04	10000	61013
HHI (Applications, CZ Quarterly, Population-Weighted)	1848.51	2127.09	0	10000	61013
HHI (Vacancies, County Quarterly)	4222.52	3331.36	76.09	10000	111109
HHI (Applications, County Quarterly)	4563.85	3369.67	0	10000	111109
HHI (Vacancies, State Quarterly)	1358.48	1634.58	64.01	10000	15124
HHI (Applications, State Quarterly)	1458.09	1781.24	0	10000	15124

Table 2. Effect of Market Concentration on Real Wages: Panel Regressions.
Data are for the period 2010Q1-2013Q4. We cluster standard errors at the market level.

Panel A: Market-level regressions

	Dependent Variable: Log(Real Wage)					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Log HHI (Vacancies)	-0.0347***	-0.0399***	-0.0378***	-0.141***	-0.143***	-0.127***
	(0.00377)	(0.00392)	(0.00406)	(0.0191)	(0.0181)	(0.0176)
Log Tightness		0.0113***	0.0132***		0.0283***	0.0305***
		(0.00320)	(0.00357)		(0.00427)	(0.00479)
Market (CZ × 6-digit SOC) FE	✓	✓	✓	✓	✓	✓
Year-quarter FE	✓	✓		✓	✓	
Year-quarter FE × CZ FE			✓			✓
Observations	59,485	58,642	56,679	59,485	58,642	56,679
R-squared	0.674	0.672	0.715	0.667	0.666	0.711
Kleibergen-Paap F-stat				854.3	1051	996.7

Panel B: Vacancy-level regressions

	Dependent Variable: Log(Real Wage)							
	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log HHI (Vacancies)	-0.0327***	-0.0331***	-0.0314***	-0.0154***	-0.200***	-0.192***	-0.188***	-0.116***
	(0.00453)	(0.00476)	(0.00500)	(0.00377)	(0.0398)	(0.0361)	(0.0370)	(0.0184)
Log Tightness		0.000665	0.00429	0.00818***		0.0540***	0.0737***	0.0315***
		(0.00342)	(0.00462)	(0.00297)		(0.0133)	(0.0180)	(0.00601)
CZ × 6-digit SOC FE	✓	✓	✓		✓	✓	✓	
Year-quarter FE	✓	✓		✓	✓	✓		✓
Year-quarter FE × CZ FE			✓				✓	
CZ × Job-Title FE				✓				✓
Observations	1,023,295	1,021,185	1,020,510	955,641	1,023,295	1,021,185	1,020,510	955,641
R-squared	0.533	0.533	0.541	0.849	0.522	0.524	0.534	0.847
Kleibergen-Paap F-stat					45.62	56.18	58.72	150.1

*** p<0.01, ** p<0.05, * p<0.1

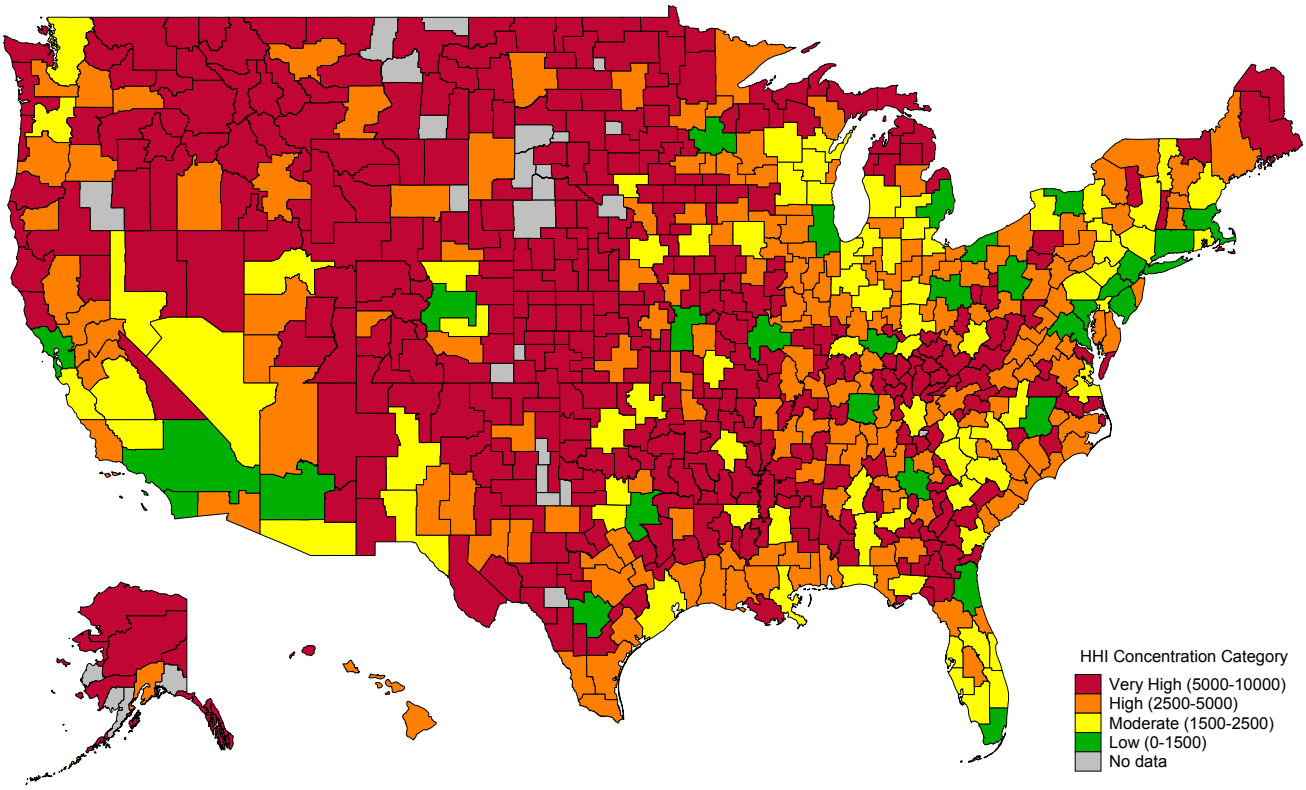


Figure 1. Average HHI by commuting zone, based on vacancy shares. This figure shows the average of the Herfindahl-Hirschman Index by 6-digit SOC occupation code for labor markets over the period 2010Q1–2013Q4. The categories we use for HHI concentration levels are: "Low": HHI between 0 and 1500; "Moderate": HHI between 1500 and 2500; "High": HHI between 2500 and 5000; "Very High": HHI between 5000 and 10000. These categories correspond to the DOJ/FTC guidelines, except that we add the additional distinction between high and very high concentration levels around the 5,000 HHI threshold. Market shares are defined as the sum of vacancies posted in CareerBuilder.com by a given firm in a given market and year-quarter divided by total vacancies posted in the website in that market and year-quarter.

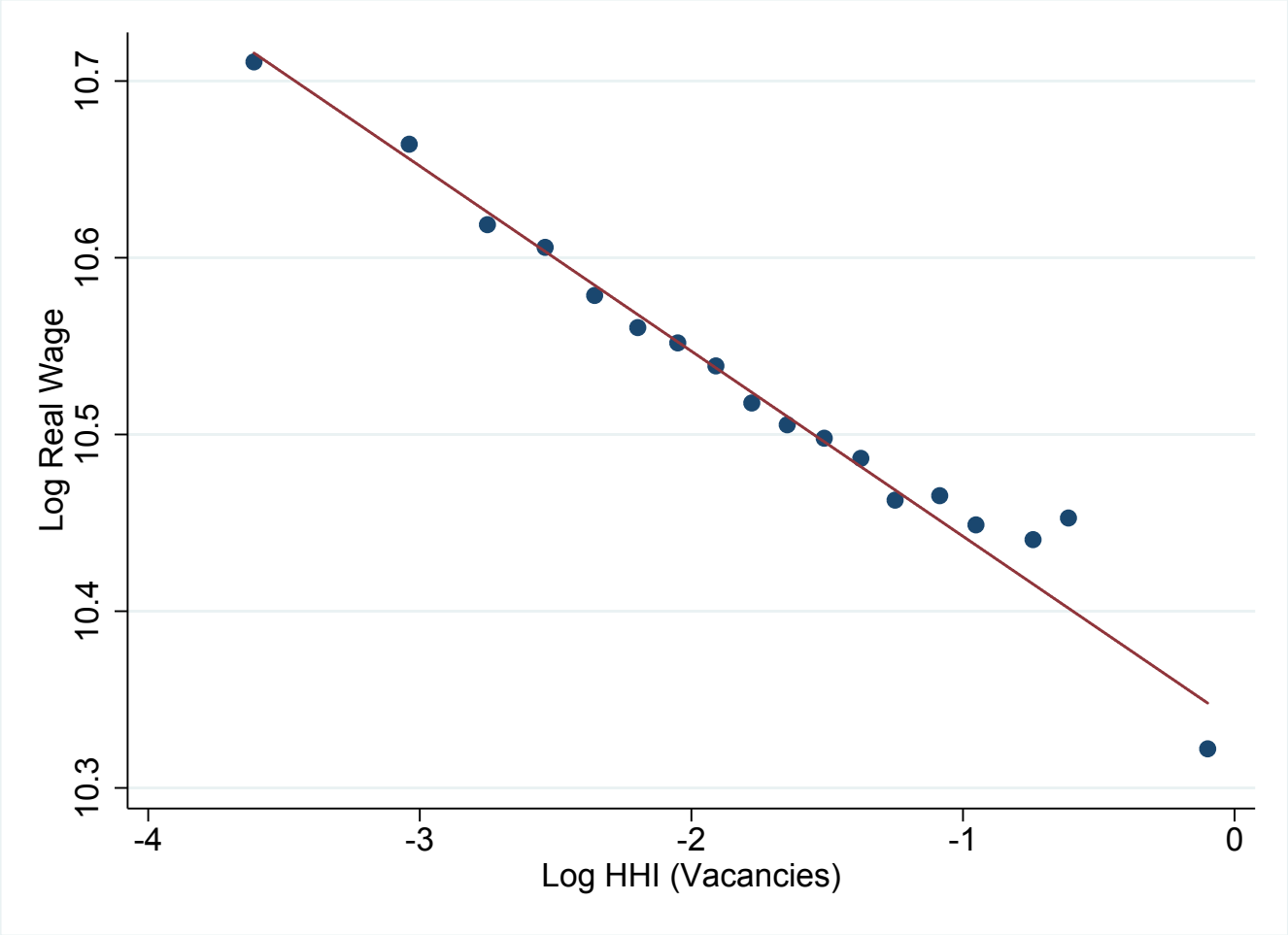


Figure 2. Binned scatter of log HHI based on vacancies and log real wage. This figure shows a binned scatter plot of log HHI based on vacancy shares and log real wage in the same market, using 18 quantiles.

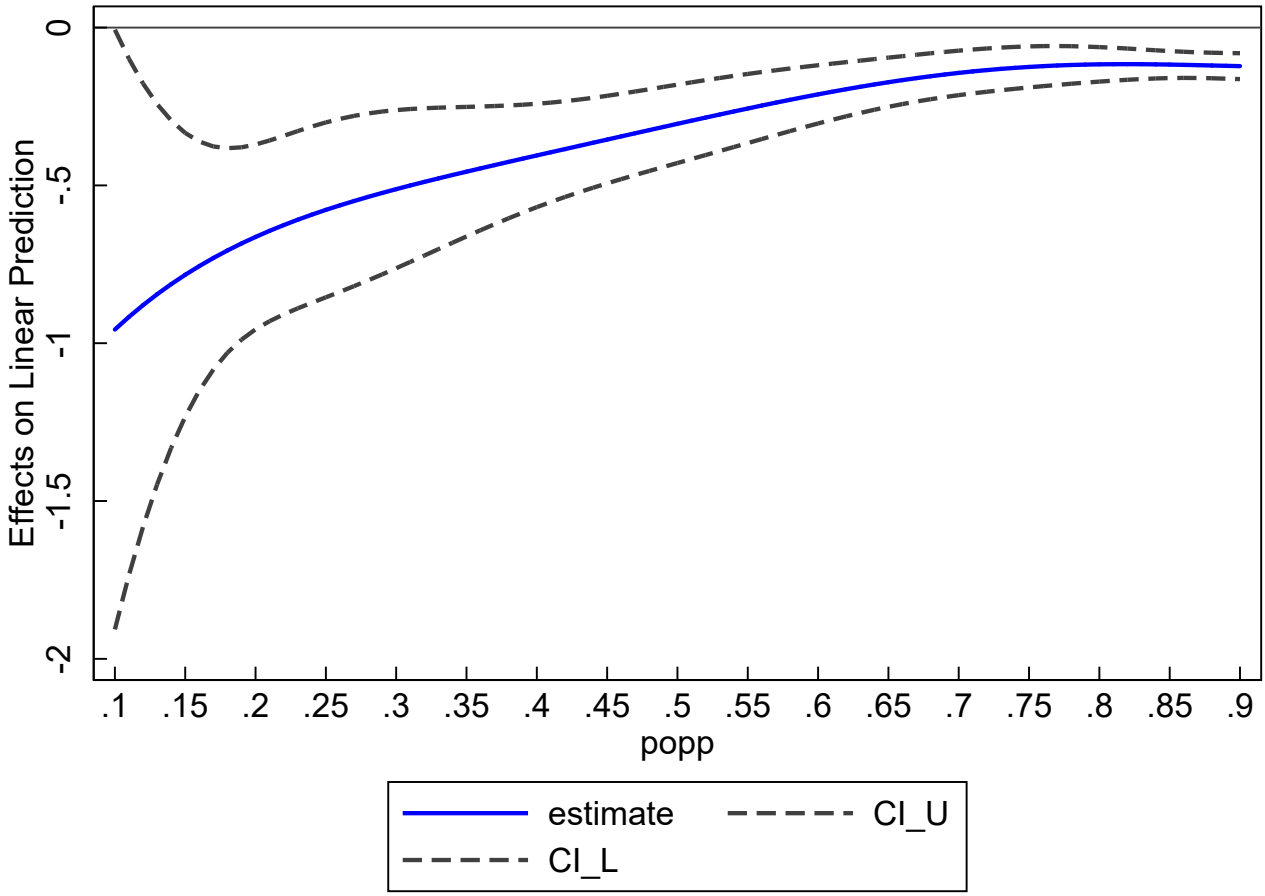


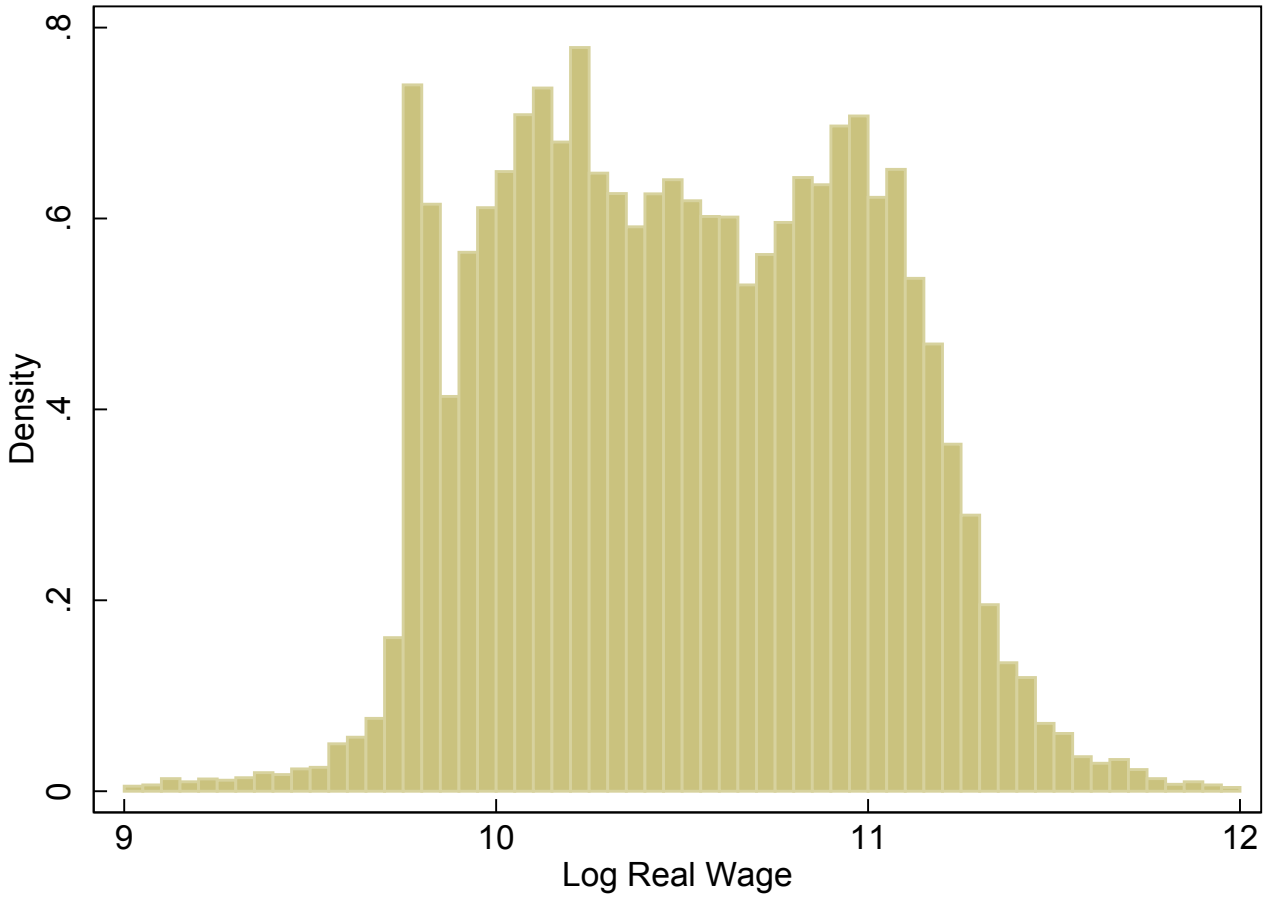
Figure 3. Effect of Log HHI (Vacancies) on Log Real Wage by Commuting Zone Population Percentile. Estimated effect from a panel IV regression of log real wage on a 5th order polynomial in log HHI (in terms of vacancies), instrumented with a 5th order polynomial in average log 1/N in other commuting zones for the same occupation, controlling for log tightness, CZ-6-digit SOC fixed effects and time fixed effects. Data are for the period 2010Q1-2013Q4. We cluster standard errors at the market level.

A Appendix Tables and Figures - For Online Publication

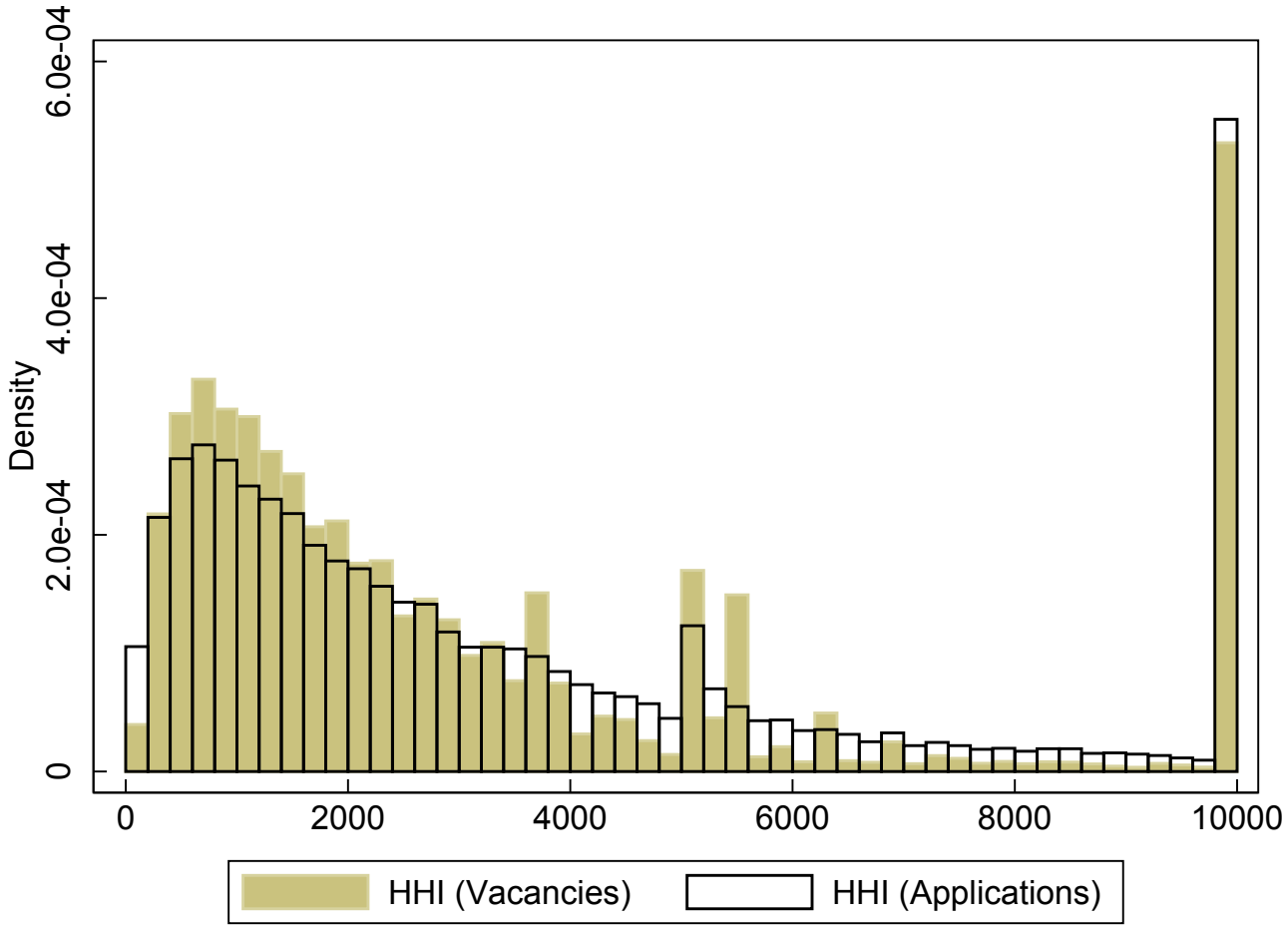
Appendix Table A.1. Effect of Market Concentration on Real Wages: Robustness Checks (Panel IV).
Data are for the period 2010Q1-2013Q4. We cluster standard errors at the market level. In all cases, we report results from a panel IV specification using the average of log(1/N) for the same 6-digit SOC occupation in other commuting zones.

	Dependent Variable: Log(Real Wage)							
	$1/N$	HHI (EOI)	County	Excluding HHI=1	Cross-Section	Cross-Section (BLS Wages)	Fraction Posting Wage	Search Tightness
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (1/N)	-0.0882***							
	(0.0123)							
Log HHI (EOI)		-0.116***						
		(0.0149)						
Log HHI (Vacancies)			-0.142***	-0.131***	-0.0710***	-0.0431***	-0.157***	-0.125***
			(0.0153)	(0.0185)	(0.0178)	(0.00837)	(0.0231)	(0.0185)
Log Tightness	0.00898***	0.00213	0.0248***	0.0359***	0.0251**	0.00620	0.0325***	
	(0.00345)	(0.00314)	(0.00337)	(0.00582)	(0.0101)	(0.00445)	(0.00510)	
Fraction Posting Wage							0.147***	
							(0.0305)	
Log (Vacancies/Searches)								0.0252***
								(0.00447)
CZ FE × 6-digit SOC FE	✓	✓		✓			✓	✓
Year-quarter FE × CZ FE	✓	✓		✓			✓	✓
County FE × 6-digit SOC FE			✓					
Year-quarter FE × County FE			✓					
CZ FE					✓	✓		
6-digit SOC FE					✓	✓		
Observations	56,679	58,642	94,714	51,607	8,895	5,363	56,679	57,383
R-squared	0.714	0.666	0.722	0.705	0.609	0.944	0.714	0.716
Kleibergen-Paap F-stat	2008	1998	1473	907.1	344.8	486.6	1305	1968

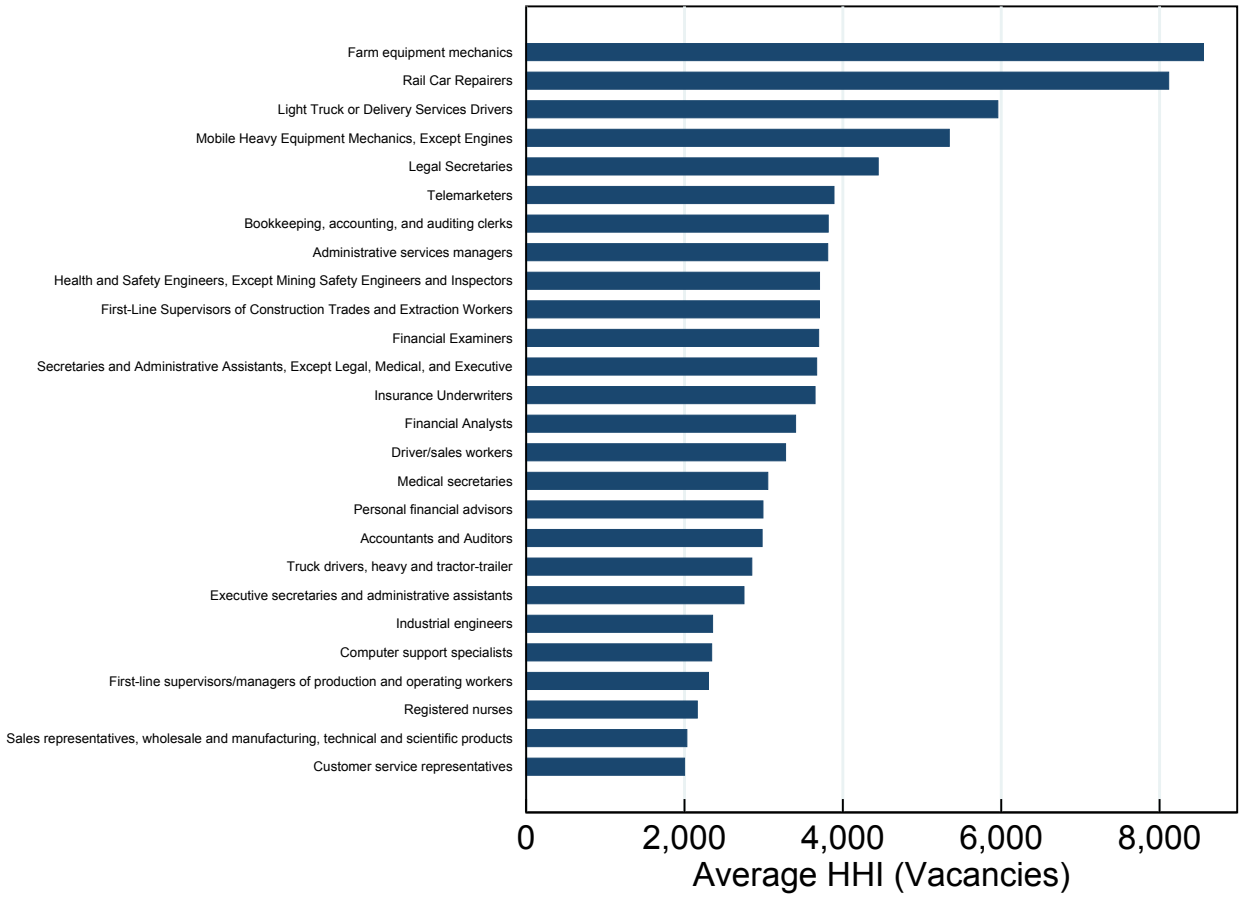
*** p<0.01, ** p<0.05, * p<0.1



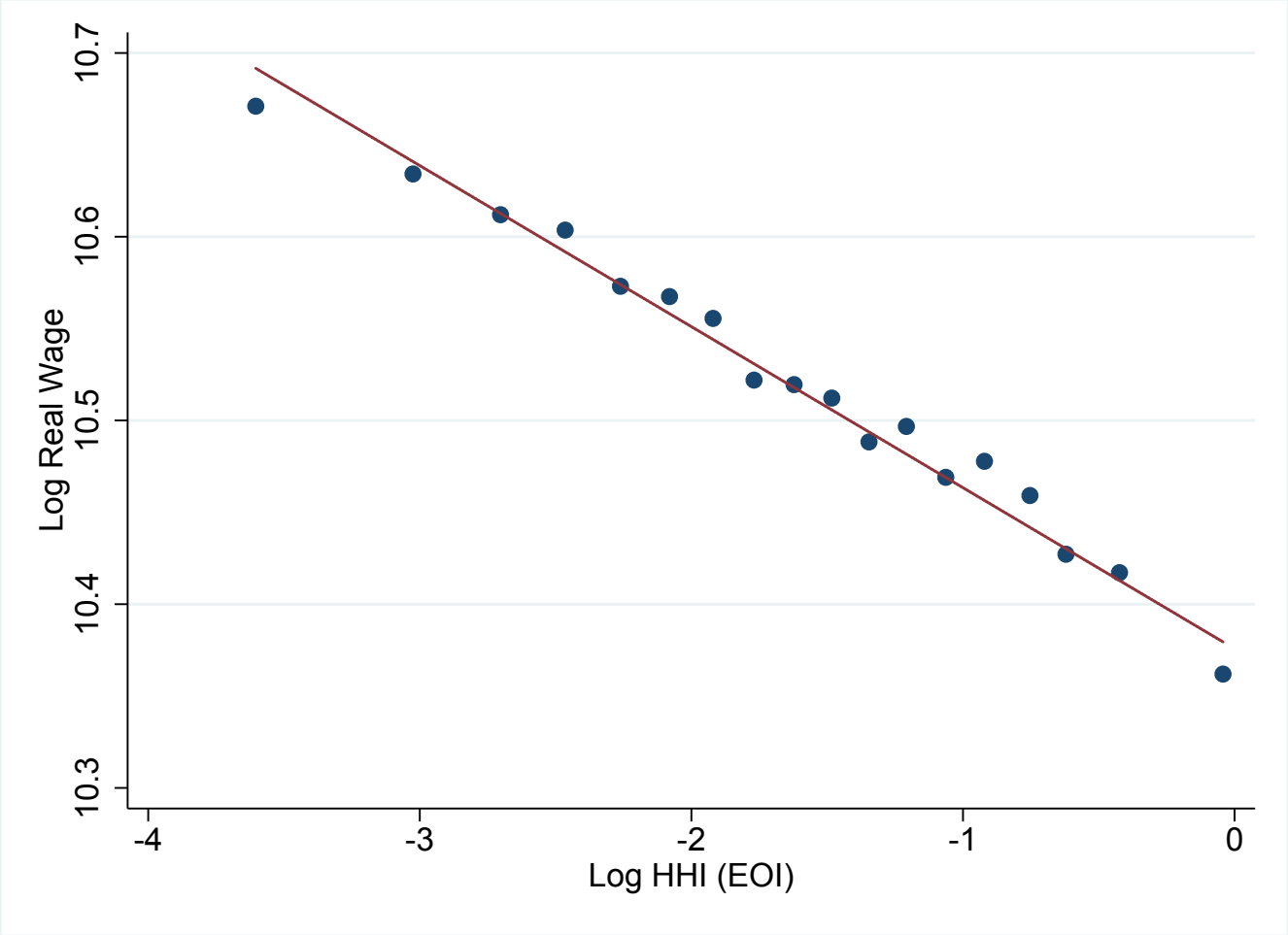
Appendix Figure A.1. Histogram of log real wages across markets. This figure shows a histogram of the log real wage for labor markets over the period 2010Q1–2013Q4. The real wage is defined as the average wage across wage-posting vacancies in a given market and year-quarter, divided by the consumer price index for that year-quarter.



Appendix Figure A.2. Histogram of HHIs based on application shares and vacancy shares. This figure shows a histogram of the Herfindahl-Hirschman Index for labor markets over the period 2010Q1–2013Q4. Market shares are defined as either the sum of vacancies posted in CareerBuilder.com by a given firm in a given market and year-quarter divided by total vacancies posted in the website in that market and year-quarter, or as the sum of applications (EOI) through the website to a given firm in a given market and year-quarter divided by the total number of applications to all firms in that market and year-quarter.



Appendix Figure A.3. Average HHI by occupation, based vacancy shares. This figure shows the average of the Herfindahl-Hirschman Index by 6-digit SOC occupation code for labor markets over the period 2010Q1–2013Q4. Market shares are defined as the sum of vacancies posted in CareerBuilder.com by a given firm in a given market and year-quarter divided by total vacancies posted in the website in that market and year-quarter.



Appendix Figure A.4. Binned scatter of log HHI based on applications and log real wage. This figure shows a binned scatter plot of log HHI based on application shares and log real wage in the same market, using 18 quantiles.