National Wage Setting*

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Abstract

How do firms set wages across space? Using vacancy data with detailed job-level information and a survey of HR managers, we show that 35 percent of multi-establishment firms *set wages nationally*, meaning they choose rigid pay structures that compel them to set exactly the same nominal wage for the same job in different regions. We start by showing that a significant minority of firms set identical wages within an occupation across all of their locations. This practice is widespread but more common among high-wage jobs. Next, using the pass-through of local shocks to wages in other locations of the firm, we argue that these identical wages indicate national wage setting. Our survey suggests that firms set wages nationally because nominal, rather than real, wage comparisons matter to workers. Finally, we show that national wage setting matters for the distribution of real wages.

JEL Codes: J24, J45, J33, H56

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1 Introduction

Local labor markets are increasingly dominated by a small number of large firms that operate in many regions. In the US, big firms have grown in large part by expanding into new regions. As such, in 2013, the largest 10% of firms accounted for around 70% of employment in the typical county (Hsieh and Rossi-Hansberg, 2019). Indeed, while the concentration of employment across firms in local labor markets has fallen in the last several decades, the concentration of employment nationally has risen (Autor, Dorn, Katz, Patterson, and Van Reenen, 2020; Rossi-Hansberg, Sarte, and Trachter, 2020). Understanding how large national firms set wages matters for many phenomena, such as wage inequality, the growth of labor market power, and the response of the economy to local shocks.

This paper investigates how firms set wages across space. Firms might vary nominal wages freely to equalize real wages across regions. Alternatively, firms might pay similar nominal wages across regions even if local conditions vary—perhaps to preserve internal equity within the firm or to simplify management (Bewley, 1999). Anecdotes suggest some firms do not vary nominal wages across space. At the bottom of the wage distribution, Amazon, Target and BestBuy announced a minimum wage of $15 per hour for all domestic workers, regardless of location (Derenoncourt, Noelke, and Weil, 2020). Among high wage workers, law and consulting firms often adopt "lockstep compensation," wherein all associates make the same salary regardless of their region. On the other hand, companies such as Facebook and Twitter announced they would reduce the pay of workers who choose to locate outside the Bay Area during the Covid-19 pandemic.

Using a combination of micro and survey data, we find that around 35 percent of firms are *national wage setters*. These firms adopt rigid pay structures, which compel them to set exactly the same nominal wage for the same job in different locations—even if labor market conditions are very different across the locations. We find that they adopt these policies because workers care about nominal pay comparisons.

The primary dataset we use to establish these results contains online job vacancies, provided by Burning Glass Technologies. The dataset includes 10% of US vacancies, either online or offline,

between 2010 and 2020, and provides posted wages for detailed occupations across establishments within a firm.[1,2] Investigating national wage setting with standard administrative datasets is difficult for two reasons. First, without detailed information on job titles, the changing job composition within a firm across regions may mask national wage-setting. For example, even if McKinsey pays the same wage to consultants in Cincinnati and San Francisco, average wages will be lower in McKinsey's Cincinnati location if McKinsey hires more administrative assistants there. Second, most administrative datasets measure earnings and not wages, which masks national wage-setting if workers in San Francisco work longer hours than similar workers in Cincinnati.

The Burning Glass data allows us to overcome these challenges. First, the data contains detailed job level information, meaning we can directly control for changes in job composition across regions. Second, vacancies separately post wages and hours, allowing us to distinguish between wages and earnings. The disadvantage of using vacancy postings is that we do not measure realized wages, which could differ from posted wages if workers negotiate or receive bonuses. This biases our conclusions only if the gap between posted and realized wages varies with geography. We show that the Burning Glass wages closely correspond to the other publicly available wage measures for occupations and regions, suggesting posted wages capture much of the variation in pay across locations. Moreover, our analysis is limited to the set of jobs that post wages online, which, while covering a broad swath of the economy, slightly over represents professional occupations.

We complement these data with a survey that we ran with HR managers and executives. We asked questions about how firms set wages and why they adopt their wage-setting policy. The survey data allows us to test whether realized wages show similar patterns to posted wages, to explore whether our findings are similar for firms outside of our Burning Glass sample, and to explain why firms choose to set wages nationally.

[1]We define a job in a firm as the detailed occupation, measured using 6-digit SOC codes, combined with the pay frequency of the job (e.g. annual or hourly) and pay type in the posting (e.g. base pay or commission). We define an establishment of the firm as the combination of the firm name and the county in which they post the vacancy.

[2]The full dataset collected by Burning Glass contains the universe of online vacancies, which is 70% of total vacancies including vacancies that are not posted online. We study only the vacancies in Burning Glass that post wage information.

We begin the analysis with four descriptive facts about wage setting across space. First, we find a large amount of identical wages across firms' establishments, with 30-40% of postings for the same job in the same firm but in different locations having exactly the same wage. Second, we find that identical wage setting is a choice made by firms for each occupation—for a given occupation, some firms set identical wages across *all* their locations, while the remaining firms set different wages across all of their locations. Third, we demonstrate that identical wages across space are widespread across the economy but are most common in higher-wage occupations. Fourth, we show that firms setting identical wages pay a wage premium.

In the next part of the paper, we argue that firms set identical wages across space in large part because of the phenomenon that we term national wage setting. To fix ideas, we develop a simple model of firms who employ workers in multiple locations. There are two types of firms: national wage setters, who due to a rigidity must pay the same nominal wage everywhere; and local wage setters, who can vary nominal pay across locations. Local wage setters might set equal wages across space if factors such as the local cost of living do not vary across space, whereas national wage setters set equal wages across space regardless. The model makes two predictions about the wage dynamics of national wage setters. First, wage changes in different establishments of national wage setters should "bunch" at the same values. Second, for national wage setters, local shocks to wages in a single establishment should affect wages throughout the firm. We test these predictions and conclude that about 35% of multi-establishment firms are national wage setters.

Next, we ask *why* firms choose to set wages nationally. We find evidence that firms set wages nationally because comparisons of nominal pay matter to workers. Specifically, according to our survey, firms do not vary nominal wages across space for three reasons. First, these firms hire workers on a national labor market, and nationally mobile workers compare nominal wages—instead of real wages—across space. Second, fairness norms matter to workers. Third, jobs setting national wages often require workers to transfer across locations within the firm. We also detect patterns consistent with each of these three reasons in the Burning Glass data. We find less evidence that firms set wages

nationally to simplify management.

Lastly, we study the implications of national wage setting for the distribution of real wages. We show that within the same job and across regions, firms tend to pay a relatively low real wage in regions with a high price level.

Related literature. The main contribution of our paper is to show that due to a rigidity, a large share of firms set the same nominal wage for the same job in different regions. This finding relates to several literatures.

First, several papers show that multi-establishment firms do not respond to local conditions in the context of price setting. For example, DellaVigna and Gentzkow (2019) show that most firms in the retail sector set the same price for the same product in different regions of the United States; Cavallo, Neiman, and Rigobon (2014) show that global retailers set the same price for the same product in different countries of the same currency union.[3] We complement these papers by studying wage setting instead of price setting, by studying the entire economy beyond the specific setting of the retail sector, and by combining survey and micro data to understand the reasons why firm behavior responds little to local conditions.

A second literature studies the firm-level determinants of worker pay. An emerging body of evidence shows that different firms often pay similar workers different wages (Card, Heining, and Kline, 2013; Song, Price, Guvenen, Bloom, and Von Wachter, 2019). There is a range of explanations for this phenomenon, including amenities (Sorkin, 2018; Lamadon, Mogstad, and Setzler, 2019), rent sharing of firm productivity (Card, Cardoso, Heining, and Kline, 2018), and variation in firms' wage setting power due to their market share (Berger, Herkenhoff, and Mongey, 2019; Jarosch, Nimczik, and Sorkin, 2019). We find other reasons why a large share of firms are compelled to pay the same nominal wage to workers in different regions—even when other factors such as amenities may vary tremendously.[4]

[3] Nakamura (2008), Hitsch, Hortaçsu, and Lin (2020) and Cavallo (2018), amongst others, also document such "uniform price setting" in the retail sector. Clemens and Gottlieb (2017) show that Medicare's uniform pricing impacts the pricing strategies of private insurers.

[4] A distinct literature studies the *worker*-level determinants of rent sharing (e.g. Caldwell and Harmon, 2019; Jäger,

Our finding also relates to work on firm wage setting and fairness norms. Various papers show that fairness norms are important for workers' performance either in qualitative survey data (Blinder and Choi, 1990; Campbell III and Kamlani, 1997; Bewley, 1999) or in specific contexts (Card, Mas, Moretti, and Saez, 2012; Breza, Kaur, and Shamdasani, 2018; Dube, Giuliano, and Leonard, 2019). We show with micro data that fairness norms affects firm wage setting for a large share of firms in the economy.[5] Additionally, the previous evidence on fairness norms shows that workers compare nominal pay to others *within* locations of a firm. Our survey finds workers also compare nominal pay *between* locations of the firm, in part because some workers are in national labor markets.[6]

Several recent papers share our focus on how firm pay varies across space. Hjort, Li, and Sarsons (2020) study wage setting in multinationals using granular firm by occupation data. Their results complement ours by showing that firms anchor the real wage paid overseas to wages paid at headquarters. By contrast this paper compares *nominal* wages across space, which is not feasible using international data on wages paid in different currencies. Our different setting leads to sharper results on the nature of firm wage setting. For instance, we are able to show that some jobs set identical nominal wages across space, that this wage setting behavior concentrates entirely in a subset of firms, and that nominal pay comparisons by workers are an important reason for why firms set uniform wages. Another related paper is by Derenoncourt, Noelke, and Weil (2020), who study the consequence for local labor markets of four large firms' national minimum wage policies. Instead, we document that national wage setting is common across firms and across the wage distribution, and then investigate the causes.[7]

Schoefer, Young, and Zweimüller, 2020).

[5]This finding complements Saez, Schoefer, and Seim (2019), who study a payroll tax cut in Sweden. They argue fairness norms can explain rent sharing of a payroll tax cut to workers who are ineligible for the policy, but are in the same firm as beneficiaries of the policy.

[6]This finding echoes Simonsohn and Loewenstein (2006), who find homebuyers are affected by nominal comparisons of house prices across locations.

[7]Three more papers on wage setting are Propper and Van Reenen (2010), who study the consequences of national wage setting among nurses in English hospitals on healthcare quality; Alfaro-Urena, Manelici, and Vasquez (2019), who report survey evidence that multinational corporations partly pay high wages overseas to ensure cross-country pay fairness; and Boeri, Ichino, Moretti, and Posch (2019), who study the effect of national wage setting among unions in Italy, compared with flexible wage setting among unions in Germany, on regional outcomes in each country.

Lastly, the findings in this paper relate to a third literature in which various macroeconomic models assume that firms cannot pay different workers different wages within the firm, and then explore the implications for diverse outcomes such as wage dispersion, unemployment fluctuations, firm dynamics, the spillover effects of minimum wages, or the evolution of the labor share (see, e.g., Burdett and Mortensen, 1998; Manning, 2003; Gertler and Trigari, 2009; Moscarini and Postel-Vinay, 2013; Gouin-Bonenfant, 2018; Fukui, 2020; or Engbom and Moser, 2021). We provide direct evidence justifying this assumption, by showing that many firms pay the same wage for all workers hired into a given job.

2 Data Description

The main dataset we use comes from Burning Glass Technologies, a company that scrapes online job postings. Throughout the paper, we complement these data with information from a survey that we ran with HR managers and executives.

2.1 Job Level Data from Burning Glass

Our main data source is an establishment-level dataset of job vacancies covering 2010-2019. The dataset was developed by Burning Glass Technologies. Burning Glass collects data from roughly 40,000 company websites and online job boards, with no more than 5% of vacancies from any one source. Burning Glass applies a deduplication algorithm and converts the vacancies into a form amenable to data analysis. In total, Burning Glass covers around 70% of vacancies in the United States (Carnevale, Jayasundera, and Repnikov, 2014). However, only 17% of vacancies in Burning Glass include wages, meaning that the subset of vacancies that include wages, the main sample that we study in this paper, is roughly 10% of total US vacancies.[8]

[8]By matching establishments to 2018 data from the analytics company Dun and Bradstreet, we estimate that these vacancies cover about 8% of private employment.

For those vacancies that include wage information, we have detailed information on the wage, including the pay frequency of the contract (e.g., whether pay is annual or hourly) and the type of salary (e.g. whether compensation includes a bonus). Given pay frequency, we define the wage as the annual earnings for that job. Roughly half of the vacancies with wage information post a range of salaries, rather than a point. For jobs that post a range, we use the midpoint of the range, but we explore the robustness of the main findings to either excluding vacancies that post a range or to making alternate assumptions about the distribution of salaries across locations within the posted range. Appendix Table A1 shows that wages are more likely to be posted at smaller firms, in occupations that have lower wages, and for jobs with lower education and experience requirements.[9]

In addition to the posted wage, the vacancies specify several additional features of the job and characteristics of the desired worker that we use throughout our analysis. On the worker side, the vacancy includes information on required years of education or years of experience. On the job side, the language of the job posting reveals an occupation, which Burning Glass codes into a six-digit (SOC) occupation code.[10] On average, firms in a given year post vacancies in 39 occupations. Throughout the analysis, we define a job as the combination of the occupation, salary type, and pay frequency (e.g. pest control workers with hourly base pay).[11] Lastly, in addition to detailed occupations, we explore alternate specifications defining jobs using the 13,436 standardized job titles

[9]Appendix Table A2 shows that firms are also slightly less likely to post wages in higher cost of living counties, but the magnitude of this difference is very small. Specifically, we find that, after controlling for the composition of vacancies across locations, firms are 0.3 percentage points less likely to post a wage on a vacancy in one of the superstar cities (i.e. LA, San Francisco, NYC or Washington DC) than in other locations. Additionally, conditional on posting wages anywhere, 80 percent of occupations in a given firm and year have posted wages in all counties in which there are vacancies. These statistics suggest that the strategic posting of wages across locations is unlikely to meaningfully affect our estimates of national wage setting.

[10]Six-digit occupation codes are highly granular, including occupations such as pest control worker, college professor in physics, and home health aide. The detailed occupation information is an important advantage of the Burning Glass data, as it is often not reported in administrative datasets (e.g. the ADP payroll data used in Grigsby, Hurst, and Yildirmaz, 2019).

[11]We define the job using salary type and pay frequency since it is challenging to make wage comparisons across those categories. We find that, within an occupation, firms rarely post vacancies with different salary types and pay frequencies, with only 5 percent of occupation and firm pairs posting multiple salary types across locations within a year and 3 percent posting multiple pay types. This small dispersion suggests that firms do not strategically vary the structure of pay across locations and therefore, looking within jobs defined by the combination of occupation, salary type and pay frequency is unlikely to bias our estimates of wage uniformity.

included in the vacancy data.

Burning Glass also assigns a firm name and county to each vacancy, which allows us to define establishments. We cleaned firm names using a deduplication procedure outlined in Appendix Section A1.2. We define an establishment of a firm as the collection of vacancies assigned to a firm within a county.[12] 72 percent of employers only have vacancies within a single establishment in a given year, but among those firms with multiple locations, the average number of establishments is 8.

One important feature of the Burning Glass data is that it provides measures of posted wages, not the realized wages paid to workers. Appendix Figure A1 plots the tight positive relationship between the median posted wage in Burning Glass in each 6-digit occupation within a metro area against the corresponding measure from the Occupational Employment Statistics (OES) data – when Burning Glass wages change by one percent, occupation wages from the OES also change by roughly 1 percent. We more extensively probe this relationship in Appendix Section A1.1 and show that i) all types of posted wages in Burning Glass closely track realized wages in the OES data and ii) the tight relationship in Figure A1 applies not only to median wages; the 10th and 90th percentiles of the wage distribution within an occupation and MSA are also highly correlated. These patterns suggest that at the detailed occupation and region level, posted wages in Burning Glass are very close to realized occupation wages in the OES.

Lastly, for our main analysis, we make several sample restrictions. Appendix Table A3 reports the sample restrictions, and how they affect the number of observations. Our main sample includes only those vacancies with non-missing wage, occupation, industry, and location information in the private sector and not in a military occupation. We collapse to have one observation per year in each establishment, occupation and pay group (e.g. hourly base pay) and take the average salary across vacancies. In Appendix Figures A2 and A3, we document how well the resulting sample represents employment in overall US economy. We over-represent occupations in computing, transportation,

[12]We also make use of Burning Glass' firm level industry information. Vacancies are assigned 2 and 3 digit industry codes in Burning Glass when industry information is available in the text of the vacancy. We assign to each firm the industry in which it posts the most vacancies.

and healthcare and under-represent sales and construction occupations. Additionally, the sample over-represents the transportation industry and the West Coast of the country.

2.2 Survey

We supplement the Burning Glass data with a survey that we administered to human resource professionals across the U.S. The survey was run in partnership with a large HR association to which tens of thousands of HR professionals belong. The survey was designed to collect extra evidence on firm wage-setting policies and to understand the motivation behind these choices.

We sent the survey to roughly 3,000 HR professionals who belong to the association and had a 13% response rate. The sample of respondents primarily work at large firms with more than 500 employees (see Appendix Figure B1), and work in a range of industries. We have a particularly large number of respondents from manufacturing, professional and scientific industries, and finance (see Appendix Figure B2). For our analysis, we drop all respondents who work at firms operating in only one city, since we are interested in the behavior of firms that operate in multiple regions.[13] The majority of respondents are HR managers or executives and are directly involved in setting pay (Appendix Figure B4).

In the survey, we asked respondents questions about how their firm sets pay across geographic locations, as well as a series of questions designed to understand the factors that inform their pay-setting strategy. More details on the sample and survey design are provided in Appendix B1.

3 Descriptive Facts on Identical Wages

We begin by presenting descriptive findings on wage uniformity within the firm across regions. We organize the patterns into a set of four empirical facts.

[13] Appendix Figure B3 shows the number of states (panel A) and cities (panel B) in which firms operate.

Fact 1: A large share of wages are set identically within firms across locations.

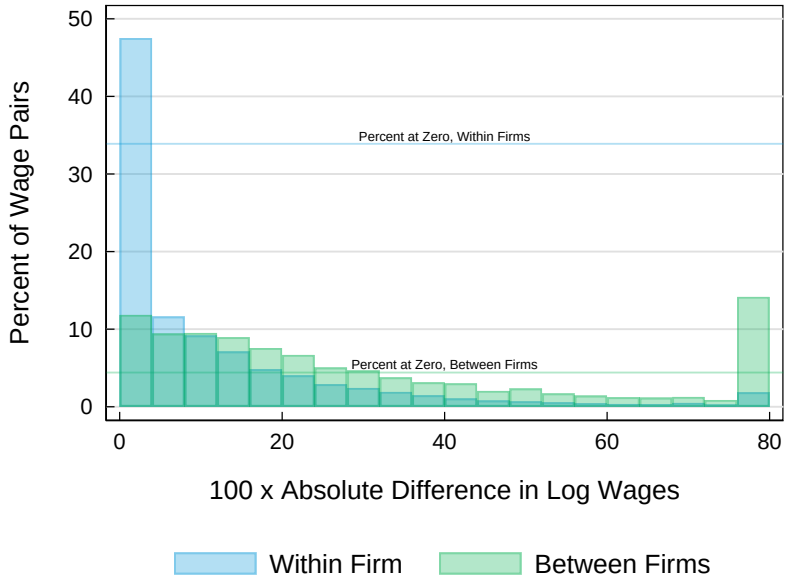
We begin by demonstrating that a large share of wages are set identically within firms across locations. To this end, we calculate the difference in the posted wage for within-firm job pairs, which we define as postings within the same year in the same job and the same firm but in different counties (i.e. postings for accountants at Deloitte in Boston and San Francisco). For each of these pairs, we construct a corresponding between-firm pair for the same job in the same locations but with the job in the second location being in a different firm in the same industry (i.e. postings for accountants at Deloitte in Boston and accountants at Ernst & Young in San Francisco). Figure 1 shows the distribution of wage differences for the within-firm pairs (blue) and the corresponding between-firm pairs (green). Approximately 35 percent of within-firm pairs post *exactly* the same wages, while only 8 percent of between-firm pairs post exactly the same wage.[14] That numbers rises to 39% if we consider all within-firm wage pairs rather than just those with a between-firm match. Moreover, 50% of within-firm pairs are within 5% of each other, while only 15% of between-firm pairs are that close to each other.

The uniformity in Figure 1 reflects national rather than regional patterns. Appendix Figure A5 divides the pairs into those that are within the same census division and those that are in different census divisions. It then plots the fraction of within-firm pairs at all differences in the wage. We see that within-firm uniformity is only slightly more prevalent for geographically-close pairs (e.g Boston and New York City) than for pairs that are geographically more dispersed (e.g. Boston and Miami).

Our survey results closely mirror these patterns within job postings. Figure 2 shows responses to the question "Which of the following describes how your firm sets pay bands (wages) across locations

[14]The left panel of Appendix Figure A4 shows that about 38 percent of within-firm job pairs post exactly the same wage when we define jobs using detailed job titles rather than occupations, suggesting that detailed 6-digit occupation codes capture much of the differences in job characteristics across space. We define jobs using occupations in the baseline analysis since many job titles are unique to firms and therefore do not have a natural between-firm comparison. Specifically, on average, job titles have only 61 firms posting within them in any given year while occupations have 643 firms in any given year. However, this suggests that the degree of uniformity would be even larger using this more detailed job definition.

Figure 1: Distribution of Wage Comparisons Between and Within Firms

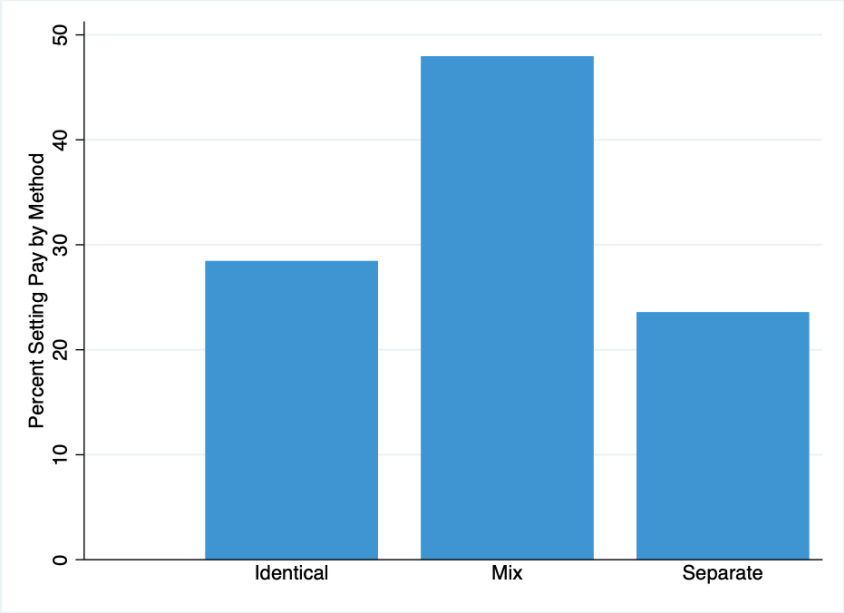


Notes: This figure shows the distribution of wage differences for within- and between-firm pairs. Differences in the log of the wage are top-coded at 0.8.

for the majority of your workers?"[15] Respondents could choose one of three options: pay bands (wages) are determined separately for each establishment, are set identically so that workers with the same job title face the same pay band (wage), or sometimes separately but not always. Nearly 30% of respondents state that they work at firms that set wages identically across establishments, where the majority of workers with the same job title face the same pay band or wage. An additional 45% of firms set pay identically for some, but not all, of their jobs ("Mix"). Only around 25% of respondents report working at a firm that sets different wages for workers with the same job title but who are working in different establishments ("Separate").

[15]Earlier in the survey, we ask respondents whether their firm primarily uses pay bands, where workers face a minimum and maximum wage, or wages, where workers are offered a single wage.

Figure 2: Survey Responses: Method of Setting Wages



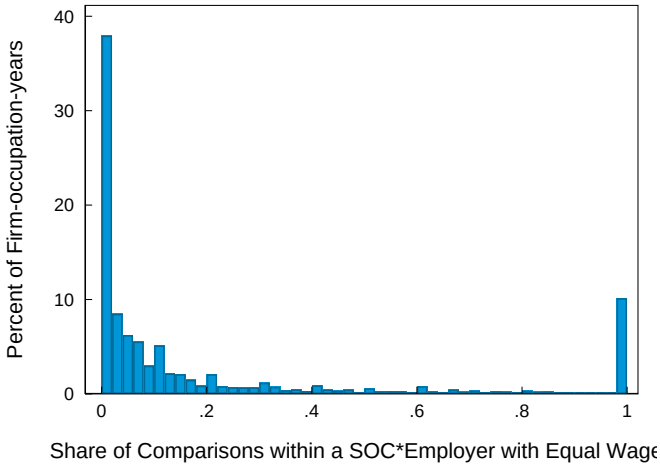
Notes: This figure shows survey responses to a question asking how the respondent's firm sets pay bands (or wages) across locations for the majority of its workers. "Identical" means that a respondent stated that pay bands (wages) are set identically across establishments so that workers with the same job title face the same pay band. "Mix" means that a respondent stated that pay bands (wages) are sometimes determined separately but not always. "Separate" means that a respondent stated that pay bands (wages) are determined separately for each establishment/plant/store. The exact question asked is shown on pages 5/6 in Appendix B1.

Fact 2: Identical wages are a characteristic of occupations within firms.

The previous figures demonstrate that 30-40 percent of within-firm job wage comparisons across counties are exactly the same. This pattern could be the result either of some firms setting identical wages for all their jobs or a larger set of firms setting identical wages for some of their jobs. Figure 3 demonstrates that the data supports the latter, with identical wages being a choice that firms make separately for each occupation within the firm. We see this first in Panel A, where we plot the share of within-firm pairs within a job and year that are identical. For example, a value of 1 in this figure would mean that, in a given year, a firm posted the same wage for accountants in all regions in which they posted a job. In order to avoid bunching coming from a small number of jobs, we include only the firm-job-years in which there are at least 5 pairs of jobs (i.e. the sample in row 6 of Appendix Table A3). The distribution in Panel A is clearly bimodal, with around 40 percent of jobs within firms

Figure 3: Prevalence of Identical Wages Within the Firm

(a) Within-Job Shares



(b) Within-Firm Shares



Notes: In the left panel, the sample excludes job cells where there are fewer than 5 within-firm pairs. This results in 25,377 firms in panel A. In the right panel, we further condition the sample to include the set of firms with at least 1 national occupation and at least 3 occupations. National occupations are defined as those where at least 80% of wage pairs are the same.

having no wages that are exactly the same and about 10 percent of jobs within firms being entirely uniform. This implies that firms tend to either set wages in a job completely uniformly across all locations or vary it across *all* regions in which they hire.[16]

Panel B of Figure 3 shows, instead, how prevalent identical wages are across jobs within a firm. Specifically, this histogram shows the fraction of occupations within a firm that are nationally identical, which we define as those occupations within the firm where at least 80 percent of the comparisons are identical. We limit the sample to firms that post in at least 3 occupations and have at least 1 occupation that is classified as nationally identical. We see that, while some firms set nationally identical wages for all occupations, most do it only in a subset of their occupations. In sum, setting identical wages across space is not a characteristic of the firm (i.e. it is not the case that Deloitte sets uniform

[16]Appendix Figure A6 shows that within the firm, the probability that posted wages are the same across pairs is decreasing in the geographic distance between the establishments and in the differences in price levels. However, while this slope exist, the magnitude is very small – in establishments that are 4000 miles away from each other are the same, 28 percent of job pairs within the firm are identical, which is only 4 percentage points less than job pairs that are within 20 miles of each other.

wages for both its accountants and janitors) or of the location (i.e. it is not the case that Deloitte sets identical wages in Austin and Dallas but in NYC and Boston), but rather a choice made by the firm for each occupation.

Motivated by the patterns in Figure 3, throughout the rest of the analysis, we define an occupation within a firm as being nationally identical if at least 80 percent of the within-firm wage pairs in a given year are the same, and we define a firm as being an identical wage setter if at least 50% of their occupations in that year are nationally identical according to that definition. Lastly, a job is nationally identical if it is within an occupation and firm that are nationally identical, and the job pays the wage that is set for the majority of jobs in that occupation and firm.[17] Using these relatively strict definitions, we find that among firms with at least 4 establishments in a given year, 19 percent of jobs are nationally identical and 32% of firms are identical wage setters.[18] These estimates from job vacancies are very similar to the almost 30% of HR managers in the survey who reported working in firms setting all wages nationally. Note, however, that there is also a substantial amount of wage uniformity that occurs in so-called "mixed" firms, where wages are set identically for a subset of jobs. These firms do not quality as an identical wage setting firm by our strict definition.

Fact 3: Identical wages are widespread but more common in high-wage jobs.

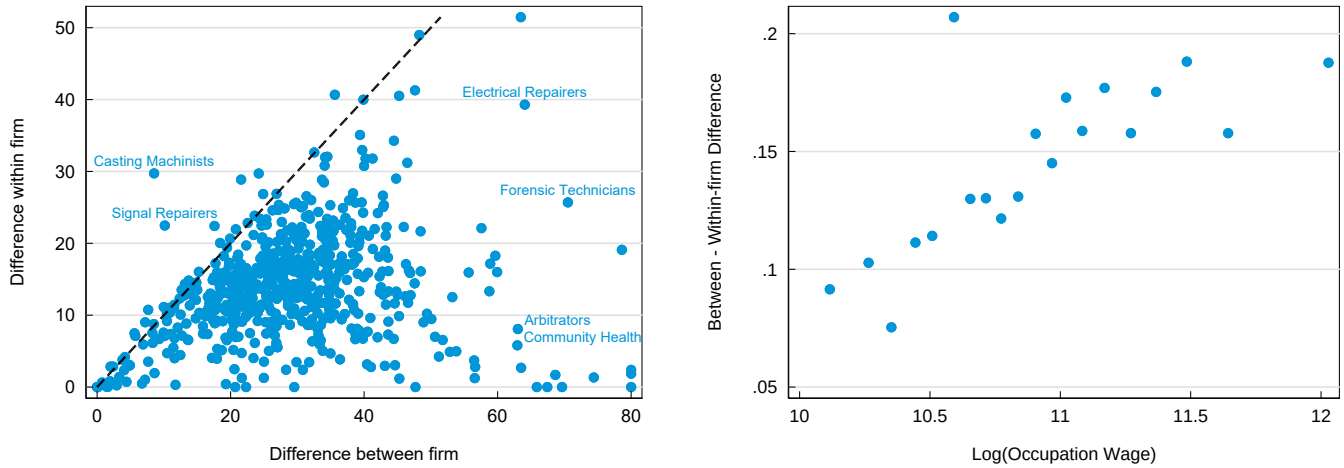
We find that identical wage setting across locations is not limited to one part of the economy. The left panel of Figure 4 demonstrates some degree of within-firm wage uniformity for the vast majority of 6-digit occupations.[19] The y-axis plots the average absolute difference in the log of posted salaries within the firm for each occupation, while the x-axis shows the same measure for the matched

[17] Since these definitions require a sufficient number of pairwise comparisons, we only define identical wage setting for the firm by occupation by year cells where there are at least 4 establishments. We summarize this sample in row 6 of Appendix Table A3.

[18] Appendix Table A6 shows the robustness of the main finding about the relative wages of nationally identical jobs (i.e. fact 4) to using alternate definitions of identical wage setting

[19] Moreover, Appendix Figure A7 shows that, in all 2-digit occupations, jobs within the same firm across space are more likely to have exactly the same wage than jobs in different firms. The difference is largest in sales and education occupations and smallest in food preparation and serving occupations.

Figure 4: Uniform Wage Setting by Occupation



Notes: The left panel shows a scatterplot including 644 occupations. For both the y- and x-axis, the difference is defined as 100 x the absolute difference in log wages. The right panel shows a binscatter that includes the same 644 underlying occupations. The occupation wage is defined using 2018 wages for employed workers from the Occupational Employment Statistics from the Bureau of Labor Statistics.

between-firm pairs. 95 percent of the 6-digit occupations lie below the 45 degree line, meaning that wages across space are more similar within firms than between firms.

Identical wage setting is moderately more common in high wage occupations, as we show in the right panel of Figure 4. The y axis takes the difference in wages for each within firm pair, and subtracts this number from the difference in wages for the matched between firm comparison pair. The x axis is the average wage of all workers in that occupation. A higher value indicates that between-firm wage differences are relatively more common compared to within-firm wage differences. We can clearly see that wage uniformity is more common in higher-wage occupations.[20]

Identical wage setting across locations of the firm is also present in all industries. Figure A8 shows the percent of jobs that are have nationally identical wages in each industry, which ranges

[20]One possible explanation for these patterns is that low-wage occupations are bound by the minimum wage. This would induce uniformity in wages both within and across firms, making the relative within-firm uniformity less stark. However, we find similar cross-occupation patterns even when we exclude all pairs where one of the observations is at the binding minimum wage for that state (i.e. the maximum of the state minimum wage and the federal minimum wage) or when looking only at within-firm differences across the wage distribution, suggesting that the minimum wage is not driving these patterns.

from above 30 in transportation and management to below 10 in accommodation and agriculture.[21] Jobs with identical wages are also relatively evenly distributed across the country. Appendix Figure A10 shows the fraction of jobs in each state that set identical wages. No state has fewer than 10 percent and some states, like Maine and Arkansas, have up to 35 percent. On average, states with higher GDP per capita have fewer jobs with identical wages, as do urban areas and in particular, superstar cities like DC, New, York, San Francisco and Los Angeles (see Appendix Table A7).[22]

Lastly, in Appendix Table B2, we use the survey data to explore whether certain types of firms are more likely to set identical wages across establishments. Specifically, we test whether identical wages are more common in large firms (column 1), firms that have mainly salaried employees (column 2), and firms with centrally-determined pay and hiring (columns 3 and 4). We find that firms with centrally-determined pay are more likely to post identical wages, but otherwise do not find any strong relationships concerning these variables.

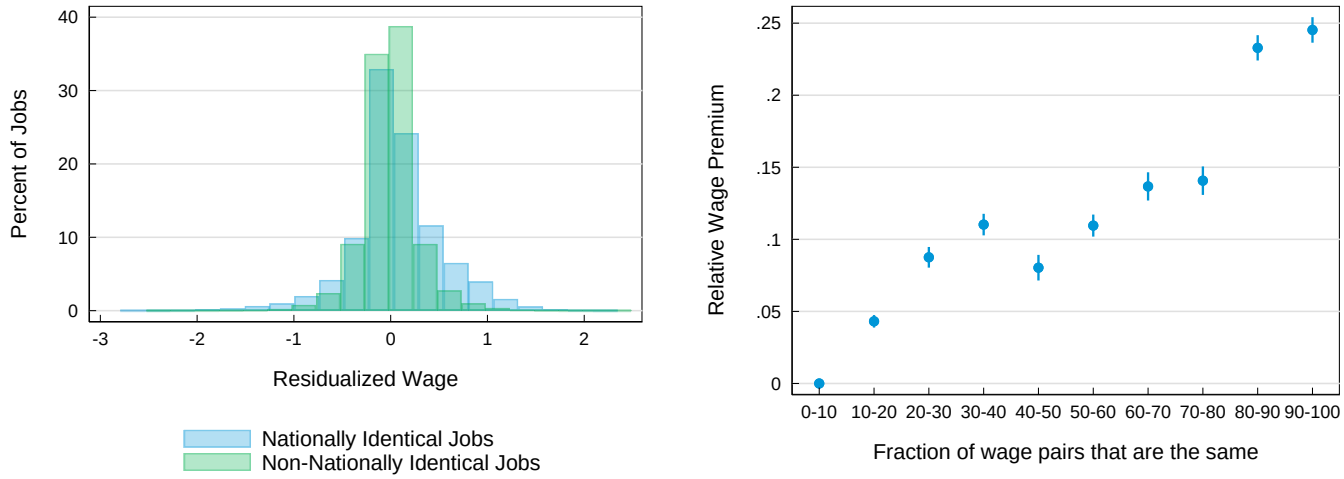
Fact 4: Firms setting identical wages pay a wage premium.

The left panel of Figure 5 plots the wages of jobs with nationally identical wages, in comparison to the wages of jobs without nationally identical wages in the same labor market. Specifically, we plot the distribution of residual wages, residualized from a regression of log posted wages on occupation by year by county by industry fixed effects. These fixed effects control for differences in wages that stem from the different distribution of nationally identical jobs across labor markets. Additionally, since large firms tend to pay higher wages on average, we also include in the regression a quadratic in establishment size and a quadratic in firm size. The blue bars show the distribution of residual wages for nationally identical jobs while the green bars show the same for all other jobs. The distribution

[21] In the main analysis we restrict attention to the private sector and exclude all firms in public administration. Appendix Figure A9 shows the baseline descriptive figures for the public sector and reveals that identical wages are present but less prevalent.

[22] In contrast, we do not find any evidence of selection of identical wage setters out of high cost of living areas in our survey. Specifically, we found that just under 30 percent of respondents at national wage setting firms did not operate in a high COLA area, compared to just over 40 percent for those reporting setting national wages for some jobs and just over 30 percent for those who report setting separate pay across locations.

Figure 5: Relative Wages of National Wage Setters



Notes: Residualized wages in the left panel are the residual from a regression of the log of the posted salary on a quadratic in establishment size, a quadratic in firm size, and fixed effects for occupation by year by county by industry. Identical jobs are defined as those jobs paying the modal wage in occupation by firm by year cells in which at least 80% of wage pairs are the same. The sample includes all firm-job pairs present in at least 4 establishments in that year.

of wages for nationally identical jobs is shifted to the right, demonstrating that nationally identical jobs tend to pay relatively high wages conditional on controls. The right panel of Figure 5 shows that this link between wage uniformity and relative wages is not just a feature of firms that set all wages identically, but rather, the relative wage premium of the jobs within the firm is increasing in the fraction of the establishments in that occupation within the firm that have the same wage.

Table 1 summarizes these patterns with regressions, showing in column 1 that, on average, nationally identical jobs pay 15 percent more than other comparable jobs within their markets. Column 2 shows that this wage premium is smaller in higher-wage occupations, and column 3 shows that the premium is lower in urban areas. Columns 4 and 5 explore the extent to which firms accompany this posted wage premium with higher requirements for education and experience. We find that there are no differences in experience requirements for jobs with nationally identical wages and that the required years of education actually is lower than the typical job in the market. Moreover, Appendix Figure A11 shows that separately for both high-cost and lower-cost of living areas, national jobs do not have greater education or experience requirements – the premium for nationally identical jobs

Table 1: Relative Wages, Education Requirements and Experience Requirements of National Firms

	Outcome:				
	Log Salary			Experience	Education
	(1)	(2)	(3)	(4)	(5)
Nationally Identical Job	0.15	0.59	0.19	0.02	-0.82
	(0.00)	(0.08)	(0.01)	(0.02)	(0.03)
Nationally Identical Job * Avg. SOC wage		-0.04			
		(0.01)			
Nationally Identical Job * Urban			-0.04		
			(0.01)		
Observations	3,580,139	3,549,979	3,555,707	1,557,918	2,767,496

Notes: Regressions in all columns include a quadratic in establishment size, a quadratic in firm size, and fixed effects for job by county by industry by year. National jobs are defined as those jobs paying the modal wage in occupation by firm by year cells in which at least 80% of wage pairs are the same. Sample includes all firm-job pairs present in at least 4 establishments in that year. Average SOC wage is defined using the median wage in the OES data in a given year. Standard errors are clustered at the county level.

is lower in counties with higher prices, but there is no offsetting change in required education or experience to attract workers in those areas.

3.1 Discussion of Descriptive Facts

In this section, we discuss the robustness of the descriptive facts above.

Posted Wages vs. Realized Wages: One key feature of the job vacancy data is that we have information on the posted, rather than the realized, wage. While we find that the posted wages track the geographic distribution of realized wages in each occupation very closely, it is possible that the relationships between posted and realized wages differ in a way that could bias our result. For example, since we take the midpoint of a posted salary range, we would overstate the amount of identical wages for firms that post the same range across locations but adjust wages within the range depending on location.

The most compelling evidence that our use of posted wages is not driving the estimates is that we

find a similar, if not higher, share of firms that do not vary nominal pay across space in our survey data (Figure 2). Our estimates of identical wage setting are also strikingly similar to what large compensation consulting companies have found in their surveys. For example, Empsight, a salary survey company that works with Fortune 500 firms, found in their 2018 survey that 30% of firms do not adopt geographically differentiated compensation policies (Empsight International LLC (2018)). We also show within the vacancy data that the degree of identical wage setting is slightly higher in those postings with a single wage than for those that post a range (see Appendix Figure A12). Moreover, we can bound the potential contribution of posted wage ranges by looking at the degree of identical wage setting within firms when we take the extreme points of the range for within-firm pairs, rather then the mean of the ranges. This would give the amount of identical wages if the realized wages for all wage pairs with posted ranges fell at opposite ends of the ranges, an unlikely extreme outcome, but a useful lower bound. The right panel of Appendix Figure A4 shows that the implied degree of identical wage setting drops with this extreme assumption, but even so, just below 20 percent of these wage pairs are exactly the same.

Worker Composition Across Locations: While using posted wages has several limitations, one key advantage of posted wages relative to realized wages is that they do not explicitly include differences in earnings across workers that are driven by individual characteristics such as performance, experience or education. Our goal is to measure the differences in the wage setting rule, capturing how firms would change the wages of the same workers in the same jobs across locations. Posted wages more closely capture the wage setting rules, while realized wages capture the outcomes of those rules. For example, if accountants in NYC tend to have masters degrees while accountants in Cleveland do not and firms adjust pay based on education, we would see that accountants in NYC earn more than those in Cleveland, although that is not driven by their location but rather is driven by their education. If the accountants in NYC are unobservably more productive (i.e. higher worker fixed effects), they would also earn higher wages even though their pay is not explicitly tied to their

location. These effects are unlikely to appear in the job vacancy data.

We can also use the information within the job posting to directly look for differences in education and experience requirements across locations. Among within-firm wage pairs where the wage is identical, over 90% of the jobs also have identical experience and education requirements, suggesting that firms are not taking the strategy of setting the same nominal wage but instead aiming to attract observably different workers across locations.

Geographic adjustments with other forms of compensation: Firms may tie other forms of compensation to geographic location in order to relax the constraint imposed by setting identical nominal wages across locations. While this behavior would still imply meaningful geographic rigidities in wage setting, it would have different implications for wage inequality and the regional distribution of labor income. Our analysis suggests that these margins of adjustment are present but likely small in magnitude. Specifically, we use information from the job vacancy on whether the position includes a bonus to explore whether firms are more likely to post a bonus for the same job in high-cost of living areas. Appendix Figure A13 shows that firms are only half a percentage point more likely to advertise a bonus in locations with price levels in the top decile, compared to locations with price levels in the bottom decile. Additionally, in our survey, we asked respondents whether bonuses are directly tied to geographic differences in the cost of living. We found that 50% of national wage-setters do not adjust any compensation regionally and that 37 percent reported using bonuses (See Appendix Figure A14). These results further suggest that bonus pay is one method of adjusting for differences in real base wages, but that a sizeable fraction of firms do not use any form of compensation to equalize real wages.

Scope of Burning Glass Data: One concern with the Burning Glass data is that firms setting nationally identical wages may be more likely to post wages than other firms. Appendix Figure A15 uses the survey data to show the prevalence of nationally identical wages separately for firms that report posting wages in their job vacancies and those that report not posting wages. As in the Burning Glass

data, 10 percent of survey respondents state that they work for a firm that posts wages. However, we find that if anything, firms with nationally identical wages are *less* likely to post wages for their job vacancies. This suggests that the estimates within the job vacancy data are informative for the broader set of firms, and that selection into posting wages is not a meaningful source of bias for our estimates.

4 Evidence for National Wage Setting

Our descriptive facts show that within an occupation, a substantial fraction of firms set exactly the same nominal wage in almost all establishments. In this section, we argue identical wages are in large part due to *national wage setting*, meaning firms adopt a rigid pay structure that constrains nominal wages to be the same across their locations.

We begin by developing a simple framework to clarify that firms might set identical wages across space either because firms set wages nationally or because firms set wages flexibly but face similar labor market conditions across their establishments. While wage levels may be similar for both types of firms, wage dynamics are different. Our framework predicts that for firms setting wages nationally: (i) nominal wage changes in different establishments of the same firm and occupation should bunch together; and (ii) an exogenous shock to a single location should pass through to wages in the firm's other locations.

We find strong evidence for both predictions, and conclude that the identical wages that we documented in Section 3 are in large part due to national wage setting. We tentatively conclude that around 35% of multi-establishment firms set wages nationally.

4.1 A Simple Framework for National Wage Setting

There are $i = 1, ..., M$ firms, and $j = 1, ..., N$ regional labor markets, and a unit measure of workers. In each labor market, firm i operates an establishment that posts wages and employs workers. There are

two types of firms. A fraction $\mathcal{N}$ of firms face a rigidity—they are compelled to pay the same nominal wage across all establishments. These firms are national wage setters. The remaining fraction $1-\mathcal{N}$ are local wage setters, who can vary wages across establishments.

Establishments have heterogeneous productivity $A_{ij} = A_i \times A_j$, where A_i and A_j are drawn from distributions that can vary with firm and location, respectively. Each establishment has constant returns to scale production. The establishment posts a wage W_{ij}, which it then pays to all its workers. Given employment L_{ij}, the establishment produces output $Y_{ij} = A_{ij}L_{ij}$ sold in a competitive product market at regional price P_j.

There is a representative household which maximizes a utility function $u(C, L)$, which is increasing and concave in C, and decreasing and concave in L. Total consumption C is a constant elasticity aggregate across consumption of goods produced in each region,

$$C = \left[\sum_{j\in N} \phi_j C_j^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}},$$

where ϕ_j determines the demand for goods produced in region j. Total labor supply L satisfies

$$L = \left[\sum_{j\in N} L_j^{\frac{\eta+1}{\eta}}\right]^{\frac{\eta}{\eta+1}} \qquad L_j = \left[\sum_{i\in M} L_{ij}^{\frac{\rho_j+1}{\rho_j}}\right]^{\frac{\rho_j}{\rho_j+1}}.$$

So, total labor supply L is a constant elasticity aggregate of labor supply to each market L_j, and labor supply within markets L_j is a constant elasticity aggregate across establishments in the market L_{ij}. We allow the elasticity of substitution within markets, ρ_j, to vary across markets. The maximization is subject to a budget constraint $\sum_{j\in N} P_j C_{ij} = \sum_{i\in M}\sum_{j\in N} W_{ij}L_{ij} + \Pi$, where Π is firms' profits, which are rebated lump sum to households. These preferences imply a labor supply curve to each establishment given by

$$L_{ij} = \kappa_j \left(W_{ij}\right)^{\rho_j} \tag{1}$$

where κ_j is a region-specific variable that each establishment treats as exogenous.[23] When ρ_j is finite, the labor supply curve to each firm is imperfectly elastic. Therefore, ρ_j measures the degree of imperfect competition in the labor market. Additionally, η measures the ability of workers to reallocate across regions through migration.[24,25]

A local wage setter i solves a separate problem in each labor market j, aiming to maximize each establishment's profits

$$\max_{W_{ij},L_{ij}} P_j A_{ij} L_{ij} - W_{ij} L_{ij} \tag{2}$$

given the establishment labor supply curve (1). In contrast, national wage setting firms pay the same wage W_i in all establishments, meaning that they sum across establishments to maximize firm profits

$$\max_{W_i,L_{ij}} \sum_{j \in N} [P_j A_{ij} L_{ij} - W_i L_{ij}] \tag{3}$$

again given the establishment labor supply curve (1). So, the rigidity affects only a subset of firms, but affects all locations within these firms. This feature matches our second descriptive fact that national wage setting concentrates in certain firms, but varies little across the firm's establishments.

4.2 Wage Dynamics for National Wage Setters

The framework shows that either type of firm – those subject to a rigidity and those able to set wages flexibly across regions – can set identical wages across locations. First, flexible wage setters will set identical wages across locations if labor market conditions are similar across their locations. The first

[23] In particular, we have $\kappa_j = W_j^{-\rho_j} L_j$ where W_j is the ideal wage index $W_j = \left[\sum_{i \in M} W_{ij}^{1+\rho_j}\right]^{\frac{1}{1+\rho_j}}$.

[24] We can microfound the representative agent's labor supply from a continuum of heterogeneous agents, with nested logit preferences for different regions and different establishments within the region (Berger et al., 2019).

[25] For simplicity, we do not allow multiple occupations in the model. We can think of an establishment in this model as corresponding to an establishment by occupation observation in the data. Alternatively, we could add another "nest" to the labor supply function, to let the representative worker reallocate across occupations within a region.

order condition of the flexible firm's problem (2) implies

$$W_{ij} = \frac{\rho_j}{1+\rho_j} P_j A_{ij} \tag{4}$$

for each establishment j of the firm. The result is standard: establishments set nominal wages as a markdown of nominal revenue product, where the markdown depends on the labor supply elasticity to the establishment. Firms pay the same nominal wage in two establishments if the establishments have the same revenue product and the same markdown. Otherwise, these firms pay different nominal wages across locations. Nominal revenue product can vary due to producer prices P_j or workers' productivity A_{ij}. Regional markdowns can vary due to factors such as regional amenities, local cost of living, or the establishment's market share, all of which affect the labor supply elasticity.[26]

Second, national wage setters must set the same nominal wage across locations. The first order condition for the problem (3) facing these firms implies

$$W_i = \sum_{j \in N} \omega_j \frac{\rho_j}{1+\rho_j} P_j A_{ij}, \tag{5}$$

where $\omega_{ij} = (1+\rho_j) / \sum_{k \in N} (1+\rho_k)$ is a weight for each location. These firms set wages as a *weighted average* of marked-down revenue product in each location, with weights that depend on labor supply elasticities in each region.

Importantly, in the model, firms that set wages nationally can have higher productivity and pay higher wages on average. This feature of the model can match our fourth fact, that firms with identical wages pay a premium. This framework therefore allows for the possibility that regionally rigid pay structures raise a firm's productivity and offset the cost of setting suboptimal wages in some regions. Indeed, in equilibrium, profit maximizing firms might prefer to adopt regionally rigid wages.

[26] We formalize the effect of local cost of living and amenities on markdowns, by developing a model extension that endogenizes the establishment labor supply elasticity, in Appendix Section C1.1. Specifically, we incorporate elements of the Rosen-Roback framework into our model to show that the labor supply elasticity with respect to nominal wages is larger when local consumer prices are high, and smaller when local amenities are more attractive.

In Appendix Section C1.2, we extend our model to formalize this argument and endogenize the share $\mathcal{N}$ of rigid wage setters.[27]

While both local and national wage setters may set the same nominal wages across space, the wage dynamics for these firms should be different. Specifically, the framework suggests the following two empirical tests that will differentiate between national wage setters and local wage setters:

1. Bunching of wage changes. For national wage setters, wages in different establishments should grow at the same rate, meaning that wage changes should bunch at the same value. We would not expect bunching for local wage setters—wages in their establishments grow at the same rate as revenue, and each location is unlikely to receive exactly the same shocks to revenue.[28] The degree of bunching of wage changes is informative about the extent of national wage setting.

2. Pass-through of local shocks to wages in the rest of the firm. Our simple framework suggests a method to directly estimate $\mathcal{N}$. To arrive at a regression equation, we let productivity vary but hold labor supply elasticities fixed, difference equations (4) and (5) and take conditional expectations. Then, for any two establishments j and j' of a firm i we have

$$E\left[\Delta \log W_{ij} | \Delta \log W_{ij'}\right] = \mathcal{N} \Delta \log W_{ij'} + (1-\mathcal{N})\, E\left[\Delta \log A_{ij} | \Delta \log W_{ij'}\right] + \text{market fixed effect}_j, \quad (6)$$

where $\Delta \log A_{ij}$ is growth in establishment $j's$ productivity. In principle, we can estimate this equation with a linear regression of wage growth in an establishment j on the wage growth of any other establishment in the firm. The coefficient of interest on $\Delta \log W_{ij'}$ is $\mathcal{N}$, the share of firms setting wages nationally – firms setting wages nationally must increase wages at establishment j one-for-one with a shock to wages in j' while other firms should not changes wages at establishment j at all, meaning that the average change in the population is $\mathcal{N}$.

Omitted variable bias affects least squares estimates of $\mathcal{N}$ if productivity growth in establishment

[27] We study a two stage game. The second stage of the game is the same as the model of the main text. In the first stage, firms choose whether to adopt nominally rigid pay structures. Rigid wage setters have higher productivity, but cannot vary wages across regions to optimally respond to local market conditions. If the productivity gains from these constraints are intermediate, there will be a mix of rigid and non-rigid wage setters in the subgame perfect equilibrium.

[28] See Cengiz et al. (2019) and Derenoncourt et al. (2020) for recent applications of bunching to wage data.

j is correlated with wage growth in the rest of the firm (i.e. $E\left[\Delta \log A_{ij} | \Delta \log W_{ij'}\right] \neq 0$). Firm-wide demand or productivity shocks lead to this kind of bias and mean that $\Delta \log W_{ij}$ and $\Delta \log W_{ij'}$ will co-move even without a rigidity. We can recover an unbiased estimate of $\mathcal{N}$ using an instrument for $\Delta \log W_{ij'}$.

4.3 Empirical Evidence for National Wage Setting

This section tests the two predictions of our framework to gauge whether national wage setting drives the patterns in Section 3.

4.3.1 Bunching of Wage Changes

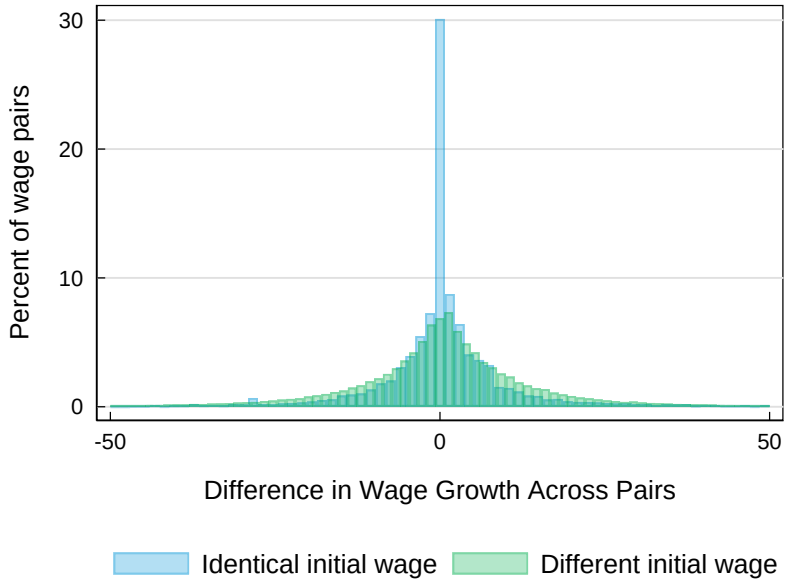
We calculate annual wage growth within each establishment and occupation and take the difference in annual wage growth for each pair of establishments in the same occupation and firm.[29] We exclude all changes where the first establishment in the pair has no change in the posted wage.[30]

We find a large amount of bunching. Figure 6 plots the distribution of the difference in wage changes across establishments of the firm, plotted separately for job pairs that pay exactly the same wage in the initial period and those that pay different initial wages. Firms that pay identical wages in the initial period display considerable bunching, with 14 percent of pairs having exactly the same change in wages. Bunching is far less common for job pairs that did not have the same level of wages in the initial period, with no visible discontinuity at zero. So, firms that initially set identical wages tend to subsequently change wages by the same amount—suggesting many firms paying identical wages are setting wages nationally.

[29] Due to the sparseness of job posting over time within a job, we construct changes over the shortest interval for which we observe the job posting in both locations and normalize by the number of years between postings to get an implied average annual change.

[30] We exclude the zero changes since they may reflect inaction on the part of the employer. We find a larger degree of bunching if we include these observations. We also find similar patterns when we restrict our attention to 4-year changes and consider only those job pairs that are observed 4 years apart.

Figure 6: Bunching of Wage Growth Across Establishments Within the Firm



Notes: Sample includes 6,084,606 pairs of jobs in different establishments of the same firm and year, that initially set the same wage; and 43,785,900 pairs of jobs in different establishments of the same firm and year, that initially set different wages. For pairs that initially set the same wage, 14% of wage changes are identical across the pairs; for pairs that initially set the same wage, 6% of wage changes are identical across the pairs. The x-axis is 100 times the difference in wage growth across the pairs.

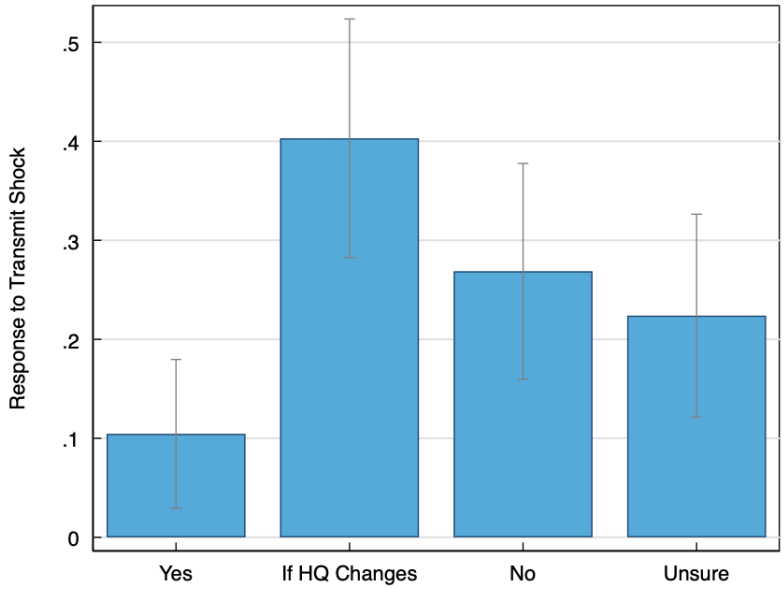
4.3.2 Pass Through of Local Shocks to Wages in the Rest of the Firm

Our second test explores the degree to which national wage setters raise wages in all locations after a shock raises wages in a single location. We begin by exploring this question using survey evidence and then in the job vacancy data using an instrument based on natural resource booms.

In the survey, we posed a hypothetical scenario to respondents working at firms that set identical wages for some or all of their jobs. We asked whether their firm would change its wages or pay bands in response to a shock that forced the firm to change its wages or pay bands in a single establishment. In our simple framework, firms that raise wages elsewhere after a shock to a single location are national wage setters.

The responses are summarized in Figure 7. Half of respondents state that a wage change in one establishment would impact the wages that they pay in other establishments (combining the first

Figure 7: Impact of Wage Change in A Single Establishment on Other Establishments



Notes: This figure shows survey responses to the question: "Say an establishment in your company located in City A had to change its wage or pay bands to keep up with local competition. Would other establishments/plants/stores in your firm located in cities B and C also then change their wage or pay bands?" The sample consists of respondents who work report working at firms that set identical pay for some or all of their jobs.

two columns). However, of those respondents, 80% stated that this would only be the case if the headquarter was the establishment that had its wages change (second column). Fewer than 30% of respondents state that a change to wages in one location would not impact wages in other locations (third column).

We next turn to the Burning Glass data. Adapting regression equation (6), our main equation of interest is

$$\log w^s_{jfct} = \alpha_{jfc} + \gamma_{jct} + \beta \log w^p_{jfct} + \varepsilon_{jfct} \tag{7}$$

where $\log w^s_{jfct}$ is the log wage that firm f pays to workers in job j in its secondary establishments located in county c in year t. The independent variable of interest, $\log w^p_{jfct}$, is the same measure for the firm's primary establishment. A primary establishment is the largest establishment of the firm,

measured using the total number of vacancies over 2010-2019. All other establishments of multi-establishment firms are secondary. We use the primary establishment since we found in Figure 7 that wages throughout the firm are most sensitive to changes in wages at the firm's headquarters. We also include job by firm by county fixed effects so that we identify β using year-to-year changes in a job's wage; as well as job by county by year fixed effects, which capture any market-level factors affecting wages in a given year. Recall that β in equation (7) estimates the share of firms setting wages nationally.

To avoid omitted variable bias, we instrument for wages in the primary establishment with a shock to natural resources demand in the county to which the primary establishment belongs. This shock is appealing because i) natural resource employment is highly localized and therefore likely to directly affect only some establishments within the firm and ii) the sector experienced large shocks over this period stemming from international movements in oil prices (See Appendix Figure A16 and Hazell and Taska (2020) for an extended discussion). Specifically, we construct a shift-share instrument that measures a county's exposure to natural resource shocks as:

$$B_{c,t} = 100 \times \frac{\text{Natural resources employment}_{c,2009}}{\text{Total employment}_{c,2009}} \times \log(\text{Natural resources employment}_{-c,t}) \quad (8)$$

This instrument measures a county's predicted exposure to natural resource shocks using county c's employment share in natural resources measured in 2009 and the growth in all other counties' employment in natural resource industries.[31]

For this instrument to be valid, a natural resource shock to the primary location must affect wages in unexposed secondary establishments *only* through the impact on wages in the exposed primary establishment. We take four steps to ensure that this is the case. First, we exclude firms that directly operate in the natural resource sector, since all establishments are likely affected by resource

[31]Natural resources industries are NAICS sectors 11 and 21, and we measure employment in each county using the Quarterly Census of Employment and Wages.

booms regardless of where they are located. Second, we exclude secondary establishments in counties exposed to natural resources, since they are naturally affected by shocks.[32] Since natural resource employment is highly concentrated in a few counties, this restriction is modest (See Appendix Figure A18). Third, to avoid geographic spillovers, we only study secondary establishments located in a different census division than the exposed primary establishment. Fourth, we include job by county by year fixed effects in our estimating equation to account for market-level effects of the natural resources shock.[33]

Panel B of Table 2 reports the first stage estimates of the impact of increased exposure to natural resources in the primary location, on the wage in the primary establishment. The first column has only job and year by county fixed effects. In the second to fourth columns, we progressively add year by occupation, year by county by occupation, and year by industry fixed effects. The shift-share instrument has a strong first stage: A one percent increase in exposure leads to a roughly 0.2% increase in posted wages (with a first-stage robust F statistic of 18-49 across the specifications).

Panel A of Table 2 shows our main result. The estimates of equation (7) using OLS are shown in column 1 of Table 2. A one percent increase in the posted wage for a specific job in a firm's primary establishment is associated with 0.33% higher posted wages for the same job in the firm's secondary establishments. This is in line with our earlier estimate that 35% of wage pairs are identical.

In columns 2-5 of Table 2, we present the results using the shift-share shock to instrument for primary establishment wages. The results suggest that a 1% increase in a primary establishment's wage for a given job increases the wage in the firm's secondary establishments by 0.55% to 0.88%.[34] The IV

[32]We define exposed counties as having more than 5% of employment in natural resources, and show robustness to this threshold.

[33]For example, one might be concerned that workers move to areas that experience a natural resource boom to take advantage of higher wages in those counties, leaving behind a labor shortage in unexposed counties which in turn bids up wages. Including job by county by year fixed effects ensures that we are not picking up on such effects, as those would be common to all firms in the market.

[34]In Appendix Table A8, we show that these results are robust to using constant weights, different levels of trimming, using only the first lag of the instrument, and clustering by primary establishment location by firm (rather than by secondary establishment county by firm). In Appendix Table A9 we also show that worker composition—proxied by education and experience requirements in the text of the vacancy—respond little to the wage change. In Appendix Table A10, we test whether the estimate could be biased by differential selection of national wage setters into vacancy posting, and find no evidence for such effects. Additionally, in Appendix Table A11, we estimate regression equation (7) using

Table 2: Pass Through of Natural Resources Shock to Wages in the Rest of the Firm

	(1)	(2)	(3)	(4)	(5)
Panel A (Structural Equation)		Outcome: Log Secondary Establishment Wage			
Log Primary Wage	0.35	0.57	0.88	0.66	0.59
	(0.03)	(0.12)	(0.38)	(0.29)	(0.22)
Observations	464,975	458,958	458,233	324,787	319,644
Specification:					
	OLS	IV	IV	IV	IV
Panel B (First Stage)		Outcome: Log Primary Establishment Wage			
Shift Share Instrument		0.28	0.17	0.20	0.25
		(0.04)	(0.04)	(0.04)	(0.04)
Observations		478,450	477,735	338,590	333,305
Panel C (Bunching)		Outcome: Primary and Secondary Wage Equal			
Shift Share Instrument		-0.001	-0.000	0.000	-0.002
		(0.000)	(0.001)	(0.000)	(0.001)
Observations		458,958	458,233	324,787	319,644
Fixed Effects:					
Job	✓	✓	✓	✓	✓
Year by county	✓	✓	✓		
Year by occupation			✓		
Year by occupation by county				✓	✓
Year by industry					✓

Notes: The primary establishment is the firm's largest establishment, by vacancies, over 2010-2019. All other establishments of the firm are secondary. The sample excludes public sector firms, firms in natural resources (NAICS industry 21), secondary establishments in a county with an employment share in natural resources greater than 5%, and secondary establishments in the same census division as their primary establishment. The observation counts exclude singletons. The standard errors are clustered by the county of the secondary establishment and the firm. Wages are trimmed at the 2.5% and 97.5% level, within each occupation, pay frequency, salary type and year. In panel A, the outcome variable, from Burning Glass, is 100 x the log of the secondary establishment wage. The regressor is 100 x the log of the primary establishment wage, also from Burning Glass. Column (1) is an OLS regression of the outcome variable on the regressor. Columns (2)-(5) are IV regressions, instrumented with the natural resources shift share instrument from the primary establishment's county, constructed from the County Business Patterns. In panel B, the outcome variable is 100 x the log of the primary establishment wage. The regressor is the natural resources instrument from the primary establishment's county. In Panel C, the outcome variable is an indicator for whether primary and secondary wages are equal. The regressor is the natural resources instrument from the primary establishment's county. The primary and secondary wages are means within pay frequency, salary type, 6 digit occupation, year and establishment cells. The natural resource instrument is calculated by county and year. All columns control for job (i.e. occupation by salary type by pay frequency by establishment) fixed effects. Columns (1)-(3) control for county by year fixed effects. Column (3) controls for 6 digit occupation by year fixed effects. Columns (4)-(5) control for year by county by occupation fixed effects. Column (5) controls for year by 3 digit industry fixed effects. The regression is weighted by the number of vacancies in the job.

estimate is likely larger than the OLS estimate due to measurement error induced by our averaging across postings within the year, and averaging across different job titles in the same occupation.

Wage shocks to primary establishments could pass through to wages in secondary establishments through other channels, such as internal financial networks or rent sharing within the firm. However, national wage setting is unique in predicting that wages should move by *exactly* the same amount in the primary and secondary establishments. We show evidence for this prediction in panel C of Table 2. We regress an indicator for whether the primary and secondary establishment pay exactly the same wage, on the natural resource shock to the primary establishment. If firms change wages in primary and secondary establishments by exactly the same amount in response to the shock, there should be no change in the probability that the wages in the two locations are the same—national wage-setters will change wages in both establishments by the same amount, local wage setters will have different wages in both periods. As predicted by national wage setting, the coefficient on the instrument is very close to 0 in all columns.

Last, we show the dynamic effects of instrument are consistent with a causal interpretation. In Appendix Figure A16, we estimate for each year the effects of exposure to the natural response shock in the primary location, separately for primary establishments (i.e. the first stage) and for secondary establishments (i.e. the reduced form). In each year, the secondary wage responds by less to the instrument than the primary wage—as expected, since only the primary establishment is directly exposed and many firms do not set wages nationally. More importantly, the dynamic effects track movement in global oil prices over this period – both the global oil price and the effect of the instrument increase in 2011, fall through to 2015, and increase afterward. The dynamics support the identifying assumption that changes in natural resource employment in the primary location are driven by shocks to natural resources demand.

city and state minimum wages as an instrument. This regression does not suggest that regional nominal rigidities drive national wage setting, consistent with national wage setting being less common for low wage workers (our descriptive Fact 3).

4.3.3 Summarizing the Magnitude of National Wage Setting

We summarize the empirical evidence from this section in order to provide a rough estimate for the fraction of firms setting wages nationally. Recall that taking the model literally, the share of firms raising wages everywhere in response to a location specific shock identifies the fraction of national wage setters. From the survey evidence, 75% of firms set at least some wages nationally (Figure 2), and of these firms, 50% raise wages in the rest of the firm after a location-specific shock (Figure 7). These estimates imply that $0.75 \times 0.5 = 0.375$ percent of firms set at least some wages nationally. From Burning Glass data and the natural resources instrument, we find that 55%-88% of jobs have wages that are set nationally (Table 2, panel A), and we pick 55% as our preferred number to be conservative. Taking the lower number across the survey and natural resources instruments, we tentatively conclude that around 35% of multi-establishment firms set national wages.

Lastly, two more pieces of evidence suggest our summary estimate is reasonable.[35] First, in the descriptive facts in Section 3, we classified 32% of multi-establishment firms as identical wage setters using a definition based on having exactly the same wage across the majority of their jobs.[36] If all firms setting exactly the same wages are subject to a rigidity, then roughly 30% of firms set wages nationally.[37] Second, as we mentioned in Section 3, a survey of Fortune 500 firms by the compensation consulting firm Empsight found that 30% of firms do not adopt geographically differentiated compensation policies, meaning that these firms set wages nationally as a result of intentionally adopting regionally rigid pay structures (Empsight International LLC, 2018).

[35] In the Appendix, we provide another piece of validation using franchises. In Appendix Table A12, using a subset of the sample, we find that firms that are franchised are less likely to have identical wages across space. Since franchised firms are operated locally and therefore not subject to the compensation structures decided on by HR managers in the headquarters, this finding lends additional support to the finding that firms set wages nationally.

[36] Specifically, we define a identical wage setter as one with at least 50% of occupations having at least 80% of wage pairs being identical.

[37] The share of firms with identical wages in the majority of their occupations could be lower than the share of national setters since there is measurement error in posted wages from aggregation across time and job titles within an occupation. Alternatively, the share of firms with identical wages could also be higher than the share of national wage setters if those firms operate in areas with similar enough conditions.

5 Reasons for National Wage Setting

This section asks why firms choose to set wages nationally. In order to understand the factors that might lead to national wage setting, we included a free-form question in the pilot of the survey, asking managers who report working at firms setting the same nominal wages across locations why their company adopted this practice. We grouped the free-form answers into seven reasons and in the full survey, we asked respondents whose firms do not vary nominal the wages of some or all jobs to rank those reasons in order of importance.[38] Figure 8 shows what HR managers report as the most important factors influencing their firms' decisions to set wages nationally. The blue bars show the fraction of respondents who chose each factor as the most important reason for why they set at least some wages nationally, while the orange shows the fraction who chose each factor as one of the top three reasons.

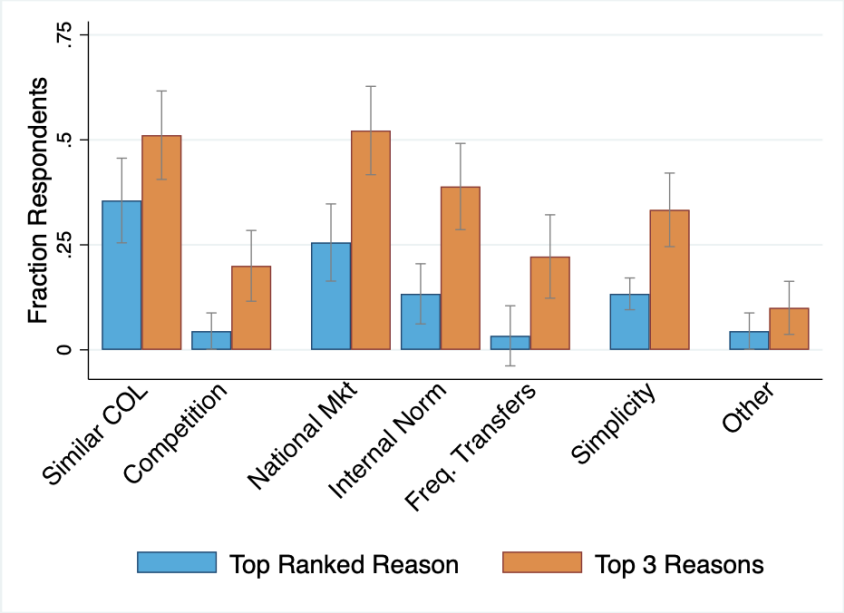
Our survey evidence confirms that both national wage setting and similar labor market conditions across establishments are reasons that firms do not vary nominal wages across space. The left two categories in Figure 8 refer to firms that do not vary nominal wages across space because either the cost of living, or the degree of labor market competition does not vary across their locations. Using the language of the conceptual framework, these firms may be able to set wages flexibly across space, but do not do so because labor market conditions are similar across locations.[39] 39% of respondents state that one of these two factors is the most important reason their firm does not vary nominal pay across space.

The remaining 61% of firms set wages nationally, meaning that the firm choses to set identical nominal wages across its establishments due to a rigidity, and regardless of whether labor market conditions are similar. Among those respondents, nominal pay comparisons by workers seem to be the most important reason for national wage setting. We see this in the collective importance of three

[38]The full responses can be seen in Appendix Section B1. We presented options to the full sample in a randomized order.

[39]It is possible that firms operate in areas with a similar cost of living *because* they adopt rigid pay structures. For example, if a firm cannot or chooses not to vary nominal pay across establishments, the firm may decide not to open up establishments in high cost of living areas. We found limited evidence for this (see Appendix Figure A19).

Figure 8: Reasons Why Firms Do Not Vary Nominal Wages Across Space



Notes: Sample is restricted to the set of respondents working at firms that set identical pay for some or all of their jobs. "Similar COL" means that the firm operates in regions with a similar cost of living. "Competition" means that the firm sets identical wages because its competitors set identical wages. "National Mkt" refers to hiring on a national market, "Internal Norm" refers to fairness norms, and " Freq. Transfers" means that employees frequently transfer across establishments within the firm. "Simplicity" means that it is logistically easier to set the same nominal pay everywhere. Specific wording of the question and options is shown in Appendix B1.

of the options: hiring on a national market, internal norms, and frequent transfers between offices. These options all potentially reflect the importance of nominal pay comparisons that workers make when considering jobs. Of those who cite a rigidity as the reason for identical wages, two thirds of respondents choose one of these three explanations as the most important reason for setting wages nationally.

Hiring on a national market is the most important factor leading to national wage setting, both in terms of the fraction of individuals who chose it first (26 percent) and the fraction who chose it as a top three factor (52 percent). Firms hire on a national market if they employ mobile workers who would move throughout the country for a job. This phenomenon is an explanation for national wage setting if workers make nominal comparisons of wages across locations. Suppose instead that mobile workers compared *real* wages across locations when choosing a job. Then firms hiring on national

markets would set similar real wages—and potentially different nominal wages—across regions.

Internal norms ranked as the most important reason for national wage setting for 13% of respondents. Specifically, respondents choosing this answer stated it mattered to their firm that workers at different establishments with the same job title earn the same wage. Previous survey evidence finds that nominal pay comparisons within establishments matters to workers, due to internal norms about fairness (Blinder and Choi, 1990; Campbell III and Kamlani, 1997; Bewley, 1999). Our survey evidence suggests that nominal pay comparisons between establishments also matters to workers, potentially because many workers are from a national labor market and learn about what others are paid across the firm. This norm could therefore reflect workers' aversion to nominal pay differences.

An additional 3% of respondents stated that frequent transfers across offices was the most important reason for setting wages nationally. These firms presumably fix a worker's nominal pay when they transfer the worker across locations within the firm, even though the worker's real wage might be different across the locations.

The Burning Glass data also suggests that national labor markets, fairness norms, and frequent transfers are important factors determining national pay setting. First, supporting the importance of national labor markets, we find that national wage setting is more common for higher-wage occupations, where the workers are more geographically mobile and recruiting is more national (Ganong and Shoag, 2017). Second, supporting the importance of internal transfers and national job markets, in Appendix Figure A18, we show that jobs are more likely to have exactly the same wage when workers move between the two locations more.[40] Third, supporting the importance of internal fairness norms, we show in Appendix Figure A20 that firms with nationally set wages have less cross-occupation wage dispersion within the firm – these firms are not only paying exactly the same wage to workers within the same job in different locations, but they are paying more similar wages

[40]Specifically, we use the Census J2J Origin Destination statistics and measure worker mobility between MSA A and B as the total number of employment to employment transitions from A to B and from B to A, divided by the population in A. A high number here demonstrates that workers often move between these two areas. Consistent with the survey evidence, we find that, within the firm, wages are more likely to be the same for job pairs in areas with more mobility.

across jobs as well.[41]

Lastly, the responses from firms that do *not* set wages nationally also suggests nominal pay comparisons matter for this decision. Respondents who work at firms that set pay for some or all jobs differently across locations report that hiring on a local market is a major reason why their firm differentiates nominal pay across regions (See Appendix Figure A21). This finding is the complement of our result in Figure 8.

An alternative explanation for national wage setting is that it lowers managerial costs. We find less support for this explanation. First, as we discussed in Section 3, many firms set wages nationally in some occupations, but set wages locally in others. Firms that are able to set wages locally for some occupations can presumably set wages locally for the other occupations with little additional difficulty. Second, as shown in Figure 8, we find that only 13 percent of survey respondents report simplicity as the most important reason for setting wages nationally, and 30 percent rank simplicity in the top 3. Third, compensation consulting firms—such as Payscale, Empsight or Aon McLagan—can provide companies with information on local wages, meaning that firms can easily acquire the relevant information to set wages locally. Interestingly, DellaVigna and Gentzkow (2019) find the opposite result in goods markets. Firms seem to set goods prices nationally in order to simplify management, and not because nominal price comparisons matter to consumers. Our contrasting results likely reflect the different mechanisms that operate in goods relative to labor markets.

[41]Specifically, we calculate the average wage within an occupation by establishment by year for firm i and use this to calculate the ratio of the 90th wage percentile to the 10th wage percentile within each establishment by year. Appendix Figure A20 plots the distribution of the 90/10 ratio in each establishments separately for those establishments at nationally wage setting firms and those at other firms. We clearly find that wages across occupations are more compressed in national firms than in other firms: the average ratio of the 90th and 10th percentile of wages in a national firms is 1.71, compared to 2.02 for non-national firms. In order to account for the fact that national wage setting firms may hire in different occupations, we also create a "benchmark" measure of compression by doing the same calculation using the wages of other firms in a given county, leaving out firm i. This benchmark captures the 90/10 ratio that would be predicted by the set of occupations employed by the establishment. Appendix Table A13 shows that nationally wage setting firms not only have lower levels of inequality (90/10 ratios and 75/25 ratios), they also have lower benchmark ratios (i.e. they choose an occupational mix that is less dispersed on average) and have even less cross-occupation wage dispersion than would be predicted by their occupational mix.

6 Consequences for the Real Wage Distribution

We conclude by exploring what the practice of national wage setting implies for the distribution of real wages. In the figure below, we show a logical implication of national wage setting in Burning Glass data – for the same job, firms tend to pay a lower real wage in regions with high prices and higher real wages in areas with lower prices. Specifically, we estimate the within-firm relationship between wages and local prices as

$$log(w_{ifct}) = \alpha_1 \text{local price}_{ct} + \theta_j + \theta_f + \theta_t + \epsilon_{fjct} \tag{9}$$

where $log(w_{ifct})$ is the posted wage in job i in firm f in county c in year t. Local price$_{ct}$ represents a local price index for the county, sourced from the Bureau of Economic Analysis. θ_j and θ_t are job and year fixed effects, which control for differences in posted wages over time and across occupations. The inclusion of firm fixed-effects (θ_f) means we estimate the correlation between nominal wages and prices within the firm.

For comparison, we also estimate the correlation of nominal wages and local prices *between* firms and across locations. This comparison is a helpful benchmark because variation between firms is not affected by nominal rigidity within firms. We follow DellaVigna and Gentzkow (2019) and estimate

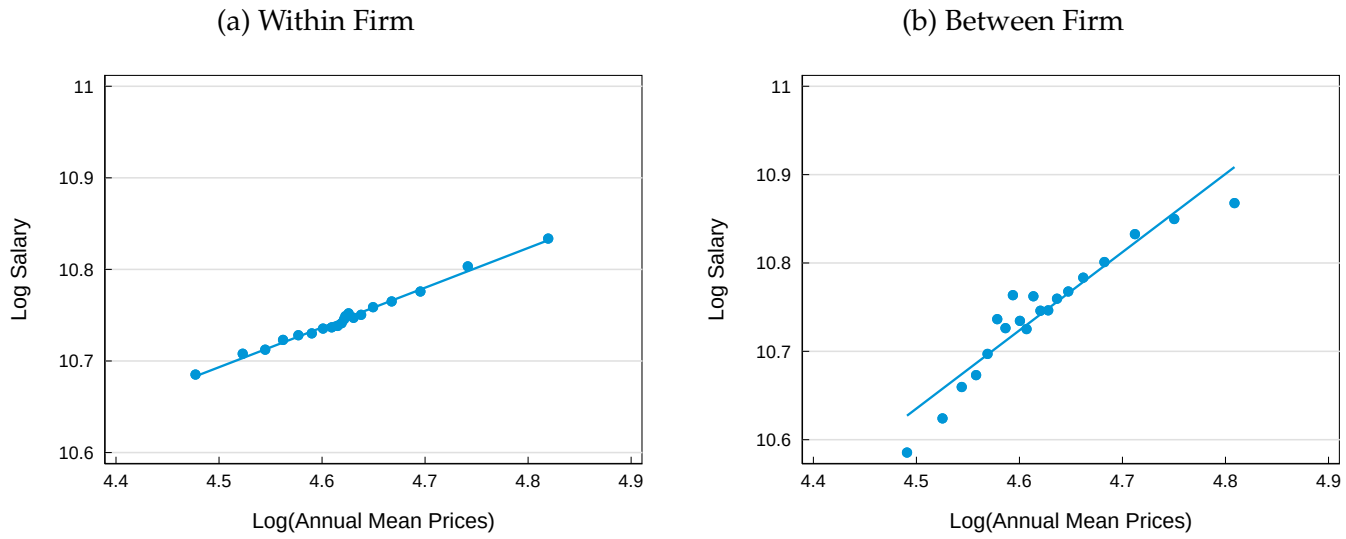
$$log(w_{ifct}) = \beta_1 \overline{\text{local price}}_{ct} + \theta_j + \theta_t + \epsilon_{fjct} \tag{10}$$

where $\overline{\text{local price}}_{ct}$ is the average value of local prices for all counties in which the firm operates.[42]

Figure 9 plots binned scatter plots corresponding to regressions (9) and (10). The within-firm coefficient is low, in absolute terms or compared to the between-firm coefficient. The left panel shows that α_1 is positive, implying that within the firm, nominal wages are higher in counties with higher prices. However the coefficient is less than 0.5—within the firm, a job in a county with 1% higher

[42]Results are very similar when estimating the between-firm relationship using Equation 9 but excluding the firm fixed effect.

Figure 9: Sensitivity of Nominal Wages to Local Prices



Notes: The coefficient for the line of best fit in Panel (b) is 0.434 and in Panel (b) is 0.88. Both figures include job and year fixed effects and the left panel includes firm fixed effects.

prices tends to pay a real wage that is 0.5% lower. The right panel of Figure 9 shows that the estimate of β_1 is almost twice as large between firms, where a 1% higher price level associates with a 0.88% higher nominal wage, meaning that real wages are roughly constant.[43]

These patterns imply that national wage setting affects the distribution of real wages. If areas with high prices pay lower real wages on average, then national wage setters could increase real wage inequality since they contribute to larger differences in real wages across space. Conversely, if high-price areas pay higher real wages on average, national wage setting could lead to a drop in real wage inequality. Either way, national wage setting should have consequences for the distribution of real wages.

[43] Appendix Table A14 shows a similar pattern using either local rents or local average income levels instead of local prices.

7 Conclusion

This paper demonstrates the prevalence of national wage setting using data from online job postings and a survey of HR professionals, finding that 35% of multi-establishment firms set wages nationally. We first demonstrated, descriptively, that firms often set exactly the same nominal wage for the same job in different locations. This practice concentrates in certain firms, is widespread across states, industries and occupations, and is more common in higher-wage occupations. Second, using information on the co-movement of wages over time within the firm, we demonstrated that the bulk of this uniformity is the result of national wage setting, meaning that firms adopt rigid pay structures that compel them to set the same nominal wage in all of the regions in which they operate. Third, we found that firms adopt these national wage setting practices because workers care about nominal wage comparisons.

These findings affect our understanding of labor markets in several ways. First, national wage setting has implications for whether monopsony power in labor markets has increased over time. According to our evidence, a large share of firms set wages nationally because they are competing for workers on a national labor market. For these firms, national measures of labor market power may matter more than local measures of labor market power for wage setting. National employment concentration has been rising while local concentration—a common measure of labor market power—has been falling (Rossi-Hansberg et al., 2018; Rinz, 2018; Berger et al., 2019; Autor et al., 2020). Second, national wage setting may have implications for the aggregate effect of nominal wage rigidity. Midrigan (2011) and Alvarez and Lippi (2014) argue that when firms synchronize price changes across products, the aggregate amount of nominal price rigidity increases. We find that firms synchronize wage changes across establishments, which may increase the aggregate amount of nominal wage rigidity through similar mechanisms.

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A1 Data Appendix

A1.1 Posted Versus Realized Wages

One important feature of the Burning Glass data is that it provides measures of posted wages, not the realized wages paid to workers. Posted and realized wages may differ if, for example, there is bargaining by workers after they are hired.

We extensively explore the extent of this deviation by comparing the posted wages in Burning Glass to realized wages from other datasets. In particular, we compare the median wage within each 6 digit occupation within an MSA in Burning Glass, averaged over 2010-2019, to the median annual wage for each 6 digit occupation and MSA in the Occupational Employment Statistics (OES) data, again averaged over 2010-2019. We construct the Burning Glass wages separately for each type of salary and pay frequency of the salary type. We then regress log occupation by MSA wages from the OES on log occupation by MSA wages from Burning Glass, weighting either occupation by its employment in the OES.

Figure A1 plots the relationship for all jobs posting an hourly base pay, demonstrating that the Burning Glass and OES measures of detailed occupation and regional wages are highly correlated – when Burning Glass wages change by one percent, occupation wages from the OES also change by roughly 1 percent. Table A4 reports the regression results for hourly base pay, annual total pay, and hourly total pay. In all cases, the regression coefficient is close to but slightly below 1. Additionally, Table A5 shows that Burning Glass wage measures not only capture the median wages, but they match the other moments of the distribution of wages as well – when the 10th and 90th percentile of posted wages in a given occupation and MSA in burning Burning Glass go up by 1 percent, the 10th percentile and 90the percentile of wages in OES go up by 0.8 and 0.87 percent, respectively. These high correlations suggest that at the detailed occupation and region level, posted wages in Burning Glass are very close to realized occupation wages in the OES.

A1.2 Cleaning Firm Names

We cleaned firm names within the Burning Glass vacancy data using a combination of standard cleaning procedures and a machine learning algorithm. Examples of stages in this process can be found in the table below.

We began with a list of (unclean) unique employer names from observations satisfying all restrictions unrelated to employer (such as requirements for non-missing variables), truncated to 128 characters; in the vacancy data, there are 1,129,983 such names. Next, we manually correct the names of some large employers, making use of code from Schubert et al. (2020) and the NBER Patent Data Project. We additionally stripped common words ("The", "Corp.", "Company", etc.), all non-alphanumeric punctuation, spacing, and capitalization.

Next, we implemented the dedupe fuzzy matching algorithm to create clusters of similar employer names. Dedupe makes use of a combination of squared edit distance comparisons subject to a confidence score threshold (which we chose to be 0.5, or 50% based on sample performance), as well as a small sample of names with manual labelling provided as training. For computational reasons, we employ blocking to limit the number of comparisons for each name to roughly 90 percent of each group of names sharing the first two letters. Within each cluster of names generated by dedupe, we set all names to that of the most common employer to form a list of 933,718 unique cleaned employer names.

Finally, we merge this crosswalk back on to the main Burning Glass data and set the names to the new, cleaned versions to complete the process.

Table: Examples of Precleaning and Dedupe Clusters

emp	cluster_id	confidence_score	employer_original
abcnursery	61334	0.796	ABC Nursery
abcnursery	61334	0.796	ABC Nursery Inc
abcnurserydaycare	61334	0.828	ABC NURSERY DAYCARE
abcnurserydaycareschool	61334	0.811	ABC NURSERY DAYCARE SCHOOL

Notes: For this example, the employer_original variable represents the original employer name, the emp variable represents the precleaned name fed to dedupe, and the cluster_id and confidence_score represent dedupe's assignment of a cluster and confidence threshold for that cluster. In the step following this, each cluster would have a cleaned firm name assigned which represents the most common name for that cluster.

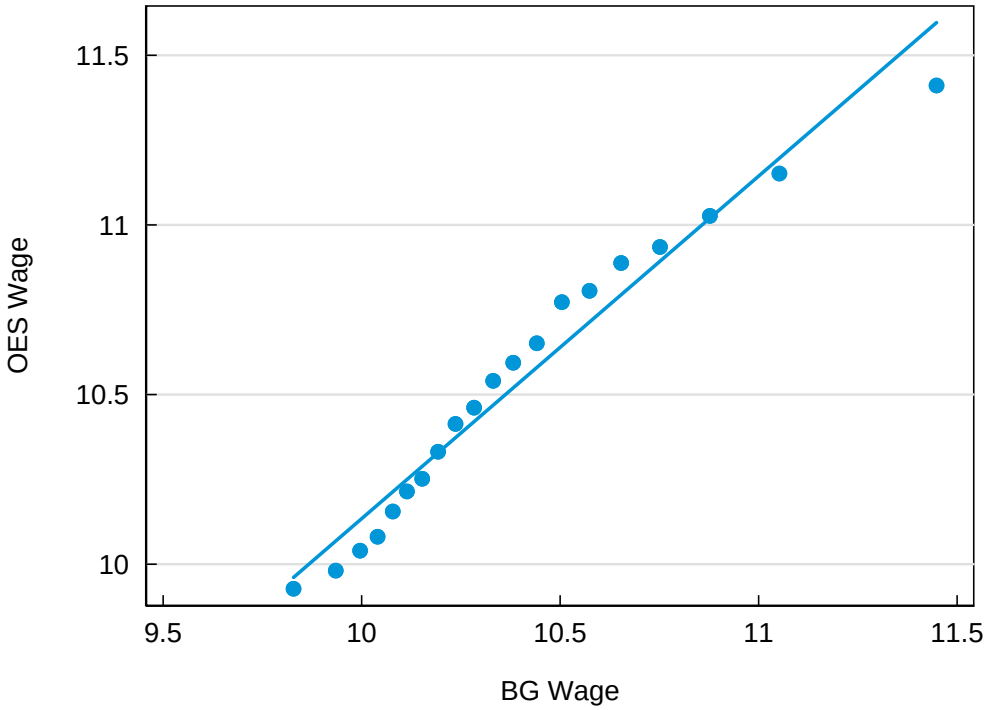
A2 Appendix For Section 3

A2.1 Comparing National and Franchised Firms

Since the Burning Glass data does not include information on whether a firm is franchised, we manually coded the 135 largest firms as either being franchised, not-franchised or following an agent model, wherein employees are independent contractors. We collected this data by searching on the company's website, trade organizations or news stories mentioning franchises. We excluded the set of firms that we determined followed an agent model and looked at the prevalence of national wage setting for the firms we were able to identify as either franchised or not-franchised. Table A12 reports the results. While the results are relatively imprecise, we find evidence that firms following a franchising model have less uniform wages. This is true overall (columns 1 and 4) and when looking within specification industries and occupations (columns 3 and 6). The estimate in column 1 suggests that franchised firms are 6.5 percentage points less likely to have occupations paying a national wage.

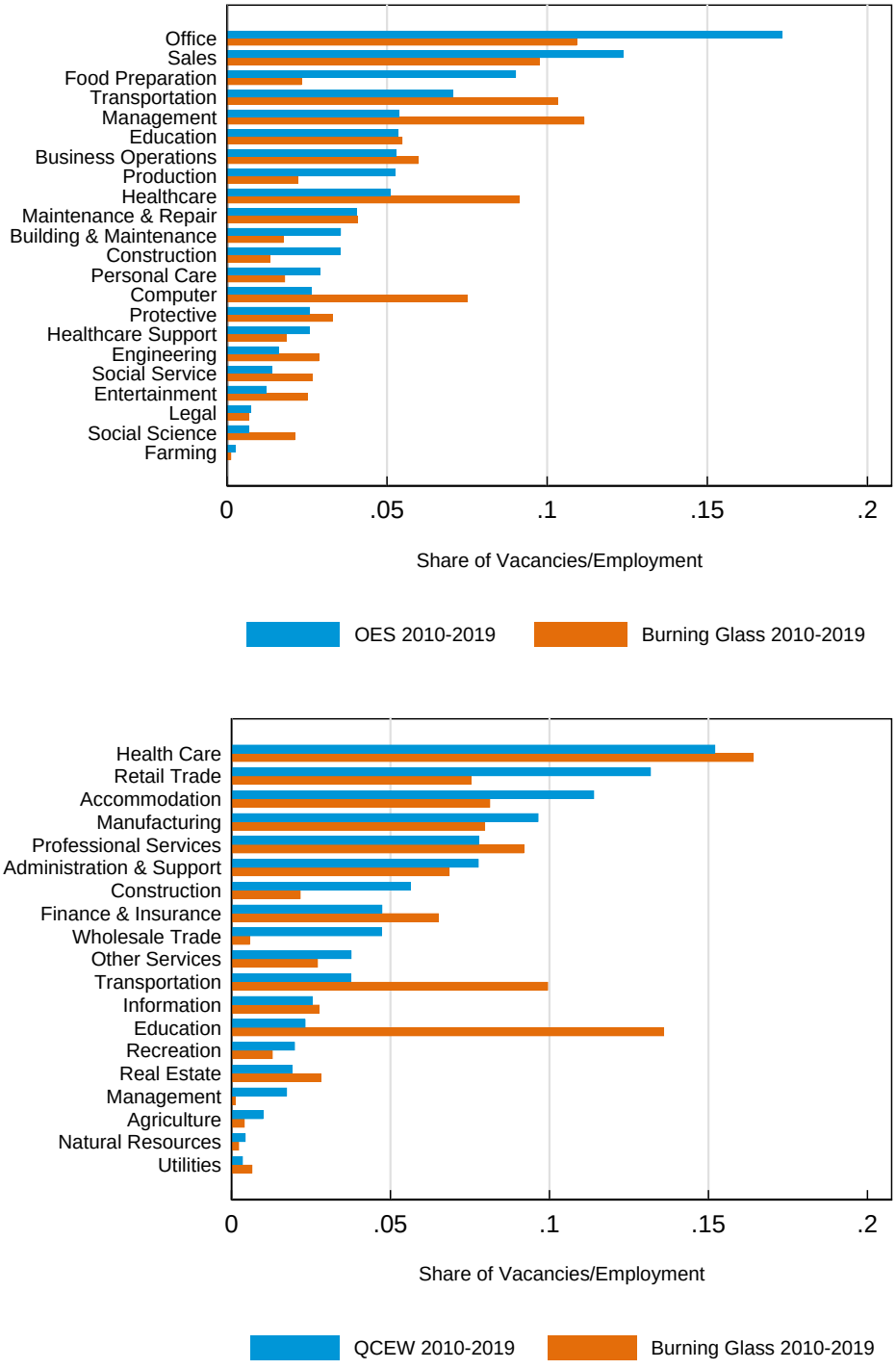
Appendix Tables and Figures

Figure A1: Distribution of Median Wages in Burning Glass and Occupational Employment Statistics



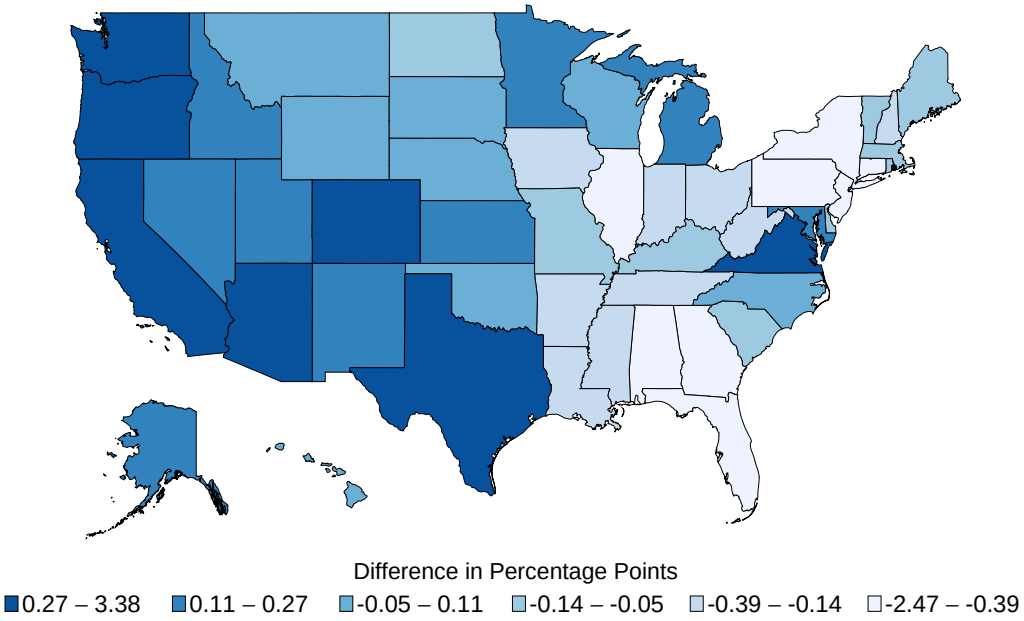
Notes: The OES wage on the y-axis is the log of the occupation by MSA median hourly wages from the Occupational Employment Statistics. The x-axis is the log median wages from Burning Glass for all jobs posting hourly basepay. In both cases, we study the wage averaged over 2010-2019. In both datasets, occupations are at the 6 digit level. MSA by Occupation cells are weighted by average occupation employment over 2010-2019. This is a binscatter plot and each dot represents 5% of the data. The slope of the line of best fit is 0.998. See Table A4 for the corresponding regression.

Figure A2: Occupation and Industry Shares in Burning Glass and Public Administrative Data



Notes: Shares are calculated using the total number of vacancies or employment summed across 2010-2019. In the top panel, employment is from the 2010-2019 Occupational Employment Statistics, by broad occupation. In the bottom panel, employment is by broad industry from the Quarterly Census of Wages and Employment. Sample includes the set of vacancies including a posted wage.

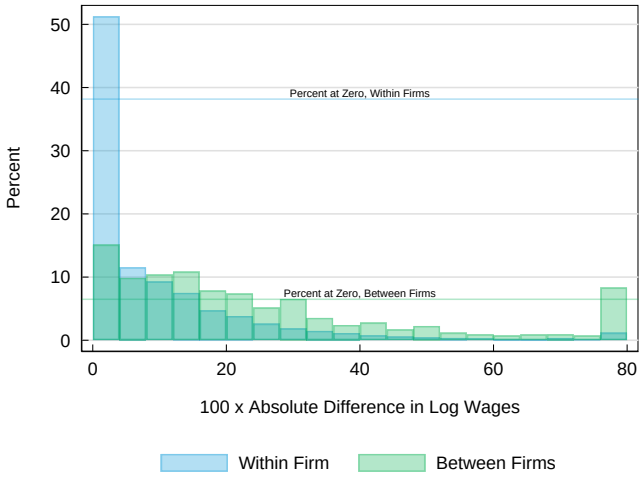
Figure A3: Geographic Representation of Burning Glass



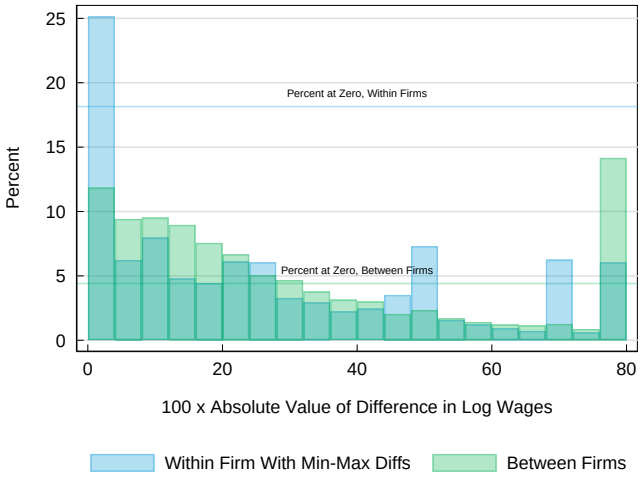
Notes: The values plotted are the difference between the vacancy share in Burning Glass and the employment share in the Occupational Employment Statistics (OES), multiplied by 100. Shares are calculated using the total number of vacancies/employment summed across 2010-2019. Sample includes the set of vacancies including a posted wage.

Figure A4: Robustness of Identical Wages to Variable Definitions

(a) Job Titles

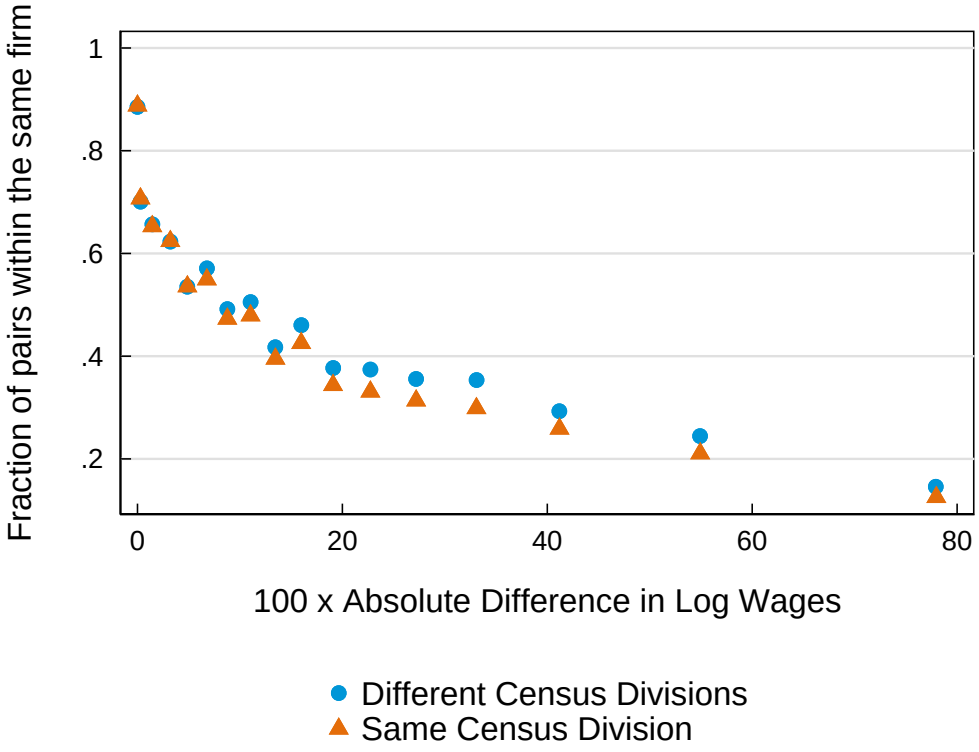


(b) Bounding Exercise for Salary Ranges



Notes: The sample in the left figure includes 2,171 job titles. The percentage of within- and between-firm pairs that are the same in the left panel are 38% and 6.5%, respectively. In the right panel, wage differences within the firm are defined using using the top of the range for one posting and the bottom of the wage for the other posting for all pairs with salary ranges for both vacancies in the pair and using the top of the range for one posting for all pairs with salary ranges for only 1 posting in the pair. In both panels, differences in the log of the wage are top-coded at 0.8.

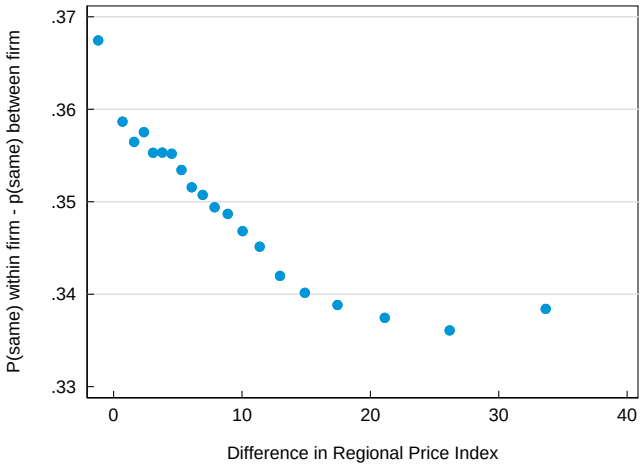
Figure A5: Identical Wages Within and Across Census Divisions



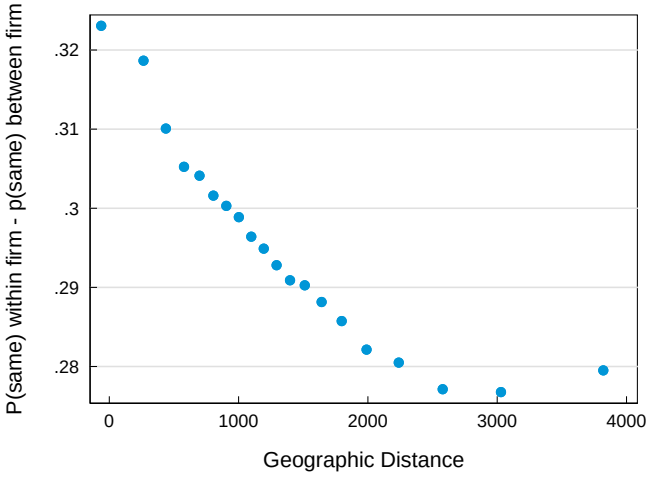
Notes: This figure is a binscatter with 20 bins. Orange triangles show the fraction of pairs that are within-firm for all pairs that are within the same census division while blue circles show the same metric for all pairs that are not in the same census division. 18,762,056 pairs are within the same census division and 99,293,010 pairs are between census divisions. There are 9 census divisions.

Figure A6: Likelihood of Identical Wages and Differences Between Markets

(a) Regional Price Index

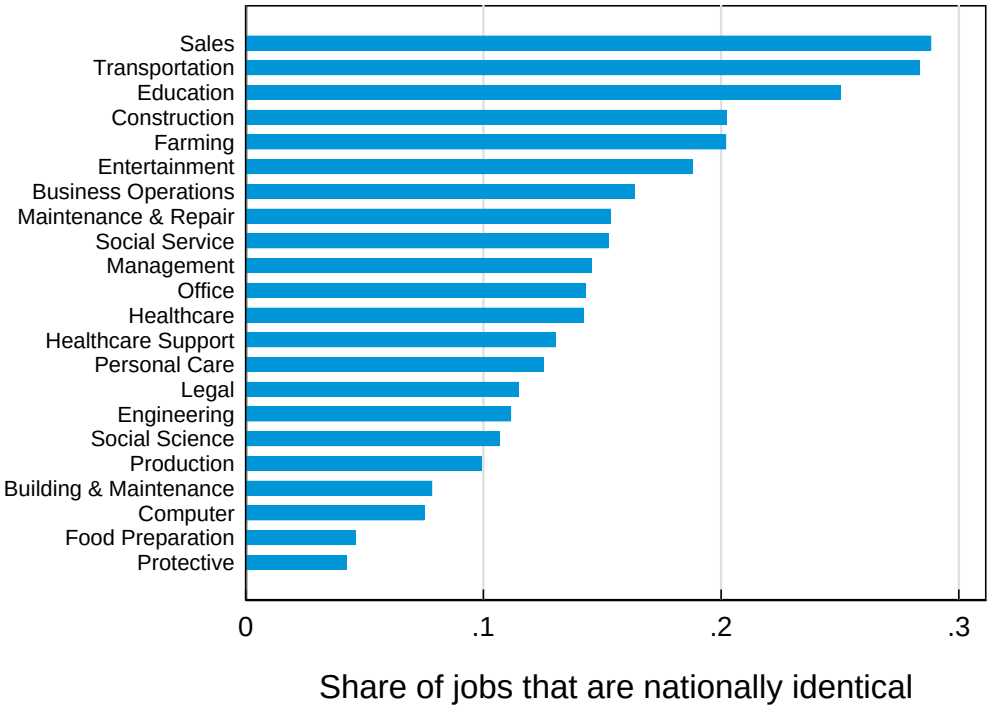


(b) Geographic Distance



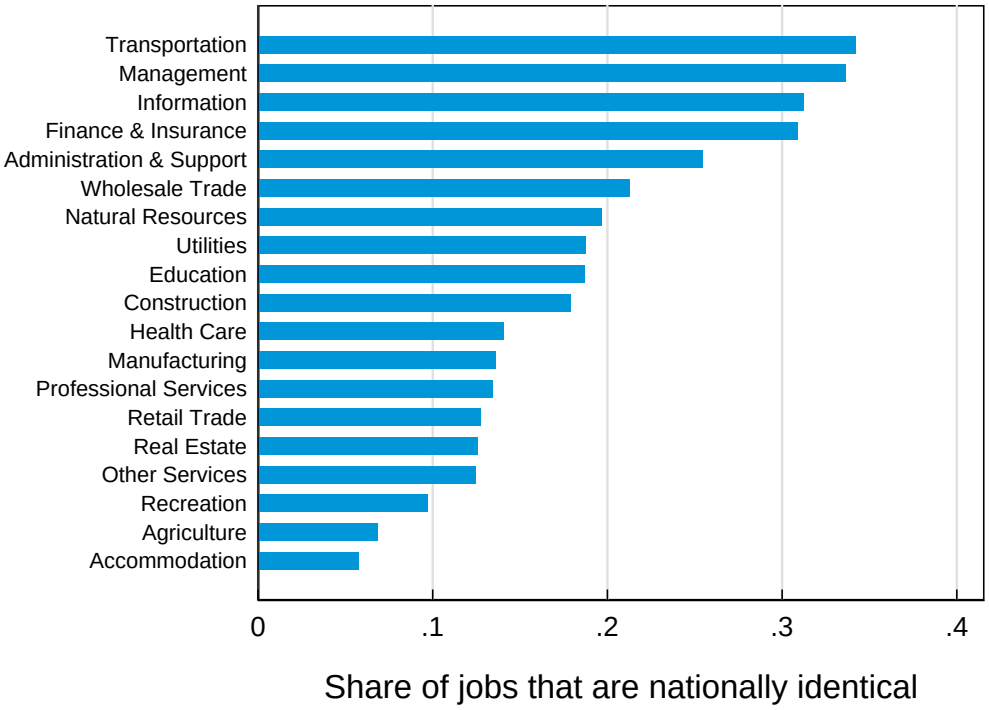
Notes: Each plot shows a binscatter with 20 bins. Binscatters include job*firm fixed effects.

Figure A7: Identical Wages by 2-digit Occupation



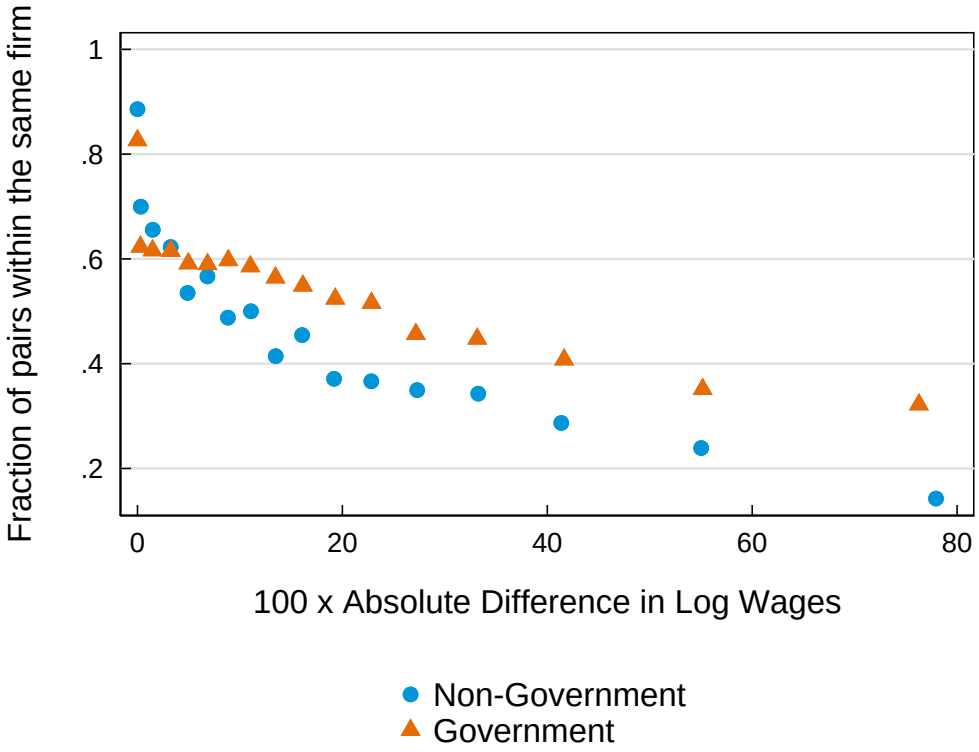
Notes: Nationally identical jobs are defined as those jobs paying the modal wage in occupation*firm*year cells in which at least 80% of wage pairs are the same. Sample includes all firm-job pairs present in at least 4 establishments in that year. Average 2-digit occupation wages come from the BLS OES data in 2018.

Figure A8: Identical Wages by Industry



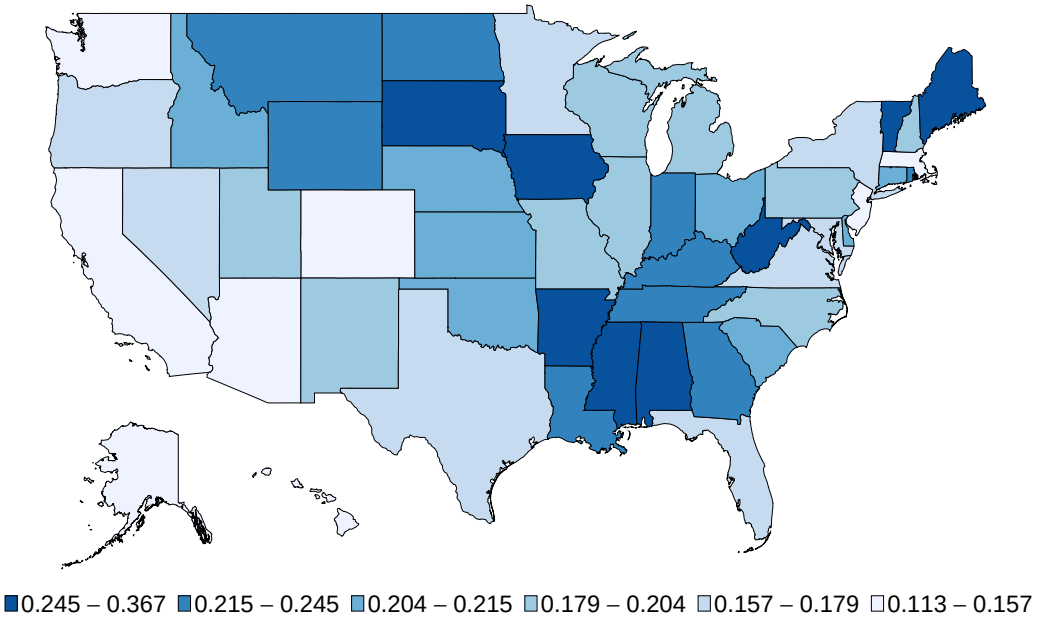
Notes: Industries are defined using 2-digit NAICS codes for the firm. Nationally identical jobs are defined as those jobs paying the modal wage in occupation*firm*year cells in which at least 80% of wage pairs are the same. Sample includes all firm-job pairs present in at least 4 establishments in that year.

Figure A9: Identical Wages in Public Sector



Notes: Each plot shows a binscatter with 20 bins. Blue dots include all firms in the private sector and orange triangles include all firms in public administration (i.e. all NAICS industry codes beginning with 9).

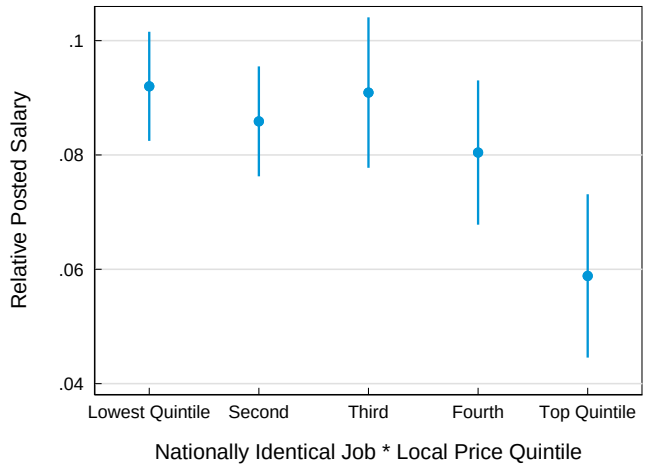
Figure A10: Fraction of Job Postings with Nationally Identical Wages



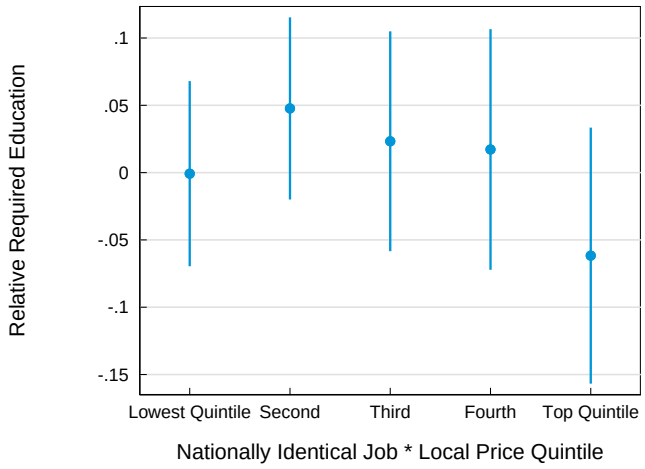
Notes: Nationally identical jobs are defined as those jobs paying the modal wage in occupation*firm*year cells in which at least 80% of wage pairs are the same. Sample includes all firm-job pairs present in at least 4 establishments in that year.

Figure A11: Relative Wages, Education and Experience by Local Price Level

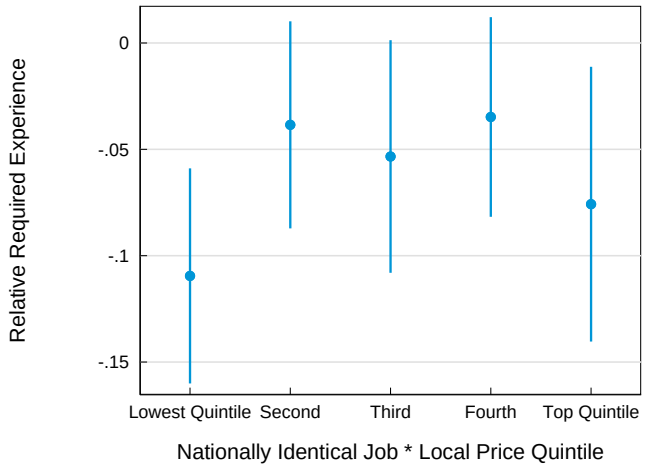
(a) Posted Wage



(b) Required Education

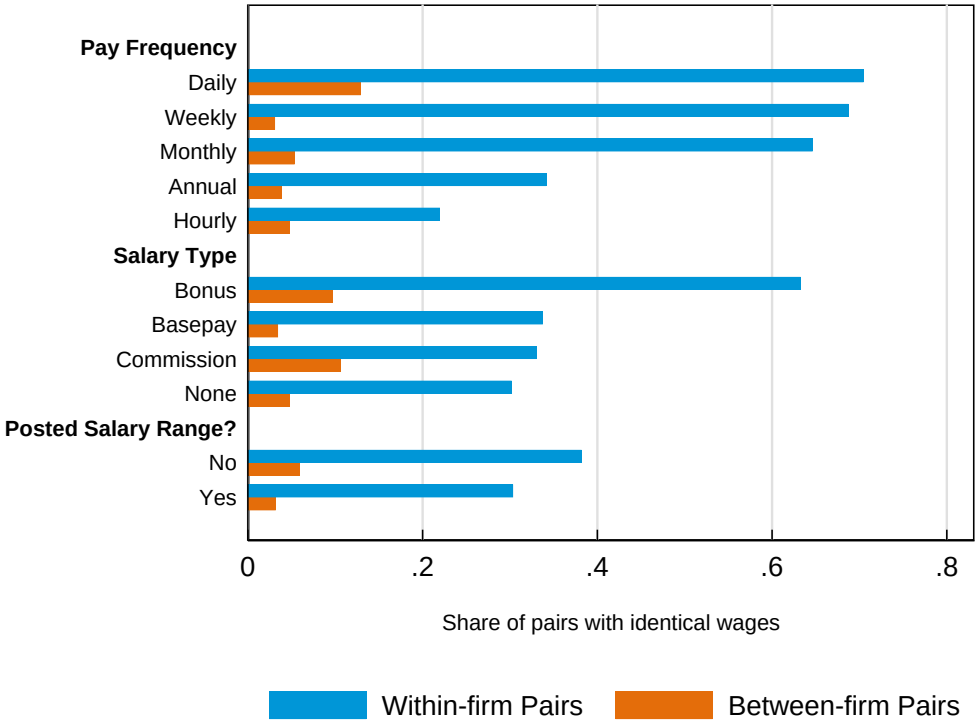


(c) Required Experience



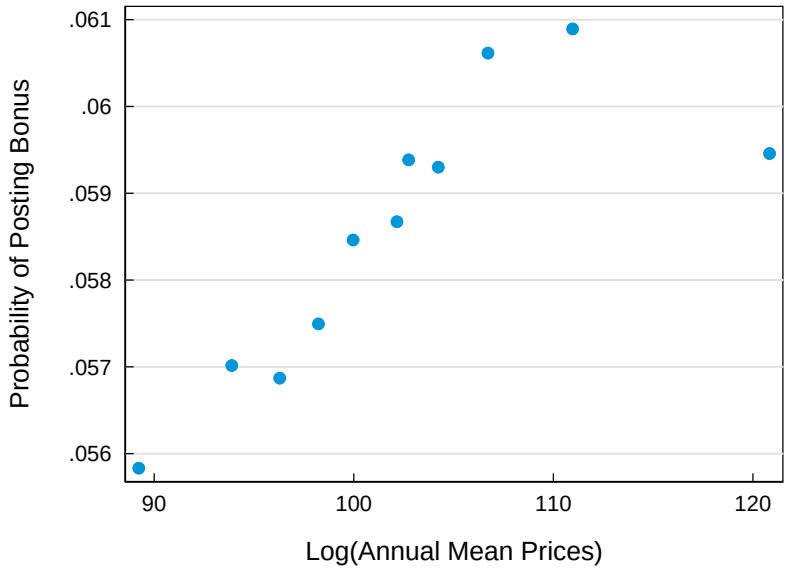
Notes: Each regression includes a quadratic in establishment size, a quadratic in firm size, and fixed effects for job*county*industry*year. Nationally identical jobs are defined as those jobs paying the modal wage in occupation*firm*year cells in which at least 80% of wage pairs are the same. Sample includes all firm-job pairs present in at least 4 establishments in that year.

Figure A12: Identical Wages by Type of Job Posting



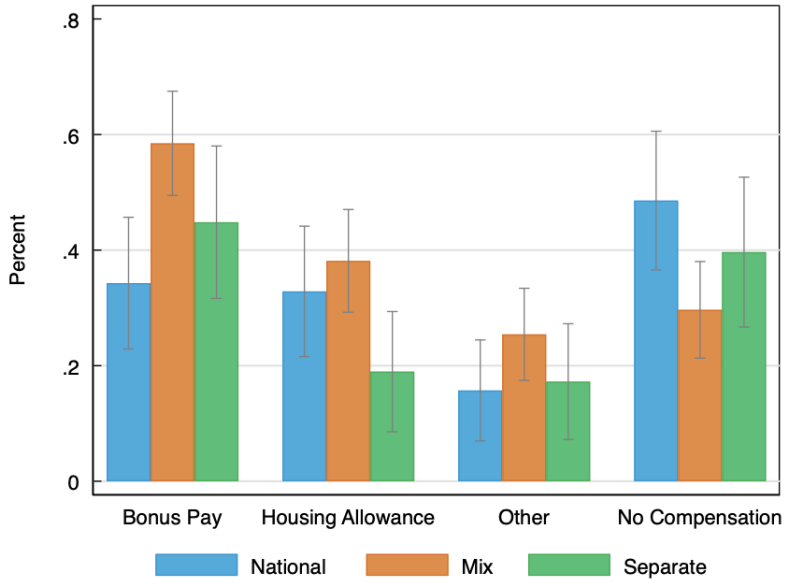
Notes: Pay frequency refers to the frequency of pay posted on the job posting. All wages are annualized by Burning Glass to reflect annual salaries a standard work schedules. Salary type refers to the stated form of compensation on the job posting. Posted salary range means that the job posting includes a range of wages rather than a single dollar value. For jobs with ranges, we take the midpoint throughout the analysis.

Figure A13: Probability of posting bonuses by local price indices



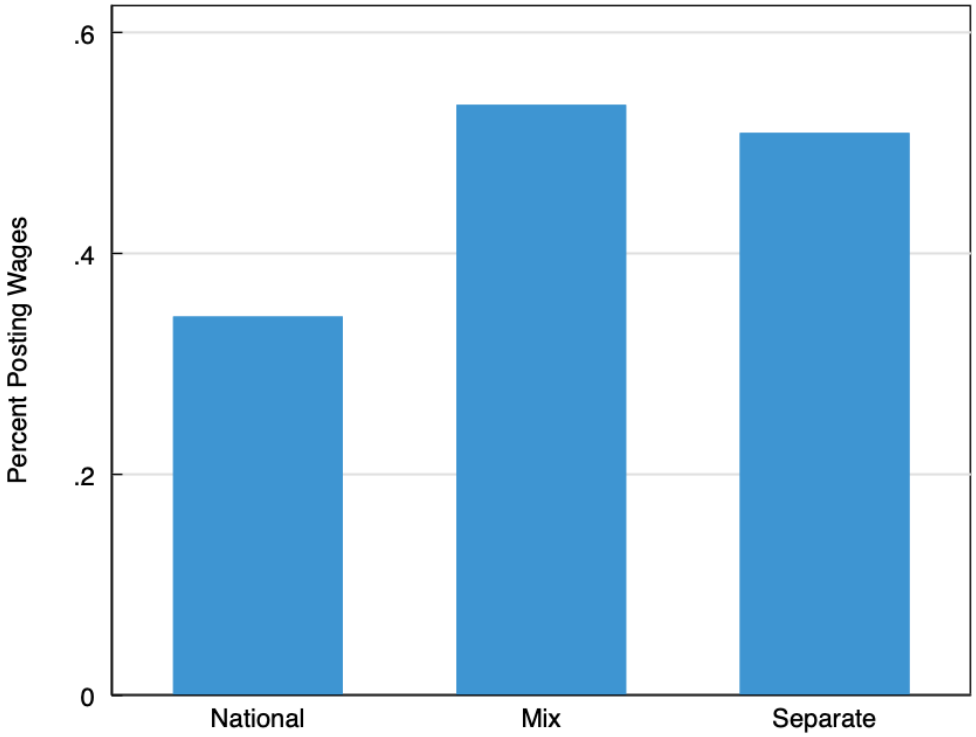
Notes: Regression includes year by occupation by firm fixed effects.

Figure A14: Compensation for Geographic Differences in Cost of Living



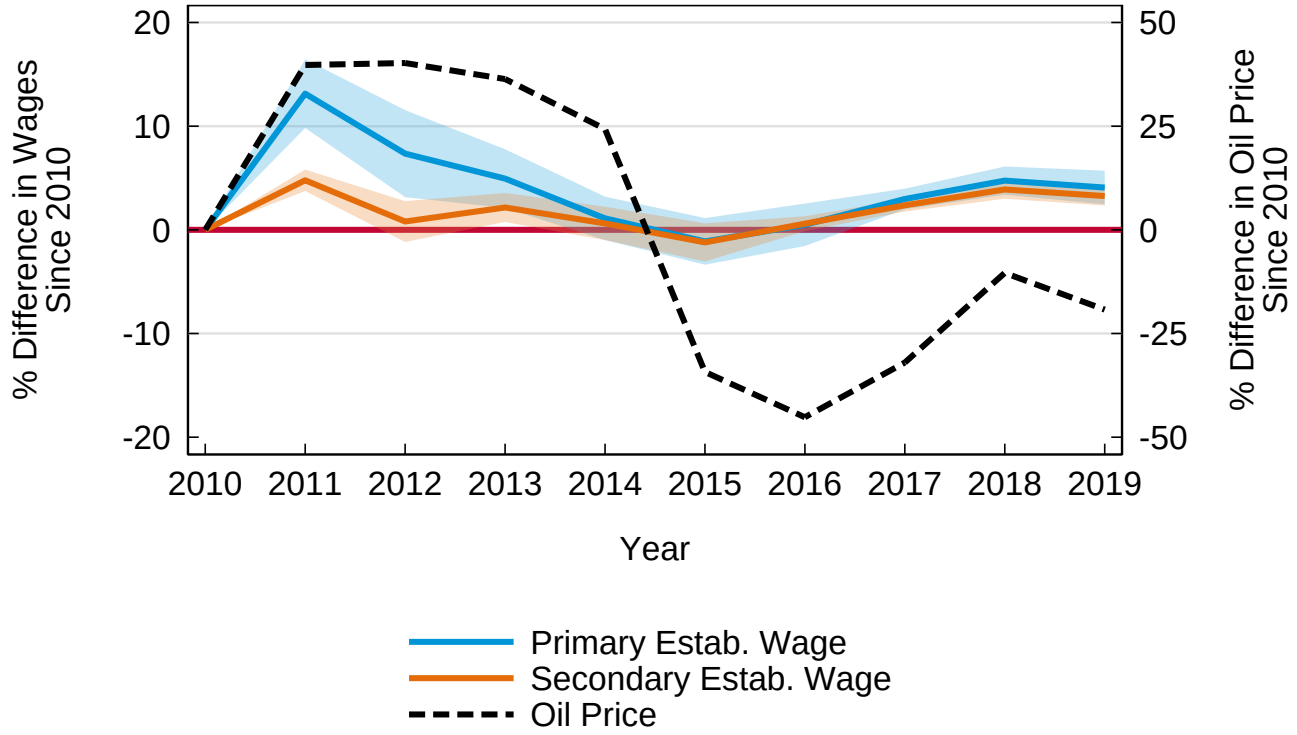
Notes: This figure shows the fraction of respondents who report using bonus pay, housing allowances, or other forms of compensation to adjust for geographic differences in the cost of living, as well as the fraction who report using no forms of compensation. If respondents stated that they used some form of additional compensation, they could choose more than one of the three options (bonus pay, housing allowance, and other). National, Mix, and Separate firms are as defined in Figure 2

Figure A15: Fraction of Firms Posting Wages



Notes: This figure shows the fraction of survey respondents who state that their firm posts wages or salary bands on the majority of their job vacancies.

Figure A16: Dynamic Effects of Natural Resources Instrument



Notes: The dashed black line is the annual average of the Brent Crude oil price. We estimate the first stage regression

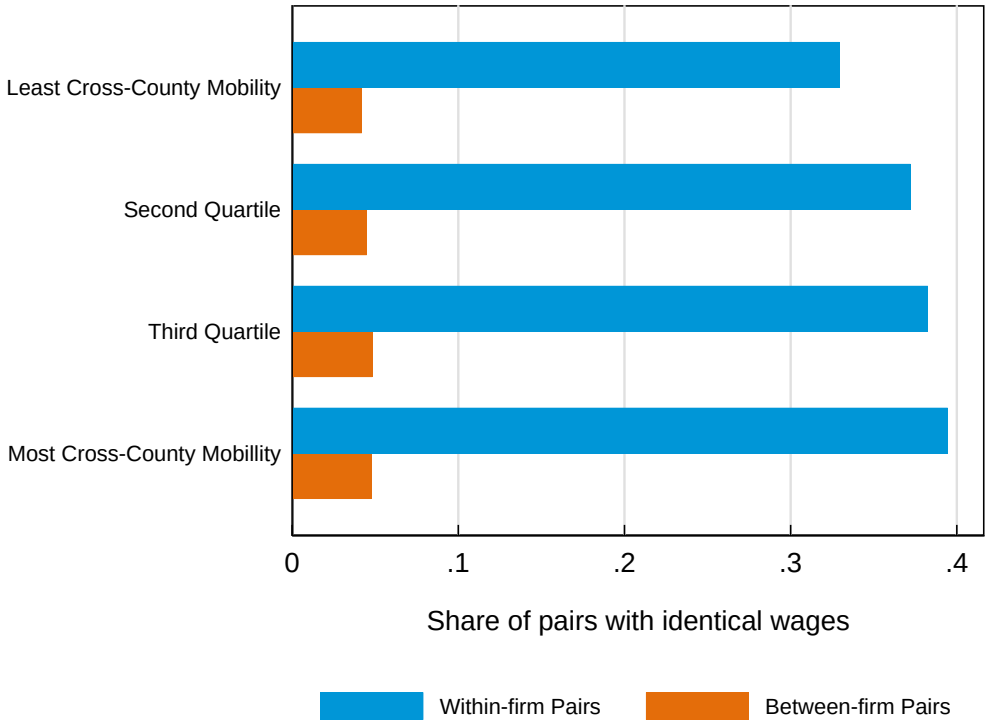
$$\log w^{p}_{jfct} = \alpha_{jfc} + \gamma_{jct} + \sum_{y=2011}^{2019} \beta_y \times \text{primary county natural resources share}_{jfc,2009} + \varepsilon_{jfct} \tag{11}$$

and the reduced form regression

$$\log w^{s}_{jfct} = \alpha_{jfc} + \gamma_{jct} + \sum_{y=2011}^{2019} \delta_y \times \text{primary county natural resources share}_{jfc,2009} + \varepsilon_{jfct} \tag{12}$$

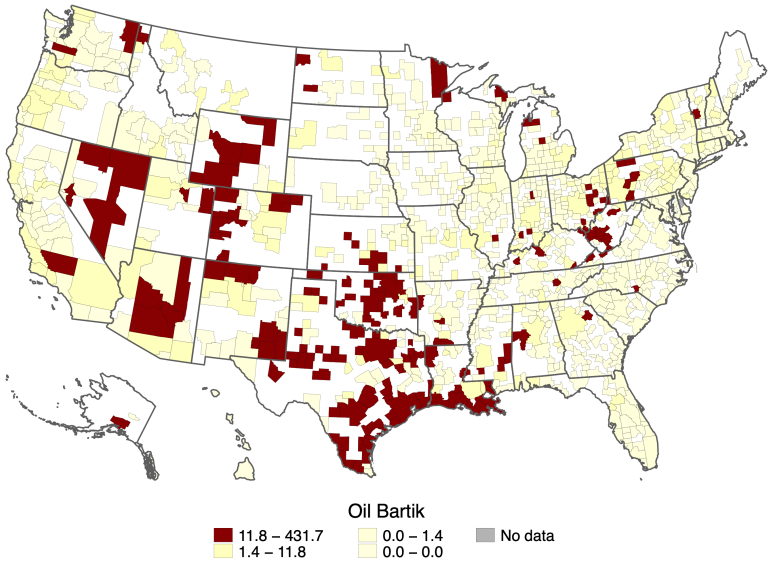
where $\log w^{p}_{jfct}$ is 100 x the log of the wage in the primary establishment, $\log w^{s}_{jfct}$ is 100 x the log of the wage in the secondary establishment, primary county mining share is the percent share of employment in natural resources industries in the primary establishment's county, α_{jfc} is a fixed effect for the job (i.e. occupation by pay frequency by salary type) and establishment, and γ_{jct} denotes occupation by time and county by time fixed effects. The blue line plots the values of β_y from the first stage regression and the orange line plots the values of δ_y from the reduced form regression, the shaded areas denote 95% confidence intervals of standard errors clustered by firm and secondary establishment county. All other details of the regression are identical to Table 2, column (3).

Figure A17: Identical Wages by Geographic Mobility



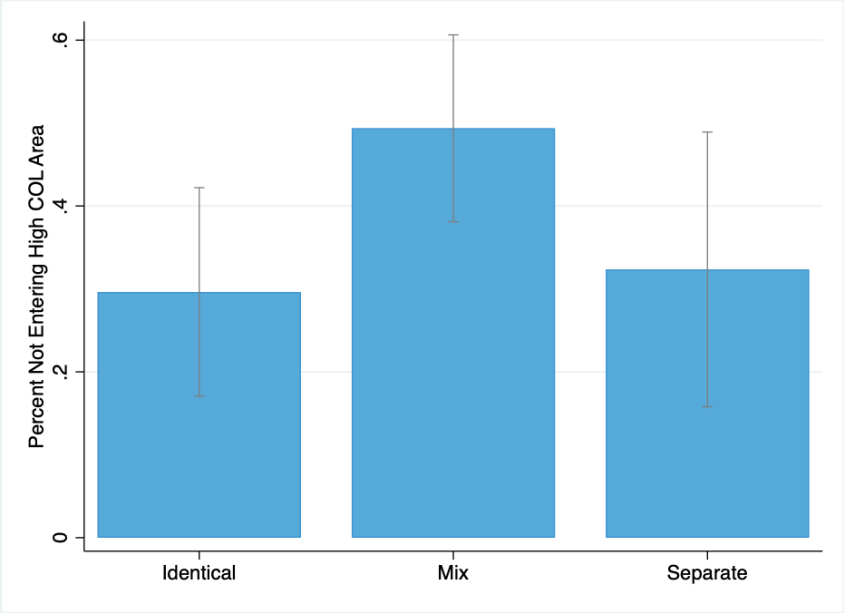
Notes: The mobility measure is computed for counties within US metropolitan areas. The level of mobility between two counties A and B is measured as the sum of employment to employment flows from A to B and employment-to-employment flows from B to A, divided by the population. These measures are then averaged from 2010-2019. The 4 groupings represent quartiles for these flows. Data on employment-to-employment inflows and outflows come from the Census J2J Origin-Destination statistics.

Figure A18: Regional Exposure to Natural Resources Instrument



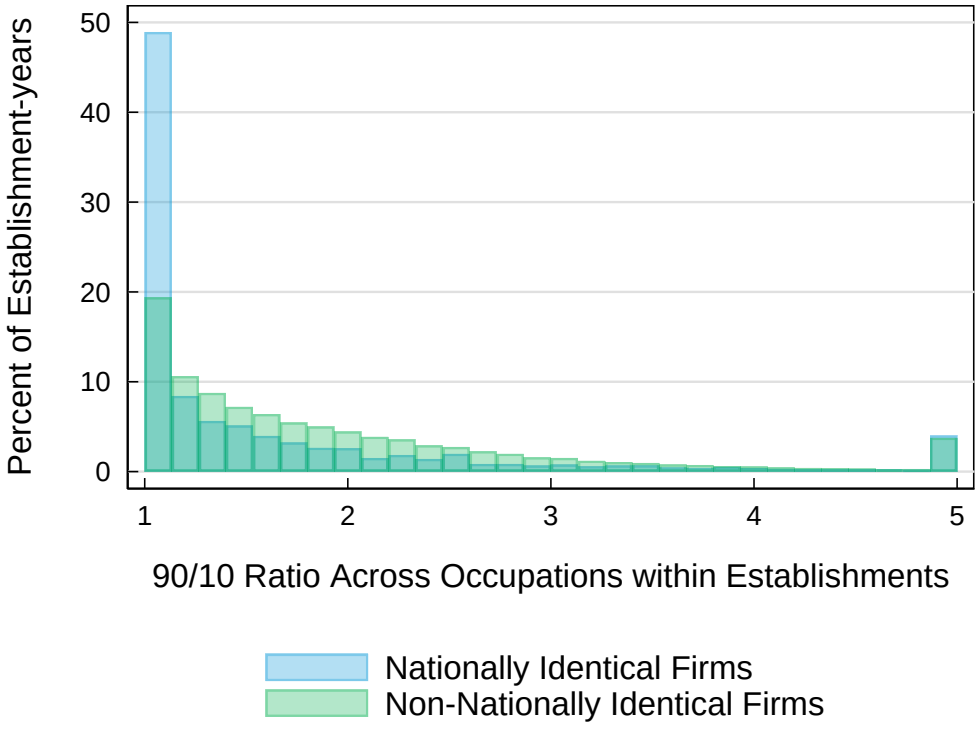
Notes: This figure presents a heat map showing the geographic distribution of natural resource shocks in the U.S., measured in 2012, by county. The map is constructed by grouping counties into ten deciles and shading such that lighter colors correspond to lower rates of natural resource demand. The natural resource instrument is defined as in Section 8.

Figure A19: National Wage Setting and Entering High Cost of Living Regions



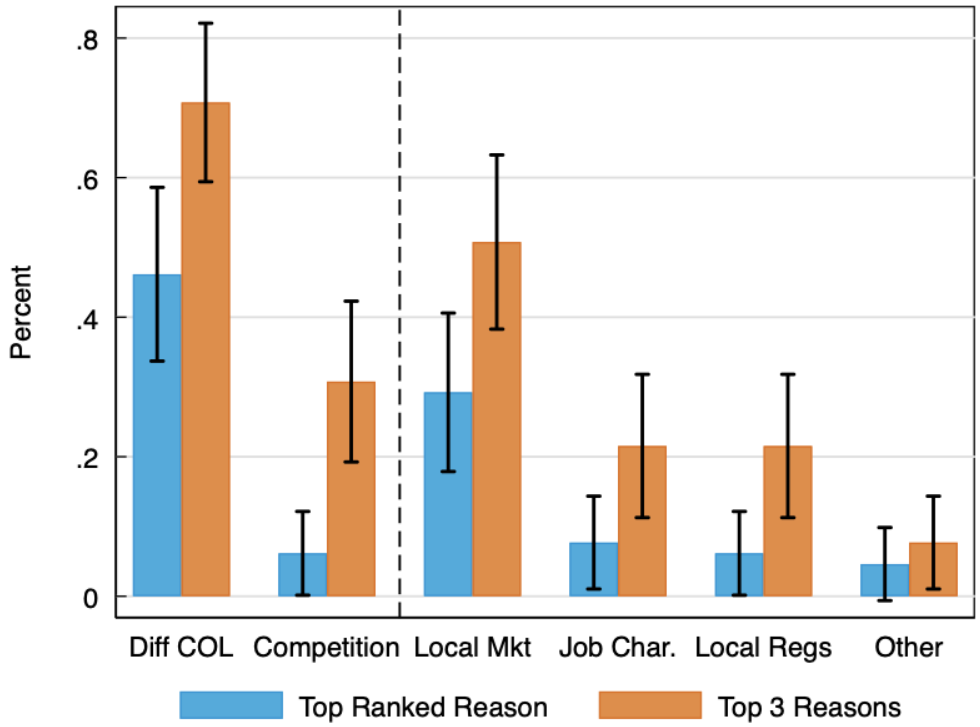
Notes: This figure shows the fraction of respondents who state that their firm would not enter a high cost of living area due to their decision to adopt a rigid pay structure.

Figure A20: Cross-Occupation Wage Dispersion within Firms: 90-10 Ratio



Notes: The sample includes all firm-years with at lease 4 establishments. The unit of observation is the establishment by year. We define a nationally identical firm as one where at least 50% of their occupations in which they post in at least 4 counties have at least 80% of their wage pairs being identical.

Figure A21: Reasons Firms Pay Differently across Geographies



Notes: This figure presents survey responses to the question: "You have mentioned that you set wages or pay bands separately across locations for some of the jobs in your firm. Why does your company choose to set separate wages or pay bands for those jobs?" The sample consists of respondents who state that they work at a firm that sets pay separately by region. "Diff COL" means that the firm operates in regions with a different cost of living. "Competition" means that the firm follows what their competitors do. "Local mkt" means that the firm hires on a local market. "Job char" means that the firm is hiring for a specific type of job. "Local regs" means that the firm is constrained by local regulations, such as minimum wages.

Table A1: The Likelihood of Posting a Wage

	Outcome: Percentage Chance of Posting a Wage			
	(1)	(2)	(3)	(4)
Median Hourly OES Occupation Wage	-0.170			
	(0.0002)			
Posted Education		-1.206		
		(0.001)		
Posted Experience			-0.931	
			(0.001)	
Firm Number of Establishments				-0.438
				(0.0004)
Observations	146,270,553	106,253,913	77,117,722	153,545,387

Notes: All sample restrictions in row 4 of Table A3 except for the removal of missing wages remain in place. The dependent variable is the percentage chance of posting a wage (0 to 100). The units for the independent variables are dollars (row 1), years (row 2 and 3), and the hundreds of establishments (row 4).

Table A2: Geographic Dispersion in Wage Posting

	Outcome: Percentage Chance of Posting a Wage					
	(1)	(2)	(3)	(4)	(5)	(6)
County Price Index	-0.055	-0.015				
	(0.0002)	(0.003)				
County Home Price Index			0.004	0.001		
			(0.00001)	(0.0002)		
Superstar Cities					-0.527	-0.339
					(0.012)	(0.131)
Observations	116,036,208	116,036,208	152,614,625	152,614,625	153,545,387	153,545,387
Fixed Effects:						
Firm by Year by SOC		✓		✓		✓

Notes: The dependent variable is the percentage chance of posting a wage (0 to 100). Standard errors are clustered at the county by year level. Sample includes all Burning Glass vacancies from 2010-2019.

Table A3: Summary Statistics on Sample Formation

	Vacancies	Firms	Establishments	Counties
Full 2010-2019 Data	239,029,970	2,742,555	9,117,553	3,224
Drops Missing Wages	40,625,295	1,267,503	3,529,713	3,221
Drops Missing Firm, County, Sector, Occupation or Military	21,192,965	934,684	3,088,056	3,213
Collapses to year-establishment-occ-pay group	12,116,117	934,684	3,088,056	3,213
Restrict to 4 establishments in year	3,504,867	43,129	1,168,656	3,200

Notes: The first row reports counts for the full data from Burning Glass, for 2010-2019. The second row restricts to observations with non-missing wage information. The third row drops observations with missing firm, region, industry sector or occupation information and excludes military occupations. The fourth row collapses the data to the year by occupation by pay group by establishment level and excludes public administration. A pay group is the pay frequency and type of the salary (e.g. hourly base pay). The fourth row is the main sample for our analysis. The fifth row restricts to firm by occupation by pay groups by year cells where there are postings in at least 4 establishments. It is on this sample that we will define national firms.

Table A4: Comparing Median Wages in OES and Burning Glass

	Annual Basepay	Hourly Basepay	Annual Total	Hourly Total
	(1)	(2)	(3)	(4)
Posted Wages	0.911	0.998	0.732	0.906
	(0.0155)	(0.00610)	(0.0112)	(0.00842)
Observations	90,155	100,503	88,044	85,586

Notes: We regress occupation by MSA log median hourly wages from the Occupational Employment Statistics, on occupation by MSA log median wages from Burning Glass. In both cases, we study the wage averaged over 2010-2019. In both datasets, occupations are at the 6 digit level. In the first column, the Burning Glass wage is annual base pay. In the second column the wage is hourly base pay; in the third, annual total pay; and in the fourth column, hourly total pay. The observations are weighted by occupation by MSA employment over 2010-2019. Robust standard errors are reported in parentheses.

Table A5: Comparing OES and Burning Glass Wages Across the Distribution

	10th	25th	Median	75th	90th
	(1)	(2)	(3)	(4)	(5)
Posted Wages	0.792	0.924	0.998	0.975	0.867
	(0.00571)	(0.00569)	(0.00610)	0.00687)	(0.00625)
Observations	100,789	100,741	100,503	100,021	99,359

Notes: In each column, the dependent variable is the specified moment of the occupation by MSA hourly wages from the Occupational Employment Statistics. The independent variable is the same moment of the posted wage distribution in the Burning glass data. In both cases, we take logs and study the wage averaged over 2010-2019. In both datasets, occupations are at the 6 digit level. In all columns, the Burning Glass wage is annual base pay. The observations are weighted by occupation by MSA employment over 2010-2019. Robust standard errors are reported in parentheses.

Table A6: Relative Wages of National Firms: Robustness to Identical Firm Definition

	Outcome: Log Posted Salary			
	(1)	(2)	(3)	(4)
Nationally Identical Job (80%)	0.15			
	(0.00)			
Nationally Identical Job (4)		0.15		
		(0.00)		
Nationally Identical Job (50%)			0.15	
			(0.00)	
Nationally Identical Job (90%)				0.14
				(0.00)
Observations	3,580,139	3,580,139	3,580,139	3,580,139

Notes: The dependent variable in all columns is the log of the posted salary. Each column differs in the definition of a nationally identical occupation within a firm. In column 1, we define a nationally identical occupation as one where at least 80% of within-firm pairs are the same. In column 2, we define a nationally identical occupation as one where at least 4 of within-firm pairs are the same. In column 3 and 4, we define a nationally identical occupation as one where at least 50% or 90% of within-firm pairs are the same, respectively. In all cases, a nationally identical job is the one that is in an occupation classified as identical for that firm and that pays the modal wage for that job within the firm. All panels include firm fixed effects. The unit of observation in all panels is the establishment*job*year and the sample includes only those firm-job-years with postings in at least 4 locations. Regressions in all columns include a quadratic in establishment size, a quadratic in firm size, and fixed effects for job*county*industry*year. The sample includes all firm-job pairs present in at least 4 establishments in that year. Standard errors are clustered at the county level and reported in parentheses.

Table A7: Geographic Determinants of National Wage Setting

	Outcome: National Wage			
	(1)	(2)	(3)	(4)
Urban	-0.0773	-0.0741	-0.0604	-0.0582
	(-101.21)	(-96.86)	(-5.01)	(-4.88)
Superstar City	-0.0381	-0.00562	-0.0273	-0.00353
	(-37.42)	(-4.99)	(-3.23)	(-0.48)
State GDP Per Capita		-1.776		-1.317
		(-66.70)		(-10.11)
Observations	3,555,707	3,554,673	3,555,707	3,554,673
Fixed Effects:				
Occupation			✓	✓

Notes: The dependent variable is an indicator for whether the job pays a nationally identical wage. Columns 1 and 2 have robust standard errors while columns 3 and 4 cluster the standard errors by occupation. T-statistics are in parenthesis

Table A8: Robustness—Pass Through of Natural Resources Shock to Wages in the Rest of the Firm

	(1)	(2)	(3)	(4)
Panel A	Outcome: Log Secondary Establishment Wage			
Log Primary Wage	0.76	0.55	0.77	0.75
	(0.29)	(0.10)	(0.30)	(0.27)
Observations	578,228	165,140	430,153	458,233
Specification:	Estab. by 3 digit	Control group	Occ. weighted	Constant weight
Panel B	Outcome: Log Secondary Establishment Wage			
Log Primary Wage	1.04	0.91	0.75	0.87
	(0.45)	(0.38)	(0.23)	(0.38)
Observations	458,228	477,735	421,357	427,940
Specification:	Pay type control	No trim	10% trim	Exposed region
Panel C	Outcome: Log Secondary Establishment Wage			
Log Primary Wage	0.88	0.88	0.89	1.50
	(0.38)	(0.39)	(0.39)	(0.49)
Observations	458,233	458,233	427,430	127,265
Specification:	First lag instrument	Primary cluster	No bonus	No range

Notes: The primary establishment is the firm's largest establishment, by vacancies, over 2010-2019. All other establishments of the firm are secondary. The observation counts exclude singletons. In all panels, the outcome variable, from Burning Glass, is 100 x the log of the secondary establishment wage. The regressor is 100 x the log of the primary establishment wage, also from Burning Glass, instrumented with the natural resources shift share instrument from the primary establishment's county, constructed from the County Business Patterns. All columns control for job (i.e. occupation by salary type by pay frequency by establishment) fixed effects, county-by-year fixed effects and 6 digit occupation-by-year fixed effects. Unless otherwise noted, the regression is weighted by the number of vacancies in the job; the standard errors are clustered by the county of the secondary establishment and the firm; wages are trimmed at the 2.5% and 97.5% level, within each occupation, pay frequency, salary type and year; the primary and secondary wages are means within pay frequency, salary type, 6 digit occupation, year and establishment cells; and the sample excludes public sector firms, firms in natural resources (NAICS industry 21), secondary establishments in a county with an employment share in natural resources greater than 5%, and secondary establishments in the same census division as their primary establishment.

In Panel A column (1) we use fixed effects at the 3 digit occupation level instead of the 6 digit level. In column (2) we let the control group be firms whose establishments are all located in counties with zero mining employment share. In column (3) we reweight to target the 6 digit occupation distribution of employment from the 2010 Occupational Employment Statistics. In Column (4) we use constant weights. In Panel B column (1) we control for pay frequency and salary types interacted with year fixed effects. In Column (2) we do not trim the outcome variable. In Column (3) we trim the top and bottom 5%. In Column (4) we define natural resource exposed counties as having employment shares in natural resources above 10%. In Panel C column (1) we use the first lag of the instrument. In Column (2) we cluster by the county of the primary location and the firm. In column (3) we drop wages with bonuses, and in column 4 we drop wages with ranges.

Table A9: Pass Through of Natural Resources to Education and Experience in Rest of Firm

	(1)	(2)	(3)	(4)
Panel A	Outcome: Years of Education Required			
Shift Share Instrument	-0.01	-0.01	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	328,980	328,145	229,708	225,600
Panel B	Outcome: Years of Experience Required			
Shift Share Instrument	-0.02*	-0.01	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	187,552	186,785	116,359	113,944
Fixed Effects:				
Job	✓	✓	✓	✓
Year by county	✓	✓		
Year by occupation		✓		
Year by occupation by county			✓	✓
Year by industry				✓

Notes: The primary establishment is the firm's largest establishment, by vacancies, over 2010-2019. All other establishments of the firm are secondary. The sample excludes public sector firms, firms in natural resources (NAICS industry 21), secondary establishments in a county with an employment share in natural resources greater than 5%, and secondary establishments in the same census division as their primary establishment. The observation counts exclude singletons. The standard errors are clustered by the county of the secondary establishment and the firm. Wages are trimmed at the 2.5% and 97.5% level, within each occupation, pay frequency, salary type and year. In panel A, the outcome variable, from Burning Glass, is the mean years of education required by the job. In panel B, the outcome is mean years of experience required by the job. In both panels, the regressor is the natural resources shift share instrument from the primary establishment's county, constructed from the County Business Patterns. Education and experience are means within pay frequency, salary type, 6 digit occupation, year and establishment cells. The natural resource instrument is calculated by county and year. All columns control for job (i.e. occupation by salary type by pay frequency by establishment) fixed effects. Columns (1)-(2) control for county-by-year fixed effects. Column (2) controls for 6 digit occupation-by-year fixed effects. Columns (3)-(4) control for year-by-county-by-occupation fixed effects. Column (4) controls for year-by-3 digit industry fixed effects. The regression is weighted by the number of vacancies in the job.

Table A10: Pass Through of Natural Resources Shock to Vacancy Posting in Rest of the Firm

	(1)	(2)	(3)	(4)
	Outcome: Probability of Vacancy Posting			
Instrument x	-0.00	-0.00	-0.00	-0.00
National Job	(0.00)	(0.00)	(0.00)	(0.00)
Observations	284,324	283,819	196,758	195,497
Fixed Effects:				
Job	✓	✓	✓	✓
Year by county	✓	✓		
Year by occupation		✓		
Year by occupation by county			✓	✓
Year by industry				✓

Notes: The primary establishment is the firm's largest establishment, by vacancies, over 2010-2019. All other establishments of the firm are secondary. The sample excludes public sector firms, firms in natural resources (NAICS industry 21), secondary establishments in a county with an employment share in natural resources greater than 5%, and secondary establishments in the same census division as their primary establishment. The observation counts exclude singletons. The standard errors are clustered by the county of the secondary establishment and the firm. The outcome variable, from Burning Glass, is an indicator variable for whether the job (i.e. occupation by salary type by pay frequency by establishment) posts a vacancy in the year. The regressors are the natural resources shift share instrument from the primary establishment's county, constructed from the County Business Patterns; and an interaction of this regressor with whether the primary and secondary wage were equal when the job previously posted a vacancy. All columns control for job (i.e. occupation by salary type by pay frequency by establishment) fixed effects. Columns (1)-(2) control for county-by-year fixed effects. Column (2) controls for 6 digit occupation-by-year fixed effects. Columns (3)-(4) control for year-by-county-by-occupation fixed effects. Column (4) controls for year-by-3 digit industry fixed effects.

Table A11: Pass Through of Minimum Wage Shock to Wages in the Rest of the Firm

	(1)	(2)	(3)	(4)	(5)
Panel A (Structural Equation)		Outcome: Log Secondary Establishment Wage			
Log Primary Wage	0.35	-0.44	-0.28	-0.01	0.05
	(0.03)	(0.79)	(0.34)	(0.17)	(0.12)
Observations	464,975	174,915	174,717	119,729	117,833
Specification:					
	OLS	IV	IV	IV	IV
Panel B (First Stage)		Outcome: Log Primary Establishment Wage			
Log Min. Wage		0.09	0.13	0.17	0.20
		(0.06)	(0.06)	(0.05)	(0.04)
Observations		183,738	183,538	125,721	123,768
Fixed Effects:					
Job	✓	✓	✓	✓	✓
Year by county	✓	✓	✓		
Year by occupation			✓		
Year by occupation by county				✓	✓
Year by industry					✓

Notes: The primary establishment is the firm's largest establishment, by vacancies, over 2010-2019. All other establishments of the firm are secondary. The sample excludes public sector firms and, for the IV regressions, occupations outside the bottom quartile of the wage distribution as measured in the 2010 Occupational Employment Statistics. The observation counts exclude singletons. The standard errors are clustered by the county of the secondary establishment and the firm. Wages are trimmed at the 2.5 and 97.5% level, within each occupation, pay frequency, salary type and year. In panel A, the outcome variable, from Burning Glass, is 100 x the log of the secondary establishment wage. The regressor is 100 x the log of the primary establishment wage, also from Burning Glass. Column (1) is an OLS regression of the outcome variable on the regressor. Columns (2)-(5) are IV regressions, instrumented with the log of minimum wages in the primary establishment's county. In panel B, the outcome variable is 100 x the log of the primary establishment wage. The regressor is 100 x the log of minimum wages in the primary establishment's county. The primary and secondary wages are means within pay frequency, salary type, 6 digit occupation, year and establishment cells. Minimum wages are calculated by county and year, and taken from Vaghul and Zipperer (2016). All columns control for job (i.e. occupation by salary type by pay frequency by establishment) fixed effects. Columns (1)-(3) control for county-by-year fixed effects. Column (3) controls for 6 digit occupation-by-year fixed effects. Columns (4)-(5) control for year-by-county-by-occupation fixed effects. Column (5) controls for year-by-3 digit industry fixed effects. The regression is weighted by the number of vacancies in the job.

Table A12: Identical Wage Setting at Franchised Firms

	Outcome:					
	Nationally Identical Job			Fraction of Identical Wage Pairs		
	(1)	(2)	(3)	(4)	(5)	(6)
Franchise Model	-0.065	-0.055	-0.078	-0.064	-0.037	-0.066
	(0.037)	(0.061)	(0.069)	(0.044)	(0.070)	(0.081)
Observations	630,599	630,585	630,580	630,599	630,585	630,580
Fixed Effects:						
Industry		✓			✓	
Occupation by Industry			✓			✓

Notes: The unit of observation is the job by year by establishment. The dependent variable in columns 1-3 is an indicator for whether the occupation within the firm is nationally identical and in columns 4-6 is the fraction of within-firm job pairs that are the same. Regression includes only jobs within the firms with postings for at least 4 establishments. Regression includes 131 firms, 55 of which are coded as franchised. Regression includes a control for the number of vacancies in each occupation*firm*year cell. Standard errors are clustered at the firm level. See text for details on how firms were classified as franchises.

Table A13: Fairness Norms: Wage Compression and Nationally Identical Wages

	Outcome: 90-10 Ratio			Outcome: 75-25 Ratio		
	Actual	Benchmark	Difference	Actual	Benchmark	Difference
	(1)	(2)	(3)	(4)	(5)	(6)
Nationally Identical Firm	-0.13	-0.26	-0.13	-0.07	-0.11	-0.04
	(0.02)	(0.03)	(0.03)	(0.01)	(0.03)	(0.03)
Observations	642,486	688,111	642,486	642,486	688,111	642,486
Dep. Var mean	1.745	1.989	.2678	1.522	1.656	.143

Notes: The sample includes all firm-years with at least 4 establishments. Standard errors are clustered at the firm level. The unit of observation is the establishment by year. All regressions include industry fixed effects and a control for the number of occupations within the establishment. The dependent variable in column 1 is the ratio of the 90th-10th percentile of posted wages in the establishment. The dependent variable in column 2 is the 90/10 ratio replacing the actual posted wage with the average wage for that occupation within the county in which the firm operates. We exclude from this variable all occupations where there are fewer than 4 firms hiring in that county in a given year. Column 3 is the difference between the actual and the benchmark, with lower values indicating that the 90/10 ratio is lower than what would have been predicted by the occupational mix of the establishment. Columns 4 through 6 replicate the analysis in columns 1-3 but using the 75/25 ratio.

Table A14: Sensitivity of Posted Wages to Local Conditions

	Local Prices		Local Rent Prices		Local Income	
Average Local Price for Firm	0.889					
	(0.019)					
Local Price		0.421				
		(0.010)				
Average Local Price for Firm			0.345			
			(0.007)			
Local House Price				0.176		
				(0.004)		
Local Income for Firm					0.435	
					(0.010)	
Local Income						0.196
						(0.004)
No. Obs.	6036403	5351551	10021584	9728441	10021594	9728674
No. Firms	454860	253886	749492	458247	749499	458249

Notes: Standard errors are clustered at the firm level.

B1 Survey Appendix

B1.1 Survey Description

The survey was run with a large HR association. The association is designed to bring together HR professionals at annual meetings, and to provide support in the form of training and mentorship. Members of the association include individuals working in an array of HR positions. We targeted people who work in management level positions or higher.

Individuals received a $15 gift card if they participated in the 10-minute survey.

B1.1.1 Sample

Because we are interested in how firms set pay across geographies, we limit our sample to respondents working at firms that are located in more than one city. Panel A of Figure B3 shows the distribution of the number of cities in which the respondents' employers operate. Roughly 18% of respondents say that they operate in a firm that only operates in one city. Panel B shows the number of states that the firms operate in. For our entire analysis, we drop the 18% of respondents who state that their firm operates in one city, but include respondents with firms operating in only one state.

Figure B4 displays the job titles of respondents.[44] The majority of respondents work as HR managers or executives. In column 1 of Table B1, we provide additional information on the respondents and the types of firms they work for. Over 60% of respondents are directly involved in setting pay. On average, they have been working in their current position for 6.8 years. Respondents report working at firms in which an average of 55% of employees are salaried (as opposed to paid hourly), and roughly 80% of the firms use pay or salary bands rather than posting a single wage.

Respondents tend to work at large firms. Nearly 70%. of respondents work at a firm that employs over 500 workers (Figure B1). Respondents work in a variety of sectors, as shown in Figure B2.

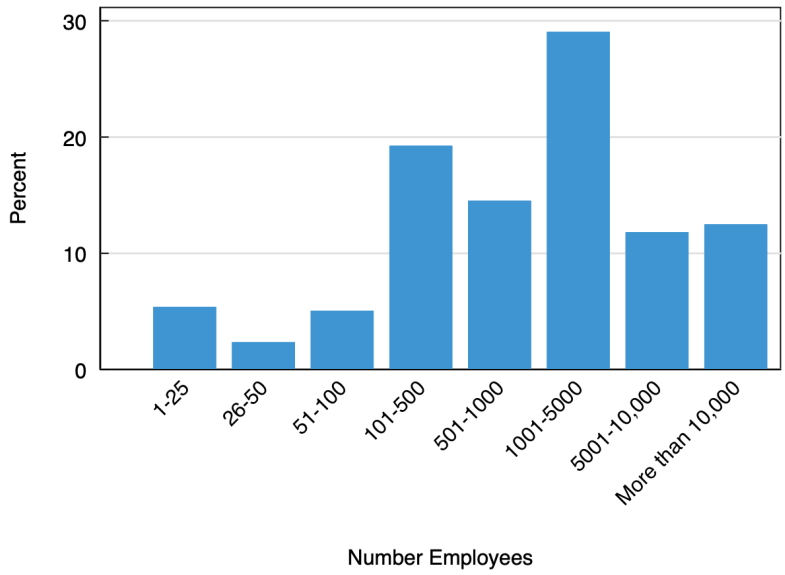
[44] We allowed respondents to write in their title and then aggregated them.

Table B1: Survey Summary Statistics

	(1) Full Sample	(2) Flexible Pay	(3) Some or All Identical Pay
Sets pay	0.609	0.672	0.592
	[0.489]	[0.473]	[0.493]
Yrs. experience	6.858	7.340	6.720
	[6.620]	[6.739]	[6.598]
Firm posts wage	0.465	0.509	0.453
	[0.500]	[0.505]	[0.499]
% salaried empl.	55.48	53.57	56.025
	[29.14]	[29.32]	[29.13]
Uses pay bands	0.802	0.672	0.841
	[0.399]	[0.473]	[0.367]
N	282	58	224

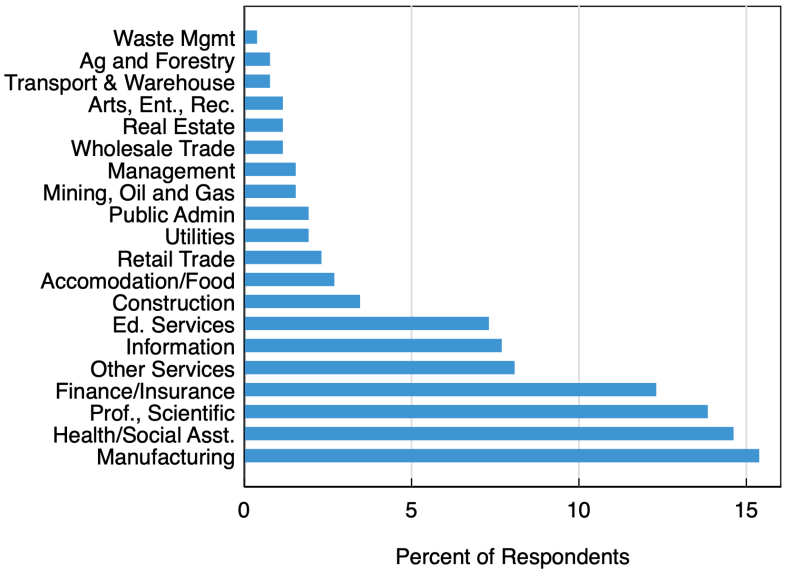
Notes: This table presents summary statistics for the set of survey respondents working at firms that operate in more than one city. Column 2 restricts to the sample of respondents who state that they work at a firm that does not set identical wages for jobs across locations. Column 3 restricts to the sample of individuals who report paying identical wages for some or all of their jobs. *Sets pay* is an indicator that takes the value one if the respondent is directly involved in setting pay within the firm. *Firm posts wages* is an indicator that the firm posts wages or salary bands on their job advertisements. *% salaried empl.* is the fraction of employees who are salaried rather than paid hourly. *Uses pay bands* indicates that the firm uses bay pands for the majority of their employees.

Figure B1: Number of Employees



Notes: This figure shows the distribution of firm size (in terms of number of employees) among survey respondents.

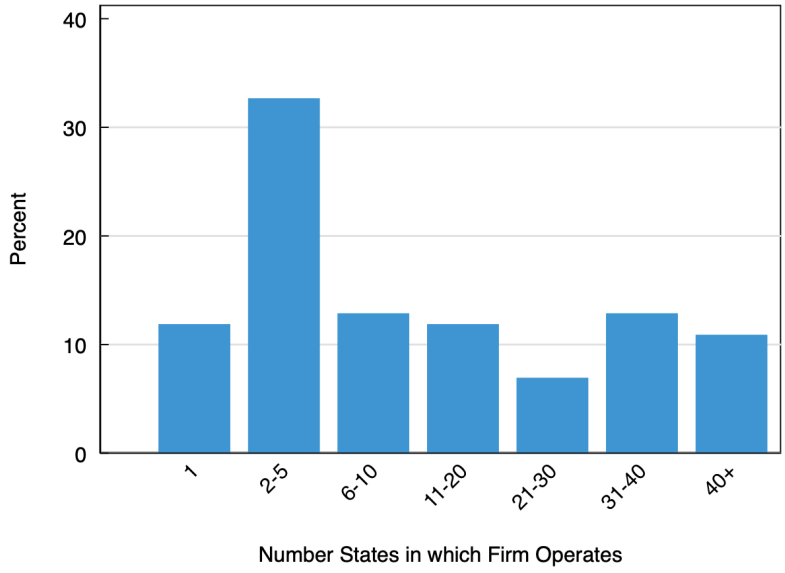
Figure B2: Sector Representation of Survey Respondents



Notes: This figure shows the percent of survey respondents who work at a firm in each of the industries represented on the y-axis.

Figure B3: Number of Cities and States in which Firms Operate

A. States

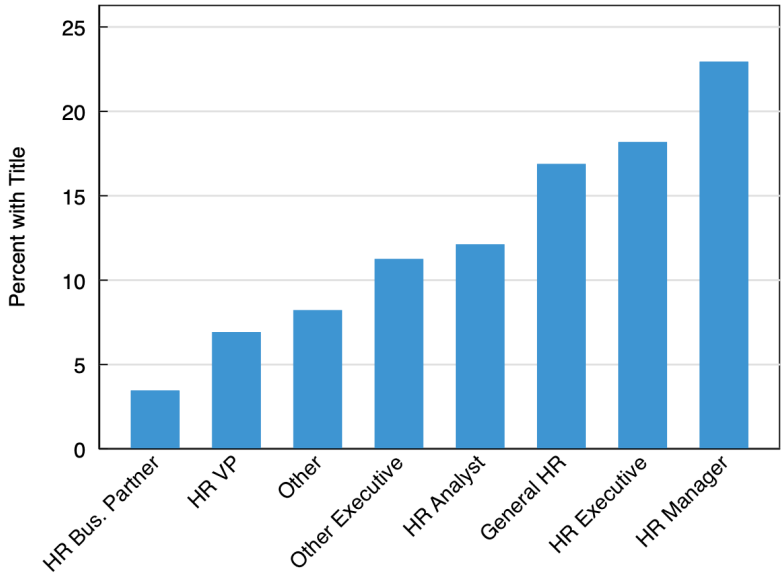


A. Cities



Notes: This figure shows the fraction of respondents working in firms that operate in the given number of states (Panel A) and cities (Panel B)

Figure B4: Respondent Job Titles



Notes: This figure shows the percent of survey respondents whose job title falls under one of the categories on the x-axis. Respondents typed in their own job titles, which were then grouped into one of the above categories.

Table B2: Correlates of National Wage Setting

	(1) More than 500 Employees	(2) More than 50% Empl. Salaried	(3) Pay Determined Centrally	(4) Centralized Hiring
National Firm	0.064	0.020	0.306***	0.072
	(0.079)	(0.081)	(0.069)	(0.074)
Mixed Pay Firm	0.139	-0.032	0.096	0.083
	(0.072)	(0.074)	(0.072)	(0.068)
Mean of Y-Var for Firms w/ No National Pay	0.574	0.485	0.574	0.279
Observations	298	298	298	297

Notes: The dependent variable in column 1 is an indicator that more than the respondent works at a firm employing more than 500 workers; in column 2 it is an indicator that more than 50% of the firm's employees are salaried (as opposed to hourly) employees; in column 3 it is an indicator that the firm's pay structure is determined my central management; and in column 4 it is an indicator that hiring is done by centralized management.

B1.2 Survey Questionnaire

Survey Block 1

1. We'd like to ask you a few questions about your position and your firm. No questions about potentially identifying information will be asked.

   Approximately how many employees does your company currently employ?

   - 1-25
   - 26-50
   - 51-100
   - 101-500
   - 501-1000
   - 1001-5000
   - 5001-10,000
   - More than 10,000

2. Do you currently work in Human Resources?
   - Yes
   - No
3. What is your current position at the firm where you currently work? If you are not currently working, please leave blank. [fill in]
4. For how many years have you worked in your current position at this firm? Please round to the nearest number. [fill in]
5. Are you involved in setting employee pay?
   - Yes
   - No
6. At what level are hiring decisions made?
   - HR managers or personnel in the location where workers are employed
   - HR managers or personnel in the headquarter or another centralized location
   - Other (please specify)
7. What is the main sector in which your firm or company operates?
   - Agriculture, Forestry, Fishing and Hunting
   - Mining, Quarrying, and Oil and Gas Extraction
   - Utilities
   - Construction
   - Manufacturing
   - Wholesale Trade
   - Retail Trade

- Transportation and Warehousing
- Information
- Finance and Insurance
- Real Estate and Rental/Leasing
- Professional, Scientific, and Technical Services
- Management of Companies and Enterprises
- Waste Management and Remediation Services
- Educational Services
- Health Care and Social Assistance
- Arts, Entertainment, and Recreation
- Accommodation and Food Services
- Public Administrative
- Other Services
- Other (please specify)

8. What proportion of your employees are salaried vs. hourly employees? Please list a number between 0 to 100% [fill in]
9. Does your firm post salaries/wages and/or pay bands on your job vacancy ads? That is, do you list a specific dollar value for the expected wage/salary (or a minimum and maximum salary)?
    - Yes
    - No
    - For some jobs but not all
    - I'm not sure
10. In how many cities in the United States does your company currently operate?
    - 1
    - 2-5
    - 5-10
    - 11-20
    - 21-30
    - 31-40
    - 41-50
    - More than 50
11. In how many states does your company currently operate?
    - 1
    - 2-5
    - 6-10
    - 11-20
    - 21-30

- 31-40
- More than 40

12. Does your firm or company have any establishments (i.e. offices/plants/stores) in any of the following high cost-of-living metro areas: San Francisco, New York, Washington D.C., Seattle, Los Angeles, or Boston
    - Yes
    - No
13. What considerations do you take into account when you set wages? Please choose up to three of the most important from the following list. If a consideration is not on the list, please choose other and write in your answer.
    - The wages our competitors are paying (including the use of salary surveys)
    - Local cost of living
    - Employee characteristics (e.g. experience or credentials)
    - Keeping workers motivated
    - Being able to recruit or retain workers
    - Other (please specify)
14. Does your firm primarily use pay bands to set wages/salaries? By a pay band, we mean a pre-specified minimum and maximum salary or wage for a given job.
    - Yes
    - No

Survey Block 2: This block is only shown to respondents who respond "Yes" to question 14 in Block 1.

1. Which of the following best describes how your firm sets pay bands across locations for the majority of your workers?
    - Pay bands are determined separately for each establishment/plant/store.
    - Pay bands are sometimes determined separately but not always. For example, workers in some jobs may face the same band regardless of where they work, but others face pay bands that differ by location. Or, pay bands might be determined separately for each state/region, but workers with the same job title within a state/region face the same pay band.
    - Pay bands are set nationally so that most workers with the same job title face the same pay band.
2. Which of the following best describes who determines pay bands within your firm?
    - Pay bands are primarily left to the discretion of management at each establishment/plant/store.
    - Pay bands are primarily decided by state or regional managers.
    - Pay bands are primarily decided centrally by national management.

3. Do local managers have any discretion in setting wages/salaries at their plant/store/location? Select all that apply. This question is only shown to respondents who do not select "Pay bands are primarily left to the discretion of management at each establishment/plant/store" in question 3.
    - Yes, they can adjust pay based on performance
    - Yes, they can adjust pay based on education or experience
    - Yes, they can adjust pay to match an employee's prior salary
    - Yes, they can adjust pay to match the pay at other competing firms in their region
    - Yes, they can adjust pay to match the cost of living in their area
    - No, local managers do not have discretion to adjust pay
4. How is an employee's wage or salary determined within a pay band? Select all that apply.
    - Education/experience
    - Competition from other firms
    - Performance
    - Local cost of living
    - His/her prior salary
5. Are any of the following approaches used to compensate employees for differences in cost of living across locations? Select all that apply.
    - Bonus pay (including signing bonuses)
    - Housing or relocation allowances
    - Other benefits or perks (such as commuting subsidies or childcare provisions)
    - Other (please specify):
    - None
6. Say you are hiring two salaried employees who have the same job title but who work in two different cities. Would you use the same pay band to determine the two employees' salaries or would you use different pay bands?
    - The pay band would be different in each location.
    - The pay band would be the same across locations.
    - The pay band would be the same but locations determine each person's salary within the pay band.
7. Say you are hiring two hourly employees who have the same job title but who work in two different cities. Would you use the same pay band to determine their hourly pay or would you use different pay bands?
    - The pay band would be different in each location.
    - The pay band would be the same across locations.
    - The pay band would be the same but locations determine each person's salary within the pay band.

Survey Block 3: This block is only shown to respondents who respond "No" to question 14 in Block 1.

1. Which of the following best describes how your firm sets wages/salaries across locations for the majority of your workers?
   - Wages are determined separately for each establishment/plant/store.
   - Wages are sometimes determined separately but not always. For example, workers in some jobs may have the same wage regardless of where they work, but others have wages that differ by location. Or, wages might be determined separately for each state/region, but workers with the same job title within a state/region face the same wage.
   - Wages are set nationally so that most workers with the same job title are paid the same.
2. Which of the following best describes who determines wages/salaries within your firm?
   - Wages are primarily left to the discretion of management at each individual store.
   - Wages are primarily decided by state or regional managers.
   - Wages are primarily decided centrally by national management.
3. Do local managers have any discretion in setting wages/salaries at their plant/store/location? Select all that apply. This question is only shown to respondents who did not select "Wages are primarily left to the discretion of management at each individual store" in question 2.
   - Yes, they can adjust pay based on performance
   - Yes, they can adjust pay based on education or experience
   - Yes, they can adjust pay to match an employee's prior salary
   - Yes, they can adjust pay to match the pay at other competing firms in their region
   - Yes, they can adjust pay to match the cost of living in their area
   - No, local managers do not have discretion to adjust pay
4. Are any of the following approaches used to compensate employees for differences in cost of living across locations? Select all that apply.
   - Bonus pay (including signing bonuses)
   - Housing or relocation allowances
   - Other benefits or perks (such as commuting subsidies or childcare provisions)
   - Other (please specify):
   - None
5. Say you are hiring two salaried employees who have the same job title but work in two different cities. Would you set the same salary for each employee or would you set different salaries?
   - We would likely pay different salaries
   - We would likely pay the same salary
   - We would offer the same salary but negotiations might result in different final salaries
6. Say you are hiring two hourly employees who have the same job title but work in two different cities. Would you set the same hourly pay for each employee or would you set different hourly pay?

- We would likely set different hourly pay
- We would likely set the same hourly pay
- We would offer the same hourly pay but negotiations might result in different final pay

Survey Block 4: This block is only shown to respondents who respond "Pay bands are set nationally so that most workers with the same job title face the same pay band" to question 1 in Block 2 and respondents who respond "Wages are set nationally so that most workers with the same job title are paid the same" to question 1 in Block 3.

1. Why are salaries or pay bands set nationally? Please choose up to three of the reasons provided below. If a reason is not on the list, please choose "other" and write in your answer.
   - For simplicity: It is administratively costly to tailor wages to each location
   - All of our employees work in the same geographic region or in areas with similar costs of living
   - We want workers performing the same job to be paid the same wage, regardless of where they are located
   - This is how our competitors set wages
   - We are hiring on a national market (i.e. we are recruiting from across the country rather than locally)
   - Workers in these jobs sometimes transfer across locations and we do not want to adjust their pay if they do
   - Other (please specify)
2. Say an establishment in your company located in City A had to change its wage or pay bands to keep up with local competition. Would other establishments/plants/stores in your firm located in cities B and C also then change their wage or pay bands?
   - Yes
   - No
   - Only if it is the headquarter that is changing its wages/pay bands
   - I'm not sure

Survey Block 5: This block is only shown to respondents who respond "Pay bands are sometimes determined separately but not always" to question 1 in Block 2 and respondents who respond "Wages are sometimes determined separately but not always" to question 1 in Block 3.

1. Do you set the same wage (or pay band) for workers with the same job title across location for any of the following groups of workers? You may choose more than one.
   - Workers who frequently travel to or work in multiple locations
   - Workers who work in a single location
   - Salaried employees
   - Hourly employees

- Workers we recruit on a national market
- Other (please specify)

2. Do you set the same wage (or pay band) for workers with the same job title within any of the following geographic locations?
   - Establishments located in the same state
   - Establishments located in the same city
   - All establishments except for those located in the most expensive cities (e.g. San Francisco or NYC)
   - All establishments except for those located in the least expensive cities
   - All establishments across the country
   - Other (please specify):
3. You have mentioned that you set the same wages or pay bands across locations for some jobs in your firm. Why does your company choose to set those wages uniformly across establishments?
   - We want workers performing the same job to be paid the same wage, regardless of where they are located
   - Workers in these jobs sometimes transfer across locations and we do not want to adjust their pay if they do
   - Other (please specify)
   - For simplicity: It is administratively costly to tailor wages to each location
   - We are hiring on a national market for these jobs (i.e. we are recruiting from across the country rather than locally)
   - This is how our competitors set wages for these jobs
   - The jobs for which we set wages nationally are located in the same geographic region or in areas with similar costs of living
4. You have mentioned that you set wages or pay bands separately across locations for some of the jobs in your firm. Why does your company choose to set separate wages or pay bands for those jobs? Please choose up to three answers and rank.
   - The jobs for which we set pay separately are located in areas with different costs of living
   - We are hiring on a local market for these jobs
   - This is how our competitors set pay for these jobs
   - There are different local regulations affecting the wages for these jobs
   - The jobs for which we set pay locally are niche jobs
   - Other (please specify)
5. Say an establishment in your company located in City A had to change its wage or pay bands to keep up with local competition. Would other establishments/plants/stores in your firm located in cities B and C also then change their wage or pay bands?
   - Yes
   - No

- Only if it is the headquarter that is changing its wage/pay bands
- I'm not sure

Survey Block 6: This block is only shown to respondents who respond "Pay bands are determined separately for each establishment/plant/store" to question 1 in Block 2 and respondents who respond "Wages are determined separately for each establishment/plant/store" to question 1 in Block 3.

1. Which, if any, of the following approaches are used to compensate employees for differences across locations? You may select more than one.
   - Separate base salary structures for various locations
   - Individual adjustments to the base salaries of certain workers in a region (including bonus pay and the outcome of individual negotiations)
   - Housing or relocation allowances
   - Other benefits or perks (such as commuting subsidies or childcare provisions)
   - None of the above
   - Other (please specify):
2. What considerations do you take into account when you decide geographic differences in wages for workers with the same job title? Please choose up to three answers and list them in order of importance. You can choose and rank answers by dragging them from the left side to the right side and reordering them.
   - Competition for workers in the local area
   - Local cost of living
   - State or municipal minimum wages
   - How niche the position is
   - Other (please specify)
   - We follow salary surveys to benchmark wages in each geographic region
   - Wages stipulations determined by a workers' union

Survey Block 7

1. Is it easier or more difficult to recruit/retain workers in your establishments/plants/stores that are located in cities with a low cost of living?
   - Easier
   - More difficult
   - It does not make a difference
   - We do not have any establishments located in such cities
2. Is it easier or more difficult to recruit/retain workers in your establishments/plants/stores that are located in cities with a high cost of living? (e.g. NYC or San Francisco)
   - Easier

- More difficult
- It does not make a difference
- We do not have any establishments located in such cities

3. Has a high cost of living ever prevented your company from entering or setting up in a certain location?
    - Yes
    - No
    - I'm not sure

Survey Block 8

1. Before the Covid-19 pandemic, was remote work common in your company?
    - No, fewer than 5% of employees worked remotely
    - It was not too common. Between 5% and 25% of employees worked remotely.
    - It was quite common. More than 25% of employees worked remotely.
    - Nearly all (¿95%) of employees worked remotely
2. Do you expect the share of your workforce that works entirely remotely to be higher after the Covid-19 pandemic relative to before?
    - Yes
    - No
3. Do you expect the share of your workforce that is able to work remotely at least two days a week to be higher after the Covid-19 pandemic relative to before?
    - Yes
    - No
4. Did you adjust employee pay if they transitioned to remote work during the pandemic?
    - Yes, we increased pay for all workers that work remotely
    - Yes, we reduced pay for all workers that work remotely
    - Yes, we adjusted pay based on the location from which the employee decided to work
    - Yes, we adjusted pay for employees hired after the start of the pandemic, but not for those who were hired before
    - We did not change pay and do not plan to in the future
    - We have not adjusted pay yet but plan to if employees continue to work remotely

C1 Model Appendix

C1.1 Introducing Local Amenities and Local Cost of Living

We consider an extension of our baseline model. The goal of this extension is to endogenize the labor supply elasticity to the establishment, as a function of local consumer prices and local amenities.

The model of labor supply is similar to, but not nested by, the model in the main text. We will consider a simplified version of the canonical Rosen-Roback model (see e.g. Moretti, 2013). There is a continuum of workers with idiosyncratic preferences for regions, and for establishments within regions. The workers consume a non-tradeable good within each region, and benefit from local amenities to which they assign a common value.

We describe the worker side of the model, and for brevity omit the firm side of the model. We show that, holding fixed the nominal wage paid by the establishment, the labor supply elasticity to the establishment is increasing in local consumer prices and decreasing in the attractiveness of local amenities.

C1.1.1 Setup

There is a unit continuum of agents, ex-ante identical, which we index by $k \in [0,1]$. There are $i = 1, ..., M$ firms, who employ workers in each of $j = 1, ..., N$ regions. A unit of firm i operating in region j is an establishment; the establishment pays wage W_{ij}.

Each agent has idiosyncratic, nested logit, preferences for working at each establishment ij, that depend on both the identity i of the firm, and of the region j. We denote the value of agent k's idiosyncratic taste for establishment ij by ε_{ijk}, and their indirect utility from working in this establishment by V_{ijk}. Agents in region j consume an amount C_{ijk} of a non-tradeable good with price P_j and receive value from an amenity B_j. Agents have preferences $u(C_{ijk}, B_j)$ over consumption and amenities, increasing and concave in both arguments. We assume $u_{ca} < 0$, so amenities and consumption are substitutes.

The agent's problem is to choose the establishment with the highest utility, that is, to solve

$$\max_{ij} V_{ijk}$$

where indirect utility is defined by

$$V_{ijk} = \max_{C_{ijk}} \left[\log u(C_{ijk}, B_j) + \varepsilon_{ijk}\right]$$

subject to a budget constraint

$$P_j C_{ijk} \leq W_{ij}.$$

We assume that the distribution of idiosyncratic preferences is a nested logit, i.e.

$$F\left(\{\varepsilon_{ij}\}_{i\in M, j\in N}\right) = e^{-\sum_{j\in N}\left(\sum_{i\in M} e^{-\rho\varepsilon_{ij}}\right)^{\frac{\eta}{\rho}}}.$$

C1.1.2 Result and Discussion

The object of this model extension is to endogenize the labor supply elasticity to the establishment, as a function of local amenities B_j and local consumer prices P_j. The first step is to simplify the indirect utility function to

$$V_{ijk} = \log u\left(\frac{W_{ij}}{P_j}, B_j\right) + \varepsilon_{ijk}.$$

Then Verboven (1996) shows that, since ε_{ijk} has a nested logit distribution, the probability that agent k chooses establishment ij is

$$\text{Prob}_{ij}^{k} = \frac{u\left(\frac{W_{ij}}{P_j}, B_j\right)^{\rho}}{\sum_{i\in M} u\left(\frac{W_{ij}}{P_j}, B_j\right)^{\rho}} \frac{\left[\sum_{i\in M} u\left(\frac{W_{ij}}{P_j}, B_j\right)^{\rho}\right]^{\frac{\eta}{\rho}}}{\sum_{m\in N}\left[\sum_{l\in M} u\left(\frac{W_{lm}}{P_m}, B_m\right)^{\rho}\right]^{\frac{\eta}{\rho}}}.$$

Integrating over agents k, it follows that

$$L_{ij} = u\left(\frac{W_{ij}}{P_j}, B_j\right)^{\rho} \times \kappa_j$$

where

$$\kappa_j = \frac{1}{\sum_{i\in M} u\left(\frac{W_{ij}}{P_j}, B_j\right)^{\rho}} \times \frac{\left[\sum_{i\in M} u\left(\frac{W_{ij}}{P_j}, B_j\right)^{\rho}\right]^{\frac{\eta}{\rho}}}{\sum_{m\in N}\left[\sum_{l\in M} u\left(\frac{W_{lm}}{P_m}, B_m\right)^{\rho}\right]^{\frac{\eta}{\rho}}}$$

is a constant that the firm takes as exogenous.

Then the elasticity of labor supply to establishment ij is

$$\begin{aligned}\frac{d\log L_{ij}}{d\log W_{ij}} &= \rho\frac{d\log u\left(\frac{W_{ij}}{P_j},B_j\right)}{d\log W_{ij}}\\ &= \rho\varphi_c\left(\frac{W_{ij}}{P_j},B_j\right)\frac{d\log C_{ij}}{d\log W_{ij}}\\ &= \rho\varphi_c\left(\frac{W_{ij}}{P_j},B_j\right)\end{aligned} \tag{13}$$

where $\varphi_c\left(C_{ij},B_j\right)\equiv d\log u/d\log C$ is the elasticity of utility with respect to consumption.

Equation (13) shows the main result of the model extension. Holding fixed nominal wages W_{ij}, we have that the labor supply elasticity is: (i) increasing in local prices P_j and (ii) decreasing in amenities. To see the first result, note that an increase in P_j lowers real consumption W_{ij}/P_j. So, the marginal utility of consumption increases and φ_c rises, increasing the labor supply elasticity in equation (13). To see the second result, note that increases in B_j lower φ_c. Amenities are substitutes for consumption by assumption, so better amenities lower the marginal utility of consumption, meaning the labor supply elasticity in equation (13) falls.

The intuition of both results is similar and straightforward. When consumer prices are higher, then all else equal, consumption is lower. Establishments must compensate workers with a higher wage. In the other direction, better amenities effectively raise consumption, so establishments need not compensate workers with such a high wage.

This result is useful because we have shown that holding fixed nominal wages, the labor supply elasticity increases in consumer prices and decreases in amenities. So there is a force that leads firms to set lower wages when amenities are better, and higher wages when consumer prices are higher.

C1.2 Endogenizing the Share of National Wage Setters

This subsection considers a two stage game that endogenizes $\mathcal{F}$, the share of wage setters subject to rigidity. We allow firms to choose whether to set rigid wages, i.e. whether to be a national wage setter. If firms choose to set rigid wages, they receive a productivity benefit, which they balance against the cost of paying the same nominal wage across all their labor markets. We show that when the productivity benefits of national wage setting are intermediate, some firms will find national wage setting optimal and others will prefer local wage setting. In equilibrium, there can be a mix of national and local wage setters as in the data.

C1.2.1 Model Setup

Consider the following stage game that extends our baseline model.

- **Stage 1.** Firms draw a *national wage setting shock* A_{iF}, from a continuous distribution with mean μ_F and support $\left[\underline{A}, \overline{A}\right]$. Then firms choose whether to be national or local wage setters. If firms choose to be national wage setters, then their productivity increases by a factor A_{iF}, but they must pay the same nominal wage everywhere. Otherwise, firms choose to be local wage setters. They can pay different wages in different regions, but forgo the productivity gain of national wage setting.
- **Stage 2**. Depending on their choice in Stage 1, firms are either national or local wage setters. Then firms set wages as in our benchmark model. For brevity, we do not repeat the model equations here. We make three simple modifications of the benchmark model for this extension. First, we assume $P_j = 1,$ i.e. prices are fixed. Second, we assume there is a unit mass of firms, instead of a discrete number as in the main section. Third, we assume that the labor supply elasticity to the establishment, ρ_j, does not vary across regions.

We solve for the subgame perfect equilibrium of this two stage game and study properties of the equilibrium share of rigid wage setters $\mathcal{F}^*$.

C1.2.2 Discussion

In this extension, firms choose whether to set rigid wages given a trade-off. They may increase their productivity, and hence their profits, by setting wages nationally. But firms may also lose profits because they must set the same wage in all labor markets, though conditions differ across markets. Alternatively, firms can tailor wages in each labor market to forgo this trade-off. Firms with high values of the national wage setting shock will find national wage setting more attractive.

Consider some examples. Firms could choose to set rigid wages, in order to improve morale from internal equity and therefore raise productivity across the firm. Or, firms might attract higher quality workers from occupations that "set wages nationally". These high quality workers would be averse to taking nominal pay cuts to work in low nominal wage regions. But they would accept jobs that pay the same nominal wage as in higher nominal wage regions. Or, firms might enjoy a reduction in costs—isomorphic to a productivity gain—from only employing human resource workers in their headquarter. However, these firms will have to pay the same nominal wage everywhere—even in the low nominal wage regions.

This model is consistent with our facts 3 and 4**:**

- **Fact 3: Identical wages concentrate within certain firms.** National wage setters pay the same nominal wage across all establishments, local wage setters can vary nominal wages across establishments.
- **Fact 4: National wage setters pay a wage premium**. If $\mu_F > 1$, (on average there is a productivity gain from frictional wage setting), then national wage setters will pay a premium.

C1.2.3 Proposition and Discussion

Proposition. *For all values $\mathcal{F}^* \in (0, 1)$, there exists a value of μ_F such that $\mathcal{F}^*$ is the equilibrium outcome.*

This proposition shows that for some values of the productivity gain from rigid wage setting, national and local wage setters will co-exist in the labor market, so $\mathcal{F}$ is a fraction strictly between zero and one. Moreover, for any given fraction of firms setting wages nationally $\mathcal{F}$, there exists a productivity gain from national wage setting that leads to $\mathcal{F}$ as an equilibrium outcome.

Intuitively, firms balance the productivity gains from adopting rigid wage setting against the costs of setting the same wage everywhere. Of course, if the gains from rigid wage setting are massive or tiny for all firms, either all or none of the firms will choose to be rigid wage setters.

But suppose that the value of μ_F is intermediate. Then some firms will be nearly indifferent between national and local wage setting. At the market level, different firms will choose either form of wage setting. Firms with a high value of the "national wage setting shock" will find it optimal to set wages nationally. Firms with a low value of this shock will set wages locally. So, with an intermediate value of μ_F, there can be a mix of national and local wage setters, as in our empirics. As μ_F grows, but remains in an intermediate range, the equilibrium share of national wage setters will also grow.

C1.2.4 Proof

First, consider the decision of an individual firm at stage 2. Fix a share of national wage setters $\tilde{\mathcal{F}}$. Then profits for national wage setters are

$$\begin{aligned}
\pi_i^F &= \sum_{j\in N}\left[A_{iF}A_iA_jL_{ij} - W_{ij}L_{ij}\right] \\
&= \sum_{j\in N}\left[A_{iF}A_iA_jW_i^{\rho}W_j^{-\rho}L_j - W_{ij}W_i^{\rho}W_j^{-\rho}L_j\right] \\
&= \sum_{j\in N}\left[A_{iF}A_iA_jW_i^{\rho}W_j^{-\rho}L_j - W_i^{1+\rho}W_j^{-\rho}L_j\right] \\
&= \sum_{j\in N}\left[A_{iF}A_iA_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_{iF}A_iA_k}{N}\right)^{\rho}W_j^{-\rho}L_j - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_{iF}A_iA_k}{N}\right)^{1+\rho}W_j^{-\rho}L_j\right] \\
&= \sum_{j\in N}W_j^{-\rho}L_j\left[A_{iF}A_iA_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_{iF}A_iA_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_{iF}A_iA_k}{N}\right)^{1+\rho}\right] \\
&= A_{iF}^{1+\rho}A_i^{1+\rho}\sum_{j\in N}W_j^{-\rho}L_j\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right] \\
&= A_{iF}^{1+\rho}A_i^{1+\rho}\sum_{j\in N}W_j^{-\rho}W_j^{\eta}W^{-\eta}L\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right] \\
&= W^{-\eta}LA_{iF}^{1+\rho}A_i^{1+\rho}\sum_{j\in N}W_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right]
\end{aligned}$$

where in the second line we use the establishment's labor supply curve

$$L_{ij} = \left(\frac{W_{ij}}{W_j}\right)^{\rho}L_j \implies L_{ij} = W_{ij}^{\rho}W_j^{-\rho}L_j$$

in the third line we use the optimal wage for frictional wage setters

$$W_{ij}^F = \frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_{iF}A_iA_j}{N}$$

and in the final line we use the labor supply curve to the region.

$$L_j = \left(\frac{W_j}{W}\right)^{\eta}L \implies L_j = W_j^{\eta}W^{-\eta}L$$

Still considering stage 2, profits for local wage setters are:

$$\begin{aligned}
\pi_i^{NF} &= \sum_{j\in N}\left[A_iA_jL_{ij} - W_{ij}L_{ij}\right] \\
&= \sum_{j\in N}\left[A_iA_jW_{ij}^{\rho}W_j^{-\rho}L_j - W_{ij}W_{ij}^{\rho}W_j^{-\rho}L_j\right] \\
&= \sum_{j\in N}\left[A_iA_jW_{ij}^{\rho}W_j^{-\rho}L_j - W_{ij}^{1+\rho}W_j^{-\rho}L_j\right] \\
&= \sum_{j\in N}W_j^{-\rho}L_j\left[A_iA_jW_{ij}^{\rho} - W_{ij}^{1+\rho}\right] \\
&= A_i^{1+\rho}\sum_{j\in N}W_j^{-\rho}W_j^{\eta}W^{-\eta}L\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right] \\
&= A_i^{1+\rho}W^{-\eta}L\sum_{j\in N}W_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right]
\end{aligned}$$

We can make the dependence on $\tilde{\mathcal{F}}$ explicit and write

$$\pi_i^F\left(\tilde{\mathcal{F}}\right) = W^{-\eta}LA_{iF}^{1+\rho}A_i^{1+\rho}\sum_{j\in N}W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right] \tag{14}$$

$$\pi_i^{NF}\left(\tilde{\mathcal{F}}\right) = A_i^{1+\rho}W^{-\eta}L\sum_{j\in N}W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right] \tag{15}$$

Now, consider the game at stage 1. Given beliefs about the share of rigid wage setters $\tilde{\mathcal{F}}$, each firm chooses whether to be a national or local wage setter, that is they choose

$$i = \begin{cases} F & \pi_i^{NF}\left(\tilde{\mathcal{F}}\right) < \pi_i^F\left(\tilde{\mathcal{F}}\right) \\ NF & \pi_i^{NF}\left(\tilde{\mathcal{F}}\right) \geq \pi_i^F\left(\tilde{\mathcal{F}}\right) \end{cases} \tag{16}$$

Substituting equations (14) and (15) into equation (16), a firm chooses to be a rigid wage setter if

$$W^{-\eta}LA_{iF}^{1+\rho}A_i^{1+\rho}\sum_{j\in N}W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right] \geq$$

$$A_i^{1+\rho}W^{-\eta}L\sum_{j\in N}W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right]$$

$$\implies A_{iF}^{1+\rho} \geq \frac{A_i^{1+\rho} W^{-\eta} L \sum_{j\in N} W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right]}{W^{-\eta} L A_i^{1+\rho} \sum_{j\in N} W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right]}$$

$$\implies A_{iF} \geq \left[\frac{\sum_{j\in N} W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right]}{\sum_{j\in N} W\left(\tilde{\mathcal{F}}\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right]}\right]^{\frac{1}{1+\rho}}. \tag{17}$$

Observe that the right hand side of this inequality does not depend on i . It follows that there exists some $A\left(\tilde{\mathcal{F}}\right)$ such that all i with $A_{iF} \leq A\left(\tilde{\mathcal{F}}\right)$ will choose to be flexible and all i with $A_{iF} > A\left(\tilde{\mathcal{F}}\right)$ will choose to be rigid.

Now we can characterize the value of $\mathcal{F}^*$, the equilibrium fraction of national wage setters. The share of frictional wage setters satisfies

$$P\left(A_{iF} > \left[\frac{\sum_{j\in N} W\left(\mathcal{F}^*\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}A_j\right)^{\rho} - \left(\frac{\rho}{1+\rho}A_j\right)^{1+\rho}\right]}{\sum_{j\in N} W\left(\mathcal{F}^*\right)_j^{\eta-\rho}\left[A_j\left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{\rho} - \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_k}{N}\right)^{1+\rho}\right]}\right]^{\frac{1}{1+\rho}}\right) = \mathcal{F}^*,$$

which we derive by converting equation (17) to a probability, and by the definition of the ideal wage index we must have

$$\begin{aligned} W\left(\mathcal{F}^*\right)_j &= \left[\int_0^1 W_{ij}^{1+\rho} di\right]^{\frac{1}{1+\rho}} \\ &= \left[\int_{i:A_{iF}\leq A(\mathcal{F}^*)} W_{ij}^{1+\rho} dF\left(A_{iF}\right) + \int_{i:A_{iF}>A(\mathcal{F}^*)} W_{ij}^{1+\rho} dF\left(A_{iF}\right)\right]^{\frac{1}{1+\rho}} \\ &= \left[\int_{i:A_{iF}\leq A(\mathcal{F}^*)} \left(\frac{\rho}{1+\rho}A_i A_j\right)^{1+\rho} dF\left(A_{iF}\right) + \int_{i:A_{iF}>A(\mathcal{F}^*)} \left(\frac{\rho}{1+\rho}\frac{\sum_{k\in N}A_{iF}A_i A_k}{N}\right)^{1+\rho} dF\left(A_{iF}\right)\right]^{\frac{1}{1+\rho}}. \end{aligned}$$

Suppose we vary μ_F while holding the other centered moments of A_{iF} fixed (which can always be achieved as long as we vary the support). This defines a function $\mathcal{F}^*\left(\mu_F\right)$. Inspecting the two equations above, the function must be continuous. It is straightforward to show that if μ_F is sufficiently low then $\mathcal{F}^* = 0$ and if μ_F is sufficiently high then $\mathcal{F}^* = 1$. It follows from the intermediate value theorem and continuity of $\mathcal{F}^*\left(\mu_F\right)$ that there exists a value of μ_F such that for all $\mathcal{F} \in (0,1)$, $\mathcal{F}^*\left(\mu_F\right) = \mathcal{F}$.