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Assessing Labor Market Concentration's Influence on Wages in the Aftermath of Covid-19

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ABSTRACT

Research has shown that U.S. labor markets are highly concentrated, threatening the welfare of American workers by lowering wages. Using establishment level data from the U.S. Census Bureau County Business Patterns, this thesis provides the first look at how the Covid-19 pandemic impacted the relationship between labor market concentration and wages in the United States. The analysis focuses on four sectors that were highly impacted by the pandemic: (1) healthcare, (2) food and accommodation, (3) arts, entertainment, and recreation, (4) and retail trade. The econometric model, using a new time period of data, confirms prior findings of a negative relationship between labor market concentration in both the arts, entertainment, and recreation and retail trade sectors. Additional analysis indicates that, in all sectors except healthcare, an increase in HHI further decreased wages in the aftermath of the pandemic. These findings serve as guidance to policy makers, highlighting the impact of the recent shifts in the labor market on workers.

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Chapter 1

Introduction

“Healthy market competition is fundamental to a well-functioning U.S. economy” - Economic Report from the President (Council of Economic Advisors, 2022)

The labor market is an integral part of American workers' lives. It directly affects the economic welfare of millions of individuals by determining wages, income, access to healthcare, and much more. Consequently, to improve economic welfare, policy makers depend on thorough economic research of the labor market. Central to this research is the evaluation of market competition, aimed to protect workers from being exploited.

Azar et al. (2020, 2022), Benmelech et al. (2022), Handwerker and Dey (2024) and Rinz (2022) have recently contributed to a growing understanding of how competition affects wages by analyzing labor market concentration. The 2022 Economic Report of the President devoted a chapter to this research and similar studies, voicing concerns about widespread labor market power. The report also discussed the repercussions of Covid-19 and the challenges the U.S. has faced in its economic recovery.

As policy makers try to untangle the impacts of Covid-19, more research is needed to quantify the pandemic’s impact on market competition and address rising political concerns. This thesis contributes to this need by using new data and a new time period to quantify the pandemic’s impact on the labor market using labor market concentration.

1.1 What is Labor Market Power and Concentration?

Monopsony is the term used to define a market where there is a single buyer of an input, such as labor. It indicates a lack of competition on the demand side of the market. The parallel idea on the supply side of the market is a monopoly, a widely recognized economic concept. A monopoly occurs when there is a single firm producing a good or service, allowing them to charge a higher price than they otherwise could in a competitive market with many producers. This lack of competition gives the producer market power in the good or service because they are unilaterally able to determine prices. Economists refer to this market power as product market power, which can also occur in a product market with only two firms, a duopoly, or a product market with a few firms that dominate the smaller firms.

The presence of market power has the ability to substantially hurt consumers if prices are too high. In order to identify where these problems may arise, The U.S. Department of Justice (DOJ) Antitrust Division and economists measure product market concentration. This is defined as how the share of supply is distributed across firms in a market. For example, if one firm is the major supplier of a good, competing against only a handful of other firms, the market would be considered concentrated because output is concentrated in one firm. However, if a market has ten firms, each with an equal supply, this market is not considered concentrated because supply is well-distributed. The Herfindahl-Hirschman Index (HHI) is a commonly used measure of concentration and is calculated by summing the squared product market share of each firm in the market. The U.S. DOJ Antitrust Division considers markets with an HHI between 1,000 and 1,800 to be moderately concentrated and those with an HHI above 1,800 to be highly concentrated (U.S. Department of Justice Antitrust Division, 2024).

The concept of monopsony was first used by economist Joan Robinson in her book *The Economics of Imperfect Competition* (1933). Robinson explored labor markets from the perspective of a monopsonist firm. Since then, economists have studied monopsony within labor markets, characterized by a firm's ability to pay a wage lower than it would in a perfectly competitive market. A classic example of a labor market monopsony is a coal factory. A coal factory traditionally opens in a small town, employing a majority of the town's working population. Additionally, it is free from many competing employers since it operates in a rural location. This gives the coal factory wage-setting power in the town.

Amazon serves as a more recent example of a monopsony within various input markets such as technology and retail goods. Although monopsonist firms like Amazon can be very harmful to American workers, exploiting their power to pay lower wages, they also bring important benefits. Consumers can benefit from the large economies of scale of monopsony firms through lower prices. In the case of Amazon, large economies of scale also enable them to quickly transport products to consumers. Additionally, many monopsonists generate high profits, which may lead to an increase in investment and research. While this paper specifically examines the effects of monopsony and employer power in the labor market, it is useful to keep in mind the larger implications of monopsonist firms.

As in product market power, labor market power arises when employment is concentrated in one or a small number of firms, allowing them to pay lower than competitive wages. Therefore, the concentration in a given labor market indicates where firms may be charging lower wages and potentially exploiting workers. Traditionally economists measured this by estimating the wage elasticity of the supply curve of labor faced by firms. Robert L. Bunting (1962) was the first to use employment ratios to quantify labor market concentration, mirroring the HHI computation used to

compute product market concentration. Instead of indicating how output was distributed across firms, Bunting's computation indicated how employment was distributed across firms. This concept re-emerged through the research of Azar et al. (2017) who quantified labor market concentration in every commuting zone across the United States by calculating HHI with job vacancy data. Since then, using employment ratios to calculate HHI has become increasingly popular in the economic literature. Following this trend, this paper computes HHI for each county and North American Industry Classification System (NAICS) code using employment shares estimated from U.S. Census Bureau data between 2012 and 2021.

This mirrors similar research done in the past ten years, particularly by Azar et al. (2020, 2022), Benmelech et al. (2022), and Lipsius (2018). These papers confirmed theoretical models indicating that wages decrease as a result of higher labor market concentration. However, they all focused on a small snapshot in time or particular industry. Other research by Handwerker and Dey (2024) for the U.S. Bureau of Labor Statistics indicated that concentration varies heavily across occupations and likewise, the corresponding impact on wages is variable. This supported Webber's (2015) findings that indicated a positive relationship between concentration in wages in some industries with a negative relationship in others. Additionally, Rinz (2022) and Rossi-Hansberg et al. (2021) both noted the deviating trends between national and local market concentration over time. As this idea gains traction among economists and policy makers, the impact of Covid-19 on labor market concentration remains an untouched area of research with important implications for the future. The next section discusses these implications and why Covid-19 may result in deviations from previous findings.

1.2 Understanding the Covid-19 Pandemic's Impact on the Labor Market

The U.S. labor market drastically changed in March 2020 after the country shut down as a result of Covid-19 health concerns. Suddenly, almost overnight, the U.S. labor market was turned upside down. The effects had a wide-spread, heterogeneous impact on industries across the U.S. (Cortes & Forsythe, 2022). Industries that were particularly and uniquely affected were the healthcare and service industries.

Huang et al. (2020) found that the initial impact of Covid-19 led to a reduction of 20-30% of non-salaried workers in the hospital industry and a similar reduction in the food/drink and leisure/entertainment sectors. These findings were expanded on by Bhandari et al. (2021) who observed that dentists and physician offices were among the most affected in the early stages of the pandemic, noting unemployment rates of 41.3% and 9.5% respectively. Additionally, Cortes and Forsythe (2022) found that employment losses have been more pronounced and more persistent in lower paying occupations such as hospitality and trade.

One important implication of this for firms is a labor supply shortage. In addition to high unemployment, there is evidence that older workers have been retiring at faster rates since the start of the Covid-19 pandemic (Cortes & Forsythe, 2022). Specifically, the healthcare sector faced supply shortages in the wake of increased demand for services related to Covid-19. At the same time, demand plummeted for non-Covid related healthcare services and in service industries as people were confined to their homes. This heterogeneous effect on labor supply could have significant impacts on labor market competition and the behavior of firms with market power. A shortage of labor supply in the face of high demand might have pushed firms with monopsony power to increase wages, as they were previously paying a lower than competitive wage. On the

other hand, monopsony firms facing decreased demand did not need to attract more workers, perhaps lowering wages instead. This idea is explored and quantified in this thesis, using data from the post-lockdown period where firms began re-opening and individuals began returning to work.

Today, almost all labor market indicators have returned to pre-pandemic levels (Forsythe et al., 2022) but the shock from the pandemic may have lingering effects. Researchers have observed more subtle changes that may have the ability to affect the labor market long-term. For example, Forsythe et al. (2022) observed a reallocation of labor away from low-skilled service jobs. They concluded that this may be driven by long-term changes in worker preferences. Two years after the start of the pandemic, there remains an employment shortage in customer-facing jobs (Forsythe et al., 2022). This has the potential to prompt monopsony firms to increase wages in order to attract labor, especially if demand for services is high.

Technology usage also surged as a result of Covid-19, with both firms and consumers finding new ways to limit human interaction. For example, video conferencing technology soared during the pandemic with millions of workers transitioning to telework, or work from home. This persisted even after the Covid-19 lockdown ended. In 2021, 17.9% of employees were reported to be primarily working from home (Silver, 2023). Furthermore, about 40% of firms intended to expand remote working opportunities (Silver, 2023). In 2023, approximately a third of workers who have jobs that can be done from home are working remotely (Parker, 2023). This could have far-reaching implications on competition and monopsony power. If workers have the option to work remotely, their job opportunities expand beyond their geographic location. In essence, the labor market expands and firms compete for labor in a much larger market.

Online ordering and home-service food kits have also grown significantly since 2020 changing the landscape of many service industries. Pandemic restrictions on restaurants and

changes in consumer preferences resulted in a 49% increase in customers for the three largest meal-kit-suppliers (Lee & Ham, 2021). Similar changes were observed in the retail industry with consumers preferences shifting toward online rather than in-store shopping (Shaw et al., 2022). These changes threaten job opportunities and small firms, especially in service industries, leaving the market vulnerable to monopsony power.

Subtle shifts like these will likely leave lasting impacts on every industry, particularly service industries, making research in this area essential. Therefore, this analysis focuses on the healthcare, hospitality, entertainment, and retail trade sectors to understand how the relationship between labor market concentration and wages changed after the Covid-19 lockdown.

The next chapter reviews the previous literature analyzing labor market concentration and its effects on wages. In Chapter 3, a theoretical model is used to predict how wages are expected to change as a result of increased labor market concentration. Chapter 4 discusses the data sources used in the empirical analysis of the model. Chapter 5 presents the findings related to market concentration and wages and discusses the results. Finally, Chapter 6 gives recommendations for future research and a conclusive summary.

Chapter 2

Review of the Literature on Labor Market Concentration and its Effect on Wages

This paper is most closely related to Azar (2022), Rinz (2022), Benmelech et al. (2022), Lipsius (2018), and Qiu and Sojourner (2023). However, it differs from each in significant ways, providing a new perspective to the conversation of the effect of labor market concentration on wages. Mainly, it uses the most recent U.S. Census Bureau data to analyze the impact from a shock to the labor market. No paper has analyzed the effect of market concentration in this way.

2.1 Measuring Labor Market Concentration

Benmelech et al. (2022), Lipsius (2018), and Rinz (2022) all utilized the U.S. Census Bureau Longitudinal Business Database to assess the impact of labor market concentration on wages. Additionally, they all computed HHI using employment shares to measure concentration. Benmelech et al. and Lipsius both calculated HHI as the sum of the squared shares of employment in a given county, industry, and year. Benmelech et al. focused specifically on manufacturing jobs in the United States from 1978 to 2016 and utilized three- and four-digit Standard Industrial Classification (SIC) codes to delineate industries. They observed a mean HHI of 5,200 for three-digit SIC codes and 6,510 for four-digit SIC codes. Lipsius found similar results using data from 1980-2012, specifically calculating an average HHI of 5,500. Lipsius differed from Benmelech et al. as he also examined concentration in the product market and the relationship between both measures of concentration. The research by Benmelech et al. and Lipsius highlight the fact that labor markets are very concentrated on a local level and concentration varies significantly across counties.

Addressing broader trends, Rinz (2022) examined concentration from 1976-2015 across all U.S. industries, focusing on how national and local concentration differ. In contrast to Benmelech et al. (2022) and Lipsius (2018), Rinz first calculated HHI for each 4-digit NAICS code, using the share of employment for each firm. National labor market concentration was then determined by summing the industry-specific HHIs weighted by their share of national employment. To calculate local concentration, Rinz multiplied the HHI in a given commuting zone-industry by the share of national employment in that commuting zone and the share of commuting zone employment in that industry. Rinz defined local HHI by summing this over each industry and commuting zone. He found that national and local concentration diverge from 1976-2015, with national concentration increasing and local concentration slightly decreasing. Rinz's calculations of HHI differed from Benmelech et al. and Lipsius as he defined national and local concentration across all industries and locations rather than for a given industry and location. All three papers used employment shares in their calculations to conclude that labor markets are quite concentrated and subject to high variability.

Azar et al. (2022) also calculated labor market concentration using HHI, but they employed a different dataset and methodology. Instead of using shares of employment, Azar et al. used job vacancy data to find a firm's share of total job vacancies in a given commuting zone/county and industry. Using data from 2010 to 2013, they calculated HHI for each county/commuting zone and industry by taking the sum of the squared shares of job vacancies in a given industry and location. They found that the local labor market has an average HHI of 4,222 at the county level and 3,480 at the commuting-zone level. Additionally, they found a standard deviation of roughly 0.3. Although they used different data, their findings confirm those observed by Benmelech et al. (2022), Rinz (2022), and Lipsius (2018), painting a picture of high labor market concentration.

Qiu and Sojourner (2023) measured labor market concentration in the private sector between 2005 and 2017. They used the American Community Survey data supplemented with a sample of the 2000 Decennial Census to calculate both labor and product market concentration. Like Benmelech et al. (2022), Lipsius (2018), Rinz (2022), Qiu and Sojourner used the squared sum of employment shares to calculate HHI by each commuting zone. Unlike others, Qiu and Sojourner used employment by occupation instead of industry. They found an average HHI of 660, a much lower HHI than found in the preceding literature. However, their findings mirror the trend in local concentration found by Rinz.

All of these papers calculated labor market concentration using HHI, the majority doing this through employment shares. Although they each added something new to the literature, they fail to consider how a shock to the labor market could affect concentration levels. This paper will be the first to delve into how labor market concentration changes after a shock to the labor market. Additionally, it will mirror the calculations used in Benmelech et al. (2022) and Lipsius (2018) but will use new and more recent data, adding to the existing literature.

2.2 Measuring the Effect of Concentration on Wages

Several researchers measured the effect of labor market concentration on wages through regression analyses, regressing wages on HHI. Lipsius (2018) and Benmelech et al. (2022) both used ordinary least squares (OLS) regressions to analyze the effect of the HHI, labor market concentration, on wages. Lipsius used a quadratic regression, regressing log wages on HHI, HHI squared, time fixed effects, and labor market fixed effects. He found that increasing the mean concentration by one standard deviation above the mean resulted in a 7.7% decrease in wages.

Benmelech et al. modeled a similar regression, to analyze how market concentration affects wages in the manufacturing sector. They regressed log average wages on log lagged HHI, plant-level controls, one-year lagged log of aggregate employment at the county-industry level, industry by year fixed effects, firm fixed effects. They found that moving from one standard deviation below to one standard deviation above the mean HHI resulted in 1.6% decrease in wages. This was a smaller decrease than was identified by Lipsius but both established a negative relationship between concentration and wages.

Rinz (2022) and Azar et al. (2022) both utilized OLS regressions; however, they both adopted an instrumental variable approach to determine the causal effect of HHI on wages. In both studies, HHI was instrumented with the average of log(1/N) across all other commuting zones for a given occupation. Using this approach, Azar et al. found that going from the 25th percentile to the 75th percentile in concentration resulted in a 17% decrease in wages. Using the OLS approach, they found just a 5% decrease in wages. When using an OLS regression, Rinz's results varied based on the measure of wages used. However, when employing an IV approach, Rinz concluded that moving from the median concentration up to the 75th percentile reduced earnings by about 15%. Both Rinz and Azar et al. found results consistent with Benmelech et al. (2022) and Lipsius (2018), highlighting the role that concentration plays on wages for workers across the United States.

All of these studies employed similar methodologies, to measure the effect of labor market concentration on wages. To varying degrees, they consistently found a negative relationship suggesting that concentration reduces earnings. This paper will utilize a similar regression model; however, it will differ by using the most recent data, addressing the question: How did Covid-19 affect the relationship between labor market concentration and wages?

Chapter 3

Theoretical Model

3.1 Perfectly Competitive Market

Consider a perfectly competitive market, then the optimal wage paid by a firm is equal to the firm's marginal cost. Let p denote the price of a good, let Q denote the quantity of a good, let w denote the price of labor (wage), let L denote the quantity of labor, let α denote the share of labor, and let A denote the firm's production function. Define the quantity of labor as:

$$Q(L) = AL^{\alpha}$$

The firm's problem is:

$$\max \pi = Total\ Revenue - Total\ Cost$$

$$\max \pi = pQ(L) - wL$$

$$\max \pi = pAL^{\alpha} - wL$$

$$\frac{\partial \pi}{\partial L} = 0 \leftrightarrow w = pMP_L$$

First order condition: $w^* = MR = MC$,

where $MR = marginal\ revenue$ and $MC = marginal\ cost$

This simple model of a competitive labor market illustrates that a firm maximizes its profit by charging a wage equal to its MR, or pMP_L. If the firm does not pay a wage equal to its marginal revenue, and instead pays a lower wage, the other firms in the market will pay a slightly higher wage (not exceeding their MR). Because it is assumed that workers will choose the job paying a higher wage, the firm that pays a lower wage will not have the labor needed to produce goods.

Therefore, firms in this model are called "wage takers" because they choose how much labor to hire based on the equilibrium wage in the labor market. This is the lowest wage they can pay that will be competitive to the other wages in the market and attract workers needed to produce goods.

3.2 Monopsony Market

Now consider a labor monopsony market. In this case the optimal wage paid by the firm is lower than its marginal cost and the number of workers it chooses to hire is less than the optimal number in a competitive market. Again, let p denote the price of a good, let Q denote the quantity of a good, let w denote the price of labor (wage), and let L denote the quantity of labor. Define $pQ(L) = R(L)$ as the firm's revenue function. Since the labor supply curve is upward sloping, wages increase as the quantity of labor increases. In a labor monopsony market, since there is only one firm choosing the quantity of labor employed, the wage is a function of the firm's choice of quantity of labor ($w(L)$). Ashenfelter et al. (2010) use the following model to illustrate monopsony power in the labor market:

The firm's problem is:

$$\max \pi = Total\ Revenue - Total\ Cost$$

$$\max \pi = R(L) - w(L)L$$

$$\frac{\partial \pi}{\partial L} = R'(L) - w'(L)L + w(L)$$

$$\frac{\partial \pi}{\partial L} = 0 \leftrightarrow R'(L) = w'(L)L + w(L)$$

First order condition: $MR = w'(L)L + w(L)$,

where $MR = marginal\ revenue$

This model of monopsony implies that the monopsonist firm will hire less labor and pay lower wages in order to maximize profit. This is true based on two important assumptions made in labor economics. The first is that MR is declining in L. This is true for all labor markets. The second is that wages are an increasing function of L. This is an assumption based on the fact that there is only one firm in the labor market (Ashenfelter et al., 2010). In a competitive labor market, firms are assumed to be "wage takers" and therefore, wages are decided by the market, not the quantity employed by a given firm. However, here, the firm's quantity of labor is impacting the entire labor market since there are no other firms hiring, thus wages are directly tied to the quantity of labor employed by the firm (Ashenfelter et al., 2010). Therefore, as the quantity of labor increases, MR decreases and similarly, as wages increase, MR decreases. This leads to the firm hiring less workers and charging lower wages than it otherwise would in a competitive market. In this case, the firm is referred to as a "wage maker" or "wage setter" because the firm has the power to choose a wage lower than its MR to maximize its profit.

Monopsony-like power can exist in any labor market, and is not confined to a labor market with just one firm. For example, this may occur when there is more than one firm in the market but one or a few firms employ most of the labor market and drive the quantity of labor. Much like a monopsonist firm, these firms have power to set a wage lower than their MR and hire fewer workers because they drive the quantity of labor, influencing wages. In this situation, since there are multiple firms, there is labor market power instead of strict monopsony power. As discussed in Chapter 1, employment HHI is often used to measure this level of power or concentration.

Using HHI as a measure of labor market power, this paper will analyze the implications of this model and assess whether wages decrease when market concentration increases, as the theoretical model suggests.

3.3 Caveats to Monopsony Model

The previous model of monopsony power presumes that firms only look to maximize profits and therefore will exercise all of their power to pay the lowest possible wage. Bronfenbrenner (1956) discusses several other considerations in his paper, "Potential Monopsony in Labor Markets". He argues that many monopsony firms will actually pay wages close to the competitive wage and not exercise all of their power. One reason a monopsonist may do this is to increase the applicant pool and attract more qualified workers. A firm that offers a higher wage will receive more high-quality job applicants that may increase the firm's productivity in the future (Bronfenbrenner, 1956). Another reason why a monopsonist may pay higher wages is if they also choose to maximize some function other than profits (Bronfenbrenner, 1956). A firm may want to maximize quantities of public perception, worker happiness, or employee engagement. These alternative considerations may lead some monopsonist firms to pay higher wages than the model proposes.

Additionally, a monopsonist firm may react to shocks to the labor market differently than firms in a competitive market. Bronfenbrenner (1956) models a shortage of labor supply from the perspective of a monopsonist firm with fixed labor requirements. He explains that a monopsonist firm would raise wages whenever the firm's labor requirements increase or when the firm faces a shortage of labor supply. If the opposite occurs, the monopsonist will do the opposite. The

monopsonist will still make money because of the gap between the competitive wage level (where $MR = MC$) and the wage they actually offer. By narrowing this gap, firms lose some potential profit but do not exceed their marginal cost.

This makes the Covid-19 shock interesting to look at as economic theory suggests that firms in concentrated markets may react differently to the labor shortage. The combination of stimulus checks, high unemployment benefits, and unsafe working conditions in the aftermath of Covid-19 made not returning to work an attractive option to many people. Job openings were at a record high of 9.3 million in April of 2021, a few weeks before the data used in this analysis was collected (Cox, 2021). These numbers reflect what many economists deemed a labor supply shortage. As a result, monopsony firms who faced the same pre-pandemic labor requirements, or an increased need for labor, might increase wages to attract workers.

At the same time, firms in certain industries saw a sharp decrease in demand, decreasing their labor requirements. It is unclear how wages would change in these markets. On one hand, a labor shortage would indicate monopsonists would be willing to pay higher wages to attract workers. On the other hand, the decrease in labor requirements would lead them to pay lower wages. This thesis quantifies how firms in different industries reacted to the supply shortage by measuring the relationship between labor market concentration and wages before and after the Covid-19 lockdown.

3.4 Hypotheses

Economic theory suggests that an increase in HHI will decrease wages, although to different magnitudes depending on firm-specific factors. In other words, the null hypothesis is that there is no relationship between HHI and earnings while the alternative hypothesis is that there is a negative relationship between the two. Economic theory further explains how this relationship may change in the aftermath of Covid-19. An increase in HHI in low-demand industries will decrease wages while an increase in HHI in high-demand industries could increase wages. Therefore, the alternative hypothesis in the healthcare sector is that there is a positive relationship between earnings and wages in 2021. The previous null hypothesis remains, and the previous alternative hypothesis remains for the food & accommodation, arts, entertainment, & recreation, and retail trade sectors. These hypotheses are tested using econometric models in Chapter 5. The next chapter discusses the publicly available data and labor market concentration variable, HHI, used in these models.

Chapter 4

Data

4.1 Data Sources

The regression models used in this paper depend on wage and employment statistics categorized by year, NAICS, and county. Both are obtained through the publicly available data sources discussed in this section, compiled from 2012-2021.

4.1.1 U.S. Census Bureau Establishment Data

To measure labor market concentration, this paper uses establishment data from the U.S. Census Bureau's County Business Patterns (CBP). This dataset has been produced by the Census Bureau since 1964 with the most recent release in 2021. It includes a variety of economic data on establishments with paid employees including employment size, number of establishments, NAICS code, first quarter payroll, and annual payroll. The dataset is categorized by county, employment size, and NAICS code for each year.

NAICS codes are the standard tool used by federal government agencies to classify businesses and other statistical data related to the economy. The U.S. Census Bureau defines 2-digit NAICS codes as sectors and 3-digit NAICS codes as subsectors. Since this paper only uses these two NAICS levels, each 2-digit NAICS code is referred to as a sector and each 3-digit NAICS code as an industry for clarity and conciseness. Table 4.1 summarizes the frequency of the industries used in this analysis, along with their corresponding NAICS codes.

Table 4.1: List and Frequency of NAICS Codes Present in Analysis (2012-2021)

Industry	NAICS Code	Frequency
Healthcare		
Ambulatory Health Care Services	621	29,120
Hospitals	622	13,666
Nursing & Residential Care Facilities	623	23,236
Social Assistance	624	27,942
Food & Accommodation		
Accommodation	721	24,693
Food Services & Drinking Places	722	30,262
Arts, Entertainment, and Recreation		
Performing Arts, Spectator Sports, & Related Industries	711	15,451
Museums, Historical Sites, & Similar Institutions	712	11,682
Amusement, Gambling, & Recreation Industries	713	24,038
Retail Trade		
Sporting Goods, Hobby, Musical Instrument, & Book Stores	451	17,934
General Merchandise Stores	452	24,887
Miscellaneous Store Retailers	453	25,298
Nonstore Retailers	454	22,861
Food & Beverage Stores	445	26,900
Health & Personal Care Stores	446	23,086
Gasoline Stations	447	28,933
Clothing & Clothing Accessories Stores	448	21,125

*This data was collected from the U.S. Census Bureau County Business Patterns dataset
*Analysis is limited to these 3-digit NAICS codes but the CBP data contains many more NAICS codes

There are two important factors of note in this data. First, this dataset is compiled during the week of March 12th each year. Therefore, the data from 2020 is likely not impacted by the changes in the labor market due to Covid-19. Similarly, the 2021 data reflects the post-lockdown period and very beginning of the labor market recovery phase. Additionally, the dataset only provides a range of employment (e.g., “establishments with 10 to 19 employees”) for each establishment. Therefore, in order to find employment shares for each, an establishment is assigned

the mean number of employees for its given range (e.g., 14.5).[1] Since the ranges begin very narrow and widen as the number of employees increases, this is likely to bias employment HHI downward. Therefore, the measure of labor market concentration is likely a conservative estimate of the true concentration. Table 4.2 summarizes the establishment data used in this analysis after this assumption was imposed. An observation is identified by a county, NAICS code, and year.

Table 4.2: Establishment Summary Statistics (2012-2021)

	Number of Establishments	Establishment Size
Mean	24	128
Std. Dev.	139	1370
Min	1	1
Max	23,894	333,939
Observations	1,046,887	1,046,887

*This data was collected from the U.S. Census Bureau County Business Patterns dataset

4.1.2 U.S. Bureau of Labor Statistics Wages Data

The U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) dataset provides data on wages used in the econometric models in Chapter 5. This dataset has been published quarterly since 1975, with the most recent publication in 2023. For this analysis the data is compiled for the years 2012-2021 and limited to the 50 U.S. states to align with the CBP data.

The QCEW dataset includes a variety of wage statistics including average weekly wages aggregated by quarter, year, county and NAICS code. The first quarter average weekly wage is

[1] The complete list of estimations is provided in Appendix A, Table A.1

utilized in the regression analyses as the CBP data is collected during the first quarter of the year. Therefore, this wage more accurately aligns with the CBP time period. Table 4.3 summarizes the first quarter average weekly wages used in this paper where an observation is identified by county, NAICS code, and year.

Table 4.3: Wage Summary Statistics by Sector (2012-2021)

Industry	Mean	Std. Dev.	Min	Max	Observations
Healthcare					
Ambulatory Health Care Services	$896	$292	$83	$6,997	26,863
Hospitals	$1,148	$601	$467	$16,786	4,216
Nursing & Residential Care Facilities	$524	$135	$184	$4,145	18,791
Social Assistance	$382	$125	$44	$3,436	19,018
Food & Accommodation					
Accommodation	$377	$239	$48	$16,050	19,756
Food Services & Drinking Places	$275	$98	$62	$2,664	25,963
Arts, Entertainment, and Recreation					
Performing Arts, Spectator Sports, & Related Industries	$863	$978	$34	$16,100	5,906
Museums, Historical Sites, & Similar Institutions	$551	$190	$100	$1,931	4,523
Amusement, Gambling, & Recreation Industries	$347	$151	$30	$3,001	15,125
Retail Trade					
Sporting Goods, Hobby, Musical Instrument, & Book Stores	$365	$238	$28	$16,177	14,948
General Merchandise Stores	$445	$212	$62	$5,661	21,080
Miscellaneous Store Retailers	$395	$195	$34	$4,843	22,599
Nonstore Retailers	$793	$356	$125	$11,006	15,186
Food & Beverage Stores	$388	$141	$104	$4,702	25,604
Health & Personal Care Stores	$694	$222	$168	$6,165	21,755
Gasoline Stations	$366	$119	$122	$3,679	28,562
Clothing & Clothing Accessories Stores	$350	$236	$52	$21,688	17,631
All Industries	**$539**	**$266**	**$28**	**$21,688**	**307,526**

*This data was collected from the U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages dataset

4.2 Variable Definitions

In order to quantify labor market concentration, definitions for a firm, labor market, and HHI are needed. A firm is defined as an establishment identified by the U.S. Census Bureau. The U.S. Census Bureau (2023) defines an establishment as "a single physical location at which business is conducted or services or industrial operations are performed". This differs slightly from the definitions used by researchers such as Benmelech et al. (2022) and Rinz (2022) as a single firm may consist of more than one establishment. However, since each establishment is conducting business operations and employs paid workers, the establishments play much the same role in the labor market as a traditionally defined firm.

A labor market is defined at the industry-county level. That is, a labor market is restricted to a county and 3-digit NAICS code. The definition of the labor market is critical when analyzing labor market concentration and labor market power. A labor market is the market in which workers are competing for wages. However, defining its boundaries is challenging as it is difficult to accurately delineate competition between workers. For example, people may choose a job in a different location from where they live, competing against workers in a different geographical area. Additionally, an investment fund manager competes for very different jobs than a physician. Therefore, it is necessary to consider these things when determining which workers are competing for a given job.

To address the first problem of location, Manning and Petrongolo (2017) analyze unemployed job applicants in their paper, "How Local Are Labor Markets? Evidence from a Spatial Job Search Model". They conclude that labor markets are very local, with the attractiveness to a job decaying sharply with distance (Manning & Petrongolo, 2017). Although county sizes can

vary across the U.S., defining a labor market at the county level is consistent with the literature and these spatial job market findings. To address the second problem of job type, NAICS codes are used to confine a labor market to a sector or industry. While some researchers choose to use occupation codes rather than industry codes to define a labor market, NAICS codes are more accessible and have been used in similar research by Benmelech et al. (2022), and Rinz (2022).

Lastly, HHI is defined using employment shares to measure of labor market concentration. This measure of HHI quantifies how much power a firm has in hiring labor. A firm with a very large share of the total employment in a given industry and county is considered to have more power in that labor market. Employment HHI ranges from 0 to 10,000 with 0 being the least concentrated and 10,000 being the most concentrated.[2] For each county and 3-digit NAICS code (industry), employment HHI is defined as:

$$\sum_{j=1}^{all\ establishments} \left(\frac{employment\ of\ establishment\ j}{total\ employment\ of\ all\ establishments} \right)^2$$

where "j" denotes an individual establishment.

Employment for each establishment in a given county, industry, and year is calculated using the U.S. Census Bureau CBP data on establishment size detailed in Chapter 4.1. Total employment is then the sum of the employment over all establishments within the county, industry, and year.

[2] An HHI of zero is a theoretical value since there are a finite number of firms and employees in the data, however an HHI close to zero represents an almost perfectly competitive market. An HHI of 10,000 represents a single firm employing 100% of the labor in the given labor market. HHI can also be measured using a scale from 0 to 1 with 0 being the least concentrated and 1 being the most concentrated.

4.3 Labor Market Concentration

4.3.1 Descriptive Statistics

Employment HHI, summarized in Table 4.4, shows that, on average across all industries and counties, the labor market is highly concentrated at 2,725.[3]

Table 4.4: Average HHI Across Counties by Sector (2012-2021)

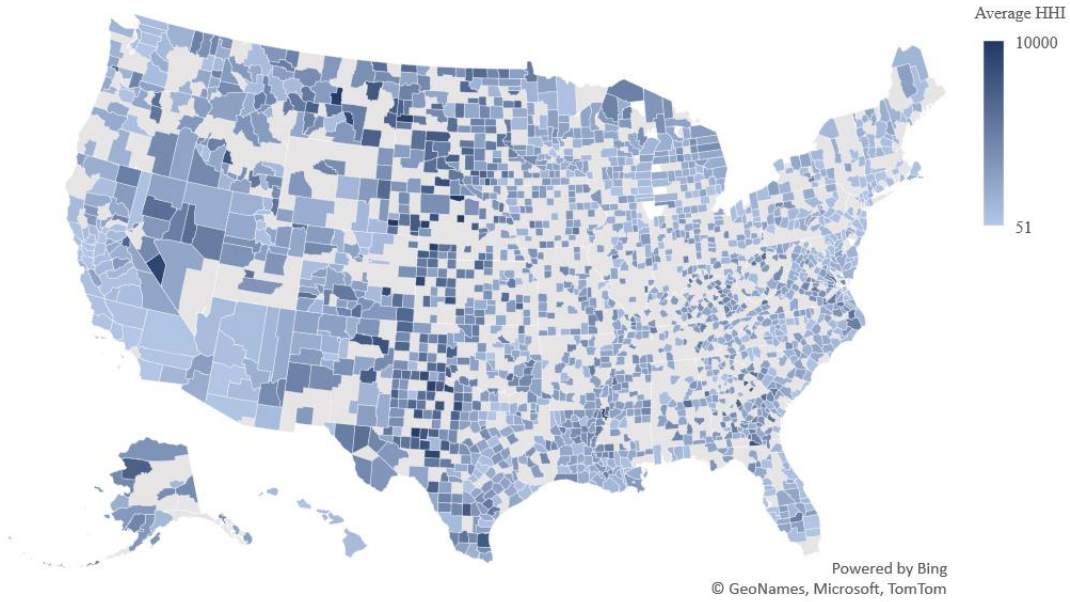
Industry	Mean	Std. Dev.	Min	Max	Observations
Healthcare					
Ambulatory Health Care Services	1,093	1,575	0.4	10,000	29,120
Hospitals	7,023	3,441	73.5	10,000	13,666
Nursing & Residential Care Facilities	2,522	2,656	4.8	10,000	23,236
Social Assistance	1,727	1,875	2.3	10,000	27,942
Food & Accommodation					
Accommodation	2,390	2,484	8.3	10,000	24,693
Food Services & Drinking Places	780.4	1,132	0.5	10,000	30,262
Arts, Entertainment, and Recreation					
Performing Arts, Spectator Sports, & Related Industries	3,829	3,407	0.9	10,000	15,451
Museums, Historical Sites, & Similar Institutions	5,523	3,459	76.3	10,000	11,682
Amusement, Gambling, & Recreation Industries	2,611	2,621	7.4	10,000	24,038
Retail Trade					
Sporting Goods, Hobby, Musical Instrument, & Book Stores	3,130	3,165	2.2	10,000	17,934
General Merchandise Stores	2,849	2,525	3.2	10,000	24,887
Miscellaneous Store Retailers	1,944	2,295	6.0	10,000	25,298
Nonstore Retailers	2,718	2,713	2.0	10,000	22,861
Food & Beverage Stores	2,165	2,090	9.2	10,000	26,900
Health & Personal Care Stores	2,510	2,705	11.7	10,000	23,086
Gasoline Stations	1,291	1,430	3.7	10,000	28,933
Clothing & Clothing Accessories Stores	2,217	2,757	4.0	10,000	21,125
All Industries	2,725	2,490	0.4	10,000	391,114

[3] The DOJ considers a labor market with an HHI above 1,800 to be highly concentrated (United States Department of Justice Antitrust Division, 2024).

Table 4.4 further indicates that the most highly concentrated industries include hospitals, performing arts, sports & related industries, museums, historical sites & related industries, and sporting goods, hobby, musical instruments, & book stores. The least concentrated industries include ambulatory health care services, food services & drinking places, and gasoline stations.

Figure 4.1 shows the average HHI by county rather than by industry. This average HHI is calculated by first averaging HHI across 3-digit NAICS codes and then years to get one HHI value per county. Light grey regions are counties with no observed data in this time period and industries. Overall, average HHI is higher in the middle of the country and lower along both the east and west coasts.

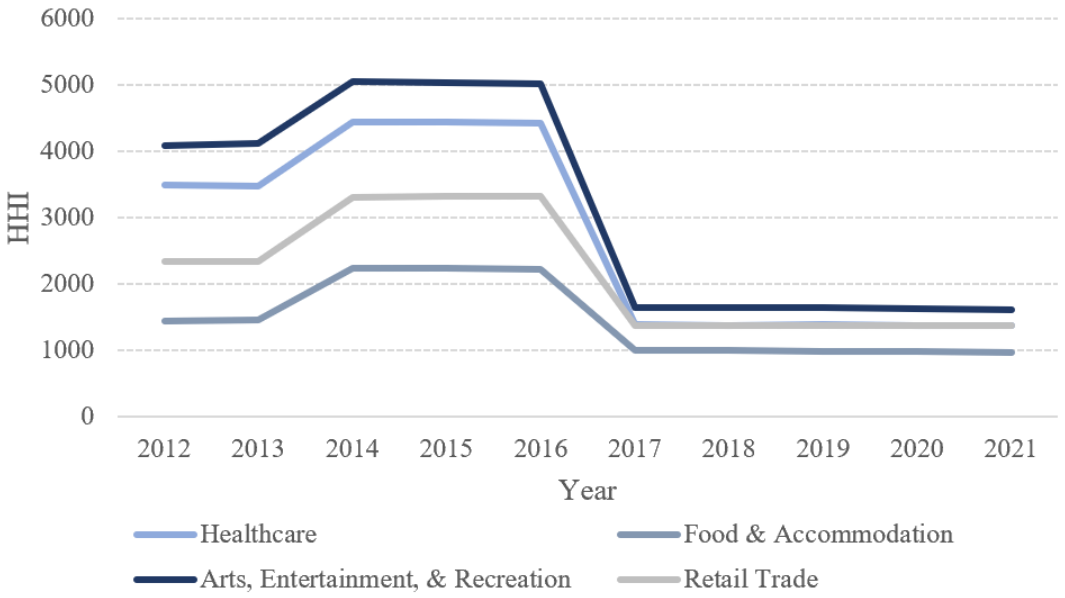
Figure 4.1: HHI by County: Averaged across NAICS Codes and Years (2012-2021)



*This figure was obtained by first taking the average across all NAICS codes present in the analysis (see Table 4.1) for a given county and year Then, for each county, the average across NAICS codes was averaged again across the total available time period, 2012 to 2021.

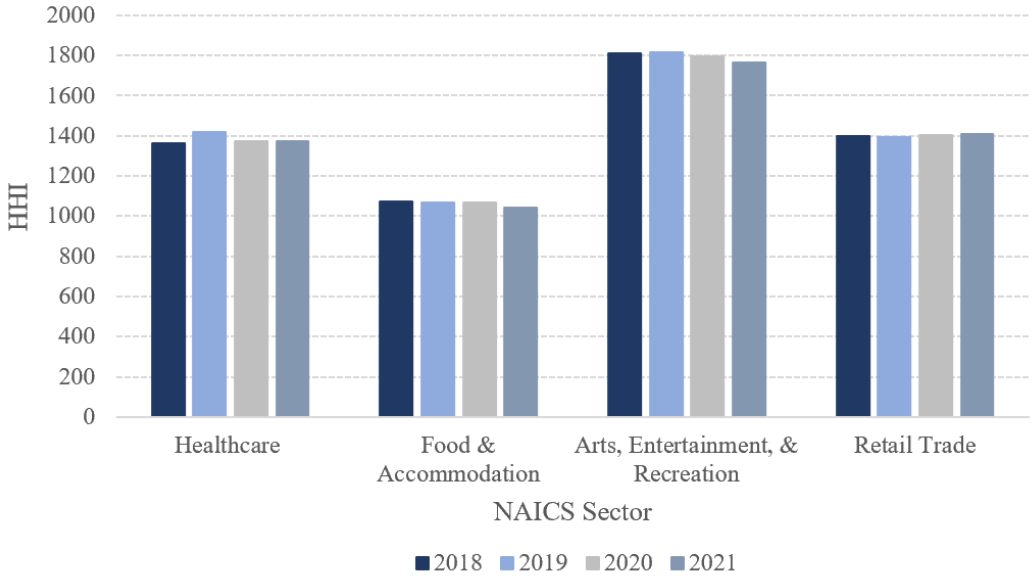
Figure 4.2 shows how the average HHI in each 2-digit NAICS code (sector) has changed over time. There is a large drop off in average HHI in 2017 most likely due to changes in data collection and documentation. The regression results are robust to using 2017-2021 data only (which appear in Appendix B).

Figure 4.2: Average HHI by Sector (2012-2021)



Overall, the highest average concentration in healthcare and arts, entertainment, and recreation sectors. Additionally, Figure 4.2 shows little variation in average HHI between 2020 and 2021 in all of the 4 sectors. Figure 4.3 breaks down the changes from 2018-2021 further to demonstrate the period of Covid-19. Overall, there do not appear to be significant changes over the Covid-19 time period.

Figure 4.3: Average HHI by Sector and Year (2018-2021)



4.3.2 Discussion of Labor Market Concentration

Table 4.4 shows very high levels of concentration in hospitals. There are several reasons why employment would be heavily concentrated in hospitals. When defining a labor market at the county level, it is unlikely that most counties would contain more than one or two hospitals. They require a high initial investment, high monitoring costs and have high returns to economies of scale. Therefore, the market is dominated by a smaller number of very large hospitals that share the employment in the industry.

Similarly, it is not surprising that concentration is high in museums, historical sites, and similar institutions due to the limited available supply in this industry. Historical sites and museums are goods that are not easily produced and are often maintained and operated by state or local governments. Therefore, only a few private firms might be able to supply these goods, forcing employment to concentrate in these firms.

On the other hand, Table 4.4 shows that concentration is very low in the food and accommodation industry. This industry has lower initial investment costs and more supply, allowing more small firms to operate in this industry, dispersing employment. This is very different from food and beverage stores, such as grocery stores, that tend to be much larger than restaurants and benefit from economies of scale. In fact, Table 4.4 confirms that concentration is higher in food and beverage stores than in restaurants. Concentration is also very low in gasoline stations. This makes sense when one considers how much gasoline stations compete with each other based on location. Overall, most labor markets are considered moderately or highly concentrated under the DOJ guidelines, leading to serious threats of high market power that could lower wages and decrease employment under the theoretical model presented in Chapter 3.

These results closely align with those found by Azar et al. (2020) novel analysis using job market vacancy data. Although their preferred specification used 6-digit occupation codes, when defining the market using 3-digit occupation codes, as this paper does, Azar et al. found an average HHI of 2,956 across all industries using 2016 data. A labor market defined using 6-digit codes provides a much narrower definition of the labor market that would lead to a higher level of concentration because firms are separated into smaller categories where there is less competition. These results are also consistent with Handwerker and Dey (2024) who observed that restaurants & other eating places was the most employed occupation of private sector non-megafirms when they were not local oligopsonists.[4] Additionally, they found that general medical & surgical hospitals is one of the most common industries of employment among megafirms as well as among both local and non-local oligopsonits (Handwerker & Dey, 2024). These findings align with the

[4] An oligopsonist is a firm in an oligopsony, that is a market where there are only a few large buyers of an input.

low concentration levels observed in the food services industry and high concentration in hospitals. Moreover, Handwerker and Dey (2024) observed retail sales worker as the most commonly employed occupation in private-sector megafirms. This affirms the relatively high concentration in the retail trade sector.

Geographically, Figure 4.1 shows that HHI is highest in counties in the Midwest and lowest in counties on the coast. HHI is likely to be higher in less densely populated counties, such as those in the Midwest because fewer firms are demanded by the population. Additionally, this area of the country is subject to the idea of "company towns" like the coal mining example in Chapter 1. Big corporations open in very small counties and towns and employ the majority of the working population, leading to high concentration. This is because there is an abundance of land that is much cheaper than that on the coast. Therefore, it is an ideal place for a firm to open a large manufacturing plant or distribution center.

This geographic pattern mirrors findings by Azar et al. (2020) who observed similar trends across the country. This is further consistent with Handwerker and Dey (2024) who found that concentration is higher in smaller labor markets. Overall, Midwest counties tend to be less populous than those on the coast and therefore have smaller labor markets. This is where higher levels of concentration are observed in Figure 4.1.

Figure 4.2 illustrates trends in average HHI for 2-digit NAICS codes. The healthcare sector and arts, entertainment, & recreation sectors are consistently the two most highly concentrated sectors over the observed time period. This aligns with the nature of these markets, where economies of scale are higher, and it makes sense for bigger firms to dominate the market. The trend in average HHI prior to 2015 is consistent with that found by Rossi-Hansberg et al. (2021) with average HHI increasing at a similar rate. It is also consistent with Rinz (2022) who

documented similar trends of decreased local concentration. Overall, the results from concentration do not contradict the existing literature and follow the macro trends documented previously.

Since average HHI is highly variable across counties, it is difficult to isolate the impact of Covid-19. Figure 4.3 shows relatively no changes in average concentration across sectors before and after the Covid-19 lockdown. However, it is important to note that the data is collected just once a year and may not reflect the variation in HHI throughout 2020. Additionally, since employment of each firm is estimated to calculate HHI, the data may not reflect some changes in concentration. This would be especially the case for large firms where the estimation is less precise. For example, a firm with 2,500 to 4,999 employees could have a large change in employment before and after 2021, but it would not be reflected in the HHI calculation if employment did not drop below 2,500 because every firm in this range is assigned 3749.5 employees. Therefore, due to the estimation of firm size, the data may not reflect all changes in labor market concentration. The next chapter sheds light on how, if at all, employment HHI tangibly affected American workers' earnings overtime and in the aftermath of Covid-19.

Chapter 5

The Effect of Concentration on Wages

5.1 Preliminary Findings on the Effect of HHI on Wages Over Time

Using the data from the previous chapter, this thesis first mimics previous research quantifying the relationship between labor market concentration and wages. This is done using an ordinary least squares (OLS) panel regression model:

$$\ln(average\ weekly\ wage_{ict}) = \beta_0 + \beta_1(\ln(HHI_{ict})) + \gamma_t + \gamma_c + \gamma_i + \varepsilon_{ict}$$

where "i" denotes either the industry or sector, "c" denotes the county, and "t" denotes the year of each observation. Additionally, γ_t, γ_c, and γ_i denote year, county, and NAICS code fixed effects respectively.

Both year and county fixed effects are used in the model to account for variation in the economy and other factors that may change across years and counties such as housing costs or inflation rates. Additionally, in the preferred model specification, HHI is defined at the 3-digit NAICS code level and then aggregated by sector to allow for NAICS fixed effects. The NAICS fixed effect accounts for the variation across 3-digit NAICS codes within the larger 2-digit sector. This is important because there are many different industries within the larger sectors of healthcare, entertainment, retail trade and food and accommodation. Another specification looks at each industry, or 3-digit NAICS code, individually and does not include NAICS fixed effects. This allows for closer analysis of a smaller labor market but may be more vulnerable to omitted variable bias if there are unobserved variables within a specific sector.

An OLS model with year, county, and NAICS fixed effects was chosen as the preferred specification based on past research by Handwerker and Dey (2024), Azar et al. (2022) and Qiu

and Sojourner (2023). These papers use an OLS regression with similar fixed effects, regressing log wages on log HHI. The results of the preferred model are shown in Table 5.1. Tables 5.2 and 5.3 show the results within the healthcare and food & accommodation sectors without NAICS fixed effects to provide a deeper analysis of the results in those sectors.[5]

Table 5.1: Effect of Log HHI on Log Wages by Sector (2012-2021)

	Dependent Variable: Log Wage				
Independent Variables	Total	Healthcare	Food & Accommodation	Arts, Entertainment, & Recreation	Retail Trade
Log HHI	0.00089	0.00394**	0.0231***	-0.0249***	-0.00258*
	(0.000994)	(0.00165)	(0.00157)	(0.00441)	(0.00147)
Constant	5.858***	6.661***	5.537***	6.481***	5.899***
	(0.00653)	(0.00885)	(0.0107)	(0.0299)	(0.00950)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	No	No	No	No	No
NAICS Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	222,997	62,701	43,311	23,155	93,574
R-squared	0.749	0.86	0.831	0.718	0.526

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1
*Total denotes the overall effect across all 4 industries: healthcare, food & accommodation, arts, entertainment, & recreation, and retail trade
*Retail Trade Industry is limited to NAICS codes that involve non-essential retail goods, excluding Health & Personal Stores, Gasoline Stations, and Nonstore Retailers. These are excluded to isolate the impact of Covid-19 on non-essential retail goods.

[5] Appendix B, tables B.3 through B.6 show the regression models without NAICS fixed effects for each of the four NAICS sectors to look at each industry individually.

Table 5.2: Effect of Log HHI on Log Wages in Healthcare Sector by Industry (2012-2021)

	Dependent Variable: Log Wage			
Independent Variables	Ambulatory Care	Hospitals	Nursing & Residential Care	Social Assistance
Log HHI	-0.00359	-0.00423	-0.00661***	-0.00333
	(0.00223)	(0.00632)	(0.00203)	(0.00295)
Constant	6.670***	6.935***	6.164***	5.849***
	(0.0119)	(0.0454)	(0.0129)	(0.0180)
Year Fixed Effects	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
NAICS Fixed Effects	No	No	No	No
Observations	25,730	2,926	16,186	16,979
R-squared	0.886	0.936	0.905	0.853

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 5.3: Effect of Log HHI on Log Wages in Food & Accommodation Sector by Industry (2012-2021)

	Dependent Variable: Log Wage	
Independent Variables	Accommodation	Food Services & Drinking Places
Log HHI	-0.00487*	0.00349
	(0.00273)	(0.00288)
Constant	5.745***	5.439***
	(0.0175)	(0.0145)
Year Fixed Effects	Yes	Yes
County Fixed Effects	Yes	Yes
NAICS Fixed Effects	No	No
Observations	18,000	24,764
R-squared	0.898	0.924

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5.2 Discussion of Preliminary Findings

The results presented in Table 5.1 indicate statistically significant findings in all sectors but do not indicate statistically significant results in the total aggregation of the four sectors (column one). The coefficient of log HHI can be interpreted as the earnings elasticity with respect to labor market concentration. For the healthcare sector, this is interpreted as the following: all else equal, a 1% increase in HHI is associated with an earnings elasticity of 0.00394 or a 0.394% increase in earnings. Similarly, holding all else equal, a 1% increase in HHI is associated with a 2.31% increase in earnings in the food and accommodation sector, a 2.49% decrease in earnings in the arts, entertainment, & recreation sector, and a 0.258% decrease in earnings in the retail trade sector.

The negative elasticities in the arts, entertainment, & recreation and retail trade sectors are consistent with the traditional monopsony model, showing that wages decrease as concentration increases. Therefore, the null hypothesis that there is no relationship between labor market concentration and HHI from Chapter 3 is rejected in these two sectors. The results from the model fail to reject this null hypothesis in the healthcare and food & accommodation sectors. Table 5.2 and Table 5.3 elaborates on these two industries.

Table 5.2 depicts the results from the regression using 3-digit NAICS codes and no NAICS fixed effects to further explore the healthcare sector. The results show negative elasticities in all industries with the only statistically significant elasticity in nursing and residential care. However, these results conflict with model using NAICS fixed effects Therefore, NAICS fixed effects may not accurately account for the differences across industries in the healthcare sector. Alternatively, there may be industry-specific omitted variables that may be the cause of the negative coefficients

in Table 5.2. It may be productive to use a different model or labor market definition to illuminate the cause of the deviation from the theoretical model in the healthcare sector. For example, the healthcare sector and its respective industries includes a wide range of occupations. Some are highly skilled occupations, such as a surgeon, while some are less skilled, such as medical receptionist. Since the healthcare sector is complex and involves a variety of work, these differences may be more pronounced in this sector. Therefore, a different definition of the labor market that uses occupation codes rather than industry codes may be more appropriate. Likewise, a narrower definition, using 4-digit or 5-digit NAICS codes may help better explain the results in this sector. Other more dynamic models that include measures of product market concentration, union characteristics, or labor productivity may also offer deeper insight into this sector and the positive relationship between HHI and wages.

Similarly, Table 5.3 depicts the OLS regression model without NAICS fixed in the food and accommodation sector. The results show a statistically significant negative wage elasticity in the accommodation industry and a non-statistically significant positive wage elasticity in the food services & drinking places industry. Since a significant portion of the data in this sector comes from the food services & drinking places industry, it could be driving the positive coefficient in Table 5.1. A different model considering other variables or a different labor market definition may be needed to better understand the relationship between concentration and wages in this sector, particularly in the food and drinking services industry. Like the healthcare sector, this industry incorporates a wide range of occupations and firms. For example, this industry includes executives from dominant fast-food chains as well as line cooks in small restaurants. Since this industry is so expansive, an occupation-based labor market definition or a more dynamic model may be more informative.

In the sectors where negative earnings elasticities were observed, the magnitude of the decrease in earnings is similar to findings in the literature. However, most of this research has not separated results by industry and instead only at the labor market as a whole, making the results difficult to compare directly. Azar et al. (2022) found a 1% increase in HHI was correlated with a 2-4% decrease in earnings in 2-digit occupation codes. Handwerker and Dey (2024) observed a smaller decrease in earnings of 0.25% across all 6-digit occupation codes in the private sector. The results in Table 5.1 in arts, entertainment, & recreation and retail trade sectors are largely consistent with these findings as the magnitude of the wage decrease falls between these two papers. Other literature further supports the findings in Table 5.1 but shed light on the positive relationships observed.

Qiu and Sojourner (2023) conducted a similar analysis regressing hourly wages on log employment HHI. They did not separate results by industry or sector, as this paper does, but they found a coefficient of positive 0.001 when using commuting zone, year, occupation, and industry fixed effects. These fixed effects were interacted but mirror those used in the preferred specification in this paper. The results are similar to those in column 1 of Table 5.1, showing a positive relationship after accounting for industry, year, and county fixed effects. Once controlling for product market concentration and other possible confounding variables, Qiu and Sojourner found a negative relationship between employment HHI and wages that more closely aligns with the theoretical model in Chapter 3.[6] Therefore, the positive relationships found could be a result of omitting these variables.

[6] Qiu and Sojourner (2023) also control for labor productivity and employment.

Webber (2015) also implemented a similar analysis and further separated the results by industry. Webber found that a 10-percentage point increase in HHI was associated with a 0.016 increase in log earnings in healthcare, a 0.021 increase in log earnings in food and accommodation, a 0.046 increase in log earnings in entertainment, and a 0.0009 decrease in log earnings in retail trade. Table 5.1 shows a similar negative relationship in retail trade when but does not find a positive relationship in arts, entertainment, & recreation. Furthermore, Table 5.1 shows a similar positive relationship in healthcare and food and accommodation. Webber pointed out that the conflicting relationships across industries may be a result of incorrectly defining the labor market as location-based. He concluded that geographic concentration ratios do a poor job of modeling constraints in the labor market. This may be more pronounced in some sectors than others. For example, workers may compete outside of the healthcare sector for jobs at particular hospitals or other care facilities. Therefore, a model that defines the labor market differently, accounting for the fact that workers may compete outside of their geographic location, might better explain some of the results shown in Table 5.1.

Overall, the null hypothesis is only rejected in two of the sectors, arts, entertainment, & recreation and retail trade. The wage elasticities are of similar magnitude as results from Azar et al. (2022) and Handwerker and Dey (2024). Additionally, they do not contradict research from Qiu and Sojourner (2023) which most closely aligns with the main specification results. When comparing the relationship across all observed industries, as done in Qiu and Sojourner's analysis, a small positive relationship is observed between HHI and wages when using county, year, and industry fixed effects. Other confounding variables may be missing to better model monopsony power as Qiu and Sojourner demonstrated in other specifications. Lastly, the results failed to reject the null hypothesis in the healthcare and food and accommodation sector and instead show a

positive relationship. This was also supported by Webber's (2015) research. In addition to confounding variables such as product market concentration and labor force composition, a non-location-based labor market definition may be more useful to test the monopsony model.

5.3 Findings on the Effect of HHI on Wages Pre and Post 2021

Next, the OLS regression model is modified to isolate the effects of Covid-19. The new model is defined as:

$$\ln(average\ weekly\ wage_{ict}) = \beta_0 + \beta_1(\ln(HHI_{ict})) + \beta_2(post\ 2021\ dummy) + \beta_3(post\ 2021\ dummy * \ln(HHI_{ict})) + \gamma_t + \gamma_c + \gamma_i + \varepsilon_{ict}$$

where "i" denotes the industry or sector, "c" denotes the county, and "t" denotes the year of a given observation. Additionally, γ_t, γ_c, and γ_i denote year, county, and NAICS code fixed effects respectively. In this model, the post 2021 dummy variable is equal to 0 in the years 2012 through 2020 and 1 in the year 2021. This isolates the effect of HHI on wages in the years before and after the Covid-19 lockdown.

It is also important to consider if the demand shock of Covid-19 may be an exogenous variable in this model, introducing bias to the results. However, the HHI results discussed in Chapter 4 showed little variation between 2020 and 2021. Therefore, Covid-19 did not have a noticeable effect on the independent variable in the data used for this regression. This makes it less likely this shock could be an omitted variable in the model, given the data.

The results from the primary specification including NAICS fixed effects are shown in Table 5.4. Another specification excluding NAICS fixed effects is provided in Table 5.5 to provide a detailed look at the food and accommodation sector. Appendix B includes this specification for

the remaining sectors to allow each industry to be observed individually. However, excluding NAICS fixed effects leaves the model more vulnerable to potential omitted variables, making the specification with year, county, and NAICS fixed effects the preferred model in the paper.

Table 5.4: Effect of Log HHI on Log Wages Before and After 2021 by Sector (2012-2021)

	Dependent Variable: Log Wage				
Independent Variables	Total	Healthcare	Food & Accommodation	Arts, Entertainment & Recreation	Retail Trade
Log HHI	0.0013	0.00374**	0.0232***	-0.0236***	-0.00209
	(0.000998)	(0.00166)	(0.00157)	(0.00445)	(0.00147)
Post 2021 dummy	0.275***	0.191***	0.266***	0.357***	0.310***
	(0.0101)	(0.0142)	(0.0105)	(0.0511)	(0.0165)
Post 2021 * Log HHI	-0.00718***	0.00394*	-0.00138	-0.0161**	-0.0146***
	(0.00150)	(0.00215)	(0.00166)	(0.00747)	(0.00238)
Constant	5.855***	6.662***	5.536***	6.473***	5.895***
	(0.00655)	(0.00888)	(0.0107)	(0.0301)	(0.00952)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes
NAICS Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	222,997	62,701	43,311	23,155	93,574
R-squared	0.749	0.860	0.831	0.718	0.526

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1
*Total denotes the overall effect across all four industries: healthcare, food & accommodation, arts, entertainment, & recreation, and retail trade
*Retail Trade Industry is limited to NAICS codes that involve non-essential retail goods, excluding Health & Personal Stores, Gasoline Stations, and Nonstore Retailers. These are excluded to isolate the impact of Covid-19 on non-essential retail goods.

Table 5.5: Effect of Log HHI on Log Wage Before and After 2021 in Food & Accommodation Sector by Industry (2012-2021)

	Dependent Variable: Log Wage	
Independent Variables	Accommodation	Food Services & Drinking Places
Log HHI	-0.00662**	0.00372
	(0.00271)	(0.00288)
Post 2021 dummy	0.120***	0.280***
	(0.0239)	(0.00671)
Post 2021 * Log HHI	0.0226***	-0.00259**
	(0.00348)	(0.00111)
Constant	5.759***	5.438***
	(0.0174)	(0.0145)
Year Fixed Effects	Yes	Yes
County Fixed Effects	Yes	Yes
NAICS Fixed Effects	No	No
Observations	18,326	24,764
R-squared	0.899	0.924

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5.4 Discussion of Main Findings

The coefficient of log HHI denotes the wage elasticity before 2021.The coefficient of the interaction term between the post 2021 dummy variable and log HHI plus the coefficient of log HHI denotes the total wage elasticity after 2021. Therefore, the interaction term represents whether the wage elasticity increased or decreased during Covid-19. The results in Table 5.4 show that earnings elasticity decreased in all but the healthcare sector, with a statistically significant coefficient in the arts, entertainment, & recreation, and the retail trade sectors. In the healthcare sector, all else equal, the elasticity pre-2021 was 0.00374 and increased to 0.00768 in 2021. In other words, a 1% increase in HHI is associated with a 0.77% increase in earnings in the healthcare sector post-2021, holding everything else constant. Therefore, the null hypothesis is rejected in support of the second alternative hypothesis.

One factor likely contributing to the result in the healthcare sector, as discussed in Chapter 3, is a monopsony firm's ability to pay higher wages in the face of a labor shortage. These jobs became much riskier and employment struggled to return to pre-lockdown levels in 2021. The U.S. Bureau of Labor Statistics (2024) reported a gap in employment of almost 1 million between March 2020 and March 2021 in the healthcare sector. As a result of this labor shortage and high demand for healthcare services, firms with market power might have offered higher wages to attract labor, while not paying more than marginal cost.

In the arts, entertainment, & recreation sector, all else equal, a 1% increase in HHI was associated with a 2.36% decrease in earnings pre-2021 and a 3.97% decrease in earnings post-2021. In the retail trade sector, all else equal, a 1% increase in HHI was associated with a 0.2% decrease in earnings pre-2021 and a 1.6% decrease in earnings post-2021. These results reject the alternative hypothesis from Chapter 3. The relationship between concentration and wages are likely different in these industries than in the healthcare industry because of the lack of demand and other factors related to Covid-19. Arts, entertainment, & recreation saw a profound decrease in demand for services as guidelines warned people from gathering in big groups. Therefore, the required labor supply in this sector decreased. Similar events occurred in the retail trade industry. As discussed in Chapter 1, technology also played an important role in the decreased need for labor in this industry as shopping moved online and consumer preferences shifted. Demand for online meal-kit services skyrocketed, demonstrating this shift and decreased labor requirement in food and beverage stores as well as apparel. As Bronfenbrenner (1956) explained, the decrease in required labor supply would lead monopsony firms to decrease wages. Therefore, these results align with the theoretical model of monopsony power in Chapter 3.

In the food and accommodation sector, the decrease in wages is not statistically significant but deviates from the positive coefficient observed across 2012-2020. Similar to the retail trade sector, this decrease could be related to the sudden drop in demand for dining-in as a result of Covid-19 guidelines. These guidelines resulted in a shift toward technology such as self-serving kiosks to limit interaction between people. As a result, firms may have invested more in technology, decreasing labor requirements and causing firms in concentrated markets to decrease wages.

In summary, the null hypothesis from Chapter 3 is rejected as there is a statistically significant decrease in wages in service industries and a statistically significant increase in wages in the healthcare industry. This is the first analysis of labor market concentration focusing on the effects from Covid-19. Therefore, more research should continue with data after the pandemic to support these results.

Chapter 6

Conclusion

Overall, the results of this thesis are consistent with previous findings in the literature that suggest labor markets are, on average, highly concentrated. Additionally, this research provides deeper insight into the relationship between labor market concentration and wages by separating the relationship by sector and industry. It supports the theoretical model and hypothesis in the arts, entertainment, & recreation and retail trade sectors, finding a negative relationship between wages. In the healthcare and food & accommodation sectors, the hypothesis does not hold as there exists a positive relationship. Additionally, this thesis is the first to use data incorporating one of the biggest shocks to the labor market in U.S. history. As a results, it illuminates preliminary ideas about how this affected the relationship between concentration and wages. The results show that after 2021, wage elasticity decreased in all but the healthcare sector, where wage elasticity increased slightly. These results all align with the theoretical model and hypotheses in Chapter 3.

Potential biases in this research may arise from the data. First, the use of average weekly wages by NAICS code may be biased due to different hours worked by varying individuals and industries. For example, long hours by healthcare workers may contribute to higher average weekly wages in that sector. Additionally, only an estimate of the number of employees for each firm in a given county, year, and industry is used. Firm level data with exact employment counts could yield more precise results. As discussed in Chapter 1 and by Webber (2015), a different, non-location-based, definition of the labor market may be needed to more accurately determine labor market power. This is even more important in the years after Covid-19 with a spike in remote

working, expanding labor markets beyond geographical boundaries. New research should consider this when conducting similar analyses.

Finally, there may also be omitted variable bias when using OLS regressions. Particularly, the regressions utilized do not consider how productivity or national concentration may be omitted variables, contributing to both concentration and wages. Further research could be done using an instrumental variable model to account for potential omitted variable bias and assess a causal relationship between HHI and wages. Additionally, further research using data continuing after Covid-19 would provide important insight into more long-term effects in concentration from the pandemic. This analysis only includes data from 2012-2021 and likely does not capture all the effects of Covid-19.

This thesis, and similar research in this field, clearly has a place in today's economic policy landscape as demonstrated by growing concerns of the adverse effects of high labor market concentration. In 2021, President Biden issued an Executive Order to promote competition in the U.S. economy saying that consolidation has made it "harder for workers to bargain for higher wages and better work conditions" (Biden, 2021). The 2022 Economic Report of the President dedicated a chapter to the role of monopsony power using research by Azar et al. (2020, 2022), Benmelech et al. (2022), Qiu and Sojourner (2023) and Rinz (2022), research that also directed this thesis.

This thesis provides policy makers with careful research on monopsony power in the wake of the Covid-19 pandemic to help them make informed decisions about Covid-19's labor market impacts. For example, healthcare is often considered a highly concentrated labor market. However, these results show that even post 2021, high concentration does not have the same negative impact on this industry as it does in other service industries. Additionally, these results suggest that the

retail trade market is most vulnerable to harm from the Covid-19 pandemic. Concentration in this sector increased dramatically and wage elasticity also decreased sharply, suggesting that wages in this industry are highly vulnerable to increases in concentration in today's labor markets. Identifying and monitoring these industries can protect millions of American workers, as wages and the labor market are an essential component of their everyday lives.

The current administration knows that "healthy market competition is fundamental to a well-functioning U.S. economy" (Council of Economic Advisors, 2022). This thesis is an important step in identifying where healthy market competition occurs and where it does not. Informed policies based on these findings and similar research can be used to improve the welfare of American workers and allow the U.S. economy to prosper under healthy market competition.

Appendix A

Data Appendix

Table A.1: Estimation of Number of Employees per Establishment

Employment size of establishment code	Number of employees assigned
Establishments with less than 5 employees	2.5
Establishments with 5 to 9 employees	7
Establishments with 10 to 19 employees	14.5
Establishments with 20 to 49 employees	34.5
Establishments with 50 to 99 employees	74.5
Establishments with 100 to 249 employees	174.5
Establishments with 250 to 499 employees	374.5
Establishments with 500 to 999 employees	749.5
Establishments with 1,000 employees or more	1500
Establishments with 1,000 to 1,499 employees	1249.5
Establishments with 1,500 to 2,499 employees	1999.5
Establishments with 2,500 to 4,999 employees	3749.5
Establishments with 5,000 employees or more	8000

*The “number of employees assigned” column indicate how employment for each firm in the CBP dataset was obtained

Appendix B

Regression Specification Appendix

Table B.1: Effect of Log HHI on Log Wages by Sector (2017-2021)

	Dependent Variable: Log Wage				
Independent Variables	Total	Healthcare	Food & Accommodation	Arts, Entertainment, & Recreation	Retail Trade
Log HHI	-0.0135***	0.00239	0.0279***	-0.0355***	-0.0255***
	(0.00158)	(0.00281)	(0.00247)	(0.00841)	(0.00228)
Constant	6.049***	6.778***	5.635***	6.673***	6.139***
	(0.0112)	(0.0165)	(0.0179)	(0.0596)	(0.0158)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	No	No	No	No	No
NAICS Fixed Effects	Yes	Yes	Yes		Yes
Observations	104,501	29,051	20,970	10,995	43,109
R-squared	0.758	0.882	0.852	0.738	0.548

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1
*Total denotes the overall effect across all 4 industries: healthcare, food & accommodation, arts, entertainment, & recreation and retail trade
*Retail Trade Industry is limited to NAICS codes that involve non-essential retail goods, excluding Health & Personal Stores, Gasoline Stations, and Nonstore Retailers. These are excluded to isolate the impact of Covid-19 on non-essential retail goods.

Table B.2: Effect of Log HHI on Log Wages Before and After 2021 by Sector (2017-2021)

	Dependent Variable: Log Wage				
Independent Variables	Total	Healthcare	Food & Accommodation	Arts, Entertainment & Recreation	Retail Trade
Log HHI	-0.0134***	0.000735	0.0279***	-0.0318***	-0.0241***
	(0.00161)	(0.00284)	(0.00249)	(0.00868)	(0.00232)
Post 2021 dummy	0.132***	0.0652***	0.138***	0.234***	0.181***
	(0.0105)	(0.0142)	(0.0106)	(0.0556)	(0.0167)
Post 2021 * Log HHI	-0.000468	0.00827***	-0.000366	-0.0138*	-0.00751***
	(0.00156)	(0.00216)	(0.00168)	(0.00810)	(0.00242)
Constant	6.048***	6.789***	5.635***	6.647***	6.129***
	(0.0113)	(0.0167)	(0.0180)	(0.0615)	(0.0161)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes
NAICS Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	104,501	29,051	20,970	10,995	43,109
R-squared	0.758	0.882	0.852	0.738	0.548

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1
*Total denotes the overall effect across all 4 industries: healthcare, food & accommodation, arts, entertainment, & recreation and retail trade.
*Retail Trade Industry is limited to NAICS codes that involve non-essential retail goods, excluding Health & Personal Stores, Gasoline Stations, and Nonstore Retailers. These are excluded to isolate the impact of Covid-19 on non-essential retail goods.

Table B.3: Effect of Log HHI on Log Wages in Healthcare Sector by Industry (2012-2021)

	Dependent Variable: Log Wage							
Independent Variables	Ambulatory Services		Hospitals		Nursing & Residential Care		Social Assistance	
Log HHI	-0.00359	-0.00345	-0.00423	-0.00349	-0.00661***	-0.00686***	-0.00333	-0.00307
	(0.00223)	(0.00223)	(0.00632)	(0.00640)	(0.00203)	(0.00203)	(0.00295)	(0.00295)
Post 2021 dummy		0.163***		0.198***		0.263***		0.277***
		(0.0132)		(0.0438)		(0.0127)		(0.0192)
Post 2021 * Log HHI		0.00742***		-0.00429		0.00410**		-0.0110***
		(0.00211)		(0.00603)		(0.00183)		(0.00282)
Constant	6.670***	6.669***	6.935***	6.930***	6.164***	6.166***	5.849***	5.847***
	(0.0119)	(0.0119)	(0.0454)	(0.0460)	(0.0129)	(0.0130)	(0.0180)	(0.0180)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NAICS Fixed Effects	No	No	No	No	No	No	No	No
Observations	25,730	25,730	2,926	2,926	16,186	16,186	16,979	16,979
R-squared	0.886	0.886	0.936	0.936	0.905	0.905	0.853	0.853

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table B.4: Effect of Log HHI on Log Wages in Food & Accommodation Sector by Industry (2012-2021)

	Dependent Variable: Log Wage			
Independent Variables	Accommodation		Food Services & Drink Places	
Log HHI	-0.00487*	-0.00662**	0.00349	0.00372
	(0.00273)	(0.00271)	(0.00288)	(0.00288)
Post 2021 dummy		0.120***		0.280***
		(0.0239)		(0.00671)
Post 2021 * Log HHI		0.0226***		-0.00259**
		(0.00348)		(0.00111)
Constant	5.745***	5.759***	5.439***	5.438***
	(0.0175)	(0.0174)	(0.0145)	(0.0145)
Year Fixed Effects	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
NAICS Fixed Effects	No	No	No	No
Observations	18,000	18,326	24,764	24,764
R-squared	0.898	0.899	0.924	0.924

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table B.5: Effect of Log HHI on Log Wages in Arts, Entertainment, & Recreation Sector by Industry (2012-2021)

Independent Variables	Dependent Variable: Log Wages Performing Arts, Spectator Sports, and Related		Museums, Historical Sites, and Similar Institutions		Amusement, Gambling, and Recreation Industries	
Log HHI	-0.0189**	-0.0151*	-0.00837	-0.0079	-0.00639	-0.00599
	(0.00788)	(0.00795)	(0.00737)	(0.00742)	(0.00394)	(0.00395)
Post 2021 dummy		0.607***		0.328***		0.267***
		(0.0908)		(0.107)		(0.0327)
Post 2021 * Log HHI		-0.0478***		-0.00774		-0.00803*
		(0.0138)		(0.0143)		(0.00485)
Constant	6.490***	6.467***	6.226***	6.223***	5.736***	5.733***
	(0.0498)	(0.0502)	(0.0520)	(0.0524)	(0.0245)	(0.0246)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
NAICS Fixed Effects	No	No	No	No	No	No
Observations	5,234	5,234	3,690	3,690	13,672	13,672
R-squared	0.864	0.865	0.875	0.875	0.862	0.862

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table B.6: Effect of Log HHI on Log Wages in Retail Trade Sector by Industry (2012-2021)

Independent Variables	Dependent Variable: Log Wage									
	Food & Beverage Stores		Clothing and Clothing Accessories Stores		Sporting Goods, Hobby, Musical Instrument, & Book Stores		General Merchandise Stores		Miscellaneous Store Retailers	
Log HHI	0.00519***	0.00510***	0.0410***	0.0405***	0.00993**	0.00993**	-0.00894***	-0.00894***	-0.00125	-0.00121
	(0.00171)	(0.00171)	(0.00467)	(0.00462)	(0.00409)	(0.00409)	(0.00149)	(0.00149)	(0.00467)	(0.00467)
Post 2021 dummy		0.187***		0.324***		0.249***		0.218***		0.271***
		(0.0143)		(0.0208)		(0.0324)		(0.0189)		(0.0258)
Post 2021 * Log HHI		-0.00551***		-0.0231***		0.000724		-0.00103		-0.00273
		(0.00200)		(0.00307)		(0.00459)		(0.00264)		(0.00382)
Constant	5.829***	5.830***	5.452***	5.457***	5.671***	5.671***	6.039***	6.039***	5.809***	5.808***
	(0.0108)	(0.0108)	(0.0279)	(0.0276)	(0.0268)	(0.0268)	(0.0101)	(0.0101)	(0.0294)	(0.0294)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NAICS Fixed Effects	No	No	No	No	No	No	No	No	No	No
Observations	23,273	23,273	16,133	16,516	13,088	13,088	18,695	18,695	20,895	20,895
R-squared	0.903	0.904	0.799	0.802	0.825	0.825	0.877	0.877	0.825	0.825

*Standard errors reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1

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