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Monopsony in Spatial Equilibrium^{*}

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Abstract

An emerging labor economics literature studies the consequences of firms exercising market power in local labor markets. These monopsony models have implications for trends in earnings inequality. The extent of this market power is likely to vary across local labor markets. In choosing what market to live and work in, workers trade off wages, rents and local amenities. Building on the Rosen/Roback spatial equilibrium model, we investigate how the existence of local monopsony power affects the cross-sectional spatial distribution of wages and rents across cities. We find an employment-weighted elasticity of land prices to concentration of -0.034 —similar to Rinz (2018)'s reported elasticity of compensation to concentration. This finding has implications for who bears the economic incidence of labor market power. We present two extensions of the model focusing on the role of migration costs and worker skill heterogeneity.

Keywords: monopsony, wages, housing costs

JEL Codes: J3, R23

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Introduction

Recent research in labor economics has questioned whether the perfect competition model offers an accurate representation for understanding how many workers' wages are set. Building on the research of Alan Manning (2003, 2006, 2009), a growing number of studies have documented that wages are lower in areas featuring greater concentration of employment among larger firms (see Benmelech, Bergman, and Kim 2018). At a time of great concern about income inequality, this research suggests that the labor market rents generated from a productive worker/firm matches are increasingly going to the firms with market power.

Finite commuting speeds constrict one's job search once a worker has selected a local labor market. In choosing a local labor market, workers have strong incentives to consider what will be their well being in such a location. This calculation is based on one's expected earnings, rents taxes, government services and amenities from locating in an area.

A mature urban economics literature has examined the compensating differentials capitalization of amenities and local taxes in wages and rents (Gyourko and Tracy 1991). Building on the insights of the classic Rosen/Roback spatial equilibrium model, this literature concludes that wages and real estate rents adjust so that the marginal worker is just indifferent between living and working in each local labor market.

This urban economics literature has direct implications for the new generation of monopsony models. A city's degree of local monopsony power is another place-based attribute and thus becomes part of the bundle one must "consume" if one locates in a city. Using the spatial equilibrium model, we argue that cities that feature monopsonistic firms, and thus pay lower wages, in equilibrium will feature lower rents. This assumes that the monopsony power is extensive enough to impact the marginal household considering staying or leaving the city. If, on the other hand, monopsony power is localized within a small sector of the city affecting only inframarginal households, then capitalization into house prices would not occur.

Labor economists have focused on estimating the earnings inequality introduced by this market power assuming that the economic incidence is on the impacted workers. Our results suggest that the economic incidence of such market power is at least partially borne more broadly by local land owners. Using county panel data from the County Business Patterns and county Zillow

data, we document that home prices are lower in counties where the Herfindahl index of establishment size concentration (HHI) is growing. This is suggestive evidence that housing markets partially capture labor market concentration dynamics.

In an extension of the model, we introduce a local government with the power to tax and provide public goods. If this government chooses to tax and redistribute the monopsony rents, then this will attenuate the land rent effect. This result builds on the work of Brueckner and Neumark (2014) who find that local governments in high amenity areas tax the local rich and use the proceeds to provide more generous compensation for local public employees.

The typical urban spatial model assumes zero migration costs. In an extension of our core model, we introduce migration costs and study how this affects the spatial equilibrium. Such migration costs means that there is a “zone of inaction” such that incumbents will not move away if firms cut their wages. This reduced mobility tends to mitigate the incidence of monopsony on local rents.

Throughout the first part of the paper, we assume that workers are homogeneous. We then relax this assumption and adopt a Roy Model approach in which each worker is a bundle of sector specific skills. A city where the firms are exercising monopsony power features a different ratio of skill factor prices than a perfect competition city. We use the Roy Model to highlight the subset of workers who choose to remain in the monopsony city and the allocation of workers across sectors within the city. We document that in the case where worker skills are positively correlated across sectors the “exploited sector” in a monopsony city will suffer a brain drain. Thus, in addition to the downward pressure on wages due to monopsony power, low wages in this sector partially reflect a composition shift as the skill of the marginal worker in these sectors declines.

Our study highlights the importance of explicitly integrating insights from urban economics into the new generation of labor economics models. Our empirical findings offer support for introducing integrated local real estate markets and labor markets when studying the consequences of local labor market power.

Introducing Monopsony Power into the Rosen-Roback Model

We use the model of Gyourko and Tracy (1989) that introduced produced government services into the spatial equilibrium model of Rosen-Roback. This model seeks to explain the pattern of compensating differentials (as reflected by spatial variation in wages and rents). Workers in a community consume non-produced local amenities as well as produced local government services. A representative worker-resident is assumed to consume a composite traded good Y at a constant price (normalized to 1) and land services N . By living in the j^{th} community, the household also consumes the amenity bundle A_j and government services G_j . The household utility is given by

$$U(Y, N; A_j, G_j) \quad (1)$$

The gross-of-tax of the composite good is $(1+s)$ where s is the combined state and local sales tax. The gross-of-tax land rental price is $r = (1+t)n$ where t is the property tax rate and n the local land rental. Assume that households inelastically supply one unit of labor that is compensated at an after-tax rate of $(1-z)W^g$ where z is the combined income tax rate. Finally, let I denote any non-wage income available to the household.

The household's budget constraint requires that expenditures on the composite good and land consumption do not exceed the household's after-tax wage and non-wage income.

$$(1+s_j)Y_j + (1+t_j)n_jN_j \leq (1-z_j)(W_j^g + I) \quad (2)$$

The associated indirect utility function is given by

$$\bar{V} = V\{W^g(1-z), t, (1+s); A, G, I\} \quad (3)$$

Firms are profit maximizing where they use labor (L), land (N) and intermediate inputs to produce the composite commodity.

$$Y_j = F(L_j, N_j, R_j; A_j, G_j) \quad (4)$$

Conditional on the firm's current location, the firm's optimization problem is given by

$$\max_{R,N,L} \pi = (1 - \tau) \left[Y_j - (1 + t_j) n_j N_j - W_j^g L_j - (1 + s_j) R_j \right], \quad (5)$$

where τ is the corporate profits tax and all other terms are as previously defined.

Substituting the firm's factor demand functions into (5) yield the firm's indirect profit function, Π . Assuming that capital is mobile, equilibrium requires that profits are equalized across localities. This gives us

$$\Pi \{W^g, r, \tau, (1 + s); A, G\} = \bar{\Pi} \quad (6)$$

Equilibrium in the local market consists of a gross of property tax land rental rate and gross of income tax wage rate that clears the market. This is shown by point A in Figure 1 where the local gross wage is W_o^g and gross of property tax housing rents $(1 + t)n_0$. An implication is that holding government services constant changes in the effective property tax rate (t_j) are fully capitalized into land prices.

Now assume that a large employer enters the market displacing the existing small employers. A recent literature has examined how Walmart makes its entry decisions and how it affects the

spatial distribution of employment in its local vicinity, see Neumark et al (2008), Holmes (2011) and Basker and Pope (2015).¹ The large employer uses its market power to act in a monopsonistic manner to reduce employment and cut wages. As a result, it increases its profit level from $\bar{\pi}_0$ to $\bar{\pi}_1$. Absent any change in the land rental rate, we would move in Figure 1 from point A to B with gross wages falling to W_B^g . However, point B would involve a lower level of indirect utility. With zero cost of mobility for workers, this would induce workers to migrate from the city. As a consequence, to restore household utility back to \bar{V} the land rental rate falls to $(1+t)n_1$ given by point C. As a result, the observed decline in wages due to the monopsonist is mitigated to $W_1^g > W_B^g$. The new equilibrium has the feature that there is no incentive for households to move out of the city.

This simple version of the Rosen (1979)-Roback (1982) urban model illustrates that with costless mobility, the impact of a monopsonist in a local market leads to offsetting compensating differentials in housing prices. In this case, households are induced to remain in the local market despite the lower wages by a reduction the cost of housing. If we introduce heterogeneity across types of households, then the incidence will vary across types of households and the equilibrium will be determined by the marginal household type.

All resident homeowners in the local market face the negative house price capitalization of the monopsonist wage effect, even if they are retired.² That is, retired households do not directly experience the lower wages due to the entry of the monopsonist, but do face the negative capitalization of these lower wages into house values. Households that own their homes effectively own an equity stake in the community and the value of that equity declines with the entry of the monopsonist. At the other extreme from retired households are two-earner vs one-earner households. The wage effect hits two-earner households more severely than for one-earner households. In contrast, renters do not face the capitalization effect and benefit from the lower housing rent. Finally, non-resident retired households would now find this locality more desirable as

¹ An important issue is whether the monopsonist creates any consumption amenities for example by providing a greater variety of goods and discount prices relative to the firms that it displaces.

² Similarly, Mayer and Hilber (2009) argue that retired households support the provision of high quality local public schools because the quality is capitalized into house prices.

a place to live in retirement. Again, if they move to the locality after the monopsonist enters, they would not be affected by the lower wages and would benefit from the lower house prices.

We can relax the assumption of costless mobility for households. Assume instead that there is a utility cost of moving of $\Delta\bar{V} = \bar{V}_0 - \bar{V}_1$.³ In this case, following the entry of a monopsonist into the local market, land prices and wages will adjust to provide households with the utility level $\bar{V}_1 < \bar{V}_0$. The introduction of costly mobility limits the degree to which land prices adjust in response to the entry of the monopsonist. The new equilibrium would be at point D in Figure 2 instead of point C with the gross wage being between W_B^g and W_1^g . In the extreme, if mobility is prohibitively costly, then the equilibrium shifts up to point B which is the standard analysis.

Local Government

The analysis so far assumes no reaction by the local government to the actions taken by the monopsonist. That is, government services and local tax rates are unchanged. Note that aggregate property taxes and wage income taxes will decline with the entry of the monopsonist.⁴ At the same time, labor costs to the local government will decline due to lower wages. Any resulting decline in net tax revenue must be offset by higher tax business taxes (perhaps on the profits of the monopsonist) for the level of government services (and taxes on households) to be unaffected. The profits by the monopsonist are a locational rent, so may be subject to expropriation by the local government if it has the ability to tax the monopsonist. If this is not possible, then the impact of the resulting reduction in government services depends on whether these services are valued by households, firm, or both. Similarly, if taxes are raised in lieu of service reductions, then the impact depends on which taxes are changed.

The interaction between the local government and the monopsonist may also depend on whether the local government is unionized. For localities that have desirable locational amenities, local public sector unions through collective bargaining may be able to bid up their wages as a way

³ For example, long-time residents may build up location specific social capital and this acts as a migration cost (Glaeser, Laibson and Sacerdote 2002).

⁴ If a local sales tax exists, then in the case of costless mobility the decline in rents offsets the lower wage income so that sales taxes may not be adversely impacted. With mobility costs, the decline in rents do not fully offset the lower wage income so sales tax revenues would likely decline.

of expropriating some of the value of the amenities (Brueckner and Neumark 2014). In this scenario, if a monopsonist enters the local market, then services may be maintained by pressure being put on the public sector unions to agree to wage concessions. In this case, rents will be transferred from the unionized public sector workers to the monopsonist. This will mitigate the need to raise taxes and/or cut services as discussed earlier.

Will New Firms Enter a Monopsonized Local Labor Market?

As the large employer enters the market and uses its market power to pay lower wages, this will induce lower equilibrium land rents. A potential entrant will now be attracted to moving to the monopsony area because rents and wages are lower. Forces that limit firm entry to the monopsony local labor market matter because if the profit opportunity could be easily arbitrated away by entering firms or taxed away by the local government then the land rent capitalization would not be observed or it would only be a short-run transitory effect.

There are at least three microfoundations that could preclude new firm entry. One is the standard entry deterrence game where the large incumbent credibly commits to lower future prices in a price war that discourages firm entry in the same industry as the incumbent. A second explanation builds on Bresnahan and Reiss (1990, 1991) and argues that in small markets there may not be sufficient scale of aggregate demand to support the incumbent monopsonist and the entrant. We recognize that both of these explanations hinge on the assumption that the monopsonist sells his output on the local (not the national market).

A third microfoundation for why firms may choose not to enter a monopsonized local labor market focuses on firm-specific tenure and the division of labor market rents. An older empirical labor literature estimated the returns to firm-specific tenure, see Altonji and Shakotko (1987) and Topel (1991). For large firms that suddenly choose to “exploit” their incumbent workers, they will alter this tenure/earnings profile and keep more of the match surplus. While a worker can quit such a firm, the worker will start out at zero tenure at the next firm. The monopsonist can calculate how much surplus that can be extracted such that older workers remains at the firm. Entering firms do not gain a wage discount on such workers. In this case, rents will be lower in such monopsony areas to compensate new hires as they anticipate their future “holdup” problem once they lock-in with such a firm.

The Economic Incidence of Monopsony in a Roy Model Featuring Heterogeneous Skills and Sectoral Choice

We now relax the assumption of homogenous workers. When workers differ with respect to their skills, the rise of monopsony power will induce behavioral change at the extensive margin and workers will sort. The early Rosen/Roback literature compensating differentials literature abstracted from explicitly considering the assignment of heterogeneous workers to sectors (based on skill) to local markets.⁵

Assume that workers in a local labor market are heterogeneous in their ability. The labor market consists of two sectors. Each worker's ability is given by a pair of sector-specific abilities (a_{i1}, a_{i2}) . These abilities have a joint distribution in the local labor market. Each sector consists of many employers who pay a common sector specific ability wage, w_k . A worker is paid a wage equal to the ability wage in that sector times that worker's sector specific ability, $w_{ik} = w_k a_{ik}$. Assume that mobility between sectors within a local market is costless for workers, but that movement between local labor markets is prohibitively expensive. In this case, each worker will select the sector of employment that provides the higher wage. That is, worker i will select sector 1 if $w_1 a_{i1} > w_2 a_{i2}$ or $w_1 / w_2 > a_{i2} / a_{i1}$. Self-selection implies that the ray with slope w_1 / w_2 divides the joint distribution of skills such that workers with skill pairs below the ray will select to work in sector 1, and workers with skill pairs above the ray will select to work in sector 2.

Positive correlation in skill attributes across sectors

We will label sector 1 as "Retail" and sector 2 as "Mfg". Assume for now that the two skill abilities are positively correlated, but that the variance of abilities in manufacturing is higher than in retail. Assume that the ability wages w_1^c and w_2^c represent a competitive equilibrium where given the selection of workers across the two sectors induced by these ability wages, firms make zero profits

⁵ The value of a statistical life literature (started by Rosen and Thaler 1974) is a first cousin of the Rosen/Roback model. In that literature, researchers seek to estimate the compensating differential for working in a riskier job (Viscusi 1993). Hwang, Reed and Hubbard's (1992) work investigates the assignment of heterogeneous workers to risky and safe jobs.

selling their output. With this joint distribution of abilities, self-selection leads the manufacturing sector to attract on average higher quality workers than retail. While high ability workers in manufacturing are also high ability in retail, the larger variance of ability in manufacturing allows many of these high skilled workers to earn more in mfg. This is illustrated in Figure 3.

Now assume that a large retail employer enters the local market and displaces the small retailers. Once the small retail employers have exited, the large retail employer acts as a monopsonist. The assignment of workers to sectors implies that the large retail employer faces an upward sloping supply curve of workers that is indexed to the ability wage paid in mfg. Acting as a monopsonist, the retail employer reduces the ability wage paid in retail, $w_1^m < w_1^c$, so that the marginal revenue product of labor equals the marginal factor cost.

Holding constant the ability wage in manufacturing, the lower ability wage in retail rotates the ray downward as shown in Figure 3. This induces workers with ability pairs between the two rays to reallocate from retail to mfg. Total employment in retail is reduced as a consequence.⁶ Wages fall for those workers who remain in the retail sector. In addition, the average ability of workers in retail is lower under the monopsony retailer than under the earlier competitive retail sector. So, the average earnings in retail falls reflecting both the lower ability wage and the lower average ability.⁷

Whether this is the new equilibrium depends on if the manufacturing sector for this labor market is a price taker in a broader manufacturing market. If this is the case, then the ability wage in manufacturing is not affected by the influx of additional workers to the local manufacturing sector. For workers who were already working in manufacturing, the entry of the monopsonist in the retail sector does not affect their wages. However, the average earnings in manufacturing increase due to the high average ability of the new entrants from the retail sector. In contrast, if the local manufacturing sector is not a price taker, then the expanded output due to the influx of workers from the retail sector will result in a lower skill wage in mfg. This shifts the supply curve facing the monopsonist and will reduce the overall movement of workers into mfg.

⁶ Our analysis ignores minimum wage restrictions that may be bindings in some markets. See Azar et al 2019 for an analysis of the interaction of minimum wages and employment concentration in determining employment effects associated with the minimum wage.

⁷ Azar et al (2019) find that controlling for job titles (a proxy for worker quality) lowers the impact of concentration on wages. This is consistent with an increase in concentration in a sector leading to a reduction in workers quality in that sector.

The entry of the monopsonist retailer reduces the skill wage in retail and possibly also in manufacturing. This reduces the utility of workers in retail and also in manufacturing if there is a negative wage externality.⁸ With migration to other labor markets not possible, the profits for the monopsonist are created at the expense of local workers and consumers. Retired households would not bear any of the wage cost. The standard analysis ignores the housing market and assumes that rents and house prices remain unaffected. Capitalization of the monopsony effect into lower house prices affects all homeowners regardless of whether they experience a lower wage from the monopsonist.

We can consider other extensions of the basic Roy model. The standard application considers households with a single worker. Assume now that there are two-earner households where their skill attributes are positively correlated, see Becker (1973, 1974). For the subset of these households that are working in the sector that the monopsonist enters, the wage effects will be compounded. The house price effect, however, does not directly vary with the number of earners. A second extension would be to add a third sector consisting of home production. If the value of home production is unaffected by the entry of the monopsonist (similar to the manufacturing sector that sells into a national market), then the reduction in the skill wage in retail will induce reallocation both to the manufacturing and home production sectors. Including a third sector likely will increase the labor supply elasticity facing the monopsonist and therefore reduce the degree of the reduction in the skill wage.

Negative correlation in skill levels

We now briefly consider the case where there is a negative correlation in skills across the two sectors. That is, workers with a relatively high skill for manufacturing tend to have a relatively low skill for retail, and vice versa. We maintain the earlier assumption that the skill variance is higher in manufacturing than in retail. This is illustrated in Figure 4. Given the competitive skill wages, workers self-select into sectors resulting in both sectors attracting workers who are relatively high skilled in their sector.

⁸ If the manufacturing sector sells to a local market so the reallocation of workers to that sector would increase supply to the local market, causing the price to decline. This price decline would lead to a reduction in the skill wage for manufacturing. This is the negative pecuniary wage externality.

With a monopsonist taking over the retail sector, as before the ratio of skill wages flattens. This induces workers to transition from retail to manufacturing. However, now the average skill quality increases in retail and declines in manufacturing.⁹ Assuming no change to the skill wage in manufacturing, the average wage in manufacturing will decline reflecting the influx of relatively low skilled workers from the retail sector. The change in the average wage in retail will reflect the conflicting effects of the lower skill wage and the higher average skill among the smaller retail workforce.

Recent Empirical Research on Local Monopsony Power

Recent research on measuring monopsony power has sought to describe the time series patterns and the cross-sectional variation in labor market power. If monopsony power rises uniformly across local labor markets, then the spatial equilibrium model is not the right model for evaluating the economic incidence of this trend. The recent empirical evidence suggests that monopsony is concentrated in specific types of local labor markets.

The most comprehensive empirical analysis on changes in local labor market concentration and worker compensation are based on the Census Longitudinal Business Database (LRB).¹⁰ This covers the universe of establishments providing for each establishment the location, NAICS classification, employment count and payroll. In addition, identifiers allow researchers to link establishments for the same firm. For each establishment, average earnings is calculated as establishment payroll divided by employment. Rinz (2018) also merges in employee W-2 information to provide employee specific earnings information. In addition he merges in Census information to provide the age, gender and race/ethnicity of individual workers.

Using the LRB data, Rinz finds that employment weighted local labor market concentration measured at a 4-digit industry/commuting zone level declined nationally between 1976 and 2008, and then increases immediately following the financial crisis with declines returning after 2010 (Rinz 2018, Figure 2). Using a more detailed 5-digit/commuting zone definition of a local market, Lipsius 2018 finds little change in employment weighted average concentration across time. Focusing just

⁹ Hershbein and Macaluso (2018) find that higher concentration based on job postings raises the skill requirements of jobs, especially for low-skilled occupations.

¹⁰ This data must be accessed through a Census Research Data Center and requires special approval.

on manufacturing, Benmelech et al 2018 find a slight increase in concentration from the late 1970s to the early 2000s.¹¹

Disaggregating by geography, Rinz shows that concentration averaged across commuting zones has been trending down from 1976 to 2006, with a slight upward movement following the financial crisis and a resumption of the downward trend starting in 2010. The more concentrated area tend to be smaller markets. This may reflect that it is more likely now that smaller local markets now have one or more national firm's operating in their market.

How does labor market concentration affect local wages? Lipsius 2018 uses regresses the log of establishment average earnings per worker on a quadratic in HHI, industry times city fixed effects, and different specifications of time effects. He finds that a one standard deviation increase in HHI is associated with around an 8 percent decline in average earnings per workers. Using a worker-specific earnings lowers slightly the impact of concentration. Using establishment average earnings per worker, Rinz 2018 finds the coefficient on the log of HHI is around -0.05. When he switches to W-2 earnings, the coefficient on the log of HHI declines to around -0.03.

The estimated negative partial correlation between employment concentration and wages is consistent with local monopsony, but does not confirm that this is the underlying mechanism at work. Berry et al (2019) reviews the potential problems in applying the *structure-conduct-performance* paradigm from the traditional industrial organization literature. The authors state that "... there are multiple causal paths that can explain a given correlation between concentration and other market outcomes" (page 46). This is distinct from an endogeneity problem.

For example, assume that employment concentration increased in some localities due to de-industrialization as manufacturing plants closed reflecting increased global competition and movement of production to non-union plants in the South.¹² Wages would fall as high pay jobs (many unionized) leave the local market. Given the inelastic supply of existing housing (Glaeser and Gyourko (2005)), the loss of income would be reflected in lower house prices. In addition, as the tax base erodes there would be upward pressure on tax rates to maintain services. This would put

¹¹ Rossi-Hansberg et al (2019) document a similar increasing trend in national product market concentration and decreasing trend in local concentration.

¹² Employment concentration could rise due to a "last plant" surviving effect.

further downward pressure on house prices. This would suggest that we test for differences in capitalization effects from employment concentration in the Rust Belt states vs outside this region.

Testing for Real Estate Market Capitalization Effects

Using U.S. county panel data set, we present reduced form regressions to test whether real estate prices are lower in counties featuring greater concentrations of employment. We include a rich set of fixed effects, but we recognize that our empirical strategy can only provide suggestive evidence. Our main goal here is to highlight what is feasible empirical specification and to suggest fruitful paths for more compelling empirical research.

Deriving County Level Employment Concentration

We use County Business Patterns (CBP) data from 1998 to 2016. This provides the total county employment and the number of establishments in each size category. The list of categories provided are: 1-4, 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-999, 1,000-1,499, 1,500-2,499, 2,500-4,999, 5,000+. Table 1 provides the share of establishments in each size category when we pool across all of the counties and years. The task is to use this information to allocate to establishments the county employment across these categories. We can then calculate the standard measures of employment concentration.

We start with the case of a county that has no establishments in the upper open size category. We assume that that all establishments have a size that places them at a given relative distance within their size category. We select this distance so that the sum the estimated establishment sizes equals the total employment for the county. An implication is that this distance can vary across counties.

For counties that have one or more establishments in the upper open size category, we start by assuming the distance is the median of the earlier distance estimates (0.338 of the width). We allocate as before employees for establishments in the closed size categories. We then aggregate the total allocated employees and subtract this from the county total employment. We check that this employment difference exceeds 5,000 times the number of establishments in the upper open size category. If this is the case, then the establishment size for these remaining firms is simply the

employment difference divided by the number of large establishments. If the check is not satisfied, then we recalculate using the 25th percentile (0.309 of the width) in place of the median. We continue in this manner until the check is satisfied.

We construct two measures of concentration using the county-level data on imputed establishment sizes. These are the share of total county employment accounted for by the top 10 establishments, and the Herfindahl index (where the maximum value is 10,000). Descriptive statistics on these two measures are provided in Table 2. The distribution of both measures of employment concentration shift to the left as we move from small to large counties. Figure 5 provides the employment weighted aggregate time-series on our measures of concentration. Similar to Rinz (2018), the data indicate a declining level of concentration up to the financial crisis with a rise to 2010 and a subsequent decline. We disaggregate by county size in Figures 6 and 7. These show that the pattern across localities observed by Rinz (2018) is most closely followed by our medium-sized cities for both concentration measures.

How important is growing employment concentration given the aggregate patterns in the data? We compute the percent change in the Herfindahl index for each county over our sample period. The median (unweighted) county experienced a slight (11 percent) decline in concentration. However, ten percent of counties (147) experienced an increase in employment concentration of 65 percent or more, while 5 percent of counties (73) experienced an increase of 104 percent or more. So, rising employment concentration is not an issue for the most counties over our sample period. However, monopsony power could be considered an issue for a subset of counties. The Rosen/Roback model would be less relevant if there were a general increase in employment concentration. In this case, the outside indirect utility would be changing where we have assumed that it is constant.

Our measure of house prices is the county median home price per square foot from Zillow. We use data from July for the years 2000 to 2016. Zillow provides these data for roughly 1,500 counties. The smallest counties are much less likely to have such data provided. Combining this with our employment concentration measures from CBP, we estimate the following regression specifications for county j in state i at time t .

$$\log(\text{house price} / \text{sq foot}_{jit}) = \beta_0 + \beta_1 \log(\text{employment}_{jit}) + \beta_2 \text{concentration}_{jit} + \alpha_j + \mu_{it} + \varepsilon_{jit} \quad (7)$$

where “concentration” is either $\log(HHI_{jit})$ or $Share\ Top\ 10_{jit}$. We control for county and state/year fixed effects.

The results using the Herfindahl employment concentration measure are provided in Table 3 and for the top 10 share in Table 4. The upper panel reports results from unweighted regressions and the bottom panel from county employment weighted regressions. The first specification is for the pooled sample. Specifications (2) and (3) split the sample into counties from the rust belt or outside the rust belt.¹³ Finally, in specifications (4) to (6) we disaggregate the counties into terciles based on total county employment. In all cases, we estimate the employment concentration coefficient using within county variation deviated from state-specific year effects.

In all of the specifications, we find a statistically significant positive relationship between County employment and house prices. The unweighted elasticity for the pooled sample is 11 to 12 percent. The relationship between employment and house prices is strongest in the upper third of counties based on total employment where the elasticity is roughly double in size.¹⁴ Similarly, the employment weighted elasticity for the pooled sample is 26 percent.

Turning to employment concentration, for both measures we generally find a statistically significant negative relationship between employment concentration and house prices. For the Herfindahl measure, for the unweighted pooled sample we find an elasticity of -0.02 . A one standard deviation change in the share top 10 (i.e. 0.17), for the unweighted pooled sample is associated with a decline in house prices of -0.04 . Importantly, for both measures of employment concentration, the relationship with house prices is stronger outside the Rust Belt. This is inconsistent with our alternative mechanism for the correlation between employment concentration, wages and house prices. Finally, when we disaggregate by county employment size, we find the

¹³ We define the rust belt to include IL, IN, MI, OH, PA and WI.

¹⁴ Pope and Pope (2015) estimate that the presence of a Wal-Mart store is associated with higher prices of between 1-2 percent for properties between a half-mile and a mile from the store location. Using Wal-Mart location data published by Holmes (2011) for the period pre-2007, we find a Wal-Mart effect on overall house prices of 1.8 percent (though not statistically significant).

strongest relationship between employment concentration and house prices for counties in the middle of the size distribution.¹⁵

Turning to the employment weighted regressions, we find a stronger elasticity between the Herfindahl measure and local house prices. For the pooled sample, we find an elasticity of -0.034 . These results should be interpreted as the effect of concentration on house prices for a typical worker, whereas the unweighted results are for the typical county.

We can compare these house price changes to the estimated wage changes to get a sense of the economic significance of the offset in house prices. Recall that Rinz (2018) finds that the employment weighted elasticity of employment concentration (as measured by the Herfindahl index) and W-2 payroll compensation is -0.032 . For a renter considering the transition to homeownership, the estimates house price reductions fully offset the increase in the debt service cost relative to income induced by the higher employment concentration.¹⁶

Conclusion

The spatial equilibrium model from urban economics imposes important cross-restrictions on the cross-sectional spatial patterns of wages and rents that will emerge. In the spatial equilibrium, no worker or firm can raise its utility or profits by moving. Wages **and** rents adjust until this condition holds. This equilibrium concept helps to evaluate the economic incidence consequences of the rise of local labor market monopsony. Recent work in labor economics has been very valuable in highlighting emerging patterns. Existing models from urban economics play a central role in evaluating who pays for this market power.

The urban perspective suggests that how employment in a city becomes more concentrated is likely to be important in addition to the increase in concentration. If a national retailer enters the market displacing local firms, this increases local monopsony power which we have shown would generate negative capitalization into house prices. However, the national retailer might also provide

¹⁵ Henderson (1997) demonstrates that “middle cities” tend to be the most specialized in their production of traded goods.

¹⁶ The “front-end” ratio or PITI is the sum of the annual principal and interest on the mortgage, property taxes and homeowner insurance divided by annual income. The PITI, therefore, is a percentage of the house price to annual income. The change in the PITI from employment concentration depends on the impact on the ratio of the house price to annual income.

consumption amenities in the form of increased product variety and lower prices. This would lead to an offsetting positive capitalization into house prices. In contrast, if increased international trade with low cost foreign manufactures results in many manufacturing plants in a city to close, any remaining plants will gain monopsony power. However, the lower prices associated with global trade are not location specific, so there would not be any offsetting positive capitalization.

Our new empirical work provides suggestive evidence that labor market power is capitalized into rent prices. An ideal test of the role of spatial equilibrium in determining the economic incidence of rising monopsony power would feature a baseline perfectly competitive labor market in many different cities. The researcher would then randomly assign a subset of major firms in the city to having labor market power. The researcher could then observe the flows of workers into the city and out of the city and the real estate market dynamics introduced by this shock.

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Table 1. Establishment Size Distribution

Size Category	Share of Total
1 – 4	0.5442
5 – 9	0.1892
10 – 19	0.1268
20 – 49	0.0866
50 – 99	0.0295
100 – 249	0.0168
250 – 499	0.0043
500 – 999	0.0016
1,000 – 1,499	0.00043
1,500 – 2,499	0.00029
2,500 – 4,999	0.00015
5,000+	0.00006

Notes: County Business Pattern data, 1998 – 2016.

Table 2 Summary Statistics on County-Level Employment Concentration

	10 th	25 th	50 th	75 th	90 th
<i>Pooled:</i>					
Top 10 employment share	10.6	16.1	25.0	34.7	44.2
Herfindahl index	24.1	51.5	112.1	212.2	378.6
<i>Small:</i>					
Top 10 employment share	25.2	30.0	36.3	44.1	53.1
Herfindahl index	112.7	153.7	226.7	356.1	637.2
<i>Medium:</i>					
Top 10 employment share	16.7	20.5	25.7	31.5	39.1
Herfindahl index	55.1	77.3	116.4	177.0	293.9
<i>Large:</i>					
Top 10 employment share	7.6	10.0	13.4	17.9	22.6
Herfindahl index	12.8	21.5	36.3	62.5	98.1

Notes: County Business Pattern data, 1998 to 2016

Table 3. House Price Impacts of Employment Concentration -- Herfindahl

	(1) All	(2) Rust Belt	(3) Non Rust-Belt	(4) Small	(5) Medium	(6) Large
<i>Unweighted</i>						
Log(employment)	0.112*** (0.015)	0.093* (0.042)	0.114*** (0.016)	0.102*** (0.023)	0.123*** (0.028)	0.237*** (0.038)
Log(HHI)	-0.021*** (0.004)	-0.010 (0.012)	-0.022*** (0.005)	-0.017* (0.007)	-0.023** (0.008)	-0.016* (0.006)
Constant	3.503*** (0.144)	3.443*** (0.419)	3.529*** (0.152)	3.572*** (0.178)	3.380*** (0.262)	2.068*** (0.430)
R-square	0.98	0.93	0.98	0.98	0.98	0.98
<i>Employment weighted</i>						
Log(employment)	0.261*** (0.038)	0.343* (0.132)	0.248*** (0.039)	0.123*** (0.023)	0.143*** (0.027)	0.339*** (0.057)
Log(HHI)	-0.034*** (0.008)	-0.032 (0.020)	-0.034*** (0.008)	-0.018** (0.007)	-0.023** (0.008)	-0.034*** (0.009)
Constant	1.810*** (0.470)	0.438 (1.600)	2.060*** (0.481)	3.387** (0.253)	3.180*** (0.253)	0.781 (0.724)
R-square	0.98	0.93	0.98	0.98	0.98	0.98
Observations	29,977	4,749	25,228	9,992	9,992	9,993

Notes: Dependent variable is log(median house price per square foot). Standard errors are given in parentheses and are clustered by County. All specifications include County and State/Year fixed effects
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 4. House Price Impacts of Employment Concentration – Share Top 10

	(1) All	(2) Rust Belt	(3) Non Rust-Belt	(4) Small	(5) Medium	(6) Large
<i>Unweighted</i>						
Log(employment)	0.125*** (0.015)	0.102* (0.045)	0.127*** (0.010)	0.113*** (0.023)	0.133*** (0.028)	0.242*** (0.038)
Share Top 10	-0.233*** (0.036)	-0.134 (0.109)	-0.244*** (0.038)	-0.179** (0.048)	-0.254*** (0.064)	-0.240** (0.088)
Constant	3.346*** (0.149)	3.344*** (0.450)	3.366*** (0.156)	3.452*** (0.183)	3.234*** (0.271)	1.984*** (0.439)
R-square	0.98	0.93	0.98	0.98	0.98	0.98
<i>Employment weighted</i>						
Log(employment)	0.268*** (0.040)	0.348* (0.135)	0.255*** (0.041)	0.113*** (0.023)	0.155*** (0.028)	0.342*** (0.058)
Share Top 10	-0.382*** (0.079)	-0.356 (0.266)	-0.386*** (0.080)	-0.181** (0.044)	-0.268*** (0.063)	-0.408** (0.119)
Constant	1.670*** (0.493)	0.322 (1.662)	1.917*** (0.505)	3.268*** (0.189)	3.025*** (0.265)	0.689 (0.742)
R-square	0.98	0.93	0.98	0.98	0.98	0.98
Observations	29,977	4,749	25,228	9,992	9,992	9,993

Notes: Unweighted regressions. Dependent variable is log(median house price per square foot). Standard errors are given in parentheses and are clustered by County. All specifications include County and State/Year fixed effects

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Figure 1. Effect of Monopsonist on Local Equilibrium – No Mobility Costs

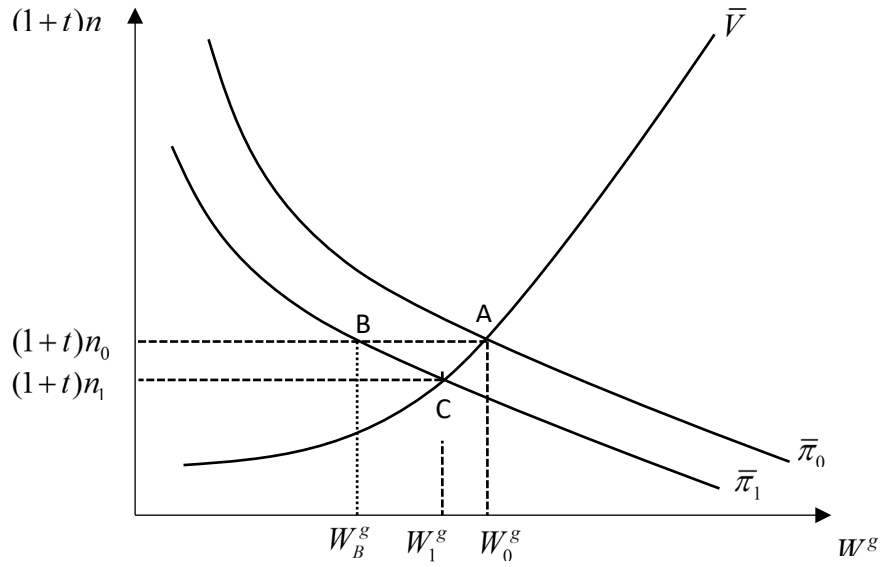


Figure 2. Effect of Monopsonist on Local Equilibrium – With Mobility Costs

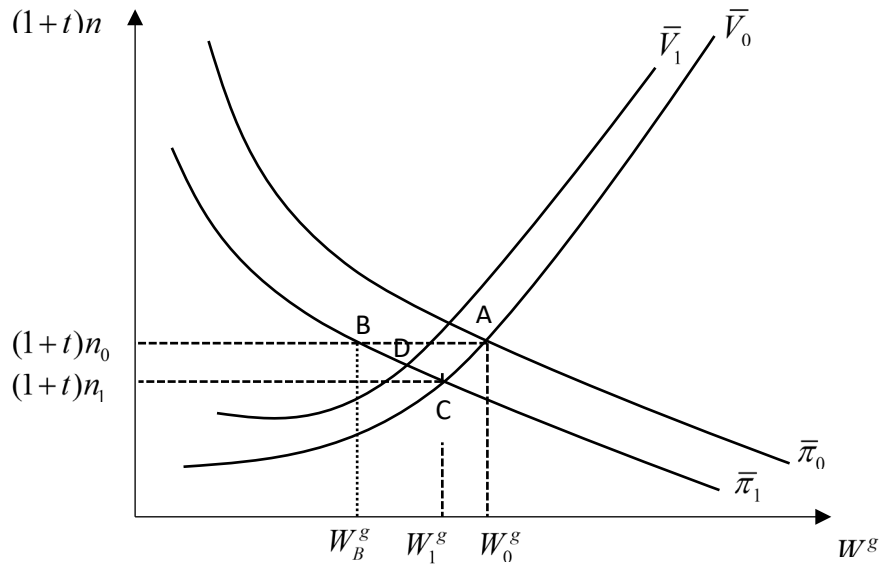


Figure 3. Impact of Monopsony on Worker Assignment – positive correlation in skills

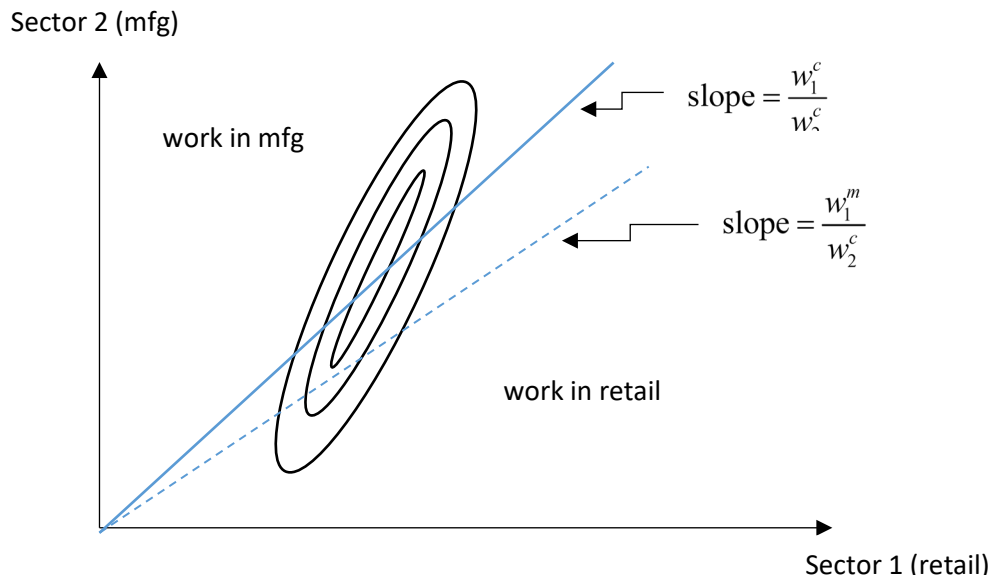


Figure 4. Impact of Monopsony on Worker Assignment – negative correlation in skills

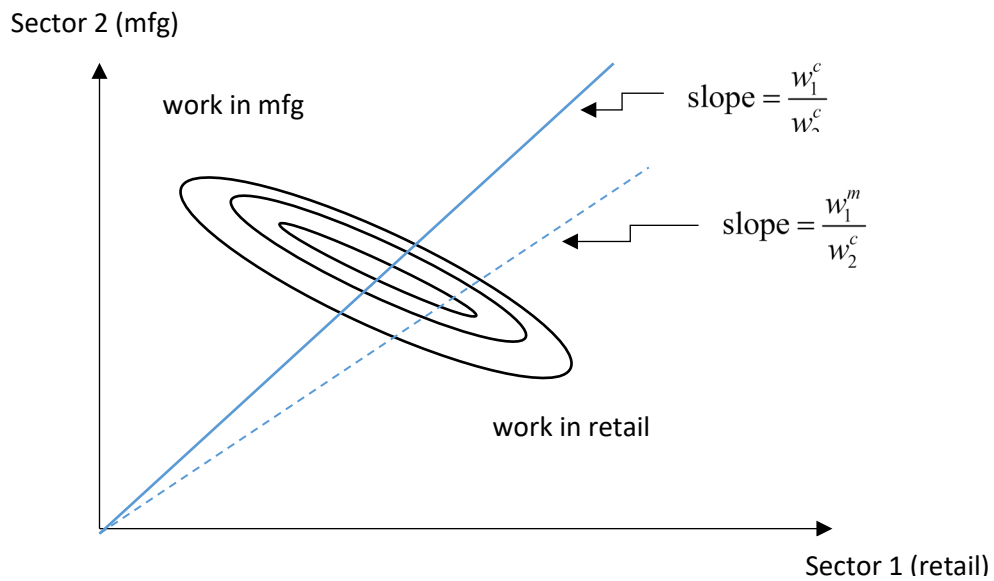


Figure 5. Time-Series of County-Level Employment Concentration

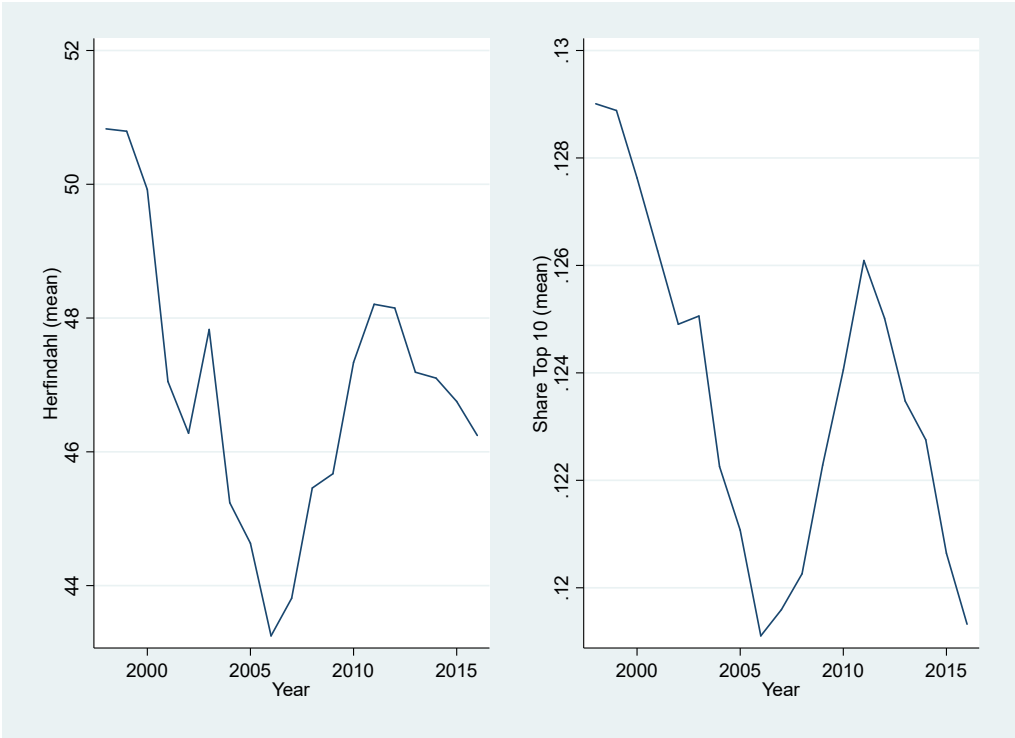


Figure 6. Time Series of Herfindahl – by Employment Tercile

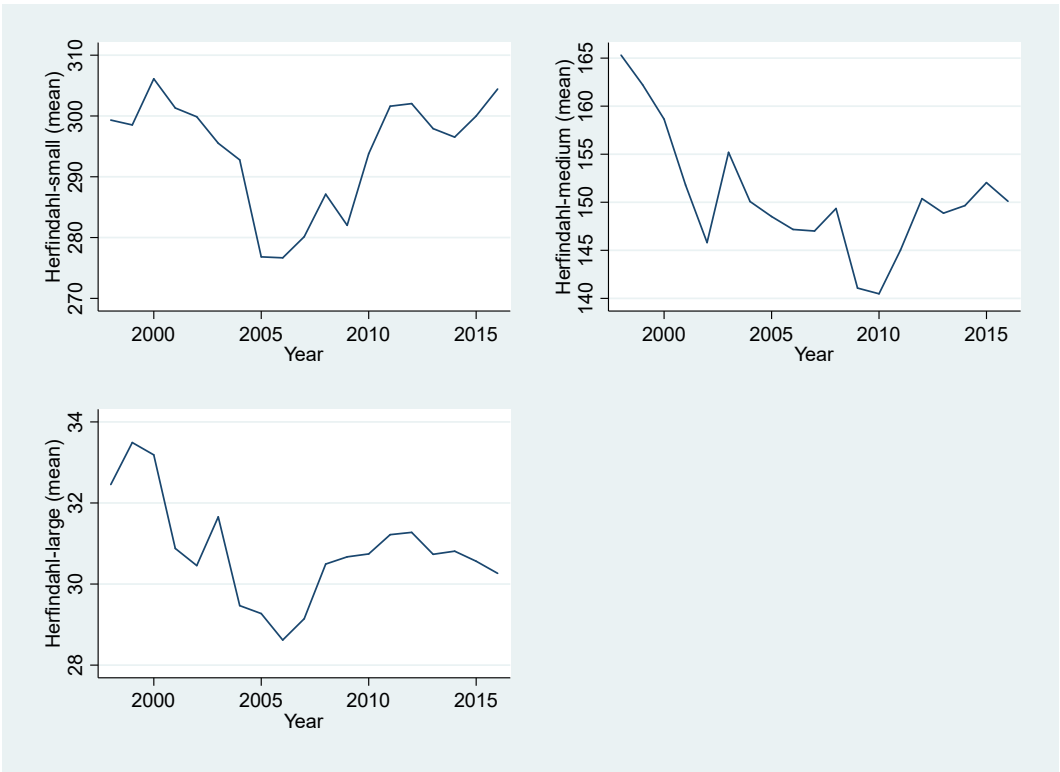


Figure 8. Time Series of Share Top 10 – by Employment Tercile

