MONOPSONY IN LABOR MARKETS: A REVIEW

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Researchers' interest in monopsony has increased in recent years. This article reviews the accumulating evidence that employers have considerable monopsony power. It summarizes the application of this idea to explaining the impact of minimum wages and immigration, in anti-trust, and in understanding how to model the determinants of earnings in matched employer–employee data sets and the implications for inequality and the labor share.

High levels of inequality and a falling labor share in national income have led to renewed interest in the idea that an imbalance in economic power occurs between employers and workers in the labor market. The belief that employers have considerable market power over their workers is not a new one: Robinson (1933) introduced monopsony as one way to model this asymmetry in power. Interest in monopsony has, however, grown in recent years, and this brief article provides an idiosyncratic overview of how the economic literature on monopsony in labor markets has developed over the past 15 to 20 years since Boal and Ransom (1997) and Manning (2003).[1] It summarizes the accumulating evidence on the key underpinning ideas and the ways in which monopsony has had influence both inside and outside academia.

The key idea behind monopsony is that the labor supply curve to an individual employer is not infinitely elastic so that an employer that cuts wages by 1 cent may find it harder to recruit and retain workers but does not immediately lose all its existing workers to competitors as is predicted by

[1]This review focuses almost exclusively on monopsony rather than the other strand of research on imperfect competition in labor markets, which is based on bargaining. I have always preferred monopsony because it seems more accurate for most jobs, especially at the lower end of the labor market (Brenčič 2012; Hall and Krueger 2012; Brenzel, Gartner, and Schnabel 2014). Monopsony also better captures the fact that an asymmetry of economic power occurs between employers and workers—power for many workers derives from their ability to leave more than their ability to negotiate wages with their employer. Though monopsony and bargaining are often observationally equivalent, there are some differences.

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the perfectly competitive model. The first part of this article describes the work that has been done on the wage elasticity of the supply curve. All of these studies, including those with high quality research designs, show that firms have considerable monopsony power, even in online markets that, a priori, one might have thought would be very competitive. The article also reviews evidence that this potential monopsony power is actually exercised by employers, resulting in lower wages.

The second part of the article discusses the areas in which the monopsony perspective has proved or could prove useful in understanding labor market issues both inside and outside academia. It considers some areas in which monopsony is an established part of the debate, others where it is emerging, and still others where it has potential to be of relevance. That monopsony can help explain why the minimum wage may not always reduce employment is well-established, though it remains contentious. Economists continue to be interested in the relevance of monopsony as more countries introduce minimum wages and there is a general tendency to higher minimum wages in many jurisdictions. A relatively new area is in competition policy: Although anti-trust law applies, on paper, equally to market power in product and labor markets, cases involving workers have been much rarer. Some high-profile examples of blatantly anti-competitive practices means there is much more interest in whether anti-trust concerns should be taken more seriously in labor markets. Immigration is a contentious area in many countries and is a topic for which monopsony may be able to provide insights. Finally, monopsony may have the potential to improve understanding of wage inequality and the labor share of national income, both the level and changes. Central to this is how to estimate and interpret earnings functions in matched employer–employee data sets and the role played by employer characteristics in wage determination.

As I write, monopsony is a thriving research area with a new and interesting paper appearing almost every week. This summary is likely out of date as I write it and almost certainly by the time it is published. I offer my apologies to those whose work I have missed.

Wage Elasticity of the Labor Supply Curve to Employers

The most direct way to assess the importance of monopsony is to estimate directly the wage elasticity of the labor supply curve to individual firms: This is a measure of what Bronfenbrenner (1956) termed "potential monopsony power." Very few papers seek to estimate directly the overall wage elasticity of labor supply to the firm,[2] perhaps because it is hard to find suitably exogenous variation in wages in a single firm. The older studies of Staiger, Spetz, and Phibbs (2010) and Falch (2010) considered plausibly exogenous

[2]I am excluding here the literature on the employer size wage effect that runs a regression of log wages on employer size and could be thought of as estimating the labor supply curve to a firm (though often that is not the interpretation given).

changes in public-sector wages. More recently, Caldwell and Oehlsen (2019) provided evidence on how randomly assigned higher wages for one week affects labor supply on both the intensive and extensive margins for Uber drivers. They found a response, but the elasticities are all less than 1, perhaps surprising given that this is a group of workers who can freely change their hours and many of whom work for more than one employer simultaneously. The elasticity is higher where Uber drivers have the option of also working for Lyft but still imply very considerable potential monopsony power.

Generally, there are two ways to model the monopsony power of employers: "modern" monopsony based on frictions in the labor market or "new classical" monopsony based on thin labor markets deriving from heterogeneity in tastes among workers. There may also be a way to combine the two models.

Modern Monopsony

When interest revived in monopsony, much of it was built around search models in which the market power of firms derived from the fact that it takes time for workers to find new jobs and that sometimes they lose their jobs: Burdett and Mortensen (1998) is the classic reference for models of this type. This approach came to be known as modern or dynamic monopsony, though calling anything modern is always a mistake: Today's modern is tomorrow's outdated. In many of these models, steady-state employment in a firm paying w with other characteristics x (including the wages offered by other firms), $N(w, x)$ can be written as:

$$N(w, x) = R(w, x)/q(w, x) \tag{1}$$

where $R(w, x)$ is the flow of recruits to the firm and $q(w, x)$ the quit rate, both assumed to be influenced by the offered wage. In this model a natural measure of the degree of monopsony power is the arrival rate of job offers relative to the rate at which workers lose their jobs.

Equation (1) implies the elasticity of the labor supply curve facing the firm can be written as the elasticity of the recruitment function minus the elasticity of the quit function. There is a growing literature on estimating the wage elasticity of the recruitment or quit functions.

The relationship between quit rates and wages has been studied for a long time (see, for example, Pencavel 1972), and it is a common finding that there is a negative effect of wages on quits. The estimates obtained are usefully surveyed in Sokolova and Sorensen (2020) who reported a separations elasticity of approximately 3 for those studies judged to be following "best practice," although 5 for those with an identification strategy. These estimates imply considerable monopsony power. Most of this evidence is from observational data. Perhaps the closest to experimental data is Dube, Lester, and Reich (2016) who studied how quit rate behavior is

influenced by changes in minimum wages (though this affects a number of firms so is not really identifying the quit rate elasticity for an individual employer). Dube, Giuliano, and Leonard (2019) considered how quits respond to changes in the minimum wage where this has higher bite in some areas than others. They found a high own-wage elasticity, but higher wages of peers also raise quits, suggestive of fairness considerations. Taking account of both own- and peer-wage effects leads to a small quit elasticity.

Estimating the wage elasticity of recruitment has proved more amenable to the use of experiments. Dal Bó, Finan, and Rossi (2013) analyzed the impact of randomizing wage offers in the Mexican public sector, finding an elasticity of applications with respect to wages equal to 2, and that the quality of the applicant pool also increases. Dube, Jacobs, Naidu, and Suri (2020) conducted experiments on MTurk and found a very low elasticity of applications with respect to the wage, which is similar in both experimental and observational data. Pörtner and Hassairi (2018) did a similar experiment distinguishing between an extensive (whether to work at all on a task) and intensive margin (how many tasks they complete, perhaps analogous to a quit rate as it is the duration of employment) and found the intensive margin to be much higher. Belot, Kircher, and Muller (2019) conducted an experiment in which they confronted Scottish job seekers with vacancies with randomly assigned wages. They found that an increase in wages of 1% attracted 0.7% more applications suggesting a relatively low elasticity of applications. Of note, they also found that in the observational part of their data, there was a negative relationship between wages and applications even with a fairly rich set of controls, suggesting that non-experimental evidence might not be reliable (a similar issue was reported in Marinescu and Wolthoff 2019). Azar, Marinescu, and Steinbaum (2019), using data from an online job posting website, estimated the elasticity of applications with respect to wages to be 0.43 and found this to be lower in more concentrated labor markets suggestive of lower competition in these markets. Using data on the expected wage that is provided by employers but not visible to potential applicants, Banfi and Villena-Roldán (2019) estimated an application elasticity of 0.25 for Chilean online job advertisements that posted a wage but a much lower (though still positive) elasticity for the majority of job openings that posted no wage.

Most of these studies only estimate either the quit or the recruitment elasticity: A link to the employment elasticity is then made using the result from Manning (2003, 2011) that the elasticity of the recruitment rate should, on average, be equal to minus the elasticity of the quit rate because, for job-to-job moves, one firms quit is another firm's recruit.

The bottom line from these studies is that there seems to be a large amount of monopsony power. If anything, there seems to be much more monopsony in the labor market than one might have expected a priori.

New Classical Monopsony

Alongside this research on modern monopsony, rooted in search frictions, has been a revival in interest in static monopsony models in which the labor supply curve facing individual firms is not perfectly elastic because of idiosyncratic tastes among workers for the amenities (such as working conditions or the length of commute) offered by firms that are not fully priced into wages. Implicit in these models is the idea that only a small number of firms are offering a particular package of wages and amenities. This can be thought of as a revival in classical monopsony based on a small number of employers, hence the name new classical model.

The simplest way to micro-found a firm-level labor supply curve in this type of model derives from discrete choice modeling in Industrial Organization (IO). Card, Cardoso, Heining, and Kline (2018) assumed the utility of worker i from working in firm f is given by:

$$u_{if} = \frac{1}{\varepsilon}\left[w_f - \tilde{b}_f\right] + \eta_{if} \tag{2}$$

where $\tilde{b}_f$ is a measure of how attractive it is to work in firm f for all workers and η_{if} an idiosyncratic factor assumed to have a type 1 extreme value distribution. If the total labor supply is L,[3] the number of workers who work for firm f will be given by the multinomial logit form:

$$N_f = \frac{\exp\left(\frac{1}{\varepsilon}\left[w_f - \tilde{b}_f\right]\right)}{\sum_{f'} \exp\left(\frac{1}{\varepsilon}\left[w_{f'} - \tilde{b}_{f'}\right]\right)} L \tag{3}$$

The denominator represents the wages and amenities offered by all firms in the market. Taking a log linear approximation, Equation (3) can be written in the form of:

$$n_f = \frac{1}{\varepsilon}\left[w_f - b_f\right] \tag{4}$$

where n_f is log employment, w_f is log wage, and b_f is a labor supply shifter, which can be written as:

$$b_f = \tilde{b}_f + \varepsilon l - \sum_{f'} s_{f'}\left[w_{f'} - \tilde{b}_{f'}\right] \tag{5}$$

where $s_{f'}$ is the probability of working for each firm in the market, that is, the market share of each firm (this includes the probability of working for this firm, an issue discussed further below).

The labor supply curve in Equation (4) implies that the wage elasticity of the labor supply curve to an individual employer is given by:

[3]This assumes total labor supply to the market as a whole is inelastic so that firms are competing for market share. A generalization is to include a non-employment option in which case wages also affect the overall level of employment in the market.

$$\frac{1}{\varepsilon_f} = \frac{1 - s_f}{\varepsilon} \tag{6}$$

where s_f is the market share of the firm. If firms are all small in relation to the total size of the market $s_f \approx 0$ and ε is the inverse of the labor supply elasticity facing the firm: $\varepsilon = 0$ represents perfect competition and a higher value equals a more monopsonistic labor market. If firms are not small in relation to the market, Equation (6) implies that firms with a higher market share are likely to have more market power.

Equation (5) implies that the supply shifter b_f is a function of the amenity offered by the firm, total labor supply, and the wages and amenities offered by other firms in the market weighted by the probability of working for those firms for a worker of this type. Employers that offer a job that is a closer substitute for this one are likely to receive a higher weight.

Azar, Berry, and Marinescu (2019) estimated a model like Equation (3) using data on job applications and borrowing techniques from the estimation of product demand elasticities in the IO literature to instrument the wage. Their preferred estimate of the firm-level labor supply elasticity is 5.8, higher than found in many other applications but still applying a nontrivial amount of monopsony power.

Measuring Variations in Monopsony Power

The employment-share weighted averages of the wage elasticity in Equation (6) can be written as a function of the Herfindahl-Hirschman Index (HHI), a traditional measure of market concentration commonly used in anti-trust. Bunting (1962) was the first to compute concentration ratios for labor markets, but the practice was revived by Azar, Marinescu, and Steinbaum (2017). They defined a labor market as a 6-digit occupation and a commuting zone in a quarter, and they showed that the HHI for vacancies in most labor markets was above the Department of Justice/Federal Trade Commission (DoJ/FTC) threshold for high concentration, though larger labor markets are less concentrated. Similar findings are reported for a different data set in Azar, Marinescu, Steinbaum, and Taska (2018).

Other studies have used alternative measures of labor market concentration. Benmelech, Bergman, and Kim (2018) and Rinz (2018) defined a labor market as a 4-digit industry in a county in a year whereas Berger, Herkenhoff, and Mongey (2019) used 3-digit industry in a commuting zone. Dey and Hendwerker (2019) found that HHIs are similar whether one defines labor markets using occupation or industry but very different from the share of employment accounted for by very large (mega-) firms.

As discussed, some studies use industry and others use occupation to measure concentration ratios. Because industry-based measures of labor market concentration might be picking up product market concentration, many studies use manufacturing only when one can argue that the market is national rather than local (though most economic geography models

include trade costs that increase with distance so that all markets are local to some extent: see Redding and Rossi-Hansberg 2017).

One problem with all of these approaches is that they divide labor markets into discrete segments, with the implicit assumption that workers cannot move across segments. Yet, substantial worker mobility occurs across industry and occupation and, although labor markets for many workers are surprisingly local (e.g., Manning and Petrongolo 2017), there is also mobility across geographical borders. Nimczik (2018) derived a measure of employer concentration based on observed worker mobility patterns: Firms are thought of as being in the same labor market if there are high flows of workers between them. The approach of Caldwell and Danieli (2018), in which they look at the types of jobs done by workers who are observationally equivalent, may also be useful here. Berger, Herkenhoff, and Mongey (2019) and Jarosch, Nimczik, and Sorkin (2019) provided other microfoundations for a link between market structure and market power, although the underlying idea is still that individual firms are not small in relation to the market as a whole.

The concentration measures also differ in whether they use vacancies or employment, with concentration ratios typically being higher for vacancies especially if vacancies are measured at a point in time rather than the total over some longer period. The choice is often dictated by the available data but here it is not clear which is preferred. One difference between product and labor markets is that while consumers can buy most products whenever they wish (because firms hold inventory) the same is not true of jobs. If vacancies are scarce then a vacancy-based measure may be preferable as a better measure of the opportunities available to workers at any time. However, most workers do not have to find a job at precisely the time data are being collected, so the period over which the concentration in vacancies should be assessed is not clear: Deriving this from economic principles has not yet been done.

Thoroughly Modern Monopsony

Modern monopsony is based on the idea that it takes time for workers to find and change jobs; new classical monopsony is based on idiosyncrasy in jobs. Both are likely to contain some element of truth, and this section sketches a way to combine them. The specification in Equation (3) implicitly assumes that workers have a choice of all firms in the market whereas search frictions imply they do not. A simple way to combine the two ideas is to assume that Equation (3) represents the way in which workers choose among firms currently in their choice set, but the choice set is smaller than the whole set of firms because of search frictions. Higher search frictions mean that, on average, workers have a smaller number of firms in their choice set. If all firms are identical in size, the N should be interpreted as the expected number of job offers at every point that will be a function both of the number of firms in the market and the extent of frictions.

New classical models of monopsony tend to be static whereas modern monopsony models are rooted in models of dynamic decision-making: Is it better to supply labor to a firm today or to wait and hope for a better opportunity tomorrow? Integrating a model such as Equation (3) into a more dynamic setting perhaps offers the chance to decide whether it is better to compute concentration ratios using employment or vacancies.

Several of the studies referred to above use applications as the measure of labor supply to the firm or vacancies as the measure of employment opportunities. Most of us know from personal experience that not all applications lead to a job offer and this may need to be incorporated into monopsony models. A simple way to do that is to assume that workers can make only one job application and do so based on expected utility, which is related not just to the wage but also to the probability of the application being successful, which, in turn, is related to the number of applications. The idea that the success probability influences applications is the key idea of the directed search literature (see Wright, Kircher, Julien, and Guerrieri 2020 for a recent survey).

One way to think about the possible difference between applications and employment is the following. Reinterpret Equation (3) as the number of applications to firm f, denoted A_f, and allow the application of workers to be influenced by the probability of the application being successful, denoted by $\theta\left(A_f\right)$ and assumed to depend negatively on the number of applications to the firm. If workers choose their application to maximize expected utility, Equation (3) can be written as:

$$A_f = \frac{\exp\left(\frac{1}{\varepsilon}\left[w_f - \tilde{b}_f + \ln\theta\left(A_f\right)\right]\right)}{\sum_{f'}\exp\left(\frac{1}{\varepsilon}\left[w_{f'} - \tilde{b}_{f'} + \ln\theta\left(A_{f'}\right)\right]\right)}L \tag{7}$$

If we assume that each firm is infinitesimally small in relation to the market as a whole then this implies that the wage elasticity of the number of applicants to the firm can be written as:

$$\varepsilon_{Aw} = \frac{1}{\varepsilon + \varepsilon_{\theta A}} \tag{8}$$

where $\varepsilon_{\theta A}$ is minus the elasticity of the probability of getting a job with respect to the number of applicants. The number of employees for the firm will be $A_f\theta\left(A_f\right)$ so the wage elasticity of employees with respect to the wage, ε_{Nw} will be:

$$\varepsilon_{Nw} = (1 - \varepsilon_{\theta A})\varepsilon_{Aw} = \frac{(1 - \varepsilon_{\theta A})}{\varepsilon + \varepsilon_{\theta A}} \tag{9}$$

This reduces to the standard formula in the case for which all applications lead to employment, $\varepsilon_{\theta A} = 0$. But in the case when more applicants lead to fewer jobs, one can see from Equation (9) that this means the labor supply to the firm is less elastic. The reason is that higher wages

are less effective in generating employment as applicants are deterred by other applicants, and the probability of accepting applicants is also less than 1. Introducing a distinction between applications and employment as in the directed search literature means labor markets are even more monopsonistic than one might have thought.[4]

From Potential to Actual Monopsony Power

All of the estimates discussed above are of the wage elasticity of the labor supply curve to an employer. In the language of Bronfenbrenner (1956), the question then is whether employers exercise this monopsony power as a simple profit-maximizing model would suggest or whether other factors act as a constraint on firm market power. The standard formula for the profit-maximizing wage under monopsony can be written as:

$$W = \frac{1}{1+\varepsilon} MRPL \tag{10}$$

Many of the estimates of ε referred to above imply very large gaps between wages and the marginal revenue product. In some labor markets the relevance of monopsony power is well-established. In US professional sports, a clear link is seen between the removal of anti-competitive labor practices and rises in the share of revenue going to athletes (see Kahn 2000 for a review). In US academia, Ransom (1993) plausibly links negative returns to job tenure with monopsony in that labor market. What is less well-established is the importance of monopsony in the labor market as a whole.

The observed level of wages is uninformative about the degree of monopsony power, but some recent studies seek to relate changes in wages to changes in measures of market power discussed earlier. Azar et al. (2017), Benmelech et al. (2018), and Rinz (2018) found a link between higher concentration and lower wages. Benmelech et al. (2018) found this effect is weaker in the presence of unions. Rinz (2018) noted that labor market concentration on his measure has been falling over time so this has little ability to explain falls in the labor share. Abel, Tenreyro, and Thwaites (2018) reported similar results for the United Kingdom.

Nonetheless, there are some unanswered questions here. The low estimated wage elasticity of the labor supply curve implies that employers have a lot of monopsony power: If this power is exercised it is not clear how it can be reconciled with observed levels of the profit share. Dube, Manning,

[4]The conclusion that allowance for directed search leads to more market power for employers might seem at odds with some directed search models that are neo-competitive in the sense that the labor supply curve to an individual employer is infinitely elastic (see Wright, Kircher, Julien, and Guerrieri 2020 for a survey). Those models do not have idiosyncratic tastes, as here, and on-the-job search also removes this feature unless the contract structure is expanded.

and Naidu (2020) used evidence on bunching in the wage distribution at round numbers to infer the existence of sizeable market power that lessens the profits penalty for firms who have optimization costs. The presence of optimization costs may be one reason that not all monopsony power is exercised by employers.

This link between higher concentration and lower wages might allay some fears about the use of concentration as a measure of the competitiveness of labor markets when it is an outcome of the market that may not always indicate market power. For example, in the canonical Burdett and Mortensen (1998) model commonly used as a micro-foundation for modern monopsony models, an increase in the competitiveness of the labor market (measured as an increased arrival rate of job offers) is associated with increased concentration. In this model, greater competition makes it easier for workers to move from low- to high-wage firms, increasing the market share of the latter (see Syverson 2019 for a similar criticism of the link between concentration and market power in the product market context). The Burdett-Mortensen way of modeling the increased competition can be thought of as closest to a decrease in ε in Equation (4).

Shifts in the Labor Supply Curve to Employers

Another way to show the relevance of monopsony is to study the consequences of an exogenous shift in the quantity of labor supply to a firm, that is, a labor supply shift for a given wage. In a perfectly competitive labor market, there should be no change in employer outcomes from such a shift as employers have access to an unlimited pool of identical workers so a replacement can and would be hired. By contrast, there would be consequences in a monopsonistic labor market: A fall in the supply of labor would lead to lower employment and, to the extent that there is a diminishing marginal product of labor, a higher wage. Studying the impact of unexpected worker deaths, Isen (2016) showed that the loss in revenue was greater than the wage, suggesting a wage paid above the marginal product, whereas Jäger and Heining (2019) found wages and retention rates of other workers rise, suggesting that the labor supply curve to the individual employer has shifted.

Applications of Monopsony

Estimating the degree of market power possessed by employers is a natural way to establish the importance of monopsony but another approach is to show that monopsony can help us understand a wider range of labor market phenomena. In this section, I discuss a few of those phenomena, some well-established, some emerging, and others in which monopsony has the potential to improve our understanding of labor markets.

Minimum Wages

For a long time, the minimum wage was the main area in which the idea of monopsony had a wide impact. The new minimum wage research that started in the early 1990s (Card and Krueger 1995) was largely empirical, but monopsony provided a useful argument for the finding that increases in minimum wages do not inevitably cost jobs (see Belman and Wolfson 2014 for a meta-study or see Cengiz, Dube, Lindner, and Zipperer 2019 for a recent US study). The employment effect of the minimum wage remains a contentious issue in the United States and other countries (see, for example, Bossler and Gerner 2019; Caliendo, Schröder, and Wittbrodt 2019; and Dustmann at al. 2019 for research with differing findings on the impact of the German national minimum wage introduced in 2015). The balance of opinion among both academics and policymakers has probably shifted to being more favorable to the use of minimum wages set at appropriate levels, and this has led to higher legislated minimum wages in many jurisdictions. Though monopsony predicts that minimum wages, over some range, need not destroy jobs, monopsony also predicts that how high minimum wages can be raised has a limit before job losses occur (for example, Kreiner, Reck, and Skov 2019 found large negative effects for very high teenage minimum wages in Denmark).

What remains unclear is how high minimum wages can be pushed without harming employment, although higher minimum wages in some US cities and other countries may be informative on this in the future. The existing literature does not really answer the question, what is the level of the minimum wage that maximizes employment? In answering this question it may be important to focus on heterogeneity in the impact of the minimum wage. Azar, Huet-Vaughn, Marinescu, Taska, and von Wachter (2019) found more positive effects in less competitive labor markets (as monopsony would predict), and Dustmann at al. (2019) found reallocation of labor toward more productive, higher-wage firms, again as monopsony would predict.

Anti-Trust

Anti-trust is an area in which the idea of monopsony has attracted more interest recently. On paper, US anti-trust law treats buyer and seller market power symmetrically. In practice, there have been many more cases relating to product than to labor markets (many of which relate to professional sports), which is what Naidu, Posner, and Weyl (2018: 541) referred to as the "historic imbalance" between product market anti-trust and labor market anti-trust. Following on from some high-profile examples of seemingly blatant anti-competitive labor market practices, economists, lawyers, and anti-trust practitioners in the United States have been more concerned about labor market competition (though this has yet to extend to other countries). There have been suggestions for reform (Krieger and Posner

2018; Naidu et al. 2018; Marinescu and Hovenkamp 2019; Marinescu and Posner 2019). The Department of Justice (2016) issued guidance for employers on appropriate behavior. Some states have banned non-competes for hourly paid workers.

The labor market practices attracting concern have been about no-poaching agreements among employers, the high use of non-competes both directly (Starr, Prescott, and Bishara 2018) and indirectly through franchisees (Krueger and Ashenfelter 2017), and the level of labor market concentration among employers in local labor markets and how that might be affected by mergers (Marinescu and Hovenkamp 2019).

In the case of non-competes, it is likely that the chances of an individual employer pursuing an individual low-skill worker who violates a non-compete is relatively small (though it has happened). But, at the same time, non-competes may intimidate workers into worrying about being pursued and this has a larger *in terrorem* effect. A growing body of research has been providing estimates of the impact of non-competes. Marx (2011), Starr, Prescott, et al. (2018), Balasubramanian et al. (2019), and Lipsitz and Starr (2019) showed chilling effects of non-competes on labor mobility and also reductions in wages, especially when presented to workers after accepting the job offer. Starr, Frake, and Agarwal (2019) showed these effects extend beyond the workers with the non-competes themselves: These externalities could be used to justify intervention as the impact of non-competes extends beyond those workers who voluntarily sign the contracts with these clauses. Starr (2019) found that greater enforceability of non-competes is associated with a higher level of firm-sponsored training, but with lower wages, suggesting that non-competes allow firms to capture a greater share of the returns to training by making the labor market less competitive. Starr, Balasubramanian, and Sakakibara (2018) found that greater enforcement of non-competes is associated with fewer within-industry spinouts (one form of entrepreneurship), but those that are created are more successful.

A related area is the debate regarding how to regulate the gig economy. In many countries there have been legal cases about whether gig workers are independent contractors who typically have fewer rights than workers. Harris and Krueger (2015) suggested changes to US labor law to introduce a category of "independent worker" between "employee" and "independent contractor" to deal with some of these emerging issues.[5] There are some theoretical arguments for why non-wage aspects of the job should be regulated. Manning (2003, section 8.4) showed restrictions on the non-wage aspects of a job can improve overall outcomes for workers if those aspects are a normal "good" (a condition we might expect to be satisfied as working conditions tend to be nicer in better-paid jobs). The intuition is that the

[5]Something like this already exists in the United Kingdom that makes a distinction between "employees," "workers," and "independent contractors," with courts ruling, for example, that Uber drivers are workers, entitled to the minimum wage and paid holidays.

wage elasticity of worker utility rises with more favorable work conditions, and this increases the wage elasticity of labor supply to the firm. Although one might expect gig economy markets to be relatively competitive because no commitments are made by either worker or employer, the studies of Caldwell and Oehlsen (2018) and Dube, Jacobs, et al. (2020) discussed earlier suggest the labor supply to employers in these markets is surprisingly low.

Immigration

One under-explored application of monopsony is to the economics of immigration. Most frameworks for thinking about the economic impact of immigration use a perfectly competitive framework (e.g., Borjas 2003) in which all workers, migrant or not, are paid their marginal product. In a perfectly competitive market, individual employers are indifferent about having access to migrants or not because the labor supply to them is perfectly elastic. In reality, many employers seem to care a lot about having access to migrants and pay more money to hire them than they would a native (see Gibbons, Greenman, Norlander, and Sorensen 2019 for some cost estimates). This finding is suggestive of a gap between wage and marginal product.

There are a number of reasons to think that the migrant labor market might be more monopsonistic than the native labor market. Immigrants, particularly from poorer countries, are likely to have lower reservation wages than do existing residents. And employers, understandably, are interested in keeping their labor costs low. If the labor market is very competitive, the competition between employers will link wages to productivity rather than to reservation wages. But, the less competitive the labor market, the more wages are likely to be linked to reservation wages so one might expect migrants to receive lower wages. Prevailing wage provisions seek to ensure that migrants on work visas are paid the going rate and do not undercut existing workers, but enforcement may be imperfect. Migrants' lack of knowledge about the local labor market may also mean migrants face greater search frictions. Consistent with this view, Hirsch and Jahn (2015) presented evidence for Germany that the wage elasticity for migrants is lower than for natives and, within migrants, lower for migrant groups who have lower earnings. Amior and Manning (2020) presented some evidence for the United States that more migrants in a labor market are associated with more monopsony power.

In addition, some types of immigrant visas restrict the ability to change jobs in ways that are institutionally anti-competitive. Naidu, Nyarko, and Wang (2106) explored the impact of a change in visa rules in the United Arab Emirates that made it easier for migrant workers to change jobs. This increased migrant earnings and employer retention, primarily driven by a drop in return migration. They argued the pattern of observed responses is

consistent with employers having substantial monopsony power. For the United States, Depew, Norlander, and Sorensen (2017) and Hunt and Xie (2019) presented evidence that job mobility of migrants on guest worker programs is reduced by these restrictions. Doran, Gelber, and Isen (2014) found that winning an H1B visa lottery leads to crowding-out of other workers, lower wages for existing workers, and higher profits, all conclusions consistent with a monopsony view of the labor market. The interaction between immigration and monopsony is an area that deserves more consideration.

Earnings Functions for Matched Employer–Employee Data

A major use of models of imperfect competition in the labor market has been to develop earnings functions appropriate for use with matched employer–employee data in which characteristics of the firm have explanatory power. Early studies with such data, for example, Abowd, Kramarz, and Margolis (1999) showed, using firm fixed effects, that employers matter for wages but did not explain which features of employers were important. More recent research has shown that measures of productivity, such as value-added per worker, are significantly related to wages (see, for example, Card, Cardoso, and Kline 2016). Although it is possible to explain the significance of firm characteristics using a competitive labor market framework, these explanations are quite convoluted and an approach based on imperfect competition (whether monopsony or bargaining) is attractive. The impact of firm-level productivity on wages, sometimes defined as the rent-sharing or pass-through parameter, has been of particular interest, because firm-level productivity should not matter for wages in a competitive market so the extent to which it does may be informative about the extent of competition in the labor market. Figure 1 demonstrates this idea using a simple monopsony model.

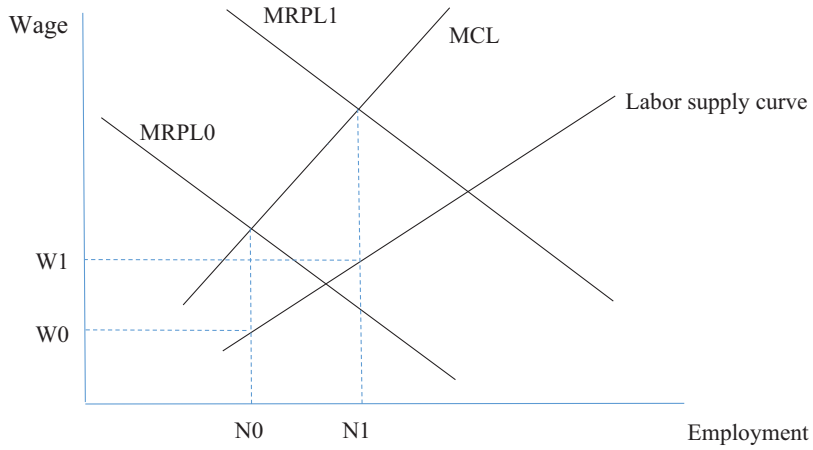
If the labor supply curve to an individual employer is upward-sloping with associated marginal cost of labor curve (MCL), then a shift in the firm's marginal revenue curve (MRPL) from MRPL0 to MRPL1 will result in an increase in wages from W0 to W1. An increase in wages will not happen if the labor market is perfectly competitive and the labor supply curve to an individual employer is perfectly elastic.

In this section we present a simple model to try to understand the relationship between wages, employment, and firm characteristics in a monopsonistic market. First, assume that the log labor supply curve to firm f can be written as in Equation (4) where we start by assuming each individual firm has an infinitesimal market share.

Assume that, in logs, the revenue of firm f can be written as:

$$y_f = a_f + (1 - \eta)n_f - \ln(1 - \eta) \tag{11}$$

Figure 1. Impact of Firm Demand Shocks on Wages and Employment under Monopsony and Perfect Competition



Notes: MCL, marginal cost of labor curve; MRPL, marginal revenue curve.

where y_f is log revenue and a_f is a shifter of the revenue function. This shifter will be affected by factors that affect the physical production function (so they could include technology and either of the other inputs or, if the revenue function is written in value-added terms, other input prices, the level of demand or prices and, possibly factors such as taxes, including taxes to labor if the wage is defined as what is received by workers). The parameter η will be influenced by returns to scale in the production function and the elasticity of the product demand curve. This model is similar to that used by Lamadon, Mogstad, and Setzler (2019).

The profit-maximizing wage will equate the marginal revenue product of labor with the marginal cost of labor. Combining Equations (4) and (11), this can be written as:

$$a_f - \eta n_f = b_f + \varepsilon n_f + \ln(1+\varepsilon) \tag{12}$$

which leads to the following expression for employment:

$$n_f = \frac{1}{\varepsilon + \eta}\left[a_f - b_f - \ln(1+\varepsilon)\right] \tag{13}$$

One can also derive the following expressions for the log wage and revenue (or value-added) per worker (that we will refer to as productivity):

$$w_f = \frac{1}{\varepsilon + \eta}\left[\varepsilon a_f + \eta b_f - \varepsilon \ln(1+\varepsilon)\right] \tag{14}$$

$$y_f - n_f = \frac{1}{\varepsilon + \eta}\left[\varepsilon a_f + \eta b_f + \eta \ln(1+\varepsilon)\right] - \ln(1-\eta) \tag{15}$$

One implication of Equation (14) is that in a perfectly competitive market ($\varepsilon = 0$), demand shocks, a_f, have no effect on wages, only affecting employment. In contrast with monopsony, there is an impact as was shown in Figure 1. Note that measuring the extent of pass-through of demand shocks to wages is a measure of the extent of importance of imperfect competition in the labor market as it is given by $\frac{\varepsilon}{\varepsilon + \eta}$, though note that η also matters. One could estimate ε by instrumenting employment using the demand shifter as long as this was not correlated with the supply shifter b_f.

Often a demand shifter is not available directly and the log of value-added (or revenue) per worker is used instead. The rent-sharing or pass-through parameter is then measured as the coefficient on the log of value-added per worker or productivity in a log wage regression. However, this measure is not the same as the pass-through parameter for demand shocks, a_f, in Equation (14): Inspection of Equations (14) and (15) shows that both demand and supply shifters have the same predicted effect on log wages and log productivity. This would imply that the pass-through coefficient would be measured as equal to 1, whatever the degree of competition in the labor market. The intuition is that wages are a mark-down on the marginal revenue product of labor that, in the benchmark model, is proportional to the average revenue product of labor that is value-added per worker. This can be seen by combining (14) and (15) to derive:

$$w_f + n_f - y_f = \ln(1 - \eta) - \ln(1 + \varepsilon) \tag{16}$$

The left side of Equation (16) is the log of the labor share and this is a function of the degree of competition in the labor market measured by ε as well as η. One implication of Equation (16) is that analysis of how the labor share varies with a measure of monopsony power could be used as a way of diagnosing the extent of that power.

The benchmark model implies that the pass-through of value-added is of no use in diagnosing the extent of imperfect competition because it should be estimated as 1. This conclusion may seem odd because demand shifters should have no effect on wages in the perfectly competitive case but some effect in the monopsony case, so it seems intuitive that the degree of pass-through is informative about labor market competition. The intuition goes wrong because one cannot equate the demand shifter with measured productivity per worker. If $\eta < 1$, productivity depends on the level of employment and adjusts itself to the level of the wage, in other words, is endogenous and cannot be treated as an exogenous demand shifter. This finding is clearest in the case of perfect competition in which the wage is proportional to productivity but the causation is from the wage to productivity not the other way around. The endogeneity of productivity to the wage would not seem to apply if $\eta = 1$ when productivity is exogenous. Inspection of Equations (14) and (15) seems to show complete pass-through in this case even for perfect competition, which feels wrong. But the perfectly competitive case is not well-defined if $\eta = 1$ as the MRPL and

labor supply curves do not cross in this case. If $\eta = 1, \varepsilon = 0$ implies employment is infinite if $a_f > b_f$.

A pass-through parameter of 1 is not what is found in empirical applications—a typical estimate would be about 0.1 (see Card et al. 2018). One possible explanation for the discrepancy is measurement error in value-added per worker leading to attenuation bias in the estimated coefficient. In this case it might be helpful simply to estimate models for the labor share as in Equation (16) because measurement error in dependent variables does not cause bias and variation in the labor share is informative about variation in monopsony power.

Alternatively, it might be that the benchmark model is wrong. Some papers derive a pass-through coefficient less than 1 from theory. Card et al. (2018) modified Equation (2) to have the utility from the job depend not just on the log of the wage but a more general utility function of the wage, specifically $\ln(W - \underline{W})$ where $\underline{W} > 0$. $\underline{W}$ could be interpreted as the disutility of work, which has the effect of making the elasticity in Equation (4) from a constant to an increasing function $\varepsilon(W/\underline{W})$. The higher is W relative to $\underline{W}$ the less elastic is the labor supply curve to the firm. The consequence of this is that a positive revenue shock raises the wage, giving the employer more market power so that the wage rises less proportionately than does productivity.[6] An alternative way to obtain the same result would be to relax the assumption that firms are infinitesimal in the market as a whole: The more productive firms in an industry will have a higher market share, which from Equation (6) means more market power so wages will rise less than proportionately with productivity.

Alternatively, it could be that the demand side is mis-specified. The Appendix works through the case in which the revenue function is the constant elasticity of substitution (CES) rather than Cobb-Douglas as in Equation (11) and shows that the pass-through parameter is generally different from 1 but could be higher or lower.

One approach to the pass-through problem is to use variables designed to measure an exogenous shock to firm revenues. Kline, Petkova, Williams, and Zidar (2019) considered the impact of patent-induced shocks to firm revenue showing increases in wages consistent with monopsony power, though not for entry wages. They estimate that for every $1 extra in patent-induced revenue, wages rise by 30 cents, though entry wages are unaffected. To convert this to an elasticity, one needs to divide by the labor share in value-added, which is approximately 50% leading to an elasticity of 0.6. This pass-through is still less than 1, predicted by the simple theory presented above and rationalized in the model by the use of a labor supply function similar to that in Card et al. (2018). With this sort of data, one could identify the inverse labor supply elasticity facing the firm as the ratio of the wage

[6]This is similar to what is derived in the typical bargaining model for which quasi-rents are specified as productivity minus a constant.

effect to the employment effect, which is approximately one-third for their estimates: This can be thought of as an instrumental variable (IV) estimate of a labor supply model instrumenting employment by the patent variable.

Wage Inequality and the Labor Share

One of the likely reasons for the current revival in interest in monopsony is anxiety about the rise in inequality, the fall in the labor share (Karabarbounis and Neiman 2013), and a vague feeling that the balance of power between workers and employers in the labor market has shifted to the advantage of business.

Even if monopsony power is not changing, it has the potential to help explain patterns and trends in wage inequality. As discussed earlier, monopsony amplifies the impact of firm-level demand shocks on wages, meaning that the transmission of firm heterogeneity to wage inequality will be stronger under monopsony.[7] Card, Heining, and Kline (2013) argued that rising firm heterogeneity can explain most of the rise in West German inequality, although Song et al. (2019) argued that a similar rise in the United States is the result of a rise in high-wage workers being increasingly likely to be employed in high-wage firms.

Monopsony may also have a role to play in explaining inequality if some labor markets are more monopsonistic than others. Joan Robinson's original application of monopsony (1933) was to the gender pay gap, and Manning (2011) summarized a number of studies that found the quit elasticity of women is lower than that for men, implying that employers have more market power over women than men, perhaps because women face greater constraints on the jobs they can take primarily because of household responsibilities. Since then Webber (2016) reported a similar finding for US data but also found that this is primarily because women are more likely to work in firms with lower labor supply elasticities. The meta-study of Sokolova and Sorensen (2020) found that the average estimated separations elasticity is lower for women than for men, although the magnitude of the difference could explain only part of the observed gender wage gap. Card et al. (2016) found the pass-through effect to be smaller for women than for men in Portugal. Caldwell and Oehlsen (2018) found, in a study of Uber drivers, that female labor supply is more responsive to wages than are men, which goes against some of the findings of other papers though that may be attributable to its being a different labor market.

Manning (2011) also discussed how the idea that denser labor markets are more competitive can explain some aspects of economic geography, notably agglomeration (Manning 2010), so has an important impact on spatial inequalities. Hirsch, Jahn, Manning, and Oberfichtner (2019) provided additional evidence for this view. More generally, Webber (2015) found

[7]The other side of this coin is that monopsony predicts a weaker association between the supply shocks and wages: This has attracted little attention.

more monopsony power in lower-wage labor markets, which would lead to greater inequality in wages than marginal products.

It may also be possible that rising monopsony power has a role to play in rising inequality. It might be labor market competitiveness has been falling as labor markets have become less dynamic (Molloy, Smith, Trezzi, and Wozniak 2016) or more concentrated (though this is less clear in the data). Alternatively, rising monopsony power may have resulted from the rise in anti-competitive practices and a decline in institutions that offered some protection against the exercise of monopsony power, the most important of which are probably the minimum wage and trade unions. Minimum wages provide some protection for those at the bottom of wage distribution; unions are more likely to protect those in the middle. The possible role of rising monopsony power in rising inequality remains unproven but is an interesting area for future research (though see Tortarolo and Zarate [2018] for an approach that extends the work of De Loecker and Eeckhout [2017] on mark-ups in the product market to include mark-downs in the labor market).

Monopsony also implies a lower labor share in national income because of the gap between wages and marginal products. Naidu et al. (2018) estimated monopsony power reduces labor share by 22%, a very large effect. As the labor share has been declining in many countries, a rise in monopsony power might have a role to play in that. Again, this is a possible area for future research.

Monopsony may also offer some insights into macroeconomics, for example, in explaining the cyclicality in wages or the changing nature of the Phillips curve. For example, Depew and Sørensen (2013) and Hirsch, Jahn, and Schnabel (2017) found that employers have more power in slack labor markets, providing a link between employer market power and the cyclicality of wages.

Conclusion

That labor markets have important elements of monopsony power is becoming clear beyond any reasonable doubt. The importance of employer market power is beginning to be recognized in anti-trust policy. Though sizeable numbers of economists cling to the view that labor markets are close to perfectly competitive, an emerging problem is perhaps the opposite, namely that the amount of monopsony power estimated in many studies is so high as to raise questions about how it can be reconciled with observed levels of profits.

Monopsony also offers a useful perspective in a number of areas, some are well-established (e.g., the minimum wage and the gender pay gap) whereas others remain to be explored (e.g., immigration, modeling earnings when employers matter, any role in rising wage inequality, or the

falling labor share). It is likely that the amount of work on monopsony will continue to become a mainstream part of labor economics.

Appendix
The Pass-Through Parameter for a CES Revenue Function

The revenue function in Equation (11) can be thought of as coming from a Cobb-Douglas production function and an iso-elastic product demand curve, so the natural way to generalize is to have a constant elasticity of substitution (CES) production function. Write the revenue function as:

$$(17) \qquad Y = \frac{1}{1-\eta} A[\alpha N^{\gamma} + (1-\alpha)K^{\gamma}]^{\frac{1-\eta}{\gamma}} = \frac{1}{1-\eta} AN^{1-\eta}\left[\alpha + (1-\alpha)\left(\frac{K}{N}\right)^{\gamma}\right]^{\frac{1-\eta}{\gamma}}$$

where K represents other inputs. In this case, one can derive the following relationship between the MRPL and (Y/N) (i.e., productivity):

$$(18) \qquad (1-\eta)\frac{Y}{N} = MRPL\left[1 + \frac{1-\alpha}{\alpha}\left(\frac{K}{N}\right)^{\gamma}\right]$$

Now there is a wedge between the MRPL and productivity that depends on the capital-labor ratio and the elasticity of substitution. If K is fixed, a positive demand shifter will increase employment causing the capital-labor ratio to fall, which causes productivity to rise proportionately more than the MRPL if $\gamma < 0$ and less if $\gamma > 0$. Accordingly, pass-through will be bigger than 1 as $\gamma < 0$ and less than 1 as $\gamma > 0$. If the variation comes from differences in K, however, then one obtains the opposite results. And this is all a short-run result—if capital is flexible and the cost of capital constant, we are back to having a pass-through of 1.

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