Equation Chapter 1 Section 1

Monopsony in Labor Markets: A Review

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Abstract

There has been an increase in interest in monopsony in recent years. This paper 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.

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Introduction

High levels of inequality and a falling labor share in national income have led to renewed interest in the idea that there is an imbalance in economic power 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 paper provides an idiosyncratic overview of how the economic literature into monopsony in labor markets has developed over the past 15-20 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 employers is not infinitely elastic so that employer that cuts wages by 1c may find it harder to recruit and retain workers but does not immediately lose all their existing workers to competitors as is predicted by the perfectly competitive model. The first part of this paper 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 paper also reviews evidence that this potential monopsony power is actually exercized by employers, resulting in lower wages.

The second part of the paper discusses the areas where the monopsony perspective has proved or could prove useful in understanding labor market issues both inside and outside academia. It considers some areas where monopsony is an established part of the debate, others where it is emerging and 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 remains contentious. As more countries introduce minimum

[1] This review focuses almost exclusively on monopsony rather 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 lower end of labor market (Hall and Krueger, 2012; Brencic, 20012; Brenzel et al, 2014)[1]. Monopsony also better captures the fact that there is an asymmetry of economic power 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.

wages and there is a general tendency to higher minimum wages in many jurisdictions, this is still an area where economists are interested in the relevance of monopsony. 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 where 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.

1. <u>The Wage Elasticity of the Labor Supply Curve to Employers</u>

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'. There are very few papers that seek to estimate 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) consider plausibly exogenous changes in public sector wages. More recently, Caldwell and Oehlsen (2018) provide evidence on how randomly assigned higher wages for a week changes affects labor supply on both the intensive and extensive margins for Uber drivers. They find 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 1 employer

[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).

simultaneously. The elasticity is higher where Uber drivers also have the option of working for lyft but still imply very considerable potential monopsony power.

This section discusses two ways to model the monopsony power of employers, 'modern' monopsony based on frictions in the labor market, 'new classical' monopsony based on thin labor markets deriving from heterogeneity in tastes among workers. It also suggests a way to combine the two ideas.

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 came to be known as modern or dynamic monopsony though calling anything modern is always a mistake: today's modern is tomorrow's out-dated. 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:

$$N(w,x) = R(w,x) / q(w,x) \qquad (1)$$

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.

(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 very common finding that there is a negative effect of wages on quits. The estimates obtained are usefully surveyed in Sokolova and Sorensen (2020) who report a 'best practice' definition separations elasticity of about 3, though 5 for those where there is 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 study how quit rate behaviour 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) consider how quits respond to changes in the minimum wage where this has higher bite in some areas than others, They find a high own wage elasticity but that 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 Bo, Finan and Rossi (2013) analyse the impact of randomizing wage offers in the Mexican public sector, finding an elasticity of applications with respect to wages of 2, and that the quality of the applicant pool also increases. Dube, Jacobs, Naidu and Suri (2019) conduct experiments on MTurk finding a very low elasticity of applications with respect to the wage that is similar in both experimental and observational data. Portner and Hairri (2018) do 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) finding the intensive margin to be much higher. Belot, Kircher and Muller (2018) conduct an experiment in which they confront Scottish job-seekers with vacancies with randomly assigned wages. They find that vacancies with wages that are 1% higher attract applications that are 0.7% higher suggesting a relatively low elasticity of applications. Interestingly they also find that in the observational part of their data, there is 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 is reported in Marinescu and Wolthoff, 2019). Azar Marinescu and Steinbaum (2019) estimate the elasticity of applications with respect to wages in data from an online job posting website to be 0.43 and find this to be lower in more concentrated labor markets suggestive of lower competition in these markets. Banfi and Villena-Roldan (2019) estimate an application elasticity of 0.25 for Chilean online job advertisements that post a wage but a much lower (though still positive) elasticity for the majority of job openings that post no wage using data on the expected wage that is provided by employers but not visible to potential applicants.

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 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 different firms that are not fully priced into wages. Implicit in these models is the idea that there are only a small number of firms 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 modelling in Industrial Organization. Card, Cardoso, Heining and Kline (2018) assume the utility of worker i from working in firm f is given by:

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

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:

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

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

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

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

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

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

Where $s_{f'}$ is the probability of working for each firm in the market i.e. 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 (4) implies that the wage elasticity of the labor supply curve to an individual employer is given by:

$$\frac{1}{\varepsilon_f} = \frac{1 - s_f}{\varepsilon} \quad (6)$$

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 a more monopsonistic labor market. If firms are not small in relation to the market (6) implies that firms with a higher market share are likely to have more market power.

(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) estimate a model like (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 non-trivial amount of monopsony power.

Measuring Variations in Monopsony Power

The employment-share weighted averages of the wage elasticity in (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 define a labor market as a 6-digit occupation and a commuting zone in a quarter, and show that the HHI index for vacancies in most labor markets was above the 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 different measures of labor market concentration. Benmelech, Bergman and Kim (2018) and Rinz (2018) define a labor market as a 4-digit industry in a county in a year while Berger, Herkenhoff anf Mongey (2019) use 3-digit industry in a commuting zone. Dey and Hendwerker (2019) find that Herfindahl-Hirschman indices (HHI) 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 some 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 where 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. However there is substantial worker mobility across industry and occupation and, while labor markets for many workers are surprisingly local (e.g. Manning and Petrongolo, 2017), there is also mobility across geographical borders. Nimczik (2018) derives 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 Daniele (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) provide other micro-foundations 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 it is measured as vacancies as a point in time rather than the total over some longer period. The choice is often dictated by the available data but here is it not clear which is to be 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 get a job now so that it is not clear the period over which the concentration in vacancies should be assessed: deriving this from economic principles has not yet been done.

Thoroughly Modern Monopsony

Modern monopsony is based around the idea that it takes time for workers to find and change jobs, new classical monopsony that there is a lot of idiosyncracy in labor markets. Both are likely to contain some element of truth and this section sketches a way to combine them. The specification in (3) implicitly assumes that workers have a choice of all firms in the market whereas search frictions imply that they do not. A simple way to combine the two ideas is to assume that (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 while modern monopsony models are rooted in models of dynamic decision-making: is it better to supply labor to a firm today or wait and hope for a better opportunity tomorrow. Integrating a model like (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 in 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 that is related to not just the wage but also the probability of the application being successful that 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 (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 $\theta\left(A_f\right)$ assumed to depend negatively on the number of applications to the firm. If workers choose their application to maximize expected utility (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:

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

This reduces to the standard formula in the case where all applications lead to employment, $\varepsilon_{\theta A}=0$. But in the case where more applicants lead to fewer jobs one can see from (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) there is then the question of whether employers exercize this monopsony power as a simple profit-maximizing model would suggest or whether other factors acts 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. There are some labor markets where the relevance of monopsony power is well-established. In US professional sports there is a clear link 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

[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, 2019, 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.

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 there are some recent studies that seek to relate changes wages to changes in measures of market power discussed earlier. Azar, Marinescu and Steinbaum (2017), Benmelech et al (2018) and Rinz (2018) find a link between higher concentration and lower wages. Benmelech et al (2018) find this effect is weaker in the presence of unions. Rinz (2018) notes 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) report similar results for the UK.

However 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 is exercized it is not clear how this can be reconciled with observed levels of the profit share. Dube, Manning and Naidu (2019) use 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 why not all monopsony power is exercized 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-Mortensen (1998) model commonly used as a microfoundation 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, because it 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 modelling increased competition can be thought of as closest to a decrease in ε in (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 i.e. 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. In 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) shows that the loss in revenue is greater than the wage suggesting a wage paid above the marginal product while Jager and Heining (2019) finds wages and retention rates of other workers rise suggesting that the labor supply curve to the individual employer has shifted.

2. Applications of Monopsony

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

Minimum Wages

For a long time, debates about the minimum wage was the main area where the idea of monopsony had a wider 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 Cengiz et al 2019 for a recent US study). The employment effect of the minimum wage remains a contentious issue in the US and other countries (see, for example, Bossler and Gerner, 2019, Caliendo, Schroder and Wittbrodt, 2019, 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 policy-makers has probably shifted to being more favourable 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, over some range, minimum

wages need not destroy jobs, monopsony also predicts that there is a limit to how high minimum wages can be raised before there are job losses (for example, Kreiner et al, 2019 do find 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 though 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) find more positive effects in less competitive labor markets (as monopsony would predict) and Dustmann at al (2019) find reallocation of labor towards more productive, higher-wage firms, again as monopsony would predict.

Anti-Trust

Anti-trust is an area where 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 labor markets (many of which relate to professional sports), what Naidu, Posner and Weyl (2018) refer to as the "historic imbalance between … product market antitrust and labor market antitrust". Following on from some high profile examples of seemingly blatant anti-competitive labor market practices, economists, lawyers and anti-trust practitioners in the US have been more concerned about labor market competition (though this has yet to extend to other countries). There have been suggestions for reform (Naidu, Posner and Weyl, 2018; Krueger and Posner, 2018, Marinescu and Hovenkamp, 2018, Marinescu and Posner, 2019). The Department of Justice (2016) has issued guidance for employers on appropriate behaviour. 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, 2018), and the level of labor market concentration among employers in local labor markets and how that might be affected by mergers (Marinescu and Hovenkamp, 2018).

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. There is a growing body of research providing estimates of the impact of non-competes. Marx (2011), Starr, Prescott and Bishara (2018), Balasubramian et al (2019) and Lipsitz and Starr (2019) show chilling effects of non-competes on labor mobility and also reductions in wages, especially when presented to workers after accepting the job offer. Starr, Frakee and Agarwal (2019) show 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) finds that greater enforceability of non-competes is associated with a higher level of firm-sponsored training, though lower wages, suggesting that non-competes allow firms to capture a greater share of the returns to training by making the labour market less competitive. Starr, Balasubramian et al (2018) find that greater enforcement of non-competes is associated with fewer within-industry spinouts (one form of entrepreneurship) but that those that are created are more successful.

A related area is the debate about how to regulate the gig economy. In many countries there have been legal cases about whether these are independent contractors who typically have fewer rights than workers. Harris and Krueger (2015) suggest changes to US labor law 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). The intuition is that the wage elasticity of worker utility rises with more favourable 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 there are no commitments made by either worker or employer, the studies of Caldwell and

[5] Something like this already exists in the UK 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.

Oehlsen (2019) and Dube, Jacobs, Naidu and Suri (2018) 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 et al, 2020, for some cost estimates). This 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 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 not reservation wages. But, the less competitive is 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 under-cut 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) present 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) present some evidence for the US that more migrants in a labor market is 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) explore the impact of a change in visa rules in the UAE making it easier for migrant workers to change jobs. This

increased migrant earnings and employer retention, primarily driven by a drop in return migration. They argue the pattern of observed responses is consistent with employers having substantial monopsony power. For the US, Depew, Norlander and Sorensen (2017) and Hunt and Xie (2019) present evidence that job mobility of migrants on guest worker programmes is reduced by these restrictions. Doran, Gelber and Isen (2016) find that winning an H1B 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 labour 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 e.g. 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 like 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, in part because it has been thought to be informative about the extent of competition in the labor market based on the idea that firm-level productivity should not matter in a competitive market. This is explained using a simple monopsony model in Figure 1.

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 from MRPL0 to MRPL1 will result in an increase in wages from W0 to W1, something that 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 (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:

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

Where y_f is log revenue, a_f is a shifter of the revenue function. This shifter will be affected by factors affecting the physical production function (so could include technology, and either 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 like 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 (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 (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 is not the same as the pass-through parameter for demand shocks, a_f , in (14): inspection of (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-hand side of (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 which is a measure of the returns to scale of labor in the production function and the degree of imperfect competition in the product market. One implication of (16) 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 i.e. is endogenous and cannot be treated as an exogenous demand shifter: this is clearest in the case of perfect competition where the wage is proportional to productivity but the causation is from the wage to productivity not the other way round. The endogeneity of productivity to the wage would not seem to apply if $\eta=1$ when productivity is exogenous. Inspection of (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 $\eta=1,\varepsilon=0$ (13) 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, Cardoso, Heining and Kline, 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 (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, Cardoso, Heining and Kline (2018) modify (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. This has the effect of making the elasticity in (4) from a constant to a decreasing [check] 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 than proportionately than productivity[6]. An alternative way to get the same result would be to relax the assumption that firms are infinitesimal in the market as a whole: more productive firms in an industry will have a higher market share which from (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 where the revenue function is CES rather than Cobb-Douglas as in (11) showing that the pass-through parameter is generally different from one 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) consider 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 30c though entry wages are unaffected. To convert this to an elasticity, one needs to divide by the labor share in value-added, which is about 50% leading to an elasticity of 0.6. This pass-through is still less than 1 predicted by the simple theory presented above, 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 effect to the employment effect, about one-third for their estimates: this can be thought of as an IV estimate of a labor supply model instrumenting employment by the patent variable.

Wage Inequality and the Labor Share

One of the probably 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 vaguer feeling that the balance of power between workers and employers in the labour market has shifted to the advantage of business.

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

Even if monopsony power is not changing it has the potential to help explain patterns and trends in wage inequality. As discussed earlier, in the model of wages (14) 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) argue that rising firm heterogeneity can explain most of the rise in West German inequality though Song et al (2019) argue 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 (Robinson, 1933) was to the gender pay gap and Manning (2011) summarizes 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) reports a similar finding for US data but also finds that this is primarily because women are more likely to work in firms with lower labor supply elasticities. The meta-study of Sokoleva and Sorensen (2020) finds that the average estimated separations elasticity is lower for women than men though the magnitude of the difference could only explain part of the observed gender wage gap. Card, Cardoso and Kline (2016) find the pass-through effect to be smaller for women than men in Portugal. Caldwell and Oehlsen (2018) find, in a study of Uber drivers, that female labor supply is more responsive to wages than men which goes against some of the findings of other papers though also might be a rather 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) provide additional evidence for this view. More generally Webber

[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.

(2015) finds more monopsony power in lower-wage labor markets, which would lead to greater inequality in wages than marginal products.

It may also 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 et al, 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 exercize 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 –see (16). Naidu, Posner and Weyl (2018) estimate 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 in macroeconomics e.g. in explaining the cyclicality in wages or the changing nature of the Phillips curve. For example Depew and Sorensen (2013) and Hirsch, Jahn and Schnabel (2017) find that employers have more power in slack labor markets, providing a link between employer market power and the cyclicality of wages.

3. 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 etc.

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) while others remain to be explored (e.g. immigration, modelling earnings when employers matter, any role in rising wage inequality or the falling labor share). So 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 (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 generalise is to have a CES production function. Write the revenue function as:

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

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

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

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 (resp. less) than 1 as $\gamma < 0$ (resp. $\gamma > 0$) check. 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 one is back to having a pass-through of one.

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Figure 1: The Impact of Firm Demand Shocks on Wages and Employment Under Monopsony and Perfect Competition