IV Monopsony and Oligopsony

Bruno Van der Linden*

May 11, 2005

Fonds National de la Recherche Scientifique
and
Department of Economics,
Université Catholique de Louvain

1 Introduction

Monopsony in the traditional sense - that is, a unique employer in a labour market - is unrealistic. One rarely sees such a situation: Employers obviously compete with one another to some extent. However, recent theoretical developments have been triggered by an influential book about the effect of minimum wages (Card and Krueger, 1995) and the following empirical analyses. The provisional conclusion of Card and Krueger (2000) is that

> The increase in New Jersey's minimum wage probably had no effect on total employment in New Jersey's fast-food industry, and possibly had a small positive effect. (p. 1419)

Such a result is hard to explain in a competitive framework (the latter remaining a widely used setting for the US labour market).

The persistency of wage dispersion among similar workers is another real (even if hotly debated) phenomenon that does not fit in the competitive framework. In a competitive labour market, the "law of one wage" tells that there should be a single market wage for a given quality of worker. Of course, the measurement of "identical" or "similar" workers raises very complicated problems (think about the

*Place Montesquieu, 3, 1348 Louvain-la-Neuve, Belgium. Tel : 32.10.47.34.33, Fax : 32.10.47.39.45, Email : vanderlinden@ires.ucl.ac.be. Home page : http://www.ires.ucl.ac.be/CSSSP/home_pa_pers/Vanderlinden/Vanderlinden.html

subtle, probably to some extent non observable, factors that could affect the shape of the firm-specific "effort function" in the Solow model).

The revival of monopsonistic models (see Bhaskar, Manning and To, 2002, and Manning, 2003) comes from the desire of providing some explanations for these phenomena. This does not mean that monopsonistic models are *the unique* way of explaining these phenomena (think about efficiency wage models as a way of explaining persistent wage differentials among similar workers).

Let us start with a very brief summary of the traditional monopsony models and then we will introduce to more recent ways of modelling monopsonistic/oligopsonistic labour markets.

2 The traditional views

2.1 Nondiscriminating Monopsonist

A nondiscriminating monopsonist faces an upward-sloping labour supply curve, $L^S(w)$, and must pay all workers the same wage, regardless of the worker's reservation wage (see any textbook such as Cahuc and Zylberberg (2004) p. 257, or Borjas, 1996). Notice that employers have only one instrument for determining their supply of labour: The wage (namely the same wage for each worker). Imagine for simplicity that each employed worker produces an exogenous quantity y of output. The Monopsonist chooses the wage w that solves the following problem:

$$\max_{w} \pi(w) \equiv L^S(w)(y-w) \tag{1}$$

The first-order condition implies that the monopsony wage w^M is defined by:[1]

$$w^M = \frac{\eta_w^L(w^M)}{1+\eta_w^L(w^M)}\, y \quad \text{where } \eta_w^L(w) \equiv \frac{w\, L^{S'}(w)}{L^S(w)} \geq 0 \tag{2}$$

Notice that $\frac{\eta_w^L(w^M)}{1+\eta_w^L(w^M)}$ is between 0 and 1. Therefore, the monopsonist pay less than the competitive wage (i.e. y). It is easily checked that $\pi(w^M) > 0$ while it should be zero in a competitive setting. It is also easily seen that employment is below its competitive level. A minimum wage higher than w^M and below the competitive wage is therefore welfare improving.

The limit case where $\eta_w^L(w^M) = +\infty$ corresponds to the competitive labour market where the wage elasticity of the labour supply curve facing an individual

[1] A second-order has also to be checked.

employer is infinite and $w = y$. By definition of an infinite elasticity of labour supply, "any attempts by an employer to cut wages will cause all existing workers to leave the employer instantaneously" (Bhaskar, Manning and To, 2002, p. 159).

2.2 Perfectly Discriminating Monopsonist

A perfectly discriminating monopsonist can hire different workers at different wages. Therefore, this perfectly discriminating monopsonist pay to each additional worker his (her) reservation wage. The monopsonist will then hire up to the point where the last worker's contribution to firm revenue (y) equals the marginal cost of hiring this worker. One ends up with exactly the same level of employment as in a perfectly competitive labour market.

3 Recent developments

3.1 Heterogeneous preferences over nonwage job characteristics

The simplest presentation of this approach can be found in Bhaskar, Manning and To (2002). For a more detailed and general study, see Bhaskar and To (1999). It may be costly for workers to move between employers or workers may have heterogeneous preferences for different jobs. Nonwage job characteristics do not necessarily affect workers' productivity (working conditions such as hours of work, commuting time, the social environment in the workplace).

The importance of nonwage characteristics has been recognised in the "*the theory of compensating wage differentials*" (also called "The theory of equalizing differentials"); see Rosen (1986). This is a theory of *vertical differentiation*: Some jobs have good nonwage characteristics while some others are bad jobs. Formulated in a purely competitive setting, this theory states that employers compensate each worker for unpleasant nonwage job characteristics by paying higher wages (and conversely in case of characteristics that raises the utility of the worker).[2]

Alternatively, one can assume *horizontal job differentiation*: different workers have different preferences over nonwage characteristics and none of them are inherently 'good' or 'bad'. This is the viewpoint adopted by Bhaskar and To (1999) and Bhaskar, Manning and To (2002). They moreover assume that employers cannot offer different wages to different workers, depending upon their tastes with respect

[2] There is a big controversy over the relevance of this theory.

to these nonwage job characteristics.[3]

The models of horizontal differentiation can then be adapted in order to represent such a situation. These models use a metaphor for heterogeneous preferences. Job characteristics are one-dimensional and distributed (a circle or a straight line is used to capture a "distance" between workers and firms, each of them being located somewhere around the circle or on the segment of a line). The cost associated with this distance is formally a cost of travelling to and from work. "This cost should be interpreted as a subjective measure of the disutility the worker suffers due to a mismatch between her preferred job characteristics and those offered by the firm" (Bhaskar and To, 1999, p. 191). "The key insight is that a worker in a preferred job may not immediately choose to leave an employer that slightly reduces its wage rate" (Bhaskar, Manning and To, 2002, p. 160). Therefore, the wage elasticity of the labour supply curve facing an individual employer is *finite*. One cannot however directly apply the standard model of the nondiscriminating monopsonist because employers compete with one another to attract workers (hence the name "oligopsony").

"If there is free entry and and exit and if fixed costs matter in production, then any extra-normal profits will be competed away. Wages will equal the average product of labour, although they will be lower than marginal product. While this divergence between wages and marginal product has no immediate normative implication that workers are exploited, it does imply that, in general, market equilibrium need not be fully efficient. In consequence, redistributive policies such as a minimum wage, which should be distortionary in a competitive labour market, need not necessarily be so in an imperfectly competitive labour market" (Bhaskar, Manning and To, 2002, p. 163).

A (binding) minimum wage has two opposing effects here. First, an employment-enhancing effect for a given number of firms. This effect can itself be decomposed into two opposite impacts. First, conditional on the wage of the competitors, each employer is in the same position as in the first subsection (a moderate minimum wage is good for employment and wages). However, since rival employers must increase their wage to the minimum, labour market competition increases so that the labour supply faced by a given firm shifts. Intuitively, because rival firms have to raise their wage to the minimum, they will attract more worker. So, this competition effect means that compared to the monopsony of the first subsection, each firm can now attract less workers at a given wage (everything else equal). "Despite [this]

[3]This assumption is debatable. Bhaskar, Manning and To (2002) argue that worker's subjective preferences regarding nonwage job characteristics are not readily observable. Not all nonwage characteristics are so subjective. For instance, commuting time and costs can be objectively measured. There are employers who reimburse their employees for these costs.

reduction in establishment level labour supply, a minimum wage set moderately above the market wage causes establishment-level employment to increase, because if all employers offer higher wages, the labour participation rate must also rise" (Bhaskar, Manning and To, 2002, p. 168).

Second, there is an employment-decreasing effect through the exit of marginal firms (some firms are forced out of business because of the introduction of the minimum wage). The net effect is therefore ambiguous but if employment decreases, this effect is necessarily smaller than in an equivalent competitive setting.

3.2 Equilibrium search models with wage posting

3.2.1 Introduction

On-the-job search is a nonnegligible phenomenon (for instance, Labour Force Surveys in the UK indicate that roughly 6% to 7% of employed workers are looking for another job at a given time). Empirical analyses have shown that workers employed in higher-paid jobs are less likely to look for other jobs. This motivated the "turnover model" introduced in a previous chapter. In an imperfect information setting where workers have to search for better jobs, a cut in wages will not result in a massive number of quits. This is a first channel by which the firm's wage policy can affect their labour supply.

A second channel is immediately derived from the Job Search model (with on-the-job search) introduced in an earlier chapter: Increasing the level of wage offers raises the acceptance rate of these offers, and hence augment firm's labour supply.

Assume that firms set wages. More precisely, for each vacancy they post a wage offer. Employed and unemployed job-seekers know only the wage of employers contacted through search. The offer is of the take-it-or-leave type. *These assumptions are more sensible in non-unionised sectors, where turnover costs (i.e. hiring and firing costs once workers and firms have matched) are negligible and in the case of workers with poor employment prospects (no individual bargaining power).* This section will not survey "wage posting models" (see for instance Mortensen and Pissarides, 1999, Rogerson and Wright, 2002 or Rogerson, Shimer and Wright, 2004). The following is based on Mortensen (2000) and *uses as far as possible notations introduced in a previous chapter entitled "Equilibrium search models".* Mortensen (2000) proposes a synthesis between the Pissarides-type equilibrium search framework and the wage-posting approach (see also Section 7 of Mortensen and Pissarides, 1999).

3.2.2 Assumptions and notations

1. The model is developed in continuous time with infinitely lived agents.

2. Workers and firms are homogeneous. The size of the labour force is fixed (normalised to 1) while the number of vacancies (employers) is given in equilibrium by a free entry condition.

3. Employed and unemployed workers are for simplicity perfect substitutes in the matching process and their search intensity is fixed to 1. Therefore all unemployed *and* employed people are searching. The rate λ_e of contacts between employed workers and job offers and the one of unemployed people, λ_u, are therefore equal and denoted simply by λ.

4. Still for simplicity, unemployed workers have no search cost (in the notations of Chapter III, $c_e = c_u = 0$). Since the *distribution of wage offers* $F(w)$ is the same for both types of job applicants, the reservation wage of unemployed job-seekers is b. The latter could denote an unemployment benefit plus the net value of time which would be gone once an employment spell begins and net of commuting costs. To keep things simple, let us ignore unemployment benefits and consider that the opportunity cost of employment is zero. Let us then consider $b \geq 0$ as an exogenous minimum wage. No (potential) employer will offer a wage below b. Hence, $F(b) = 0$.

5. Workers and vacancies are matched randomly. The matching function measures the rate of contacts between vacancies v, the unemployed u and the employed $1-u$: $m(v, u, 1-u)$.[4] By assumption 3, $m(v, u, 1-u)$ can simply be rewritten as $m(v, 1)$. Furthermore, the flow of contacts verify : $\lambda \cdot (u+1-u) = m(v, 1)$. So, one can write $\lambda = \lambda(v)$. With standard assumptions about function $m(\cdot)$, $\lambda(v)$ is increasing and concave. The Inada conditions are assumed ($\lambda(0) = 0; \lambda'(0) = +\infty$).

3.2.3 The steady-state equilibrium

The model is developed in steady state. Then the equality between exits out of unemployment and entries into unemployment leads to the "Beveridge curve":

$$u = \frac{\phi}{\phi + \lambda(v)}, \quad \text{where } \phi = \quad \text{the exogenous job destruction rate} \tag{3}$$

[4] v, u and $1-u$ are rates, the denominator being the normalised size of the labour force

The fraction of those employed at a wage w or less, the *wage distribution function* $G(w)$, should not be confused with *the distribution of job offers* $F(w)$. Recall that employed workers quit if they can be paid more in other jobs. The flow into the set of workers earning w *or less* is $\lambda(v)\, F(w)\, u$. The flow out of the same set is $[\phi + \lambda(v)(1 - F(w))]\, G(w)\, (1 - u)$. Taking (3) into account, the equality between these two flows allow to relate $G(w)$ to $F(w)$ in the following way:

$$G(w) = \frac{\phi F(w)}{\phi + \lambda(v)[1 - F(w)]} \tag{4}$$

Notice that $G(w) \leq F(w)$. Mathematically $\phi \leq \phi + \lambda(v)[1 - F(w)]$, with a strict inequality if $\lambda > 0$ and $w <$ the highest possible wage. The economic intuition is: Firms who offer higher wages attract more workers.

One now has to write the Bellman equations characterising the intertemporal discounted values of vacant (respectively, filled) jobs. The notations and the interpretations are those of the "Equilibrium search models" chapter. Let $q(v) = \frac{\lambda(v)}{v}$ be the contact rate per vacancy and c be the flow cost of posting a vacancy. Since firms set wages, one has for vacancies:

$$rJ_v = \max_{w \geq b}\{-c + q(v)\,[u \cdot 1 + (1 - u)G(w)]\,(J_e(w) - J_v)\}, \tag{5}$$

where $u \cdot 1 + (1 - u)G(w)$ is the probability that the worker contacted will accept (a function of the wage!) and $J_e(w)$ is the intertemporal flow of profits once a worker is hired at wage w. The latter verifies the following condition:

$$rJ_e(w) = y - w - \{\lambda(v)[1 - F(w)] + \phi\}[J_e(w) - J_v], \tag{6}$$

where y is the constant marginal product and $\lambda(v)[1 - F(w)]$ is the quit rate (a function of the wage!).

In equilibrium with free entry of vacancies, $J_v = 0$. This property can then be introduced in (5) and (6) to yield two expressions for $J_e(w)$. Equating them and using (3) and (4) lead to

$$\frac{c}{q(v)} = \max_{w \geq b}\left[\underbrace{\frac{\phi}{\phi + \lambda(v)[1 - F(w)]}}_{\text{acceptance rate}}\underbrace{\frac{y - w}{r + \phi + \lambda(v)[1 - F(w)]}}_{\text{retention rate}}\right] \tag{7}$$

This equation emphasises that employers have two reasons of offering a wage above b. In addition to its negative effect on profits (the term $y-w$), an increase in w raises the employer's retention rate and also the rate at which her job offers are accepted.

Imagine that these effects would be absent and compare with the 'vacancy supply curve' in the chapter about Equilibrium search models.

A steady-state equilibrium is a vacancy rate v and a wage distribution F such that the value of hiring workers is optimal and equal for every wage of the support of F.

In what follows, the equilibrium vacancy rate is characterised and then the distribution and the support of F are defined.

At the minimum wage, unemployed workers accept job offers. The optimal lower support is therefore b with $F(b) = 0$. For $w = b$, (7) can be written as an implicit equation in v (conditional on b), namely (remember that $q(v) = \frac{\lambda(v)}{v}$):

$$c \cdot v = \left[\frac{\phi}{\phi + \lambda(v)}\right] \left[\frac{(y - b)\lambda(v)}{r + \phi + \lambda(v)}\right] \tag{8}$$

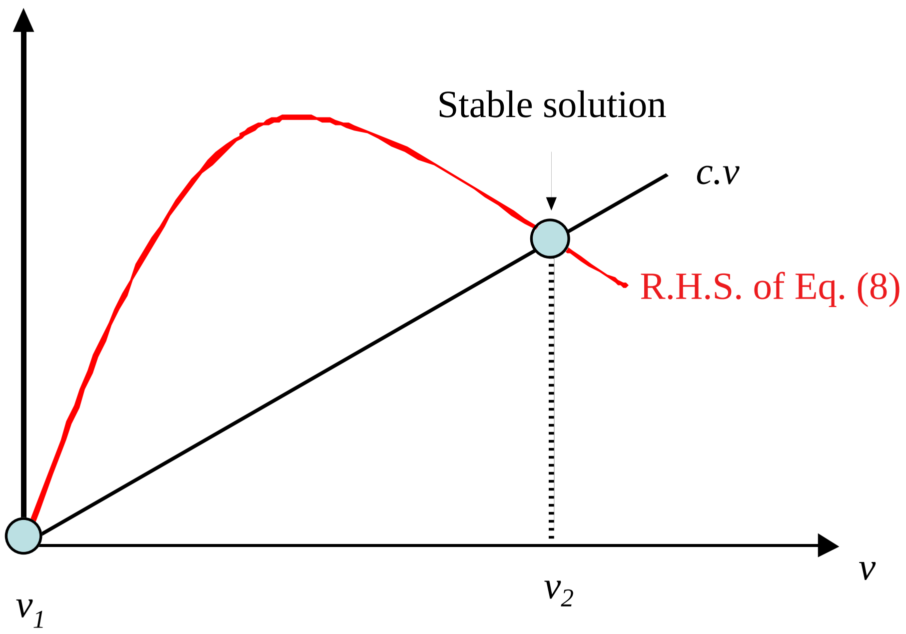

Figure 1: The equilibrium rate(s) of vacancies.

As Figure 1 shows, a first equilibrium is $v_1 = 0$. This solution is unstable since a small increase in v raises return to vacancy creation (the R.H.S. of Eq. (7)) more than the cost (its L.H.S.). On the contrary the second positive equilibrium, say v_2, is stable. As can be seen from Eq. (7), v_2 decreases with the minimum wage. Therefore, from (3), the equilibrium unemployment rate increases with the minimum wage! Therefore, this model cannot be used to understand the quotation of Card and Krueger (in the introduction). However, extension to the present model, where the supply of labour becomes elastic, should lead to properties more in accordance with Card and Krueger's conclusion (see Chapter 3 of Manning, 2003).

It can be shown that:[5]

1. $F(w)$ contains no mass points (i.e. the probability of observing a given level of wages is zero). Therefore, $F(\cdot)$ is a smooth function.

2. Some firms pay exactly $w = b$.

3. There can be no gaps on the support of F.

Now, every wage in the support of the equilibrium wage offer distribution should yield the same return to the employers. Call this support $[b, \overline{w}]$. Equating the R.H.S. of (7) and (8) leads for each $w \in [b, \overline{w}]$ to the following equality

$$\frac{y - w}{(r + \phi + \lambda(v_2)[1 - F(w)])(\phi + \lambda(v_2)[1 - F(w)])} = \frac{(y - b)}{(r + \phi + \lambda(v_2))(\phi + \lambda(v_2))} \quad (9)$$

Before analysing this equation and characterizing $F(w)$, notice that $\overline{w}$ is obtained by exploiting this equation and the property that $F(\overline{w}) = 1$. This yields that

$$\overline{w} = b + \left(1 - \frac{(r + \phi)\phi}{(\phi + \lambda(v_2))(r + \phi + \lambda(v_2))}\right)(y - b) \quad (10)$$

Conditional on v_2, $\overline{w}$ is higher than b and it increases with b. However, v_2, and hence $\lambda(v_2)$, decrease with b. This induced effect reduces $\overline{w}$. However, wage dispersion, measured by $\overline{w} - b$ decreases with b.

For any value of w, the L.H.S. of (9) increases with $F(w)$ while the R.H.S. stays constant. So for any value of $w \in [b, \overline{w}]$, the solution $F(w)$ of (9) is unique. Now, if

[5] To show (1) suppose there were a mass point at w. Then, if a firm offers $w + \epsilon$ instead of w it can increase its inflow of workers by a discrete amount for any $\epsilon > 0$, whereas the decrease in profit per worker goes to 0 as ϵ goes to 0. To show (2), suppose the lowest wage paid is $w' > b$. Then any firm paying w' can increase its profit by paying $w = b$, since it still attracts and loses the same number of workers (given there are no mass points). Hence, the lowest wage paid is exactly b. To show (3), suppose there is an non-empty interval $[w'; w"]$, with $w' > b$ and some firm paying $w"$ but no firm paying $w \in [w'; w"]$. Then the firm paying $w"$ can make strictly greater profit by paying $w" - \epsilon$ for some $\epsilon > 0$ (Rogerson and Wright, 2002, p. 27).

the wage rises, $y-w$ decreases. To fulfil (9), the denominator of the *L.H.S.* should decrease, too. Therefore, $F(w)$ has to be raised. So, starting from $F(w=b)=0$, the equilibrium value of $F(w)$ is an increasing function of w. One ends up with the conclusion that the equilibrium distribution of wages exists, is unique and is not degenerated (i.e. wages are dispersed).

Eq. (9) is a rather complex expression. To keep things as simple as possible, let us from now on take the limit case where $r \to 0$. The solution to (9) is then immediately computed:

$$F(w) = \frac{\phi+\lambda(v_2)}{\lambda(v_2)}\left(1-\sqrt{\frac{y-w}{y-b}}\right) \tag{11}$$

with a density function $F'(w)$ that increases with w. This property is at odds with the data. Introducing more heterogeneity (in the b's or the y's) helps to reconcile this model with the data.

3.2.4 Efficiency

To conclude this section, notice that the positive impact of the minimum wage on unemployment does not imply that the minimum wage is detrimental to welfare. For employers exploit their monopsony (or better their oligopsony) power and set wages too low. With risk-neutral agents, $r \to 0$ and in the absence of any value to unemployment, a benevolent utilitarian planner would choose v so as to maximise output net of recruiting costs (see the same reasoning in the chapter about Equilibrium search models). This planner then solves the following problem:

$$\max_v \; y(1-u) - c\cdot v = y\frac{\lambda(v)}{\phi+\lambda(v)} - c\cdot v \tag{12}$$

Let v^* denote a solution to this problem. v^* verifies:

$$y\frac{\phi\lambda'(v^*)}{[\phi+\lambda(v^*)]^2} = c \tag{13}$$

The assumption $\lambda"(v) < 0$ is a sufficient condition. Let us compare v^* with the decentralised equilibrium v_2 *when* $b=0$. Given the assumptions about the function $\lambda(\cdot)$, one can combine (13) and (8) (evaluated at $r=b=0$). This yields:

$$y\frac{\phi\lambda'(v^*)}{[\phi+\lambda(v^*)]^2} = c = y\frac{\phi\lambda(v_2)/v_2}{[\phi+\lambda(v_2)]^2} > y\frac{\phi\lambda'(v_2)}{[\phi+\lambda(v_2)]^2} \tag{14}$$

The inequality holds because $\lambda(v)$ is increasing and concave. Now, since $\frac{\phi\lambda'(v)}{[\phi+\lambda(v)]^2}$ is a decreasing function of v, one can conclude that

$$v_2 > v^*$$

Put another way, *in the decentralised equilibrium without minimum wages, too many vacancies are created.* The intuition for this result is the following. Vacancies that are created to hire unemployed people have a social value (they generate a social gain of y minus the value of time in unemployment, namely zero here). However, vacancies are also created to attract employed people in better paid jobs. The social gain of this is zero. That is the reason why the *laissez-faire* economy creates too many vacancies.

A *positive* minimum wage equal to

$$b^* \equiv y\left(1 - \frac{v^*\lambda'(v^*)}{\lambda(v^*)}\right)$$

would be needed to induce the optimal number of vacancies (and the optimal unemployment rate). Mortensen (2000) concludes that

> Available empirical estimates of the elasticity $[\frac{v^*\lambda'(v^*)}{\lambda(v^*)}]$ suggests a value for the ratio b/y somewhere in the range between 40% and 60%. (p. 288)

4 Conclusion

In this chapter, some recent ways of thinking about monopsony/oligopsony have been introduced. Efficiency wage models have also been used in the recent past (see Manning, 1995). As the power of unions has been reduced in many countries and several reforms have introduced more "flexibility" in the labour market, the recent interest for monopsony/oligopsony models is probably well motivated. These models shed new light on the role of several public interventions.

5 Exercise

This question is about equilibrium search models with wage-posting.

1.1 In this model, from the point of view of each firm, what are the three effects of a rise in the wage?

1.2 Except for the highest wage, $\overline{w}$, check that the cumulated density functions verify $G(w) < F(w)$. Then, provide an intuitive argument that explains this property.

1.3 Increasing the minimum wage, b, raises the unemployment rate here. Nevertheless, a positive level of b is needed to maximise social output $y(1-u) - c \cdot v$. What is the intuition for this property?

References

Bhaskar, V., A. Manning and T. To (2002) "Oligopsony and monopsonistic competition in labor markets". *Journal of Economic Perspective*, 16:155–174.

Bhaskar, V. and T. To (1999) "Minimum wages for Ronald McDonald monopolies: A theory of monopsonistic competiton". *Economic Journal*, 109:190–203.

Borjas, G. (1996) *Labor economics.* McGraw-Hill, New-York.

Cahuc, P. and A. Zylberberg (2004) *Labor economics.* MITPress, Cambridge.

Card, D. and A. Krueger (1995) *Myth and measurement: The new economics of minimum wages.* Princeton University Press.

Card, D. and A. Krueger (2000) "Minimum wages and employment: A case study of the fast-food industry in new jersey and pennsylvania: Reply". *American Economic Review*, 90:1397–1420.

Manning, A. (1995) "How do we know that real wages are too high?" *Quarterly Journal of Economics*, 110:1111–1125.

Manning, A. (2003) *Monopsony in motion: Imperfect competition in labour markets.* Princeton University Press.

Mortensen, D. (2000) equilibrium unemployment with wage posting: Burdett-Mortensen meet Pissarides. In H. Bunzel, B. Christensen, P. Jensen, N. Kiefer and D. Mortensen, editors, *Panel data and structural labour market models.* Elsevier Science Publisher (North-Holland), Amsterdam.

Mortensen, D. and C. Pissarides (1999) New developments in models of search in the labor market. In O. Ashenfelter and D. Card, editors, *Handbook of Labor Economics, Volume 3B.* Elsevier Science Publisher (North-Holland), Amsterdam.

Rogerson, R., R. Shimer and R. Wright (2004) “Search-theoretic models of the labor market: A survey”. Working Paper 10655, NBER, Department of Economics, University of Pennsylvania.

Rogerson, R. and R. Wright (2002) “Search-theoretic models of the labor market: A survey”. Working Paper 02-041, Penn Institute for Economic Research, Department of Economics, University of Pennsylvania.

Rosen, S. (1986) The theory of equalizing differentials. In O. Ashenfelter and R. Layard, editors, *Handbook of Labor Economics, Volume 1*. North-Holland, Amsterdam.