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Abstract

This paper extends the equilibrium search model of Burdett and Mortensen by introducing two different occupations. Local monopsony power and the complementarity of the occupations in production imply that firms occupy the same position in the wage distribution of each occupation. The model also solves for the explicit occupation-specific wage distribution and links them via the production function. Due to search frictions fewer individuals choose the occupation with high education cost compared to the first best. Furthermore, wages of higher educated workers are more compressed than wages of lower educated workers, because firms can extract more search rent from higher educated workers.

Keywords: occupational choice, wage correlation and distribution.

JEL Classification: J21, J31, J41, J42.

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1 Introduction

This paper extends the Burdett-Mortensen (1998) model of equilibrium on-the-job search by introducing two different occupations. This extension allows for the analysis of firms' wage posting behavior, where firms compete for workers of different occupations. It is shown that firms will post these wages, such that they occupy the same position in the wage offer distribution for all occupations. This positive correlation between the wages of workers in different occupations within firms is a well established fact. Katz and Summers (1989) show evidence that secretaries earn more where average wages are higher. More recently, Barth and Dale-Olsen (2003) find that "[h]igh-wage establishments for workers with higher education are high-wage establishments for workers with lower education as well." The explanation provided in this paper rests on two things. Firstly, labor market frictions lead to an upward sloping labor supply curve for each occupation. This results from the fact that on-the-job search implies that the higher the wage offer the more employed workers are attracted from firms offering lower wages and the less workers quit to employers paying higher wages. This leads to a higher steady-state occupation size for firms offering higher wages. Secondly, I need the assumption of complementarity of the occupations in the production process. This guarantees that increasing both labor inputs simultaneously is optimal.

Similar ingredients are also used by Kremer (1993) in his O-ring theory to explain the same observation. The production function he proposes exhibits high complementarity of the working colleagues' abilities not to make a mistake, since a mistake results in wasted output regardless of the performance of others. Thus, firms recruit equal ability types for each task (occupation). Since higher ability types are more productive, they are paid higher wages in a competitive market. Thus wage differentials in the O-ring theory are attributable to workers' ability, whereas wage differentials in the paper presented here are explained by efficiency turnover wages.

The O-ring theory also suggests that wages increase with the number of tasks performed in a firm, since only high ability workers are able to produce goods requiring many tasks. Thus, the O-ring theory implies a positive correlation between wages and the number of tasks and therefore the overall size of the workforce, whereas this paper predicts a positive correlation between skill-group size and wages. The findings of Barth and Dale-Olsen (2002) indicate that the employer-size wage effect vanishes once they look at the skill-group size, thus they provide empirical evidence in favour of the labor market frictions approach in this paper compared to the O-ring theory.

The fact that firms occupy the same position in the wage distribution for each occupation is essential for the derivation of the explicit occupation-specific wage offer distributions. The occupation-specific wage offer distributions have the same drawback as in the simple version by Burdett and Mortensen (1998) for a homogenous workforce, namely that the derived increasing left skewed density is at odds with the empirical observation of a log-normal wage earnings density. Aggregation over all occupations, however, yields a spiky, right-tailed density if the production elasticities increase for occupations with lower cost of education, an assumption supported by many empirical studies (see Hamermesh 1996, chapter 3). The theory presented in this paper thus puts a systematic structure on the heterogeneity in occupations and industries, which empirical researcher such as Kiefer and Neumann (1993), Koning et al. (1995), and van den Berg and Ridder (1993, 1998) introduced in an ad hoc way to estimate the simple version of the Burdett-Mortensen model.

This model is not the first one that extends the Burdett-Mortensen model in order to generate a more realistic-shaped wage distribution. Mortensen

(1990) and Burdett and Mortensen (1998) combine their simple model with atomless ex-ante worker heterogeneity, as in the model of Albrecht and Axell (1984). However, this generally does not generate a right-tailed distribution. Mortensen (1990) introduced di;erences in firm productivity and showed that more productive employers pay higher wages. Bontemps et al. (2000) and Burdett and Mortensen (1998) formulate a closed-form solution for a continuous atomless productivity distribution, which translates into a right-tailed wage earnings distribution, depending on the assumed productivity dispersion. The heterogeneity in productivity across occupations generated in my model is an equilibrium outcome where the occupation-specific marginal products account for the di;erences in the cost of education and the degree of search frictions in the labor market. The di;erences in the marginal products are therefore above the first best competitve level.

Hence, the model allows us to analyse the influence of search frictions on the shape of the wage distribution. It is shown that higher search frictions lead to larger wage di;erentials across occupations for given di;erences in the cost of education. Futhermore, search frictions give each firm some local monopsony power, which each firm uses to extract some rent from its workers. This search rent depends on the degree of labor market frictions and is higher for high skilled workers. In addition, the gap between the marginal product and the expected wage o;ers increases for occupations with higher education costs. This gap is exactly what Acemoglu and Pischke (1999) define as a compressed wage structure.

The paper preceeds as follows. The framework of the model is laid out in section 2. Section 3 derives the main result on the positive correlation of wages across occupations within a firm and characterises the labor market equilibrium as well as the wage o;er distributions for each occupation. Section 4 links the wage o;er distributions with the cost of education and analyses the equilibrium occupation decision. Section 5 investigates the impact of search frictions on search rents across occupations and on the shape of the wage distribution.

2 The Framework

The model has an infinite horizon and is set in continuous time. The paper concentrates on steady states. Each worker of the measure ® of ex-ante identical workers joins one of two occupations ª = 1[2 before he starts to search for a job in the labor market. The measure of each occupation ª is defined as ²ª, satisfying $^2{}_1$ + $^2{}_2$ = ®. The measure ¶ª of workers is unemployed and the measure ²ª ¶ª is employed. At a rate . ^ 0, a worker leaves the labor market and is replaced by a young worker, who has to choose an occupation before he enters the labor market as unemployed. Workers incur a one-o; cost ¤ª for occupation specific education. By assuming perfect capital and insurance markets, workers are able to borrow the cost of education before they start to earn money. They pay the interest rate . on the cost of education due to their uncertain life span. Workers are assumed to be risk neutral and hence join the occupation with the highest expected value of being unemployed.

After joining an occupation workers search for a job in the separated labor markets of their occupation. They follow a sequential search strategy, i.e. they sample only one job o;er and decide whether or not to accept it. With probability 5¶ unemployed workers encounter a firm that makes them a wage o;er corresponding to their occupation, and with probability 5¦ employed workers encounter a firm. The arrival rate of o;ers across occupations is assumed to be constant.

The measure of ex-ante identical firms is normalised to 1. All firms have the same production technology º = y (-1[-2) where -ª (¸ ª | ¸ ³ª[fª (¸ ª)) is the occupation size of a firm that o;ers wage ¸ª, given the reservation wage ¸$^3_ª$ and the wage o;er distribution fª(¸ª). The production function exhibits diminishing marginal returns, i.e. \`y (-$_1$[ -$_2$) ]\`-ª ^ 0, \`$^2$y (-$_1$[ -$_2$) ]\`-$^2_ª$ \ 0, has a positive cross derivative, i.e. \`$^2$y (-$_1$[ -$_2$) ]\`-$_1$\`-$_2$ ^ 0, and satisfies the Inada conditions. For the derivation of the explicit wage o;er distribtion is the additional assumption of constant returns to scale necessary. Firms maximize profits by o;ering a wage schedule (¸$_1$[¸$_2$).

3 Labor Market Equilibrium

3.1 Workers' optimal search strategy

The optimal search strategy for a worker of occupation ª depends on the reservation wage ¸$^3_ª$, where the unemployed worker is indi;erent between accepting or rejecting a wage o;er, i.e. uª = vª(¸$^3_ª$), where uª is the value of being unemployed and vª(¸$^3_ª$) the value of being employed at the reservation wage ¸$^3_ª$. Wage o;ers below the reservation wage have no value to the worker. For wage o;ers above the reservation wage, the Belmann equation is[1]

$$. u_ª = 5_¶ \int_{¸^3_ª}^{¸_ª} (v_ª(¹_ª) \quad u_ª) ¥ f_ª(¹_ª) \quad .¤_ª, \qquad (1)$$

where fª(¹ª) is the wage o;er distribution for occupation ª and ¯¸ª the supremum wage o;ered for occupation ª. It says that the flow value of being unemployed equals the expected gain from changing from unemployment to emploment minus the interest payment on the cost of education,

The flow value of being employed at wage ¸ª is given by

$$. v_ª(¸_ª) = ¸_ª + 5_¦ \int_{¸_ª}^{¸_ª} (v_ª(¹_ª) \quad v_ª(¸_ª)) ¥ f_ª(¹_ª) \quad .¤_ª. \qquad (2)$$

[1] The details of the derivation can be found in Mortensen and Neuman (1988).

If an employed worker is offered his current wage, he is indifferent between changing employer or not. Thus his current wage is also his reservation wage. Evaluating equation (2) at the reservation wage and subtracting (2) from (1) as well as integrating the resulting equation by parts gives the reservation wage equation,

$$w_i^* = (\lambda_0 - \lambda_1)\int_{w_i^*}^{\bar{p}_i}\left(\frac{1 - F_i(x_i)}{\delta + \lambda_1(1 - F_i(x_i))}\right)dx_i. \tag{3}$$

which gives the minimum wage for which an unemployed person is willing to accept a job. Due to the fact that workers' education cost is sunk at the time they enter the labor market (hold-up problem), the cost of education does not affect their labor market decision on whether or not to accept an offered wage.

3.2 Steady state flows and occupation size

Given the reservation wage one can easily construct the steady state measure u_i of unemployed workers. The outflow of unemployment is given by the measure of unemployed u_i multiplied by the probability of receiving an offer λ_0 and the proportion of workers who accept the wage offer $1 - F_i(w_i^*)$ as well as the flow of workers retiring δu_i. The inflow into unemployment is given by the measure of young workers entering the labor market, which is equal to the flow of workers δm_i leaving each occupation. Thus the steady state measure of unemployed is given by

$$u_i = \frac{\delta m_i}{\delta + \lambda_0(1 - F_i(w_i^*))}. \tag{4}$$

Now we define $G_i(w_i)$ as the cumulative wage earnings distribution, that is the proportion of employed workers of occupation i, who earn a wage less or equal to w_i. Then the measure of workers who earn w_i or less is given by $G_i(w_i)(m_i - u_i)$. The inflow into this group out of unemployment u_i is given by the probability $\lambda_0(F_i(w_i) - F_i(w_i^*))$ of receiving and accepting wage offers up to

$¸_a$ multiplied by $¶_a$. Workers exit the group $g_a(¸_a)(2_a \; ¶_a)$ either because they retire at rate . or they receive a higher wage o;er from another firm, which occurs at rate $5_¦$, and accept it, which happens with probability $(1 \; f_a(¸_a))$. Equating the inflow and outflow gives the steady-state measure of employed workers earning a wage not greater than $¸_a$.

$$g_a(¸_a)(2_a \; ¶_a) = \frac{5_¶(f_a(¸_a) \; f_a(¸^3_a))}{(. + 5_¦(1 \; f_a(¸_a)))(. + 5_¶(1 \; f_a(¸^3_a)))} . 2_a \qquad (5)$$

The next step is to derive the steady-state occupation size per firm. From (5) it follows that the measure of workers in occupation ª earning a wage in the interval $[¸_a \; B[¸_a]$ is given by $[g_a(¸_a) \; g_a(¸_a \; B)](2_a \; ¶_a)$. Similarly, $f_a(¸_a) \; f_a(¸_a \; B)$ is the measure of firms o;ering a wage in the same interval. Hence, the occupation size per firm is given by the measure of workers earning wage $¸_a$ divided by the measure of firms o;ering $¸_a$.

$$-_a(¸_a \,|\, ¸^3_a[f_a(¸_a)) = \lim_{BY0} \frac{g_a(¸_a) \; g_a(¸_a \; B)}{f_a(¸_a) \; f_a(¸_a \; B)}(2_a \; ¶_a)$$

Therefore, the steady-state occupation size available to a firm o;ering a particular wage can be expressed as

$$-_a(¸_a \,|\, ¸^3_a[f_a(¸_a)) = \frac{[. + 5_¦(1 \; f_a(¸^3_a))] £[. + 5_¶(1 \; f_a(¸^3_a))]}{[. + 5_¦(1 \; f_a(¸_a))] \; . + 5_¦(1 \; f_a(¸^P_a))} ¢ . 2_a \qquad (6)$$

if $¸_a \; 5 \; ¸^3_a$ and $-_a(¸_a \,|\, ¸^3_a[f_a(¸_a)) = 0$, if $¸_a \; \backslash \; ¸^3_a$, where

$$f_a(¸_a) = f_a(¸^P_a) + =(¸_a)$$

given $=(¸_a)$ is the mass of firms o;ering $¸_a$. From (6) it follows that the occupation size $-_a(¸_a \,|\, ¸^3_a[f_a(¸_a))$ (for $¸_a \; 5 \; ¸^3_a$) is (i) increasing in $¸_a$; (ii) continuous except where $f(¸_a)$ has a mass point; and (iii) strictly increasing on the support of $f_a(¸_a)$ and a constant on any connected interval o; the support of $f_a(¸_a)$.

3.3 Firms' profit maximization problem

Firms take workers' on-the-job search strategy as well as the size of the occupations 2_{a} as given. Each firm posts a wage schedule $(¸_1[\ ¸_2)$ in order to maximize its profit, conditional on $¸_a^3$ and $f_a(¸_a)$.

$$9\,(¸_1[\ ¸_2) = \max_{(¸_1[\,¸_2)} [y\ (-_1[-_2) \quad ¸_1 -_1 \quad ¸_2 -_2] \tag{7}$$

where $-_a(¸_a \mid ¸_a^3[\ f_a(¸_a))$ is the occupation size per firm defined by equation (6).

3.4 Equilibrium solution to wage posting game

The labor market equilibrium consists of a single profit 9 and a combination $(¸_a^3[\ f_a(¸_a))$ for each occupation ^{a} such that unemployed workers follow their optimal search strategy, characterised by (3). Firms maximize their profits by o;ering a wage schedule $(¸_1[\ ¸_2)$ such that the first and second order conditions are satisfied, and $f_a(¸_a)$ for all $^a = 1[2$ is such that

$$\begin{aligned} 9 &= y\ (-_1[-_2) \quad ¸_1 -_1 \quad ¸_2 -_2 \quad \text{for all } ¸_a \text{ on the support of } f\ (¸_a) \\ 9 &\ 5\ y\ (-_1[-_2) \quad ¸_1 -_1 \quad ¸_2 -_2 \quad \text{otherwise.} \end{aligned} \tag{8}$$

Let $\underline{w}_a$ and $\bar{¸}_a$ denote the infimum and supremum of the support of an equilibrium wage distribution $f_a(¸_a)$. Since no worker would accept a wage below his reservation wage, o;ering a wage below the reservation wage would imply zero profits. Without the loss of generality, we therefore only consider distribution functions that satisfy $\underline{w}_« \ 5\ ¸_«^3$.

Lemma 1 The wage o;er distributions are continuous.

Proof: See appendix.

The basic argument is given by Burdett and Mortensen (1998). If all firms o;er the same wage for one occupation, then by o;ering a slightly higher wage a firm could attract a significantly larger steady-state occupation size.

This wage increase can be arbitrarily small, whereas the resulting increase in occupation size is significant, since all workers currently working for the mass point wage will change to the new employer as soon as they get this higher wage offer. This generates a higher profit for the firm since the increase in total output due to the significantly larger workforce is higher than the increase in total cost induced by this slight wage increase. Thus, firms find it profitable to deviate from a mass point by offering a slightly higher wage. Thus no mass point exists. The resulting labor supply curve a single firm faces is upward sloping, since a higher wage w_j attracts more workers and reduces turnover and thus leads to a larger steady-state occupation size for this firm.

The firm offering the lowest wage maximizes its profit if and only if it offers the reservation wage, i.e. $\underline{w}_j = w_j^*$. Lemma 1 implies that $F_j(w_j)$ is continuous for $\underline{w}_j \geq w_j^*$, and that the occupation size of a firm posting the wage w_j can be expressed as

$$l_j(w_j \mid w_j^*, F_j(w_j)) = \frac{\lambda(\lambda+\delta_1)(\lambda+\delta_2)}{[\lambda+\delta_1(1-F_j(w_j))]^2}\, m_j \tag{9}$$

since $F_j(w_j^*) = 0$. Note again that the occupation size is increasing in the posted wage, since firms offering higher wages attract more workers and reduce turnover.

Proposition 1 Firms' profit maximization behavior ensure that firms occupy the same position in the wage distribution for both occupations. This is the so called k-percent rule $F_1\left(\bar{w}_1\right) = F_2\left(\bar{w}_2\right)$.

Proof. Profit maximization puts certain restrictions on the cross-occupation relation between wages and occupation size. The first order condition of the profit maximization problem (7) for both occupations is

$$\frac{\partial \pi(w_1, w_2)}{\partial w_j} = \frac{\partial y}{\partial l_j}\frac{\partial l_j}{\partial w_j} - w_j\frac{\partial l_j}{\partial w_j} - l_j = 0\,.$$

We now introduce an index j, which orders the firms as they increase their wage offer for occupation k (i.e. firm $j = 1$ offers w_k^1). The first order condition must hold for any wage schedule posted on the support of both wage offer distributions $F_k(w_k)$. Thus, the total derivative of the first order condition has to be zero, which implies that

$$\frac{dw_1^j}{dw_2^j} = -\frac{\frac{\partial^2 \pi(w_1, w_2)}{\partial w_2^2}}{\frac{\partial^2 \pi(w_1, w_2)}{\partial w_1 \partial w_2}}.$$

Since the size of occupation k does not depend on the wage of other occupations, (i.e. $\partial L_k / \partial w_{k'} = 0$) as can be seen from equation (9), and since the occupations are assumed to be complements, it follows that the cross derivatives are positive

$$\frac{\partial^2 \pi(w_1, w_2)}{\partial w_1 \partial w_2} = \frac{\partial^2 Y}{\partial L_1 \partial L_2} \frac{\partial L_1}{\partial w_1} \frac{\partial L_2}{\partial w_2} > 0.$$

For a maximum the Hessian matrix has to be negative semi-definite. Hence, the second derivative has to be non-positive, i.e.

$$\frac{\partial^2 \pi(w_1, w_2)}{\partial w_k^2} \leq 0.$$

The continuity result of lemma 1 implies that the second derivatives are strictly negative, since it rules out $dw_1^j / dw_2^j = 0$. Thus firm j, which posts a higher wage for occupation 1 than firm $j - 1$, also posts a higher wage for occupation 2. Since the relationship dw_1^j / dw_2^j is continuous due to the continuity of the derivatives, it implies that the proportion of firms $F_1\left(w_1^j\right)$ offering a wage no greater than w_1^j is the same as the proportion of firms $F_2\left(w_2^j\right)$ offering a wage no greater than w_2^j. Since these wages are set by the same firm j, it follows that $F_1\left(w_1^j\right) = F_2\left(w_2^j\right)$. ■

Each firm occupies the same position in the wage distribution for all occupations because each single firm faces an upward sloping labor supply curve for each occupation and in addition, because the cross derivative of the production function is assumed to be positive; this means that the two occupations are complements.[2] Thus, the cheapest way to increase output is to increase the size of both occupations simultaneously, which can only be done by increasing both wages simultaneously. The complementarity implies that it is optimal to increase the output along the support of both wage-offer distributions $f_a(¸_a)$.

This positive correlation between the wages of workers in different occupations within a single firm is well established empirically. Barth and Dale-Olsen (2003) find that "[h]igh-wage establishments for workers with higher education are high-wage establishments for workers with lower education as well".

The k-percent rule derived in proposition 1 also implies that one firm offers the reservation wage for all occupations. The equilibrium condition (8) defines the isoprofit curve that the firms have to be on. In particular the firm offering the reservation wage to both occupations must also earn the equilibrium profit, i.e. $9 = y(-^3_1[-^3_2) \quad ¸^3_1 -^3_1 \quad ¸^3_2 -^3_2$, where $-_a(¸^3_a \mid ¸^3_a[0)$ is defined by (9). Consider the example of firm $¬$ offering a wage schedule above the reservation wage. The k-percent rule, $f_1\left(¸^¬_1\right) = f_2\left(¸^¬_2\right)$ and the constant return to scale assumption allows for $f_a\left(¸^¬_a\right)$ to be factored out. Since this holds for any $¬$, the index can be dropped. Using the equilibrium condition, i.e. $9^3 = 9$, and rearranging, gives:

$$f_a(¸_a) = \left(\frac{. + 5_¦}{5_¦} \quad 1 \quad \sqrt{\frac{y(²_1[²_2) \quad ¸_1 ²_1 \quad ¸_2 ²_2}{y(²^3_1[²^3_2) \quad ¸^3_1 ²_1 \quad ¸^3_2 ²_2}} \right) \tag{10}$$

for both occupations. The following proposition solves for $f_a(¸_a)$ as a function of solely $¸_a$ and not of $¸_«$.

[2] A production function where inputs are independent is the same as assuming two different firms are operating in different labor markets. Furthermore, since all wages on the support of both occupation-specific wages offer distributions must promise the same profit in equilibrium, it follows that any combination of wages is an equilibrium.

Proposition 2 The closed form solutions for the unique wage offer distributions for each occupation $^a = 1[2$ is given by

$$f_a(¸_a) = \frac{. + 5_¦}{5_¦}\left(1 - \sqrt{\frac{`y\,(^2{}_1[\,^2{}_2)\,]`\,^2{}_a - ¸_a}{`y\,(^2{}_1[\,^2{}_2)\,]`\,^2{}_a - ¸^3_a}}\right). \qquad (11)$$

Proof: See appendix.

The explicit wage offer distribution for each single occupation resembles the distribution derived by Burdett and Mortensen (1998). The single wage offer distributions depend on the occupation-specific marginal product. Thus all occupations are linked by the production function.[3]

With the closed form solution for the wage offer distribution it is easy to calculate the reservation wage:

$$¸^3_a = \frac{(5_¶ - 5_¦)`y\,(^2{}_1[\,^2{}_2)\,]`\,^2{}_a}{. + 5_¶}. \qquad (12)$$

The occupation specific supremum wage can be derived from $f_a(\bar{¸}_a) = 1$.

4 Equilibrium Occupation Decision

Young individuals replace the retired. Before they enter the labor market as unemployed they have to choose an occupation. Since they are risk neutral, young workers compare the flow value of being unemployed across occupations and join the occupation with the highest expected value. Thus, in equilibrium all occupations must promise the same expected value of being unemployed.

Given the reservation wages and the wage-offer distributions, it is easy to compare the flow value of being unemployed across occupations. The value of

[3] The closed form solution to the wage offer distributions satisfies the FOC and SOC, as shown in the appendix.

being unemployed (4) can be written as follows

$$
\begin{aligned}
rU_i(\theta_i) &= \lambda \int_{\sigma_i} \left(\frac{1 - F_i(\varepsilon_i)}{r + \lambda(1 - F_i(\varepsilon_i))} \right) d\varepsilon_i - r c_i \qquad (13)\\
&= \frac{\lambda}{r + \lambda} \frac{\partial y(\theta_1, \theta_2)}{\partial \theta_i} - r c_i
\end{aligned}
$$

for all $i = 1, 2$.

The equilibrium occupation decision is given by an equilibrium in the labor market and a common value of being unemployed U as well as proportions (θ_1^*, θ_2^*) that satisfy

i) $U_i(\theta_i) = U$ for all $\theta_i = \theta_i^*$

$U_i(\theta_i) \leq U$ for all $\theta_i \neq \theta_i^*$

ii) $\theta_1^* + \theta_2^* = \alpha$

iii) $\theta_i^* \geq 0$ for all $i = 1, 2$.

Proposition 3 There exists a unique equilibrium occupation decision that maximises the equilibrium unemployment value U but encourages too few individuals to choose the high cost occupation compared with the first best.

Proof: see appendix.

The fact that young workers aim for the occupation with the highest marginal product and the diminishing marginal rate of return for a single occupation implies that the marginal products adjust to equate the values of unemployment across occupations. The positive cross derivatives guarantee that the equilibrium value has a unique maximum.

The marginal products adjust to compensate the young worker in expected terms for the cost of education c_i but also for losses in the expected unemployment period

$$
r(c_1 - c_2) = \frac{\lambda}{r + \lambda} \left(\frac{\partial y(\theta_1, \theta_2)}{\partial \theta_1} - \frac{\partial y(\theta_1, \theta_2)}{\partial \theta_2} \right) \qquad (14)
$$

Thus the di;erence between the marginal products is higher than in a world without frictions. Put di;erently fewer individuals than in a first best competitive environment are willing to choose the occupation with a higher cost of education. If labor market frictions vanish, i.e. $5_{¶}$ A Q, unemployment spells become negligible and thus the reservation wage converges to the marginal product. This implies that the wage distribution collapses to a mass point at the marginal product, which induces a first best education investment.

5 Search Frictions, Rents and the Shape of the Wage Distribution

5.1 Search rents and the compression of wages

Firms make positive profits as shown in the labor market equilibrium of section 3. Given that firms pay a wage below the marginal product, the question arises whether firms extract more search rent from occupations with a high cost of education or occupations with a low cost of education. We define the search rent going to the firm as the gap between the marginal product and the expected earnings of a worker in occuaption ª. The occupation-specific earnings distribution can be derived from the wage o;er distribution by using equations (4) and (5).

$$g_{ª}(¸_{ª}) = \frac{.}{5_{¦}} \left(s \frac{`y\,(^2{}_1[\,^2{}_2)\,]\,`\,^2{}_{ª} \quad ¸^3_{ª}}{`y\,(^2{}_1[\,^2{}_2)\,]\,`\,^2{}_{ª} \quad ¸_{ª}} \quad 1 \right) \tag{15}$$

Proposition 4 Firms extract more search rent from workers with a higher marginal product, i.e. from workers with higher education.

Proof. Integration and substitution of $\bar{¸}_{ª}$ and $¸^3_{ª}$ gives:

$$s_{ª} = \int_{¸^3_{ª}}^{\bar{¸}_{ª}} \left(\frac{`y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_{ª}} \quad ¸_{ª} \right) ¥ g_{ª}(¸_{ª}) = \frac{.}{.+5_{¶}} \frac{`y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_{ª}}$$

Thus, s_a increases with the marginal product. ■

Search frictions prevent workers from obtaining the full marginal product. The surplus of the expected match, i.e. the marginal product, is split according to the (un)employment rate. Workers get the expected proportion equivalent to the employment rate, which equals the value of being unemployed not considering the sunk cost of education. Firms get the fraction equal to the unemployment rate $¶_a$. Since unemployment and employment rates - that determine the split - are constant across occupations, firms extract more rent from the occupation with the higher marginal product and thus the higher cost of education.

Acemoglu and Pischke (1999) define a wage structure as compressed if the gap between the marginal product and the expected wage o;er rises for occupations with higher education cost. They argue that search and bargaining in a Pissarides environment leads to a compressed wage structure. Wage posting in an on-the-job search model can lead to a similar structure as stated in the following proposition.

Proposition 5 Wages of higher educated workers are more compressed than wages of lower educated workers.

Proof. Integration and substitution of $\bar{¸}_a$ and $¸_a^3$ gives:

$$c_a = \int_{¸_a^3}^{\bar{¸}_a} \left(\frac{`y\,(²_1[²_2)}{`²_a} ¸_a \right) ¥ f_a(¸_a) = \frac{1}{3} \frac{(. + 5_¦)^3 \quad .^3}{5_¦\,(. + 5_¦)\,(. + 5_¶)} \frac{`y\,(²_1[²_2)}{`²_a}$$

Thus, c_a increases with the marginal product and hence for workers with higher education cost. ■

Wage compression occurs if future employers are not able to extract the same rent from workers than the current employer. The simple fact that only a higher wage than the current wage induces a worker to change his employer implies that future employers can extract less search rent than the current employer. Since a firm's search rent is higher for higher educated workers, wage compression also increases with education.

The gap between the marginal product and the expected wage o;ers only closes if wage o;ers for unemployed arrive at an infinite rate. A higher o;er arrival rate of employed workers leads to a higher wage compression, because recruitment of employed workers becomes easier and o;ering a higher wages to attract more employed workers becomes therefore less attractive. The wage o;er distribution is therefore less steep leading to more compressed wage structure.

5.2 The shape of the wage o;er and earnings distribution

The following section presents a simulation exercise based on a Cobb-Douglas productions function with five occupations, which di;er in the cost of education. Assumed exogenously are the production factor ± = 500, the population size ® = 50, unemployment benefits £ = 50, the arrival rates $5_{¶}$ = 0:15 and $5_{¦}$ = 0:08, the separation rate . = 0:02 as well as the cost of education ¤ₐ and the production elasticites +ₐ. A natural assumption supported by many empirical studies is to let the production elasticity decrease while the cost of education increases (for a summary of the literature see Hamermesh 1996, chapter 3). The production function has the following form:

$$y\,(l) = \pm \prod_{a=1}^{5} -_a(\,¸_a\,|\,¸^3_a[\,f_a(\,¸_a))^{+_a},$$

where l represents the vector of the five occupation sizes $-_a(\,¸_a\,|\,¸^3_a[\,f_a(\,¸_a))$.

Table 1 presents the equilibrium occupation size 2^{t}_a, which is determined endogenously according to section 4. These determine the marginal products `º]`2_a, which in turn determine the reservation $¸^3_a$ and supremum wages $\bar{¸}_a$ according to the analysis given in section 3.

Table 1: Occupation size, reservation and supremum wages

	Occupations				
	1	2	3	4	5
Production elasticities α_i	0.45	0.30	0.10	0.10	0.05
Cost of education c_i	0	300	700	1800	3000
Occupation size m_i^*	25.2	15.3	4.7	4.0	1.7
Marginal products $\partial y / \partial m_i$	271.2	429.4	1379.0	1471.4	3434.3
Reservation wages w_i^r	79.7	82.5	86.2	96.5	107.7
Supremum wages $\bar{w}_i$	120.3	127.0	135.8	160.2	186.7

The equilibrium occupation-specific, wage-offer densities are increasing and convex as is the original wage offer density of the simple Burdett-Mortensen model:

$$f_i(w_i) = \frac{\delta + \lambda}{2\lambda} \sqrt{\frac{1}{\frac{\alpha_i}{m_i} y(q) - w_i^r}} \sqrt{\frac{1}{\frac{\alpha_i}{m_i} y(q) - w_i}}.$$

The aggregate density across all occupations is the weighted average of the individual densities, where the support of the individual densities starts at the respective reservation wage and ends with the supremum wage at different points:

$$f_{agg}(w) = \sum_{i=1} \frac{m_i}{M} f_i(w_i).$$

Figure 1 presents the simulation with five occupations. The density has five jumps at each occupation's reservation wage and five spikes, one at the supremum wage of each occupation.

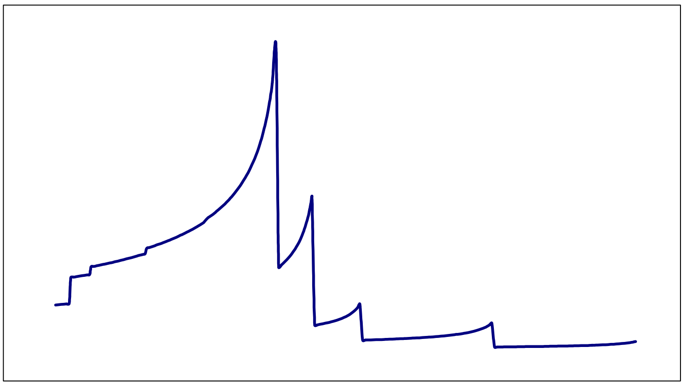

Figure 1: Density of aggregate wage offers

As the number of occupations increase, the aggregate density function mirrors more and more a right-tailed, wage-o;er density. The earnings density functions also have an increasing convex density, as can be easily verified from the cumulative distribution given in equation (15). Figure 2 shows the aggregate wage-earnings density analogue to Figure 1.

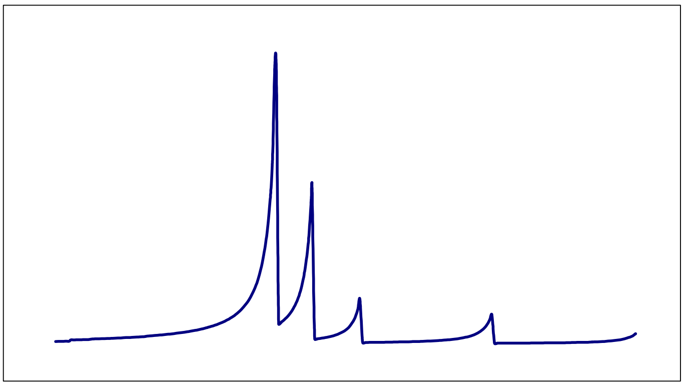

Figure 2: Density of aggregate wage earnings

6 Conclusion

This paper's extension of the Burdett-Mortensen (1998) model by introducing two di;erent occupations provides an explanation for the empirically observed positive correlation between the wages of workers in di;erent occupations within firms. The driving forces are the complementarity of the occupations in the production process and the local monopsony power of each firm that leads to an upward sloping labor supply curve for each occupation.

The result that firms occupy the same position in the wage distribution for each occupation allows us to solve for the explicit occupation-specific, wage-o;er distributions. Although the single, occupation-specific wage distributions have an increasing left-skewed density aggregation over all occupations, a spiky right-tailed density results when assuming that the production elasticities increase for occupations with a lower cost of education.

In the occupation-decision equilibrium, marginal products adjust to account for the di;erences in the cost of education and the degree of search frictions in the labor market. The di;erences in the marginal products are therefore higher than in a first best competitve environment. This wedge between the marginal products increases with the degree of market frictions. In addition, search frictions give each firm some local monopsony power, which the firm uses to extract some rent from its workers. This search rent depends on the degree of labor market frictions and is higher for high skilled workers. In addition, the gap between the marginal product and the expected wage o;ers increases for occupations with higher education costs. Thus, wages are compressed.

Appendix

Proof of Lemma 1:

Recall that -«(¸« | ¸³«[fª (¸«)) is only discontinuous at ¸« = ¸̂« if ¸̂« is a mass point of fª (¸«) and ¸̂« 5 ¸³«. Suppose there exists a mass point at ¸« = ¸̂«, then by o;ering a slightly higher wage than ¸̂« a firm could attract a significantly larger steady state labor force for this occupation «. This could generate a higher profit if the increase in total output, induced by this slight wage increase, is higher than the increase in total cost. The first thing to notice is that the increase in the wage is insignificant, since ¸« is continuous, whereas the increase in the labor force is significant, since -«(¸« | ¸³«[fª (¸«)) is discontinuous at the mass point. It follows that the increase in total cost is ¸« ¹ -« and the increase in total output is

$$¹ º = y (-ª[-« + ¹ -«) \quad y (-ª[-«) .$$

Using a first order Taylor-series-expansion around the initial occupation size -« gives

$$¹ º = \frac{` y}{` -«} ¹ -«.$$

Therefore, a deviation from the mass point at the wage ¸« is profitable as long as the marginal product exceed the wage:

$$¹ º \quad ¸« ¹ -« = µ \frac{` y}{` -ª} \quad ¸« ¶ ¹ -« ^ 0. \tag{16}$$

Given ` y ] ` -ª ^ ¸« it is optimal for each firm to deviate from any mass point (i.e. o;er a slightly higher wage). Since it is always possible to increase the wage by / ^ 0 such that the wage remains below the marginal product, it follows that no mass point exists. ` y ] ` -ª ^ ¸« is a necessary condition for firms to earn positive profits in equilibrium. The existence of an equlibrium with positive profits (given the Inada conditions) rules out any zero profits equilibrium and hence any equilibrium with mass points. ¥

Proof of Proposition 2:

Homogeneity of degree one implies, according to the Euler Theorem:

$$y\ (\text{-}_1[\text{-}_2) = \text{-}_1 \text{`} y\ (\text{-}_1[\text{-}_2)\ ]\text{`}\text{-}_1 + \text{-}_2 \text{`} y\ (\text{-}_1[\text{-}_2)\ ]\text{`}\text{-}_2.$$

The first order condition implies

$$\frac{\text{`}y}{\text{`}\text{-}_a} = \text{¸}_a \text{-}_a + \frac{\text{-}_a^2}{\text{`}\text{-}_a]\text{`}\,\text{¸}_a}.$$

Thus, the equal profit condition looks like the following:

$$\text{-}_a \text{`} y\ (\text{-}_1[\text{-}_2)\ ]\text{`}\text{-}_a \quad \text{¸}_a \text{-}_a + \frac{\text{-}_«^2}{\text{`}\text{-}_«]\text{`}\,\text{¸}_«} = \text{-}_a^3 \text{`} y\ (\text{-}_1^3[\text{-}_2^3)\ ]\text{`}\text{-}_a^3 \quad \text{¸}_a \text{-}_a^3 + \frac{\text{i}_{\ 3}\text{¢}_2\ \text{-}_«}{\text{`}\text{-}_«^3]\text{`}\,\text{¸}_«}.$$

Using the wage o;er distribution with the sum of wage payments (10) it is easy to show that $\text{-}_a^2]\,(\text{`}\text{-}_a]\text{`}\,\text{¸}_a)$ is equal to $y\ (\text{-}_1^3[\text{-}_2^3) \quad \text{¸}_1^3\text{-}_1^3 \quad \text{¸}_2^3\text{-}_2^3$ for any wage on the support of $f_a(\text{¸}_a)$. Substituting this result back into the equal profit condition, using the homogeneity of degree one property again and rearranging, gives:

$$\frac{\text{`}y\ (\text{-}_1[\text{-}_2)\ ]\text{`}\text{-}_a \quad \text{¸}_a}{\text{`}y\ (\text{-}_1^3[\text{-}_2^3)\ ]\text{`}\text{-}_a^3 \quad \text{¸}_a} = \frac{[.\ +5_{\text{¦}}(1 \quad f_a(\text{¸}_a))]^2}{(.\ +5_{\text{¦}})^2}.$$

The Euler theorem for a linearly homogenous production function also implies that the first derivatives of the production function are homogenous of degree zero, therefore

$$\frac{\text{`}y\ (^2{}_1[^2{}_2)\ ]\text{`}\,^2{}_a \quad \text{¸}_a}{\text{`}y\ (^{2\,3}_{\ 1}[^{2\,3}_{\ 2})\ ]\text{`}\,^{2\,3}_{\ a} \quad \text{¸}_a} = \frac{[.\ +5_{\text{¦}}(1 \quad f_a(\text{¸}_a))]^2}{(.\ +5_{\text{¦}})^2}.$$

Rearranging gives the equilibrium wage o;er distribution (11). ¥

The FOC and SOC hold with the equilibrium f$_a$(¸$_a$), **proof:**

First order condition:

$$\frac{`9(¸_1[¸_2)}{`¸_a} = \left(\frac{`y}{`-_a} \quad ¸_a \right) \frac{`-_a}{`f_a(¸_a)} f_a^0(¸_a) \quad -_a$$

Using the fact that

$$\frac{25_¦ f_a^0(¸_a)}{[. + 5_¦(1 \quad f_a(¸_a))]} = \frac{1}{(`y\ (^2{}_1[^2{}_2)\ ]`^2{}_a \quad ¸_a)}$$

and the homogeneity of degree zero property of the first derivative of the production function shows

$$\frac{`9(¸_1[¸_2)}{`¸_a} = \left(\frac{`y}{`^2{}_a} \quad ¸_a \right) \frac{25_¦ f_a^0(¸_a)}{[. + 5_¦(1 \quad f_a(¸_a))]} -_a \quad -_a = 0.$$

Second order condition:

Define: 9_{aa} 1 $\frac{`^2 9(¸_1[¸_2)}{`¸_a^2}$ and $9_{a«}$ 1 $\frac{`^2 9(¸_1[¸_2)}{`¸_a `¸_«}$

For the Hessian matrix to be negative semi-definite, it has to be the case that (i) 9_{aa} \ 0 and that the determinant of the (2 × 2) Hessian matrix has to be non-negative, (ii) $9_{11}9_{22} \quad 9_{12}9_{21} > 0$. The second derivative is given by:

$$\frac{`^2 9(¸_1[¸_2)}{`¸_a^2} = \left(\frac{`y}{`-_a} \quad ¸_a \right) \frac{`^2 -_a}{`¸_a^2} \quad 2\frac{`-_a}{`¸_a} + \frac{`^2 y}{`-_a^2} \left(\frac{`-_a}{`¸_a} \right)^2$$

Using the first order condition to substitute `y ]`-$_a$ ¸$_a$ out and recognizing after some calculations that

$$\frac{`^2 -_a}{`¸_a^2} = 2\frac{`-_a}{`¸_a}\frac{`-_a}{`¸_a}\frac{1}{-_a}$$

gives (i)

$$\frac{`^2 9(¸_1[¸_2)}{`¸_a^2} = \frac{`^2 y}{`-_a^2} \left(\frac{`-_a}{`¸_a} \right)^2 \quad \backslash\ 0.$$

The Euler theorem for a linearly homogenous production function also implies that the first derivatives of the production function are homogenous of degree zero, i.e.

$$-_1 \frac{`^2 y}{`-_1^2} + -_2 \frac{`^2 y}{`-_1 `-_2} = -_2 \frac{`^2 y}{`-_2^2} + -_1 \frac{`^2 y}{`-_1 `-_2} = 0,$$

which implies:

$$9_{11}9_{22} \quad 9_{12}9_{21} = µ \frac{`^2y}{`-_1^2}\frac{`^2y}{`-_2^2} \quad \frac{`^2y}{`-_1`-_2}\frac{`^2y}{`-_1`-_2} ¶ µ \frac{`-_1}{`¸_1}\frac{`-_2}{`¸_2} ¶_2$$

$$= µ \frac{`^2y}{`-_1^2}\frac{`^2y}{`-_2^2} \quad \frac{`^2y}{`-_1^2}\frac{`^2y}{`-_2^2} ¶ µ \frac{`-_1}{`¸_1}\frac{`-_2}{`¸_2} ¶_2 = 0.$$

¥

Proof of Proposition 3:

In the occupation decision equilibrium the two values of being unemployed (13) have to be equal, hence

$$.\,(¤_1 \quad ¤_2) = \frac{5_¶}{. + 5_¶} µ \frac{`y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_1} \quad \frac{`y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_2} ¶ .$$

This defines the implicit function $^2{}_1(^2{}_2)$. The implicit function theorem implies:

$$\frac{¥^2{}_1}{¥^2{}_2} = \frac{\frac{`^2y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_2`\,^2{}_1} \quad \frac{`^2y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_2^2}}{\frac{`^2y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_2`\,^2{}_1} \quad \frac{`^2y\,(^2{}_1[\,^2{}_2)}{`\,^2{}_1^2}} \wedge 0.$$

Hence $^2{}_«(^2{}_ª)$ is an increasing function with domain and range (0[Q). The occupation decision equilibrium also requires that summation condition $^2{}_1 + {}^2{}_2 =$ ® holds. The summation condition defines a decreasing function $^2{}_1(^2{}_2)$ with domain and range [0[®]. Thus there exists a unique equilibrium $(^2{}_1^t[\,^2{}_2^t)$, with $^2{}_1^t \wedge 0$ and $^2{}_2^t \wedge 0$.

Note also, that for $5_¶$ \ Q the di;erence in the marginal products are larger than compared with an environment without frictions, i.e. $5_¶$ A Q. ¥

References

Acemoglu D. and J.-S. Pischke, (1999), "The Structure of Wages and Investment in General Training", Journal of Political Economy 107, 539-572.

Albrecht J.W. and B. Axell, (1984), "An Equilibrium Model of Search Unemployment", Journal of Political Economy 92, 812-840.

Barth E. and H. Dale Olsen, (2002), "Employer Size or Skill-Group Size E;ect on Wages", mimeo, Institute for Social Research, Norway.

Barth E. and H. Dale Olsen, (2003), "Assortative Matching in the Labour Market", mimeo, Institute for Social Research, Norway.

Bontemps C., J.-M. Robin and G.J. van den Berg, (2000), "Equilibrium Search with Productivity Dispersion: Theory and Estimation", International Economic Review 41, 305-358.

Burdett K. and D.T. Mortensen, (1998), "Wage Di;erentials, Employer Size and Unemployment", International Economic Review 39, 257-273.

Hamermesh D. S., (1996), Labor Demand, Princeton, New Jersey, Princeton University Press.

Katz L. and L. Summers, (1989), "Industry Rents: Evidence and Implications", Brooklings Papers on Economic Activity: Microeconomics, 209-275.

Kiefer N.M. and G.R. Neumann, (1993), "Wage Dispersion with Homogeneity: The Empirical Equilibrium Search Model", in H. Bunzel et al., eds., Panel Data and labor market analysis, Amsterdam: North Holland.

Koning P., G. Ridder and G.J. van den Berg, (1995), "Structural and Frictional Unemployment in an Equilibrium Search Model with Heterogeneous Agents", Journal of Applied Economics 105, 133-151.

Kremer M., (1993), "The O-ring Theory of Economic Development", Quarterly Journal of Economics 108 (August), 551-575.

Mortensen D.T., (1990), "Equilibrium Wage Distribution: a Synthesis", in J.

Hartog et al., eds. Panel Data and Labor Market Studies , Amsterdam: North Holland.

Mortensen D.T. and G.R. Neuman, (1988), "Estimating Structural Models of Unemployment and Job Duration", in W.A., Barnett et al., eds., Dynamic Econometric Modelling, Proceedings of the Third International Symposium in Economic Theory and Econometrica Cambridge: Cambridge University Press.

van den Berg G.J. and G. Ridder, (1993), "On the Estimation of Equilibrium Search Models with Panel Data", in van Ours J.C. et al., eds. Labor Market Demand and Equilibrium Wage Formation, Amsterdam: North Holland.

van den Berg G.J. and G. Ridder, (1998), "An Empirical Equilibrium Search Model of the Labor Market", Econometrica 66, 1183-1221.

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