Economics Letters 147 (2016) 138–141

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Asymmetric information and search frictions: A neutrality result

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HIGHLIGHTS

- A job search model with asymmetric information is presented.
- Some but not all firms observe worker ability.
- Wage dispersion neutralizes the effect of asymmetric information.
- The full information outcome may be implementable.
- Implementability depends on market parameters.

ARTICLE INFO

Article history:
Received 14 May 2016
Received in revised form
27 August 2016
Accepted 27 August 2016
Available online 1 September 2016

JEL classification:
D82
D83
J31
J63

Keywords:
Asymmetric information
Human capital
Equilibrium search
Wage dispersion

ABSTRACT

This paper integrates asymmetric information between firms into a canonical model of on-the-job search. Workers are heterogeneous in ability, but not all employers observe a worker's type. Wage dispersion caused by search frictions makes the equilibrium wage distribution insensitive to informational asymmetries. Hence, the equilibrium outcome may be the same as when a worker's ability is known to every firm. The supportability of the full information outcome depends on market parameters related to productivity, knowledge, and search. The theoretical results elucidate an empirical puzzle about demographic differences in asymmetric information between employers.

1. Introduction

Informational frictions can have significant implications for the efficiency of labor markets and the equilibrium distribution of wages. A seminal paper by Stigler (1961) ascribes price dispersion to search frictions, and a classic article by Akerlof (1970) illustrates market failure from asymmetric information. Depending on how such mechanisms interact, there may be a role for government intervention to improve welfare. In some cases, adverse selection radically alters market outcomes. In others, informational imperfections may not constrain the attainable equilibria.

This paper studies asymmetric information between employers in a search model based on Burdett and Mortensen (1998). Workers differ in productivity, but only some firms can detect such variation. A necessary and sufficient condition is derived for the existence of an equilibrium achieving the full information outcome, which is the wage distribution that arises when all firms observe worker ability. This outcome is supportable because there exists a nonempty set of wages that are optimal for an employer to offer workers regardless of their types. When search is random, such a result can be obtained, even though no signaling or screening occurs, and workers are employed at both informed and uninformed firms in equilibrium.

The analysis contributes to research on asymmetric information in search models. Albrecht and Vroman (1992) demonstrate how private information causes the nonexistence of an equilibrium in symmetric pure strategies. Guerrieri et al. (2010) examine competitive search with adverse selection. Carrillo-Tudela and Kaas (2015) present a search model in which asymmetric information affects wages and mobility. The last paper considers only two types of workers and assumes that ability becomes contractible. By

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http://dx.doi.org/10.1016/j.econlet.2016.08.040
0165-1765/

contrast, ability is noncontractible in the current model, which accommodates an arbitrary number of worker types. Moreover, the neutrality result derived here is novel to the literature. The implementability of the full information outcome is an important question in mechanism design and contract theory.

The findings also illuminate a puzzle in empirical studies. Schönberg (2007) detects asymmetric information between employers of college graduates but not less educated workers. Likewise, Hu and Taber (2011) observe adverse selection in the labor market for white males but not women or blacks. The model here can generate differential evidence of asymmetric information across groups with dissimilar search parameters. In a population with high unemployment due to a low offer arrival rate or a high job destruction rate, informational asymmetries may not affect the equilibrium wage distribution. In the opposite situation, the full information outcome may not be supportable.

2. Model

The labor market comprises a continuum of agents in continuous time. The measures of firms and workers are respectively 1 and $m > 0$. Unemployed and employed workers receive the respective flow payoffs $b \geq 0$ and $w \geq 0$, where b and w correspond to the unemployment benefit and the current wage. The arrival of job offers to workers follows a Poisson process with rate parameter $\lambda > 0$. An employed searcher accepts an offer if and only if it exceeds the current wage, and an unemployed individual accepts a job if and only if it pays at least b. Matches between workers and firms are destroyed at Poisson rate $\delta > 0$, in which case a worker transits from employment to unemployment.

Workers vary in general ability. There is a finite number $N > 1$ of worker types, indexed by the set $S = \{1, 2, \dots, N\}$. Let $m_i > 0$ signify the measure of type i workers, where $\sum_{i=1}^{N} m_i = m$. Let $\theta_i > b$ denote the flow of output produced by a type i worker, where $\theta_1 < \theta_2 < \cdots < \theta_N$. Define $\theta^l = \theta_1$ and $\theta^u = \theta_N$.

Firms differ in information about workers.[1] Letting $p \in [0, 1]$, a fraction p of employers are informed I, and a fraction $1 - p$ are uninformed O. An informed firm observes a worker's ability and offers a wage w_i contingent on worker type. An uninformed firm does not know a worker's productivity and posts a wage w_O irrespective of worker type. The wage offered by an employer to a worker is constant over time.[2]

Let H_i represent the distribution of wages that type I firms offer to workers of type $i \in S$. Denote the collection $\{H_1, H_2, \dots, H_N\}$ by C_I. Let H_O be the distribution of wage offers across type O employers. Accordingly, type i workers sample wage offers from $F_i = pH_i + (1-p)H_O$, which is the distribution of all wages offered to type i workers. In addition, define $F_i(\omega^-) = \lim_{\upsilon \uparrow \omega} F_i(\upsilon)$ for $\omega > 0$, and let $F_i(0^-) = 0$.

Several properties of a steady state can now be described.[3] Equating the flows into and out of employment, the fraction of workers unemployed is:

$$u_i = \frac{\delta}{\delta + \lambda[1 - F_i(b^-)]}. \tag{1}$$

[1] Firms might vary in the screening and monitoring of workers. See Mansour (2012) for an analysis of occupational differences in employer learning.

[2] Burdett and Coles (2003) as well as Stevens (2004) examine wage contracts that depend on tenure.

[3] The ensuing formulae for the unemployment rate, wage distribution, and employment level correspond to equations (7), (9), (10) in Burdett and Mortensen (1998), who provide more details regarding their derivation.

The distribution of wages across employed workers of type $i \in S$ can be expressed as follows for $w \in \mathbb{R}_+$:

$$G_i(w) = \frac{\delta[F_i(w) - F_i(b^-)]}{[1 - F_i(b^-)]\{\delta + \lambda[1 - F_i(w)]\}}, \tag{2}$$

which is obtained by equating the flow of workers from unemployment into jobs paying no more than w with the flow from such jobs into unemployment or higher paying jobs. Let $\ell_i(w|H_O, H_i)$ denote the measure of type $i \in S$ workers employed at a firm offering them a wage $w \in \mathbb{R}_+$. Equating the flow of workers recruited to and separating from an employer paying w, the following holds for $w \geq b$:

$$\ell_i(w|H_O, H_i) = \frac{\delta \lambda m_i}{\{\delta + \lambda[1 - F_i(w)]\}\{\delta + \lambda[1 - F_i(w^-)]\}}, \tag{3}$$

and $\ell_i(w|H_O, H_i) = 0$ for $w < b$.

The payoff functions are next specified in steady state. The profit flow from type $i \in S$ workers employed at a firm paying them a wage $w \in \mathbb{R}_+$ is:

$$\pi_i(w|H_O, H_i) = (\theta_i - w)\ell_i(w|H_O, H_i). \tag{4}$$

The profit of a type O firm offering the wage w_O to each worker is:

$$\Pi_O(w_O|H_O, C_I) = \sum_{i=1}^{N} \pi_i(w_O|H_O, H_i). \tag{5}$$

The profit of a type I firm posting the wage vector $v_I = (w_1, w_2, \dots, w_N)$ is:

$$\Pi_I(v_I|H_O, C_I) = \sum_{i=1}^{N} \pi_i(w_i|H_O, H_i), \tag{6}$$

where w_i is the wage paid by the firm to any worker of type $i \in S$.

3. Equilibrium

Employers make wage offers so as to maximize their profits in steady state, given the distribution of wages across workers of each type. An uninformed employer is constrained to post a uniform wage, whereas an informed employer may condition the wage on worker type. Formally, an equilibrium consists of a wage offer distribution H_O for type O firms and a collection $C_I = \{H_1, H_2, \dots, H_N\}$ of wage offer distributions for type I firms such that: $w_O \in \operatorname{argmax}_{w \in \mathbb{R}_+} \Pi_O(w|H_O, C_I)$ for all w_O in the support of H_O; $v_I = (w_1, w_2, \dots, w_N) \in \operatorname{argmax}_{v \in \mathbb{R}_+^N} \Pi_I(v|H_O, C_I)$ if w_i is in the support of H_i for all $i \in S$.

Suppose that all employers observe worker ability, in which case $p = 1$ representing full information. The resulting model is analytically equivalent to Burdett and Mortensen (1998), who derive a unique equilibrium outcome. From their equation (16), the equilibrium distribution of all wages offered to type $i \in S$ workers is as follows for $w \in (w_i^l, w_i^u)$:

$$K_i(w) = \frac{\delta + \lambda}{\lambda}\left(1 - \sqrt{\frac{\theta_i - w}{\theta_i - b}}\right), \tag{7}$$

where $K_i(w) = 0$ for $w \leq w_i^l$, $K_i(w) = 1$ for $w \geq w_i^u$, and the infimum and supremum of the support are respectively $w_i^l = b$ and

$$w_i^u = \theta_i - (\theta_i - b)\left(\frac{\delta}{\delta + \lambda}\right)^2. \tag{8}$$

Now let $p \in [0, 1]$. An equilibrium (H_O, C_I) is said to achieve the full information outcome if and only if $pH_i(w) + (1-p)H_O(w) = K_i(w)$ for all $w \in \mathbb{R}_+$ and any $i \in S$. That is, the distribution of all wages offered to workers of each type is the same as when every firm is informed about worker type.