AN EMPIRICAL EQUILIBRIUM SEARCH MODEL OF THE LABOR MARKET
Van den Berg and Ridder (1998)

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Overview

Literature review

- "Economics of information and job search" by McCall (1970)
- Equilibrium search models:
  - Albrecht and Axell (1984)
  - Burdett and Mortensen (1998)
- Empirical analyses:
  - Eckstein and Wolpin (1990)
  - Van den Berg and Ridder (1998)

Equilibrium Search Models

- The reservation wage property
- Labor market search model as the outcome of optimal choices by both workers and employers
- The wage offer distribution is endogenous
- A dispersed wage offer distribution as a result of a dispersed distribution of reservation wage
- Differences:
  - In AA model job-to-job transitions or layoffs are not allowed
  - AA model require the unemployed to be heterogeneous in order to obtain a dispersed wage offer distribution

Possibility of on the job search in BM model

- Optimal search strategy of unemployed job seekers
- The reservation wage for an employed job seeker
- Wage offer distribution is dispersed even if all workers and firms are identical
- Explicit solution for the equilibrium wage offer and earning distributions

Heterogeneity

- EW(1990)
  - Single labor market
  - Unobserved differences in the value of leisure between workers
  - Unobserved differences in productivity between firms
  - No observed differences
  - Allows for within market heterogeneity
- VR(1998)
  - A large number of segments in labor market
  - All workers and firms are identical in each segment
  - Observed differences in age, educational level, occupational level of the workers and jobs
  - Unobserved differences in the productivity of the jobs or other characteristics of the segments
  - Allows for between-market heterogeneity

Estimation, Data, Results

- Maximum likelihood method
- Panel data of unemployed and employed individuals in The Netherlands in the eighties
- On average, the arrival rate of job offers is only slightly larger when employed
- A small number of observed personal characteristics is sufficient to capture the heterogeneity in arrival and separation rates, but insufficient to capture heterogeneity in the productivity of firms
- Contrary to EW(1990) they find that a relatively small fraction of wage variation is explained by measurement error and that about a fifth is pure wage variation as generated by the presence of search frictions

Model

- There are continua of workers and firms with measures m and 1, respectively
- λ_0 and λ_1 are job offers arrival rates for unemployed and employed workers
- A job offer is an i.i.d. drawing from a wage offer distribution with c.d.f. F(w)
- δ is matches break up rate
- Utility flow of being unemployed is b
- Firms have a linear production function with the marginal revenue product of p
- The mandatory minimum wage is $\underline{w}_L$

Model

$$r = b + (\lambda_0 - \lambda_1) \int_r^{\infty} \frac{\bar{F}(w)}{\delta + \lambda_1 \bar{F}(w)}\, dw \qquad \text{with } \bar{F} = 1 - F.$$

$$G(w) = \frac{F(w)}{\delta + \lambda_1 \bar{F}(w)} \cdot \frac{\lambda_0 u}{(m-u)}.$$

Outflow:

$$\lambda_1 \bar{F}(w) G(w)(m-u)$$

$$\delta G(w) \cdot (m-u)$$

Inflow:

$$\lambda_0 (F(w) - F(r)) u$$

Model

$$\frac{u}{m} = \frac{\delta}{\delta + \lambda_0}.$$

The measure of individuals earning a wage w equals g(w)(m - u)dw, and the measure of firms offering a wage w equals f(w)dw.

$$l(w;r,F) = \frac{g(w)dw}{f(w)dw}(m-u) = \frac{m\lambda_0\delta(\delta+\lambda_1)}{(\delta+\lambda_0)\left(\delta+\lambda_1\overline{F}(w)\right)^2} \quad \text{on } [\underline{w},\overline{w}].$$

Model (Production)

$$F(w) = \frac{\delta + \lambda_1}{\lambda_1} \cdot \left(1 - \sqrt{\frac{p - w}{p - \underline{w}}}\right) \qquad \text{on} \quad [\underline{w}, \overline{w}]$$

$$f(w) = \frac{\delta + \lambda_1}{2\lambda_1\sqrt{p - \underline{w}}} \cdot \frac{1}{\sqrt{p - w}} \qquad \text{on} \quad [\underline{w}, \overline{w}].$$

$$r = \frac{(\delta + \lambda_1)^2 \cdot b + (\lambda_0 - \lambda_1)\lambda_1 \cdot p + \delta_0(\lambda_0 - \lambda_1) \cdot \underline{w}_L}{(\delta + \lambda_0)(\delta + \lambda_1)} \qquad \text{if} \quad r < \underline{w}_L,$$

$$r = \frac{(\delta + \lambda_1)^2 \cdot b + (\lambda_0 - \lambda_1)\lambda_1 \cdot p}{(\delta + \lambda_1)^2 + (\lambda_0 - \lambda_1)\lambda_1} \qquad \text{if} \quad r \geq \underline{w}_L,$$

$$\overline{w} = \left(\frac{\delta}{\delta + \lambda_1}\right)^2 \cdot \underline{w} + \left(1 - \left(\frac{\delta}{\delta + \lambda_1}\right)^2\right) \cdot p.$$

Model (Productivity)

$$g(w) = \frac{\delta\sqrt{p - \underline{w}}}{2\lambda_1} \cdot \frac{1}{(p - w)^{3/2}} \qquad \text{on} \quad [\underline{w}, \overline{w}].$$

Given an arbitrary transformation of w, $y = \frac{p-w}{p-\underline{w}}$, the excess wage equation is $w - \underline{w} = (1 - y)(p - \underline{w})$. ($\eta = \frac{\delta}{\delta+\lambda_1}$)
$\frac{\lambda_1}{\delta}$: expected number of wage offers during a spell of employment

$$f_y(y) = \frac{1}{2(1-\eta)} y^{-1/2}, \qquad \eta^2 \leq y \leq 1,$$

$$g_y(y) = \frac{\eta}{2(1-\eta)} y^{-3/2}, \qquad \eta^2 \leq y \leq 1,$$

The Likelihood Function

- The probability of being unemployed at a randomly chosen date : $\frac{\delta}{\delta+\lambda_0}$
- The elapsed unemployment duration t_{0b} and the residual unemployment duration t_{0f} are i.i.d. and have an exponential distribution with parameter λ_0
- d_{0b} denote a dummy that is one if it is only known that the elapsed duration exceeds a certain value, i.e. is right-censored, and zero otherwise
- d_{0f} is for residual duration

$$\mathscr{L}_0 = \frac{\delta}{\delta + \lambda_0} \cdot \lambda_0^{1-d_{0b}+1-d_{0f}} \cdot \exp(-\lambda_0(t_{0b} + t_{0f})).$$

The Likelihood Function

- The job duration t_1 has an exponential distribution with parameter $\delta + \lambda_1 \bar{F}(w)$
- Exit into unemployment occurs with probability $\frac{\delta}{\delta+\lambda_1 \bar{F}(w)}$ and exit into another job with probability $\frac{\lambda_1 \bar{F}(w)}{\delta+\lambda_1 \bar{F}(w)}$
- Measurement errors in the wage data is represented by ϵ. The observed wage $\tilde{w}$ equals the true wage w times an error term ϵ
- d_1=1 if $\tilde{w}$ is missing and zero otherwise
- If $d_{0f} = 1$ or $d_1 = 1$, then we do not follow the individual any further
- $d_2 = 1$ if t_1 is right-censored and zero otherwise
- $d_3 = 1$ if the destination following exit out of the job is unknown and zero otherwise
- $d_4 = 1$ if the destination is another job and zero if the destination is unemployment

The Likelihood Function

$$\mathscr{L}_1 = f(w) \cdot \exp(-(\delta + \lambda_1 \bar{F}(w)) \cdot t_1) \cdot (\delta + \lambda_1 \bar{F}(w))^{d_3(1-d_2)}$$
$$\cdot (\lambda_1 \bar{F}(w))^{d_4(1-d_2)(1-d_3)} \cdot \delta^{(1-d_4)(1-d_3)(1-d_2)}$$

The total individual likelihood contribution for a respondent who is unemployed at the date of the first interview equals

$$\mathscr{L}_0 \cdot \mathscr{L}_1^{(1-d_{0f})(1-d_1)}.$$

The Likelihood Function

- The probability of being employed at a randomly chosen date equals $\frac{\lambda_0}{\delta+\lambda_0}$
- $d_5 = 1$ if $\tilde{w}$ is unobserved, and zero otherwise
- The elapsed job duration t_{1b} and the residual job duration t_{1f} are i.i.d. and have an exponential distribution with parameter $\delta + \lambda_1 \bar{F}(w1)$
- d_{6b} denote a dummy that is one if it is only known that the elapsed duration exceeds a certain value, i.e. is right-censored, and zero otherwise. d_{6f} is for residual duration
- $d_7 = 1$ if the destination following exit out of the job is unknown and zero otherwise
- $d_8 = 1$ if the destination is another job and zero if it is unemployment
- $d_0 = 1$ if t_0, unemployment duration, is right-censored, and zero otherwise
- Dummy variables d_{10}, d_{11}, d_{12}, and d_{13} indicate whether w_2 is unobserved, whether t_2 is right-censored, whether the destination state is unobserved, and whether the destination state is another job, respectively.

$$
\begin{aligned}
\mathscr{L} = {} & \frac{\lambda_0}{\delta+\lambda_0} \cdot g(w_1) \cdot (\delta + \lambda_1 \bar{F}(w_1))^{1-d_{6b}} \cdot \exp(-(\delta + \lambda_1 \bar{F}(w_1)) \cdot (t_{1b} + t_{1f})) \\
& \cdot (\delta + \lambda_1 \bar{F}(w_1))^{d_7(1-d_{6f})} \cdot [\, \delta \cdot \lambda_0^{(1-d_9)} \cdot \exp(-\lambda_0 t_0)]^{(1-d_8)(1-d_7)(1-d_{6f})} \\
& \cdot \Bigg[\lambda_1 \bar{F}(w_1) \cdot \Bigg[\frac{f(w_2)}{\bar{F}(w_1)} \cdot (\delta + \lambda_1 \bar{F}(w_2))^{d_{12}(1-d_{11})} \\
& \qquad \cdot \exp(-(\delta + \lambda_1 \bar{F}(w_2)) \cdot t_2) \cdot \delta^{(1-d_{13})(1-d_{12})(1-d_{11})} \\
& \qquad \cdot (\lambda_1 \bar{F}(w_2))^{d_{13}(1-d_{12})(1-d_{11})} \Bigg]^{(1-d_{10})} \Bigg]^{d_8(1-d_7)(1-d_{6f})}
\end{aligned}
$$

Heterogeneity

- Separate labor markets as different segments of the labor market, for different types of individuals and firms
- The deep structural parameters in the model (p, λ_0, λ_1, and δ) do not vary over the different labor markets significantly
- x is the vector of age, education, and occupation dummies (and a constant). We assume that p, λ_0, λ_1, and δ are log-linear functions of x

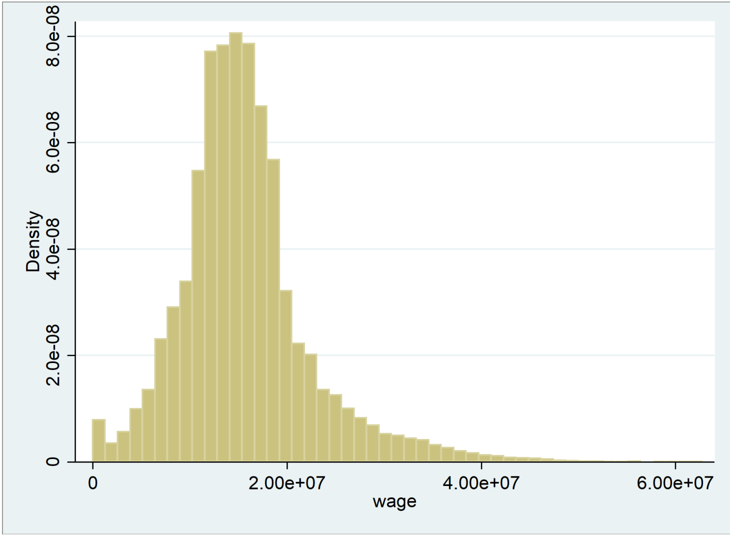
$$p = \exp(\beta_1' x), \qquad \lambda_0 = \exp(\beta_2' x),$$
$$\lambda_1 = \exp(\beta_3' x), \qquad \delta = \exp(\beta_4' x).$$

In order to capture unobserved heterogeneity, p is represented by $p = v \cdot exp(\beta_1' x)$ that v has a discrete distribution with a finite number of unknown points of support.

Data

- Labor Force Survey(LFS) data of Iran's labor market
- Household Budget Survey(HBS) data of Iran's population

Data



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6.0e-08
4.0e-08
2.0e-08
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Density
0
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Data

Unemployed _t1	Period 1	2	Total
0	59,675	27,845	87,520
1	10,780	2,140	12,920
Total	70,455	29,985	100,440

Unemployed _t1	Unemployed_t2 0	1	Total
0	25,587	2,258	27,845
1	2,140	0	2,140
Total	27,727	2,258	29,985

Thank you for your attention.
Any questions?