A Tractable Equilibrium Search Model with Experience Accumulation

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ABSTRACT

We present an equilibrium search model of individual labor market careers with human capital accumulation, employer heterogeneity and individual level shocks. The model is estimated on Danish matched employer-employee data. We seek to quantify the roles of human capital and job search in shaping individual earnings over the life cycle. The structural model decompose wage growth into contributions from human capital and from job search, within and between jobs. We find that job-search-related within-job effects dominates between-job effects. Human capital is quantitatively more important for wage growth vis-á-vis job search early in workers' careers, and is more important for high-skilled workers.

1. MODEL OUTLINE

Production: A worker-firm match produces Y_t:

$$Y_t = PH_t \Leftrightarrow y_t = p + h_t$$

where $p = \ln P$ is a *firm-specific* component and where $h_t = \ln H_t$ is the worker's human capital.

Human capital:

$$h_t = \alpha + g_t + \varepsilon_t$$

where α is a *worker-specific* component, g_t captures *experience accumulation* and ε_t is an individual specific AR(1) *productivity shock*.

Transitions (per-period probabilities):

Retirement/attrition: μ

Job destruction (if employed): δ

Job offer (if employed): λ_1

Job offer (if unemployed): λ_0

Alternative employers have type: $p' \sim F(\cdot)$

Wage contracts: Piece-rate contracts, i.e.

$$w_t = \ln(RY_t) = r + p + h_t$$

where r is the *endogenous* log piece-rate.

$E_tV(r, h_t, p)$ is expected value of employment in type-p firm with piece-rate r to a worker with human capital h_t w.r.t. information available in period t.

Piece-rate $R = 1 \Leftrightarrow r = 0$ is the *best* contract a worker can obtain. Hence, the highest value a type-p firm can offer is $E_tV(0, h_t, p)$

Definition: $q = q(r, h_t, p)$ is the minimum firm-type required to offer the worker an improvement in employment value. That is, q solves

$$\underbrace{E_tV(r, h_t, p)}_{\text{Current value in type-}p\text{ firm}} = \underbrace{E_tV(0, h_t, q)}_{\text{Type-}q\text{ firm's best offer}}$$

2. WAGE SETTING

Consider a worker with human capital h_t who are employed in a type type-p firm who are approached by a type-p' firm. The two firms *Bertrand compete* for the worker's services.

Outcome of the game (3 possibilities):

1. $p' > p \Rightarrow$ worker moves to poaching employer (type-p') where s/he is offered contract r' s.t.

$$\underbrace{E_tV(r', h_t, p')}_{\text{Poacher's offer}} = \underbrace{E_tV(0, h_t, p)}_{\text{Incumbent's best offer}}$$

2. $p > p' > q \Rightarrow$ worker remains employed at the current employer (type-p), but the worker's contract (piece-rate) is improved to $\tilde{r}$ s.t.

$$\underbrace{E_tV(\tilde{r}, h_t, p)}_{\text{Updated value at incumbent}} = \underbrace{E_tV(0, h_t, p')}_{\text{Poacher's best offer}}$$

3. $p' < q \Rightarrow$ worker remains at current employer. Poaching firm (type-p') is not productive enough to improve the worker's current contract since

$$\underbrace{E_tV(r, h_t, p)}_{\text{Current value in }p\text{-firm}} > \underbrace{E_tV(0, h_t, p')}_{\text{Poacher's best offer}}$$

The wage equation: Working out the value fcts one arrive at the following wage equation (i index workers, $J(i,t)$ maps workers into firms):

$$w_{it} = \underbrace{p_{J(i,t)} + \overbrace{\alpha_i + g_t + \varepsilon_{it}}^{h_{it}}}_{y_{J(i,t)}} - \overbrace{\int_{q_{it}}^{p_{J(i,t)}} \left[1 + \frac{\lambda_1(1-F(x))}{\rho + \mu + \delta}\right] dx}^{r_{it}:\text{ log piece rate}}$$

where ρ is the discount rate.

3. DATA

- Danish MEE (firm+worker IDs) data 1986-99.
- Wages (av. hourly wage in job held in Nov.),
- Labor market states (weekly basis): E, U or N
- Experience is *actual* experience.
- Select: Males, age < 51, experience > 5 years.
- Stratify on education (9-11, 12, 13-18 years).

4. INDIRECT INFERENCE

Let θ be the stuctural parameter with true value θ_0

Step 1: Estimate *auxiliary* models on the data, [producing a vector of real moments $\beta^{real} = \beta^{real}(\theta_0)$]

Step 2: Simulate the structural model for given θ and estimate same *auxiliary* models on sim. data [producing a vector of sim. moments $\beta^{sim} = \beta^{sim}(\theta)$]

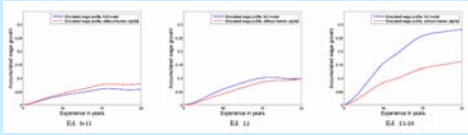
Step 3: Find θ that minimize $DIST(\beta^{sim}(\theta), \beta^{real}(\theta_0))$

Parameters of *reduced form* models as moments:

- Duration model (Burdett and Mortensen, 1998)
- Wage eq. w/ 2-sided het. (Abowd et al 1999)
- Wage-growth eq. (within-job diff'ed wage eq.)

5. RESULTS

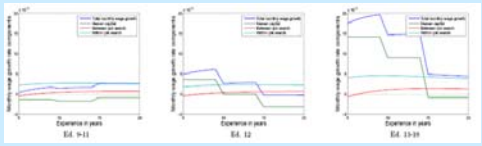
Counter-factual analysis: Eliminating human capital accumulation.



Wage growth decomposition: The structural wage equation admits the a decomposition of period by period wage growth:

$$\underbrace{E[w_{t+1} - w_t \mid p_t, q_t, t]}_{\text{Period-to-period total wage growth}} = \underbrace{E[h_{t+1} - h_t \mid t]}_{\text{human capital}}$$
$$\underbrace{- \tilde{\lambda}_1 \int_{p_t}^{\infty} f(x) \int_{p_t}^{x} \frac{\lambda_1(1-F(z))}{\rho + \mu + \delta} dz dx}_{\text{search, between job spells}}$$
$$\underbrace{+ \tilde{\lambda}_1 \int_{q_t}^{p_t} \left[1 + \frac{\lambda_1(1-F(x))}{\rho + \mu + \delta}\right] dx}_{\text{search, within job spells}}$$

where $\tilde{\lambda}_1$ is a fct. of the transition parameters. Using the estimated model we obtain the following decomposition of monthly wage growth:



6. CONCLUSION

Monthly wage growth can be decomposed into

- Human capital effects
- Between job effects due to job search
- Within-job effects due to job search

Our structural model encompasses standard reduced form models of wage growth and dynamics, and we find that

- Human capital is more important in the beginning of workers' careers.
- Human capital's importance for wage growth is increasing in education.
- Within-job search effects dominates between-job search effects.

Present shortcoming: We face some difficulties in fitting job-to-job transitions.

Work in progress: We are currently working on incorporating data on firm productivity and estimating the model on a longer panel with more frequent wage observations.