Risk and Return Trade-Offs in Lifetime Earnings, Journal of Labor Economics, 2018

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1. A Life-Cycle Model of Career Choices and Earnings

I model a labor market with search frictions in which jobs are differentiated by occupation and workers face multiple sources of earnings risk from shocks to wages and the possibility of job destruction. Unemployed workers receive job offers from all occupations and may choose to accept an offer that involves a change in occupation from their previous work. I do not include an out-of-the-labor-force state in which people neither work nor search for work. Workers are risk averse and can borrow and save to smooth over earnings fluctuations. My aim is to model working life parsimoniously while still capturing the major sources of lifetime earnings uncertainty and allowing workers to mitigate negative wage shocks through occupational mobility.

All variations in earnings and earnings uncertainty in this model come at the occupation level, with no distinction between different employers or industries within an occupation.

In the model, workers are assigned a starting occupation, although they may later transition to other occupations. In reality, workers also choose their starting occupations. These choices by risk-averse workers drive the relationship between riskiness and expected earnings, although the sorting of workers who are more risk tolerant into higher-risk occupations will also mute any observed compensating wage differential for additional risk. The aim of this working model is not to re-create this initial choice but rather to capture average earnings and earnings risk conditional on first occupation. Without incorporating differences across occupations in the cost of initial training, the arduousness of the work, and other factors, workers in my model would all flock to the highest-paying professions. While in my simulations, as in life, workers from lower-paying occupations are more likely to eventually change occupations, I prevent wholesale herding into a few occupations by making search costly and by matching the distribution of new offers for workers in each occupation to observed transition rates between occupations.

*This note is written in my MPhil period at the University of Oxford.

1.1. Wages

The expected wage of a worker i employed at time t in occupation $k_{it} \in \{1,\ldots,K\}$ depends on his total labor market experience, x_{it}; his tenure in his current occupation, τ_{ikt}; and his age, s_{it}. Realized wages, W_{ikt}, depend on these observed characteristics; fixed effects for the worker, η_i, and his current occupation, μ_k; and four stochastic components:

$$\log(W_{ikt}) = \mu_k + \eta_i + \phi(x_{it}, s_{it}) + \psi_k(\tau_{ikt}) + \alpha_{ik} + \varepsilon_{kt} + \zeta_{it} + \xi_{it}. \tag{1}$$

The effects of occupation tenure differ by occupation. This variation and the occupation fixed effect generate differences in expected wages across occupations.

On starting in a new occupation, workers draw a match quality, $\alpha_{ik} \sim N\big(-\frac{1}{2}\sigma_\alpha^2, \sigma_\alpha^2\big)$, that remains fixed during their time in that occupation. The distribution of match is the same across occupations and individuals. This worker-occupation match captures an additional level of uncertainty about untried occupations and will generate some churning in the early periods of working life as workers who are poorly matched with their starting occupations quit and search elsewhere.

Wages for all workers in occupation k at time t depend on an $AR(1)$ component, ε_{kt}, with occupation-specific persistence ρ_k and innovation $e_{kt} \sim N\big(-\frac{1}{2}\sigma_{ke}^2, \sigma_{ke}^2\big)$:

$$\varepsilon_{kt} = \rho_k \varepsilon_{k,t-1} + e_{kt}. \tag{2}$$

This shock captures fluctuations in productivity or demand that affect all workers in each occupation. Workers can escape negative occupation shocks by searching for work in other occupations. I do not separately model a fully macroeconomic shock, so business cycle variations will be captured in this occupation-level shock [1].

Workers also experience idiosyncratic and fully permanent shocks:

$$\zeta_{it} = \zeta_{i,t-1} + u_{it}. \tag{3}$$

While the variance of this idiosyncratic shock is also occupation specific, $u_{it} \sim N\big(-\frac{1}{2}\sigma_{ku}^2, \sigma_{ku}^2\big)$, workers carry their current level of this stochastic component between occupations, so they cannot escape negative shocks through occupation changes. Carrying this component across occupations makes sense if it consists mainly of general skills and physical capacity or if a worker's most recent wage affects his bargaining power at his next job.

Finally, employed workers experience a transitory wage shock with occupation-specific variance, $\xi_{it} \sim N\Big(-\frac{1}{2}\sigma_{k\xi}^2, \sigma_{k\xi}^2\Big)$. Idiosyncratic permanent and transitory shocks, occupation shocks, and match quality are all independent of one another.

[1] Estimating the degree to which these occupation shocks covary with each other or with a macro business cycle shock is beyond the scope of this paper but would be a valuable extension for future work.

1.2. Employment and Earnings

Individuals live for L periods and may work for the first T of them. In the estimation, each period is a quarter, and I set $L = 160$ and $T = 120$. Prior to the first working period, $t = 0$, individuals receive a starting occupation. In the first working period, $t = 1$, all individuals are employed in that occupation and learn and receive their starting wage. This framework for the start of working life resembles a world where individuals sort into careers while still in school and have a position lined up by the time they are ready to begin work.

In all subsequent working periods, employed workers face an occupation-specific probability $0 \le \delta_k \le 1$ of losing their job and entering unemployment. To greatly ease the computational burden I do not allow workers to receive outside job offers while working, but workers may quit if they wish to search for work in other occupations. Unemployed workers who were most recently employed in occupation k receive a job offer from their current occupation with per-period probability $0 \le \lambda_{ck} \le 1$ and from a new occupation with probability $0 \le \lambda_{nk} \le 1 - \lambda_{ck}$. The per-period probability that a worker most recently employed in occupation k receives an offer from a new occupation k' is defined as $\lambda_{kk'}$, where $\sum_{k' \neq k} \lambda_{kk'} = \lambda_{nk}$. Unemployed workers may choose to accept an offer if they receive one or remain unemployed.

When not employed, workers receive a fraction, b, of their wage. This estimated fraction of wages captures both monetary unemployment benefits and the monetary equivalent of other benefits of not working. Earnings therefore depend on employment status, $N_{it} \in \{0, 1\}$, and are given by

$$Y_{ikt} = \begin{cases} W_{ikt} & N_{it} = 1, \\ bW_{ikt} & N_{it} = 0 \end{cases} \tag{4}$$

Expected wages for unemployed workers, in their current occupation, continue to be affected by the aggregate wage shocks of their most recent occupation, ε_{kt}, but they do not experience further idiosyncratic shocks. The first assumption reflects the interpretation of ε_{kt} as occupation-wide variations in potential worker productivity, the evolution of which does not depend on the employment status of one worker. The second assumption reflects the idea that many of these individual shocks come from new skills learned or capacities lost while working and should therefore not evolve during unemployment. Workers accumulate labor market experience whenever they are employed, and this experience does not depreciate during unemployment spells. Workers accumulate occupation-specific tenure while working in that occupation. Tenure does not depreciate during unemployment, but it is lost when a worker changes occupations.

Finally, during retirement individuals receive a fraction, pen, of their earnings in their last period of work as a pension. The worker has no uncertainty about this pension once his earnings in his last period of working life are revealed. If the worker is employed in period T, his pension is $pen \cdot W_{ikT}$. If he is not employed in period T, his pension is $pen \cdot b \cdot W_{ikT}$. Each working period starts with shocks to wages, job destruction shocks for some employed workers, and new offers for some unemployed workers. Workers then choose to quit, to accept a job offer if they have one, and how much to consume.

This model ignores any heterogeneity in jobs within occupation. The wage process modeled here will capture the returns to intra occupation job mobility in two ways. The estimated returns to occupation tenure will combine true returns to occupation tenure, true returns to job tenure, and the average effects of searching for better-matched jobs within an occupation. The estimated idiosyncratic wage shocks (σ^2_{ku} and $\sigma^2_{k\xi}$) will capture both shocks to wages within a job and variation in wages due to job changes within an occupation. Another implication of this simplification is that the model may overpredict occupation changes because the simulated workers have no opportunity to improve their job match without also changing occupations.

1.3. Consumption

I assume that individuals have standard time-separable constant relative risk aversion utility over consumption with coefficient of relative risk aversion γ and discount rate β. I further assume that individuals get no utility from leisure. Individuals can save and borrow over their lives at a constant risk-free interest rate r, but they cannot buy state-dependent assets to insure against idiosyncratic earnings risk. The worker's problem is therefore to choose each period his consumption, C_{it}; employment; and occupation to maximize

$$\max_{C_{it},N_{it},k_{it}} E_t\left[\sum_{s=t}^{L}\beta^{s-t}\frac{C_{is}^{1-\gamma}}{1-\gamma}\right], \tag{5}$$

subject to a terminal asset condition $A_{iT} \geq 0$ and the dynamic budget cconstraint

$$A_{i,t+1} = (1+r)(A_{it} + Y_{ikt} - C_{it}). \tag{6}$$

I assume that everyone begins life with no assets, $A_{it} = 0$. A worker's ability to borrow is subjet to a natural borrowing constraint, equal to the discounted value of worst-case earnings for all remaining working periods [2]. Workers cannot borrow against their pensions, $a_{T+1} \geq 0$. Prohibiting all borrowing would make workers less willing to quit and search for new jobs, since they would have to first build up savings to cover low earnings during unemployment.

Because wages are expected to grow over the lifetime and workers are impatient, individuals will prefer to consume more than their earnings early in life. Working against that inclination, uncertainty about future earnings will cause people to build up precautionary savings to guard against negative shocks. In practice, workers accumulate substantial debt early in life to fund the costly search for a high-wage match.

1.4. Model Solution

[2] Idefine the worst-case scenario as being unemployed for all remaining periods with the occupation-specific AR(1) component held fixed at the 0.01 percentile in each occupation (between 0.8 and 0.92 in levels).