Bonus Calibration

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1 Overview

This document outlines some thoughts on how to calibrate the model

- Section 2 writes down the parameters we are planning to calibrate
- Section 3 provides a heuristic identification argument
- Section 4 describes a simple recursive way to identify the moments
- Section 5 reviews the calibration targets
- Section 6 voices some thoughts and concerns, and mentions an overidentification test of the model.

2 Parameters to Calibrate

We are trying to calibrate our quantitative EGSS model, with cyclical variation in promised utilities (due to either fluctuations in the value of not working, or due to Nash bargaining.

Other than the standard, the parameters to calibrate are:

- σ_η—the variance of idiosyncratic shocks
- ε—the elasticity of the disutility of effort
- γ—the cyclicality of the value of not working, where $\xi(z) = b_0 + \gamma(z - z_{ss})$
  - For now, this is a stand in for the Nash bargaining parameter, depending on how our equivalence result works out
  - We can also calibrate to $\xi(z) = \chi \times z$ in line with the evidence of Chodorow-Reich & Wieland

3 Heuristic Identification Argument

- This section argues that we can identify σ_η and ε from (i) the pass through of idiosyncratic shocks into wages and (ii) the variance of wage growth.

- In EGSS the earnings schedule with savings satisfies

$$\log\left(w_t\left(a_t,\eta^t|z^t\right)\right)=\log\left(w_{t-1}\left(a_{t-1},\eta^{t-1}|z^{t-1}\right)\right)+\psi_t h'(a_t)\,\eta_t+\frac{1}{2}\left(\psi_t h'(a_t)\,\sigma_\eta\right)^2$$

Let's simplify by assuming we are in the infinite horizon case, so, we get

$$\log\left(w_t\left(a_t,\eta^t|z^t\right)\right)=\log\left(w_{t-1}\left(a_{t-1},\eta^{t-1}|z^{t-1}\right)\right)+\psi h'(a_t)\,\eta_t+\frac{1}{2}\left(\psi h'(a_t)\,\sigma_\eta\right)^2,$$

recall that ψ is known.

- Then wage growth for continuing workers is

$$\Delta\log\left(w_t\left(a_t,\eta^t|z^t\right)\right)=\psi h'(a_t)\,\eta_t+\frac{1}{2}\left(\psi h'(a_t)\,\sigma_\eta\right)^2$$

$$\begin{aligned}\implies Var\left[\Delta\log\left(w_t\left(a_t,\eta^t|z^t\right)\right)\right]&=Var\left[\psi h'(a_t)\,\eta_t+\frac{1}{2}\left(\psi h'(a_t)\,\sigma_\eta\right)^2\right]\\&=Var\left[\psi h'(a_t)\,\eta_t\right]\\&=\psi^2 h'(a_t)^2\,Var\left[\eta_t\right].\end{aligned}$$

- **Therefore there is a mapping between the variance of wage growth and the variance of the idiosyncratic shock,** given a value of $h'(a_t)$, which depends on ε.

- Now let's identify ε using the pass through of of an idiosyncratic shock η_{it} into effort and wages. Remember that the production function is $y_{it}=z_t\left(a_{it}+\eta_{it}\right)$. By assumption action is independent of effort, and the idiosyncratic shock is independent of aggregates, so

$$\frac{\partial\log y_{it}}{\partial\eta_{it}}=\frac{\partial\log\left(z_t\left(a_{it}+\eta_{it}\right)\right)}{\partial\eta_{it}}=\frac{\partial\log\left(a_{it}+\eta_{it}\right)}{\partial\eta_{it}}=\frac{1}{a_{it}+\eta_{it}}$$

- Then if the shock is not serially correlated we have

$$\frac{\partial\log\left(w_t\left(a_t,\eta^t|z^t\right)\right)}{\partial\eta_t}=\psi h'(a_t)$$

which means that the regression coefficient identifies

$$\frac{\partial\log\left(w_t\left(a_t,\eta^t|z^t\right)\right)}{\partial\log y_{it}}=\psi h'(a_t)\left(a_{it}+\eta_{it}\right),$$

which clearly informs ε, the slope of the effort disutility function.

- Finally, we can calibrate γ to the cyclicality of new hires' wages, which is $d\log w_{i0}/d\log z_0$ in the model.

4 Computation

- This procedure will be relatively straightforward because we can estimate the parameters in two loops as follows:

1. Simulate from the ergodic distribution, ~~fixing $z$at its steady state value~~
   - Calculate a panel of wage growth for continuing workers, in order to calculate $Var[\Delta \log w_{it}]$
   - Run a regression of individual output and individual wages on η in order to obtain $d \log y_{it}/d\eta_{it}$ and $d \log w_{it}/d\eta_{it}$
   - Calibrate values of ε and σ_η, to minimize the distance between the model vs. the data for $Var[\Delta \log w_{it}]$ and $d \log y_{it}/d \log w_{it}$ (where this derivative is after an η_{it} shock)
2. Simulate from the distribution with aggregate risk, i.e. time varying z, with values of ε and σ_η in place
   - Calculate the value of $d \log w_0/dz$ and du/dz in the model
   - Calibrate γ to minimize the distance between these values and estimates of $d \log w/du$ in the data
   - If this procedure is too computationally costly we can calculate the response of w_0 to an MIT shock to z_0 like Mitman et al or Auclert et al

5 Calibration Targets

- The range of estimates of $d \log w_0/dU$ at quarterly frequency are $[-0.5, -1]$ based on John and my estimates, our selection adjusted estimates of new hire wage cyclicality agree (!) on -0.5 but I think we want to try the larger estimates too (these are the selection unadjusted estimates from John's paper.)
- John can hopefully come up with the appropriate estimate of $Var[\Delta \log w_{it}]$ from his paper. I think we should experiment with two calibrations. The unconditional average variance of wage growth. And a calibration to "high incentive pay occupations" if these data are available.
- The range of estimates of pass through to idiosyncratic shocks $d \log y_{it}/d \log w_{it}$ can be found in Card, Cardoso, Heining & Kline (JoLE, 2018). Seems like elasticities of 0.05-0.15 is about right, there is one paper that finds pass through estimates of 0.5, which is Kline et al (QJE). So we could have a range of 0.05-0.5.

6 Thoughts and Concerns

- Is there some way to only measure pass through for high incentive pay occupations or jobs?
- Calibrate to earnings or to wages? It seems to me that the relevant concept in the model is wages inclusive of bonuse and **not** earnings.
- What are the shortcomings of this strategy? I think the main shortcoming is that we are assuming all pass through of idiosyncratic shocks into the wages of continuing workers is due to incentives and not bargaining. I think we could relax this in a model extension with Nash rebargaining in every period. So this is the right way to start.
- We have a "spare moment" which is the cyclicality of effort. Maybe we can use this as an overidentifying test of the model assumptions.