Project Description: Skills, family and education choice

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1 Research question

Can we identify the correlation between skill and family background from educational choices?

2 References to relevant literature

We are heavily inspired by the analysis performed by Abbott et al. (2019). The authors build and estimate a general equilibrium model for educational attainment, taking into account heterogeneity in cognitive and non-cognitive ability, parental transfers, subsequent returns to education and marriage market prospects. We aim to recreate a small part of this model. In our model, we focus solely on heterogeneity in cognitive ability and parental background. We abstract from the preferences of the parental generation by having parental transfers be an exogenous parameter rather than a result of an endogenous decision process. Moreover, we only consider the partial equilibrium outcomes, abstracting from how the supply of highly education agents may affect returns to education.

3 Sketch of model

We aim to answer the question by solving and simulating a life-cycle model, consisting of first an education stage, next a working period stage. In the education stage, agents choose their consumption, c_t as well as whether or not to continue studying, s_t. In the working stage, agents choose consumption and labor supply, ℓ_t. Agents are heterogenous in terms of their cognitive types, $\theta_i \in \{\theta_{high}, \theta_{low}\}$, and their family types: $\phi_i \in \{\phi_{good}, \phi_{bad}\}$.

The states of the model include cognitive type, family type, assets, an indicator for currently studying, accumulated years of schooling, $\Omega_{i,t} = \{\theta_i, \phi_i, a_t, s_{t-1}, S_t\}$

Choices: c_t (consumption), s_{t+1} (continue to study, only while in studying period).

In each period, behavior is described by the Bellman equation:

$$V(\Omega_t) = \max_{s_t \in \mathcal{S}(\Omega_t)} s_t V_{study}(\Omega_t) + (1 - s_t) V_{work}(\Omega_t)$$

$$s.t. \quad \mathcal{S}(\Omega_t) = \begin{cases} \{0, 1\} & \text{if } s_{t-1} = 1 \text{ and } S_t < S_{max} \\ \{0\} & \text{else} \end{cases}$$

Note that the agent can choose to keep studying only if the agent was studying in the previous period and the agent have been studying for less periods than the maximum number of periods allowed. The working stage is therefore an absorbing state.

The value while studying is given by:

$$
\begin{aligned}
V_{study}(\Omega_t) &= \max_{c_t} u(c_t) + \epsilon_{study} + \beta V(\Omega_{t+1}) \\
s.t. \quad a_{t+1} &= (1+r)a_t + t(\phi_i) - c_t \\
S_{t+1} &= \sum_{\tau=0}^{t} s_t \\
a_t &\geq \underline{\text{a}}
\end{aligned}
$$

Here, ϵ_{study} is a choice specific taste shock, assumed to be i.i.d. type I extreme value. While studying, the agent receives a transfer $t(\phi_i)$, which depends on family type. This is meant to capture transfers from parents. The agent also faces a liquidity constraint while studying to prevent full borrowing against future income.

The value while working is given by:

$$
\begin{aligned}
V_{work}(\Omega_t) &= \max_{c_t, \ell_t} u_{work}(c_t, \ell_t) + \epsilon_{work} + \beta V(\Omega_{t+1}) \\
st. \quad a_{t+1} &= (1+r)a_t + w(S_t * \theta_i)\ell_t - c_t \\
S_{t+1} &= S_t \\
a_T &\geq 0
\end{aligned}
$$

ϵ_{work} is another i.i.d. type I extreme value taste shock. The wage w depends on interaction of years of schooling S_t and cognitive type θ_i so returns to schooling is higher for agents with $\theta_i = \theta_{high}$.
We model the agent up until the point of retirement, from where we impose a functional form on the value function, for ease of computation. Here we will follow Gourinchas and Parker (2002), who postulate a retirement value function that holds under some assumptions on the types of uncertainty after retirement.

4 Solution methods and numerical techniques

- We use Endogenous Grid Method (EGM) to solve the model in the working stage. Here we have two choice variables, c_t and ℓ_t, but by specifying the utility function strategically, we can solve for one optimal choice using the inter-period Euler, and the other optimal choice using the intra-perod FOC.
- In the education stage, we solve the model using Discrete Choice Endogenous Grid Method (DC-EGM), with the continuous choice of c_t and the discrete choice of studying or not.
- We use quadrature methods to account for income uncertainty in the working stage.

5 Estimation methods

After having solved and simulated the model, we plan to perform a simple estimation exercise. We assume a set of parameters based on results from Abbott et al. (2019) and a distribution over types (cognitive and educational background), which we will use to simulate data for education choice. Based on this simulated data, we will try to identify the distribution of cognitive types conditional on educational background, $p(\theta_i = \theta_{high}|\phi_i), \phi_i = \phi_{good}, \phi_{bad}$. We will do this through simulated method of moments, where our targeted moments are the share of individuals obtaining each level of education, conditional on their family type.

6 Progressive plan of action

- Step 1
  - Solve Working stage model:
    - EGM with one choice variables (exogenous labor supply), no uncertainty
    - EGM with two choice variables (endogenous labor supply), no uncertainty
    - EGM with two choice variables (endogenous labor supply), productivity shock to labor
  - Solve Study stage model
    - No heterogeneity
    - Heterogeneity
- Step 2
  - Introduce study stage model to working stage model
- Step 3
  - Simulate data for estimation:
  - Parameter of interest: correlation between parental types and cognitive types
- Step 4
  - Estimate parameter of interest via simulated method of moments
- Step 5
  - Write paper

References

Abbott, B., Gallipoli, G., Meghir, C., & Violante, G. L. (2019). Education policy and intergenerational transfers in equilibrium. *The Journal of political economy*, *127*(6), 2569–2624.

Gourinchas, P.-O., & Parker, J. A. (2002). Consumption over the life cycle. *Econometrica*, *70*(1), 47–89. https://doi.org/https://doi.org/10.1111/1468-0262.00269