

Human Capital in a Macroeconomic Model

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Research Focus

- Interactions between monetary and fiscal policies and their impacts on economic stability and growth.
- Relationship between economic policies and environmental sustainability.
- Providing insights for policymakers using advanced statistical methods and computational models.

Model Structure

This model incorporates human capital and educated human capital into a standard macroeconomic framework, examining their roles in the production process, consumption, and labor decisions. The model is divided into sectors: households, firms, and equilibrium conditions.

1. Household Sector

Consumption and Labor-Leisure Choice

Households maximize their utility, which depends on consumption C_t and labor supply L_t , given by:

$$C_t = \frac{\gamma}{1-\gamma}(1 - L_t - E_t)H_tW_t$$

where:

- γ is the consumption share.
- E_t represents the effort devoted to education.
- H_t is human capital.
- W_t is the wage rate.

Intertemporal Consumption Choice

Households' intertemporal consumption choice is governed by the Euler equation:

$$1 = \beta \left(\frac{C_t}{C_{t+1}} \right) (R_{t+1} + (1 - \delta_k))$$

where:

- β is the discount factor.
- R_{t+1} is the return on capital.
- δ_k is the depreciation rate of capital.

2. Firm Sector

Production Function

Firms produce output Y_t using capital K_{t-1} , labor L_t , human capital H_t , and educated human capital HE_t :

$$Y_t = A_t (K_{t-1}^\alpha) (L_t H_t + L E_t H E_t)^{1-\alpha}$$

where:

- α is the capital share in production.
- A_t represents technology shocks.
- $L E_t$ is the fraction of labor that is educated.

Capital Accumulation

Capital evolves according to:

$$K_t = (Y_t - C_t) + (1 - \delta_k) K_{t-1}$$

Investment in capital is given by:

$$I K_t = Y_t - C_t$$

Human Capital Accumulation

Human capital and educated human capital evolve as follows:

$$H_t = I H_t + (1 - \delta_h) H_{t-1}$$

$$H E_t = I H_t + (1 - \delta_{he}) H E_{t-1}$$

where:

- δ_h and δ_{he} are the depreciation rates of human capital and educated human capital, respectively.
- IH_t is investment in human capital.

Investment in human capital is determined by:

$$IH_t = B_t E_t^\theta$$

where:

- θ is the elasticity of education effort.
- B_t represents education shocks.

Fraction of labor that is educated is defined as:

$$LE_t = \omega L_t$$

where:

- ω is the weight parameter for educated human capital.

Wage and Return on Capital

Wages and returns are determined by:

$$W_t = (1 - \alpha) A_t (K_{t-1}^\alpha) (L_t H_t + LE_t H E_t)^{-\alpha}$$

$$R_t = \alpha A_t (K_{t-1}^{\alpha-1}) (L_t H_t + LE_t H E_t)^{1-\alpha}$$

3. Shocks

Technology Shock

The technology shock A_t follows an AR(1) process:

$$\log(A_t) = \rho_A \log(A_{t-1}) + e_t$$

Education Shock

The education shock B_t follows an AR(1) process:

$$\log(B_t) = \rho_B \log(B_{t-1}) + v_t$$

where:

- e_t and v_t are innovations with standard errors.

4. Equilibrium Conditions

Market Clearing

Goods market clearing requires:

$$Y_t = C_t + IK_t$$

Capital market clearing requires:

$$K_t = (Y_t - C_t) + (1 - \delta_k)K_{t-1}$$

Labor market clearing requires:

$$L_t H_t + LE_t H E_t$$