An Overlapping Generations Model with Endogenous Health Care

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Introduction

Grossman [1] proposed a framework where health care is modeled as depreciative and durable capital good, with an initial endowment, making health care a perfect candidate for agents' endogenous decision in an overlapping generations model. The model reads:

$$H_{t+1} = (1-\delta)(H_t + I_t)$$

Hashimoto (2010) [2] can represent previous efforts in building such a model. It separated health care industry from non-health care industry, assuming that the health care industry is a labor-intensive one, and thus needs no capital input. My model inherits such setup. It builds heavily on Evans' OLG model with demographics [3].

Objectives

This project aims to build an overlapping generations model with the following features:

1. **Endogenous health care decisions**;
2. **Boosted productivity due to health care**;
3. **Adding demographic dynamics** of the population;
4. Dividing **Health-care VS non-health-care** markets;
5. **Exogenous labor supply**.

This model will allow me to see how the individual and aggregate **health care spending evolves over time**, and also how the existent **labor is divided between health-care and non-health-care market**. I will also simulate the **effect of population ageing** on the previous dynamics.

Consumer

Budget Constraint

$$c_{s,t} + b_{s+1,t+1} + P_t^H h_{s,t} = (1+r_t)b_{s,t} + w_t n_{s,t} f(h_{s-1,t-1}) \quad (1)$$

Utility

$$U = ln(c_{s,t}^{\gamma} h_{s,t}^{1-\gamma}) \quad (2)$$

Optimization

$$\max_{\substack{\{c_{s,t+s-1}, h_{s,t+s-1}\}_{s=E+1}^{E+S} \\ \{b_{s+1,t+s}\}_{s=E+1}^{E+S-1}}} \sum_{s=E+1}^{E+S} \beta^{s-E-1} [\Pi_{n=E}^{s-1}(1-\rho_n)]$$

$$U(c_{s,t+s-E-1}, h_{s,t+s-E-1}) \quad \forall s,t$$

$$s.t. \quad 1 \quad \text{and} \quad 2, \quad \text{and} \quad b_{E+1,t}, b_{E+S+1,t} = 0 \quad \forall t$$

Firm & Market Clearing

Output

$$Y_H = A_t^H P_t^H (L_t^H)^{\alpha_H} \quad (4)$$

$$Y_N = A_t^N (K_t^N)^{\alpha_N} (L_t^N)^{(1-\alpha_N)} \quad (5)$$

Capital

$$K_t^N = \sum_{s=E+2}^{E+S} b_{s,t} \quad (6)$$

Labor

$$L_t^N + L_t^H = \sum_{s=E+1}^{E+S} \omega_{s,t} n_s f(h_{s-1,t-1}) \quad (7)$$

Solution

Euler Equations

$$\beta w_{t+1} n_{t+1} (1+\delta) \frac{\gamma}{c_{s+1,t+1}} + \frac{(1-\gamma)}{h_{s-1,t-1}} - P_t^H \frac{\gamma}{c_{s,t}} = 0 \quad (8)$$

$$c_{s,t} = \frac{\beta(1+r_t)c_{s-1,t-1}}{\gamma} \quad (9)$$

Clearing Prices

$$r_t^N = A^N \alpha_N \left(\frac{L_t^N}{K_t^N}\right)^{1-\alpha_N} - \delta \quad (10)$$

$$w_t = A^N (1-\alpha_N) \left(\frac{A^N \alpha_N}{r_t + \delta}\right)^{\frac{\alpha_N}{1-\alpha_N}} \quad (11)$$

$$P_t^H = \frac{w_t}{A^H} \quad (12)$$

Calibration and Initial Results

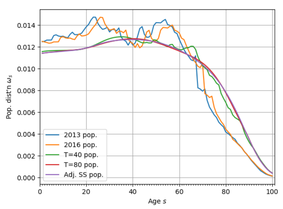

Figure 1: Population Distribution at Points in Time Path

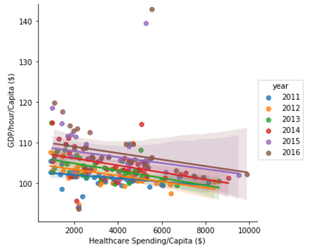

Figure 2: Health Care Spending VS Productivity

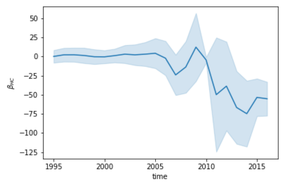

Figure 3: Effect of Health Care on Productivity over Time

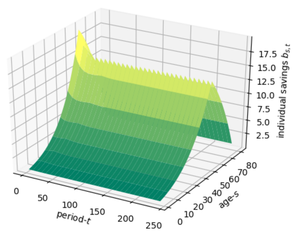

Figure 4: Time Path for Individual Savings b over One's Lifetime

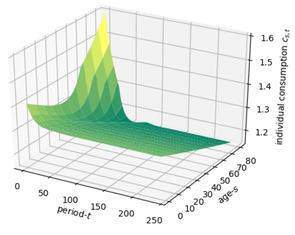

Figure 5: Time Path for Individual Consumption c over One's Lifetime

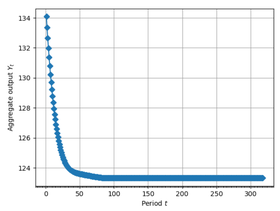

Figure 6: Time Path for Aggregate Output Y

Simulation & Future Work

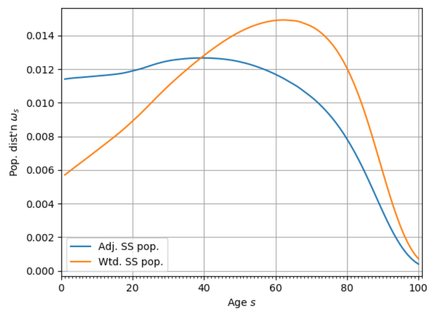

Figure 7: Simulation of Population Ageing

- Add endogenous labor supply
- Better calibrated $f(h_{s-1,t-1})$ with micro-level health care panel data
- Model boosted chance of survival caused by health care into demographics in a non-stationalized manner

Contact Info

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References

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[2] Ken-ichi Hashimoto and Ken Tabata. Population aging, health care, and growth. *Journal of Population Economics*, 23(2):571–593, 2010.

[3] Richard W. Evans and Jason DeBacker. Overlapping generations models for policy analysis: Theory and computation. *Unpublished Draft*, pages 146–175, 2018.