Demographic Patterns and Household Saving in China

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The Research Problem

- Model the time-path of the saving rate of Chinese households over time (1960-2008).

- Why is this interesting?
  - Saving rate is very high and growing. (27 percent in 2008).
    - Large by international standards.
    - Contributes to international imbalances
  - Saving rate used to be low by international standards (3.9 percent before 1977).
    - Large variation over time.

What can explain it?

- Life-cycle factors combined with demographic variations. This is what this paper is about

- Precautionary saving

- Sex imbalance

- Variations in old-age expenditures (retirement, medical)

The data

- Historical + projected demographics: United Nations World Population Prospects.

- Chinese household saving rate: Modigliani and Cao (2004) + China Statistical Yearbook.

Figure 1: Household Saving Rate in China

Table 1: Household Saving as a Percent of GDP in 2004

	China	USA	France	Japan	Korea
Saving Rate	18.5	5.1	10.9	6.2	8.0

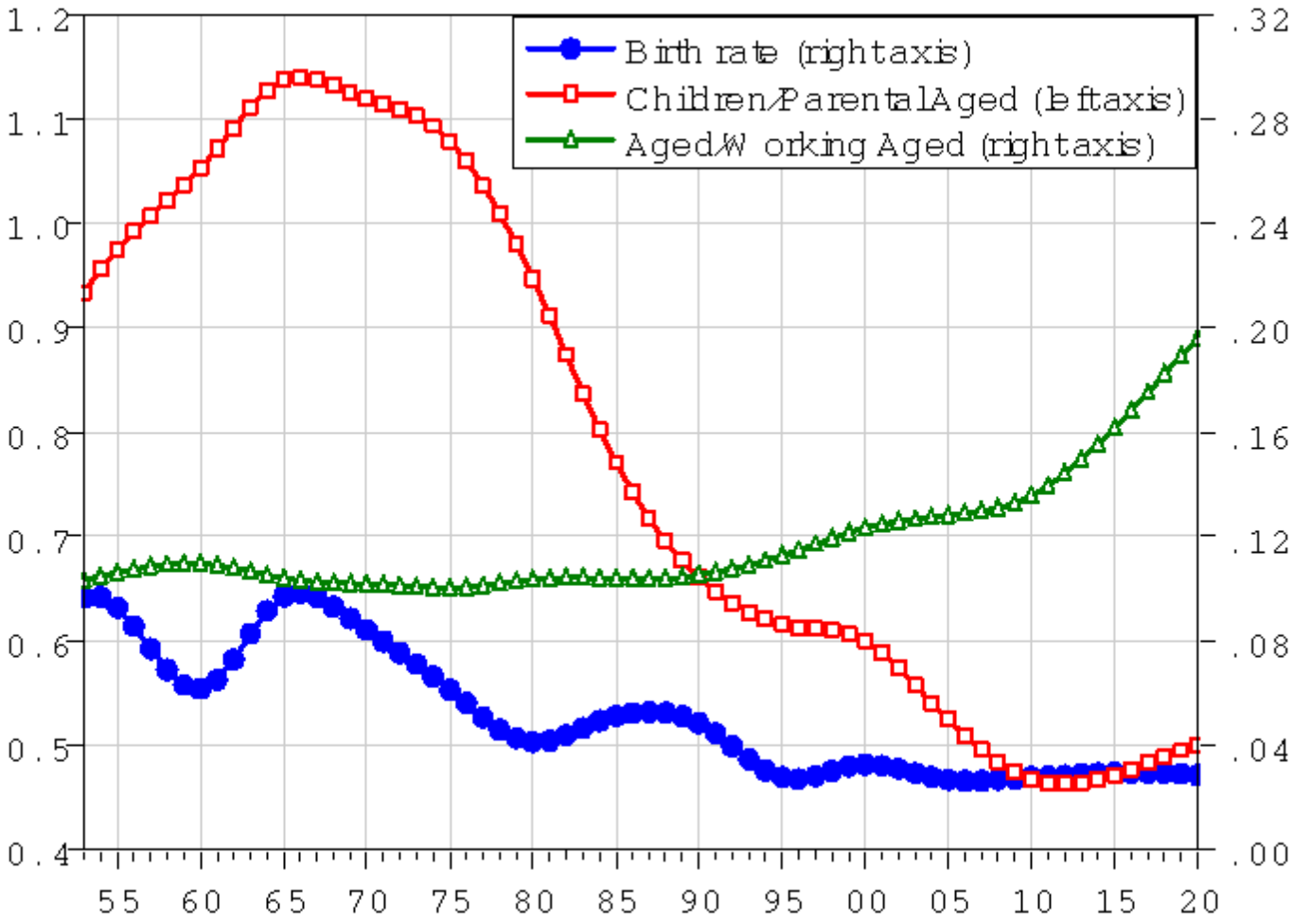

Figure 2: Demographic variation

Table 2: Total Fertility Rates

Year	China	USA	Japan
1950-54	6.1	3.4	3.0
1955-59	5.5	3.7	2.2
1960-64	5.6	3.3	2.0
1965-69	5.9	2.5	2.0
1970-74	4.8	1.8	2.1
1975-79	2.9	1.8	1.8
1980-84	2.6	1.8	1.8
1985-89	2.0	1.9	1.7
1990-94	1.8	2.0	1.5
1995-99	1.8	2.0	1.4
2000-04	1.8	2.0	1.3
2005-09	1.8	2.1	1.3

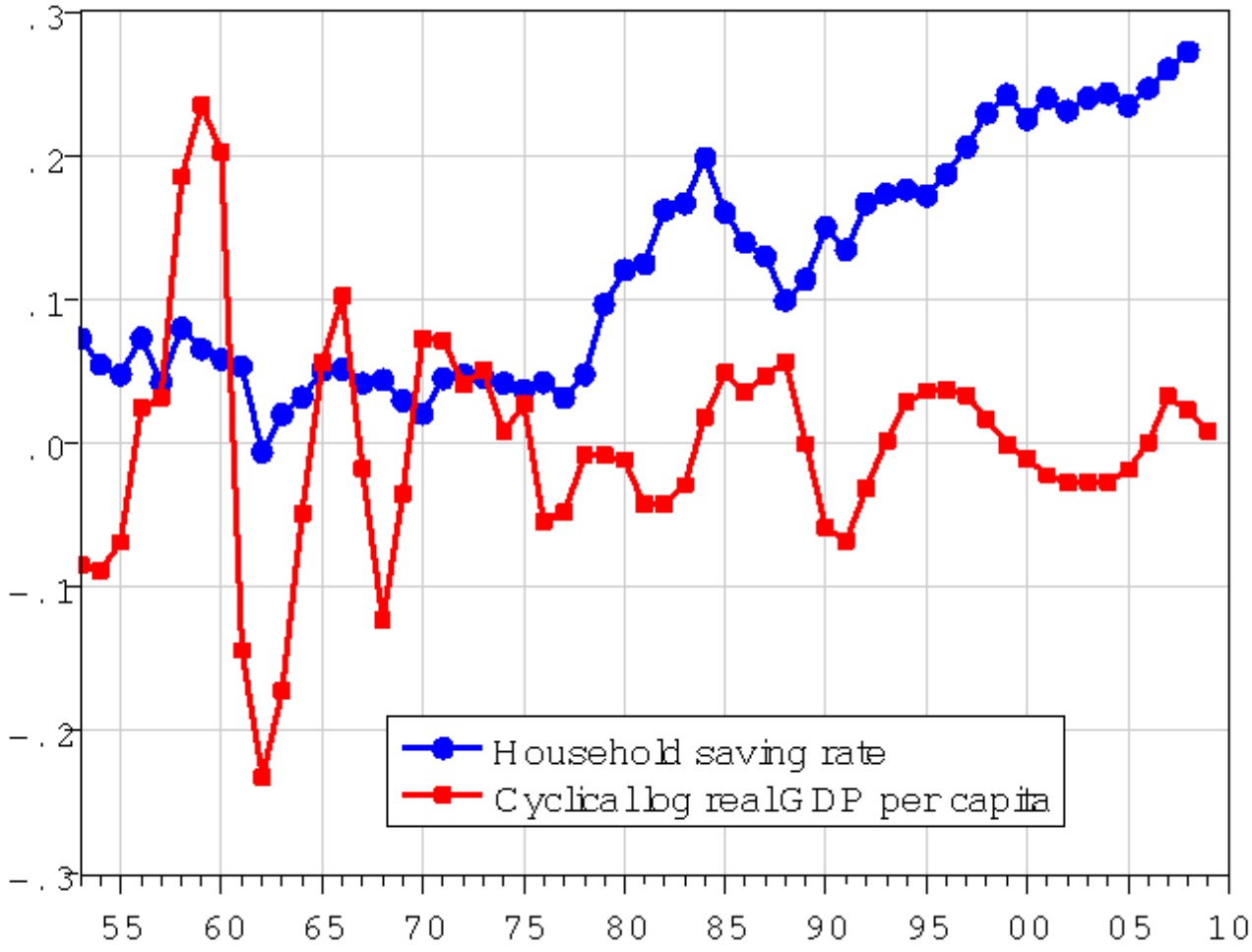

Figure 3: Household saving rate and cyclical variation in GDP

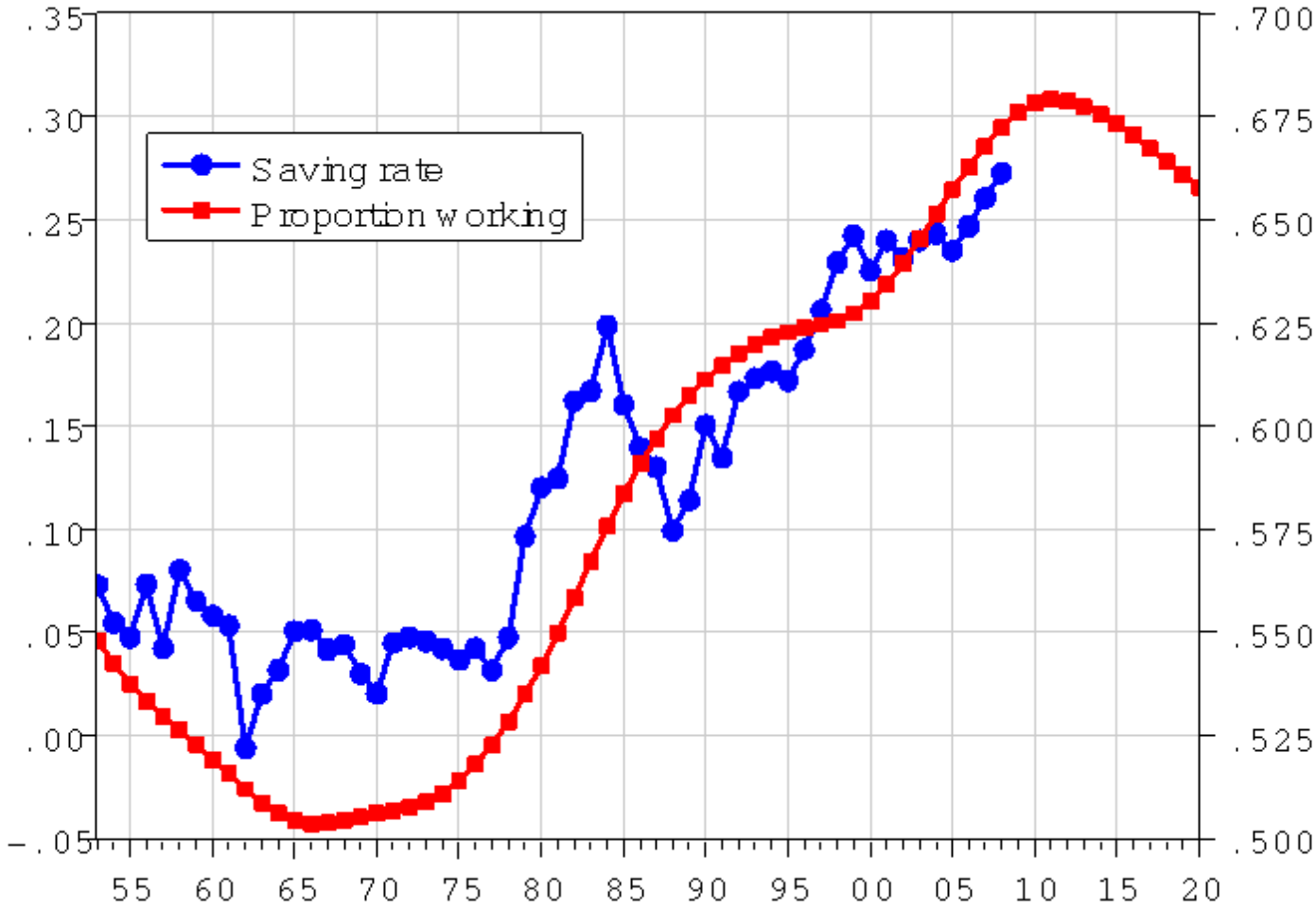

Figure 4: Household saving and proportion of working age population

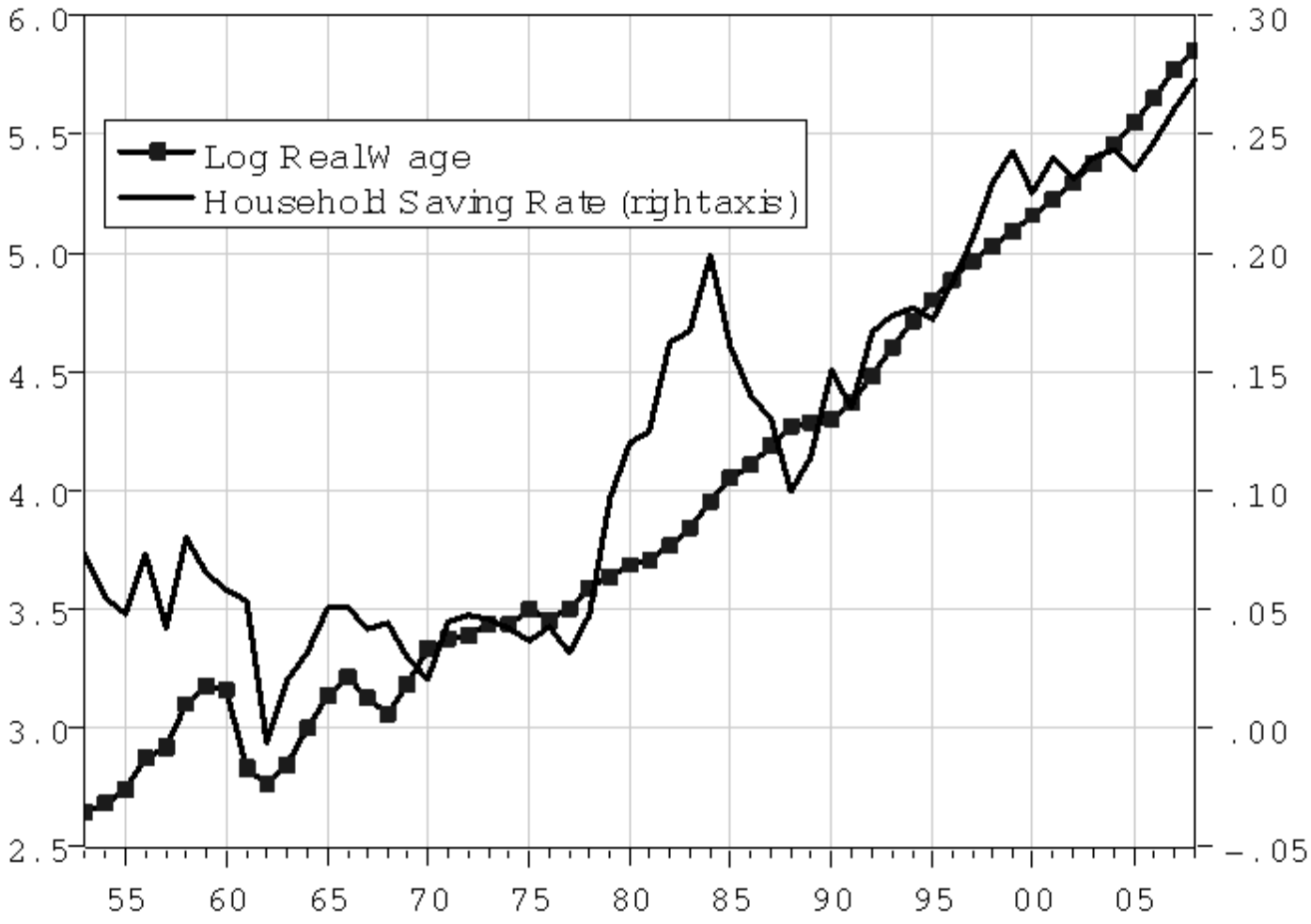

Figure 6: Household saving and log real wage

Take-aways from the data

- Household saving should increase
  - in response to exogenous reductions in family size:
    - fewer mouths to feed frees up resources
    - fewer children to help provide for old age
  - with proportion of working age
    - they are the savers

- Household saving should decrease
  - in response to higher labor income growth

- Pre-reform: Low income growth (High S), large household size, small proportion of working age (Low S).

- Post-reform: All in reverse.

- Demographics and income growth work in opposite directions.

- Sort out various factors with a model.

An Overlapping Generations Model of Saving

Households

- Consumers live 85 years. Those aged 18 to 85 make decisions

- Children (age 0 to 17), parents (age 18 to 47), workers (age 18 to 63), adult children (age 45 to 65), and retirees (age 64 to 85).

- Parental and children's consumption enter separately into parental utility, as in Barro and Becker (1989).

- People work and support aging parents from ages 18 to 63

- People are retired from 64 to 87 and live off accumulated assets and transfers from working aged children.

- Die at 85 with bequest given to adult aged (45 to 65) children.

Budget constraint of

- HHs with dependent children

$$n_t^c c_t^{c,i} + c_t^i + a_{t+1}^{i+1} = (1-\tau_t)w_t + (1+r_t)a_t^i + B_t^i \ , \qquad i \in [18, 47]. \quad (1)$$

- Working aged, no dependent children

$$c_t^i + a_{t+1}^{i+1} = (1-\tau_t)w_t + (1+r_t)a_t^i + B_t^i, \qquad i \in [48, 63], \quad (2)$$

- Retired cohorts

$$c_t^i + a_{t+1}^{i+1} = P_t + (1+r_t)a_t^i, \qquad i \in [64, 85], \quad (3)$$

Preferences

- With dependent children

$$u_t^i\left(c_t^{c,i}, c_t^i\right) = \mu\left(n_t^c\right)^\eta \left(\frac{\left(c_t^{c,i}\right)^{1-\sigma} - 1}{1-\sigma}\right) + \left(\frac{\left(c_t^i\right)^{1-\sigma} - 1}{1-\sigma}\right), \qquad i \in [18, 47]$$

- Last year of life

$$u_t^{85}\left(c_t^{85}, a_{t+1}^{85}\right) = \mu\left(n_t^{ac}\right)^\eta \left(\frac{\left(a_{t+1}^{85}\right)^{1-\sigma} - 1}{1-\sigma}\right) + \left(\frac{\left(c_t^{85}\right)^{1-\sigma} - 1}{1-\sigma}\right). \tag{4}$$

- Others

$$u_t^i\left(c_t^i\right) = \frac{\left(c_t^i\right)^{1-\sigma} - 1}{1-\sigma}, \qquad i \in [48, 84].$$

- The problem facing in recursive form

$$V_t^i\left(a_t^i\right) = \max\left\{u_t^i\left(c_t^{c,i}, c_t^i\right) + V_{t+1}^{i+1}\left(a_{t+1}^{i+1}\right)\right\}$$

subject to budget constraints, and where $V_t^{86}\left(a_{t+1}^{86}\right)$

Representative Firm

Produces with Cobb-Douglas technology, and accumulates capital in the standard way.

Return to assets

$$r_t = \alpha A_t K_t^{\alpha-1} \left(N_t^w\right)^{1-\alpha} - \delta$$

Wages

$$w_t = (1-\alpha) A_t K_t^{\alpha} \left(N_t^w\right)^{-\alpha}$$

Intermediation and Net Foreign Assets

The capital stock financed by intermediary bank through foreign and domestic borrowing. The net foreign asset position is difference between deposits (assets supplied by consumers) and loans (capital demanded by the firm)

$$B_t = \underbrace{\sum_{i=18}^{85} \left(N_t^i a_t^i \right)}_{\text{deposits}} - K_t.$$

Table 3: Baseline parameterization

Parameter	Symbol	Value	Source
weight on children	μ	0.65	Manuelli and Seshadri (2009)
concavity for children	η	0.76	Manuelli and Seshadri(2009)
labor's share of output	α	0.69	Hu and Khan (1997)
transfer share	τ	0.12	Lee and Xiao (1998)
discount rate	β	$0,96$	standard
coef. of relative risk aversion	σ	2	standard
depreciation rate	δ	0.10	standard

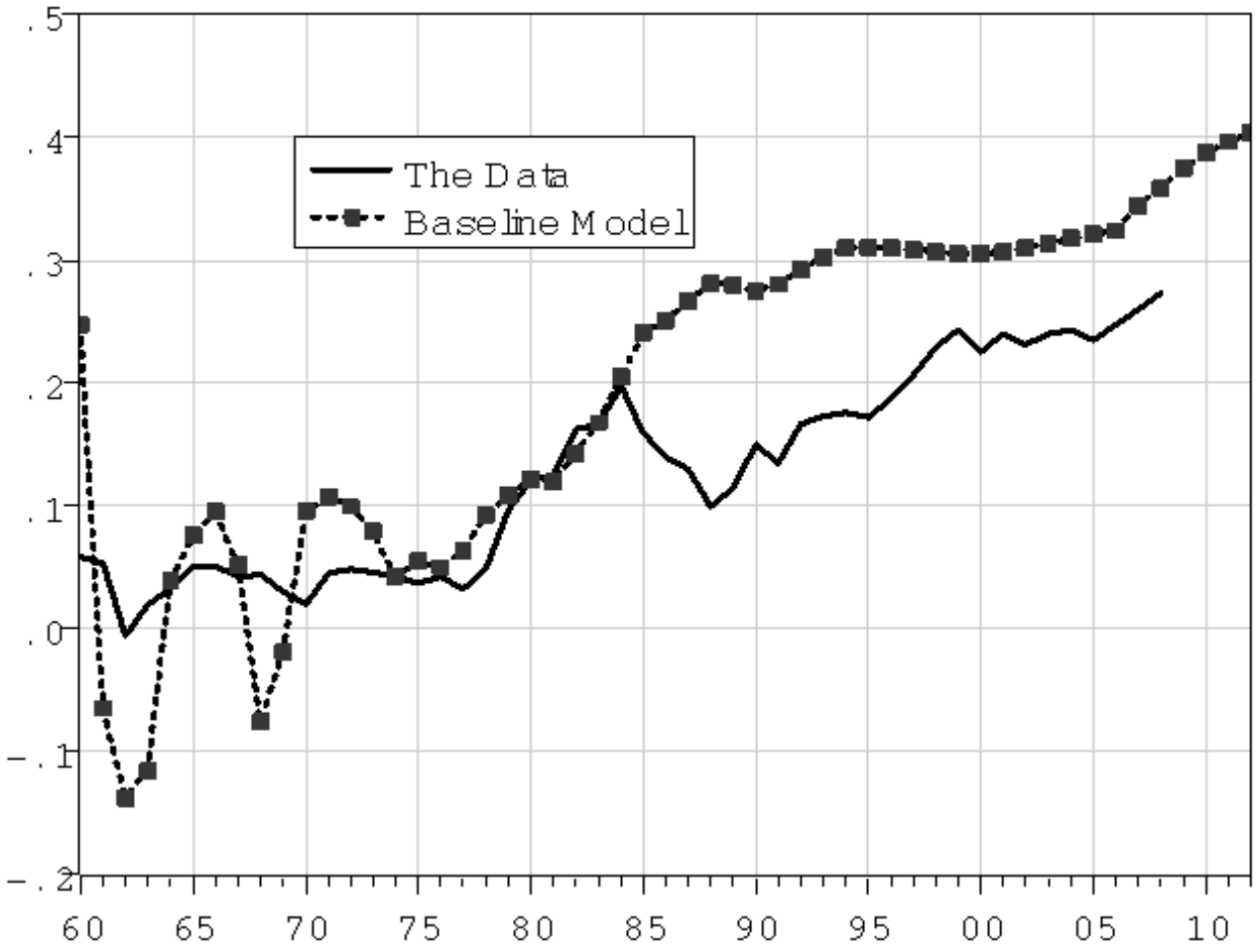

Figure 6: Baseline model results

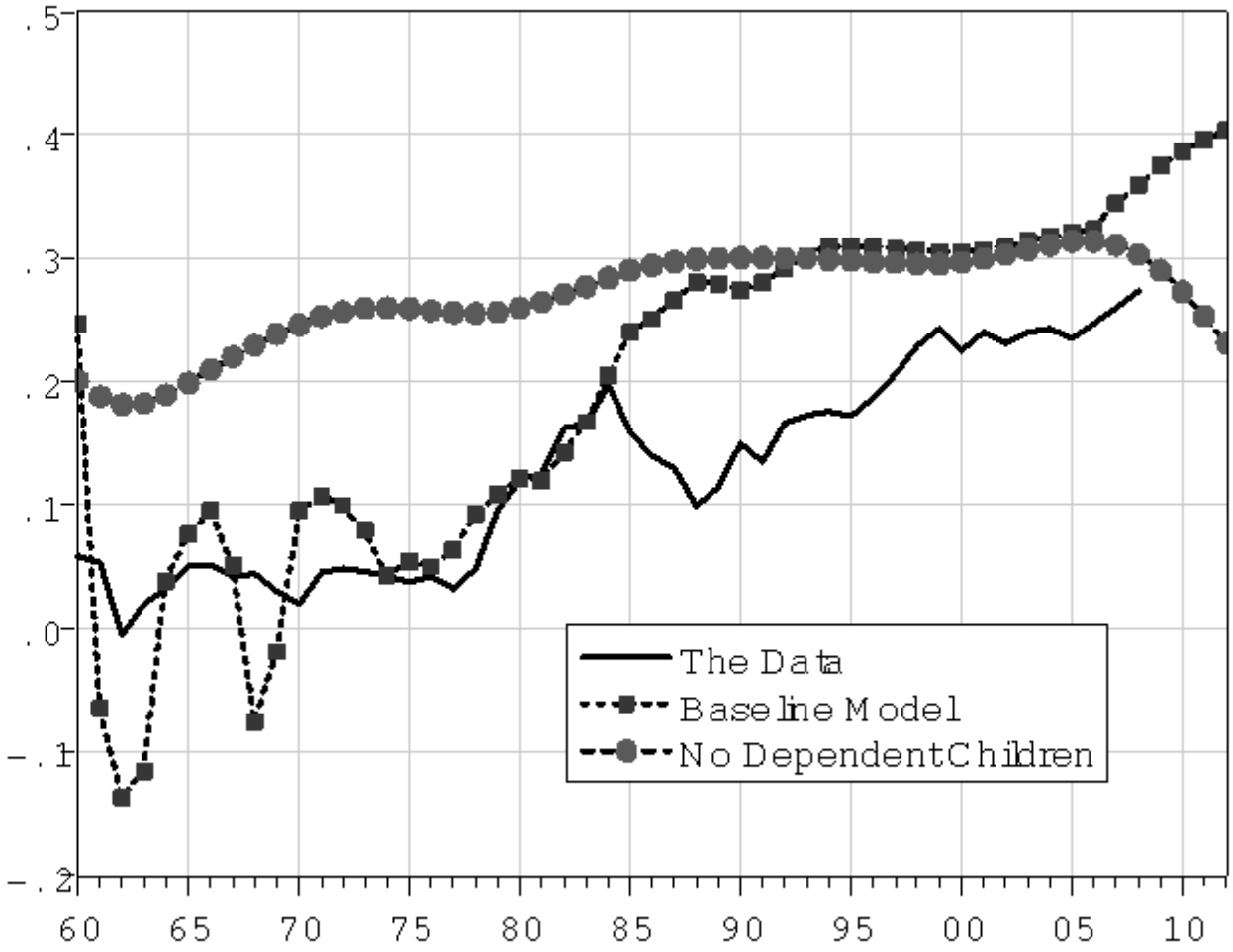

Figure 6: Experiment 1: Eliminate dependent children

Proposition 1: (Effective Discount Rate) The first term of the utility function can be written as

$$U_t = \sum_{j=0}^{30} \widehat{\beta}_j \frac{c_{t+j}^{j+18}}{1-\sigma} - \Omega_j$$

where the effective discount rate is

$$\widehat{\beta}_j = \beta^j \left(1 + \left[\mu \left(\frac{N_{t+j}^c}{N_{t+j}^w} \right)^{\sigma+\eta-1} \right]^{\frac{1}{\sigma}} \right)$$

which for $\sigma + \eta > 1$ *is decreasing in* N_{t+j}^c / N_{t+j}^w. $\Omega_j = \beta^j / (1-\sigma)$ *has no effect on decision making*

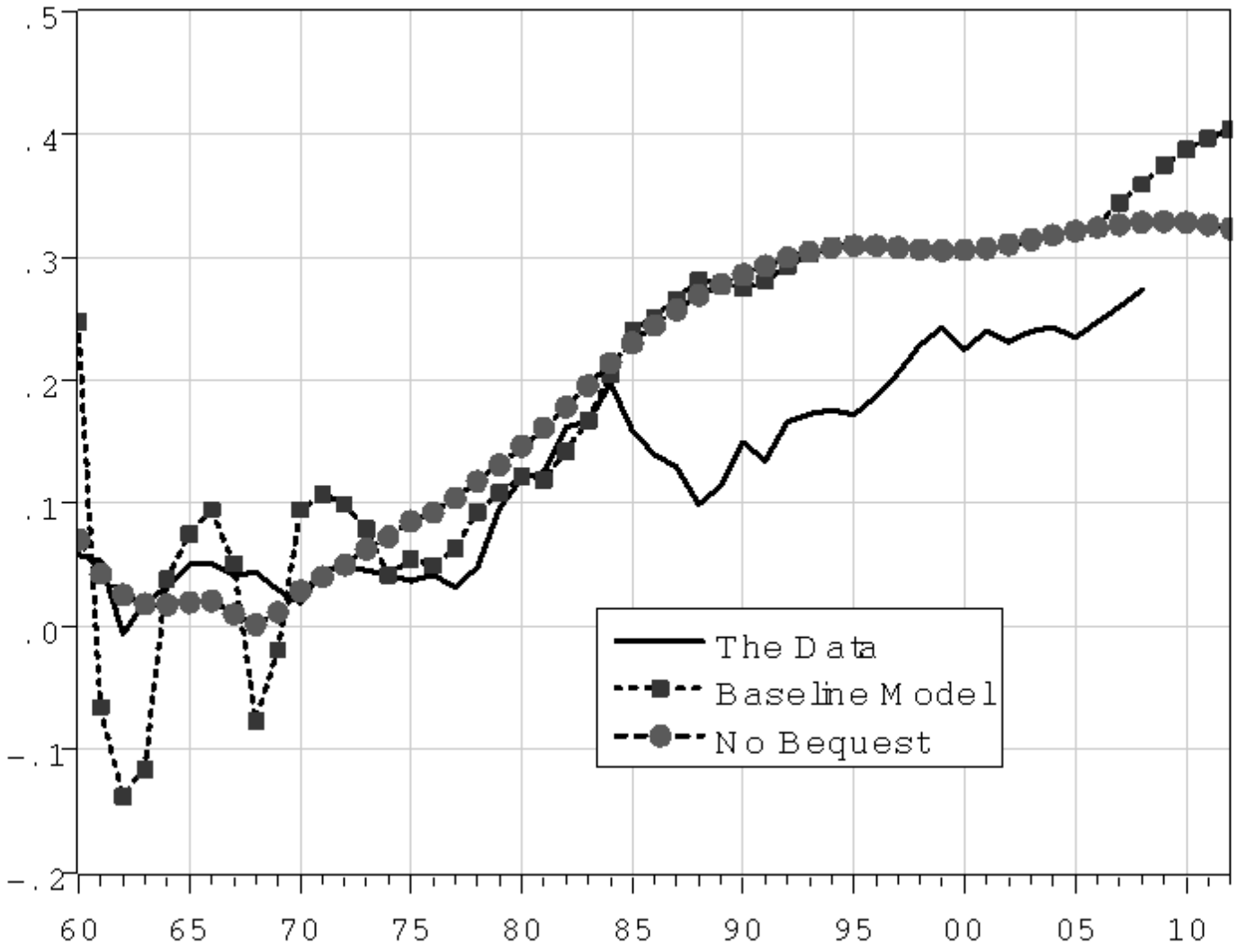

Figure 7: Experiment 2. No bequest motive.

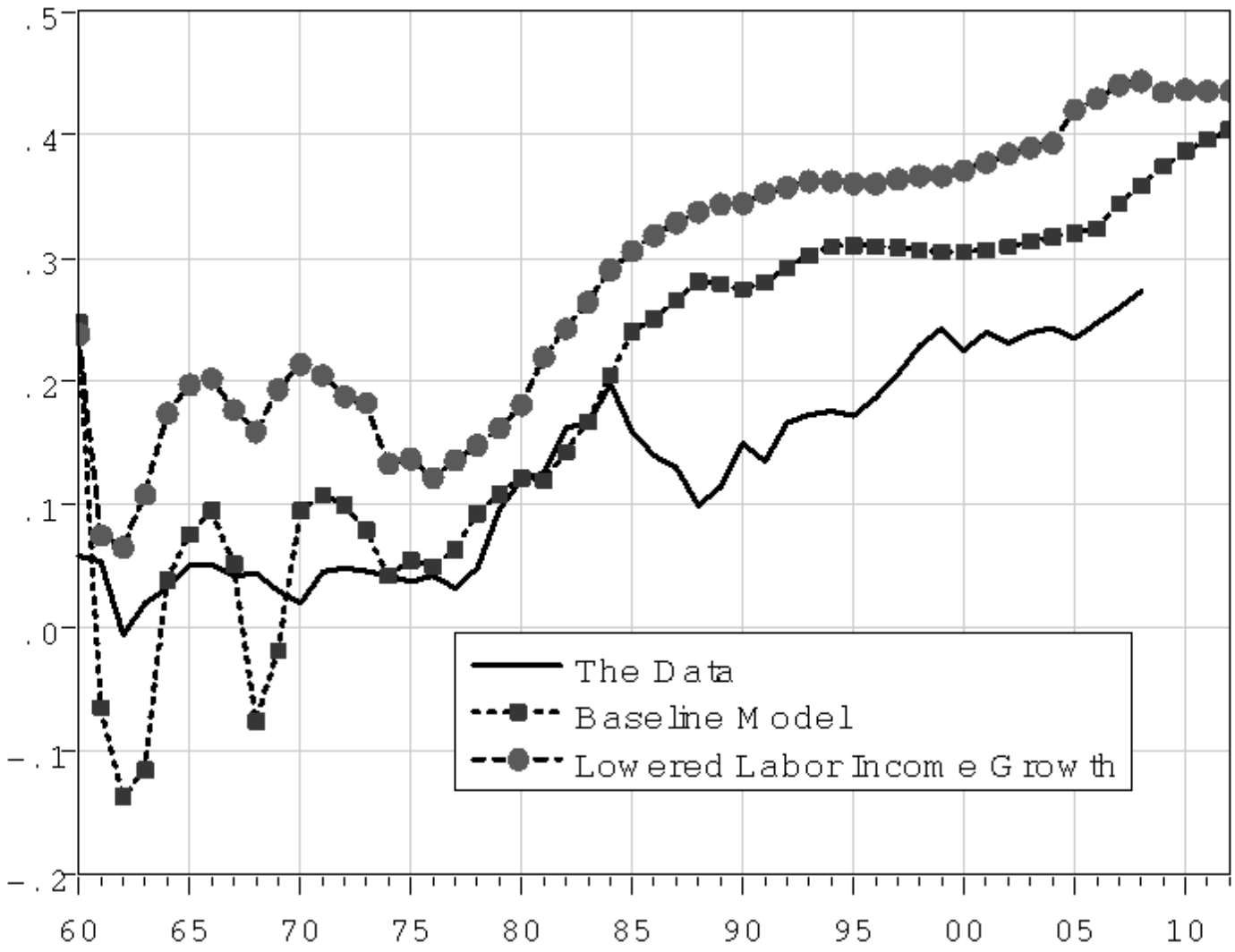

Figure 8: Experiment 3. Reduced labor income growth by 70 percent

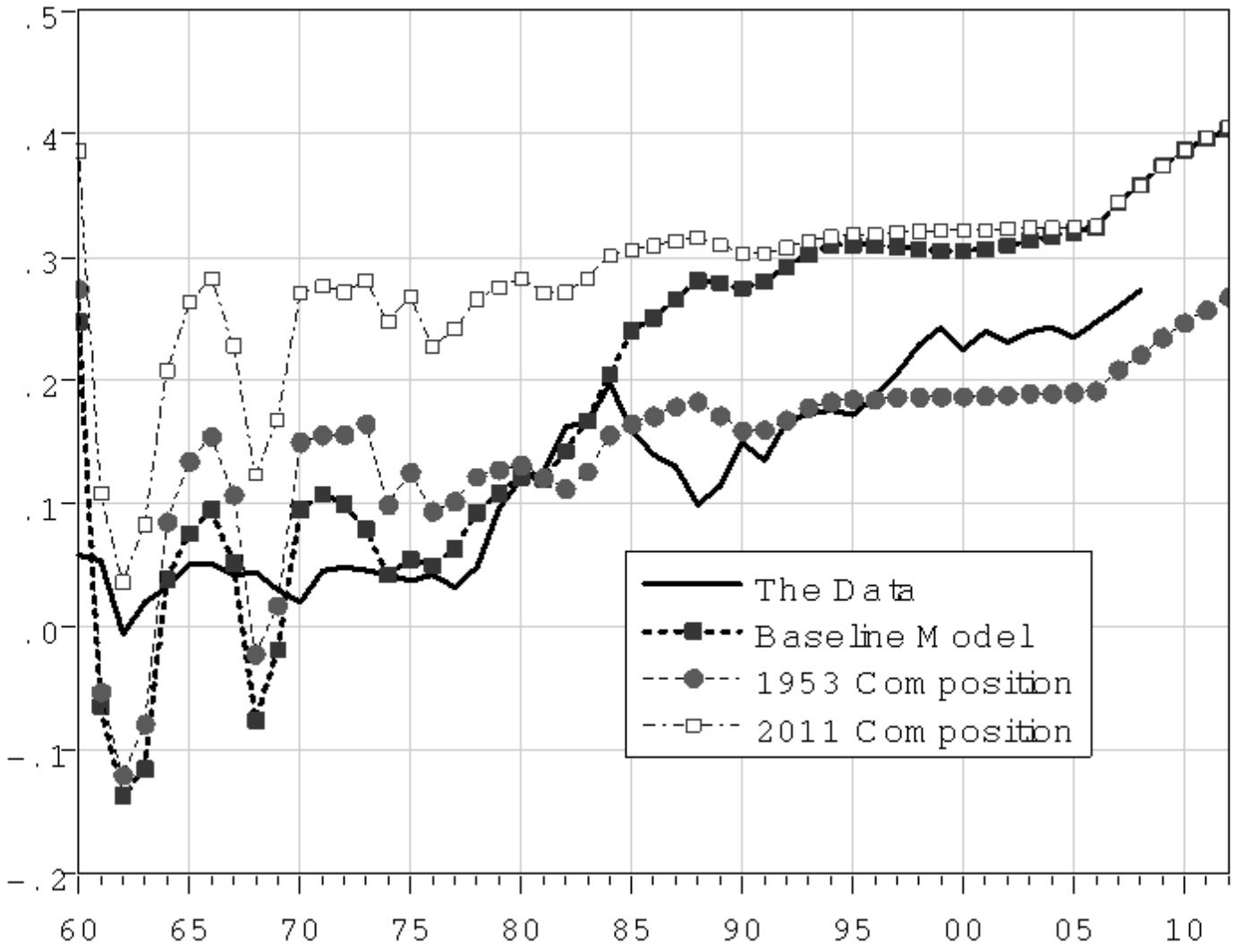

Figure 9: Experiment 4. Constant composition

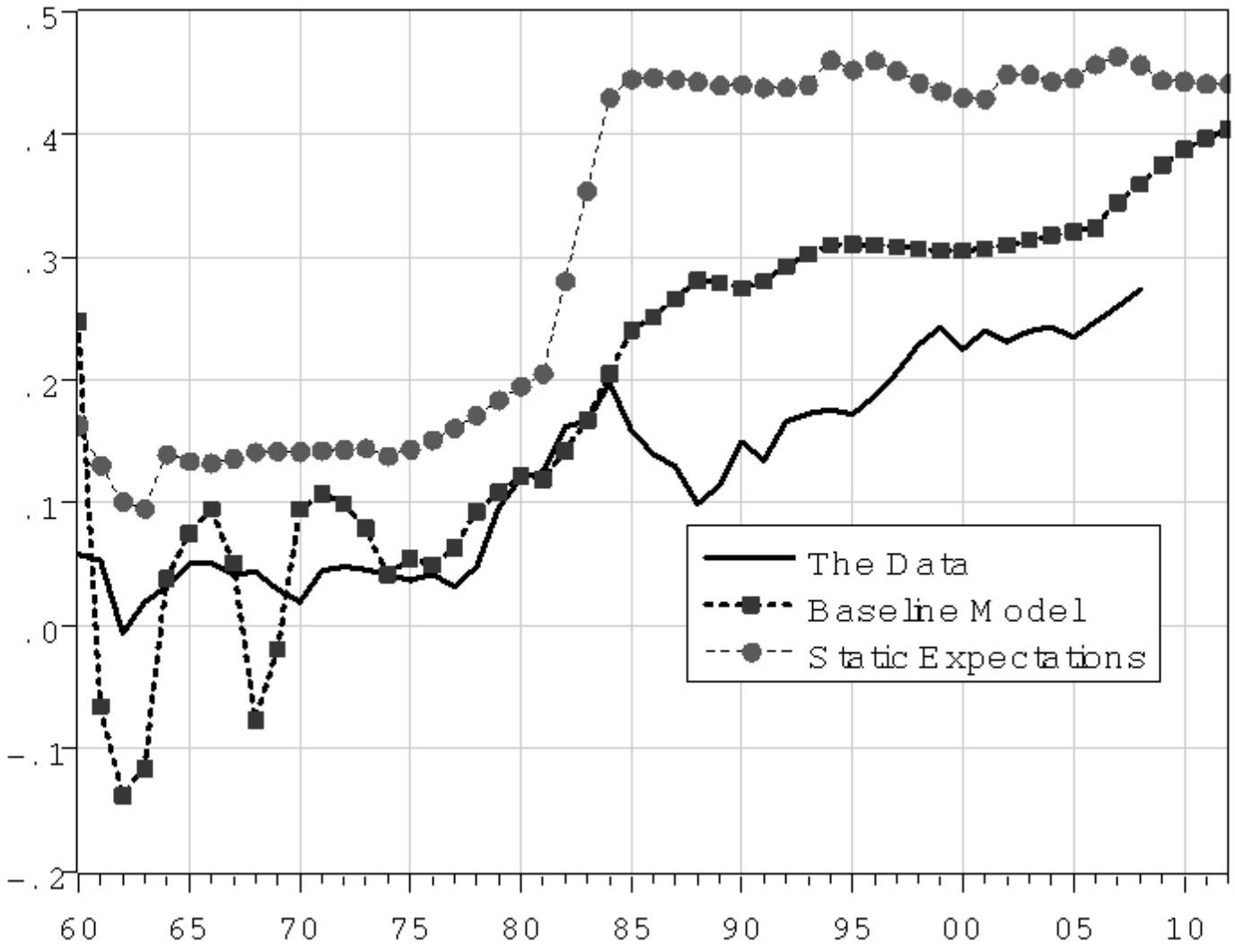

Figure 10: Experiment 5. Static expectations

Conclusion

- Standard life-cycle considerations go a long way in explaining evolution of household saving in China from 1960 to 2008.

- Two features are central: First, young dependent children should enter explicitly into household utility. Second, changing age distribution of entire economy should be represented.

- Rapid labor income growth depresses household savings. Therefore high saving rate is driven by the reduction in family size from population control policies and relatively large size of the today's working population.

- As population ages, and it is aging quite rapidly, the rising household saving rate should be arrested.