Pareto-improving Immigration in the Presence of Social Security

Hisahiro Naito

University of Tsukuba, Japan

July 25, 2022

Why accepting more immigrants?

- Retirement of baby boom generation
- Increasing aged population
- Low fertility
- Increasing inequality of tax/befit ratio of the SS between the current cohorts and future cohorts

Can immigration be the solution ?

- One view: Not the solution to the problem.
- It just postpones the problem
- When accepted immigrants retire, it will becomes a bigger problem
- Higher population growth rate will decrease the GDP per capita and consumption per capita at the steady state

Simulation Result (1) in the literature

- Storesletten (JPE 200)
- Using the computational OLG model, he showed that accepting a particular type of immigrants, tax hike due to the retirement of baby boom generation can be avoided.
- Accept immigrants who are skilled, middle aged and who cannot claim the social benefit due to the minimum duration of the social security tax payment

Simulation Result (2) in the literature

- Fehr, Jokisch and Kotlikoff(FA,2004)
- Using more detailed computational OLG model, they show that such a welfare gain does not exist.

For the Case of Spain

- For the case of Spain, Collardo, Ormaetexand and Valera(2004) argues that accepting more immigrants brings a positive welfare gain.
- Feldstein is negative on the use of immigrants as the solution of the fiscal problem caused by baby boom retirement in Spain.

Questions

- Why are the simulation results so different in different papers ?
- If the intuition of the neoclassical growth model is right, the result should be more consistent

Outline of this paper(1)

- I theoretically investigate whether acceptance of immigrants can Pareto-improve welfare of all generations or not in the presence of social security
- I showed that if MPL condition is satisfied, it is Pareto-improving to accept more immigrants.
- This Pareto-improvement can be achieved by accepting immigrant with a relatively simple tax rule in a decentralized way
- MPL condition is likely to be satisifed in the presence of SS
- I show that if this condition is satisfied, then the government can make the economy reach the (modified) golden rule level in a Pareto-improving way within a finite time.
- Using the computational OLG model, I quantify the welfare gain and explore the implication on capital accumulation

Outline of this paper(2)

- For simulation, I consider a moderate increase of immigrant/native ratio in the US
- Historically in the past 40 years, from 1970 to 2010, the percentage of immigrant to native (PITN) increased by 13 percent point in the US.(1970, 5 percent. 2010, 18.3 percent)
- For simulation, I assume that PITN increases 10 percent point in the next 80 years, 50 percent slower than the speed between 1970-2010.
- Initial PITN is 15.5 percent. Target PITN is 25.5 percent.
- PINT starts to increase from 15.5 and reach 25.5 at 80th year and remains at 25.5 percent in all later years in the slowest case scenario.

Outline of this paper(3)

- I show that the economy reaches the golden rule level at the 112th year in a Pareto-improving way
- Capital stock per capita increases by 102 percent.
- Publicly provided private good increases by 36 percent
- PDV of the welfare gain is about 10-20 percent of the initial GDP
- When the target captial stock is the modified golden rule level(with 3% discount rate), it takes 65 years to reach it in a Pareto-improving way
- PDV of the welfare gain is 13-26 percent of the initial GDP in this case
- At the new balanced growth path, interest income of the increased government saving amount to 70 percent of SS benefit payment.

Outline of this paper(4)

- I conduct robustness checks by changing the value of the following parameters:
- The share of the surplus for the gov.saving, the replacement rate, initial government debt level, immigrants' earning level, immigrants' use of public services, CRRA, the time preference rate, return rate of immigrants.
- The results are robust in magnitude

Theoretical Model: Assumptions

- Standard two period OLG model
- PYGO social security at the initial steady state
- The government debt or asset at the initial steady state

Assumptions(2)

- Publicly provided private goods is provided to consumers
- Welfare gain is used for the government saving or distributed as an increase of publicly provided private goods
- The government treats native and immigrants in the same way in the linear tax and social security system once immigrant are accepted. (This assumption is important.)

- Define the immigration policy as follows:

$$imi_t = \alpha_t \times nat_t$$

$$\begin{aligned} N_t^n + N_t^m &= N_t^n \times (1 + \alpha_t) \\ &= \{(1 + \pi_m) \times N_{t-1}^m + (1 + \pi_n) \times N_{t-1}^n\} \times (1 + \alpha_t) \\ &= \{(1 + \pi_m) \times \alpha_{t-1} + (1 + \pi_n)\} \times N_{t-1}^n (1 + \alpha_t) \end{aligned}$$

Constrained Pareto-efficient allocation

- Maximize the utility of old at period 0 given the utility of the following cohorts is greater than at the inital steady state level:

$$V(\alpha) = \max_{\{c_t^{y,n}, c_t^{o,n}, s_t^n,\ a_t | t=1,2,..\}} \frac{1}{1+\rho}\left[u^o\left(c_1^{o,n}\right) + v^o\left(g_o, g^{ind}\right)\right]$$

$$\text{s.t. } u^y\left(c_t^{y,n}\right) + v^y\left(g^y, g^{ind}\right)$$

$$+\frac{1}{1+\rho}\left[u^o\left(c_{t+1}^{o,n}\right) + v^o\left(g^o, g^{ind}\right)\right] \geq u^* \quad \text{for } t = 1, 2, ...$$

and the resource constraint for period $t = 1, 2, .$

The resource constraints are as follows:

$$F(\{(1+\pi_m)\alpha^* + (1+\pi_n)\}\, N_0^t \times (1+\alpha), K_0) + (1-\delta)K_0 \geq$$
$$\{c_1^{y,n} + s_1^n + g^y + g^{ind} + a_1\}\{(1+\pi_m) \times \alpha^* + (1+\pi_n)\} \times N_0^n(1+\alpha)$$
$$+\{c_1^{o,n} + g^o + g^{ind}\}\ N_0^n(1+\alpha^*)$$
$$F(\{(1+\pi_m)\alpha + (1+\pi_n)\}N_t^n(1+\alpha), K_t) + (1-\delta)K_t \geq$$
$$\{c_{t+1}^{y,n} + s_{t+1}^n + g^y + g^{ind} + a_{t+1}\} \times \{(1+\pi_m) \times \alpha + (1+\pi_n)\}N_t^n(1+\alpha)$$
$$+\{c_{t+1}^{o,n} + g^o + g^{ind}\}\ N_t^n(1+\alpha) \quad \text{for } t = 1, 2, ..$$
$$\text{where } K_0 = (s^* + a^*) \times N_0^n(1+\alpha^*)$$
$$K_t = (s_t^n + a_t)N_t^n(1+\alpha) \text{ for } t = 1, 2, ...$$

Characterization of V(.)

- At $\alpha = \alpha^*$,the solution of the above programming problem coincides with the initial steady state.
- $dV/d\alpha|_{\alpha=\alpha^*} = \{\{(1+\pi_m)\alpha^* + 1 + \pi_n\}\lambda_1^* + (1+\pi_m)\sum_{t=2}^{\infty}\lambda_t^*\} \times \left\{F_L((1+\pi_m)\alpha^* + 1 + \pi_n, s^* + a^*) - c^{y*} - s^* - g^y - g^{ind}\right\}$
- The welfare effect depends on $\left\{F_L((1+\pi_m)\alpha^* + 1 + \pi_n, s^* + a^*) - c^{y*} - s^* - g^y - g^{ind}\right\}$

- $dV/d\alpha|_{\alpha=\alpha^*}$ is the lagrangian multiplier of the resoucce constraint times

$$\left\{F_L((1+\pi_m)\alpha^*+1+\pi_n, s^*+a^*)-c^{y*}-s^*-g^y-g^{ind}\right\}$$

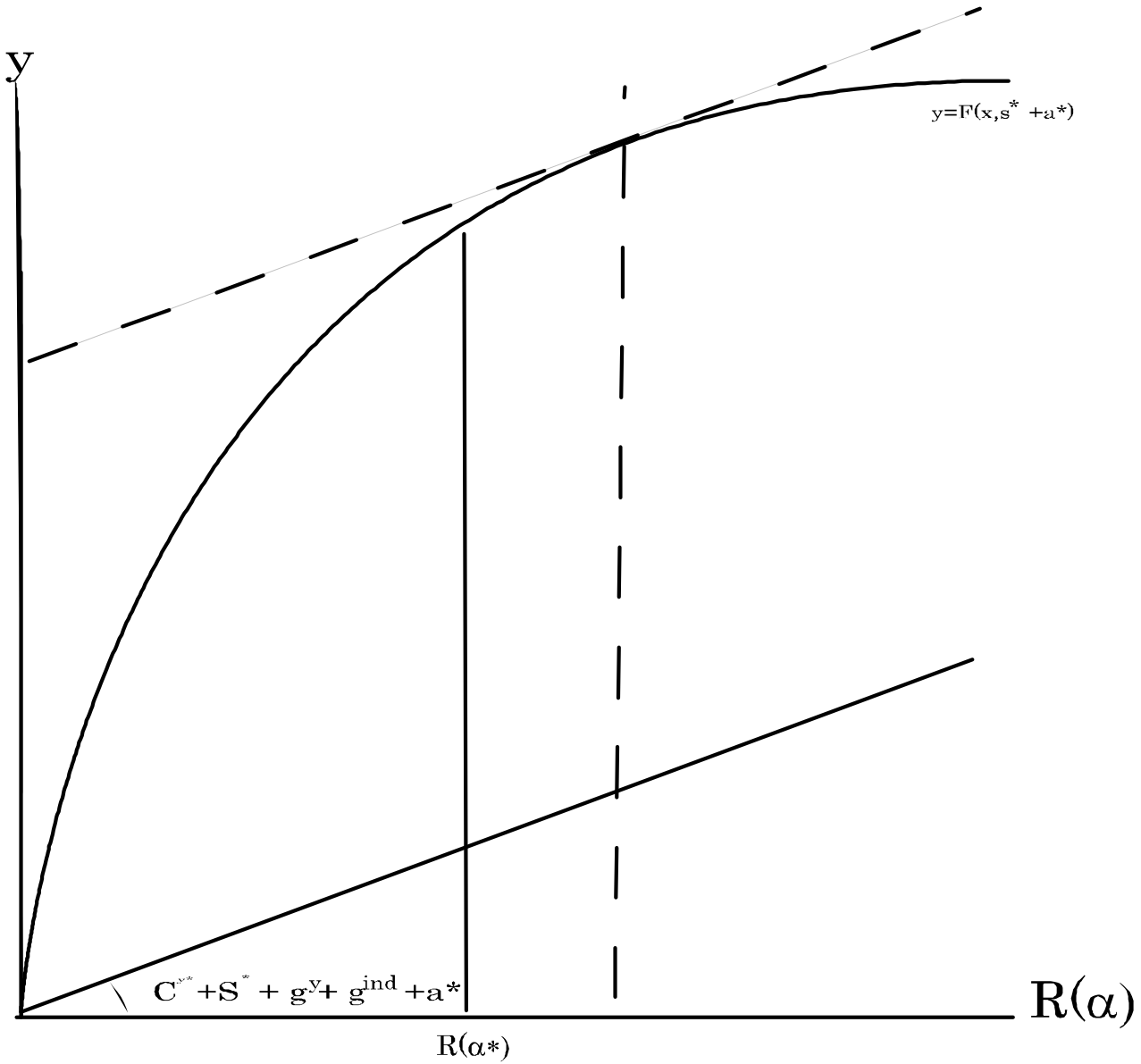
- $c_y^*+s^*$ is the after tax income of the young
- g^y+g^{ind} is the publicly provided private goods for the young
- $c_y^*+s^*+g^y+g^{ind}$ is the resource allocated to the young
- If MPL is greater than what is allocated to the young, then accepting immigrant is Pareto-improving.

Proposition 1

Proposition1. (MPL condition) *If there is an intergenerational transfer from the young to the old at the initial steady state in the sense that the marginal product of labor of the young is greater than the resource allocated to the young(private consumption, saving plus publicly provided private goods of the young), then accepting immigrants is Pareto-improving for all generations.*

Graphical analysis

- Measure $F(x,s^*) = F(xN, Ns^*)/N$. This is the GDP per old where x is the 1 plus the population growth rate.
- $F(x,s^*)$ is the GDP when the number of the old is one and the population of the young is x.
- Measure the total resource used by the young divided the number of old.
- This is
  $y = (c^{y*} + s^* + g^{y*} + g^{ind})N(1+x)/N = (c^{y*} + s^* + g^{y*} + g^{ind})x$
- The difference between $F(x,s^*)$ and the straight line is the resource available for the old.
- If the slope of F is greater than the slope of the straight line, increasing x increases the resource per old without decreasing the resource for the young.


y
y=F(x,s* +a*)
C* +S* + g^y + g^ind +a*
R(α)
R(α*)

Elastic labor supply, presence of distortionary taxes and government saving

- Now I introduce elastic labor supply and capital income tax.
- I cannot use the previous method since the initial allocation is not constrained-Pareto-efficient in the presence of distorting taxes.
- Thus, I will develop a different approach.
- It turns out that a new approach allow me any pre-existing distortion It also allow the analysis of the government savings.

Elastic labor supply, presence of distortionary taxes and government saving (2)

- When the government accept immigrants, wage rate falls and interest rate increases. Then, change the tax rate as follows:

$$w_t(1-\tau_{wt}) = w^*(1-\tau_w^*) \text{ and } r_t(1-\tau_{rt}) = r^*(1-\tau_r^*)$$

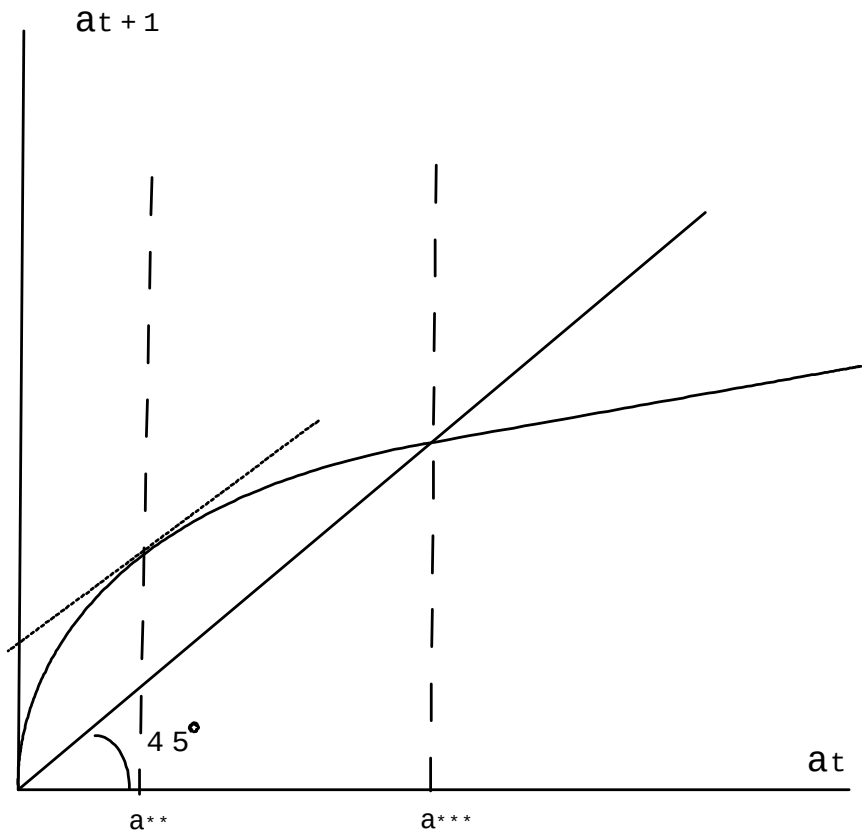
- With this tax adjustment, after-tax factor prices are the same as before. No welfare change.
- The question is whether this tax change is fiscally feasible or not.
- It turns out that as long as MPL condition is satisfied, it is feasible.
- Apply the above tax change and use the surplus for increasing publicly provided private goods. Then, accepting immigrant Pareto-improves welfare.

Elastic labor supply, presence of distortionary taxes and government saving (3)

- Even after compesating losers, there is a surplus.
- The government can use some of the surplus for the government saving for future cohort instead of increasing publicly provided private goods.
- Assume that the governments uses the interest income from the government saving at the period t-1 plus the principal to the government saving at the period t.
- It turns out that this is fiscally feasible.
- Let a_t be the balance of the government saving per young at the period t.
- Dynamics of the government saving

$$a_{t+1} = \frac{1}{1+\Omega(\alpha,\phi(\alpha))}[F(1+\Omega(\alpha,\phi(\alpha)), s^* + a_t) - F(1+\Omega(\alpha,\phi(\alpha)), s^* + a^*) + (1-\delta)a_t]$$

- Dynamics of the government saving



Proposition 2

- *Suppose that MPL condition is satisfied. Then, by accepting immigrants and using the proposed taxes and government saving policy, the government can make the economy reach the (modified) golden rule level within in a finite time in a Pareto-improving way.*

Quantifying the welfare gain

- Two propositions show that
- It is Pareto-improving for all generations to accept immigrant as long as MPL condition is satisfied
- Using the surplus obtained from accepting immigrants, the government can make the economy reach the (modified) golden rule within finite time
- **Questions**
- How long does it take for the economy to reach the (modified) golden rule?
- What is the size of the welfare gain?
- Using the computational OLG model (AK model), I answer those questions.

Immigration in the Auerbach-Kotlikoff model

- The standard Auerbach-Kotlikoff model.
- The model economy mimics the US economy in important dimensions for population and production.
- People live for 80 years at the maximum. Age 1 in the model is age 20 in real life.
- Stochastic death.
- No bequest motive.
- no annuity market

Immigration in the Auerbach-Kotlikoff model(2)

- 1.5 percent GDP per capita growth
- endogenous labor supply
- PYGO social security, wage tax and capital income tax
- 100 percent bequest tax for accidental bequest
- Dynamics of population is explicitly considered
- Infant mortality and child mortality are considered.
- Initial governmnet debt or asset is considered

Immigration in the Auerbach-Kotlikoff model (3)

- Difference of productivities(wage levels) between immigrants and natives is modeled
- Difference of consumption of public services by immigrant and native is modeled
- Difference of fertility rates between immigrant and native is modeled using CPS data

Simulated immigration

- I consider an increase of PINT(percentage of immigrant to native) in the US economy
- As of year 2000, PITN above 20 years old is 15.5 percent in the US.
- I set 15.5 percent as the starting INR.
- Historically, PITN was 5 percent in 1970 (Census) and 18.3 percent in 2010(CPS). For last 40 years, it increased more than 10 percent point.
- Assuming increasing another 10 percent point in 80 years in the US seems politically tolerable given the past experience in the US.
- Thus, I assume that PITN increases from 15.5 percent and reach 25.5 percent at 80th year in my simulation.
- I also consider faster cases.

Preference and the budget constraint

- $\max \sum_{i=1}^{45} \beta^i \prod_{q=1}^{i} p_q \left\{ \frac{[(c_{t-1+i}^{i,j})^{\alpha}(1-l_{t-1+i}^{i,j})^{1-\alpha}]^{1-\gamma}}{1-\gamma} + g_{t-1+i}^{ij} \right\} +$

  $\sum_{i=46}^{80} \beta^i \prod_{q=1}^{i} p_q \left\{ \frac{[c_{t-1+i}^{i,j}]^{\alpha(1-\gamma)}}{1-\gamma} + g_{t+1-i}^{ij} \right\}$

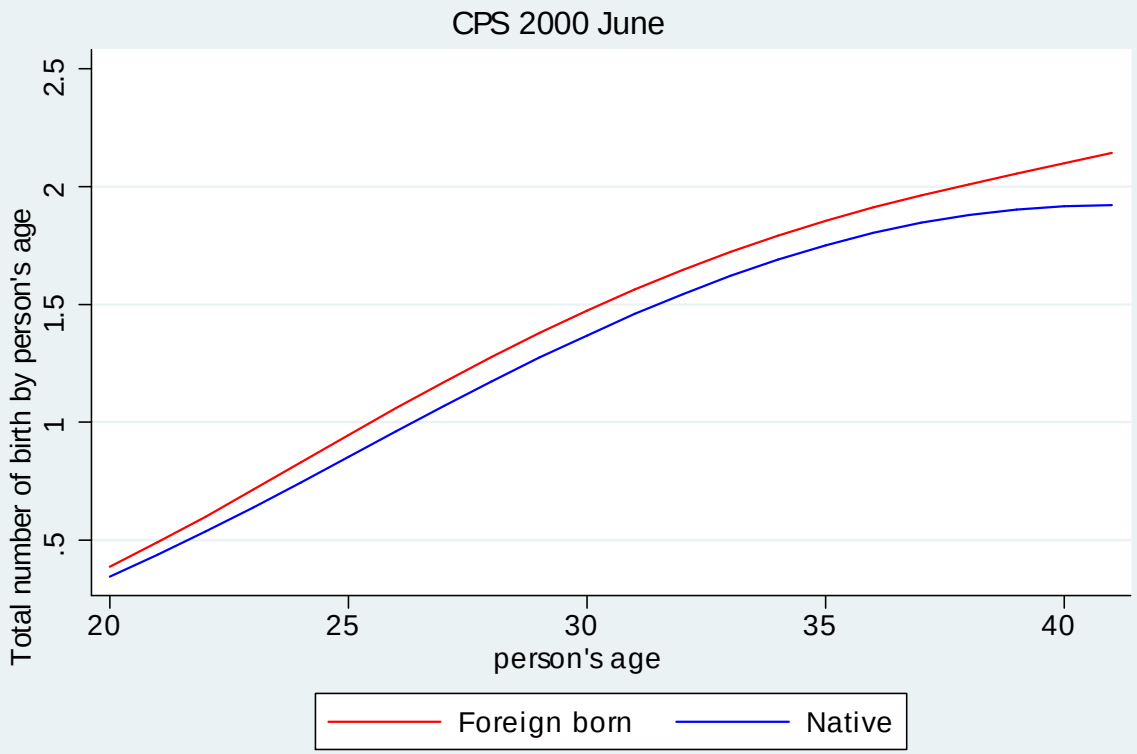
Production function and human capital profile

- Production function is $Y_t = K_t^{\theta}(E_t L_t)^{1-\theta}$ and $\mu = (E_{t+1} - E_t)/E_t$
- Labor supply is $L_t = \sum_{i=1}^{44} \sum_{j=n,m} H^{i,j} N_t^{ij} l_t^{ij}$ where $N_t^{im} = p_i \widehat{p}_i N_t^{i-1,m}$ and $N_t^{in} = p_i N_t^{i-1n}$
- $H^{i,j}$ is the human capital profile of type j.

Difference of fertility rate between immigrants and natives

- CPS data show that fertility rates are different for immigrants and natives:
- I calculate age-nativity specific fertility rate

Figure 3 Total number of birth by person's age



Population dynamics

- The population of age 1 at the period t+20 is

$$N_{t+20}^{1,n} = (1-d) \times \left\{ \sum_{i=1}^{80} \eta^{i,m} N_t^{i,m} \Pi_{x=1}^{20} \widehat{p}_{i+x} + \sum_{i=1}^{80} \eta^{i,n} N_t^{i,n} \right\}$$

where $\eta^{i,j}$ is the age-nativity specific fertility of type j=n,m

Population dynamics (2)

- I assume that that at the initial steady state, the populaiton dynamic is at the steady state.
- At the population steady state, PITN stays constant.
- This is possible if and only if $N_t^{1,n}$ and $N_t^{1,m}$ grow at the same rate σ. Thus, we have

$$\frac{N_t^{1,n}(1+\sigma)^{20}}{1-d} = \sum_{i=1}^{80} \frac{N_t^{1,m}}{(1+\sigma)^{i-1}} \eta^{i,m} \times \Pi_{q=1}^{i} p_q \widehat{p}_q \Pi_{x=1}^{20} \widehat{p}_{i+x} + \sum_{i=1}^{80} \frac{N_t^{1,n}}{(1+\sigma)^{i-1}} \eta^{i,n} \times \Pi_{q=1}^{i} p_q$$

- Immigrant native ratio at the steady state becomes

$$\frac{\sum_{i=1}^{80} N_t^{i,m}}{\sum_{i=1}^{80} N_t^{i,n}} = \frac{\frac{1}{1-d} - \sum_{i=1}^{80} \frac{1}{(1+\sigma)^{i+19}} \eta^{i,n} \times \Pi_{q=1}^{i} p_q}{\sum_{i=1}^{80} \frac{1}{(1+\sigma)^{i+19}} \eta^{i,m} \times \Pi_{q=1}^{i} p_q \widehat{p}_q \Pi_{x=1}^{20} \widehat{p}_{i+x}} \times \frac{\sum_{i=1}^{80} (1+\sigma)^{-(i-1)} \times \Pi_{q=1}^{i} p_q \widehat{p}_q}{\sum_{i=1}^{80} (1+\sigma)^{-(i-1)} \times \Pi_{q=1}^{i} p_q}$$

- RHS is an increasing function of σ.
- We find σ that is consistent with 15.5 percent PITN.

Factor prices

- Capital stock at the period t
- $K_t = \sum_{i=1}^{80} \sum_{j=n,m} N_{t-1,i}^{i,j} s_{t-1}^{i,j} + a_{t-1} \sum_{i=1}^{80} \sum_{j=n,m} N_{t-1}^{i,j}$
  - Factor prices are

$$w_t = (1-\theta) K_t^{\theta} E_t^{1-\theta} L_t^{-\theta} \qquad \text{and} \qquad r_t = \theta K_t^{\theta-1} E_t^{1-\theta} L_t^{1-\theta}$$

Adjustment of taxes and the government saving

- When immigrants increases, initially the wage rate decreases and the interest rate increases.
- To achive Pareto-improvement, I assume the following tax adjustment
- $w_t(1-\tau_{wt}) = w_t^*(1-\tau_w^*)$ and $r_t(1-\tau_{rt}) = r^*(1-\tau_r^*)$
- After-tax factor prices are the same as before.
- Even after this tax adjustment, there is surplus for the government.
- The government uses some of the surplus for increasing the government saving balance for the future cohort.

Parameter values (1)

- CRRA=3
- Capital share in the production function is 0.4
- depreciation rate is 0.047
- time preference rate is 1.011
- Human capital profile of native is
  $H^{i,n} = \exp(4.47 + 0.033 \times i - 0.00067 \times i^2)$ for $1 \leq i \leq 45$ and
  $H^{i,n} = 0$ for $46 \leq i$
- For immigrant, $H^{i,m} = 0.843 \times H^{i,n}$
- For CRRA and the time preference rate immigrant human capital level, I conduct robustness checks for different values

Parameter values (2)

- For the initial government debt level, different authors used different values. Storesletten is 10% and Nishiyama and Smetter is -10 percent of the private capital.
- 0 percent in the benchmark case. Conduct robustness checks assuming it is 10% or -10%

- Replacement rate is set 0.6 in the benchmark case and conduct robustness checks by setting at 0.55 or 0.5.
- Age-nativity specific fertility is calculated from the CPS data (2000 June).
- The return rate of immigrants is calculated from the census data
- depreciation rate is 0.047
- time preference rate is 1.011
- Capital income tax is 28 percent

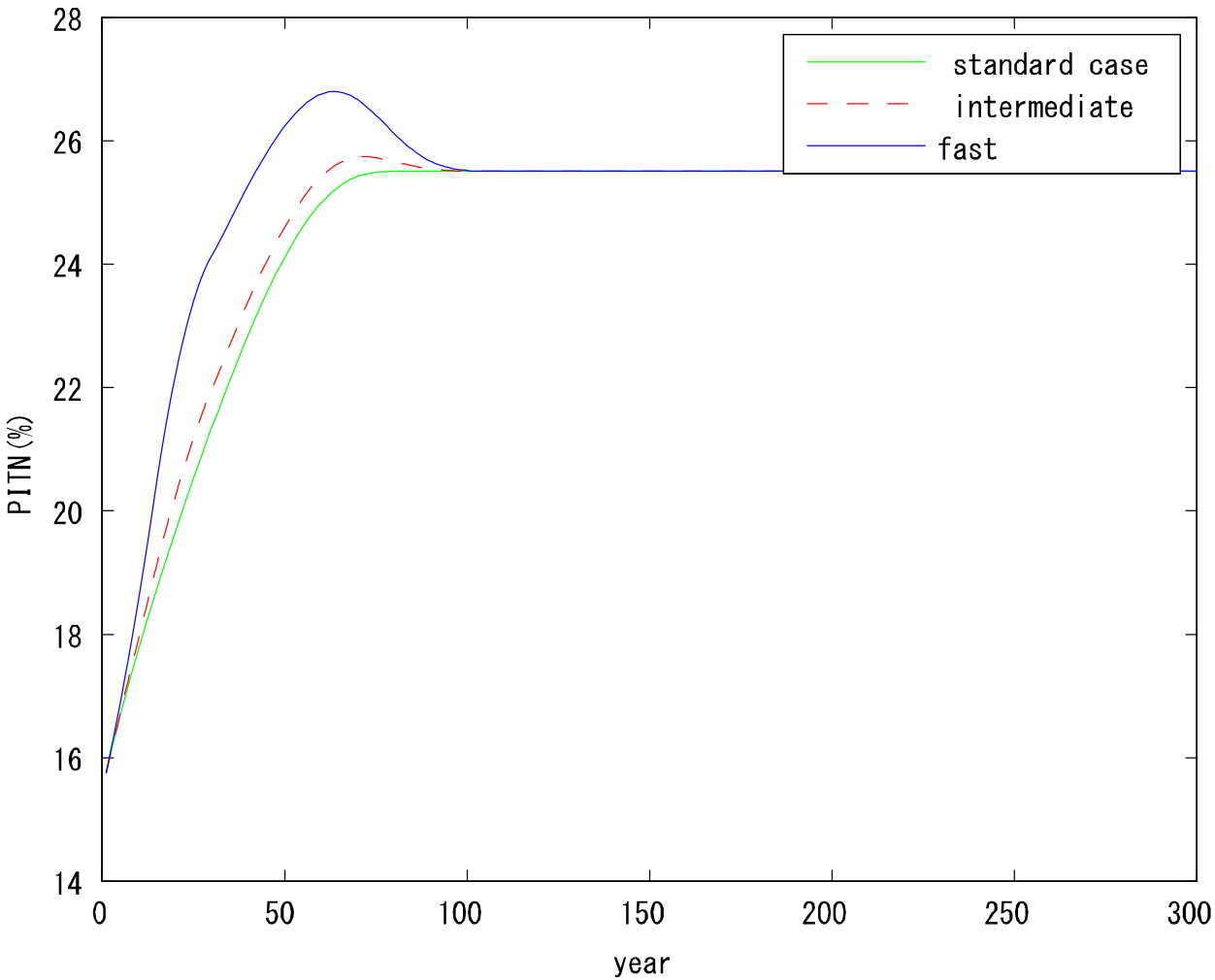
Age-nativity specific government expenditure

- Borjas and Hilton (1996) shows that immigrants have a higher participation rate in welfare programs than natives.
- Fix, Passel, and Zimmermann (1996) shows that these differences are explained by the higher participation rate in welfare programs among refugees and retired immigrants, not in labor immigrants.
- Thus, in the benchmark case, I assume that there is no difference between immigrant and native for the use of public services:

  $1 \leq i \leq 24$, $g^{*i,j} = g^y$, for $25 \leq i \leq 44$, $g^{*i,j} = g_m$ and for $45 \leq i \leq 80$, $g^{*i,j} = g_o$

- g^y, g^m and g^o are 24.5%,13.4% and 23.2 % of GDP per capita at the initial balanced growth path
- I condut robustness checks by assuming that immigrant consumes public services 20 percent more

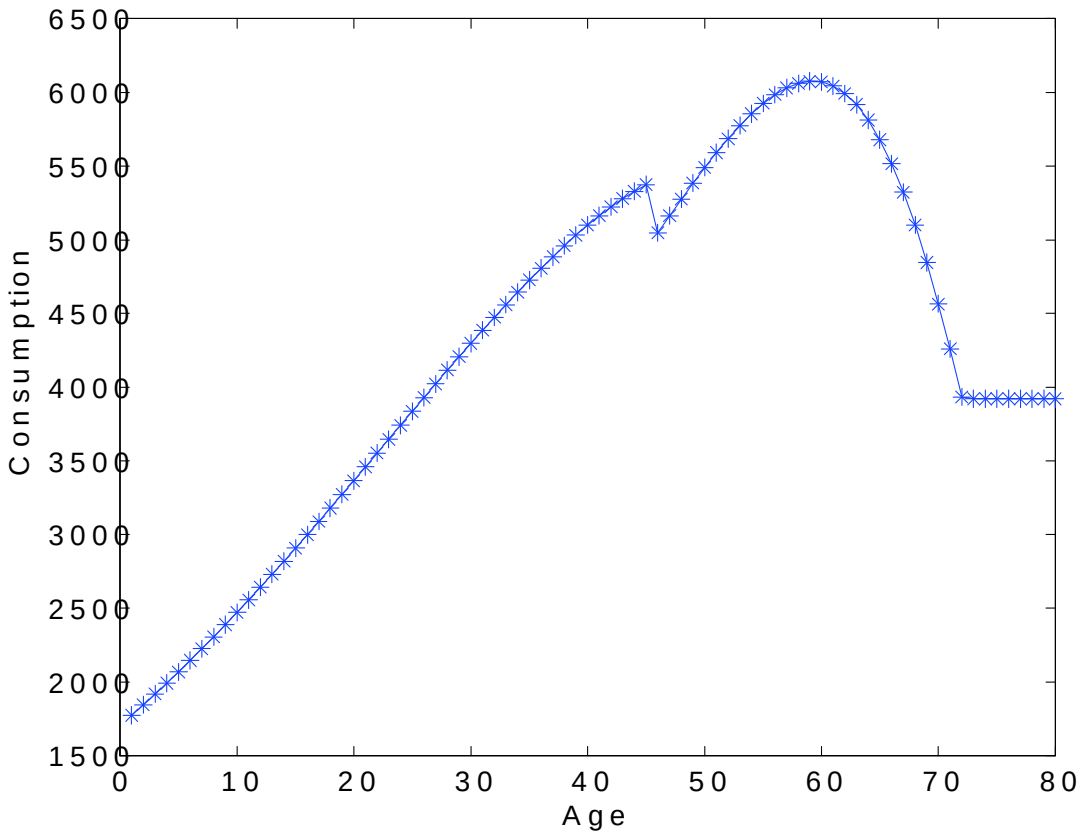
Profile of PITN for the next 300 years.



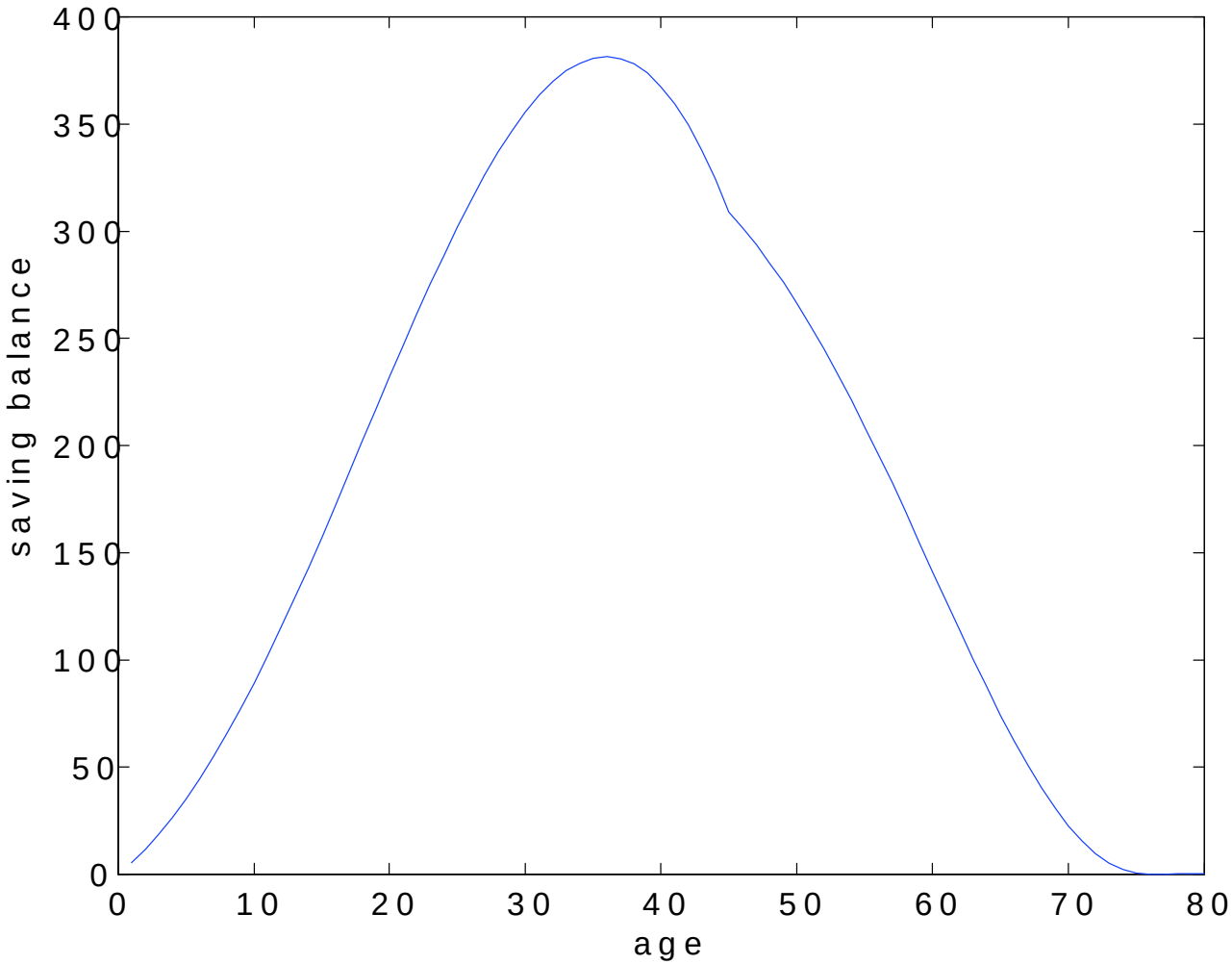
Computation

- The equilibrium is calculated by the standard method.
- Coding errors are checked by several methods such as checking Walras's law, zero asset condition at the end of life, the steady state condition.

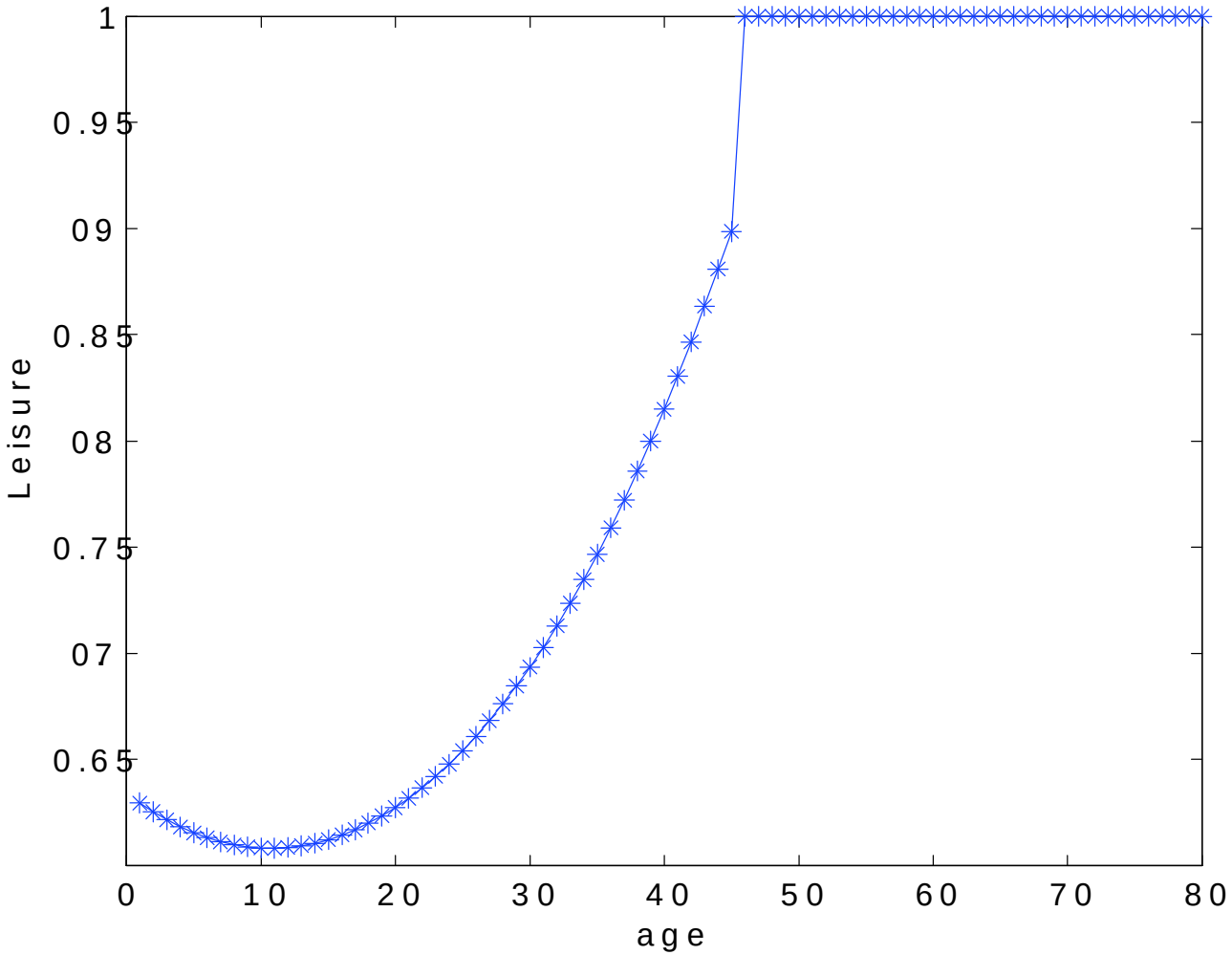
Consumption profile at the initial balanced growth path



Asset balance over life cycle



Consumption of leisure over life-cycle



The equilibrium values at the initial balanced growth path

- Capital output ratio is 2.98. This is lower than Cooly and Prescott (3.2) but higher than Storesletten (2.4) and Nishiyama and Smetter (2.7)
- MPK is 11.1 percent.
- Wage tax rate is 30.7 percent.
- V is the parameter indicating how much the surplus is used for the governmnet savings.

- Marginal Product of capital over time

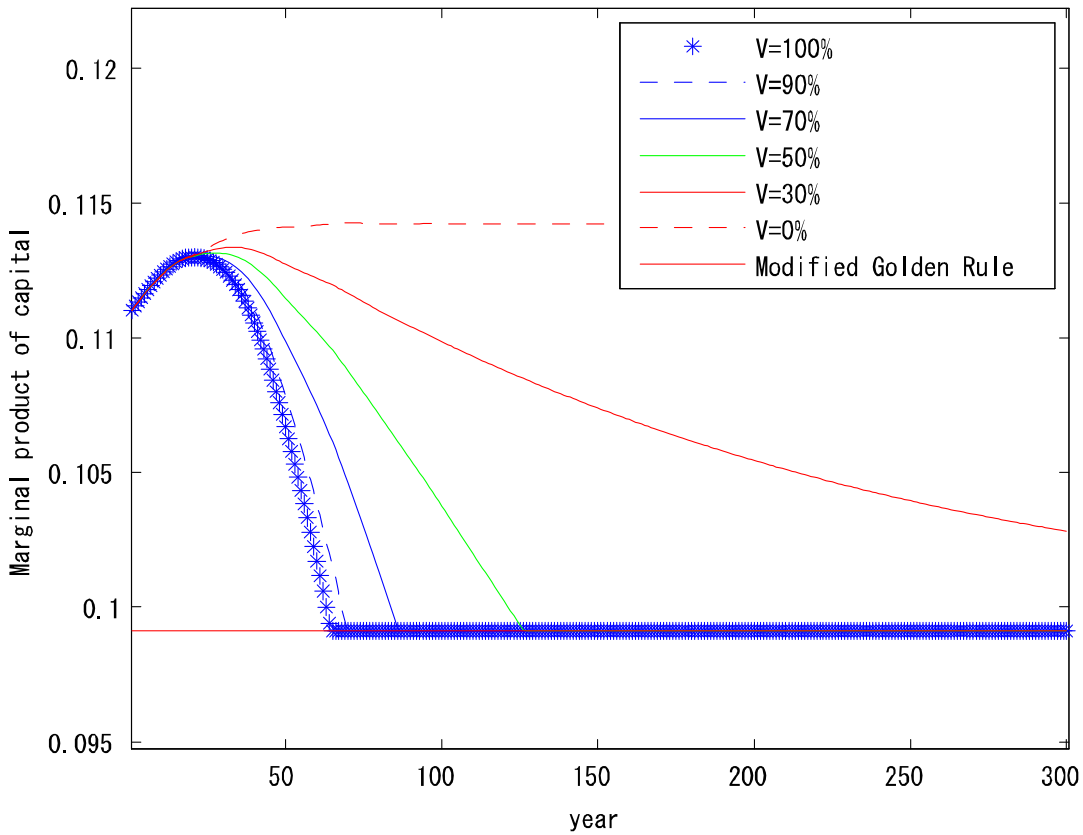
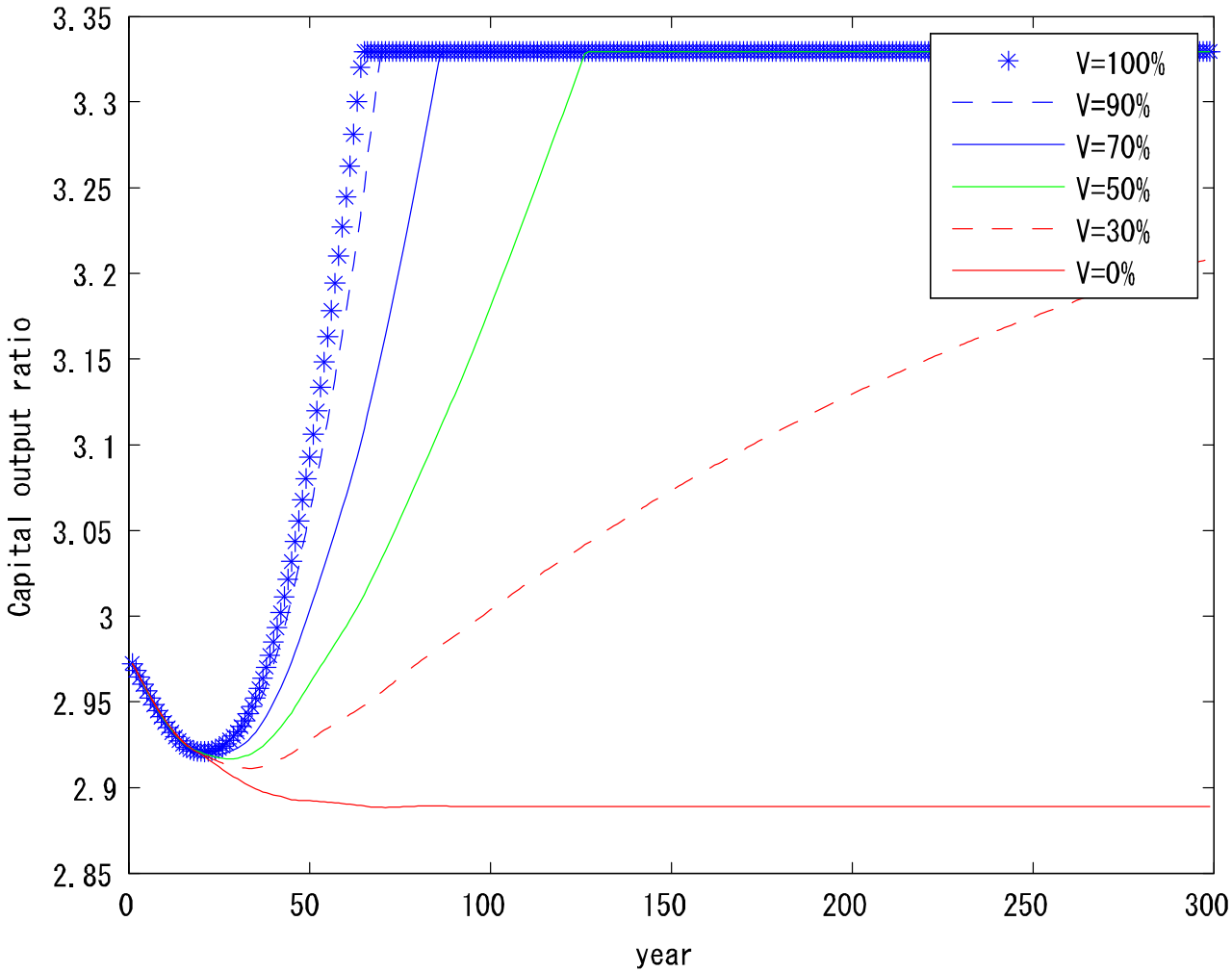


Figure: The marginal product of capital over time for different values of the share of the surplus used for government savings (V). The target capital stock is the modified golden rule level with 3 % intergenerational discount rate.

- Capital output ratio over time



Utility of different cohorts over time

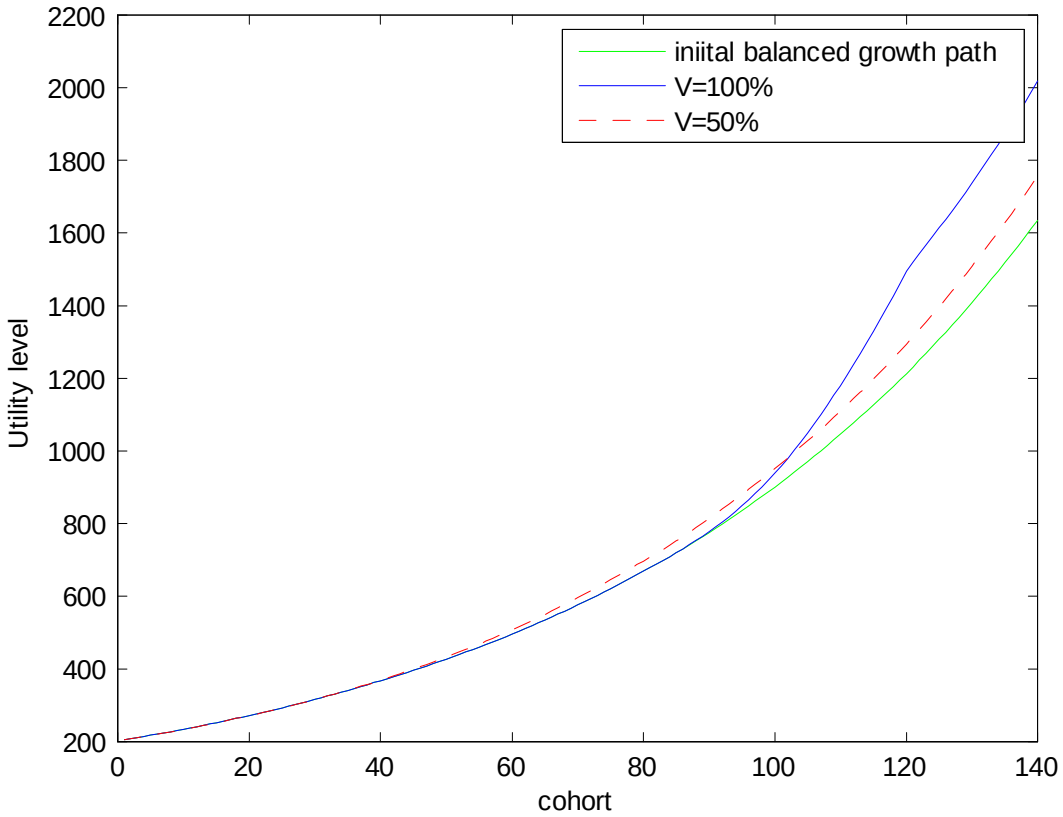


Figure: Utility level of different cohorts for different values of the share of the surplus used for government savings (V). The target capital stock level is the modified golden rule level with 3% intergenerational discount rate for the modified golden rule.

Ratio between interest income from the government asset and SS benefit

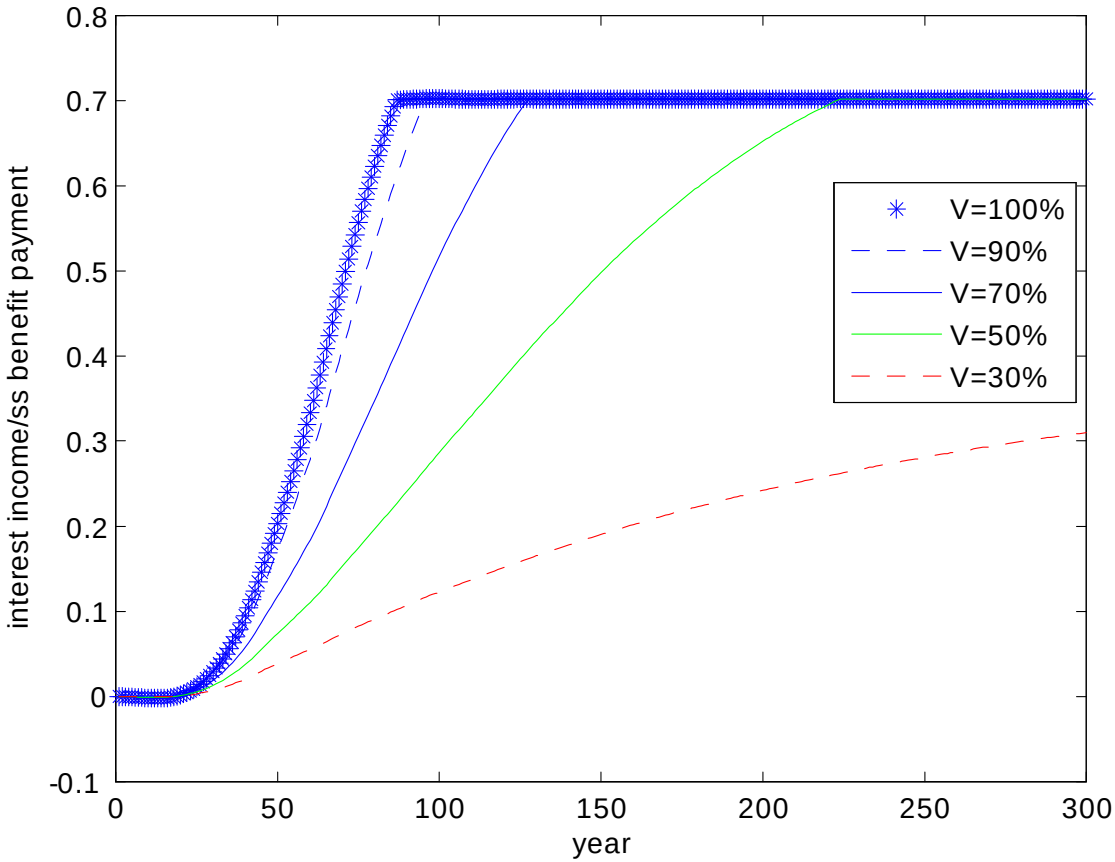


Figure: The ratio between the interest income from the government savings balance and the social security benefit payment in each period. It is assumed that the PITN reaches the target PITN at 80th year. The inter-generational discount rate for the modified golden rule is set at 3%.

Some selective results (1)

years needed to reach the target PITN	share of the surplus for the gov. savings (V)	year reaching the golden rule	% increase of capital stock per efficient unit labor at the golden rule	%change of publicly provided private goods per capita at the golden rule	% change of welfare of cohort born at the golden rule	share of the sum of the PDV of increased publicly provided private goods in the initial GDP
80	0%	300**	-4.37%	5.00%	0.53%	15.57%
80	30%	300*	11.89%	14.69%	1.41%	17.86%
80	50%	300*	71.21%	30.27%	2.79%	19.66%
80	70%	184	102.43%	35.86%	3.77%	18.48%
80	90%	127	102.43%	35.86%	3.77%	14.52%
80	100%	112	102.43%	35.86%	3.77%	12.23%

Increasing the speed of accepting immigrants

years needed to reach the target PITN	share of the surplus for the gov. savings (V)	year reaching the golden rule	% increase of capital stock per efficient unit labor at the golden rule	%change of publicly provided private goods per capita at the golden rule	% change of welfare of cohort born at the golden rule	share of the sum of the PDV of increased publicly provided private goods in the initial GDP	s su we all des th
42	0%	300**	-4.37%	5.00%	0.53%	20.20%	
42	30%	300*	73.43%	30.82%	2.88%	25.32%	
42	50%	300*	73.43%	30.82%	2.88%	25.32%	
42	70%	119	50.99%	30.14%	3.17%	25.87%	
42	90%	120	102.43%	35.86%	3.77%	18.21%	
42	100%	106	102.43%	35.86%	3.77%	15.38%	

The role of the initial government debt ratio

years needed to reach the target PITN	capital to output ratio at the initial balanced growth path	years taken to reach the modified goldren rule level	% increase of capital stock per efficient unit labor at the new balanced growth path	%change of publicly provided private goods per capita at the new balanced growth path	% change of welfare of the cohort born at the new balanced growth path	share of the sum of PDV of increased publicly provided private goods in the initial GDP	share of the sum of the PDV of welfare gain of all natives and their descendants in initial GDP
initial government debt ratio (% of private capital)= 10 %							
80	2.91	63	22.39%	21.87%	2.29%	28.48%	27.22%
62	2.91	61	22.39%	21.87%	2.29%	30.31%	28.82%
42	2.91	57	22.39%	21.87%	2.29%	35.66%	33.30%
initial government debt ratio(% of private capital)= -10 %							
80	3.04	67	14.71%	15.75%	1.67%	18.30%	19.68%
62	3.04	65	14.71%	15.75%	1.67%	19.51%	20.87%
42	3.04	61	14.71%	15.75%	1.67%	23.01%	24.16%

The role of earning level of immigrants

- CPS data shows that immigrants earn 10 % less than the native.
- In the benchmark case, I assume that immigrant earn 15 % less than the native to estimate conservatively.
- In the table below, I assume that the human capital level of immigrants is 74.9% of natives.

years needed to reach the target PITN	capital to output ratio at the initial balanced growth path	years taken to reach the modified goldren rule level	% increase of capital stock per efficient unit labor at the new balanced growth path	%change of publicly provided private goods per capita at the new balanced growth path	% change of welfare of the cohort born at the new balanced growth path	share of the sum of PDV of increased publicly provided private goods in the initial GDP	share of the sum of the PDV of welfare gain of all natives and their descendants in initial GDP
80	2.98	73	18.18%	17.58%	1.83%	17.32%	17.20%
62	2.98	71	18.18%	17.58%	1.83%	18.430%	18.20%
42	2.98	67	18.18%	17.58%	1.83%	21.629%	20.96%

The role of immigrants' consumption of publicly provided private goods

years needed to reach the target PITN	capital to output ratio at the initial balanced growth path	years taken to reach the modified goldren rule level	% increase of capital stock per efficient unit labor at the new balanced growth path	%change of publicly provided private goods per capita at the new balanced growth path	% change of welfare of the cohort born at the new balanced growth path	share of the sum of PDV of increased publicly provided private goods in the initial GDP	share of the sum of the PDV of welfare gain of all natives and their descendants in initial GDP
young adult immigrants consume publicly provided private goods 20% higher than young adlut natives							
80	2.97	74	18.46%	17.70%	1.90%	17.27%	17.01%
62	2.97	72	18.46%	17.70%	1.90%	18.343%	17.96%
42	2.97	68	18.46%	17.70%	1.90%	21.409%	20.56%
immigrants of all ages consume publicly provided private goods 20% higher than natives							
80	2.96	77	18.84%	16.89%	1.86%	15.71%	15.25%
62	2.96	75	18.84%	16.89%	1.86%	16.674%	16.09%
42	2.96	71	18.84%	16.89%	1.86%	19.410%	18.36%

Summary

- If MPL condition is satisfied, the government can make the economy reach the golden rule in a Pareto-improving way in a finite time by accepting immigrants.
- The computational OLG model confirms those results.
- It takes 80-200 years for the model economy to reach the golden rule level in a Pareto-improving way by accepting immigrants in a reasonable size.
- At the new steady state, capital stock per efficient unit of labor increases by 102 percent in the bench mark case.
- At the new steady state, the publicly provided private goods increases by 36 percent.
- The welfare gain of this Pareto-improvement amount to 19 percent of the initial GDP when V=70%
- The results are robust regarding the different values of paramters.
- Increasing PITN brings non-trivial amount of the welfare gain to the US economy.