Achieving Actuarial Balance in Social Security: Measuring the Welfare Effects on Individuals

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Effects of Aging Population on Households

Aging population affects the individual decision as follows:

- With lower mortality rates and higher life expectancy, individual households would save more by working longer for their retirement. [direct effect]
- With fewer children, households would likely consume less for dependent children. [not considered]
- Possible changes in factor prices and government policies would affect the households' current and future decisions further. [G.E. effects]

Effects of Aging Population on the Overall Economy

Aging population affects the overall economy as follows:

- With the lower (higher) share of working-age (elderly) population, the labor supply per capita and GDP per capita would decrease.
- The government tax revenue per capita would likely decrease, and its transfer spending would increase.
- To finance the budgetary cost of aging, the government would have to raise taxes and/or cut spending.
- These fiscal policy changes would affect the overall economy further. [G.E. effects]

Main Questions of This Paper

This paper addresses the following questions:

- How would the U.S. aging population affect the individual behavior and the overall economy?
- How large would the cost of the aging population in the Social Security pension (OASI) program be?
- How should (could) the government close the fiscal gap generated by the aging population?
- How would different policy changes to close the fiscal gap affect the overall economy and the welfare of households?

The Approach of This Paper

This paper quantitatively analyzes the effect of the U.S. aging population in a heterogeneous-agent OLG economy in the following way:

- Incorporating SSA's population projection to a G.E. OLG model with idiosyncratic wage shocks.
- Constructing the aging baseline (calibrated to 2015 U.S. economy) as an equilibrium transition path over 1975–2200.
- Solving the model for 2016–2200 with alternative reform plans to close the fiscal gap in the Social Security pension (OASI) program.

Recent Related Literature

On the U.S. aging population

- Bewley-type heterogeous-agent OLG economy
  Kitao (RED2014), Nishiyama (JEDC2015)
- Representative-agent OLG economy
  Kotlikoff, Smetters & Walliser (JME2007) and many others

On the Japanese aging population

- Bewley-type heterogeous-agent OLG economy
  Yamada (JEDC2012), Kitao (JEDC2015)
- Representative-agent OLG economy
  Braun & Joines (JEDC2015), İmrohoroğlu, Kitao & Yamada (IER2016), etc.

The Model Economy

The economy consists of

- a large number of heterogeneous & OLG households,
- a perfectly-competitive representative firm with CRS production technology,
- a government with a commitment technology.

A model period is a year. In a stationary equilibrium, the economy grows with

- the labor-augmenting productivity growth rate, μ, of 1.5%,
- the long-run population growth rate, ν, which is about 0.31%.

Heterogeneous Households

Households are heterogeneous with respect to

- ages, $i = 21, \ldots, I$,
- beginning-of-period wealth, a,
- average historical earnings, b,
- working ability, e.

In each period t, the households each receive idiosyncratic working ability shocks, e, and choose

- consumption, c,
- working hours, h,
- wealth at the beginning of the next period, a',

to maximize their (remaining) lifetime utility.

Individual & Aggregate States

The individual state of the heterogeneous households is

$$\mathbf{s} = (i, a, b, e).$$

The aggregate state vector of the economy in period t is

$$\mathbf{S}_t = (x_t(\mathbf{s}), w_{G,t}, W_{S,t}),$$

which consists of

- the joint distribution function of households, $x_t(\mathbf{s})$,
- the government's net worth per capita, $w_{G,t}$,
- the Social Security (OASI) trust funds, $W_{S,t}$.

The Government Policy Schedule

The government policy schedule as of period t is

$$\Psi_t = \left\{c_{G,s}, tr_{LS,s}, \tau_{I,s}(\cdot), \tau_{P,s}(\cdot), tr_{SS,s}(\cdot), \tau_{C,s}, w_{G,s+1}, W_{S,s+1}\right\}_{s=t}^{\infty},$$

which includes

- the government's consumption per capita, $c_{G,t}$,
- lump-sum transfers per capita, $tr_{LS,t}$,
- progressive income tax function, $\tau_{I,t}(\cdot)$,
- Social Security payroll tax function, $\tau_{P,t}(\cdot)$,
- Social Security benefit function, $tr_{SS,t}(\cdot)$,
- flat consumption tax rate, $\tau_{C,t}$.

The Population Projection

The population projection as of period t is,

$$\Phi_t = \left\{ (p_{i,s})_{i=0}^{I}, (\phi_{i,s})_{i=0}^{I} \right\}_{s=t}^{\infty},$$

which consists of

- the population, $p_{i,s}$, of age i households in year s,
  - changes in $p_{i,s}$ includes changes in net immigrants,
- the survival rate, $\phi_{i,s}$, at the end of age i in year s,

for $i = 0, \ldots, I$ and $s = t, \ldots, \infty$, each of which satisfies

$$p_{i,s} = \int_{A \times B \times E} x_s(i, a, b, e) dadbde = \int_{A \times B \times E} dX_s(\mathbf{s}).$$

The Household's Optimization Problem

The optimization problem is

$$v(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t) = \max_{c,h,a'} \Big\{ u(c,h) + \beta \phi_{i,t} E\big[\, v(\mathbf{s}', \mathbf{S}_{t+1}; \Psi_{t+1}, \Phi_{t+1}) \,|\, \mathbf{s} \,\big] \Big\}$$

subject to the constraints of the decision variables,

$$c > 0, \qquad 0 \leq h < h_{\max}, \qquad a' \geq 0,$$

and the law of motion of the individual state,

$$\mathbf{s}' = (i+1, a', b', e').$$

The Laws of Motion of the State

The laws of motion of the individual state are

- the intertemporal budget constraint,

$$a' = \frac{1}{1+\mu}\Big[(1+r_t)a + w_t eh + tr_{SS,t}(i,b) + tr_{LS,t} + q_t \\ - \tau_{I,t}(w_t eh, r_t a, tr_{SS,t}(i,b)) - \tau_{P,t}(w_t eh) - (1+\tau_{C,t})c\Big],$$

- the average historical earnings,

$$b' = \mathbf{1}_{\{i<I_R\}} \frac{1}{i-20}\Big[(i-21)\, b\, \frac{w_t}{w_{t-1}} + \min(w_t eh, \vartheta_{\max})\Big] \\ + \mathbf{1}_{\{i \geq I_R\}} b.$$

The Decision Rules of the Households

Solving the above problem for c, h, and a', we obtain the household's decision rules as

$$c(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t), \qquad h(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t), \qquad a'(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t),$$

and

$$b'(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t) = \mathbf{1}_{\{i<I_R\}} \frac{1}{i-20} \Big[(i-21)\, b\, \frac{w_t}{w_{t-1}} + \min(w_t e h(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t), \vartheta_{\max}) \Big] + \mathbf{1}_{\{i \geq I_R\}} b.$$

Solving the Household Problem (1)

Let Ω_t be a time series of vectors of factor prices and government policy variables that describes a future path of the aggregate economy,

$$\Omega_t = \{r_s, w_s, c_{G,s}, tr_{LS,s}, \tau_{I,s}(\cdot), \tau_{P,s}(\cdot), tr_{SS,s}(\cdot), \tau_{C,s}, w_{G,s+1}, W_{S,s+1}\}_{s=t}^{\infty}.$$

Since the dimension of the aggregate state vectors in $v(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t)$ is infinite, it is almost impossible to solve the above problem—“the curse of dimensionality”.

In the absence of aggregate productivity or policy shocks, however, we can avoid this by replacing $(\mathbf{S}_t, \Psi_t, \Phi_t)$ with Ω_t.

Solving the Household Problem (2)

Let l be leisure, $l = h_{\max} - h$, and let the objective function be

$$f(c, l; \mathbf{s}, \Omega_t) = u(c, l) + \beta\phi_{i,t} E\left[\, v(\mathbf{s}'; \Omega_{t+1}) \,\middle|\, \mathbf{s} \,\right].$$

Then, the first-order conditions for an interior solution are

$$f_c(c, l; \mathbf{s}, \Omega_t) = u_c(c, l) - \frac{\beta\phi_{i,t}(1 + \tau_{C,t})}{1 + \mu} E\left[\, v_a(\mathbf{s}'; \Omega_{t+1}) \,\middle|\, \mathbf{s} \,\right] = 0,$$

$$\begin{aligned} f_l(c, l; \mathbf{s}, \Omega_t) &= u_l(c, l) \\ &- w_t e \left[1 - \tau_{I,1,t}\left(w_t e(h_{\max} - l), r_t a\right) - \tau'_{P,t}\left(w_t e(h_{\max} - l)\right) \right] \frac{u_c(c, l)}{1 + \tau_{C,t}} \\ &- \mathbf{1}_{\{i < I_R,\, w_t e(h_{\max} - l) < \vartheta_{\max}\}} \frac{w_t e}{i} \beta\phi_{i,t} E\left[\, v_b(\mathbf{s}'; \Omega_{t+1}) \,\middle|\, \mathbf{s} \,\right] = 0, \end{aligned}$$

where $\tau_{I,1,t}(\;)$ and $\tau'_{P,t}(\;)$ are the marginal labor income and payroll tax rates, respectively.

Solving the Household Problem (3)

With the inequality constraints for the decision variables, the Kuhn-Tucker conditions of the household's problem are expressed as the following nonlinear complementarity problem,

$$
\begin{aligned}
f_c(c, l; \mathbf{s}, \Omega_t) &= 0 \quad \text{if} \quad 0 < c < c_{\max}, \quad > 0 \quad \text{if} \quad c = c_{\max}, \\
f_l(c, l; \mathbf{s}, \Omega_t) &= 0 \quad \text{if} \quad 0 < l < h_{\max}, \quad > 0 \quad \text{if} \quad l = h_{\max},
\end{aligned}
$$

where $c_{\max} = c + a'$ and $a' \geq 0$.

This complementarity problem is expressed more compactly as the nonlinear system of equations,

$$
CP(c, l) = \min \left\{ \max \left[\begin{pmatrix} f_c(c, l; \mathbf{s}, \Omega_t) \\ f_l(c, l; \mathbf{s}, \Omega_t) \end{pmatrix}, \begin{pmatrix} \varepsilon - c \\ \varepsilon - l \end{pmatrix} \right], \begin{pmatrix} c_{\max} - c \\ h_{\max} - l \end{pmatrix} \right\} = \mathbf{0},
$$

where ε is a small positive number.

The Distribution of the Households (1)

The households of age 21 enter the economy with no assets and working histories, i.e.,

$$\int_{A\times B\times E} dX_t(21, a, b, e) = \int_E dX_t(21, 0, 0, e) = p_{21,t},$$

where $p_{21,t}$ is normalized to unity in 2015. The population distribution of the age 21 households is exogenous,

$$x_t(21, 0, 0, e) = \pi_{21}(e) \times p_{21,t},$$

where $\pi_{21}(e)$ is the unconditional probability density function of working ability at age 21.

The Distribution of the Households (2)

For $i = 21, \ldots, I$, the growth-adjusted population distribution of households is obtained recursively by

$$
\begin{aligned}
x_{t+1}(\mathbf{s}') &= x_{t+1}(i+1, a', b', e') \\
&= \frac{\phi_{i,t}}{1+\nu} \int_{A \times B \times E} \mathbf{1}_{\{a' = a'(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t),\, b' = b'(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t)\}} \\
&\qquad \times \pi_i(e' \,|\, e)\, dX_t(\mathbf{s}),
\end{aligned}
$$

where $\pi_i(e' \mid e)$ is the conditional probability density function of working ability e' at age $i+1$ given e at age i.

The Supply of Capital and Labor

Private wealth, government wealth, domestic wealth (capital stock), and labor supply are calculated as

$$W_{P,t} = \sum_{i=21}^{I} \int_{A\times B\times E} a\, dX_t(\mathbf{s}),$$

$$W_{G,t} = w_{G,t} \sum_{i=21}^{I} p_{i,t},$$

$$K_t = W_{P,t} + W_{G,t},$$

$$L_t = \sum_{i=21}^{I} \int_{A\times B\times E} eh(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t)\, dX_t(\mathbf{s}).$$

Production Factor Prices

From the representative firm's profit-maximizing condition and the market-clearing condition, the rate of return to capital, r_t, and the average wage rate, w_t, are obtained as

$$r_t = F_K(K_t, L_t) - \delta, \qquad w_t = F_L(K_t, L_t),$$

where $F(K_t, L_t)$ is a Cobb-Douglas production function,

$$F(K_t, L_t) = A\,K_t^{\theta} L_t^{1-\theta}.$$

The Government Revenue and Expenditure

- The government's income tax revenue, $T_{I,t}$, payroll tax revenue, $T_{P,t}$, and consumption tax revenue, $T_{C,t}$, are obtained by using the distribution of households, $x_t(\mathbf{s})$.
- The government purchases, $C_{G,t}$, non-S.S. (lump-sum) transfer spending, $TR_{LS,t}$, and S.S. transfer spending, $TR_{SS,t}$, are also obtained by using $x_t(\mathbf{s})$.
- The government collects wealth left by deceased households as accidental bequests, and it redistributes the revenue uniformly, q_t, to all households.

The Government's Tax Revenue

The government's income tax revenue, $T_{I,t}$, payroll tax revenue, $T_{P,t}$, and consumption tax revenue, $T_{C,t}$, are obtained as

$$T_{I,t} = \sum_{i=21}^{I} \int_{A\times B\times E} \tau_{I,t}(w_t eh(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t), r_t a, tr_{SS,t}(i, b); \varphi_t)\, dX_t(\mathbf{s}),$$

$$T_{P,t} = \sum_{i=21}^{I} \int_{A\times B\times E} \tau_{P,t}(w_t eh(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t); \tau_{P,t})\, dX_t(\mathbf{s}),$$

$$T_{C,t} = \sum_{i=21}^{I} \int_{A\times B\times E} \tau_{C,t}\, c(\mathbf{s}, \mathbf{S}_t; \Psi_t, \Phi_t)\, dX_t(\mathbf{s}),$$

where φ_t is a parameter of the income tax function, and $\tau_{P,t}$ is the OASI payroll tax rate on earnings below the max taxable earnings.

The Government's Expenditure

The government's purchases, $C_{G,t}$, non-S.S. (lump-sum) transfer spending, $TR_{LS,t}$, and S.S. transfer spending, $TR_{SS,t}$, are obtained as

$$C_{G,t} = c_{G,t} \sum_{i=21}^{I} p_{i,t}, \qquad TR_{LS,t} = tr_{LS,t} \sum_{i=21}^{I} p_{i,t},$$

$$TR_{SS,t} = \sum_{i=21}^{I} \int_{A \times B \times E} tr_{SS,t}(i, b; \psi_{SS,t})\, dX_t(\mathbf{s}),$$

where $\psi_{SS,t}$ is the OASI benefit adjustment factor.

The Government's Intertemporal Budget Constraint

The government budget is assumed to be unified, and it satisfies the following constraint,

$$W_{G,t+1} = \frac{1}{(1+\mu)(1+\nu)} \Big[(1+r_t) W_{G,t} + T_{I,t}(\varphi_t) + T_{P,t}(\tau_{P,t}) \\ + T_{C,t}(\tau_{C,t}) - C_{G,t}(c_{G,t}) - TR_{LS,t}(tr_{LS,t}) - TR_{SS,t}(\psi_{SS,t}) \Big].$$

The OASI trust funds, $W_{S,t}$, are the accounting tool to check the sustainability of the program,

$$W_{S,t+1} = \frac{1}{(1+\mu)(1+\nu)} \max \Big[0, (1+r_t) W_{S,t} + T_{P,t}(\tau_{P,t}) \\ - TR_{SS,t}(\psi_{SS,t}) \Big].$$

Recursive Competitive Equilibrium

A time series of factor prices, the gov't policy variables, the value functions, the decision rules, and the distribution of households are in a recursive competitive equilibrium if, for all $s = t, \ldots, \infty$,

- the households each solve their utility maximization problem, taking the current state of the economy, the gov't policy schedule, and the population projection as given;
- the firm solves its profit maximization problem, taking factor prices as given;
- the government follows its policy schedule; and
- the goods and factor markets clear.

Population Projection

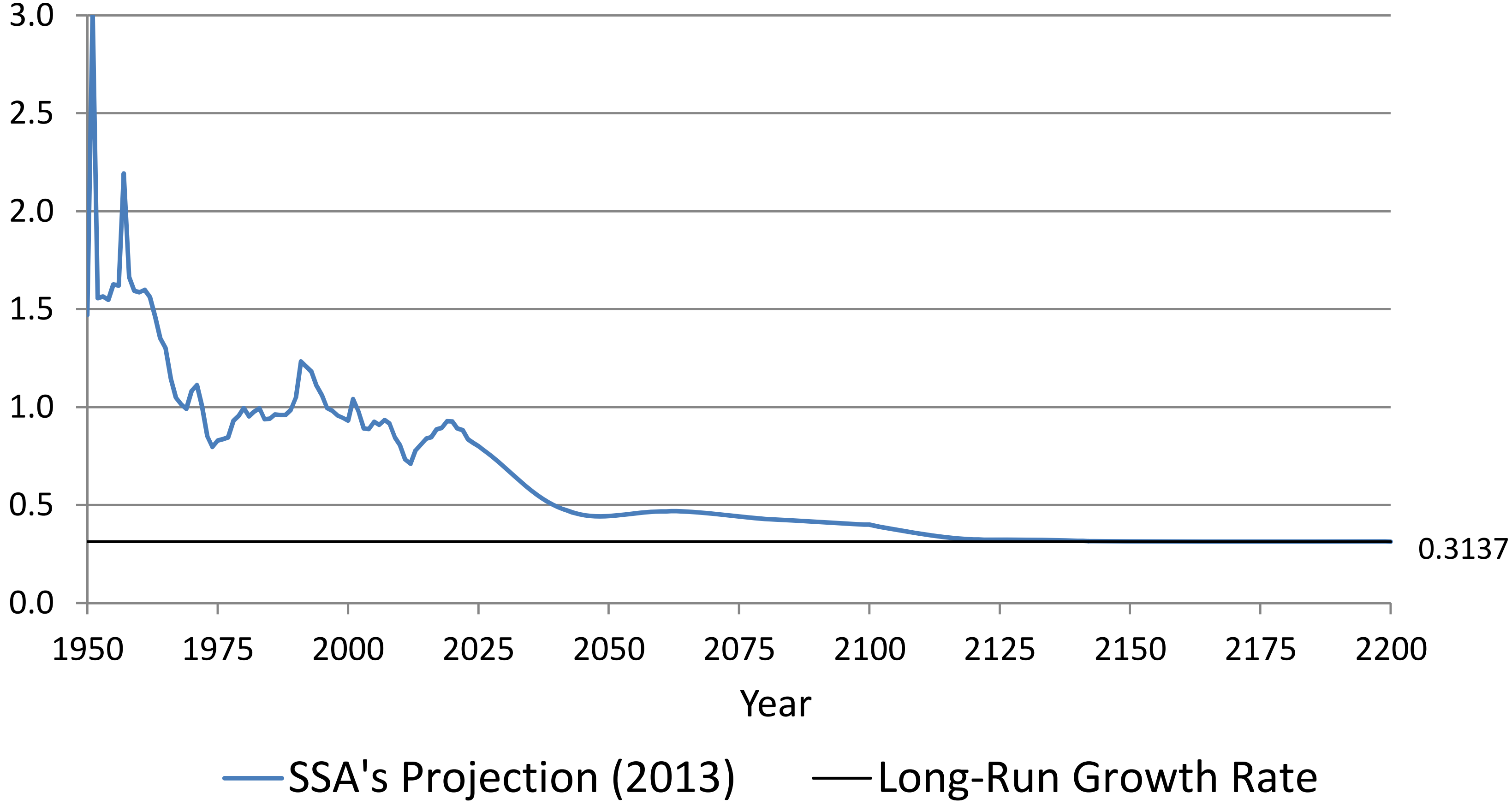
This paper uses SSA's intermediate population projection (1941–2100) provided for the 2014 trustees report.

This paper extrapolates SSA's projection through 2200 by using

- the projected mortality rates in 2099,
- the age-specific fertility rates in 2100 (estimated from the 2006 fertility rates).

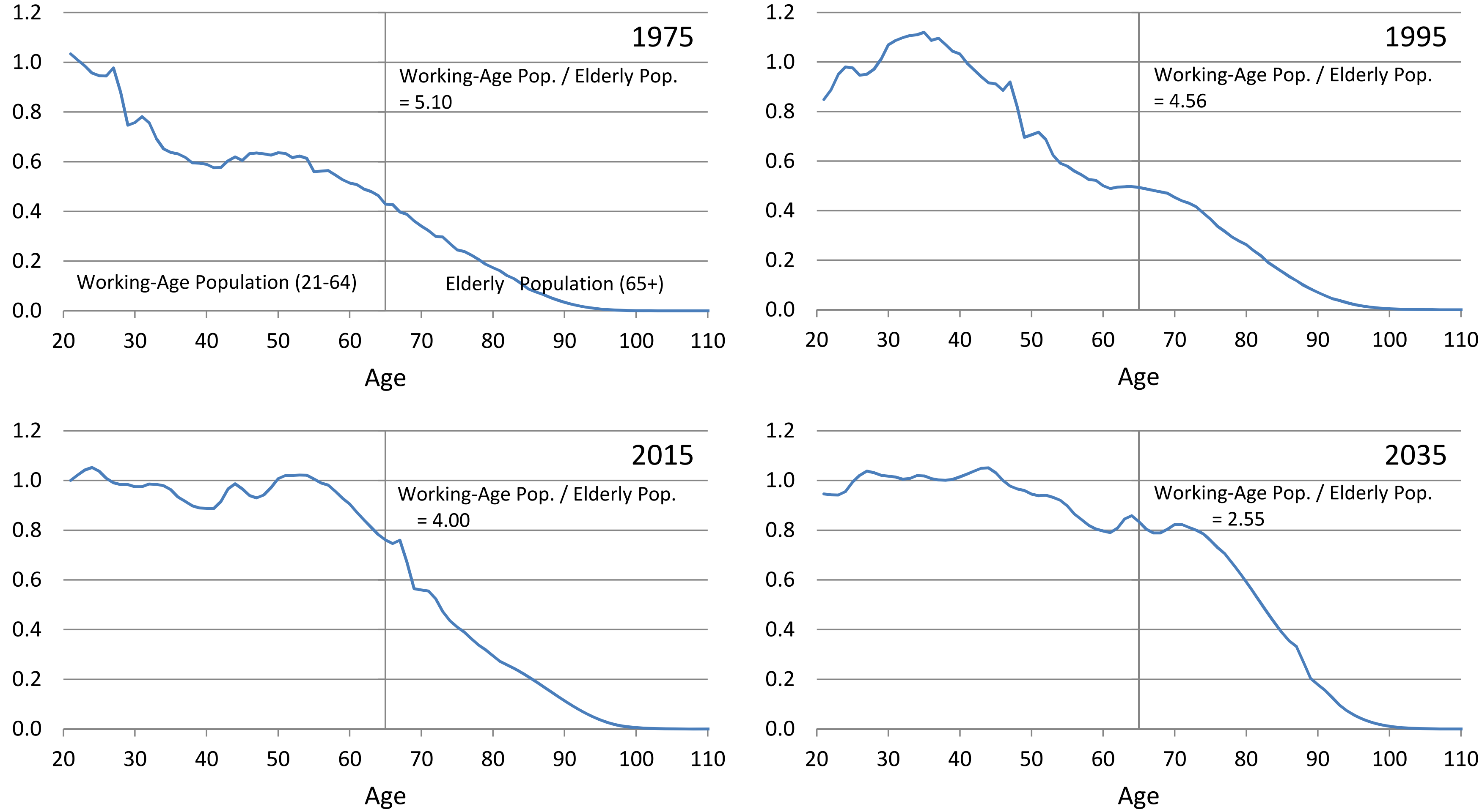
Under these assumptions, the population distribution in 2200 is almost stationary, but the distribution in 2015 is non-stationary.

Population Growth Rate by Year



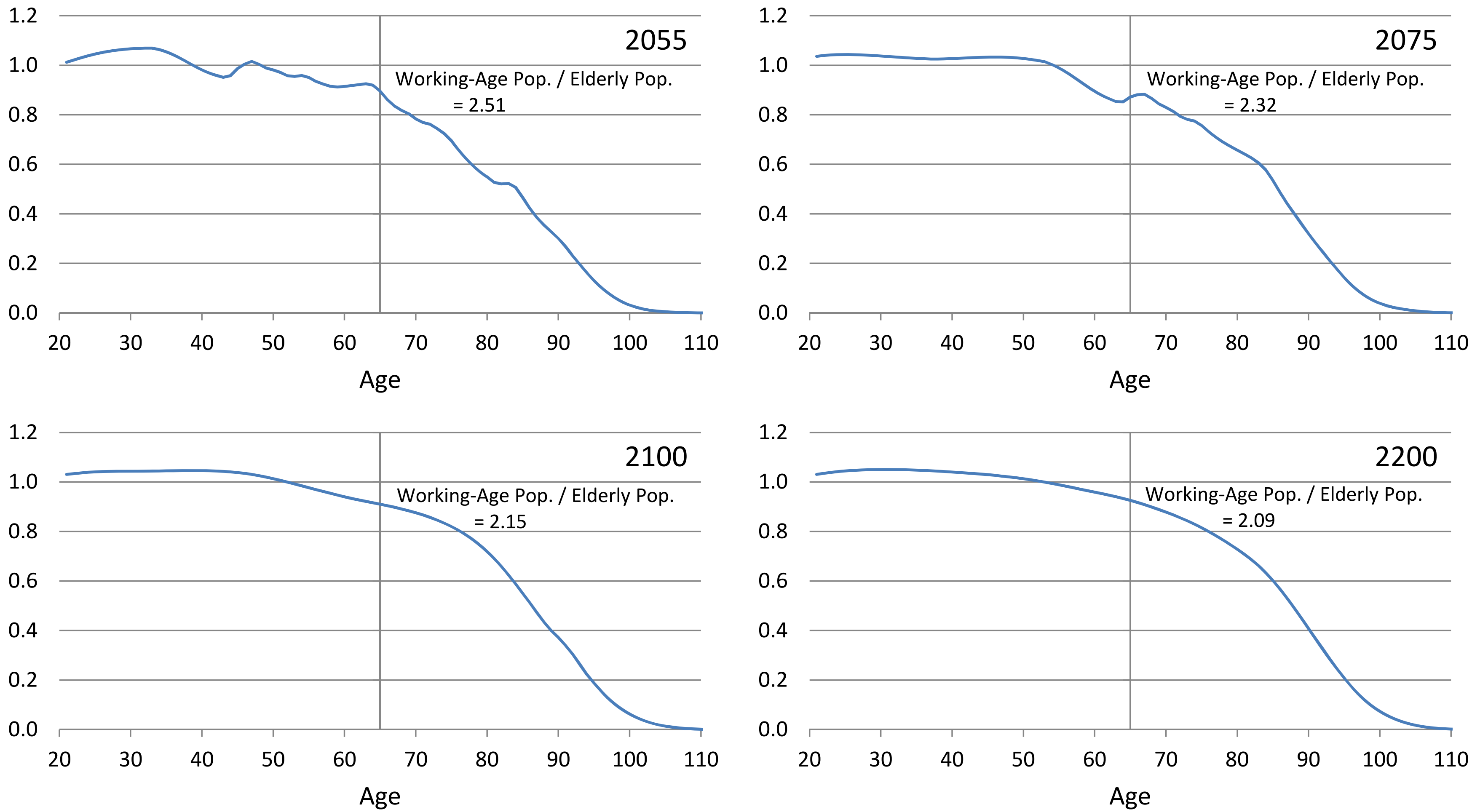
Population Distribution by Age in Selected Years (1)

Growth-adjusted by the long-run growth rate ν ($p_{21,2015} = 1.0$)



Population Distribution by Age in Selected Years (2)

Growth-adjusted by the long-run growth rate ν ($p_{21,2015} = 1.0$)



The Calibration Procedure (1)

This paper constructs the aging-population baseline as follows:

1. the paper first solves the model for a 1975 stationary equilibrium by using the historical population distribution in 1975, assuming the households falsely believe that the population distribution is time-invariant;

2. the paper next solves the model for a 2200 stationary equilibrium and an equilibrium transition path in 1975–2200 by using the projected population distribution, assuming the households suddenly realize that the population distribution is aging in 1975.

The Calibration Procedure (2)

To finance the budgetary cost of the aging population, the aging-population baseline economy assumes that the gov't decreases its consumption spending so that the wealth (debt) per capita stays at the 2015 level after growth adjustment.

This policy change will not affect the households' decision, because the government's consumption is not in the households' utility function or the budget constraint.

Repeating the above steps 1 and 2, the parameters of the model are chosen so that the model economy in 2015 over the transition path is consistent with the 2015 U.S. economy.

Main Parameter Values in the Aging Baseline

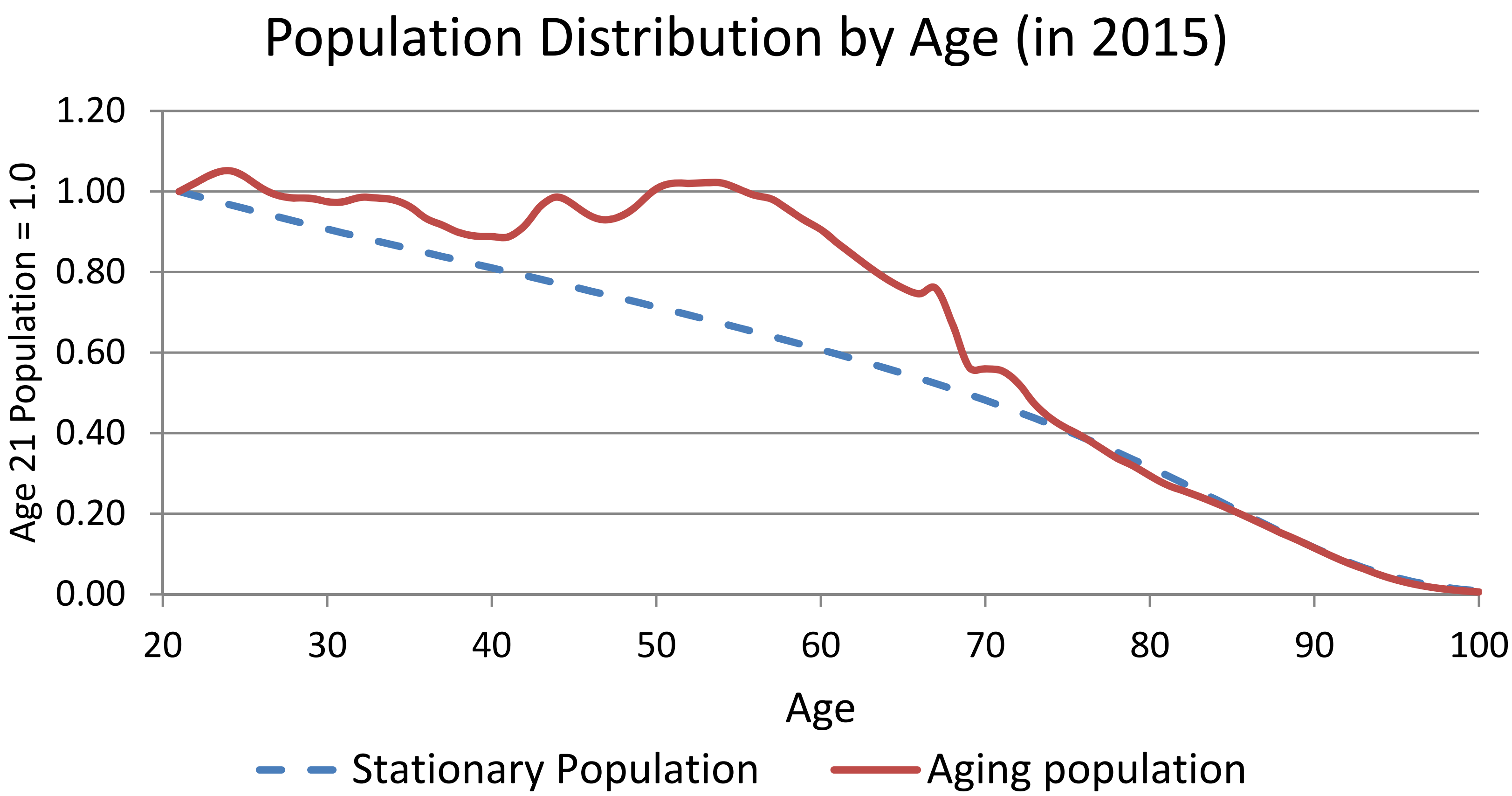
Parameter		Value	Comment
Demographics			
Maximum age	I	100	
Maximum age households can work		80	
Minimum age of elderly households	I_R	66	OASI full retirement age
Productivity growth rate	μ	0.0150	Real GDP per capita growth in 1990–2015
Long-run population growth rate	ν	0.0032	Population growth projected in 2200
Total population (ages 21–100) in 2015		52.470	When $p_{21,t} = 1.0$ in 2015
Working-age population (ages 21–65) in 2015		42.725	
Preferences			
Discount factor	β	1.0012	Target: $K_t/Y_t = 3.0$ in 2015
Growth-adjusted discount factor	$\tilde{\beta}$	0.9816	$\tilde{\beta} = \beta(1+\mu)^{\alpha(1-\gamma)}$
Coefficient of relative risk aversion	γ	3.0000	
Share parameter of consumption	α	0.6613	Target: Frisch elasticity 0.5 in 2015
Production technology and wage process			
Share parameter of capital stock	θ	0.3700	Labor income share 0.63 in 2011–2015
Depreciation rate of capital stock	δ	0.0733	Target: $r_t = 0.05$ in 2015
Total factor productivity	A	0.8910	Target: $w_t = 1.0$ in 2015
Auto correlation parameter of log wage	ρ	0.9500	
Standard deviation of log wage shocks	σ	0.2800	Var. of log earnings in 2013 SCF
Average hourly wage by age	$\bar{e}_i$		Estimated by OLS with 2013 SCF

Policy Parameter Values in the Aging Baseline

Parameter		Value	Comment
Model units			
Taxable labor income ratio	η	0.6810	SS covered earnings / NIPA labor income in 2013
Scale adjustment[a]		96.596	Average earnings \$71,475 in 2015
Progressive income tax			
Income tax: tax rate limit	φ_t	0.3960	Target: $T_{I,t}/Y_t = 0.106$ in 2015
: curvature	φ_1	0.7653	} Estimated by OLS
: scale	φ_2	0.5412	} Estimated by OLS
: deduction/exemptions[b]	d	0.1706	$0.6 \times \$20{,}600 + 0.4 \times \$10{,}300$ in 2015
Social Security system			
S.S. payroll tax rate: OASI	$\tau_{P,t}$	0.1060	Statutory rate in 2015
Maximum taxable earnings[c]	$\vartheta_{\max}$	1.5334	$1.25 \times \$118{,}500$ in 2015
Repl. rate threshold: 0.90 & 0.32[c]	ϑ_1	0.1280	$1.25 \times \$824 \times 12$ in 2015
: 0.32 & 0.15[c]	ϑ_2	0.6451	$1.25 \times \$4{,}154 \times 12$ in 2015
Benefit adjustment factor: OASI	ψ_t	1.6753	Target: benefits 4.1% of GDP in 2015
Other policy variables			
Government's consumption per capita	$c_{G,t}$	0.1518	Calculated as a residual
Consumption tax rate	$\tau_{C,t}$	0.0286	Target: $T_{C,t}/Y_t = 0.017$ in 2015
Government's net worth per capita	$w_{G,t}$	-1.0183	Target: $W_{G,t}/Y_t = -0.70$ in 2015
Social Security (OASI) trust fund	$W_{S,t}$	11.6024	Target: $W_{S,t}/Y_t = 0.152$ in 2015

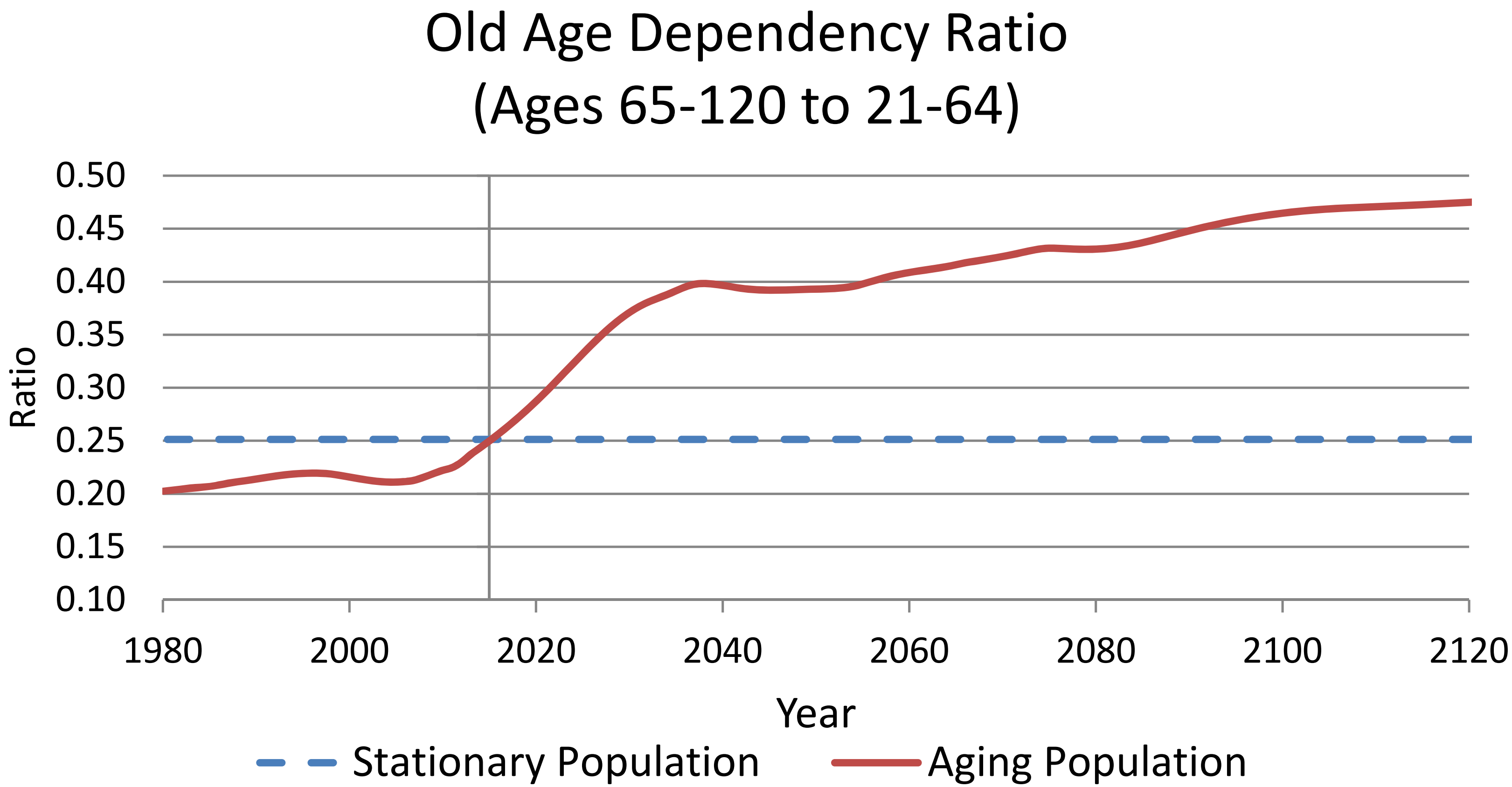
Demographics in the Aging-Population Economy (1)

This paper uses the SSA's population projection over 1941-2100 and extrapolates it through 2200.



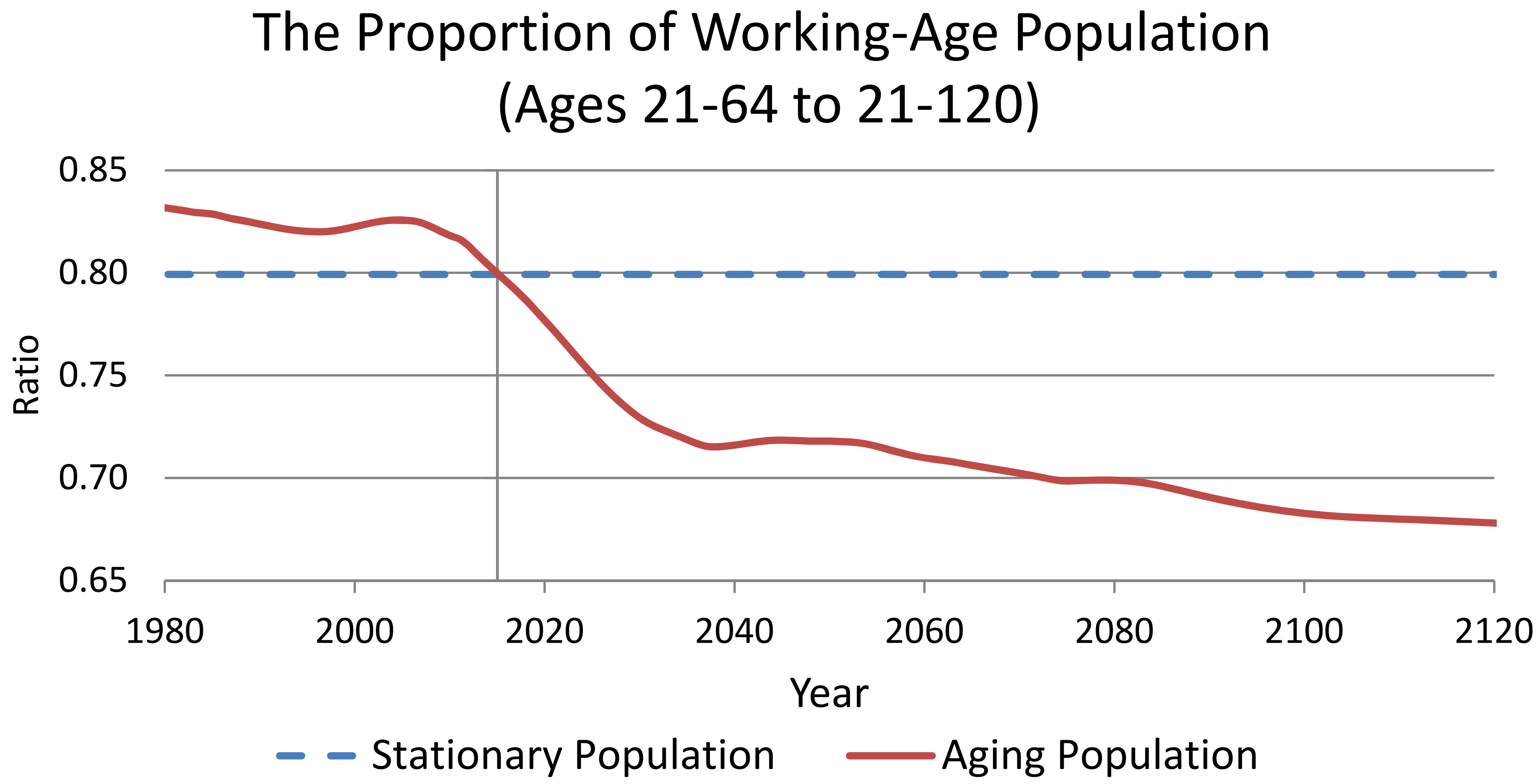
Demographics in the Aging-Population Economy (2)

The old age dependency ratio indicates how the aging population will affect the Social Security budget in the future.



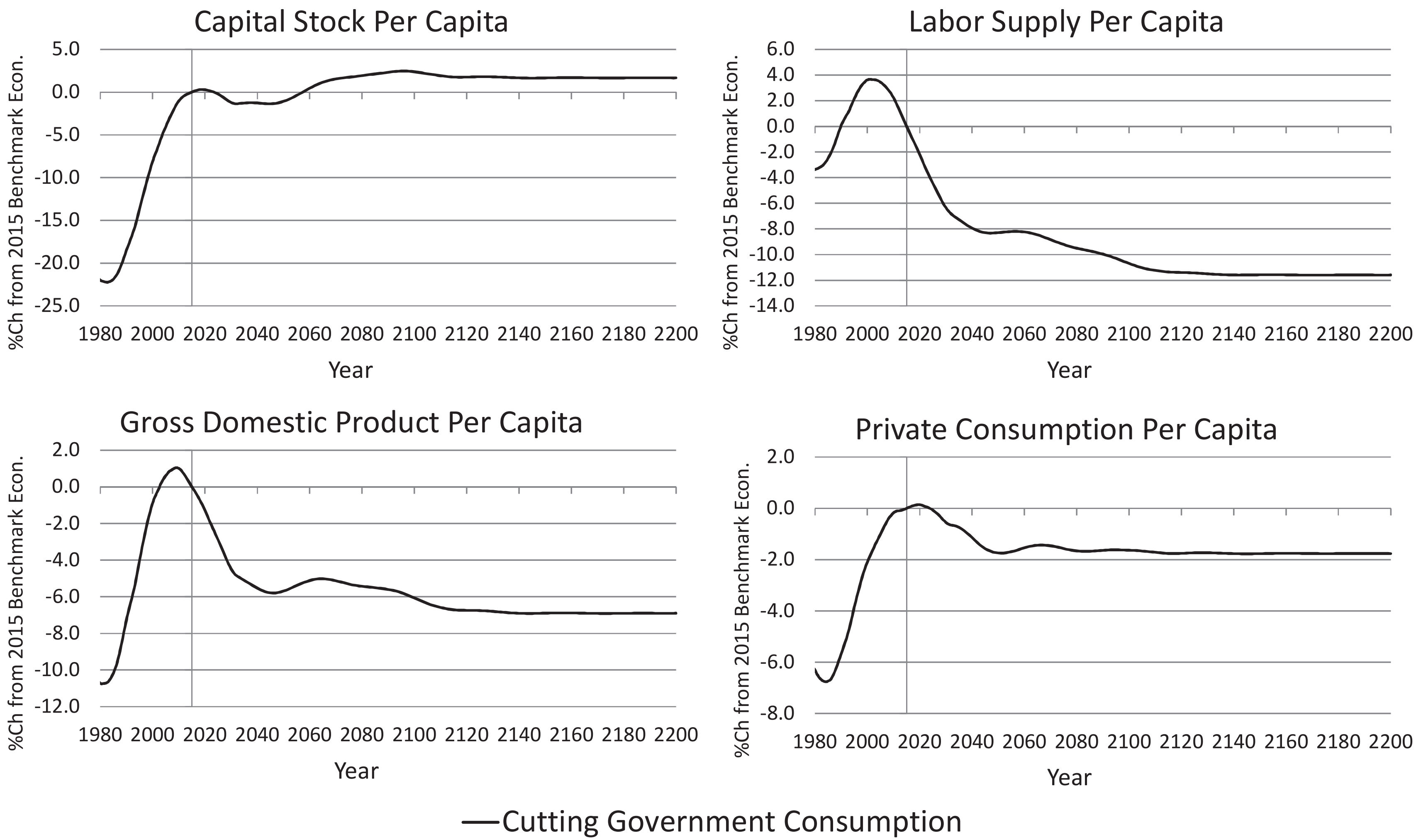
Demographics in the Aging-Population Economy (3)

The decreasing share of working-age population partially explains how labor supply per capita will change in the future.



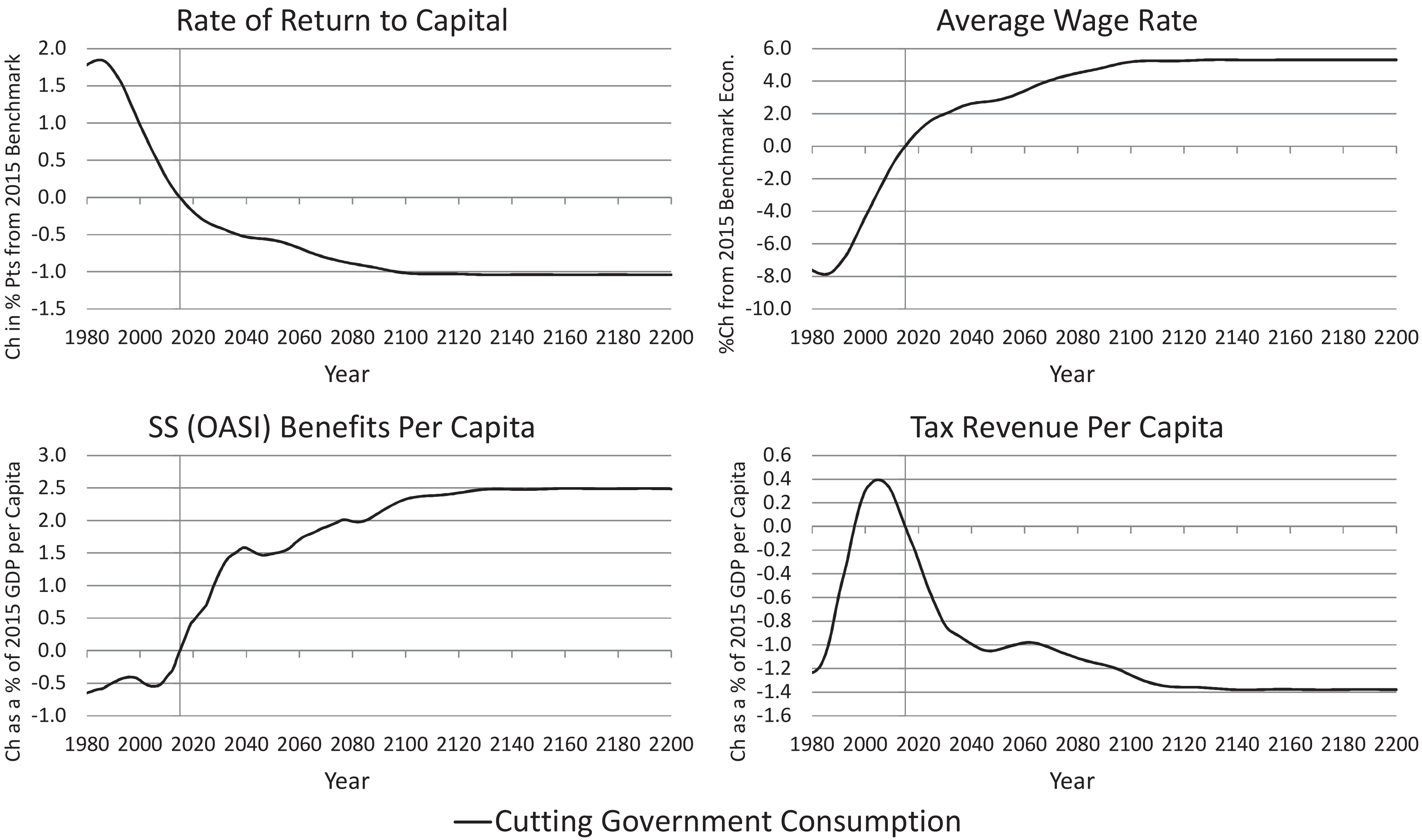
The Aging-Population Baseline Economy (1)

% changes from the 2015 growth-adjusted economy



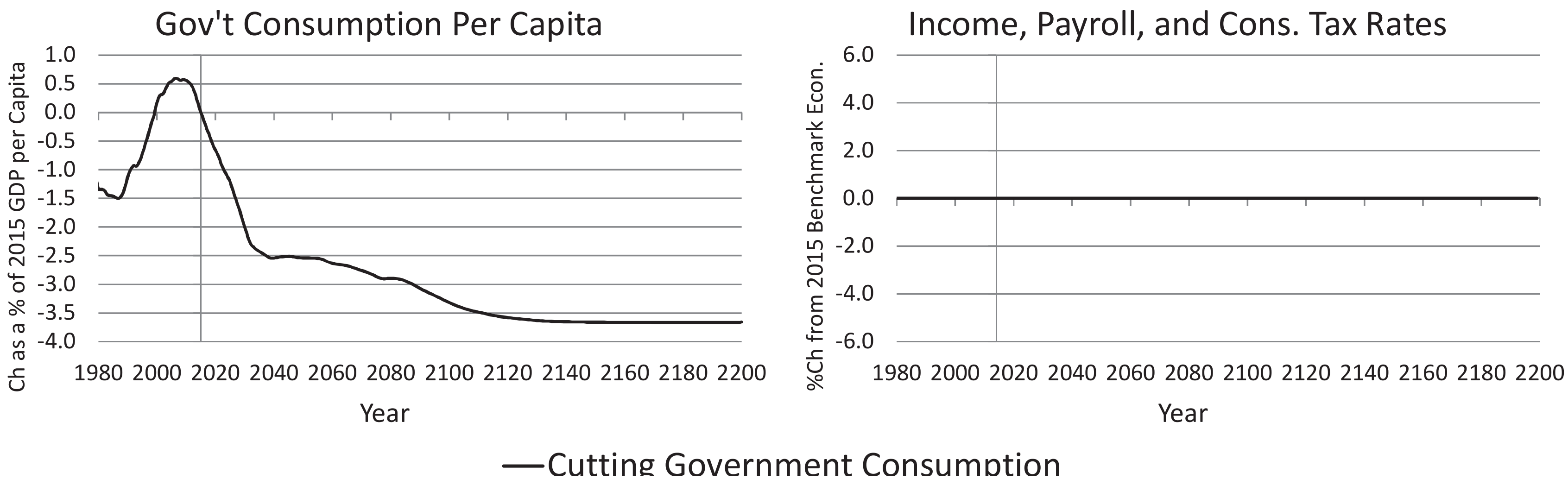
The Aging-Population Baseline Economies (2)

% changes from the 2015 growth-adjusted economy



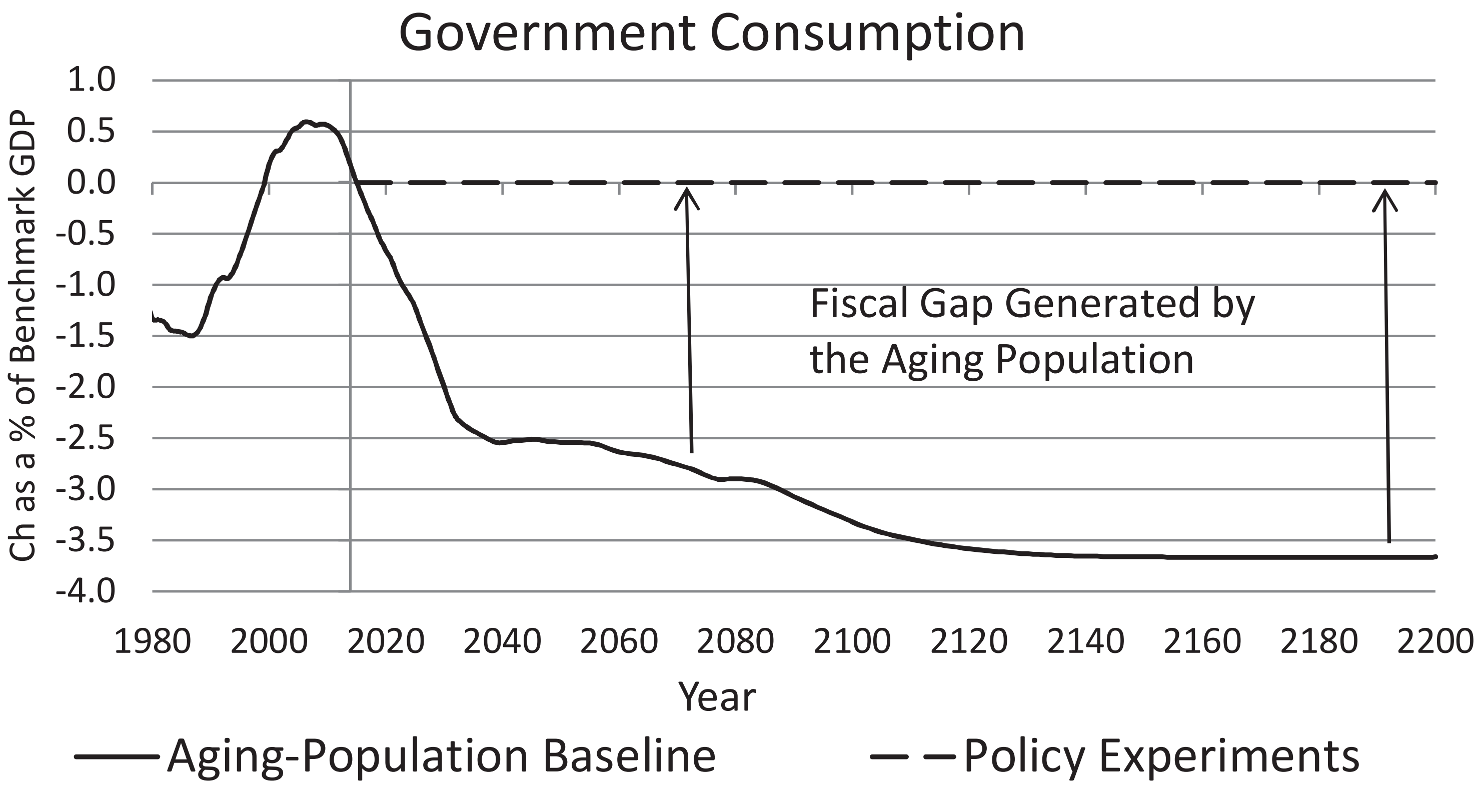
The Aging-Population Baseline Economies (3)

% changes from the 2015 growth-adjusted economy



Fiscal Gap of the OASI Program

The government is assumed to keep its consumption in 2016–2200 at the 2015 level instead of cutting it to finance the budgetary cost of aging population.



Increasing Payroll Tax vs Cutting Benefits (1)

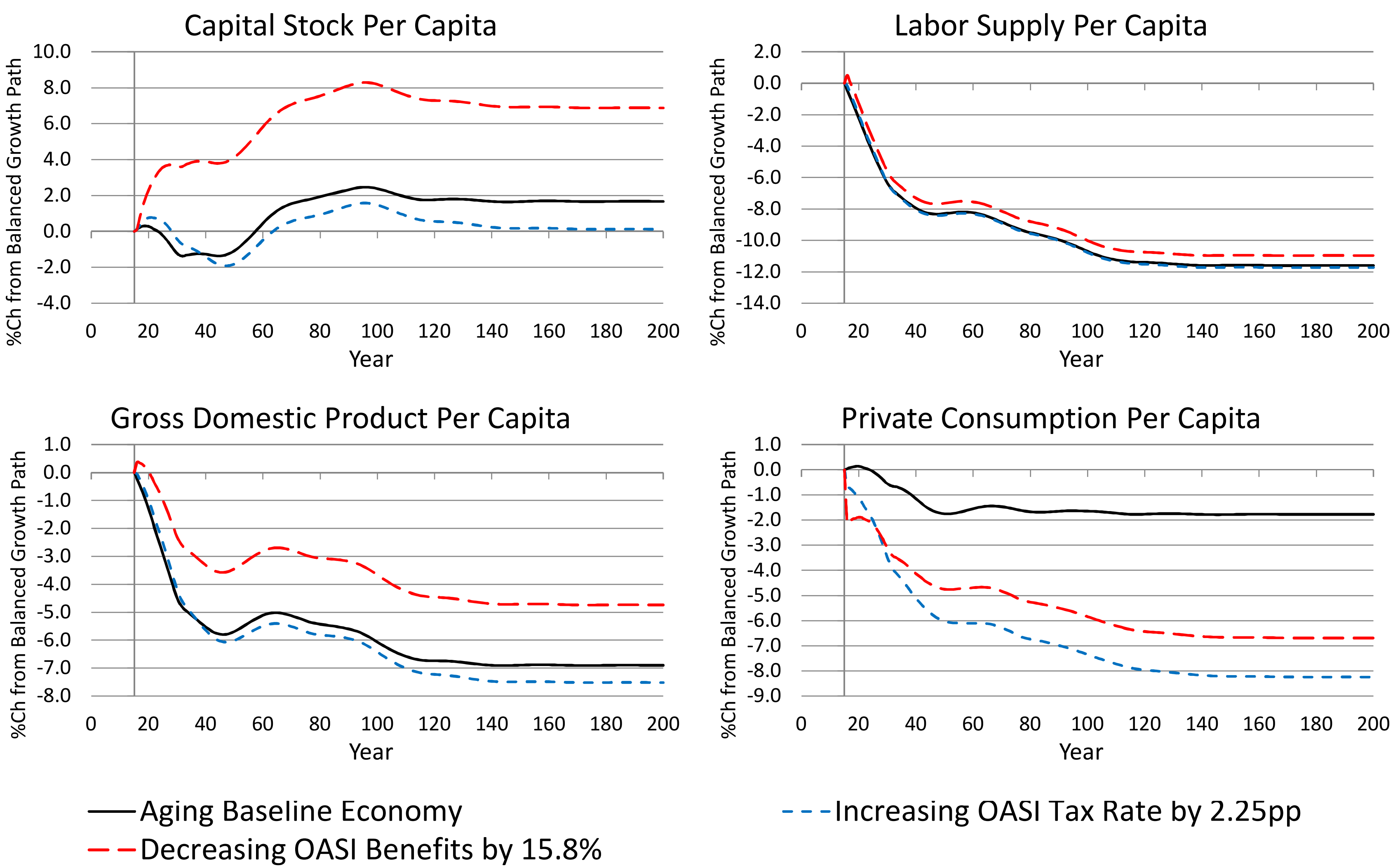
According to the 2016 Social Security Trustees Report, the OASI program would be sustainable for the next 75 years if the government introduced either one of the following policy changes:

- increasing the OASI payroll tax immediately by 2.25 pp;
- cutting the OASI benefits immediately & proportionally by 15.8%.

In each of these policy experiments, in addition, the government adjusts the consumption tax rate so that the wealth (debt) per capita stays at the 2015 level after growth adjustment.

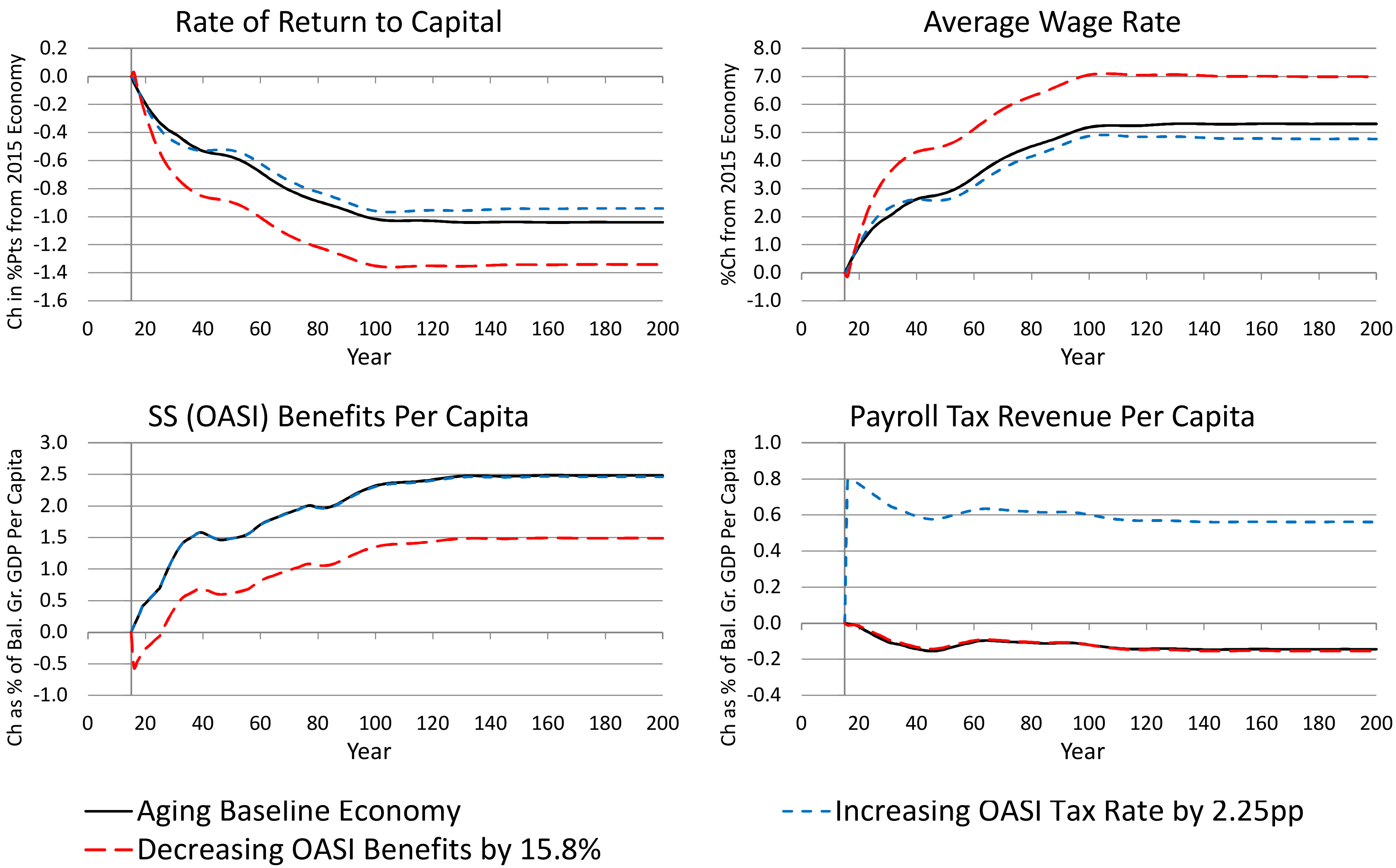
Increasing Payroll Tax vs Cutting Benefits (2)

% changes from the 2015 growth-adjusted economy



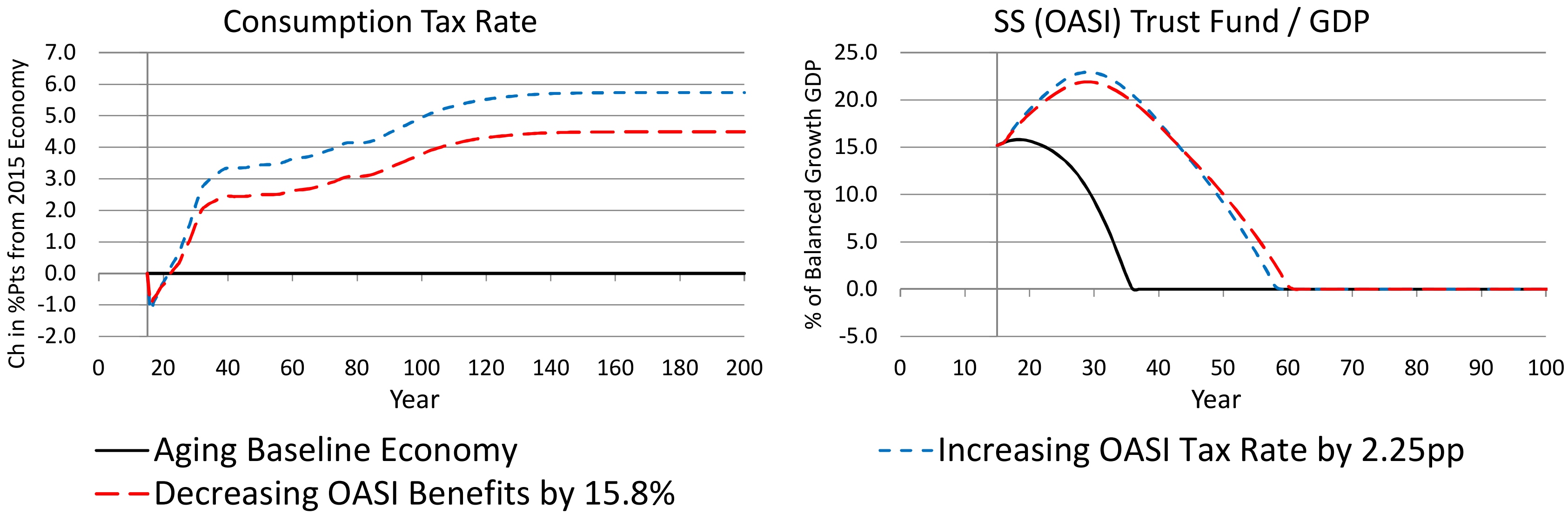
Increasing Payroll Tax vs Cutting Benefits (3)

% changes from the 2015 growth-adjusted economy



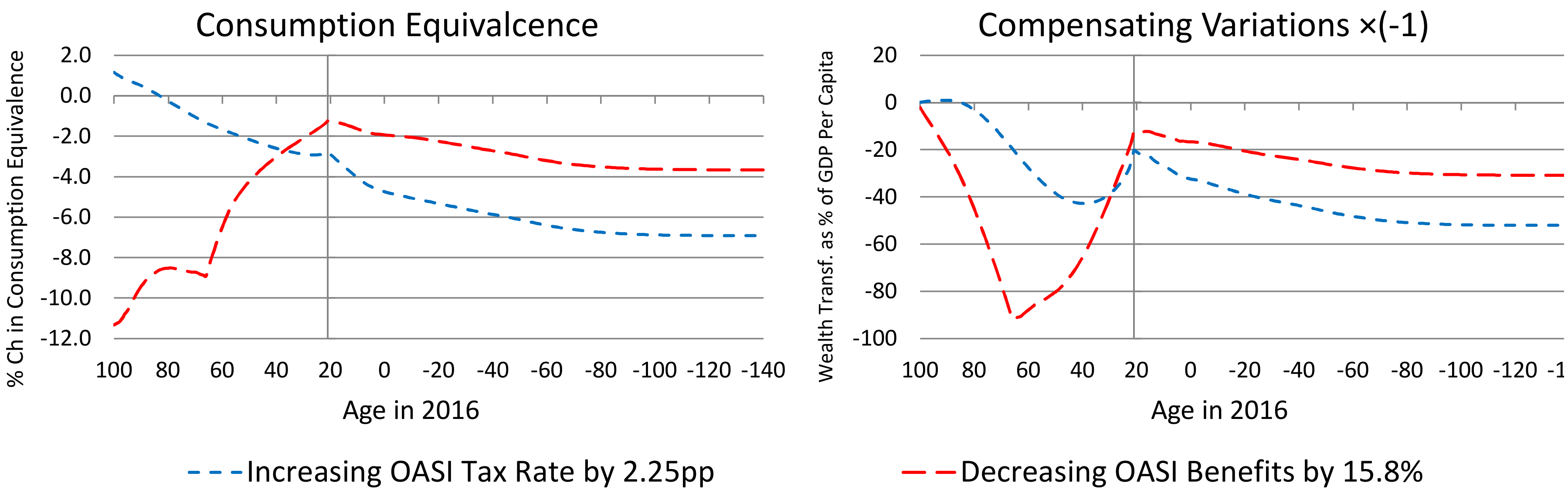
Increasing Payroll Tax vs Cutting Benefits (4)

% changes from the 2015 growth-adjusted economy



Increasing Payroll Tax vs Cutting Benefits (5)

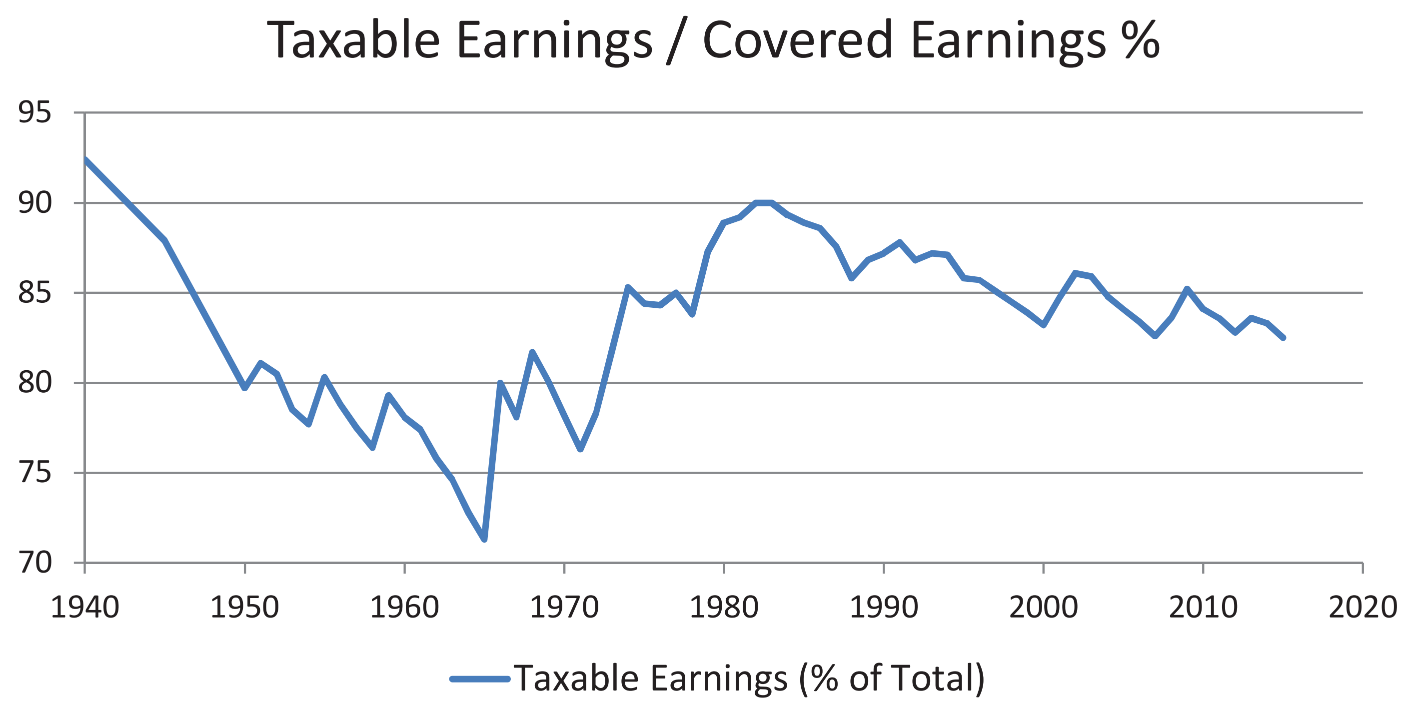
% changes from the aging baseline economy



Covered Earnings vs Taxable Earnings

The annual maximum taxable earnings in 2015 and 2016 are both $118,500. All (covered) earnings are taxable for Medicare (HI) but only those below $118,500 are taxable for OASDI.

The share of taxable earnings has decreased from 90.0% in 1982-83 to 82.5% in 2015.



Removing Max Taxable Earnings (1)

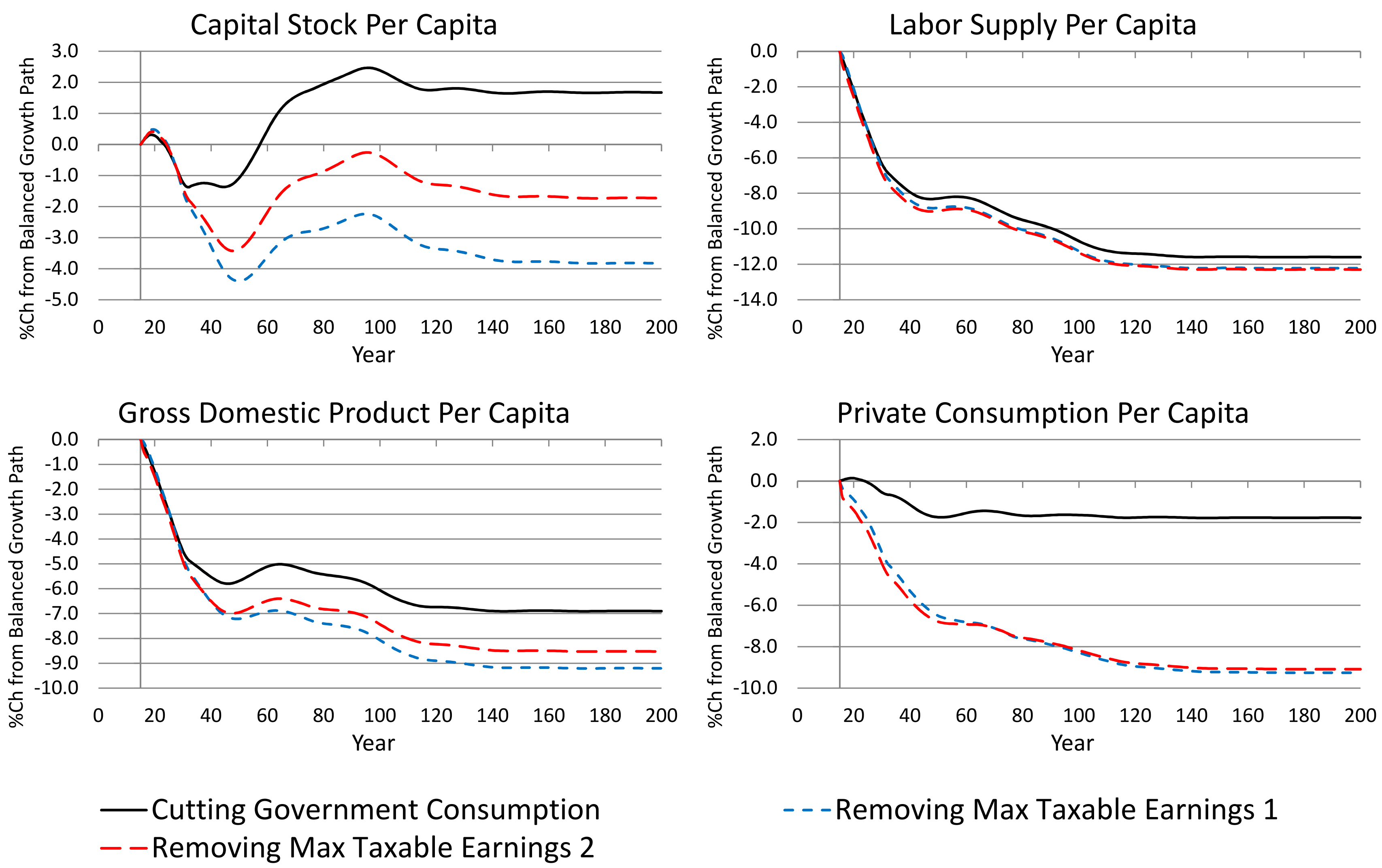
To improve the actuarial balance of the OASI program, the government is assumed to remove the maximum taxable earnings together with either one of the following changes:

- removing the maximum of annual earnings for the calculation of AIME as well.
  - The benefits of high-earnings workers will increase in the future.
- keeping the maximum of annual earnings for the calculation of AIME at the current level.

In each of these policy experiments, in addition, the government adjusts the consumption tax rate.

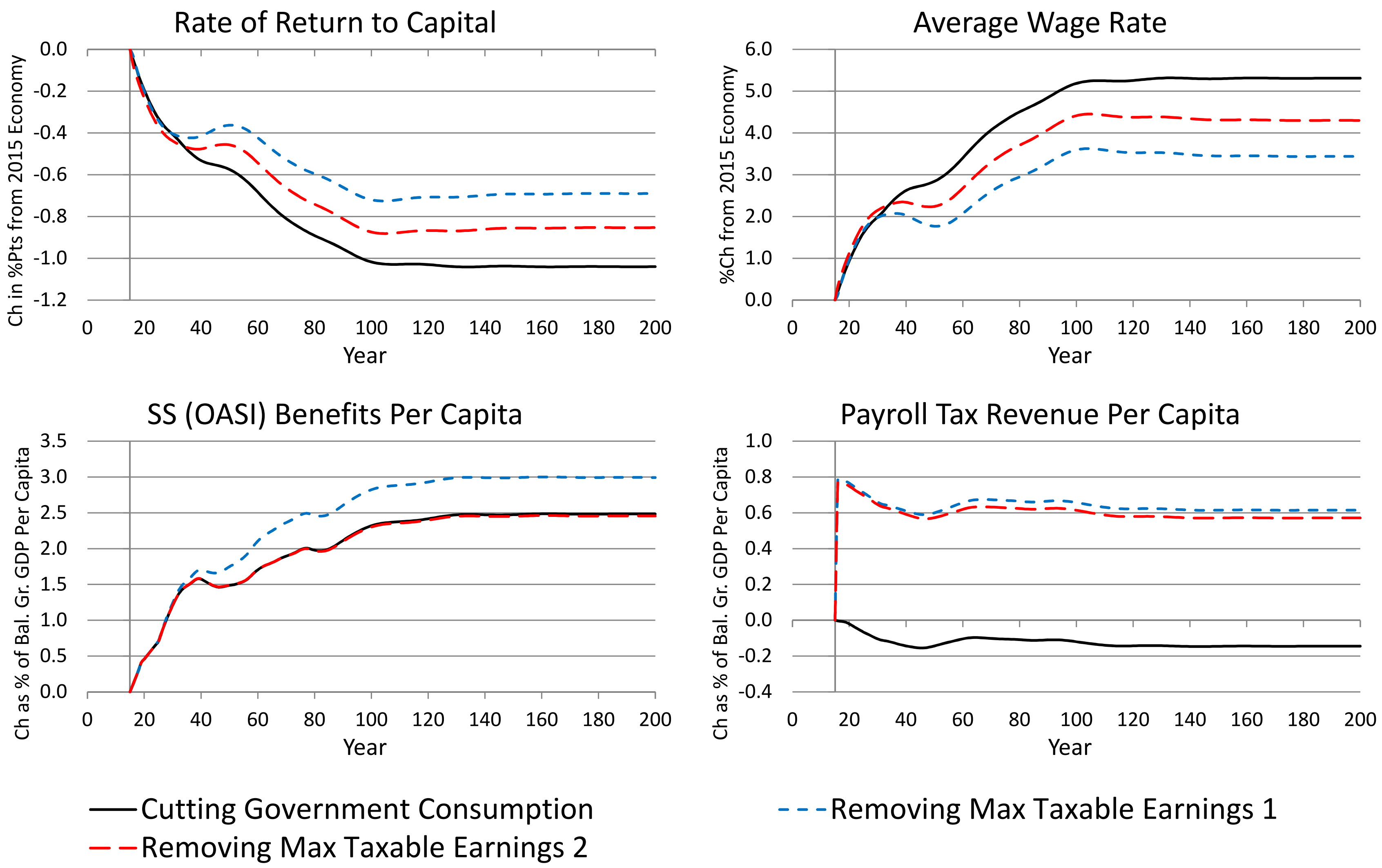
Removing Max Taxable Earnings (2)

% changes from the 2015 growth-adjusted economy



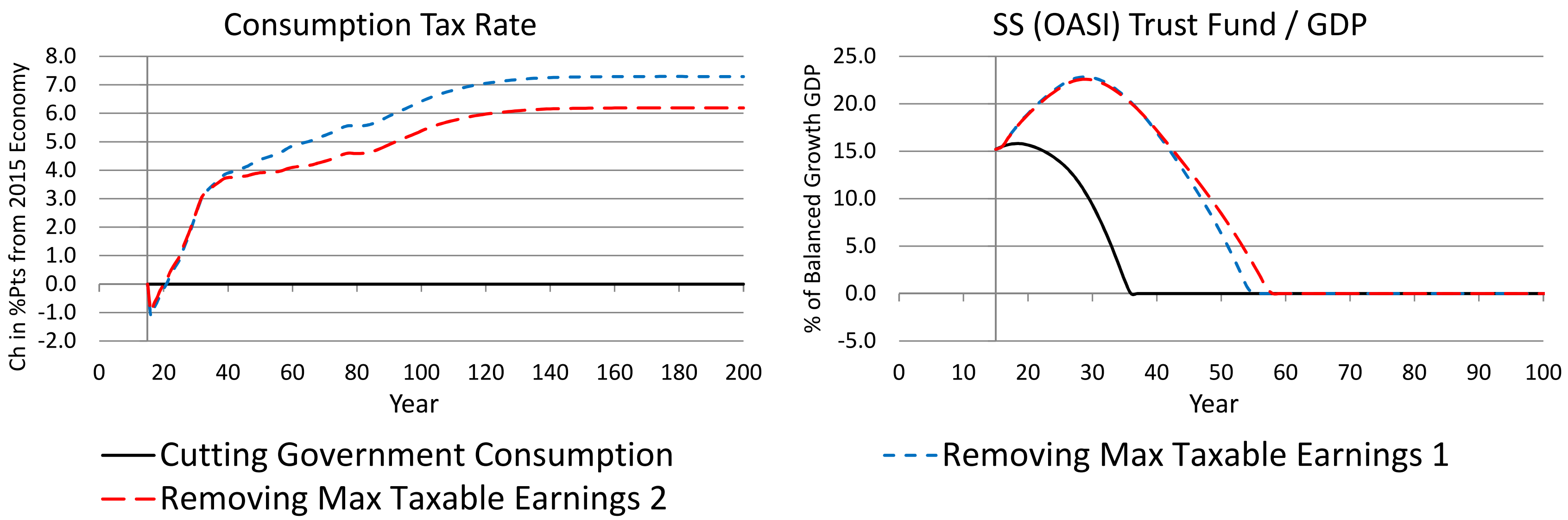
Removing Max Taxable Earnings (3)

% changes from the 2015 growth-adjusted economy



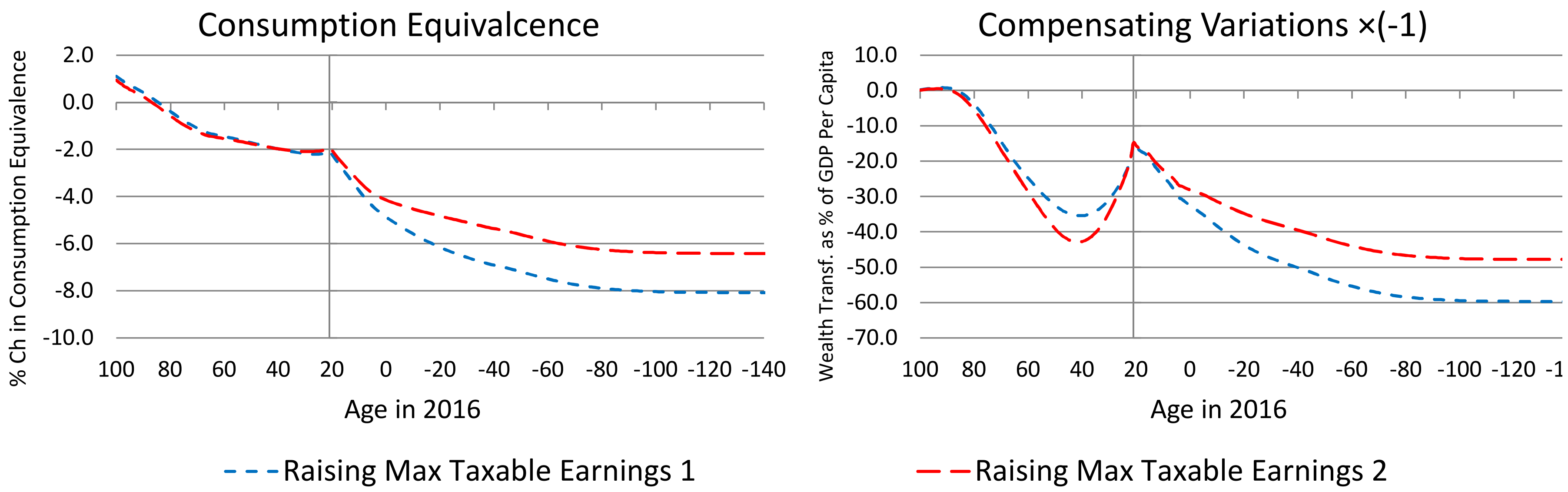
Removing Max Taxable Earnings (4)

% changes from the 2015 growth-adjusted economy



Removing Max Taxable Earnings (5)

% changes from the aging baseline economy



Taxing All Benefits vs Raising FRA (1)

The OASI benefits are partially income-taxable if the sum of the other income and 50% of benefits is larger than $25,000 for a single household and $32,000 for a married household.

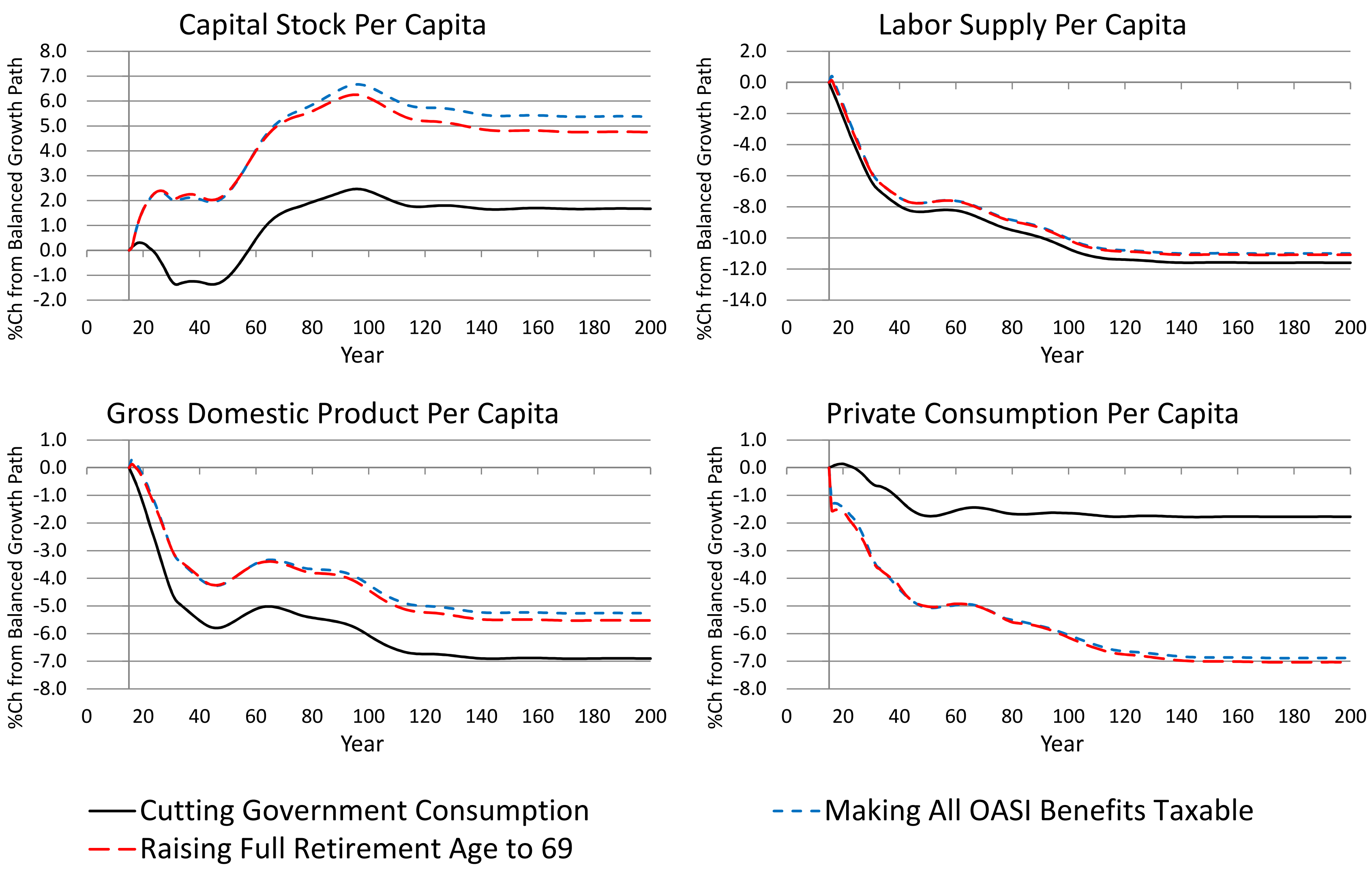
To close the fiscal gap, the government is assumed to introduce one of the following policy changes:

- making all OASI benefits taxable and move the increase in income tax revenue into the OASI budget;
- raising the full retirement age of the program gradually from age 67 to age 70.

In each of these policy experiments, in addition, the government adjusts the consumption tax rate.

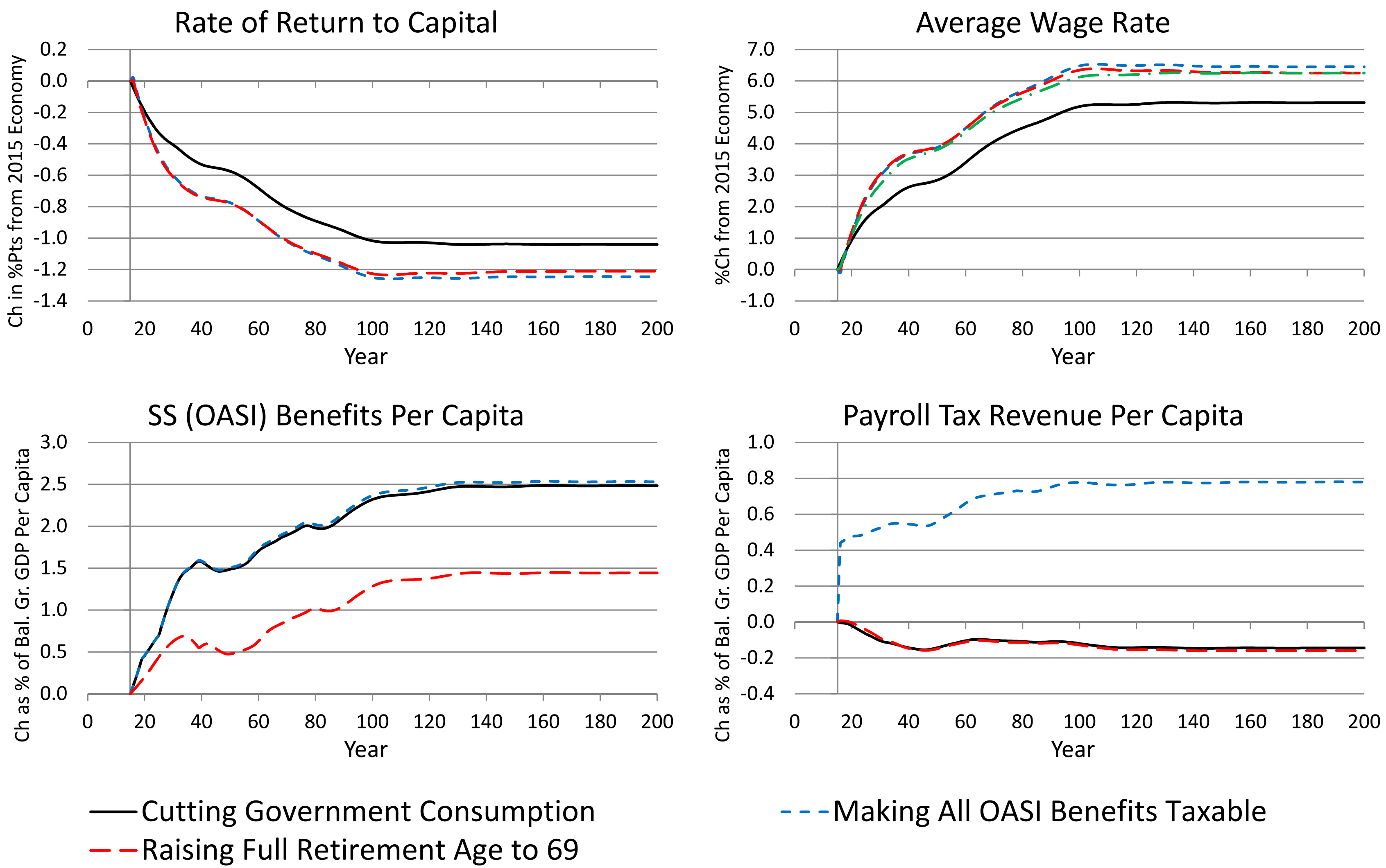
Taxing All Benefits vs Raising FRA (2)

% changes from the 2015 growth-adjusted economy



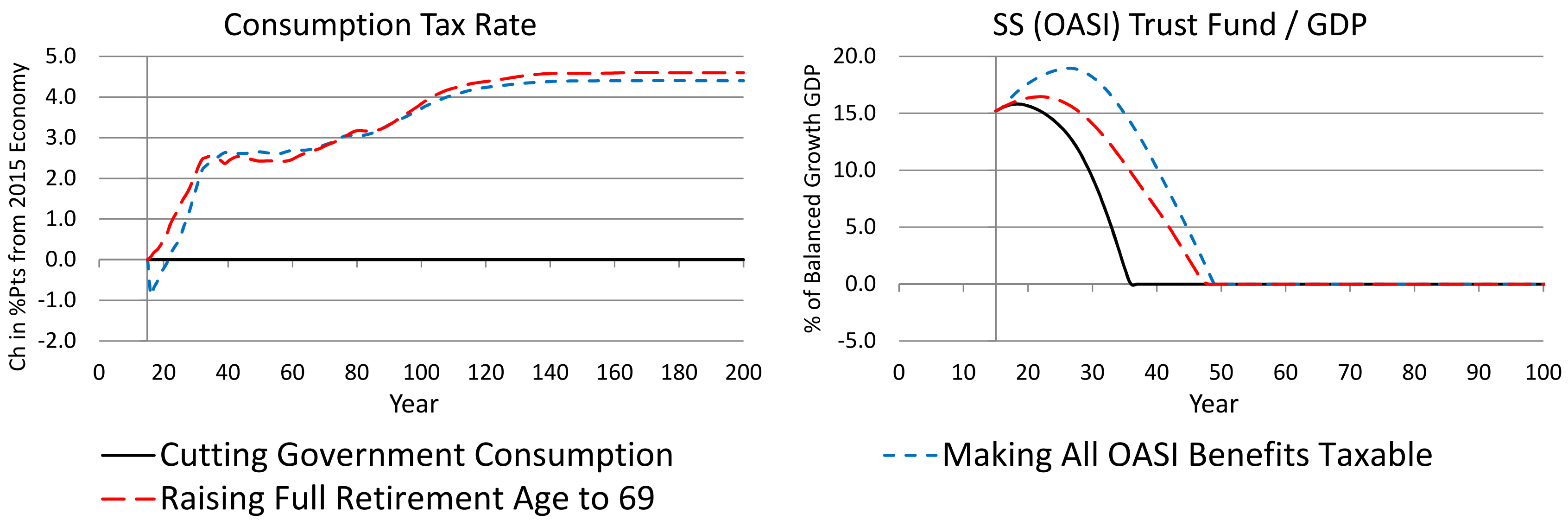
Taxing All Benefits vs Raising FRA (3)

% changes from the 2015 growth-adjusted economy



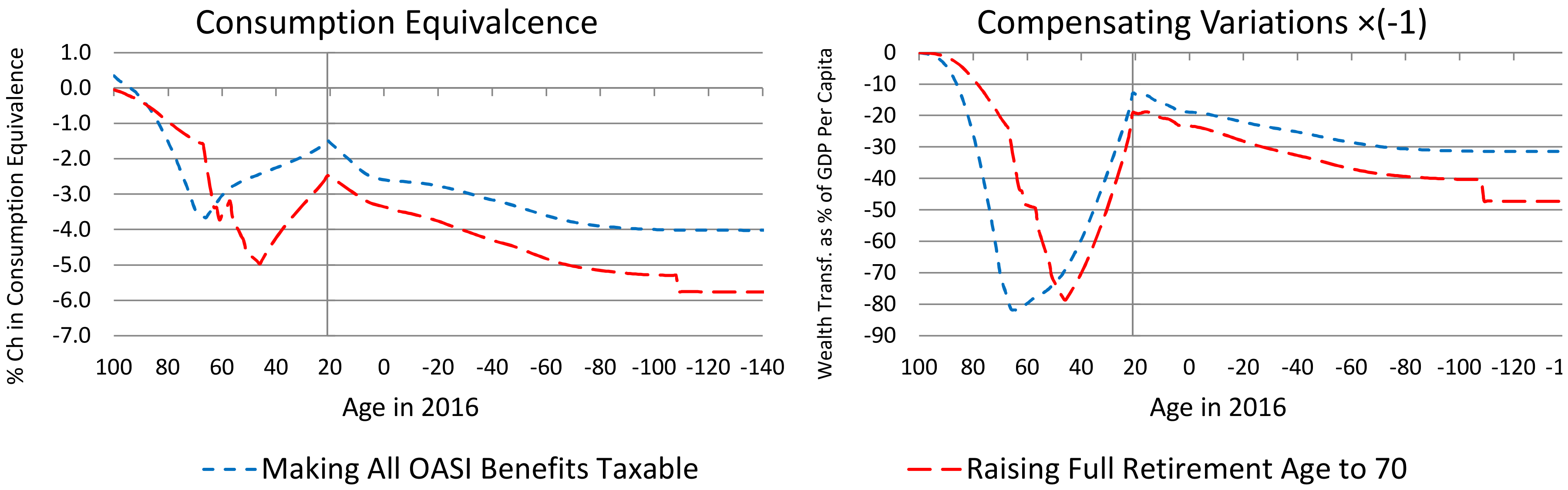
Taxing All Benefits vs Raising FRA (4)

% changes from the 2015 growth-adjusted economy



Taxing All Benefits vs Raising FRA (5)

% changes from the aging baseline economy



Concluding Remarks

The years of OASI Trust Funds depletion and long-run changes in the GDP per capita (%) and the consumption tax rate (p.p.) are as follows:

	Trustees Rep. 2016	OLG model economy		
	year	year	GDP	τ_C
Do nothing (baseline)	2035	2035	-6.9%	-
Incr. payroll tax by 2.25pp	2090	2058	-7.5%	5.7%
Decr. benefits by 15.8%	2090	2060	-4.7%	4.5%
Rem. max taxable earn. 1	-	2054	-9.2%	7.3%
Rem. max taxable earn. 2	-	2057	-8.5%	6.2%
Make all benefits taxable	-	2048	-5.3%	4.4%
Raise FRA from 67 to 70	-	2047	-5.5%	4.6%