Replacing Income Taxation with Consumption Taxation in Japan

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Tax Reform and the Japanese Economy

- In April 2014, the Japanese government announced plans to gradually reduce the corporate income tax rate from 35% to 25%
- In April 2015, the government reduced the tax rate by 3.29%
- In previous work, we showed that the labor income tax is more distorting than the consumption tax, for a given amount of revenue raised
- In this paper, we study the impact of replacing income taxation with consumption taxation
- Using a neoclassical growth model in the current context of Japan
  - Consider long run and short run effects on the economy.
  - Welfare analysis.
- Context: one where government debt to output is growing and expected to continue to grow, and, there is already a very high debt to output ratio

The Japanese Economy: Current Context

- Net debt to GDP ratio at about 150% in 2015
- Dependency ratio projected to rise from 40% in 2013 to 92% in 2092

Fundamental Problem: Aging Population

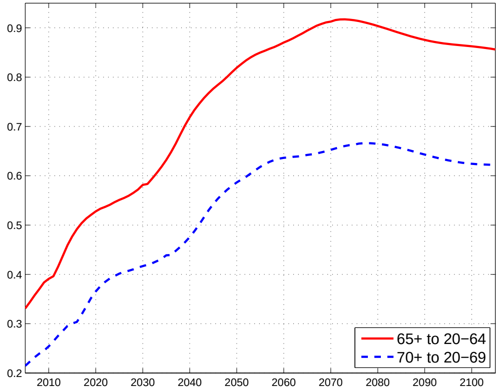


Figure: Dependency Ratios

Implications of Aging Population

Fukawa and Sato (2009), consistent with İmrohoroğlu, Kitao and Yamada (2015)

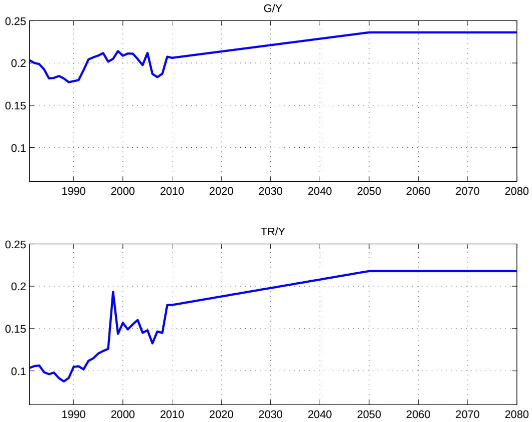


Figure: Government Expenditures to GNP Ratios

Why Consumption Tax

Ministry of Finance, Japan

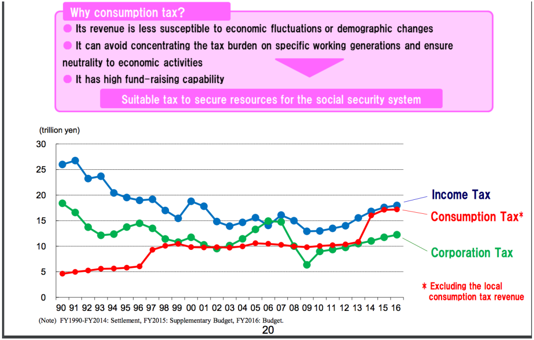


Figure: Sources of Tax Revenues

Why Consumption Tax

Economic Theory

From first order condition for labor, we can define

$$1 - \tau_t \equiv \frac{1 - \tau_{h,t}}{1 + \tau_{c,t}}$$

$$\Rightarrow \tau_t = \frac{\tau_{c,t} + \tau_{h,t}}{1 + \tau_{c,t}}$$

Economic Model

- Use framework from Hansen and İmrohoroğlu (2016).
- Assume maximum debt to output ratio that once reached, taxes must be increased and/or expenditures reduced.
- Raising the consumption tax is the best of revenue enhancing policies considered.
- All policies are fully anticipated–people know that taxes will have to increase and when and how they will be increased.
- Here we consider *unanticipated* tax reform in the context of the previous paper.
- Agents still anticipate tax increases to stabilize debt to output, but expectations change after reform.

Economic Model, continued

- Similar to Hayashi and Prescott (2002), Chen, İmrohoroğlu and İmrohoroğlu (2006), and Hansen and İmrohoroğlu (2016).
- Standard neoclassical growth model.
- Characterize how model performs from 1981-2014.
  - Take as exogenous TFP, tax rates, government consumption, transfers and population growth.
  - Use observed values 1981-2014 and forecasts for 2015 and beyond.
    - Government projections for population to 2060.
    - Forecasts of Fukawa and Sato (2009) of G/Y and TR/Y to 2050. [Consistent with independent projections of İmrohoroğlu, Kitao, and Yamada (2015)]
- Model simulation provides forecasts of endogenous variables from 2015 and beyond.

Features of Model

- Endogenous labor choice $\Rightarrow$ consumption and labor income taxes distort labor decision.
- Capital income tax distorts the saving decision.
- Consumption tax distorts less per unit of revenue gained then does labor income tax.

Related Literature

- İmrohoroğlu and Sudo (2011): Will a 15% consumption tax or a growth miracle save Japan? No.
- Doi, Hoshi and Okimoto (2011): Combination of reforms.
- Hoshi and Ito (2015): Back-of-the-envelope calculations.
  - İmrohoroğlu and Hansen (2015): Given the projected increases in government expenditures and the decline in working age population, how high must the consumption tax rate go to achieve fiscal sustainability? Very, very high.
- İmrohoroğlu, Kitao, and Yamada (2015): Accounting exercise to measure which policies/outcomes help achieve fiscal sustainability. Pension reform, increase in FLFP.
  - Braun and Joines (2015): Raise co-pay for the elderly to the level of working age people.
  - Kitao (2015): Raise normal retirement age to 70.

Model: Structure and Demographics

- Representative household with N_t members at time t.
- $N_{t+1} = \eta_t N_t$.
- Working age population varies over time.

Model: Government Budget

$$\begin{aligned} G_t + TR_t^* + B_t &= \eta_t q_t B_{t+1} + \tau_{c,t} C_t + \tau_{h,t} W_t h_t \\ &\quad + \tau_{k,t}(r_t - \delta) K_t + \tau_{b,t}(1 - q_{t-1}) B_t. \end{aligned}$$

Debt Sustainability Rule

- Consumption tax rate (τ_c) is increased at first date that $B_t/Y_t > b_{max}$
  - Denote trigger date by T_1.
  - τ_c is increased sufficiently so that B_t/Y_t begins to fall.
  - In addition, TR_t is reduced by eight percent of output ($0.08Y_t$) (tax base broadening).
- When B_t/Y_t reaches $\overline{b}$, we set $\tau_{c,t} = \overline{\tau}_c$.
  - Denote this second trigger date by T_2.
  - $\overline{\tau}_c$ is the consumption tax rate that guarantees that the government budget constraint is satisfied in steady state with a debt to output ratio equal to $\overline{b}$.
  - TR_t for $t > T_2$ is adjusted to guarantee convergence to steady state (minor).

Debt Sustainability Rule, continued

Let $\tau^A_{c,t}$ be the announced tax rate assuming date T_1 hasn't arrived.

$$\tau_{c,t} = \begin{cases} \tau^A_{c,t} & \text{if } t < T_1 \;\; (B_s/Y_s \leq b_{\max} \text{ for all } s \leq t) \\ \overline{\tau}_c + \pi & \text{if } T_1 \leq t < T_2 \;\; (B_s/Y_s > b_{\max} \text{ for some } s \leq t \text{ and } B_t/Y_t > \overline{b}) \\ \overline{\tau}_c & \text{if } t \geq T_2 \;\; (B_t/Y_t \leq \overline{b}), \end{cases}$$

.

- π is chosen as the smallest increment that leads to the activation of the second trigger (convergence to steady state).
- $TR^*_t = TR^B_t$ for $t < T_1$
- $TR^*_t = TR_t - 0.08 Y^B_t$ for $t \geq T_1$

Announced Tax Rates

- Tax rates from 1981 to 2014 are set equal to actual tax rates in Japan.
  - Up to 2014, agents forecast based on current policy continuing, including expected changes once trigger bond to output ratio is reached.
- Tax rates beginning in 2015 incorporate unanticipated policy changes that are the focus of this paper.
  - Forecasts now based on new policy, including expected changes once trigger bond to output ratio is reached.

Model: Household's Problem

$$\max \sum_{t=0}^{\infty} \beta^t N_t [\log C_t - \alpha \frac{h_t^{1+1/\psi}}{1+1/\psi} + \phi \log(\mu_t + B_{t+1})]$$

subject to

$$\begin{aligned}
&(1+\tau_{c,t})C_t + \eta_t K_{t+1} + q_t \eta_t B_{t+1} \\
&= (1-\tau_{h,t})W_t h_t + \left[(1 + (1-\tau_{k,t})(r_t - \delta)\right] K_t \\
&\quad + [1 - (1-q_{t-1})\tau_{b,t}] B_t + TR_t,
\end{aligned}$$

Model: Technology

$$\begin{aligned} N_t Y_t &= A_t (N_t K_t)^{\theta} (N_t h_t)^{1-\theta} \\ N_{t+1} K_{t+1} &= (1-\delta) N_t K_t + N_t X_t \\ A_{t+1} &= \gamma_t A_t \end{aligned}$$

Stationary Equilibrium Conditions

Given a per capita variable Z_t we obtain its detrended counterpart

$$z_t = \frac{Z_t}{A_t^{1/(1-\theta)}}.$$

- First order conditions and market clearing conditions combine to give 10 equations in 10 unknowns $\{c_t, x_t, h_t, y_t, k_{t+1}, b_{t+1}, d_t, q_t, w_t, r_t\}$ for each period t.
- Two step solution procedure:
  - Find value for k_{1982} given k_{1981} such that sequence converges to steady state.
  - Unanticipated change in 2015 requires second shooting: Find value for k_{2016} given k_{2015} from first shoot.

Equilibrium Conditions

Capital Euler Equation

$$\frac{(1+\tau_{c,t+1})\gamma_t^{1/(1-\theta)} c_{t+1}}{(1+\tau_{c,t})c_t} = \beta[1+(1-\tau_{k,t+1})(r_{t+1}-\delta)]$$

Equilibrium Conditions

Bond Euler Equation

$$\frac{\phi}{\mu + b_{t+1}} + \frac{\beta\eta_t[1-(1-q_t)\tau_{b,t+1}]}{(1+\tau_{c,t+1})c_{t+1}} = \frac{q_t\eta_t\gamma_t^{1/(1-\theta)}}{(1+\tau_{c,t})c_t}$$

Equilibrium Conditions

Labor FOC, Production Function, Law of Motion

$$\alpha h_t^{1/\psi} = \frac{(1-\tau_{h,t})w_t}{(1+\tau_{c,t})c_t}$$

$$y_t = k_t^{\theta} h_t^{1-\theta}$$

$$\eta_t \gamma_t^{1/(1-\theta)} k_{t+1} = (1-\delta)k_t + x_t$$

Equilibrium Conditions

Household Budget Constraint

$$
\begin{aligned}
(1+\tau_{c,t})c_t + \eta_t\gamma_t^{1/(1-\theta)}k_{t+1} + q_t\eta_t\gamma_t^{1/(1-\theta)}b_{t+1} \\
= (1-\tau_{h,t})w_t h_t + [1-(1-q_{t-1})\tau_{b,t}]b_t \\
+ tr_t - d_t + [1+(1-\tau_{k,t})(r_t-\delta)]k_t
\end{aligned}
$$

Equilibrium Conditions

Government Budget Constraint

$$
\begin{aligned}
g_t + tr_t + b_t = {} & q_t \eta_t \gamma_t^{1/(1-\theta)} b_{t+1} + \tau_{c,t} c_t + \tau_{h,t} w_t h_t \\
& + \tau_{k,t}(r_t - \delta)k_t + \tau_{b,t}(1 - q_{t-1}) b_t + d_t
\end{aligned}
$$

Equilibrium Conditions

Fiscal Sustainability Rule

$$d_t = \begin{cases} \kappa(b_t - \overline{b}_t\ \overline{y}) & \text{if } b_s / y_s \ \geq b_{\max} \ \text{ for some } s \leq t, \\ 0 & \text{otherwise} \end{cases}$$

Equilibrium Conditions

Market Clearing Conditions

$$
\begin{aligned}
r_t &= \theta k_t^{\theta-1} h_t^{1-\theta}, \\
w_t &= (1-\theta) k_t^{\theta} h_t^{-\theta}, \\
c_t + x_t + g_t &= y_t
\end{aligned}
$$

Population and Labor Input

- $N_t =$ working age population between the ages of 20 and 69
- Use actual values for 1981-2014
- Use official projections for 2015-2060
- Population growth rate converges to zero linearly from 2060 to 2080 and is assumed to be zero after that.
- h_t is employment per working age population multiplied by average weekly hours worked divided by 98 (discretionary hours available per week).

National Accounts: Hayashi and Prescott (2002)

Table: Adjustments to National Account Measurements

$C =$	Private Consumption Expenditures
$I =$	Private Gross Investment
	+ Change in Inventories
	+ Net Exports
	+ Net Factor Payments from Abroad
$G =$	Government Final Consumption Expenditures
	+ General Government Gross Capital Formation
	+ Government Net Land Purchases
	− Book Value Depreciation of Government Capital
$Y =$	$C + I + G$

Government Accounts

- Public health expenditures in Japan are included in G_t.
- TR_t, includes social benefits (other than those in kind, which are in G_t,) that are mostly public pensions, plus other current net transfers minus net indirect taxes.
- 8% of output is added to TR_t since modeling of flat tax rates ignores deductions and exemptions.

Tax Rates

- $\tau_{h,t}$, are average marginal labor income tax rates estimated by Gunji and Miyazaki (2011).
  - Last value is 0.324 for 2007 and we assume that this remains constant thereafter or change in 2015.
- $\tau_{k,t}$, is constructed following methodology in Hayashi and Prescott (2002).
  - Last value is 0.3409 for 2014 and we assume that this remains constant thereafter or change in 2015.

Tax Rates, continued

- Tax Rate on Consumption, $\tau_{c,t}$
  - 0% 1981-1988
  - 3% 1989-1996
  - 5% 1997-2013
  - 8% 2014
- Tax Rate on Bond Interest, τ_b, 20% for all time periods.

Tax Rates, continued

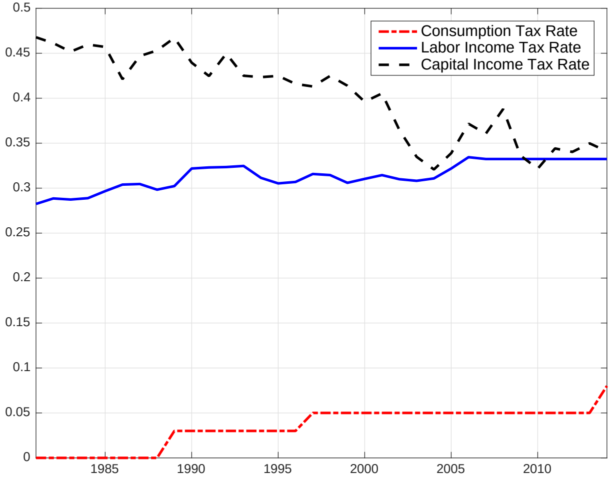


Figure: Tax Rates

Technology Parameters

- $A_t = Y_t/(K_t^{\theta} h_t^{1-\theta})$.
- $\theta = 0.3798$, which is the average value from 1981-2014.
- $\gamma_t = A_{t+1}/A_t$, comes from the actual data between 1981 and 2014.
- $\gamma_t = 1.015^{1-\theta}$ for 2015 and beyond.
- $\delta = 0.0816$, which is the average value from 1981-2014.

Preference Parameters

- Five preference parameters, $\beta, \alpha, \psi, \phi$, and μ.
- $\mu = \mu_t / A_t^{1/(1-\theta)} = 1.1$.
- $\psi = 0.5$, the Frisch elasticity of labor supply estimated by Chetty et al (2012).

Preference Parameters, continued

For β, α, and ϕ, use equilibrium conditions to obtain a value for each year, and then average over the sample:

$$\beta_t = \frac{(1+\tau_{c,t+1})\gamma_t^{1/(1-\theta)} c_{t+1}}{(1+\tau_{c,t})c_t \left[1 + (1-\tau_{k,t+1})\left(\theta \frac{y_{t+1}}{k_{t+1}} - \delta\right)\right]}$$

$$\alpha_t = \frac{h_t^{-1/\psi}(1-\tau_{h,t})(1-\theta)y_t}{(1+\tau_{c,t})c_t h_t}$$

$$\phi_t = \eta_t(\mu + b_{t+1}) \left[\frac{q_t \gamma_t^{1/(1-\theta)}}{(1+\tau_{c,t})c_t} - \frac{\beta_t \left[1 - (1-q_t)\tau_{b,t+1}\right]}{(1+\tau_{c,t+1})c_{t+1}}\right].$$

Bond Price

Need empirical counterpart to q_t :

$$q_t = \frac{B_{t+1}/F_t}{(B_{t+1} + P_{t+1})/F_{t+1}}.$$

- B_t is beginning of period debt.
- P_t is interest payments made in period t.
- F_t is the GNP deflator.

Structural Parameters

Table: Calibration of Structural Parameters

Parameter	Value	
θ	0.3798	Data Average
δ	0.0816	Data Average
β	0.9671	FOC, 1981-2014
α	23.05	FOC, 1981-2014
ψ	0.5	Chetty et al (2012)
ϕ	0.12	FOC, 1981-2013
μ	1.1	fit q_t for 1981-2014

Solution Method

We take as given a value for k_{1981} and a sequence $\{\tau_{c,t}, \tau_{h,t}, \tau_{b,t}, \tau_{k,t}, \eta_t, \gamma_t, g_t, tr_t\}_{t=1981}^{\infty}$, where the elements of this sequence are constant beyond some date. These constant values determine the steady state to which the economy ultimately converges. We use a shooting algorithm, similar to that in Hayashi and Prescott (2002)and Chan, İmrohoroğlu, and İmrohoroğlu (2006), to determine the value of c_{1981} (or, equivalently, k_{1982}) such that the sequence of endogenous variables $\{c_t, x_t, h_t, y_t, k_{t+1}, b_{t+1}, d_t, q_t, w_t, r_t\}$ determined by equations (5)-(14) converges to the steady state. That is, the shooting algorithm guarantees that the capital stock sequence satisfies the transversality condition. Note that our fiscal sustainability rule guarantees that the bond to output ratio is equal to $\overline{b}$ in the steady state achieved in the limit.

Long Run Tradeoffs

Iso-Revenue Curve ($\tau_h = 0.3324$)

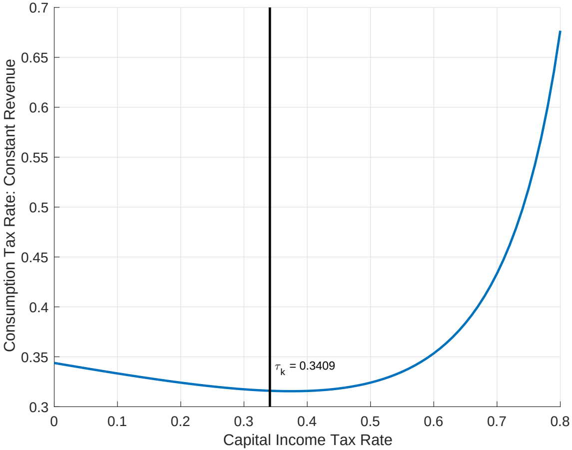


Figure: Steady State Iso-Revenue Curve ($\tau_h = 0.3324$)

Long Run Tradeoffs

Iso-Revenue Curve ($\tau_k = 0.3409$)

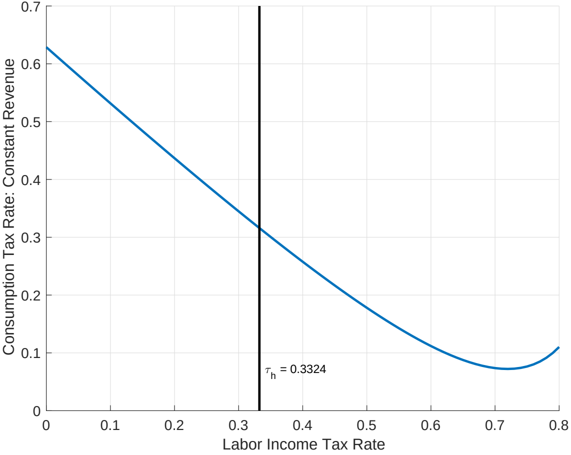


Figure: Steady State Iso-Revenue Curve ($\tau_k = 0.3409$)

Experiments

Reducing Income Tax Rates

- Unanticipated reduction in τ_k and/or τ_h from 2014 value
  - to 20% in 2015
  - to 0% in 2015
- For each case, consider two possibilities:
  - τ_c is raised in 2015 to replace lost 2015 revenue.
  - Increase in τ_c is delayed until trigger date T_1.
- Reductions in corporate tax rate in Japan consistent with second approach.

Tax Reform Experiments

Table: Experiments

	For $t \geq 2015$	
	$\tau_{k,t}$	$\tau_{h,t}$
$E1$	0.3409	0.3324
$E2$	0.20	0.3324
$E3$	0.0	0.3324
$E4$	0.3409	0.20
$E5$	0.3409	0.0
$E6$	0.20	0.20
$E7$	0.0	0.0

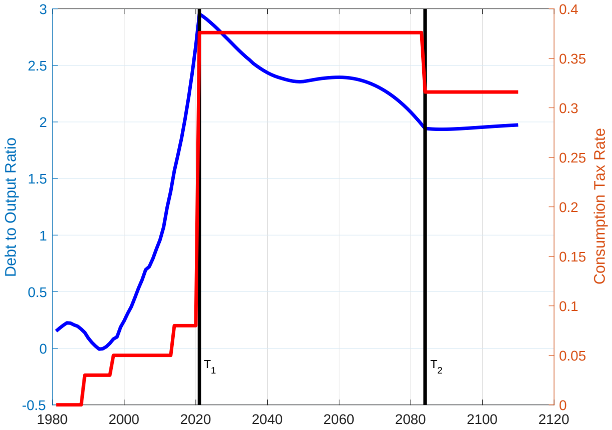
Tax Wedge

From first order condition for labor, can define

$$1 - \tau_t \equiv \frac{1 - \tau_{h,t}}{1 + \tau_{c,t}}$$

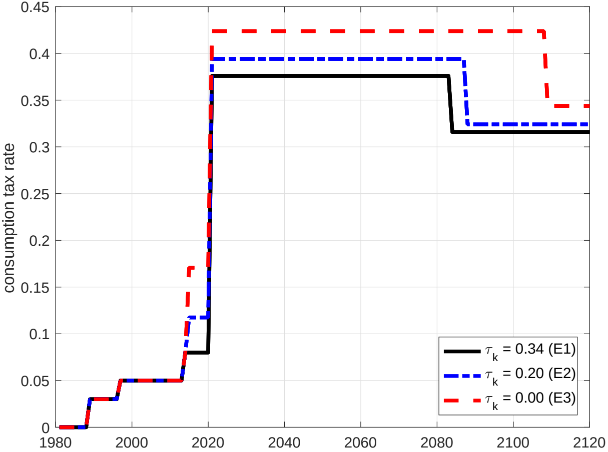
$$\Rightarrow \tau_t = \frac{\tau_{c,t} + \tau_{h,t}}{1 + \tau_{c,t}}$$

Demonstration of the fiscal rule in the baseline case.



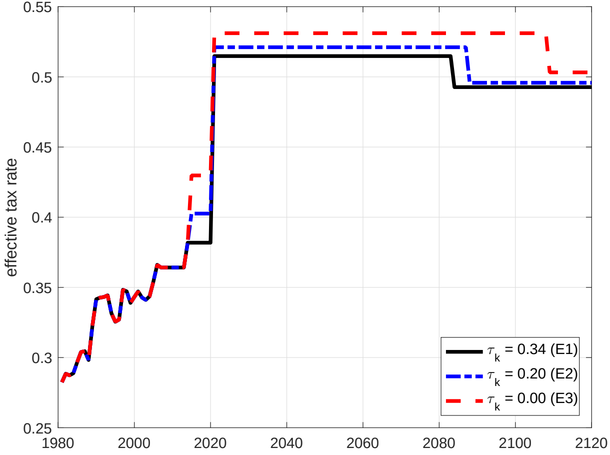
Replacing Capital Tax with Consumption Tax

Consumption Tax Rate



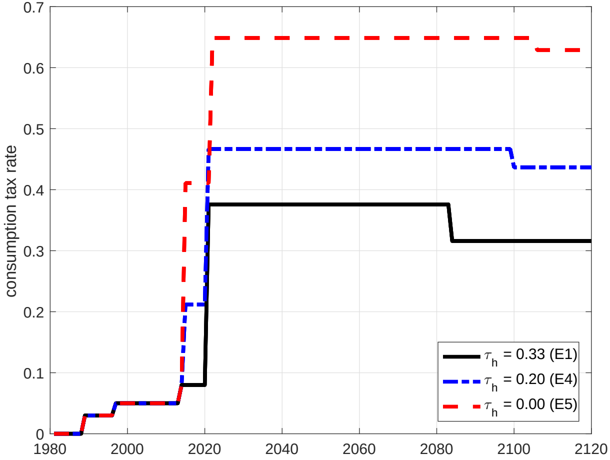
Replacing Capital Tax with Consumption Tax

Effective Tax Rate



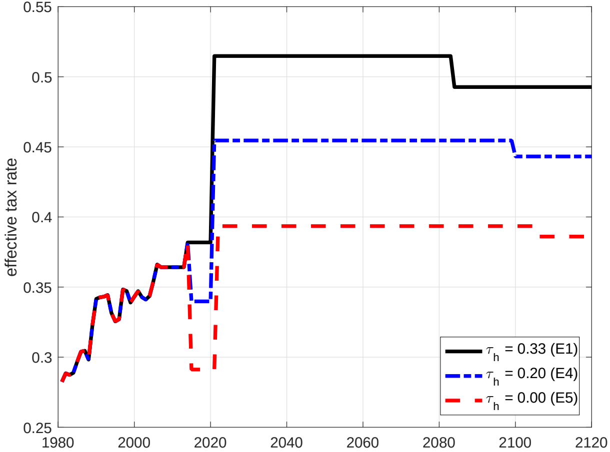
Replacing Labor Tax with Consumption Tax

Consumption Tax Rate



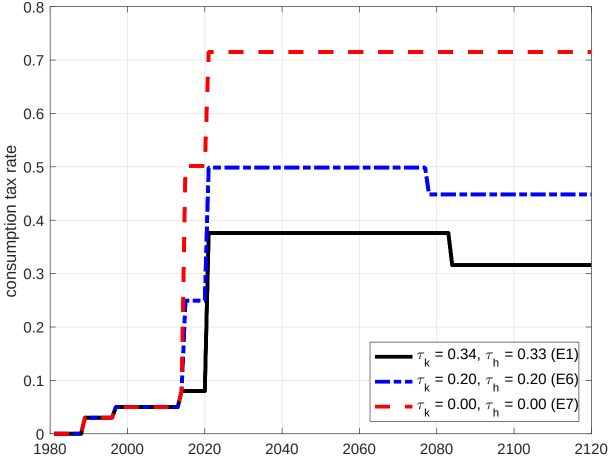
Replacing Labor Tax with Consumption Tax

Effective Tax Rate



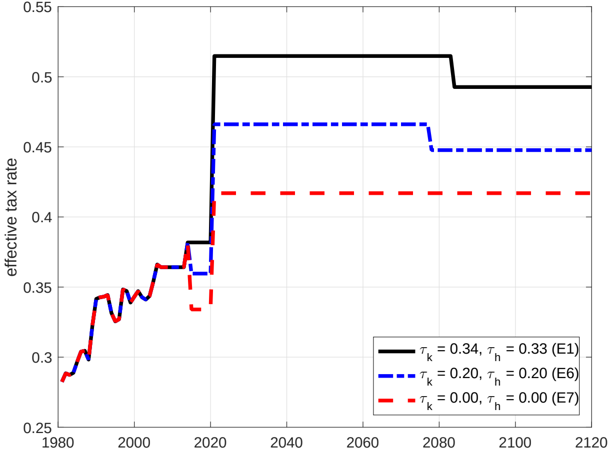
Replacing Income Taxation with Consumption Tax

Consumption Tax Rate



Replacing Income Taxation with Consumption Tax

Effective Tax Rate

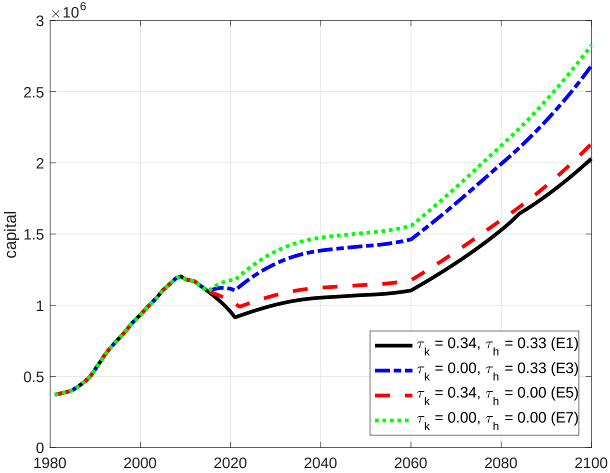


Unanticipated Reform with a Revenue-Neutral Increase in τ_c

	$E1$	$E2$	$E3$	$E4$	$E5$	$E6$	$E7$
$\tau_{c,2015}$	0.08	0.1175	0.1708	0.2117	0.4108	0.2493	0.5016
τ_{2015}	0.3818	0.4026	0.4298	0.3398	0.2912	0.3596	0.3340
T_1	2021	2021	2021	2021	2022	2021	2021
τ_{c,T_1}	0.3760	0.3941	0.4238	0.4667	0.6487	0.4985	0.7152
τ_{T_1}	0.5148	0.5211	0.5311	0.4546	0.3935	0.4661	0.4170
T_2	2084	2088	2109	2100	2106	2078	2141
τ_{c,T_2}	0.3160	0.3241	0.3438	0.4367	0.6287	0.4485	0.6752
τ_{T_2}	0.4927	0.4958	0.5032	0.4432	0.3860	0.4477	0.4031

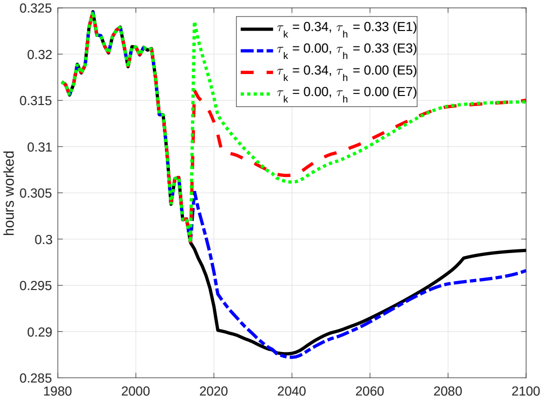
Transition Paths

Capital Stock



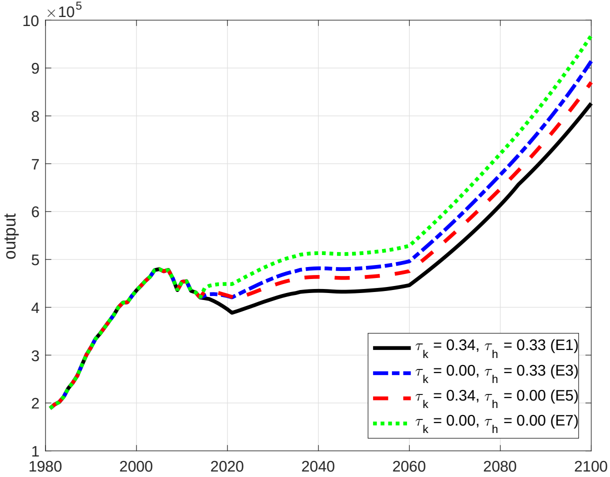
Transition Paths

Labor Input



Transition Paths

Output



Improvements in living standards

To get a sense for how these policy changes would affect living standards, we show output per person in Figure 7. In all cases where income taxation is substituted for consumption taxation, the Japanese economy is predicted to enjoy considerable growth in income per capita relative to the benchmark starting in 2015 until date $T_1 = 2021$.[1] After 2021, all cases grow at a similar rate, although living standards are permanently higher in the cases with higher growth beginning in 2015.

[1] The value of T_1 in E5 is 2022.

Improvements in living standards

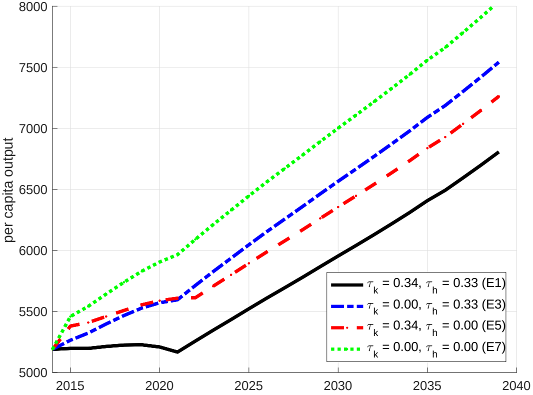


Figure: Output per Person

Immediate Gains

Table: Average Annual Growth Rate of Output per Working Age Population

	$E1$	$E3$	$E5$	$E7$
2015 – 2021	0.17%	1.18%	0.61%	1.58%
2025 – 2060	1.58%	1.62%	1.58%	1.62%

Delaying the increase in the consumption tax rate

	$E1$	$E2$	$E3$	$E4$	$E5$	$E6$	$E7$
$\tau_{c,2015}$	0.08	0.08	0.08	0.08	0.08	0.08	0.08
τ_{2015}	0.3818	0.3819	0.3819	0.2593	0.0741	0.2593	0.0741
T_1	2021	2020	2020	2020	2019	2019	2018
τ_{c,T_1}	0.3760	0.3841	0.4438	0.5067	0.7287	0.5285	0.8052
τ_{T_1}	0.5148	0.5177	0.5376	0.4690	0.4215	0.4766	0.4460
T_2	2084	2103	2122	2112	2084	2070	2073
τ_{c,T_2}	0.3160	0.3241	0.3438	0.4367	0.6287	0.4485	0.6752
τ_{T_2}	0.4927	0.4958	0.5032	0.4432	0.3860	0.4477	0.4031

Delaying the increase in the consumption tax rate

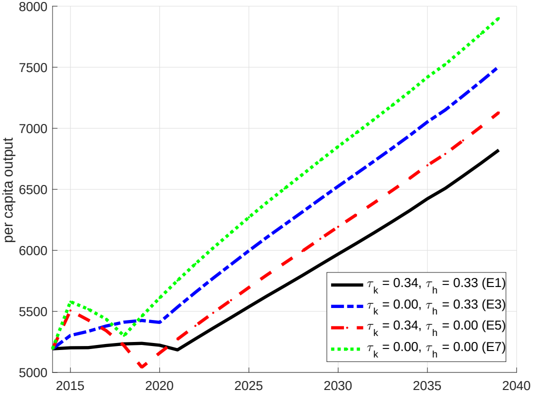


Figure: Output per Person

Welfare Analysis

- $\widehat{W}$ is the realized discounted 1981 value of utility if income tax rates are unchanged.

$$\widehat{W} = \sum_{t=1981}^{\infty} \beta^t N_t \Big[\log \widehat{C}_t - \alpha \frac{\widehat{h}_t^{1+1/\psi}}{1+1/\psi} + \phi \log(\mu_t + \widehat{B}_{t+1}) \Big].$$

- W is the corresponding realized utility from an alternative experiment.
- Report λ that solves following:

$$W = \sum_{t=1981}^{\infty} \beta^t N_t \Big[\log \left[(1+\lambda) \widehat{C}_t \right] - \alpha \frac{\widehat{h}_t^{1+1/\psi}}{1+1/\psi} + \phi \log(\mu_t + \widehat{B}_{t+1}) \Big].$$

Welfare Gains

Welfare Gains Over Case E1: $\tau_k = 0.34\%$ and $\tau_h = 0.33$

Table: Welfare Effects: CEV

	For $t \geq 2015$ $\tau_{k,t}$	$\tau_{h,t}$	λ (R-neutral)	λ (delay)
$E1$	0.3409	0.3324	–	–
$E2$	0.20	0.3324	0.0090	0.0099
$E3$	0.0	0.3324	0.0196	0.0257
$E4$	0.3409	0.20	0.0047	0.0138
$E5$	0.3409	0.0	0.0111	0.0212
$E6$	0.20	0.20	0.0120	0.0144
$E7$	0.0	0.0	0.0309	0.0362

Conclusion

What We Did ...

- Evaluate the impact of unanticipated reductions in income taxes in Japan.
- Context is one where debt to output ratios are at unprecedented levels and climbing due to rapid societal aging.
- Consider a case where
  - Revenue is replaced immediately with an increased consumption tax.
  - Tax increase is delayed until debt to output reaches 250%.

Conclusion continued

What We Found ...

- Significant output gains in the short run.
- Welfare is increased by 3% by eliminating income taxation.
- Welfare is increased by almost 4% if consumption tax increase is delayed.

Conclusion continued

What Next ...

- Optimal taxation? Lots of moving parts in our model.
- Generational winners/losers? Need an OG model.
- Insurance role for taxes? Need a model with uninsurable risks.
- Political economy role for taxes? Need a political-economic equilibrium model.