

Recardian equivalence



Fall semester, 2024

Public Finance

Today's talk

Effects of public debt. Is public debt bad?

- Burden of public debt
- Ricardian equivalence
 - 2-period model, graphical explanations
 - Necessary assumptions
 - Empirical analysis
- Some arguments about public debt
 - Public debt overhang
 - Non-Keynesian effects
 - Fiscal policy under low interest rates

Burden of Debt

- Is a national debt a burden on a economy? ([CRS report](#))
- “We owe it to ourselves” (Samuelson)
 - The alternative use of resources in the private sector
- Lerner (1948, 1961, REStat)
 - No burden: national debt is a liability of the government and an asset of the people (in a closed economy or an internal debt)
 - An external public debt is a burden, because the trade surplus needed to finance the debt service
- Bowen, Davis, Kopf (1960, AER)
 - Generations when borrowing can differ those when repaying
 - The burden can be shifted to future generations
- Modigliani (1961, EJ)
 - A reduction in the aggregate stock of private capital, which decrease the flow of goods and services for future generations

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Ricardian Equivalence / neutrality

□ Also referred as Barro-Ricardo Equivalence

- Under certain conditions, an increase in government spending through borrowing or taxation has no effect on the total demand for goods and services in an economy and hence on economic growth.
- A starting point to discuss the effect of public debt in macroeconomics



2 period model

□ Agents: household, firm, (government)

- Household maximizes the utility from consumption in the present and future, controlling consumptions and savings.
- Firm maximizes the profit using household savings (capital) and labor

□ Government budget constraint (no money)

- Present: $B = G_1 - T_1$
- Future: $T_2 = G_2 + (1 + r)B$
- Rearranging: $G_1 + \frac{G_2}{1+r} = T_1 + \frac{T_2}{1+r}$

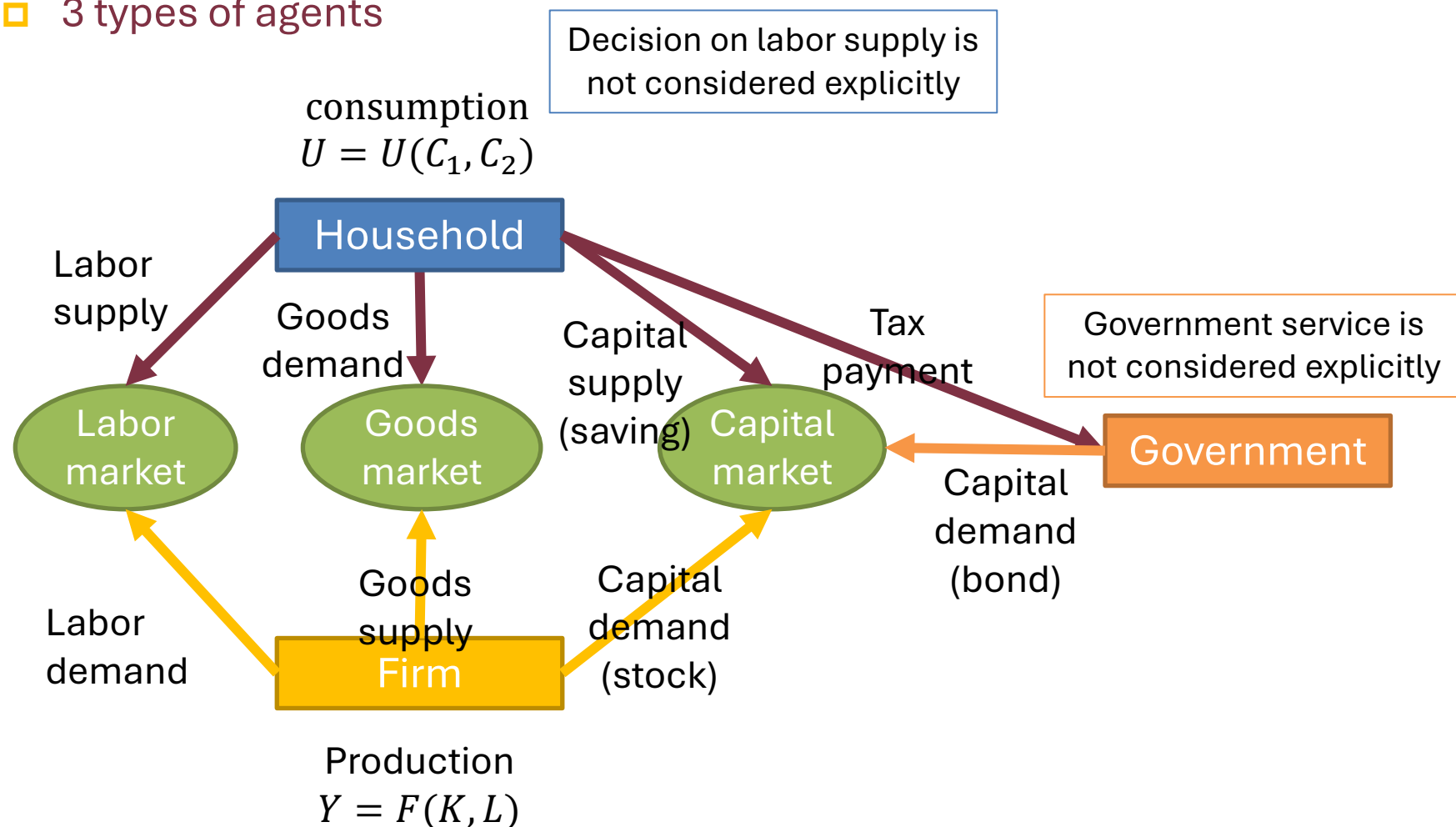
Present value of
govt expenditures

Present value of
govt revenues

- Regardless of the amount of borrowing, the government must collect taxes so that PV of expenditures is equal to PV of revenues

A model of macroeconomy

□ 3 types of agents



2 period model

□ Household budget constraint

- Present: $c_1 = w_1 - T_1 - a$
- Future: $c_2 = (1 + r)a + w_2 - T_2$
 - Household does not consider periods after the 2nd period.
 - No bequest
 - Asset (saving) a can be positive or negative
- Rearranging

$$c_1 + \frac{c_2}{1 + r} = w_1 - T_1 + \frac{w_2 - T_2}{1 + r}$$

Present value of
household's consumption

Present value of household's
disposable income

2 period model

- Substitute government budget constraint into household budget constraint,

$$c_1 + \frac{c_2}{1+r} = \left(w_1 + \frac{w_2}{1+r} \right) - \left(G_1 + \frac{G_2}{1+r} \right)$$

PV of household's
consumption

PV of household's
before-tax income

PV of government's
expenditures

- Household budget constraint depends on government expenditure (G_1, G_2), NOT depends on tax schedule (T_1, T_2)
- Even if public debt changes tax schedule (T_1, T_2), household budget constraint does NOT change $\rightarrow (c_1, c_2)$ does NOT change
 - Disposable income $w_1 - T_1$ increases = saving a increases
 - Saving increases = buy public debt
 - \rightarrow No changes in capital stock \rightarrow No changes in output
 - No changes in consumption, wage and interest rates

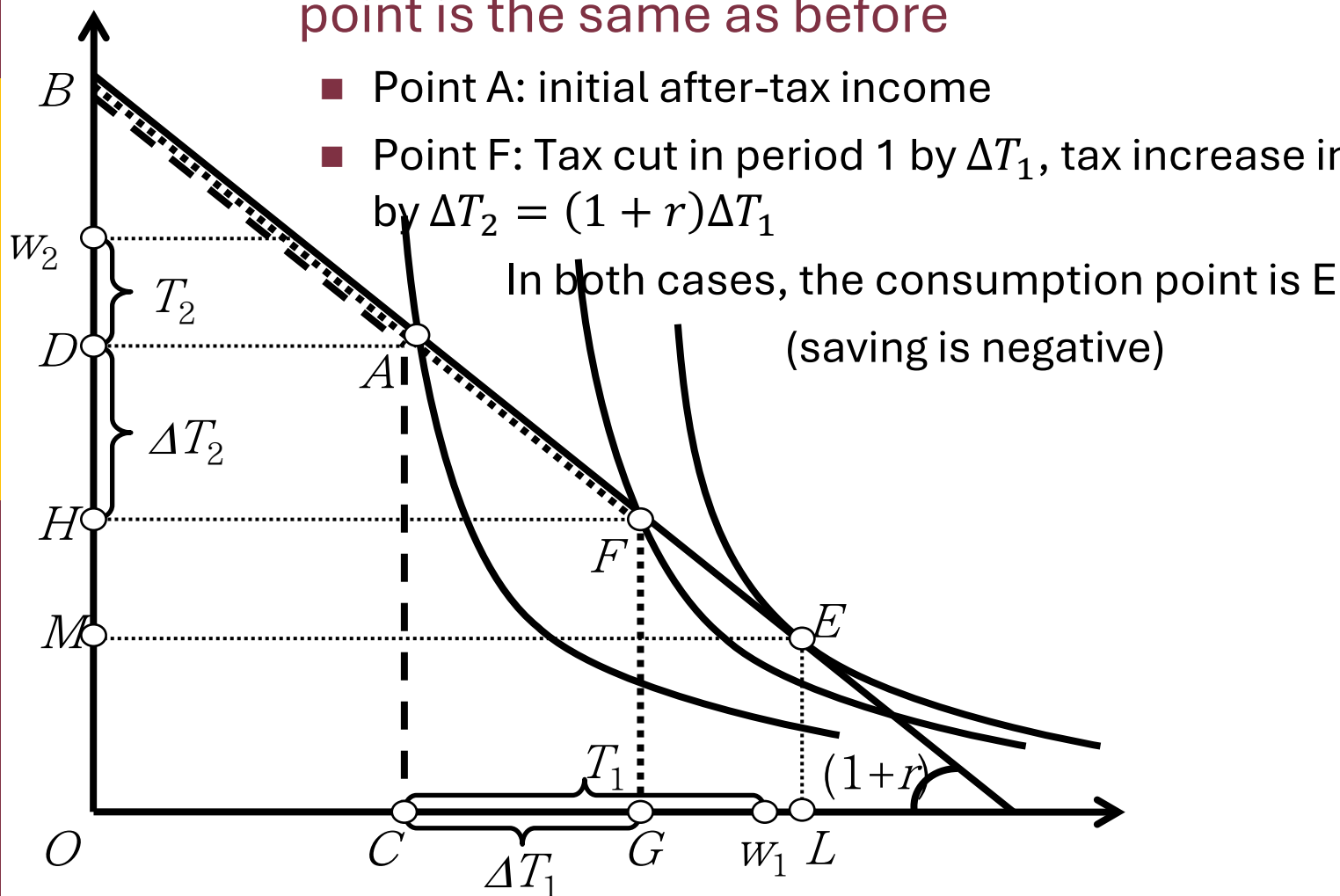
2 period model: interpretation

- Interpret c_2 as future generations' consumption
 - Neutrality holds across generations
 - “Saving” is bequest from present to future generation
 - “Tax cut and public debt” do not change consumption of present generation. An increase in disposable income is transferred to future generation as bequest. Future generation pay taxes using the bequest.
 - Dynasty model
 - One integrated decision maker of present and future generations
 - Present generation has altruistic bequest motive
- Barro's neutrality
 - When generations and bequest are taken into account, this is called as Barro's neutrality

2 period model: graph

- Budget line does not change, the consumption point is the same as before

- Point A: initial after-tax income
- Point F: Tax cut in period 1 by ΔT_1 , tax increase in period 2 by $\Delta T_2 = (1+r)\Delta T_1$



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Assumptions

□ Household is forward looking and rational

- If myopic, tax cut increase the consumption
- If future projection is impossible, the consumption may change
- If life is short and forward looking, they use bequest
 - Assumption of altruistic bequest motive
 - No accidental bequest, No strategic bequest
 - No empirical agreement on bequest motive
 - Maybe not perfectly altruistic

□ Perfect capital market

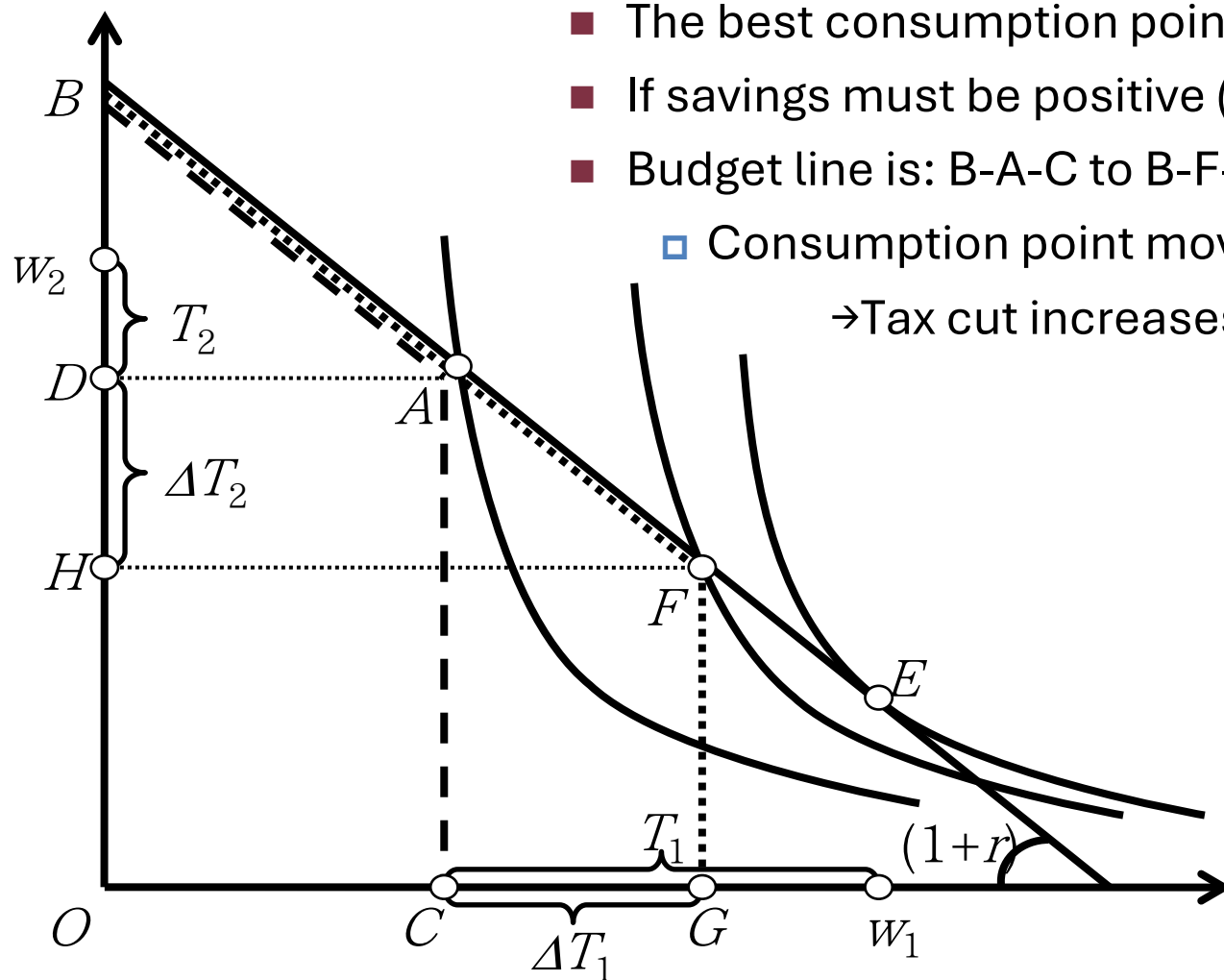
- Household and government face the same interest rate
- No constraint on saving and borrowing
- In reality, saving interest rate $<$ borrowing interest rate. Borrowing is also constrained
- (next slide)

Borrowing constraints

□ Disposable incomes changes A to F

- The best consumption point is , but
- If savings must be positive (no borrowing)
- Budget line is: B-A-C to B-F-G

□ Consumption point moves from to F
 → Tax cut increases consumption



Assumptions

- Government budget constraint is satisfied
 - Fiscal situation is sustainable, bond is redeemed
 - If there is a default, household does not buy bond
 - When neutrality holds, government is sustainable as long as household buy bonds
 - Fiscal sustainability matters only when neutrality does not hold
- Lump-sum tax
 - Distortionary tax generates substitution effects
 - Exogenous labor supply = no substitution effects
 - Those who receive tax cuts pay tax later
- No risks
 - No risks on future wage, taxation timing, tax items, etc.
 - Risk generates precautionary savings
 - If tax changes risk, it also changes savings.

Assumptions

□ Other assumptions

- All households have children, # of children is exogenous, etc.

□ Validity of Ricardian equivalence

- Not all assumptions are satisfied
- → Ricardian equivalence does not hold perfectly
- “How valid” is an empirical issue
 - If it is significantly valid, the issues of fiscal sustainability, stimulus effects of tax cuts, burden of public debt are all nonsense.
- Note: Ricardian equivalence does not say anything about government expenditures.

Empirical tests

□ Tests on implications

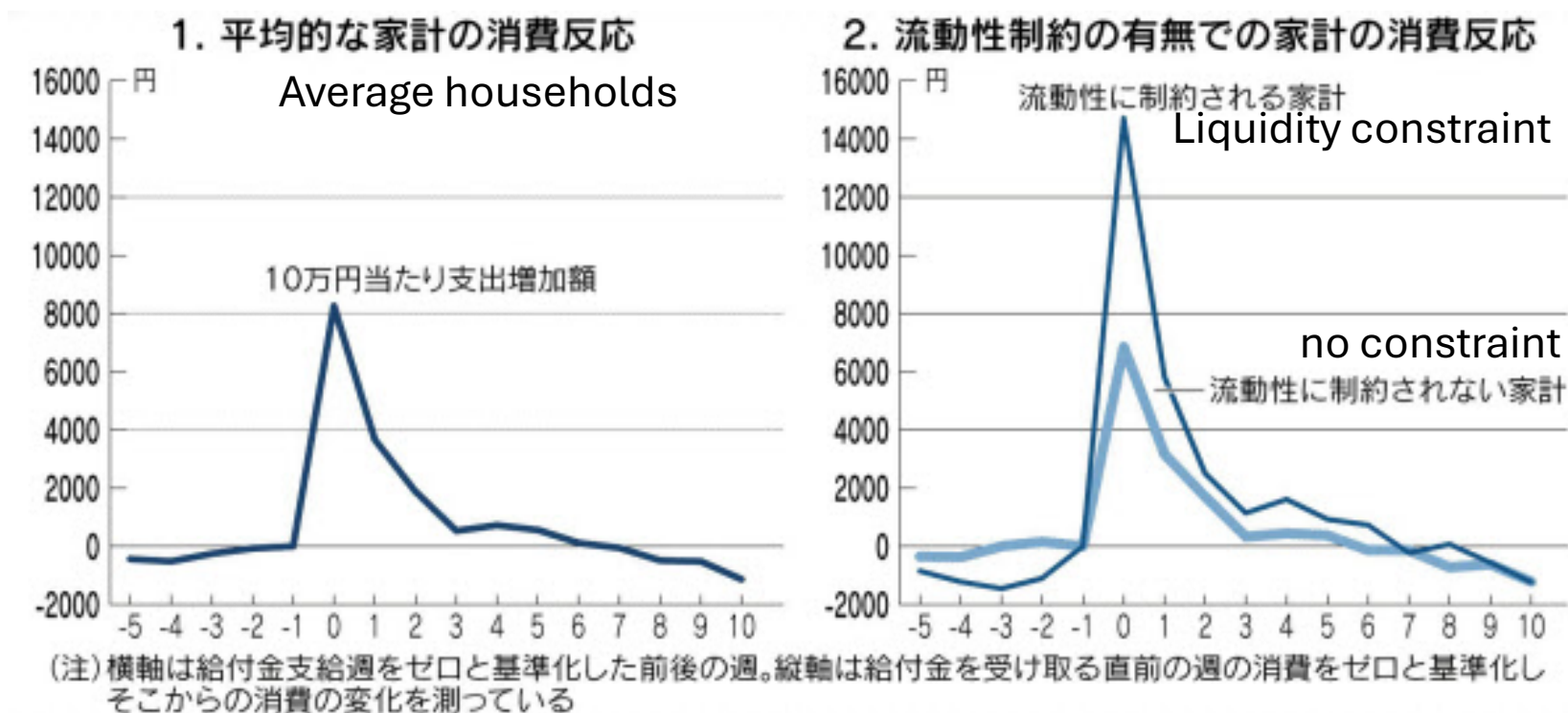
- Macro consumption is not affected by the current tax revenues
- The effects of household's asset is the same as public debt,...
- Feldstein (1982) is negative
- Homma et al. (1987) is negative
- Hatano (2004)
 - Neutrality partially holds in the late 1950s
 - Not in the early 1970s
 - After 1980s, neutrality again tends to hold
- Forward looking households are empirically supported

cf) Covid-19 benefits

Special lump-sum benefits

- Started in May, 2020, as a countermeasure for Covid-19
- Households under liquidity constraints responded more to the benefits

Increases in expenditures



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Public bonds and excess savings

- Most simple economic growth model
 - Household's saving will be optimal
- With some extensions...
 - Idiosyncratic risks
 - Uninsurable risks: individual's ability
 - Overlapping generations models
- Households' excess savings
 - Precautionary savings for risks
- Public bonds play a role
 - To keep the aggregated capital to be at optimal level
 - Government consumes more, as households save more

Debt accumulation and growth

□ Public debt overhang

- Public debt (as a stock) depress economic growth
- Reinhart et al. (2012, JEP)
 - Public debt accumulation since the 19th century in developed countries
 - Economic growth declined in 23 cases, out of 26 cases where public debt/GDP were more than 90% over 5 years
 - When public debt/GDP < 90%, economic growth is not correlated with debt outstanding

Japan	1995–2012	18, ongoing	1989 equity market crash, severe banking crisis in 1991; large private sector debt “overhang” by any measure since 1980s.
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Debt accumulation and growth

- Textbook interpretation: Quantitative effects
 - Decreases in private investment and saving
 - Public debt crowds out private capital
 - Private investment decrease because of tax hike, inflation, financial depression
- Textbook interpretation: Risk premium on public debt
 - Debt accumulation: default risk: high interest rate
 - High long-term interest rate decreases private investment
- Reverse causality?
 - Nonlinear effects
- Other possibility
 - Governments use resources for inefficient projects

Non-Keynesian effects

- Consumption expands under fiscal austerity
 - Consumption shrinks under fiscal expansion
 - Observed in the case of fiscal consolidation in Denmark and Ireland in the 1980s (Giavazzi and Pagano 1990, NBER)
- More likely to happen in a country with high public debt
 - Fiscal expansion (tax cuts, expenditure increases)
 - Expectation of economic slowdown in future due to tax hike
 - Increases in distortionary taxes
 - Consumption demand shrinks
 - Cannot be completely ruled out in Japan
 - Non-Keynesian effect of increases in tax revenue ([Afonso et al. 2022](#))
 - Under fiscal consolidation, higher tax revenues will lead to higher private consumption

Not against public debt

FISCAL POLICY
UNDER LOW
INTEREST RATES

OLIVIER BLANCHARD

□ Argument by Olivier Blanchard

- [AER \(AEA Presidential Lecture\)](#), [PIIE policy brief](#)

□ Transition equation of bond

$$\frac{B_t}{Y_t} = \frac{1 + i_t}{1 + g_t} \frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t} \rightarrow \Delta b_t = (i_t - g_t)b_t + ps_t$$

- Fiscal costs of public debt is low under low interest rates
- When interest rate is lower than growth rate ($i_t < g_t$), **put bluntly, public debt may have no fiscal cost**
- Primary fiscal deficit keeping bond/GDP ratio constant
 - $i - g = -1.5\%$, $b = 150\%$, then fiscal deficit can be 2.25% of GDP to keep bond-GDP ratio constant
 - If government expenditures are used wisely, it is desirable

*cf) Rearranging transition equation

$$\frac{B_t}{Y_t} = \frac{1 + i_t}{1 + g_t} \frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t} \rightarrow \Delta b_t = (i_t - g_t)b_t + ps_t$$

Proof: Define variables as GDP-ratios: $b_t = \frac{1+i_t}{1+g_t} b_{t-1} + ps_t$

Set $f(i_t, g_t) = \frac{1+i_t}{1+g_t}$, and Taylor-expansion around $f(0,0)$

Using $\frac{\partial f}{\partial i_t} = \frac{1}{1+g_t}, \frac{\partial f}{\partial g_t} = -\frac{1+i_t}{(1+g_t)^2}$

$$\begin{aligned} f(i_t, g_t) &\cong f(0,0) + \frac{\partial f}{\partial i_t}(0,0)(i_t - 0) + \frac{\partial f}{\partial g_t}(0,0)(g_t - 0) \\ &= 1 + 1(i_t - 0) - 1(g_t - 0) = i_t - g_t + 1 \end{aligned}$$

Define $\Delta b_t = b_t - b_{t-1}$

$$\Delta b_t = \left(\frac{1+i_t}{1+g_t} - 1 \right) b_{t-1} + ps_t \cong (i_t - g_t)b_t + ps_t$$

Not against public debt

- To begin with,
 - Japan's macroeconomy is in long-term stagnation
 - Real interest rates are expected to remain below real economic growth rate in future
 - (Expected) inflation rates are low, demand gap is almost zero
- Accumulated public debt is harmful for growth and welfare?
 - No, if monetary policy cannot boost demand any more
 - Decreases in primary deficit expand demand gap
- Then, what if when interest rate rise?
 - It depends on why interest rate rise
 - Because investors run away? : unlikely in Japan
 - BoJ raises interest rate because of increased private demand: budget deficit can be reduced
 - Interest rates increases overseas: weaker yen: exports increase

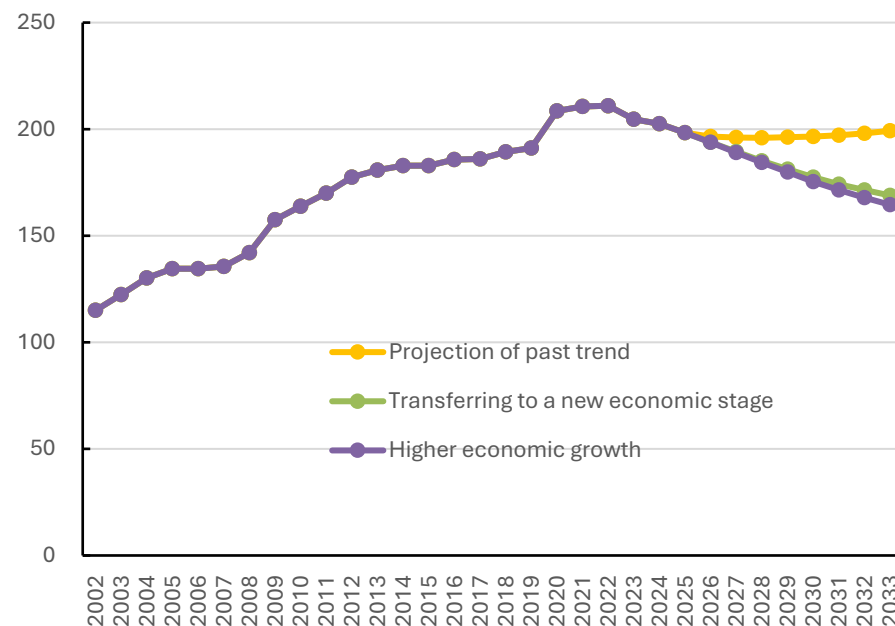
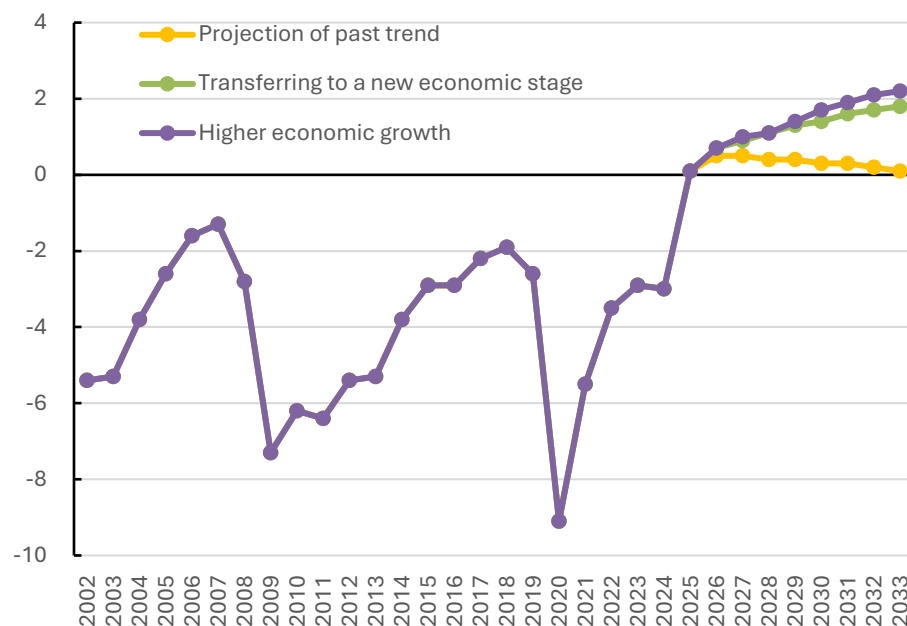
Not against public debt: remarks

- Not saying that public deficit can increase without limit
 - Risks if public debts accumulate too much
 1. Interest rates are likely to rise due to uncertain repayment
 - When interest rate is higher than growth rate, fiscal surplus is necessary
 2. More fiscal surplus is necessary to stabilize the public debt
 3. Higher risk of sudden rise in interest rate
 - Should be due to liquidity concerns

Projections of primary balance

□ Cabinet office

- Economic and Fiscal Projections for Medium to Long Term Analysis
- <https://www5.cao.go.jp/keizai3/projection-e.html>
- the PB-to-GDP ratio is projected to be around 0.5% in FY2026, followed by a gradual deterioration (simple projection).

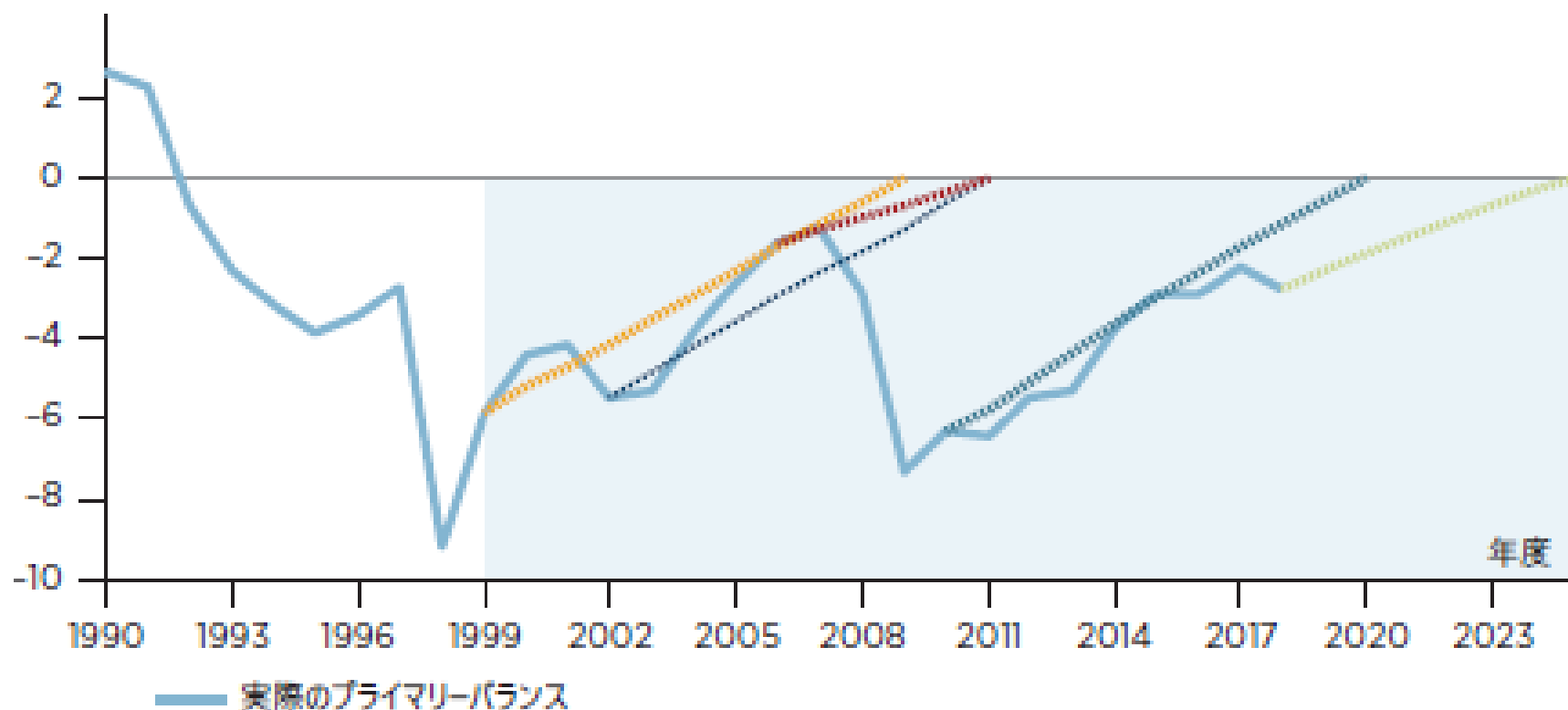


Primary fiscal deficits

- More than 2% of GDP

図1 日本のプライマリーバランス、実際と目標

GDP 比 (%)



Counterarguments

□ Takeo Hoshi (October 8, 2019, Nikkei)

- Primary deficit of 2% of GDP can stabilize the debt-to-GDP ratio
- Already over 2% and in danger of increasing in the future
- Interest rates are low “The hypothesis is that the market believes the Japanese government will implement sufficient fiscal reforms in the near future and thus market interest rates are low. If so, this is a rather dangerous equilibrium.”

□ Kenichi Ueda (October 9, 2019, Nikkei)

- In terms of debt in the broad sense, Japan has been in a debt crisis for more than a decade.
 - Reduction of public pensions, reduction of public employee salaries, etc.
- Decreases in public debt is necessary
 - In the event of a major natural disaster or national security crisis, the government must step in, which will require large expenditures. To prepare for such an event, it is necessary to have enough fiscal space to issue new government bonds. For this reason, the debt-to-GDP ratio should be aggressively lowered in times of peace.