

# The Consumption-Savings Decision and Credit Markets: Part II

Yi Xin  
(Singapore Management University)

Macroeconomics 1 (Econ 112)  
Term Two, 2023–2024, Week 5

## Overview

- ▶ Previously we have studied how consumers behave and make decisions across multiple time periods.
- ▶ To complete our description of the model we now describe what the government does and explore the equilibrium effects of tax policy
- ▶ In this environment, the government does not have to balance its budget and can issue debt to finance a budget deficit.
- ▶ An important implication is that the **Ricardian equivalence theorem** holds.
- ▶ The size of the government's deficit is irrelevant, in that it does not affect any macroeconomic variables of importance or the economic welfare of any individual. *\*under certain assumptions*

## Plan for this Class

1. **Closing the Model**
2. Ricardian Equivalence Theorem

---

3. Public Finance in the Real World



## Model Setup

- ▶ We continue from the consumption-savings model.
- ▶ We suppose that the government wishes to purchase  $G$  consumption goods in the current period and  $G'$  units in the future period, with these quantities of government purchases given exogenously.
- ▶ The aggregate quantity of taxes collected by the government in the current period is  $T$ . Recall that there are  $N$  consumers who each pay a current tax of  $t$ , so that  $T = Nt$ .
- ▶ The government can **borrow** in the current period by **issuing bonds**.
- ▶ The government bonds and private bonds are indistinguishable, with all bonds bearing the same real interest rate  $r$ .

## Government's Budget Constraint

(borrowing)

- ▶ Letting  $B$  denote the quantity of government bonds issued in the current period, the government's **current-period budget constraint** is

*Total Govt expenditure*  $\rightarrow G = T + B$

- ▶ Government spending is financed through taxes and the issue of bonds. Alternatively, we can say that the **budget deficit**  $G - T = B$  in the current period is financed by issuing bonds.
- ▶ The government's **future-period** budget constraint is

$$G' + (1 + r)B = T'$$

- ▶ In the future period, the government has to pay for the principal and interest on the government bonds issued in the current period.

## Government's Budget Constraint (Cont'd)

- ▶ Similar to the consumer's budget constraint, we can take the budget constraints for the current and future periods and collapsed them into a single government present-value budget constraint. (**B is common**)
- ▶ From the future-period budget constraint, we have

$$G' + (1+r)B = T' \Rightarrow B = \frac{T' - G'}{1+r}$$

- ▶ Substituting this into the current-period budget constraint gives the government present-value budget constraint

$$G + \frac{G'}{1+r} = T + \frac{T'}{1+r}$$

- ▶ The present value of government purchases must equal the present value of taxes. The government must eventually pay off all of its debts by taxing its citizens.

## Competitive Equilibrium

Supplying a market clearing condition

- ▶ Now that we have described the behavior of the consumers and the government in our model, we can now **close the model** and define the competitive equilibrium.
- ▶ In a competitive equilibrium for this two-period economy, three conditions must hold.
  1. Each consumer chooses first- and second-period consumption and savings optimally given the real interest rate  $r$ .
  2. The government present-value budget constraint holds.
  3. The credit market clears.

## Credit Market Clearing (*endowment economy*)

- The credit market clears when the **net quantity** that consumers want to lend in the current period is equal to the quantity that the government wishes to borrow

(1)

$$S^P = B,$$

that is the aggregate quantity of private savings is equal to the quantity of debt issued by the government in the current period.

- Furthermore, we know that

$$S^P = Y - C - T$$

↓ current period endowment
→ Tax  
→ consumption

- Given the government's current-period budget constraint  $B = G - T$ , we have that

$$G - T = Y - C - T \Rightarrow Y = C + G.$$

(B)      (S<sup>P</sup>)

endowment = consumption + G when  
 market clears

- This is an alternative way of describing the **credit market clearing condition**.

- (1) Govt.  $\downarrow T$  in present
- (2) Private saving in present increase to fund bond purchases
- (3) Govt. must pay  $\Delta T(H_t)$  in future
- (4) Govt.  $\uparrow T$  in future to pay  $\Delta T(H_t)$
- (5) Private saving falls due to  $\uparrow T$

Ricardian Equivalence Theorem

## Plan for this Class

1. Closing the Model
2. **Ricardian Equivalence Theorem**
3. Public Finance in the Real World

## Ricardian Equivalence Theorem

- ▶ From week 2, recall that an increase in government spending comes at a cost, in that it crowds out private consumption expenditures.
- ▶ But we assumed that the government budget must balance and the government was unable to borrow in the model. Not true in the current setup.
- ▶ Given our current model, we can show a key result in macroeconomics, called the Ricardian equivalence theorem. This theorem states that a change in the timing of taxes by the government is neutral.
- ▶ By neutral, we mean that in equilibrium a change in current taxes, exactly offset in present-value terms by an equal and opposite change in future taxes, has no effect on the real interest rate or on the consumption of individual consumers.
- ▶ Key message: a tax cut is not a free lunch.

→ since no impact on  $r$  &  $C$

## Ricardian Equivalence Theorem

- ▶ Each of the  $N$  consumers shares an equal amount of the total tax burden in the current and future periods, with  $T = Nt$  and  $T' = Nt'$ .
- ▶ Substituting this into the government's present-value budget constraint gives

$$G + \frac{G'}{1+r} = Nt + \frac{Nt'}{1+r} \Rightarrow t + \frac{t'}{1+r} = \frac{1}{N} \left[ G + \frac{G'}{1+r} \right].$$

*1 consumer*

*spending on one person*

- ▶ The present value of taxes for a **single consumer** is the consumer's share of the present value of government spending.
- ▶ Further substitute this expression into a consumer's lifetime budget constraint gives

$$y = c + \frac{1}{N}(r)$$

$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \frac{1}{N} \left[ G + \frac{G'}{1+r} \right]$$

\*consumer funds lifetime Govt Expenditure from their lifetime endowment,  $y$

## Ricardian Equivalence Theorem

- ▶ Now consider an experiment in which current taxes change by  $\Delta t$  for each consumer, with future taxes changing by  $-\frac{\Delta t}{1+r}$ , so that the government budget constraint continues to hold.
- ▶ From the previous equation

$$c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \frac{1}{N} \left[ G + \frac{G'}{1+r} \right]$$

*G do not change*

we know that all the RHS variables are not changing, given the real interest rate  $r$ .

- ▶ Hence, the consumer's lifetime wealth does not change. Therefore, the consumer's decisions would stay the same given  $r$ .
- ▶ This is true for every consumer, so that aggregate consumption would also stay the same.

\* *-on less T today*

*test*

## Ricardian Equivalence Theorem

- In addition, since both  $C$  and  $G$  are not changing. It is still the case that

$$Y = C + G.$$

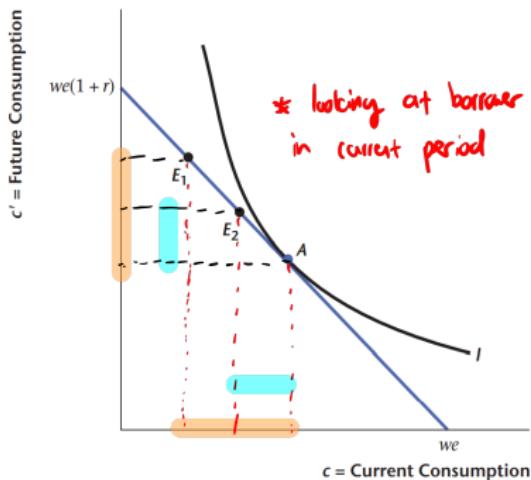
- So the credit market still clears given the original  $r$ , i.e., there is not imbalances in the credit market and hence there is no need for real interest rate  $r$  to change. *\* r does not change.*
- Therefore, we have shown that **a change in the timing of taxes** has no effect on equilibrium consumption or the real interest rate.
- Because each consumer faces the same budget constraint before and after the change in the timing of taxes, all consumers are no better or worse off with the change in taxes.
- We have, thus, demonstrated that the Ricardian equivalence theorem holds in this model. *\* this assures G does not change.*

## Comments

- ▶ Though the timing of taxes has no effect on consumption, welfare, or the market real interest rate, there are effects on private saving.
- ▶ Because aggregate private saving is  $S^P = Y - T - C$ , any change in the timing of taxes that decreases current taxes  $T$  increases current private saving and decreases government saving by equal amounts.  
 $G - T$
- ▶ The government must issue more debt today to finance the tax cut, and it will have to increase taxes in the future to pay off this higher debt.
- ▶ Consumers anticipate this, and they increase their savings by the amount of the tax cut to pay the higher taxes they will face in the future.  
 $- S^P = b = G - T$   
 $\Delta S^P = - \Delta T$
- ▶ In the credit market, there is an increase in savings by consumers which just matches the increase in borrowing by the government. Therefore, no effect on the market real interest rate.

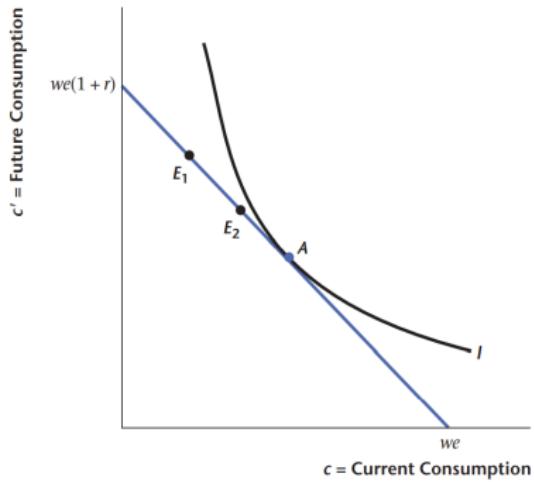
## Graphical Illustration: The Consumer

$E_1 \rightarrow E_2$ : after  $T \downarrow$



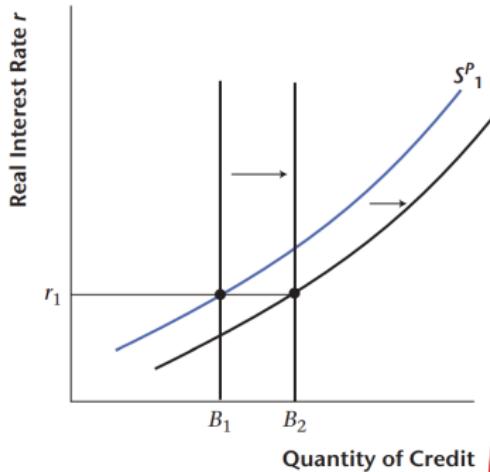
- ▶ Suppose that a consumer initially has an endowment point  $E_1$ , and chooses consumption bundle  $A$ .
- ▶ Now, suppose there is a tax cut in the current period, so that  $\Delta t < 0$ .
- ▶ Therefore, the government must borrow  $N\Delta t$  more in period 1 to finance the larger current government deficit.
- ▶ Taxes **must rise for each consumer** by  $-\Delta t(1 + r)$  in the future period to pay off the increased government debt.

## Graphical Illustration: The Consumer



- ▶ The lifetime wealth of the consumer remains unchanged, as the present value of taxes are not changed.
- ▶ The budget constraint is unaffected, and the consumer still chooses point  $A$ .
- ▶ What changes is the endowment. It moves from  $E_1$  to  $E_2$ .
- ▶ That is, the consumer has more disposable income in the current period and less disposable income in the future period due to the tax cut in the current period.
- ▶ Private savings increase.

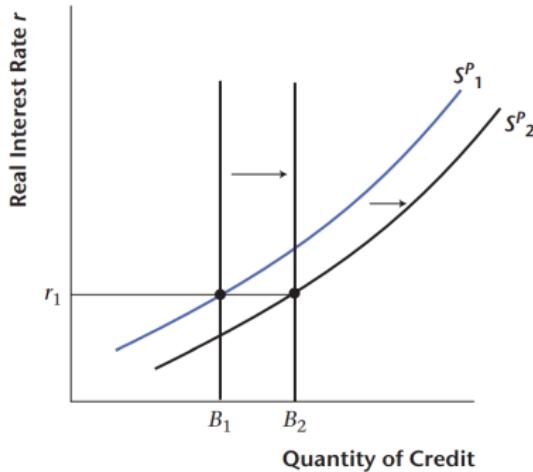
## Graphical Illustration: Credit Market Equilibrium



- ▶ Suppose the curve  $S_1^P(r)$  denotes the private supply of credit, which is the total desired saving of private consumers given the market real interest rate  $r$ .
- ▶ Further assume that  $S_1^P(r)$  is upward-sloping (substitution effects outweigh the income effects).
- ▶ The government demand for credit is  $B_1$ , the exogenous supply of bonds issued by the government in the current period.
- ▶ The equilibrium real interest rate that clears the credit market is  $r_1$ .

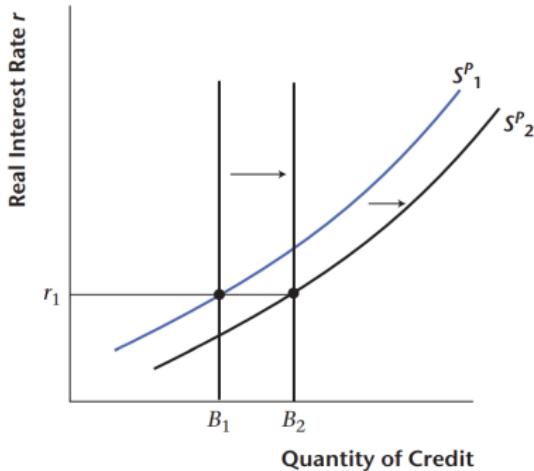
+ demand for credit is regardless of interest rate  $r$ , hence

## Graphical Illustration: Credit Market Equilibrium



- ▶ Now, if the government reduces current taxes by the same amount for each individual, this results in an increase in government bonds issued from  $B_1$  to  $B_2$ .
- ▶ The government has to borrow more in order to finance the budget deficit due to the tax cut.
- ▶ However, there will be a simultaneous increase in the supply of credit (recall slide 15).
- ▶ The amount of increase in private saving will be equal to  $B_2 - B_1$  for each  $r$ , so that the real interest rate remains unchanged at  $r_1$ .

## Graphical Illustration: Credit Market Equilibrium



- ▶ In the previous week, we determined that, because of the consumer's consumption-smoothing motive, some of the increase in disposable current income would be saved.
- ▶ The Ricardian equivalence theorem carries this logic one step further.
- ▶ Because any current tax cut must be paid for with government borrowing, this implies higher future taxes to pay off the government debt.
- ▶ In making their lifetime wealth calculations, consumers recognize that the current tax cut is exactly offset by higher taxes in the future, and they save all of the current tax cut to pay the higher future taxes. **Not a free lunch.**

## Comments: Ricardian Equivalence and the Burden of the Government Debt

- ▶ The Ricardian equivalence theorem tells us that government debt represents our future tax liabilities as a nation.
- ▶ The government debt is a burden in that it is something we owe to ourselves; the government must pay off its debt by taxing us in the future.
- ▶ In practice, however, many issues in fiscal policy revolve around how the burden of the government debt is shared.
  1. What if some consumers receive a larger tax cut?
  2. What if there are multiple generations? (population growth)
  3. What if taxes are progressive?
  4. What if credit market is imperfect and there is credit constraint?

## Default on Government Debt

- ▶ Government debt can reach levels that are unsustainable. A government will default, if it cannot meet the interest payments on its debt.
- ▶ Most of our experience with sovereign default relates to countries that have a large amount of **external** debt.
- ▶ Typically occur after severe recessions, and they are usually preceded by large run-ups in the interest rates on the government's debt.
- ▶ Financial market participants foresee the difficulty of paying the debt after the recession, and those financial market participants will only hold the government's debt if it bears a default premium, i.e., a higher interest rate.



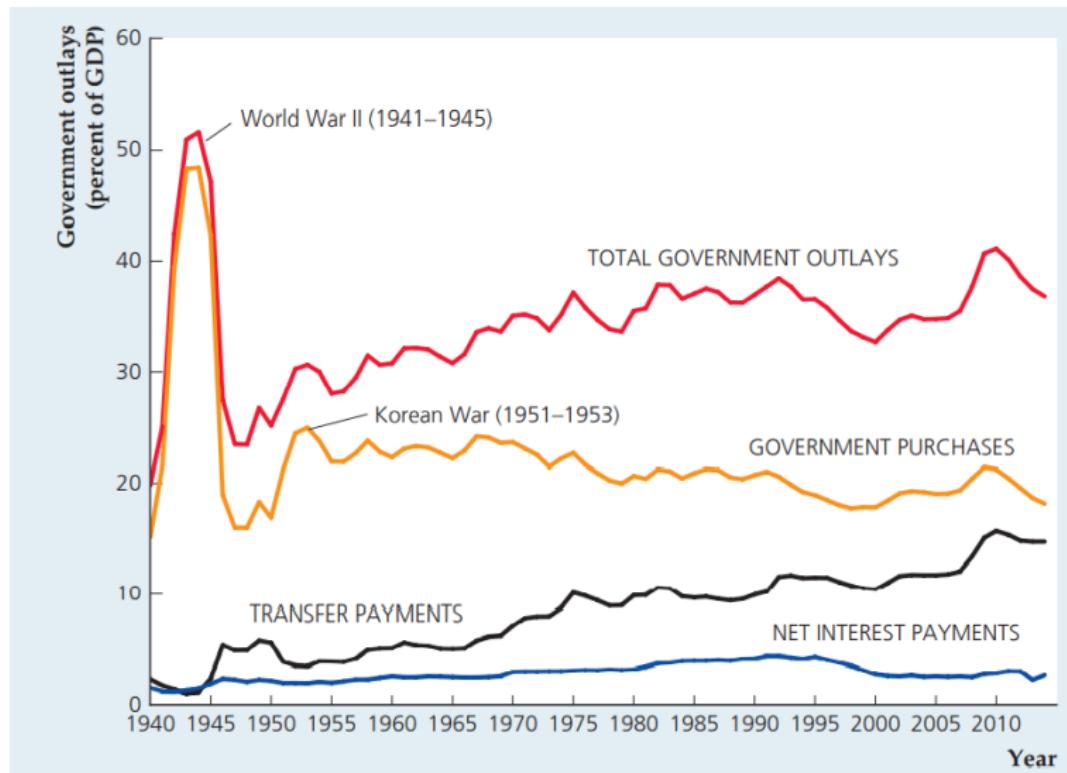
## Plan for this Class

1. Closing the Model
2. Ricardian Equivalence Theorem
3. **Public Finance in the Real World**

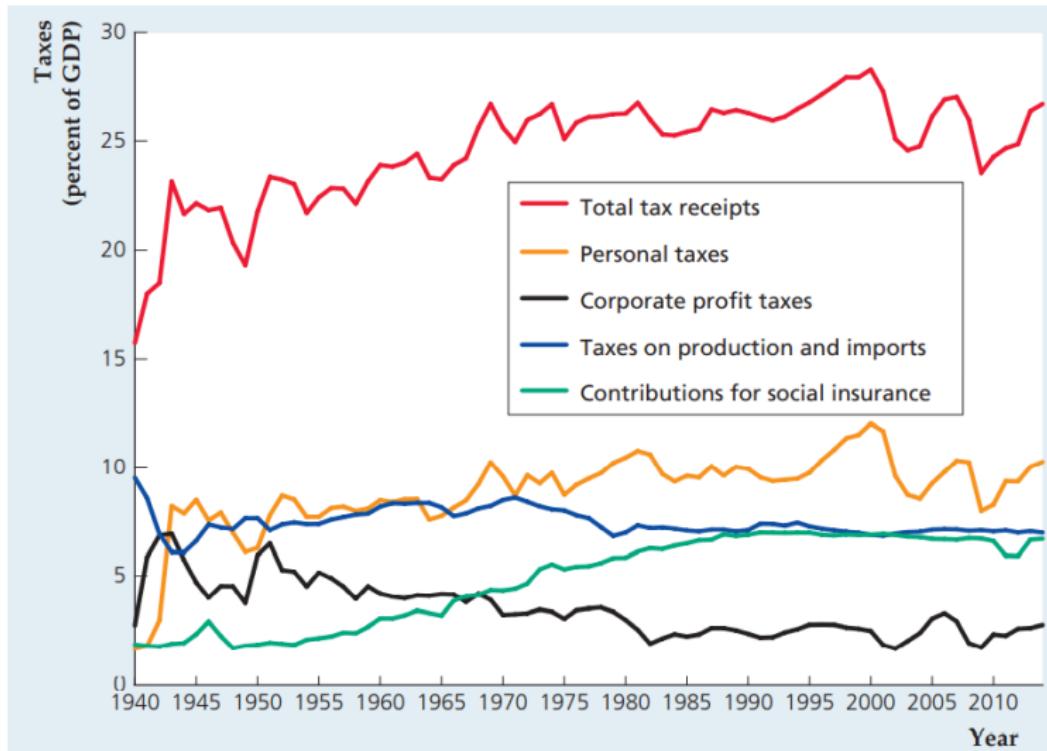
## A Decomposition of Government Spending

- ▶ The total spending by the government during a period of time, are classified into three primary categories: government purchases, transfer payments, and net interest payments
- ▶ *Government purchases* are government expenditure on goods and services, including capital goods.
- ▶ *Transfer payments* are payments made to individuals for which the government does not receive current goods or services in return. (Social Security, military and civil service pensions, unemployment insurance, medicare).
- ▶ *Net interest payments* are the interest paid to the holders of government bonds less the interest received by the government – for example, on outstanding government loans to students.

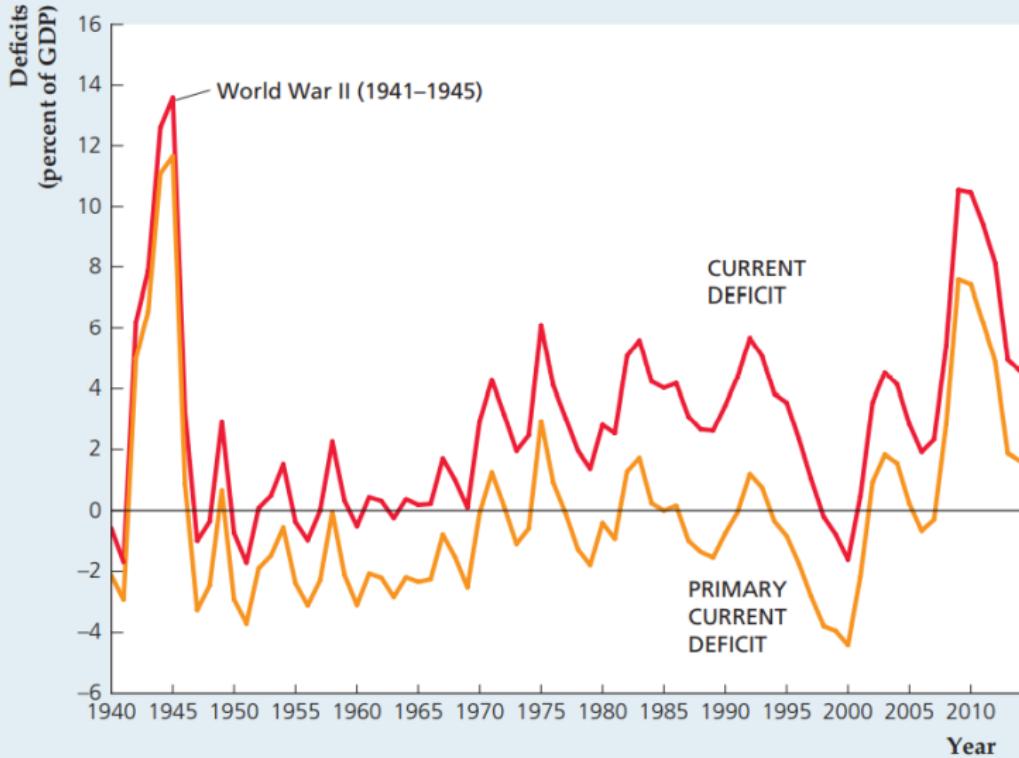
## US Government Spending



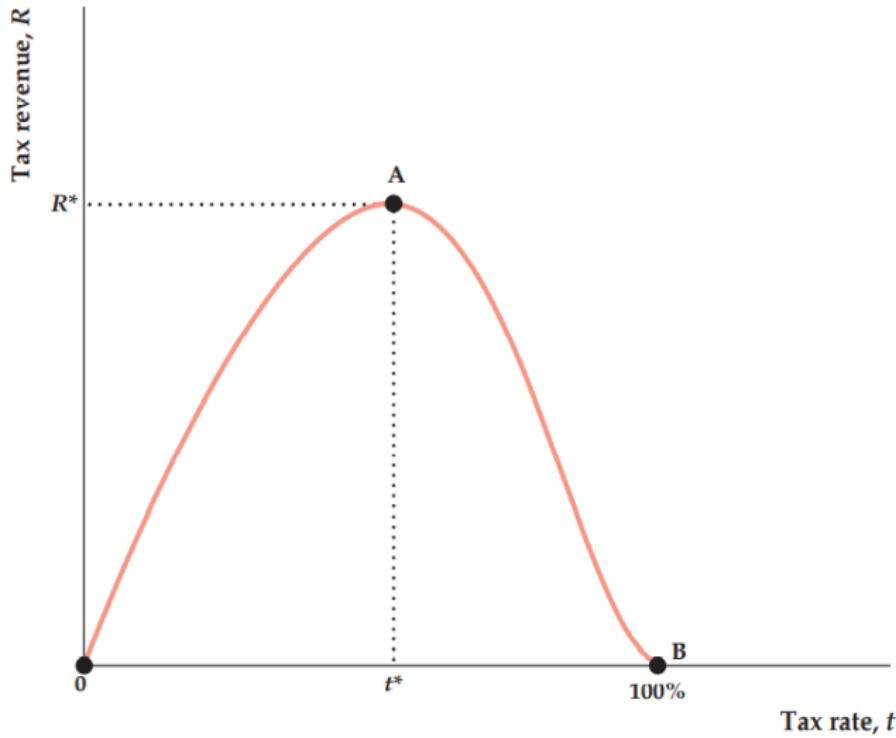
## US Taxes



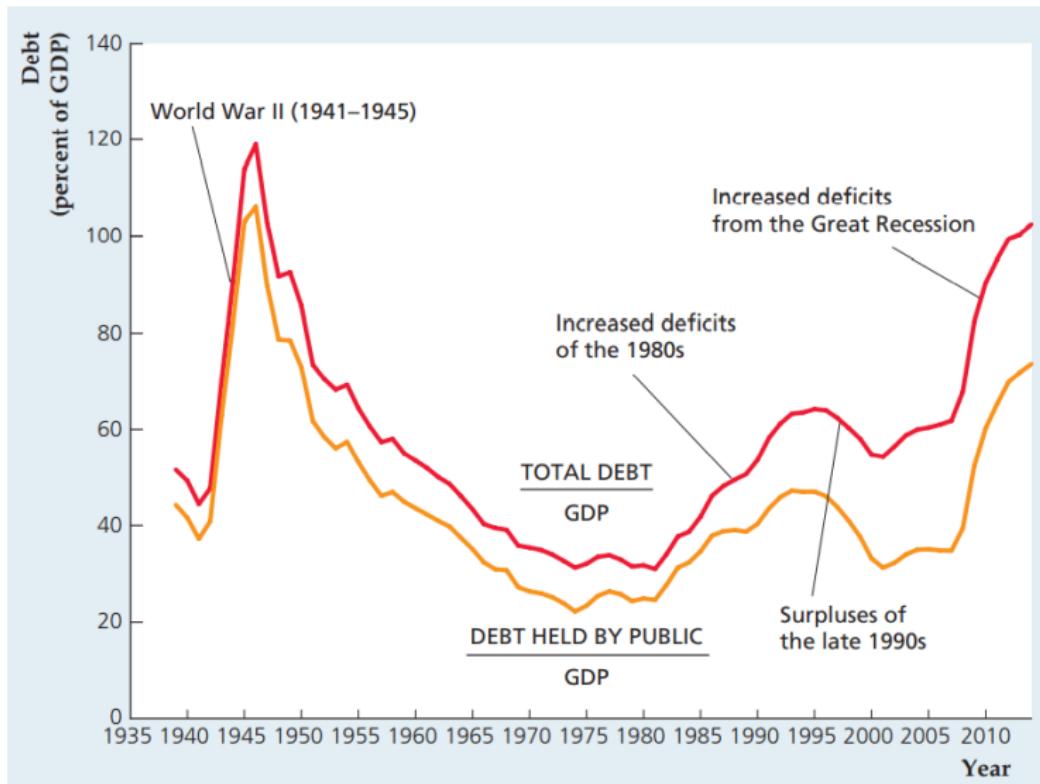
## US Budget Deficit



## Laffer Curve



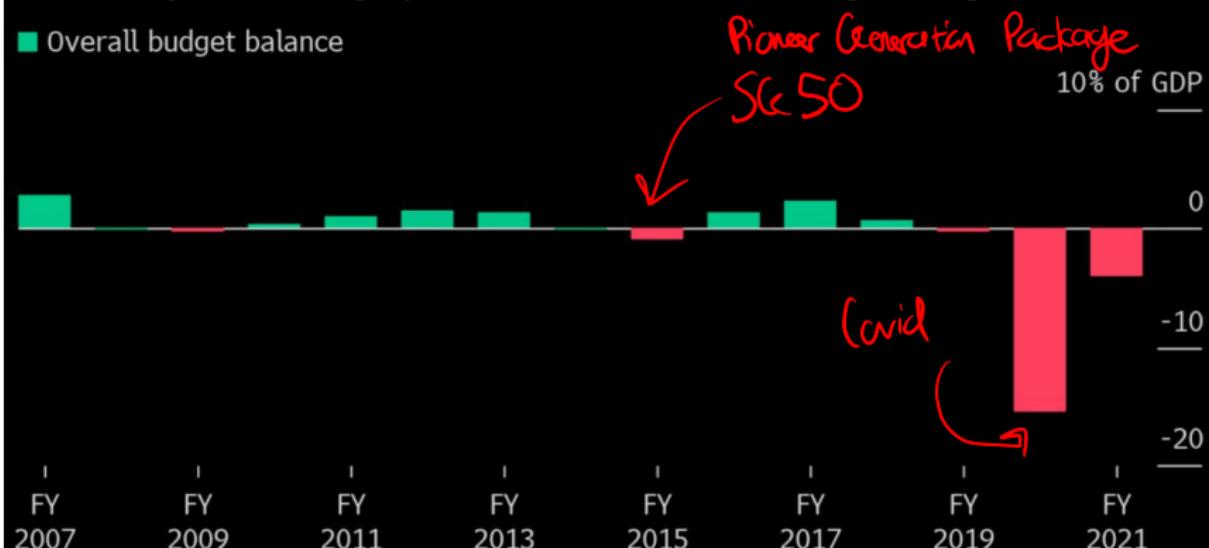
## Federal Debt



## Budget Balance in Singapore

### Singapore Spending

Financial year starting April 1 could mark third straight budget deficit



Source: Data.gov.sg, Bloomberg

Note: FYs 2020, 2021 are medians in Bloomberg survey (Feb. 5-11, 2021)

Bloomberg

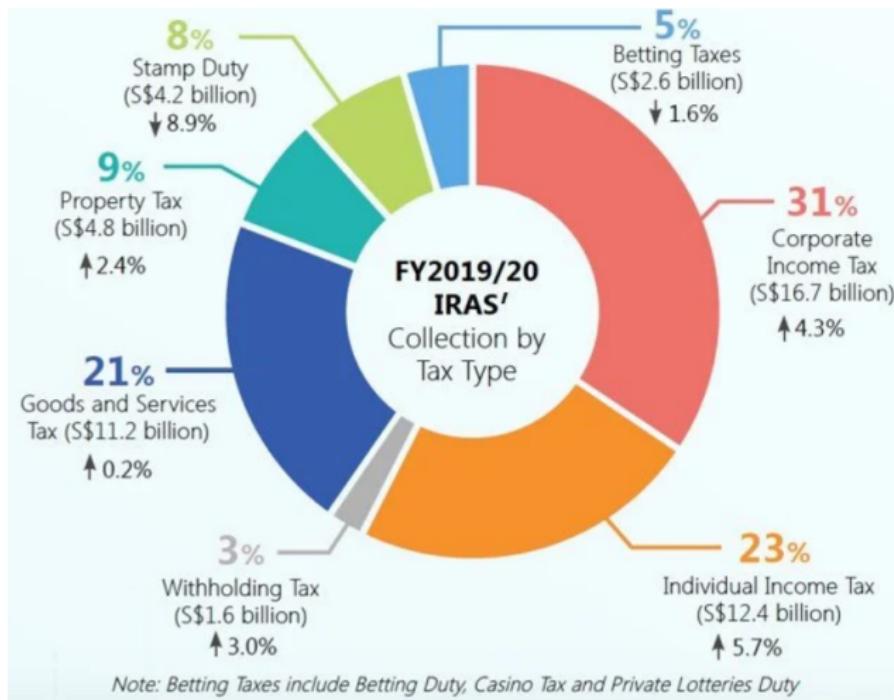
## Government Spending in Singapore (Source: Ministry of Finance)

### Breakdown of Total Expenditure by Sector for FY2010 and FY2019\*\*



|  | Actual<br>FY2020 | Estimated<br>FY2021 | Revised<br>FY2021       |
|--|------------------|---------------------|-------------------------|
|  | \$billion        | \$billion           | \$billion               |
| <b>OPERATING REVENUE</b>   | <b>67.38</b>     | <b>76.64</b>        | <b>80.37</b>            |
| Corporate Income Tax   | 16.11            | 17.97               | 17.51                   |
| Personal Income Tax  | 12.75            | 12.37               | 13.83                   |
| Withholding Tax  | 1.62             | 1.65                | 1.73                    |
| Statutory Boards' Contributions <sup>1</sup>                     | 2.52             | 2.51                | 2.86                    |
| Assets Taxes   | 3.13             | 4.74                | 4.60                    |
| Customs, Excise, and Carbon Taxes                                | 3.58             | 3.77                | 3.63                    |
| Goods and Services Tax   | 10.35            | 11.34               | 12.01                   |
| Motor Vehicle Taxes  | 2.13             | 2.52                | 2.39                    |
| Vehicle Quota Premiums   | 2.30             | 2.28                | 3.22                    |
| Betting Taxes  | 1.72             | 2.41                | 2.32                    |
| Stamp Duty   | 3.90             | 4.25                | 6.45                    |
| Other Taxes <sup>2</sup>   | 3.61             | 6.43                | 5.46                    |
| Fees and Charges (Excluding Vehicle Quota Premiums)              | 3.18             | 3.91                | 3.44                    |
| Others   | 0.49             | 0.49                | 0.90                    |
| Less:  |                  |                     |                         |
| <b>TOTAL EXPENDITURE</b>   | <b>86.37</b>     | <b>102.34</b>       | <b>98.41</b>            |
| Operating Expenditure  | 72.94            | 82.46               | 81.54                   |
| Development Expenditure  | 13.43            | 19.87               | 16.87                   |
| <b>PRIMARY SURPLUS / DEFICIT<sup>3</sup></b>                     | <b>(18.99)</b>   | <b>(25.70)</b>      | <b>(18.04)</b>          |
| Less:  |                  |                     |                         |
| <b>SPECIAL TRANSFERS<sup>4</sup></b>                             | <b>50.82</b>     | <b>4.86</b>         | <b>7.90</b>             |
| Special Transfers Excluding Top-ups to Endowment and Trust Funds | 33.50            | 4.86                | 7.90                    |
| Jobs Support Scheme  | 24.68            | 2.89                | 4.66                    |
| Other Transfers <sup>5</sup>                                     | 8.82             | 1.97                | 3.23                    |
| <b>BASIC SURPLUS / DEFICIT<sup>6</sup></b>                       | <b>(52.49)</b>   | <b>(30.57)</b>      | <b>(25.94)</b>          |
| Top-ups to Endowment and Trust Funds                             | 17.32            | -                   | -                       |
| GST Voucher Fund   | 6.00             | -                   | -                       |
| Coastal and Flood Protection Fund                                | 5.00             | -                   | -                       |
| National Research Fund   | 2.00             | -                   | -                       |
| Skills Development Fund  | 2.00             | -                   | -                       |
| Other Funds <sup>7</sup>   | 2.32             | -                   | -                       |
| Add:   |                  |                     |                         |
| <b>NET INVESTMENT RETURNS CONTRIBUTION</b>                       | <b>18.24</b>     | <b>19.56</b>        | <b>20.33</b>            |
| Less:  |                  |                     |                         |
| <b>INTEREST COSTS AND LOAN EXPENSES<sup>8</sup></b>              | <b>-</b>         | <b>-</b>            | <b>0.00<sup>9</sup></b> |
| <b>OVERALL BUDGET SURPLUS / DEFICIT</b>                          | <b>(51.57)</b>   | <b>(11.01)</b>      | <b>(5.61)</b>           |

## Tax Revenue (Source: Inland Revenue Authority)



## Student Discussions (Page Intentionally Left Blank)

## Summary

By the end of this class, you should be able to understand the following:

- ▶ The setup of the two-period intertemporal consumption model with government borrowing.
- ▶ Derivation of the government's present-value budget constraint.
- ▶ Ricardian equivalence theorem and its graphical representation.
- ▶ The limitation of Ricardian equivalence theorem.

## Disclaimer

The slides for this course have been made available to students for the sole purpose of self study. They should not be disseminated without prior permission, nor should they be re-used for commercial purposes. The material draws on, among others:

- ▶ S. D. Williamson, Macroeconomics, Pearson Education, 5th edition.
- ▶ Andrew B. Abel, Ben S. Bernanke, and Dean Croushore, Macroeconomics, 9th edition, Pearson.