

Chapter 8

A Two-Period Model: The Consumption-Saving Decision and Ricardian Equivalence

Introduction

- **Inter-temporal decisions** (across periods) and their implications on the influence of government deficits.
- An important implication of the models is the Ricardian Equivalence theorem.
- **The Ricardian Equivalence Theorem:** Under certain conditions, the size of the government's deficit is irrelevant. The timing of taxation does not matter for economic activity.

- HH decision is DYNAMIC.

Decisions

Note

**Intra-temporal
STATIC** (chap 4-5)

c: consumption

N: labor supply

s: equals zero

**Inter-temporal
DYNAMIC** (chap 8)

c: consumption today

c': consumption tomorrow

s: saving today

Model

- **Two-period model:**
 - **First period: current period.**
 - **Second period: future period.**
- **Real Interest Rate (r) to borrow/lend, i.e., to transfer goods across periods.**
- **r : determines the relative price of future consumption in terms of present consumption = $1 / 1 + r$**
- **Consumption-smoothing behavior: important to understand how consumers respond to changes in government policies.**
- **For simplicity, leave out production and investment until chap 9 → income is exogenous, forget the intra-temporal decision.**

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Notation

- Use primes to denote next (future) period variables. e.g., c' : future consumption
- Lowercase variables to denote individual level. e.g., c : individual consumption
- Uppercase variables to denote aggregate level. e.g., C : aggregate consumption

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Assumptions

- Consumer starts current period with no assets and ends future period with no assets (no bequests).
- Consumer and government can issue bonds.
- All bonds are indistinguishable → one interest rate for all bonds.
- No risk associated with holding bonds (no default risk, no risk) → no expectation.
- Bonds are traded directly on the credit market (no need for financial intermediaries, no banks) → r on borrowing is the same as r on lending.
- Income is exogenous → forget intra-temporal decision.

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Consumer Budget

■ Current period budget:

$$c + s = y - t$$

$(y - t)$ is disposable income (after-tax income)

$s > 0 \rightarrow$ lender (buys bonds)

$s < 0 \rightarrow$ borrower (sells bonds)

■ Future period budget:

$$c' = y' - t' + (1+r)s$$

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Consumer Problem

Max Utility

subject to

■ current period budget and

■ Future period budget.

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Derivation of the Lifetime Budget

$$c + s = y - t \quad \text{Current Budget}$$

$$c' = y' - t' + (1+r)s \quad \text{Future Budget}$$

From future budget solve for s

$$s = (c' - y' + t') / (1+r)$$

Plug into current budget

$$c + (c' - y' + t') / (1+r) = y - t$$

Rearrange to get the **LIFETIME BUDGET**

$$c + c' / (1+r) = y + y' / (1+r) - t - t' / (1+r)$$

$$PV(c) = PV(y) - PV(t) = \text{Lifetime wealth}$$

Let **LIFETIME WEALTH (we)** be the RHS of the Lifetime Budget.

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Consumer Optimization

Given: r, y, y', t and t'

Choose: c, c' and consequently s

Figure 8-1 Consumer's Lifetime Budget Constraint

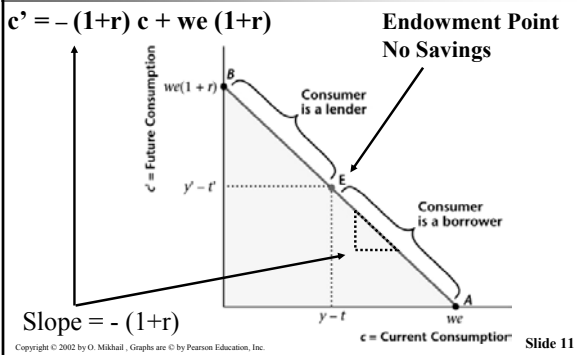


Figure 8-2 A Consumer's Indifference Curves

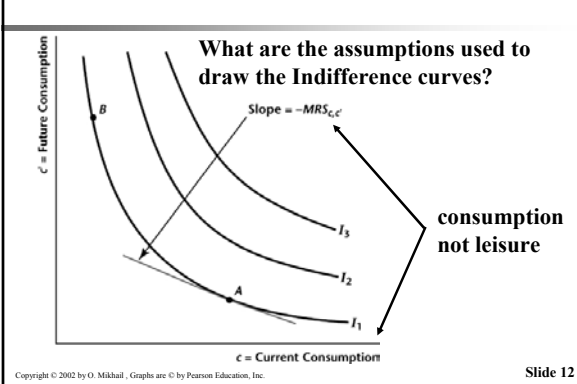


Table 8-1 Desire for Consumption Smoothing

Sara's Desire for Consumption Smoothing			
	Week 1 Coconuts	Week 2 Coconuts	Total Consumption
Bundle 1	5	15	20
Bundle 2	17	3	20
Preferred Bundle	11	9	20

Which assumption made regarding the Utility implies consumption smoothing?

Note that consumption smoothing does not imply equal quantities over each period

Figure 8-3 A Consumer Who Is a Lender

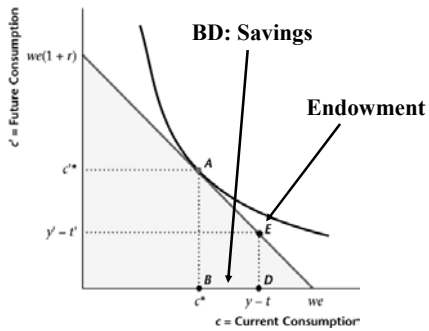
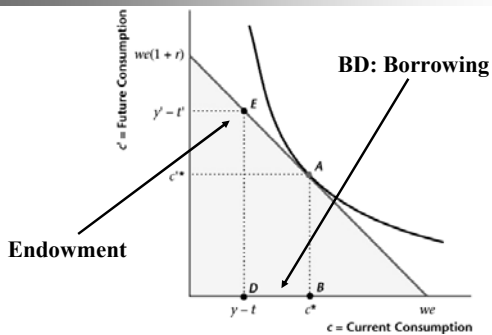


Figure 8-4 A Consumer Who Is a Borrower



THE GAME

Changes in:

- Current income
- Future income
- Real interest rate

GAME I an Increase in CURRENT Income

GAME I : An increase in CURRENT income

■ **Intra-Temporal:** an increase in income (same as an increase in dividend income or a reduction in taxes) → pure income effect → $c \uparrow$ and $\text{labor} \downarrow$

■ **Inter-Temporal:** What will be the effect on c , c' and s ?

Excess Variability of Consumption

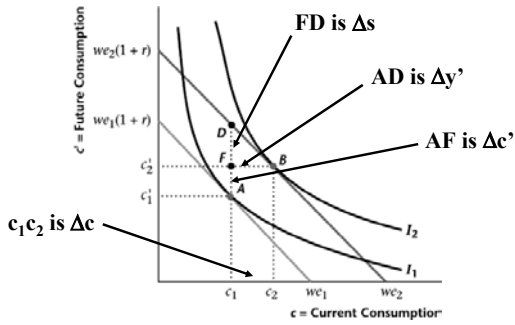
- The observed fact that measured consumption is more volatile than theory appears to predict.
- Proposed reasons:
 - Capital market imperfections
 - Change in market prices

GAME II an Increase in FUTURE Income

GAME II : An increase in FUTURE income

- **Intra-Temporal** : when it happens, treat it as an increase in current income.
- **Inter-Temporal** : increase present consumption to smooth the consumption pattern, by borrowing.

Figure 8-7 An Increase in Future Income



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GAME III

Temporary vs. Permanent and the Permanent Income hypothesis

Permanent vs. Temporary increase in income

Temporary increase in income

- Ex: Bonus.
- Expect to increase current c by small amount.

Permanent increase in income

- Ex: Promotion, salary raise.
- Expect to increase current c by a larger amount.

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Friedman's Permanent Income Hypothesis

A primary determinant for current consumption is permanent income, which is closely related to lifetime wealth.

- Therefore, changes in temporary income have little influence on current consumption. Changes to permanent income have much larger effect on current consumption.
- Do you remember the Keynesian consumption function?

Why Important?

Tax Cut

- If consumers perceive the tax cut to be **temporary** then
- If consumers perceive the tax cut to be **permanent** then

Model incorporates Temporary vs. Permanent

How?

- **Temporary:** increase in current income.
- **Permanent:** increase in current and future income.

GAME IV

A change in the Real Interest Rate

NOTATION

■ **Real interest rate** **r**

■ **Nominal interest rate** **R**

Change in the **REAL INTEREST RATE**

- → will change the relative price ($1/1+r$) of leisure and consumption.
- $r \uparrow \rightarrow$ future consumption is cheaper relative to current consumption.
- $r \uparrow \rightarrow$ income and substitution effects
- $r \uparrow \rightarrow$ budget steeper [slope = $-(1+r)$]

Example

Let $y = \$20$ and $y' = \$0$, no taxes.

- $r = 50\%$

save \$10, $c = \$10 \rightarrow c' = \15

- $r = 100\%$

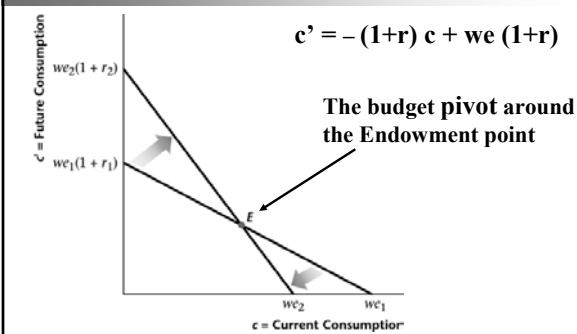
save \$10, $c = \$10 \rightarrow c' = \20

- The Point: $r \uparrow \rightarrow$ future consumption is cheaper relative to current consumption.

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Figure 8-11 An Increase in the Real Interest Rate



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Effect on the economy

Depends on the financial situation of the consumer:
lender or borrower.

Remember

Substitution Effect: Move towards the cheaper good.

Income Effect: Feeling wealthy \rightarrow increase both goods.

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Figure 8-12 An Increase in the Real Interest Rate for a Lender

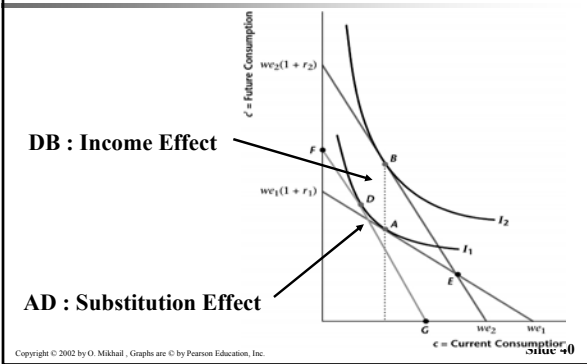
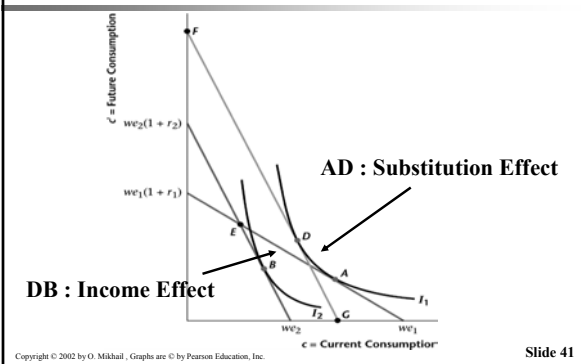


Figure 8-13 An Increase in the Real Interest Rate for a Borrower



Intertemporal Substitution Effect

- For both (lender/borrower), a higher real interest rate lowers the relative price of future consumption in terms of current consumption → substitution of future consumption for current consumption → increase in savings

Table 8-2 and Table 8-3

Effects of an Increase in the Real Interest Rate for a Lender

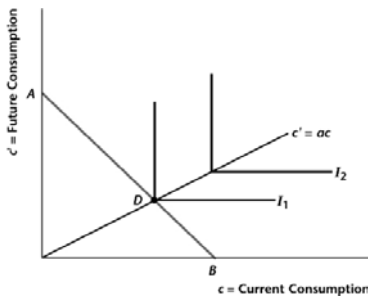
Current Consumption	?
Future Consumption	increases
Current Savings	?

Effects of an Increase in the Real Interest Rate for a Borrower

Current Consumption	decreases
Future Consumption	?
Current Savings	increases

Figure 8-14 Example with Perfect Complements Preferences

Extreme consumption smoothing, the consumer desire c and c' in fixed proportions.

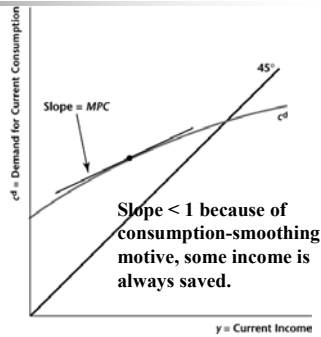


The Point

Figure 8-15 A Consumer's Demand for Current Consumption Goods, c^d , as a Function of Current Income

GAME I

Consumption increases with income



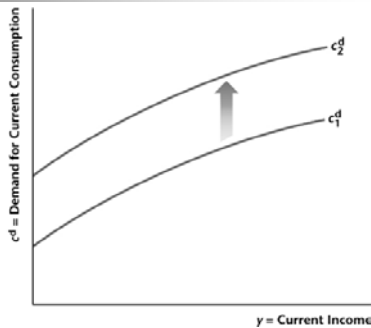
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Figure 8-16 A Shift in a Consumer's Demand for Current Consumption

Shifters are GAME II and GAME IV

y' (+) and r (-)



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Government

Current Budget: $G = T + B$

Future Budget: $G' + (1+r) B = T'$

Collapse into a single PV budget

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

$$PV(G) = PV(T)$$

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Competitive Equilibrium

Describe the competitive Equilibrium for this ECN.

Ricardian Equivalence Theorem

- A change in the timing of taxes by the government is neutral, i.e., has no real effects.
- This implies that government deficits do not matter.
- By saving/borrowing, the consumer offsets the government action.

The Ricardian Equivalence Theorem

If current (G) and future government spending (G') are held constant, then a change in current taxes (t) with an equal and opposite change in the present value of future taxes ($PV(t')$) leaves the equilibrium real interest rate (r) and the consumptions of individuals unchanged.

Four Assumptions

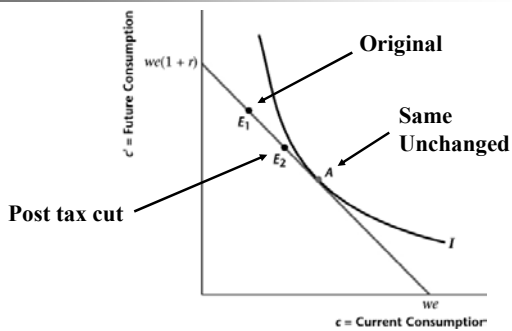
- Taxes change by the same amount for all consumers, in the present and the future.
- Any debt issued by the government is paid during the lifetimes of the people alive when the debt was issued.
- Taxes are lump sum.
- Perfect credit markets.

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Ricardian Equivalence Numerical Example p. 269

Figure 8-17 Ricardian Equivalence with a Cut in Current Taxes for a Borrower



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Credit Market Imperfections

Role of credit market imperfections and the Ricardian Equivalence

Figure 8-18 A Consumer Facing Different Lending and Borrowing Rates

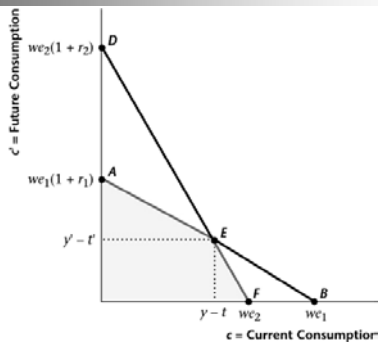
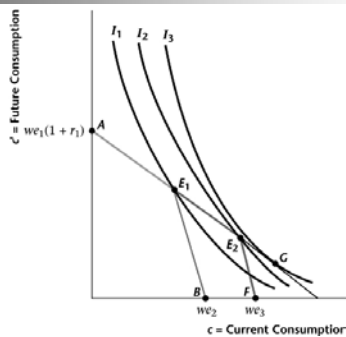


Figure 8-19 Effects of a Tax Cut for a Consumer with Different Borrowing and Lending Rates



**The Ricardian Equivalence
v.s.
President Bush in 1992**

Figure 8-20 Deviations from Trend in Consumption, 1947-1999

