

# Chapter 8

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

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### 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.

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### 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

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## 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 7 → 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  $s$

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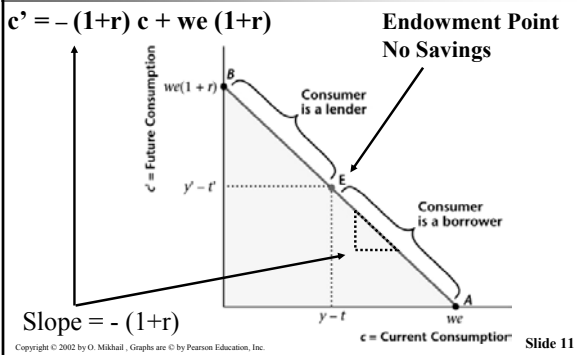
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### Figure 8-1 Consumer's Lifetime Budget Constraint




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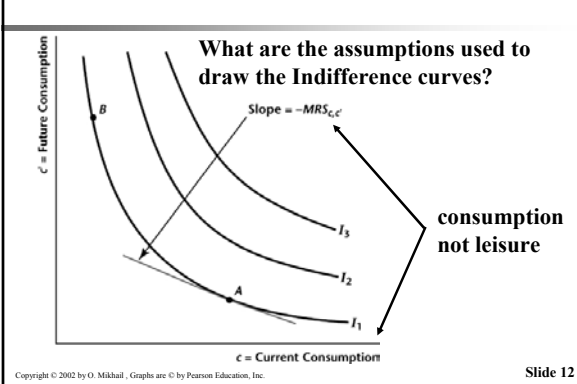
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### Figure 8-2 A Consumer's Indifference Curves




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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

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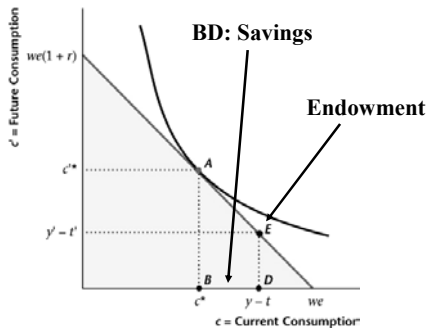
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Figure 8-3 A Consumer Who Is a Lender




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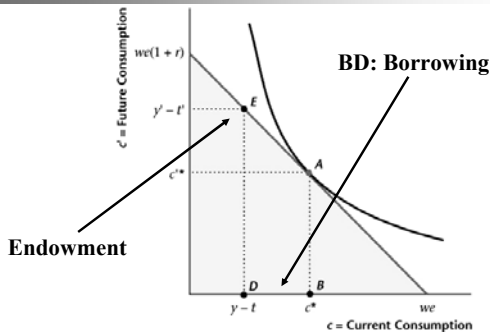
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Figure 8-4 A Consumer Who Is a Borrower




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# THE GAME

Changes in:

- Current income
- Future income
- Real interest rate

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## GAME I an Increase in CURRENT Income

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### 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  $s$  ?

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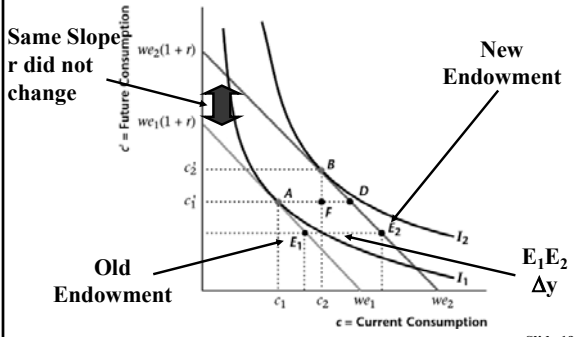
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Figure 8-5 The Effects of an Increase in Current Income for a Lender




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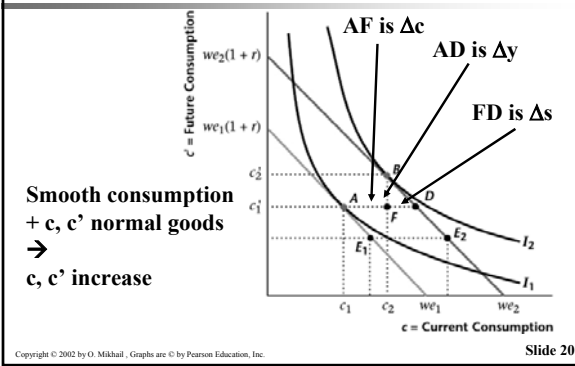
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Figure 8-5 The Effects of an Increase in Current Income for a Lender - Continued




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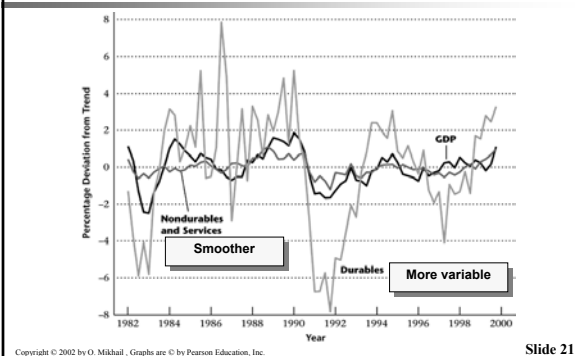
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Figure 8-6 Percentage Deviations from Trend in GDP and Consumption, 1982-1999




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## 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

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## GAME II an Increase in FUTURE Income

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## 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.

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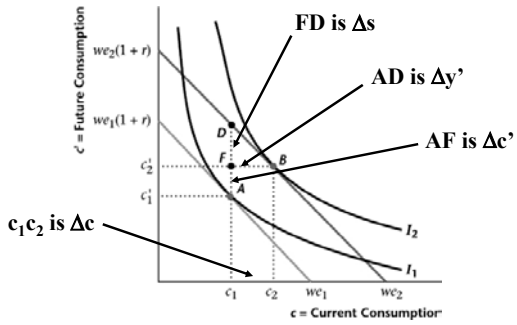
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Figure 8-7 An Increase in Future Income



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### GAME III

## Temporary vs. Permanent and the Permanent Income hypothesis

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### Permanent vs. Temporary increase in income

#### Temporary increase in income

- Ex: Winning a lottery.
- 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?

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## Why Important?

### Tax Cut

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

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## Model incorporates Temporary vs. Permanent

How?

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

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## GAME IV

### A change in the Real Interest Rate

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#### NOTATION

■ **Real interest rate**                      **r**

■ **Nominal interest rate**                      **R**

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#### 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 =  $-(1+r)$ ]

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## 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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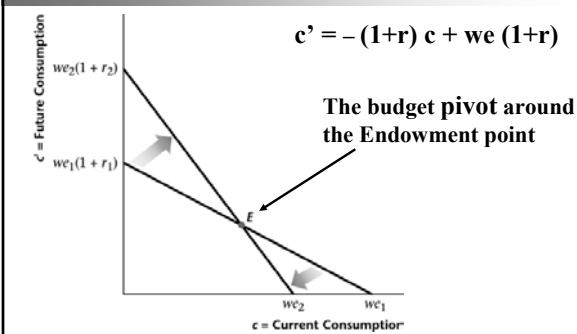
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## Figure 8-11 An Increase in the Real Interest Rate



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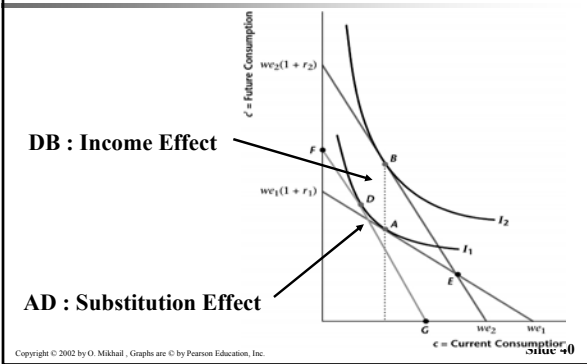
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Figure 8-12 An Increase in the Real Interest Rate for a Lender




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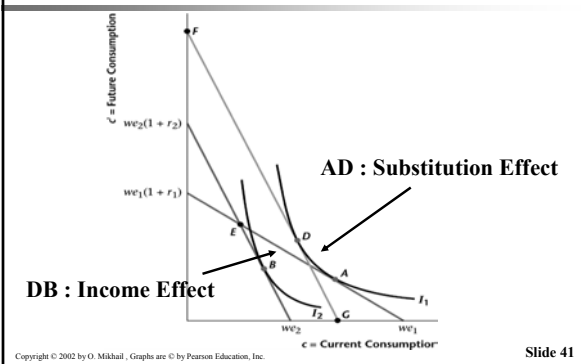
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Figure 8-13 An Increase in the Real Interest Rate for a Borrower




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### 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

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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

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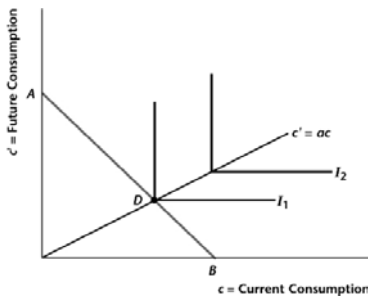
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Figure 8-14 Example with Perfect Complements Preferences

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




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The Point

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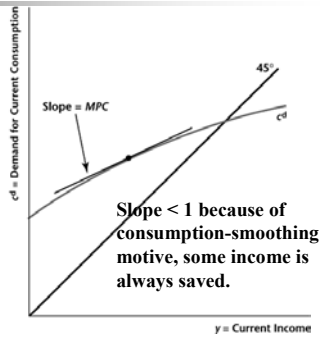
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Figure 8-15 A Consumer's Demand for Current Consumption Goods,  $c^d$ , as a Function of Current Income

**GAME I**

**Consumption increases with income**



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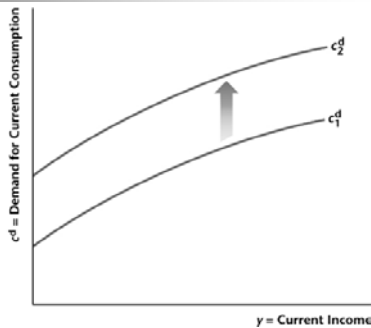
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Figure 8-16 A Shift in a Consumer's Demand for Current Consumption

**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.

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## 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.

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## 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.*

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## 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

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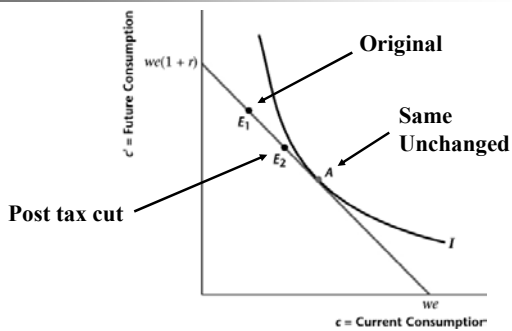
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Figure 8-17 Ricardian Equivalence with a Cut in Current Taxes for a Borrower



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# Credit Market Imperfections

## Role of credit market imperfections and the Ricardian Equivalence

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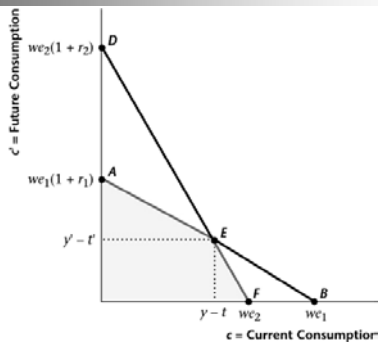
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### Figure 8-18 A Consumer Facing Different Lending and Borrowing Rates



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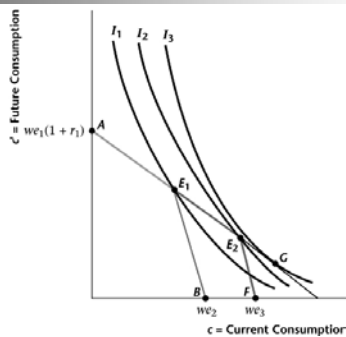
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### Figure 8-19 Effects of a Tax Cut for a Consumer with Different Borrowing and Lending Rates



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

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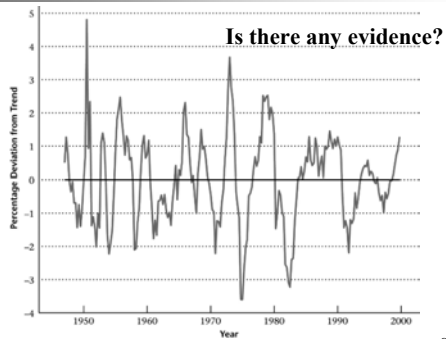
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Figure 8-20 Deviations from Trend in Consumption, 1947-1999



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