Consumption

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Objectives

We learn how households make consumption decisions

Key points:

- Consumption decisions are forward looking
- The household's objective is to keep consumption smooth, even though income fluctuates
- Lifetime income, not current income, is the key determinant of consumption

We talk about policy implications.

A Model of Consumption

- Households live for 2 periods (young and old).
  - nothing important changes when households live longer
- They work when young / retire when old.
- The government imposes lump-sum taxes.
  - so we can study the effects of redistribution

Preferences

- Households want to consume when young c and when old c'.
- Lifetime utility: $u(c) + \beta u(c')$
- $\beta > 0$ is the discount factor
- u has nice properties (increasing, concave)
- Example: $\ln(c) + 0.95 \ln(c')$.

Notation convention:

Tomorrow's variables are indicated by primes: c'.

Markets

Households trade

- **goods** at price 1
- one period **bonds** at price 1 with real interest rate $R = 1 + r$

Households are price-takers.

Government

- Imposes lump-sum taxes t, t'.
- The young pay t
- The old pay t'
- Later we have to worry about how the government balances its budget.

Household Behavior

- Households max utility $u(c) + \beta u(c')$
- subject to budget constraints
- Result: consumption functions that give c as function of prices, endowments, tax rates

Young household

- Income is earnings net of taxes: $y - t$.
- Budget constraint:

$$y - t = c + s \tag{1}$$

- The choice variable: $s > 0$ is saving. $s < 0$ is borrowing.

Old household

- The household makes no choices: simply consume all income.
- Expenditure: c' – households do not save.
- Income:
  - from labor: $y' - t'$.
  - from capital: $(1+r)\ s$.
- Budget constraint:

$$y' - t' + (1+r)\,s = c' \tag{2}$$

Household problem

$$\max_{c,c',s} u(c) + \beta u(c')$$

$$s.t.$$

$$y - t = c + s$$

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

Household problem

Sub budget constraints into utility function:

$$\max_s u(y-t-s)+\beta u\left(y'-t'+[1+r]s\right)$$

First-order condition:

$$u'(c)=\beta u'(c')[1+r]$$

Solution to the household problem: c, c', s that satisfy

1. first-order condition
2. 2 budget constraints

Intuition

$$u'(c) = \beta u'(c')[1 + r]$$

- The first-order condition is called the **Euler equation**.
- It equates marginal benefit and marginal cost of a small change in saving s.
- Marginal cost is:
- Marginal benefit is:

This is a very general result

Many details of the household problem do not affect the Euler equation.

Lifetime budget constraint

- The household really chooses between c and c'.
- The **lifetime budget constraint** tells us all combinations of (c, c') the household can afford.
- An insight emerges: the **Permanent Income Hypothesis**.

Lifetime budget constraint

Start from the 2 period budget constraints:

$$c + s = y - t \tag{3}$$
$$c' = y' - t' + (1+r)s \tag{4}$$

Solve the period 2 constraint for s:

$$s = \frac{c' + t' - y'}{1+r} \tag{5}$$

Substitute into period 1 constraint, eliminating s:

$$y' - t' + (1+r)\underbrace{(y - t - c)}_{s} = c' \tag{6}$$

Lifetime budget constraint

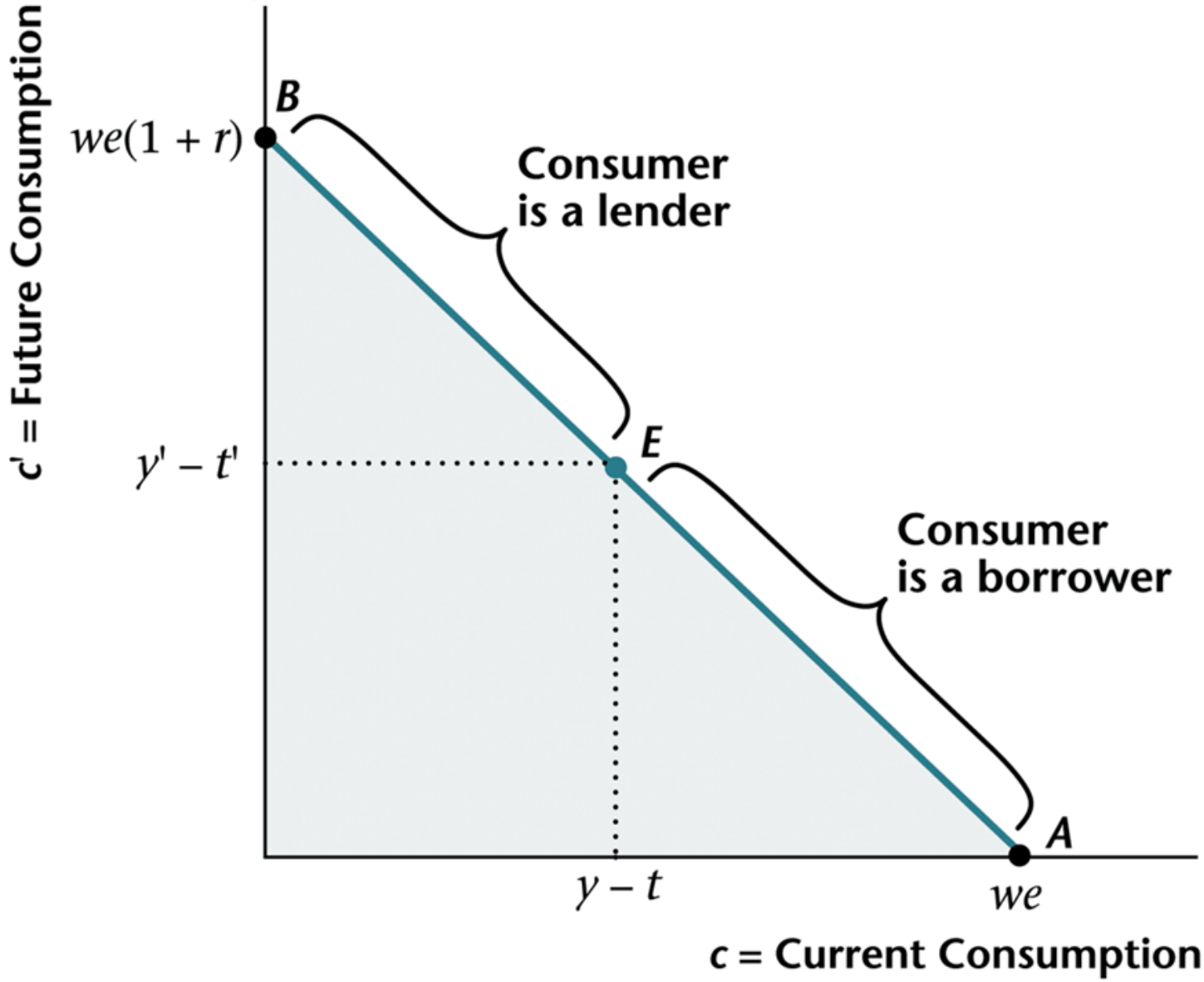
Rearrange:

$$\underbrace{c + \frac{c'}{1+r}}_{\text{Present value of c}} = \underbrace{y + \frac{y'}{1+r}}_{\text{Present value of y}} - \underbrace{t + \frac{t'}{1+r}}_{\text{Present value of t}}$$

Call the right hand side **lifetime wealth** (we).

$$c' = (1+r)(we - c) \tag{7}$$

Lifetime budget constraint



Source: Williamson, Macroeconomics

Household Problem

With present value budget constraint

$$\max_{c,c'} u(c) + \beta u([1+r][we-c])$$

First-order condition: ...

Intuition: Moving along the budget constraint

- Think about moving along the lifetime budget constraint.
- Give up a little consumption Δc. Marginal cost:
- Raise s by $\Delta s = -\Delta c$.
- Tomorrow: earn additional income of $(1+r)\Delta s$.
- Marginal benefit:
- Plot marginal cost and marginal benefit against Δc...

The same with indifference curves

Definition

An indifference curve shows all combinations of (c, c') that yield the same utility.

Properties of indifference curves:

1. Downward sloping
2. Higher level $\rightarrow$ higher utility
3. Convex

Indifference curves

An indifference curve solves

$$u(c) + \beta u(c') = \bar{U} \tag{8}$$

Slope:

$$u'(c)\,dc + \beta u'(c')\,dc' = 0 \tag{9}$$

or

$$\frac{dc'}{dc} = -\frac{u'(c)}{\beta u'(c')} = -MRS_{c,c'} \tag{10}$$

MRS: marginal rate of substitution

Indifference curves are convex

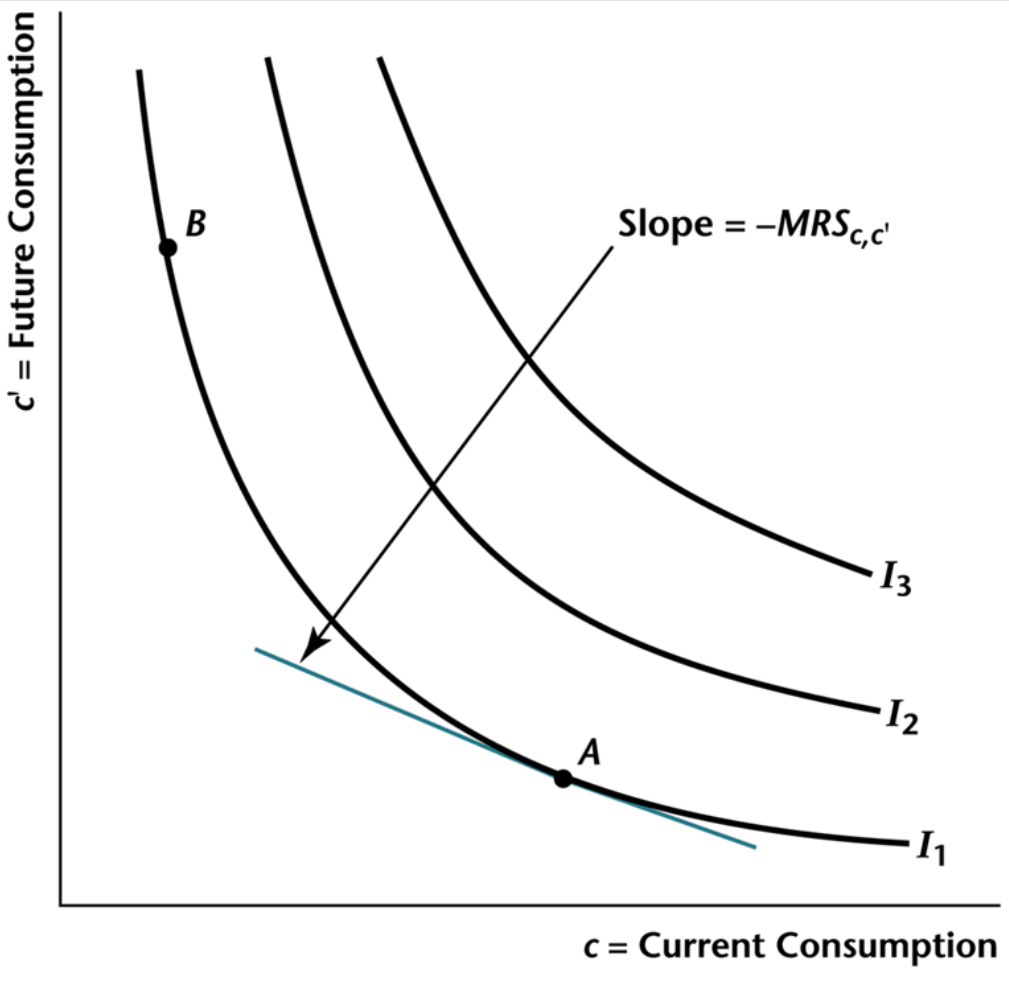
High $c \implies$ low c'

Low $u'(c) \implies$ high $u'(c')$

and therefore low $MRS_{c,c'} = \frac{u'(c)}{\beta u'(c')}$

and therefore flat indifference curve

Indifference curves



The slope of the IC is the marginal rate of substitution, $MRS_{c,c'} = u'(c)/[\beta u'(c')]$.

Consumption smoothing

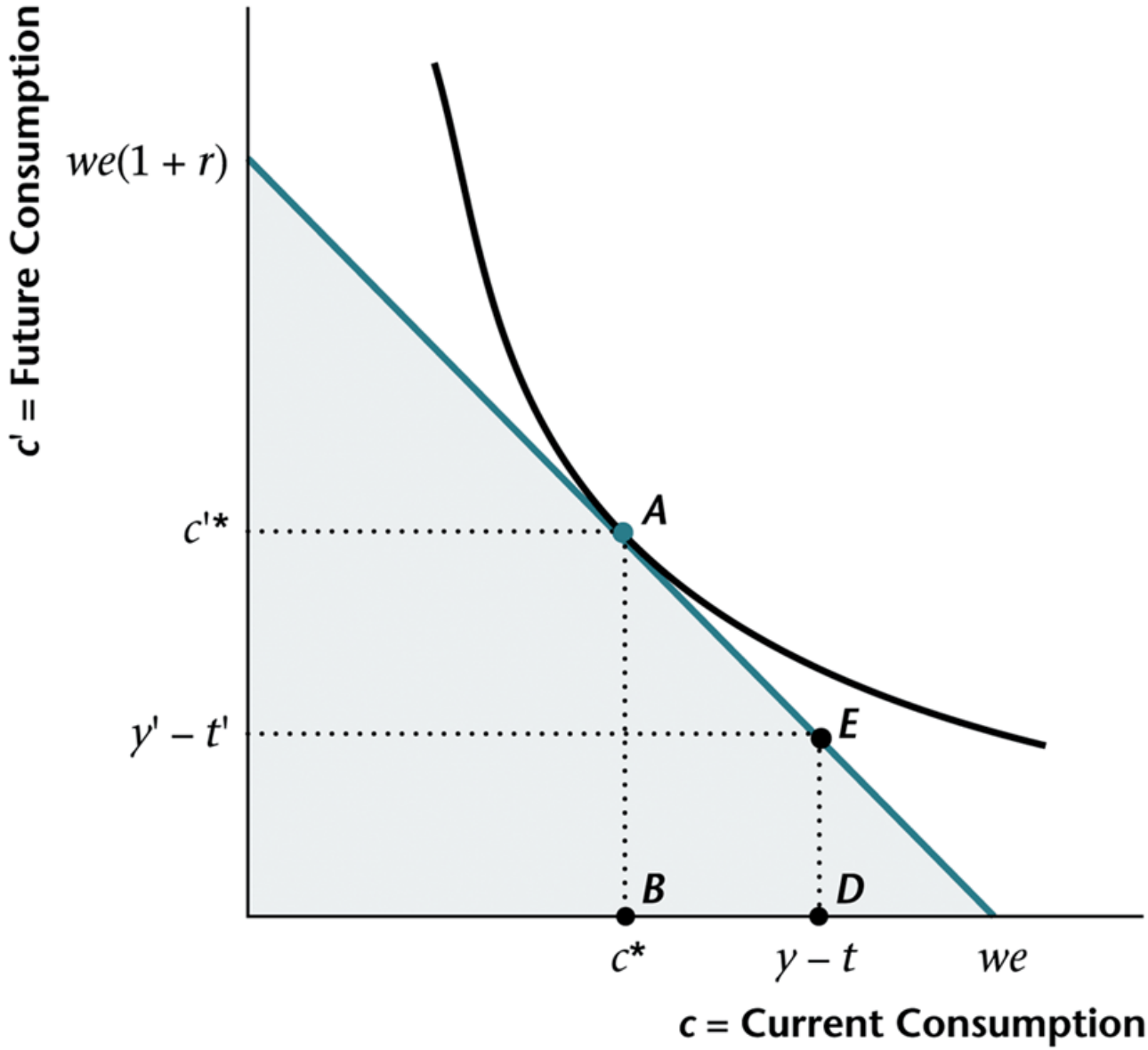
- A consequence of diminishing marginal utility:
  - indifference curves are convex
  - households prefer "smooth" consumption over "unequal" consumption
- That means:
  - if (c_A, c'_A) and (c_B, c'_B) are on the same indifference curve
  - then the household prefers any average

$$[\lambda c_A + (1-\lambda)c_B, \lambda c'_A + (1-\lambda)c'_B]$$

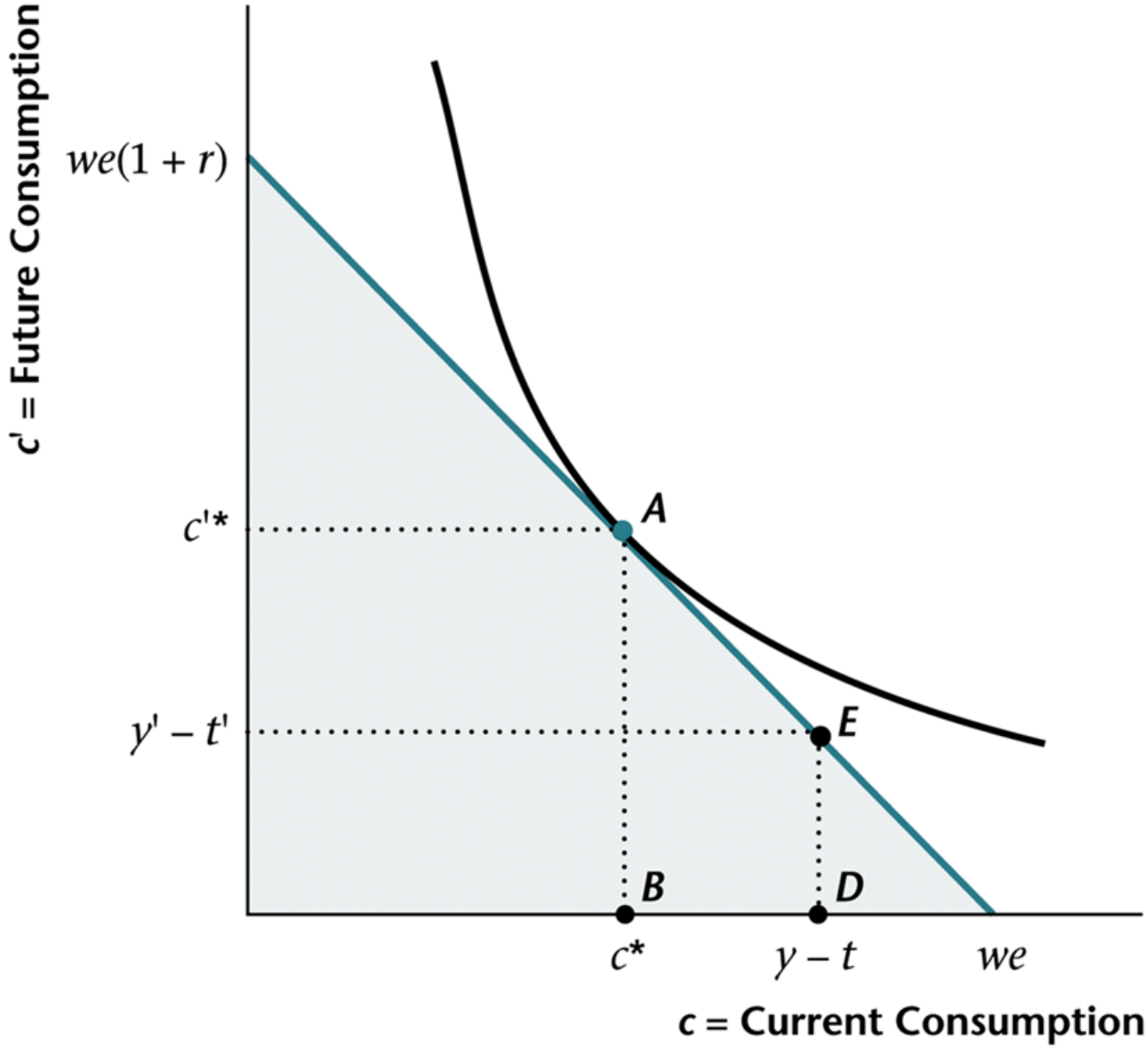
- Graph...

Optimal consumption-saving choice

Tangency of IC and budget constraint implies: $MRS_{c,c'} = 1 + r$.



A positive income shock (we rises)



Consumption smoothing

- Current income shocks are only partly consumed: $\Delta c < \Delta y$.
- The household prefers smooth consumption.
- Note: It does not matter for (c, c') whether current or future income is higher!

Permanent vs Transitory Income Shocks

- How do they differ?
- Draw a picture...
- What does it imply for tax policy?

Permanent Income Hypothesis

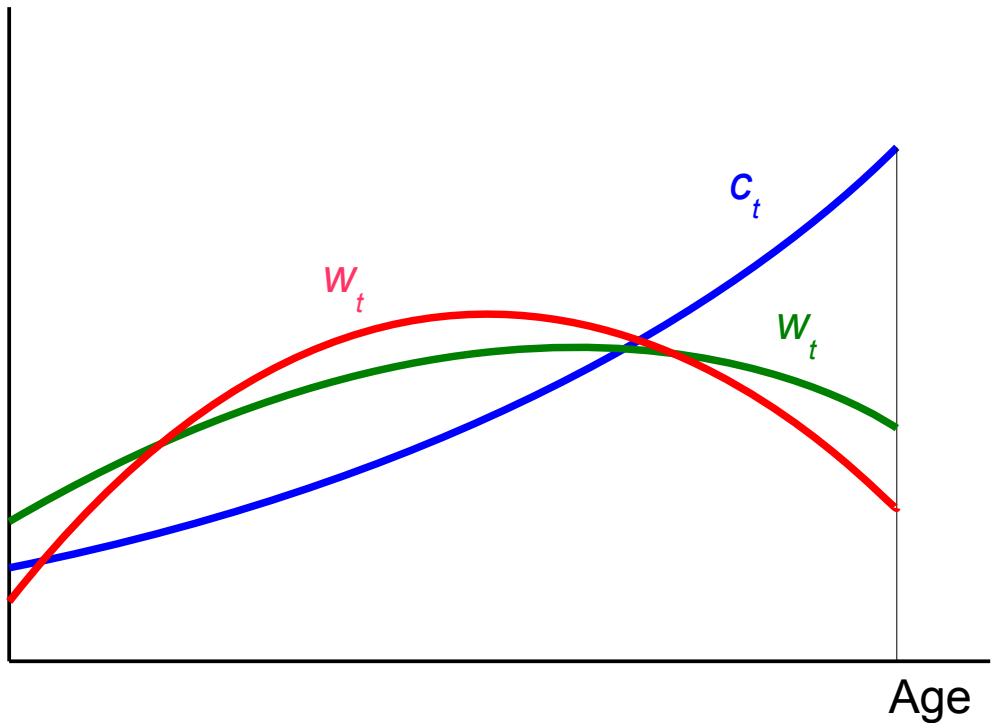
Permanent Income Hypothesis

Consumption only depends on the **present value** of lifetime income, not on its time profile.

- The PIH follows from the fact that a **lifetime budget constraint exists**.
- It does not depend on preferences (with a few exceptions).

Permanent income hypothesis

Two households with different wage profiles $\{w_t\}$ but with the same lifetime income choose the same age consumption profiles.



Permanent Income Hypothesis: Implications

A **temporary** income shock (y rises today) has a smaller effect on consumption than a **permanent** income shock (y rises today and in all future periods).

- Graph this...

This is important for **fiscal policy**:

- Stimulating consumption with temporary tax cuts is often not very effective.
- Households view tax cuts as transitory - government only postpones revenue collection.
- Therefore, refund checks are largely saved, not consumed.

Ricardian Equivalance

A change in the timing of lump-sum taxes that leaves the present value of lifetime income unchanged has no effect on the household's consumption path.

This follows directly from the Permanent Income Hypothesis (the fact that the household only considers lifetime income).

One application:

- fully funded Social Security is neutral
- it works by taxing the young and paying the old the tax amount + accumulated interest

Household: Example

- Assume log utility, $u(c) = \ln(c)$:

$$\max \ln(c) + \beta \ln(c') \tag{11}$$

- Then

$$u'(c) = 1/c \tag{12}$$

- Euler equation:

$$\frac{1}{c} = \beta [1 + r] \frac{1}{c'} \tag{13}$$

- Or, in terms of consumption growth:

$$1 + g(c) = \frac{c'}{c} = \beta [1 + r] \tag{14}$$

- Consumption growth only depends on the **interest rate**.

Household: Example

Permanent income hypothesis

How does the household choose (c, c')?

Think about a household with many periods.

For each pair of periods:

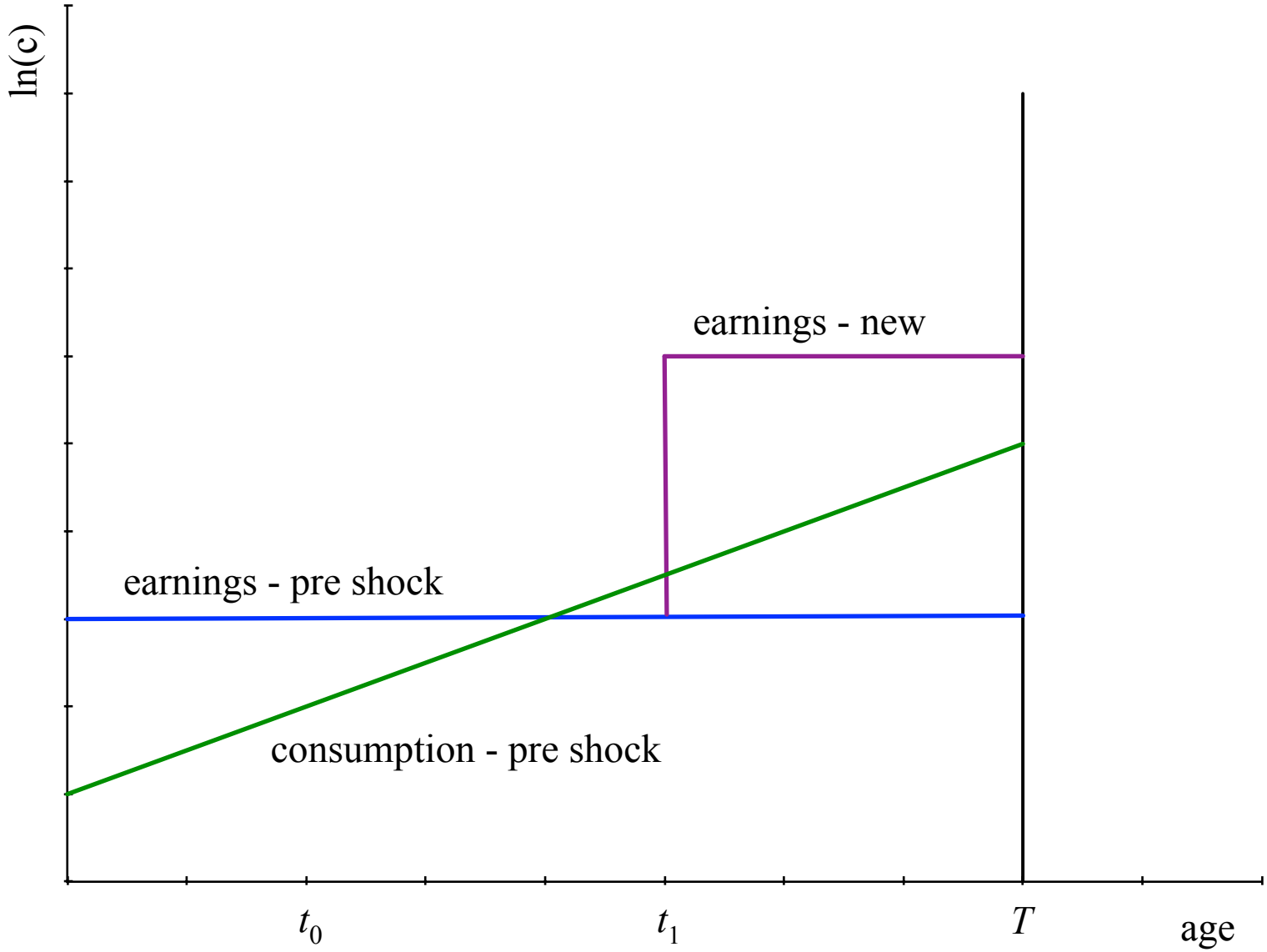
$$c'/c = \beta(1+r) \tag{15}$$

Step 1: Figure out the slope of the age consumption profile from the Euler equation.

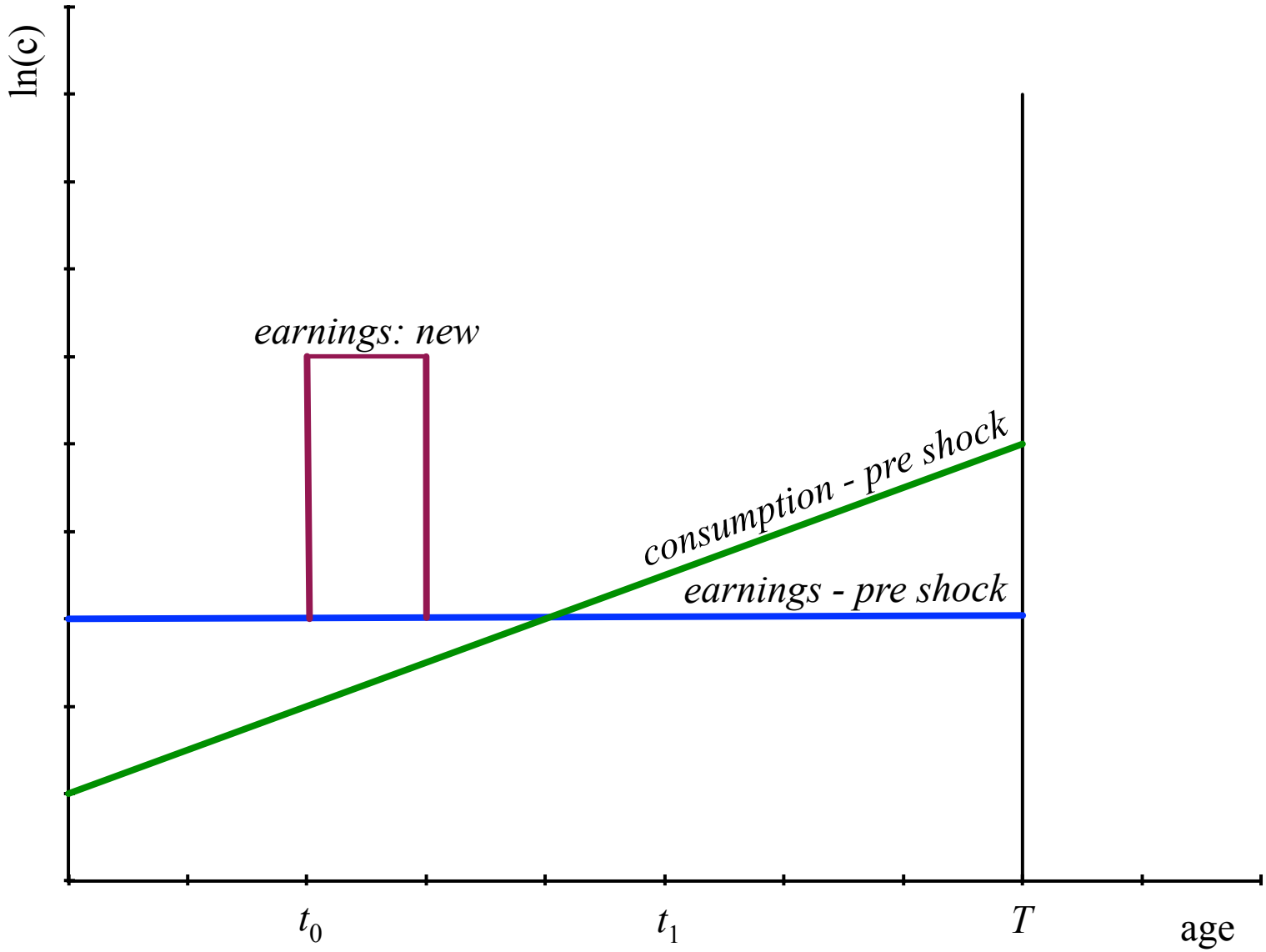
Step 2: Pick the highest profile the household can afford.

Response to shocks

Imagine the household learns at date t_0 that his earnings will be higher from date t_1 onwards.



Transitory income shock



Response to shocks

This has two important implications:

1. **Expected shocks have current effects**.
   For example, an innovation that occurs today but does not affect productivity for some time will increase consumption today.
2. Households spread the effects of transitory shocks over time in an attempt to smooth consumption.
   This is important for understanding the business cycle properties of the model.

Empirical Evidence

How could one test the permanent income hypothesis?

Interest rate shocks

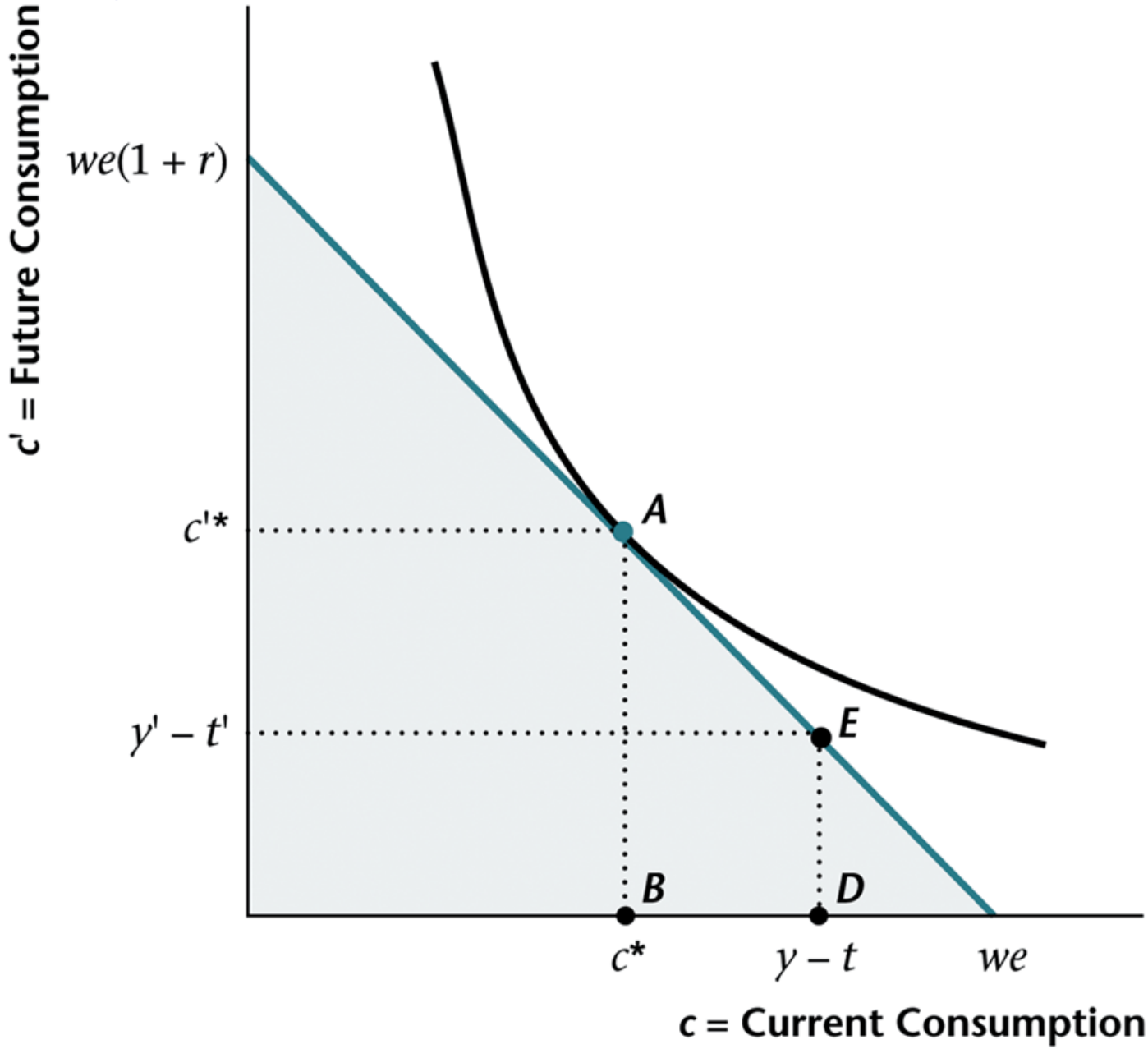
Do savings rise when the interest rate increases?

Does it matter whether the higher interest rate is permanent or transitory?

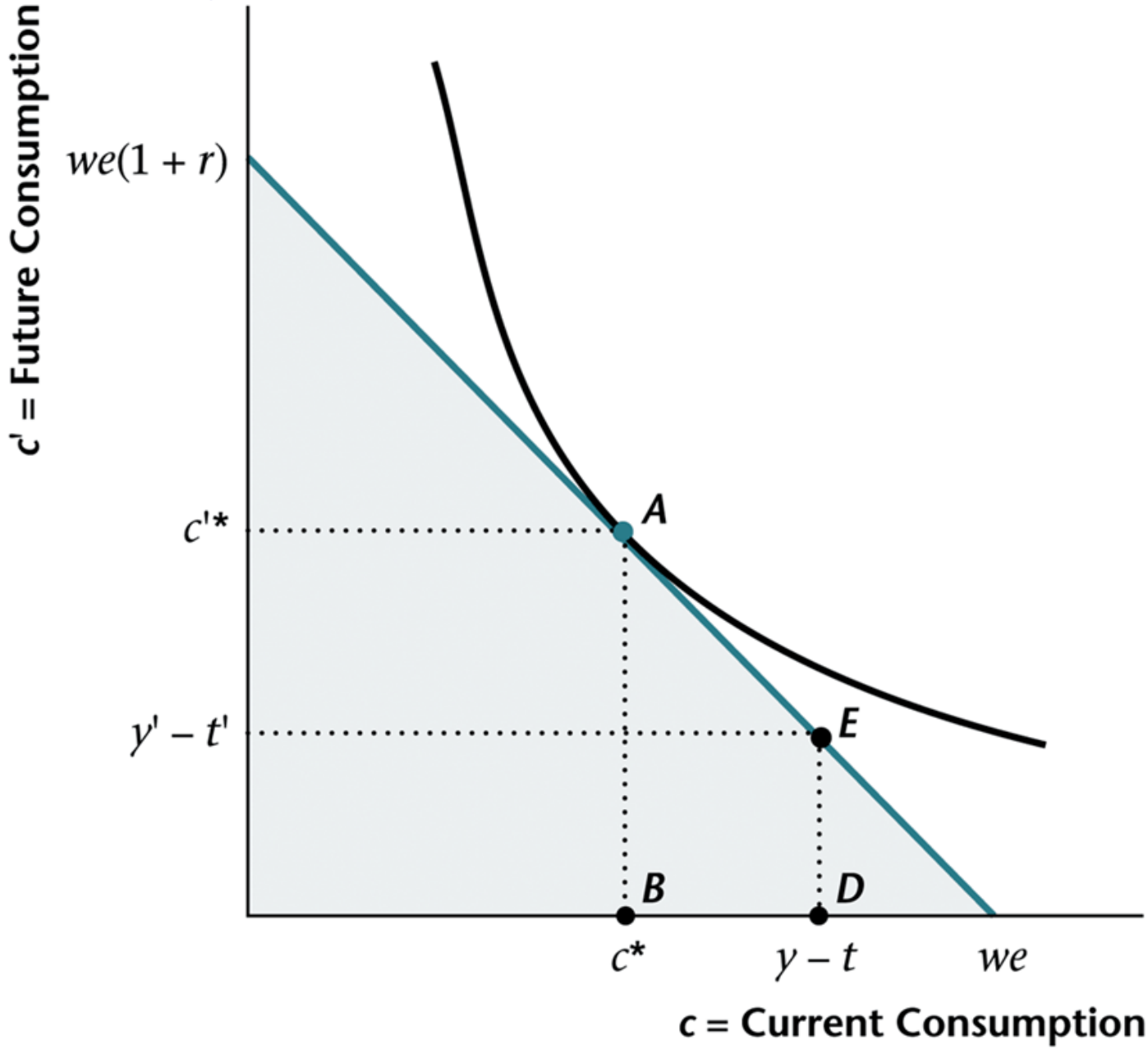
How does higher r change the lifetime budget constraint?

$$(y - t - c)\ (1 + r) = y' - t' - c' \tag{16}$$

A saving household



A borrowing household



Permanent versus transitory interest rate shocks

Does it make a difference whether a change in r is permanent or transitory?

Aggregate consumption function

Aggregate consumption (C) depends on:

- the present value of current and future income net of taxes $(+)$,
- interest rate $(?)$,
- wealth $(+)$.

The **marginal propensity to consume** out of current income is small.

This is the payoff from micro-foundations:

We know exactly what the properties of the consumption function are.

Reading

Blanchard / Johnson, Macroeconomics, 6th ed., ch. 15+16

Further Reading:

- Williamson, Macroeconomics, ch. 8
- Romer, Advanced Macroeconomics, 4e, 2.8-2.9, 8.1, 8.4