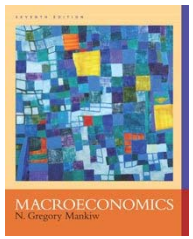
Intermediate Macroeconomics

ECON 302

Professor Yamin Ahmad

Lecture 12:

- Consumption Theory
- The Microfoundations of Consumption
- Ricardian Equivalence



Key Concepts In This Lecture

- Indifference Curves and Budget sets
- Utility Maximization and the Consumption Euler Equation
- Life Cycle Hypothesis
- Permanent Income Hypothesis
- Ricardian Equivalence

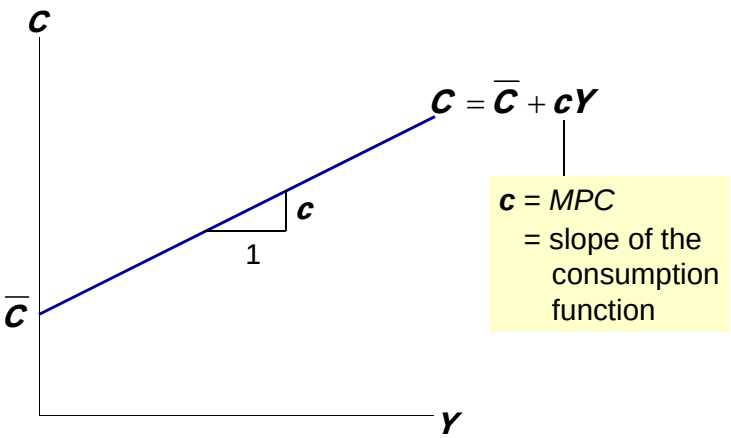
Note: These lecture notes are incomplete without having attended lectures

Keynes's conjectures

1. $0 < MPC < 1$
2. **Average propensity to consume** (*APC*) falls as income rises. (*APC* = $\boldsymbol{C/Y}$)
3. Income is the main determinant of consumption.

Note: These lecture notes are incomplete without having attended lectures

The Keynesian consumption function



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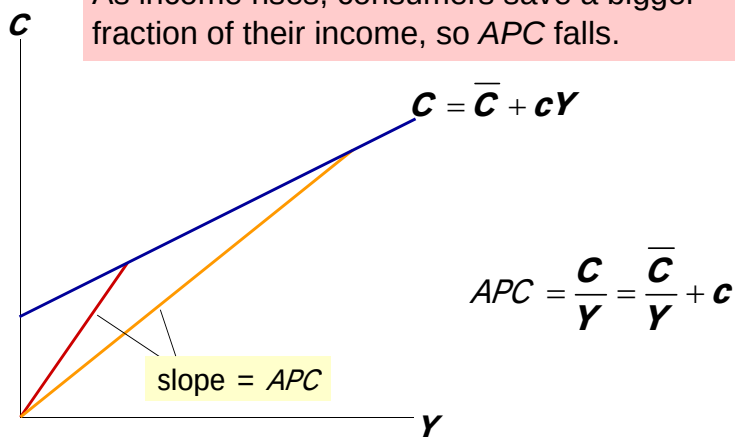
The Keynesian consumption function

As income rises, consumers save a bigger fraction of their income, so *APC* falls.



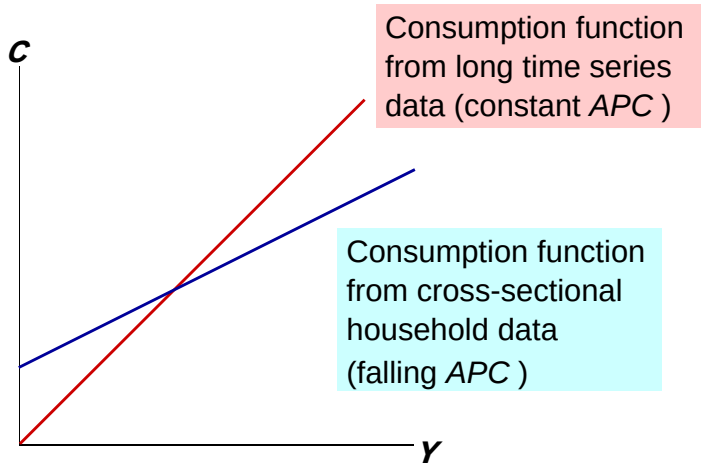
Early empirical successes: Results from early studies

- Households with higher incomes:
  - consume more, $\Rightarrow$ *MPC* > 0
  - save more, $\Rightarrow$ *MPC* < 1
  - save a larger fraction of their income, $\Rightarrow$ *APC* ↓ as ***Y*** ↑
- Very strong correlation between income and consumption:
  - $\Rightarrow$ income seemed to be the main determinant of consumption

Problems for the Keynesian consumption function

- Based on the Keynesian consumption function, economists predicted that ***C*** would grow more slowly than ***Y*** over time.
- This prediction did not come true:
  - As incomes grew, *APC* did not fall, and ***C*** grew at the same rate as income.
  - Simon Kuznets showed that ***C***/***Y*** was very stable in long time series data.

The Consumption Puzzle



Consumption

Puzzle in Data

- In cross-section data i.e. across households at a given movement, the relationship between consumption and disposable income is rather flat:
  - $(c_1 < C/(Y-T); C_0 > 0)$;
- In time series data on aggregate consumption and disposable income, we find that the relationship is much steeper:
  - $(c_1 \approx C/(Y-T); C_0 \approx 0)$;

Irving Fisher and Intertemporal Choice

- The basis for much subsequent work on consumption.
- Assumes consumer is forward-looking and chooses consumption for the present and future to maximize lifetime satisfaction.
- Consumer's choices are subject to an **intertemporal budget constraint**,
  a measure of the total resources available for present and future consumption.

Basic Consumption/Savings Theory

Economic Environment

- Representative consumer lives for two periods
- Beginning of each period, they get income, Y
- Representative consumer chooses:
  - How much to consume
  - How much to save
- If they save, they get a real rate of interest, r.

Basic Consumption/Savings Theory

Assumptions

Consumers:

- are rational!
- have perfect foresight
- maximize lifetime utility
- For now, we will also assume that
  - Taxes, T = 0;
  - There is no uncertainty
- Question: What is "utility" and how do they maximize it?

Digression: Indifference Curves

Tool of Analysis: Indifference Curves

- Represents demand side of the economy (consumers)

- **Indifference Curve** — shows combinations of two goods that yield the same level of satisfaction ("utility") to a consumer.

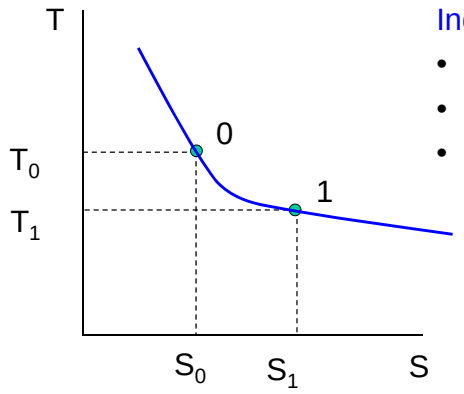
A Quick Question For You

Think of two goods/items that you like. Let's call them good S and good T. Suppose that you have 10 of each type of good. Now consider the following:

In a table, write down numbers for:

- Additional S: How many units of good T would you be willing to give up for an additional unit of good S? … or for the 12th,13th or 14th unit of good S?
- Additional T: How many units of good S would you be willing to give up for an additional unit of good T? … or for the 12th, 13th or 14th unit of good T?
- Plot these on a graph! What shape have you drawn?

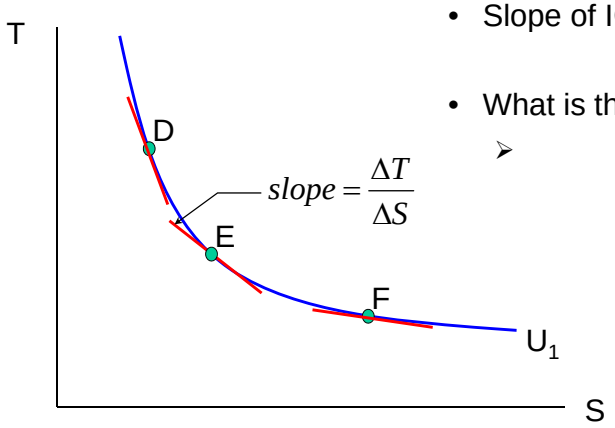
An Indifference Curve



Indifference Curves are:

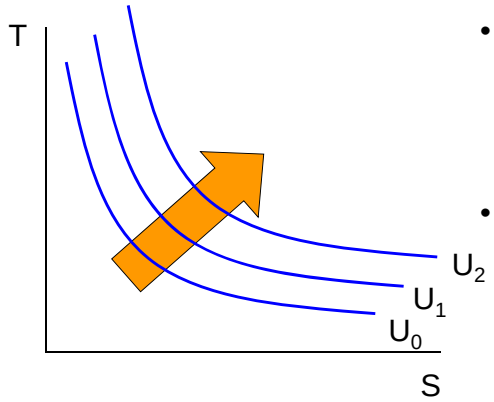
- Individual Specific
- Downward Sloping
- Convex to the origin

Marginal Rate of Substitution (MRS)



- Slope of IC = -MRS
  $= \Delta T / \Delta S$
- What is the MRS?
  ➢

Indifference Curves (cont.)



- Higher Indifference Curves represent higher levels of utility.
- Why? U_1 and U_2 represent combinations of T and S that are at least the same (if not more) of either good (compared to U_0).

Some Things to Think About…

- Question: Can indifference curves cross?
- Answer:

- Question: Are the indifference curves "parallel"?
- Answer:

Properties of Indifference Curves

To summarize, indifference curves are:

- Individual-specific
- Downward-sloping
- Convex to the origin
- Higher curves indicate higher levels of satisfaction
- Non-intersecting
- Slope of indifference curve is the marginal rate of substitution (MRS)

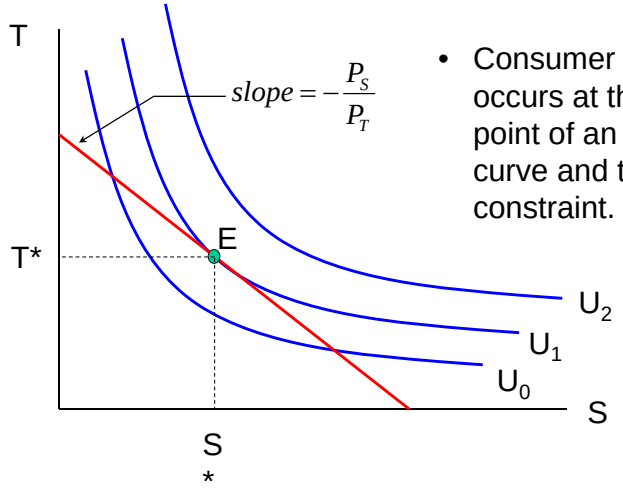
Consumer Utility Maximization

- Consumer maximizes utility subject to an income or budget constraint

- What does this mean?...
  - Given your budget (income), you try and pick combinations of S and T that lie within your budget whilst giving you the greatest utility!

- Question: Suppose that you have an income, Y, which you want to spend on two goods, S and T, which cost P_S and P_T.
  - Write out the budget constraint!

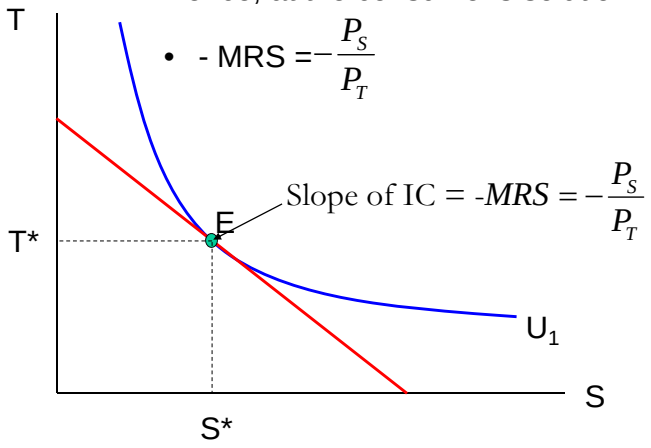
Consumer Utility Maximization



- Consumer solution occurs at the tangency point of an indifference curve and the budget constraint.

Consumer Utility Maximization

Hence, at the consumer's solution:



End Digression… Back to Consumption/Savings

- What are our two goods, S and T here?
  - Choice of consumption today (C_1) and consumption tomorrow (C_2)!
- What is our budget in each period?
  - Income today, Y_1
  - Income tomorrow, $Y_2 + S(1+r)$
- Recall that we set taxes, T= 0;

Consumption-Savings Decision

- Hence, given an ***endowment, e,*** of income, i.e. e = {Y_1, Y_2}, and facing our budget constraint in each period, we decide:
  - Consumption today, C_1
  - Consumption tomorrow, C_2
  - (and hence…. Savings between today and tomorrow)

Budget Constraints

- Flow budget constraints:
  - Period 1: $C_1 + S = Y_1$ (1)
  - Period 2: $C_2 = Y_2 + (1+r)S$ (2)

- Present Value budget constraint:
  - Eliminate S in equations above to yield

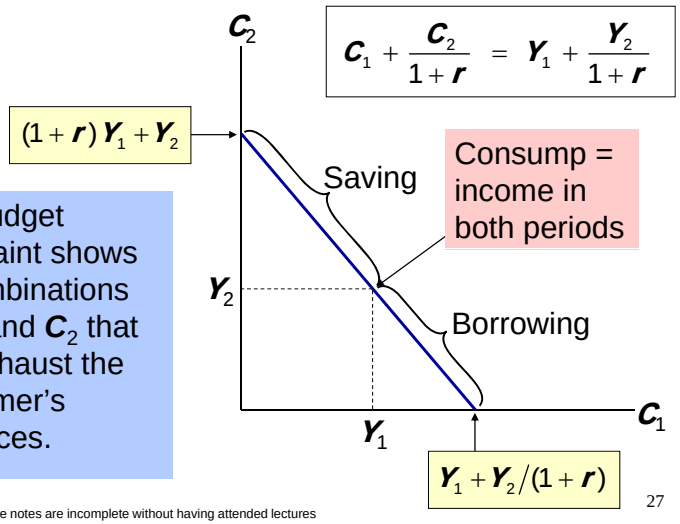
$$C_2 = Y_2 + (1+r)(Y_1 - C_1)$$

$$\Rightarrow C_1 + \frac{C_2}{1+r} = Y_1 + \frac{Y_2}{1+r} \qquad (3)$$

The intertemporal budget constraint

$$\underbrace{C_1 + \frac{C_2}{1+r}}_{\text{present value of lifetime consumption}} = \underbrace{Y_1 + \frac{Y_2}{1+r}}_{\text{present value of lifetime income}}$$

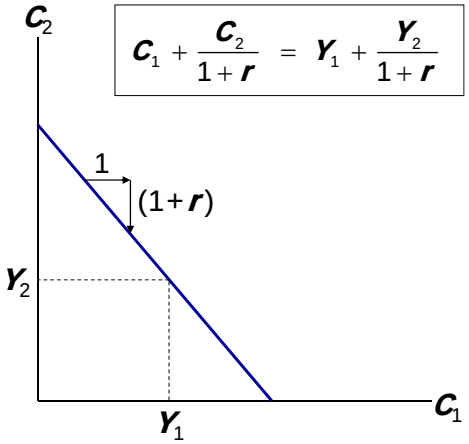
The intertemporal budget constraint



The budget constraint shows all combinations of C_1 and C_2 that just exhaust the consumer's resources.

The intertemporal budget constraint

The slope of the budget line equals $-(1+r)$



Formal Definition of Consumer Problem

Consumers maximize utility:

$$\max_{C_1,C_2} U(C_1,C_2) \quad \text{e.g. } U(C_1,C_2) = \ln C_1 + \ln C_2$$

- subject to:

$$C_1 + S = Y_1 \qquad (1)$$

$$C_2 = Y_2 + (1+r)S \qquad (2)$$

- or alternatively:

$$C_1 + \frac{C_2}{1+r} = Y_1 + \frac{Y_2}{1+r} \qquad (3)$$

Solution to Consumer's Problem

- Recall from earlier that at solution, slope of IC equals slope of budget constraint
- What is the slope of the budget constraint?
  - Re-write equation (3) as:

$$C_2 = Y_2 + (1+r)(Y_1 - C_1)$$

$$\Rightarrow C_2 = \left[Y_2 + (1+r)Y_1\right] - (1+r)C_1$$

- Hence, the slope of the budget constraint equals *-(1+r)*

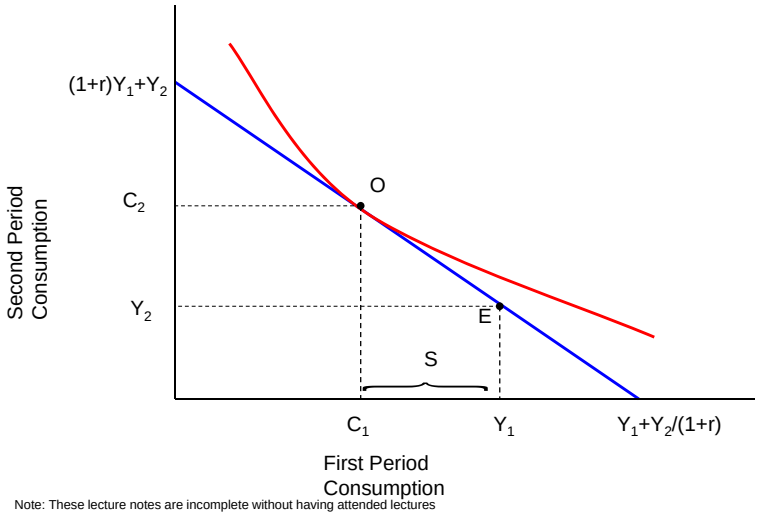
Solution to Consumer's Problem (cont.)

- Hence at the solution, MRS = (1+r), i.e.:

$$\Rightarrow \text{MRS} = \frac{\partial U/\partial C_1}{\partial U/\partial C_2} = 1+r = \text{Intertemporal Price}$$

- This condition is known as the **Euler equation**
  - Slope of Indifference curve, i.e. MRS equals slope of the budget constraint at the tangent point.
- Thus, we can write the consumption function as:
  - Consumption function: $C_1 = C[r, Y_1 + Y_2/(1+r)]$

The Consumption-Savings Decision



Walkthrough Example

- Suppose that consumers maximize utility

$$\max_{C_1,C_2} U\left(C_1,C_2\right)=\ln C_1+\ln C_2$$

subject to equation (3) from before.

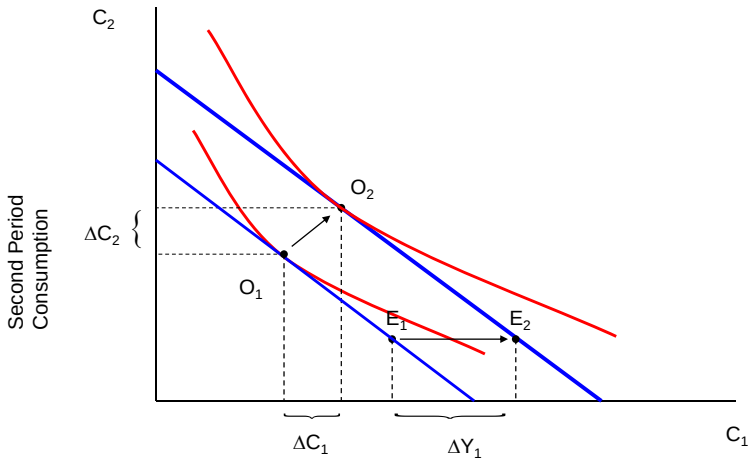
- Questions:
  1. Write down the consumption Euler equation.
  2. Write down the consumption function.

What Happens If…?

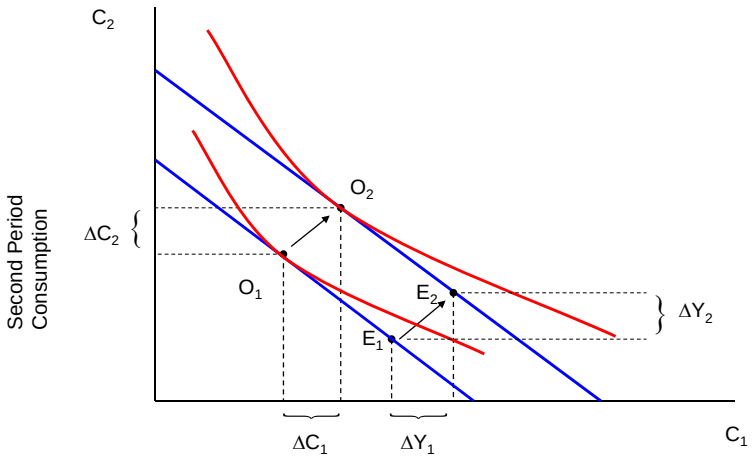
What is the Impact of…

1. A change in Income
   - Temporary change
   - Permanent Change
2. An increase in interest rates
   1. Borrower perspective
   2. Lender perspective
3. Borrowing Constraints faced by consumers

A Temporary Increase in Income

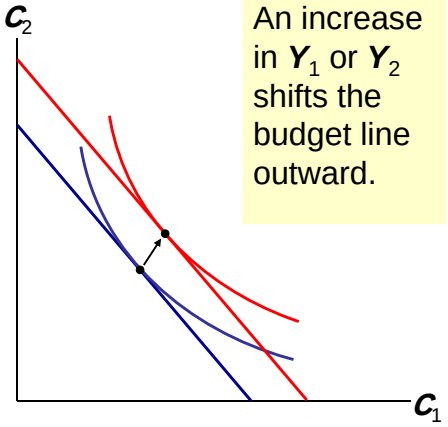


A Permanent Increase in Income



How *C* responds to changes in *Y*

Results:
Provided they are both normal goods, C_1 and C_2 both increase,
…regardless of whether the income increase occurs in period 1 or period 2.



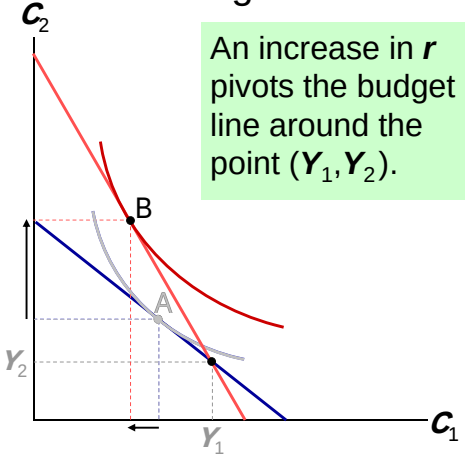
An increase in Y_1 or Y_2 shifts the budget line outward.

Keynes vs. Fisher

- Keynes:
  Current consumption depends only on current income.
- Fisher:
  Current consumption depends only on the present value of lifetime income.
  The timing of income is irrelevant because the consumer can borrow or lend between periods.

How *C* responds to changes in *r*

As depicted here, C_1 falls and C_2 rises.
However, it could turn out differently…



An increase in r pivots the budget line around the point (Y_1, Y_2).

How *C* responds to changes in *r*

- **income effect**: If consumer is a saver/lender, the rise in r makes him better off, which tends to increase consumption in both periods.
- **substitution effect**: The rise in r increases the opportunity cost of current consumption, which tends to reduce C_1 and increase C_2.
- Both effects $\Rightarrow \uparrow C_2$.
  Whether C_1 rises or falls depends on the relative size of the income & substitution effects.

Practice Question

- Consider the same scenario as before, except now from the point of view of a borrower.

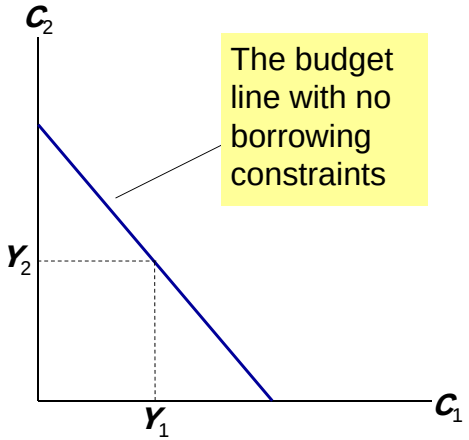
Work in pairs to figure this question out:

- What happens to a borrower if interest rates go up?
- What happens to C_2?
- What happens to C_1?
  - [Hint: Think about income and substitution effects of a rise in interest rates on consumption today]

Constraints on borrowing

- In Fisher's theory, the timing of income is irrelevant: Consumer can borrow and lend across periods.
- Example: If consumer learns that her future income will increase, she can spread the extra consumption over both periods by borrowing in the current period.
- However, if consumer faces borrowing constraints (aka "liquidity constraints"), then she may not be able to increase current consumption
  …and her consumption may behave as in the Keynesian theory even though she is rational & forward-looking.

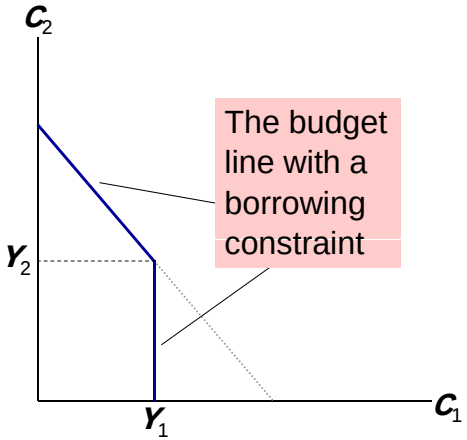
Constraints on borrowing



Constraints on borrowing

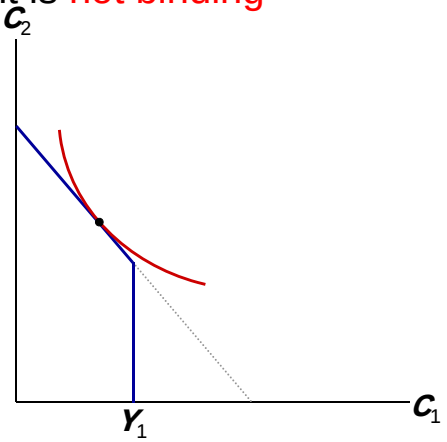
The borrowing constraint takes the form:

$$C_1 \leq Y_1$$



Consumer optimization when the borrowing constraint is not binding

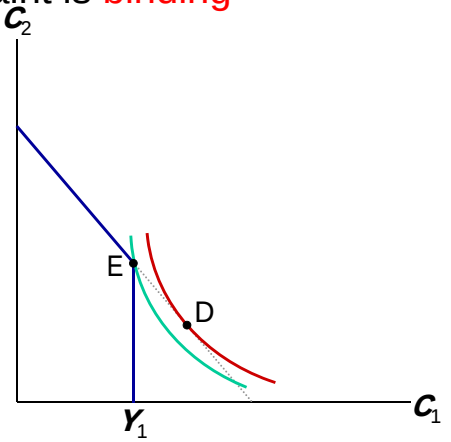
The borrowing constraint is not binding if the consumer's optimal C_1 is less than Y_1.



Consumer optimization when the borrowing constraint is binding

The optimal choice is at point **D**.

But since the consumer cannot borrow, the best he can do is point **E**.



The Life-Cycle Hypothesis

- Due to Franco Modigliani (1950s)
- Fisher's model says that consumption depends on lifetime income, and people try to achieve smooth consumption.
- The LCH says that income varies systematically over the phases of the consumer's "life cycle,"
  and saving allows the consumer to achieve smooth consumption.

The Life-Cycle Hypothesis

Start with a basic model:

W = initial wealth

Y = annual income until retirement (assumed constant)

R = 1 (number of years until retirement)

T = 2 (lifetime in years)

- Assumptions:
  - zero real interest rate (for simplicity)
  - consumption-smoothing is optimal

The Life-Cycle Hypothesis

- Lifetime resources = $W + RY$
- To achieve smooth consumption, consumer divides her resources equally over time:

$$C = (W + RY)/T \text{ , or}$$

$$C = \alpha W + \beta Y$$

where

$\alpha = (1/T)$ is the marginal propensity to consume out of wealth

$\beta = (R/T)$ is the marginal propensity to consume out of income

Implications of the Life-Cycle Hypothesis

The LCH can solve the consumption puzzle:

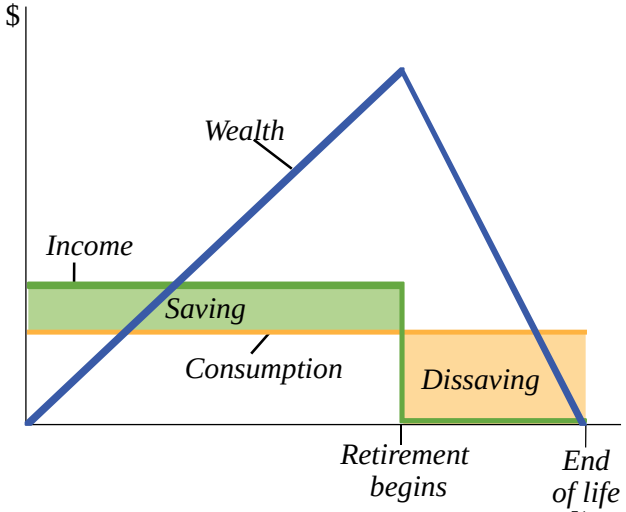
- The life-cycle consumption function implies

$$APC = C/Y = \alpha(W/Y) + \beta$$

- Across households, income varies more than wealth, so high-income households should have a lower *APC* than low-income households.
- Over time, aggregate wealth and income grow together, causing *APC* to remain stable.

Implications of the Life-Cycle Hypothesis

The LCH implies that saving varies systematically over a person's lifetime.



Beyond Two Periods

Economic Environment

- Representative consumer lives for T periods
- Beginning of each period, they get income, Y
- Each period, representative consumer chooses:
  - How much to consume
  - How much to save
- If they save, they get a real rate of interest, r (assume constant)

The Life Cycle Hypothesis (Ando-Modigliani)

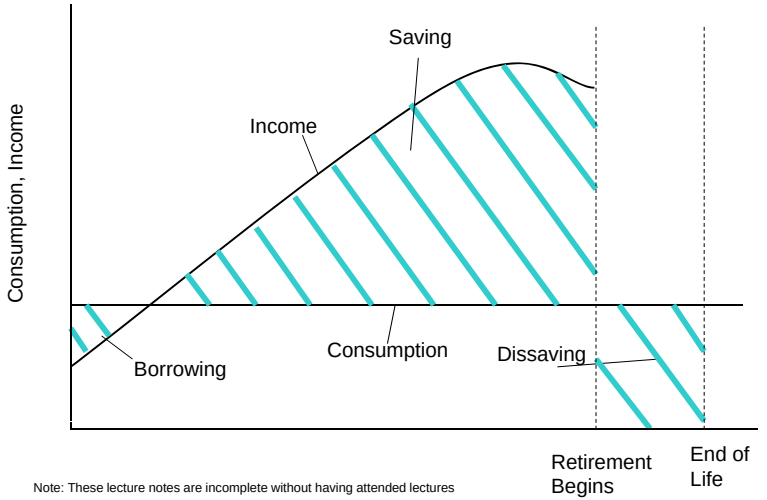
Maximise $U(C_1,C_2,\ldots,C_T)$ subject to:

$$C_1+\frac{C_2}{1+r}+\ldots+\frac{C_T}{(1+r)^{T-1}} = W+Y_1+\frac{Y_2}{1+r}+\ldots+\frac{Y_T}{(1+r)^{T-1}} \equiv W+HW$$

Where W = initial assets and HW = "Human Wealth"

- Consumption Euler equation $\Rightarrow$ smooth consumption over lifetime
- Consumption function: $C_1 = C(r,W+HW)$
- Homothetic preferences $\Rightarrow$ $C_1 = \alpha(W+HW)$ where α depends on interest rates, r, and the lifetime, T.

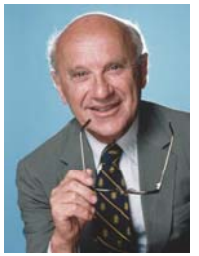
Consumption and Income over the Life Cycle



Explaining the Puzzle

- In cross section:
  - high C/Y people are at the beginning and end of the life cycle
  - low C/Y individuals are those in the middle.
- Over time:
  - old people die and are replaced by younger ones.
- Economic growth means that the lifetime wealth of young is higher than those they replace.
  - Hence "average" consumer is getting richer over time.

The Permanent Income Hypothesis



- Due to Milton Friedman (1957)
- $Y = Y^P + Y^T$

  where

  Y = current income

  Y^P = **permanent income**
  average income, which people expect to persist into the future

  Y^T = **transitory income**
  temporary deviations from average income

The Permanent Income Hypothesis

- Consumers use saving & borrowing to smooth consumption in response to transitory changes in income.
- The PIH consumption function:

$$C = \alpha Y^P$$

where α is the fraction of permanent income that people consume per year.

The Permanent Income Hypothesis

The PIH can solve the consumption puzzle:

- The PIH implies

$$APC = C/Y = \alpha Y^P/Y = \alpha(1-Y^T/Y)$$

- If high-income households have higher transitory income than low-income households, *APC* is lower in high-income households.
- Over the long run, income variation is due mainly (if not solely) to variation in permanent income, which implies a stable *APC*.

Permanent Income Hypothesis (Friedman)

Another Way to Explain it

- In *cross sectional data*, high C/Y individuals have negative transitory income and vice versa.
- In aggregate, mean $Y^P \approx$ mean Y, so $C/Y = \alpha$

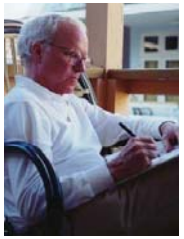
Permanent Income Hypothesis (Friedman)

- If $Y^P = r(W+HW)$ (annuity value of wealth) …
- … then **Permanent Income Hypothesis** (PIH) is the same as the **Life Cycle Hypothesis** (LCH).

PIH vs. LCH

- Both: people try to smooth their consumption in the face of changing current income.
- LCH: current income changes systematically as people move through their life cycle.
- PIH: current income is subject to random, transitory fluctuations.
- Both can explain the consumption puzzle.

The Random-Walk Hypothesis



- Due to Robert Hall (1978)
- based on Fisher's model & PIH, in which forward-looking consumers base consumption on expected future income
- Hall adds the assumption of **rational expectations**, that people use all available information to forecast future variables like income.

Excess Smoothness of Consumption

- Suppose that consumption is proportional to permanent income (PI), i.e. $C_t = \alpha Y^P_t$.
- Question:

  What is the expected value of consumption tomorrow under rational expectations, i.e. $E_t(C_{t+1})$?

Income Expectations and Consumption (Hall)

- Since $C_t = \alpha Y^P_t$, then $C_{t+1} = \alpha Y^P_{t+1}$
- Under rational expectations, $(Y^P_{t+1})^e = E_t(Y^P_{t+1}) = Y^P_t$.
- Hence:

$$C_{t+1} = \alpha(Y^P_{t+1})^e + \alpha[Y^P_{t+1} - (Y^P_{t+1})^e]$$
$$= \alpha Y^P_t + \alpha[Y^P_{t+1} - (Y^P_{t+1})^e]$$
$$= C_t + \alpha[Y^P_{t+1} - (Y^P_{t+1})^e]$$

- Taking expectations: $E_t C_{t+1} = C_t$

  - the best guess of tomorrow's consumption is today's consumption, i.e. consumption follows a "random walk"

The Random-Walk Hypothesis

- If PIH is correct and consumers have rational expectations, then consumption should follow a **random walk**: changes in consumption should be unpredictable.
  - A change in income or wealth that was anticipated has already been factored into expected permanent income, so it will not change consumption.
  - Only unanticipated changes in income or wealth that alter expected permanent income will change consumption.

Implication of the R-W Hypothesis

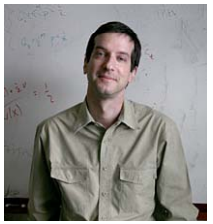
If consumers obey the PIH
and have rational expectations,
then policy changes
will affect consumption
only if they are unanticipated.

Policy Implications of the LCH-PIH Model

- Best guess of tomorrow's consumption is today's consumption!
  - Roughly 75% of consumers satisfy this.
- Households smooth consumption over their lifetime
- Key Question: Are changes in income permanent ($c_1 \approx 1$) or temporary ($c_1 \approx 0$)?
- In essence the answer to the question above will determine whether people respond to a policy action or not.

The Psychology of Instant Gratification

- Theories from Fisher to Hall assume that consumers are rational and act to maximize lifetime utility.



- Recent studies by David Laibson and others consider the psychology of consumers.

The Psychology of Instant Gratification

- Consumers consider themselves to be imperfect decision-makers.
  - In one survey, 76% said they were not saving enough for retirement.

- Laibson: The "pull of instant gratification" explains why people don't save as much as a perfectly rational lifetime utility maximizer would save.

Two questions and time inconsistency

1. Would you prefer (A) a candy today, or (B) two candies tomorrow?
2. Would you prefer (A) a candy in 100 days, or (B) two candies in 101 days?

In studies, most people answered (A) to 1 and (B) to 2.

A person confronted with question 2 may choose (B).

But in 100 days, when confronted with question 1, the pull of instant gratification may induce her to change her answer to (A).

RICARDIAN EQUIVALENCE

Do Taxes Matter?

- How does consumption respond to a change in a policy variable, like taxes?

- Depends on the kind of taxes are being cut?
  - Temporary income tax cut will have little effect on demand.
  - Temporary cut in *expenditure* taxes e.g. sales tax will encourage consumers to bring forward spending (intertemporal substitution of consumption).

Including The Government

- Economic Environment: 2 periods
- Suppose further that each period, the government collects taxes, T, and spends G.
- Question: Write out the flow budget constraints for the consumer and the government!
  - Hint: If G does not equal T in period 1, then the government can issue debt, D!
- Question: Write out the present value budget constraint for both the consumers and the government

Ricardian Equivalence

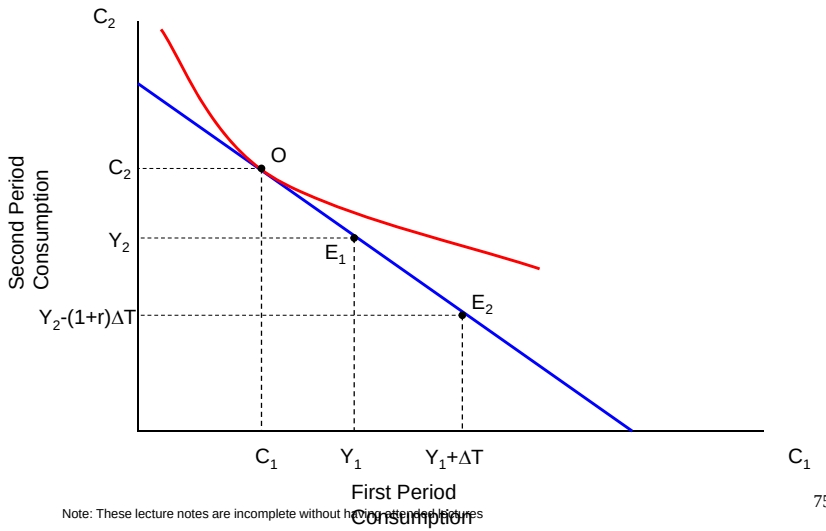
Add taxes: $C_1=C[r,(Y_1-T_1)+(Y_2-T_2)/(1+r)]$

Government Budget Identity:

$$\left.\begin{aligned} D&=G_1-T_1 \\ T_2&=(1+r)D+G_2 \end{aligned}\right\} \Rightarrow T_1+\frac{T_2}{1+r}=G_1+\frac{G_2}{1+r}$$

- Hence: $C_1=C[r,(Y_1-G_1) + (Y_2-G_2)/(1+r)]$
- Thus the time profile of taxes do not matter. (Also known as "ultra-rationality" or "**debt neutrality**".)

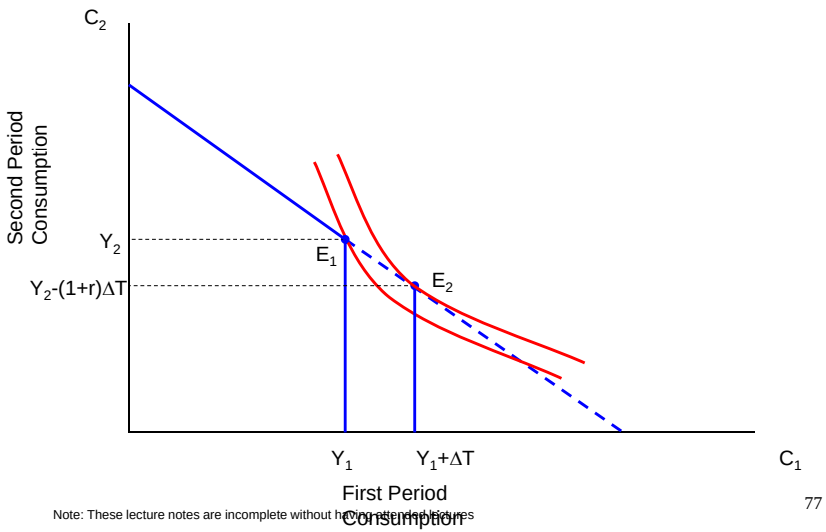
A Debt-Financed Tax Cut



Breaking Ricardian Equivalence

- **Myopia**: People are short sighted and do not internalize government budget identity.
- **Borrowing Constraints**. Debt financed tax cut today may relax borrowing constraint.
- **Future Generations**. If future generations pay the taxes, then present generation are better off. However, if they care about future generations, then present generation may increase their bequests and Ricardian Equivalence is re-established (Barro).

Debt-Financed Tax Cut: Borrowing Constraints



Summing up

- Keynes: consumption depends primarily on current income.
- Recent work: consumption also depends on
  - expected future income
  - wealth
  - interest rates
- Economists disagree over the relative importance of these factors, borrowing constraints, and psychological factors.

Summary

- Utility Maximization:
  - Consumers maximize utility subject to a budget constraint
  - Optimal consumption choice is represented by the Consumption Euler equation, where the MRS = Intertemporal Price
- Life Cycle Hypothesis suggests that households smooth consumption over their lifetime.
  - Goes towards explaining the consumption puzzle of a low C/Y ratio for cross-sectional data and a higher C/Y ratio for time series data
- Permanent Income Hypothesis suggests households consume out of permanent income

Summary

- If Permanent Income equals the annuity value of your lifetime wealth, then PIH and LCH are the same
- Incorporating uncertainty about future income with PIH yields the implication that consumption follows a random walk process.
- Ricardian Equivalence would suggest that the time profile of taxes do not matter
  - Breaks down with myopic households, borrowing constraints, and without intergenerational equity