



A.Y. 2025/2026



HANDOUTS

MACROECONOMICS (MODULE 2) -SECOND PARTIAL-

WRITTEN BY

ALICE ELLISTON



TEACHING DIVISION

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This handout is written by students and is not intended to replace university materials.

It is a useful tool for studying the subject, but it does not guarantee the same comprehensive and complete preparation for passing the exam as the materials recommended by the University.

The content may contain errors and has not been reviewed or approved in any way by the instructors. It is recommended that it be used as a supplementary resource, in conjunction with the official sources and materials indicated in the exam syllabus.





- expectations

- people modify behaviour accordingly
- key in determining the impact of policies

↳ Exchange: Demand/Supply

goods are financial products (money)

- The role of expectations in financial markets

- Determination of prices of assets

- Yield curve (interest rate) → use it to forecast future

- Stock prices

how expectations change overtime

↳ share of company

- Part 1

- EXPECTED PRESENT DISCOUNTED VALUE (EPDV) → how much is today a value related to the future and is discounted

- Bond prices and Bond Yields: intro

if I postpone my consumption, I want more (interest)

We prefer to consume today! Same amount tomorrow should be discounted, value will be less.

- Part 2:

- Bond prices for different maturities
- Bonds' Yields (to maturity)

- Part 3:

- Yield curve
- Yield curve with risk aversion

EXPECTED PRESENT DISCOUNTED VALUE of a sequence of future payments =

value today of this expected sequence of payments

not directly observable ⇒ expectations !! (depends on our expectations)

What do you get if you lend 1€ today for 1 year?
What is the amount you have to pay if you borrow 1€ today?

today: t

1 year from now: $t+1$

$$1€ \longrightarrow 1 \cdot (1 + i_{1,t}) € = 1 + i_{1,t} €$$

↓

amount I get today

today interest rate related to a product that will be repaid 1 year in the future

$i_{1,t} \equiv$ one-year interest rate (from t to $t+1$)

Since I cannot consume today, I want to get more

What is the value **TODAY** of 1€ received in $t+1$?

today: t

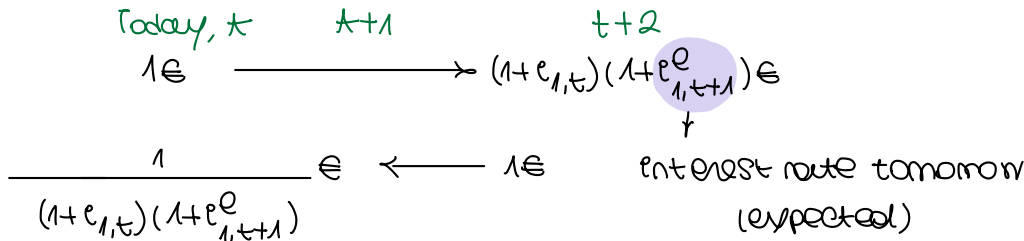
1 year from now: $t+1$

$$1€ \longrightarrow 1 + i_{1,t} €$$

$$\frac{1}{1 + i_{1,t}} \longleftarrow 1€$$

$$\frac{1}{1 + i_{1,t}}$$

And what if that € is received two years from now ($t+2$)?



↓
expected present
discount value

$i_{1,t+1}^e \equiv$ one-year interest rate (from $t+1$ to $t+2$) we expect will prevail in $t+1$

Note: If constant interest rate, the PDV is simply $\frac{1}{(1+i)^2}$

EPDV of a sequence of (future) payments €:

$$E_r t = \underbrace{€ z_t}_{\text{expected present discounted value of today payment (t)}} + \underbrace{\frac{€ z_{t+1}^e}{1+i_{1,t}}}_{\text{expected present discounted value of a payment tomorrow (t+1)}} + \underbrace{\frac{€ z_{t+2}^e}{(1+i_{1,t})(1+i_{1,t+1}^e)}}_{\text{expected present discounted value of a payment day after tomorrow (t+2)}} + \dots$$

Timeline for the third term:

t to $t+1$: $(1+i_t)$
 $t+1$ to $t+2$: $(1+i_{t+1}^e)$
 $t+2$ to $t+3$: $(1+i_{t+2}^e)$

Expectations allow me to move from future to PRESENT
 move from FUTURE to PRESENT $\Rightarrow$ expectations!

• The EPDV depends:

- **positively** on future expected payments
- **Negatively** on current and future expected interest rates

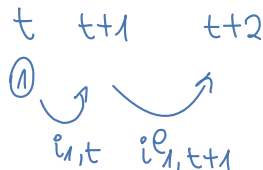
Timeline for interest rates:

t : $\frac{1}{(1+i_t)(1+i_{t+1}^e)}$
 $t+1$: $\frac{1}{1+i_{t+1}^e}$
 $t+2$: $\frac{1}{1}$

Timeline for payments:

t : $\frac{1}{1+i_t}$
 $t+1$: $\frac{1}{1+i_{t+1}^e}$ (labeled "1€ tomorrow")
 $t+2$: $\frac{1}{1}$

If i^e today you are poorer (lower value today) $\rightarrow$ expect to be poorer
 look at policy and worried about future interest rate
 $\rightarrow$ Bond is a promise of payment



Bond prices and Bond yields

Pay today to get more money in the future

• Real world: many bonds!

Differences in terms of: **Risk**, **Issuer**, **Maturity**, **Structure of payments**

Issuer:

- government bond
- corporate bond

Structure of payments

• Coupon bonds



- multiple payments before maturity (coupon)
- payment at maturity (face value)

o Discount bond

- payment at maturity (face value)

RISK

o Default risk

- ⇒ risk that the issuer do not pay the full amount promised
- Junk bonds: bonds with high risk of default

o Price risk

- ⇒ UNCERTAINTY about the price if you resell the bond BEFORE maturity

Risk premium!

ROLE OF RATING AGENCIES



spread $\neq$ interest rate paid between Germany (considered very safe) and Italy
Government Bonds' Ratings → it is a suggestion (expectations)

	Moody's ratings [★]	S&P ratings [★]	Fitch ratings [★]
United States [★]	Aaa	AA+	AAA
United Kingdom [★]	Aa2	AA	AA
Germany [★]	Aaa	AAA	AAA
France [★]	Aa2	AA	AA
Japan [★]	A1	A+	A
Spain [★]	Baa1	A-	A-
Italy [★]	Baa3	BBB	BBB
Portugal [★]	Baa3	BBB	BBB
Greece [★]	B1	B+	BB-

→ very safe

→ cease to be junk bonds
 (during crisis)

Maturity

Length of time over which the bond promises to make payments to the holder

- o Different maturity ⇒ different prices ⇒ different returns

Yield (to maturity) of an n-year bond (n-year interest rate)

≡

Interest rate associated with a bond with maturity n years
 (average annual interest rate paid by the bond)

→ from 1 month to 30 years

o Focus on MATURITY

- assume no risk! (risk premium = 0)

Term structure of interest rates or yield curve

the relation between maturity and yield

It contains useful information about people's expectations

ECB YIELDCURVE

relation maturity-yield

info about people's expectations → we can predict the future

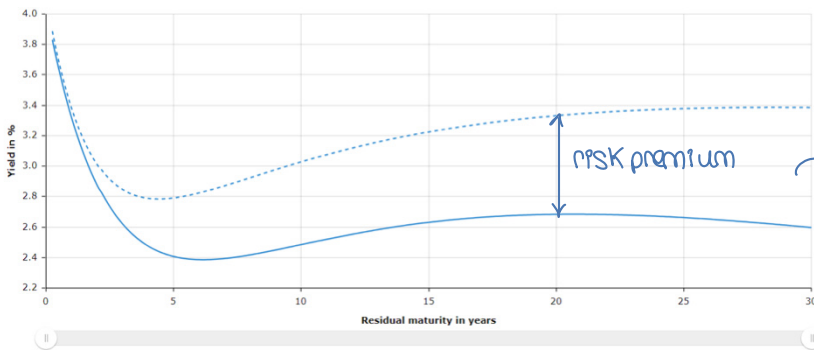


19 March 2024

AAA rated bonds All bonds Select maturity

Spot rate Instantaneous forward Par yield

Curve Yields Parameter



YIELD: avg interest rate paid on my bonds

→ evolution of expectations of prices (what agents expect)

difference two risk curves (risky and riskless bonds)

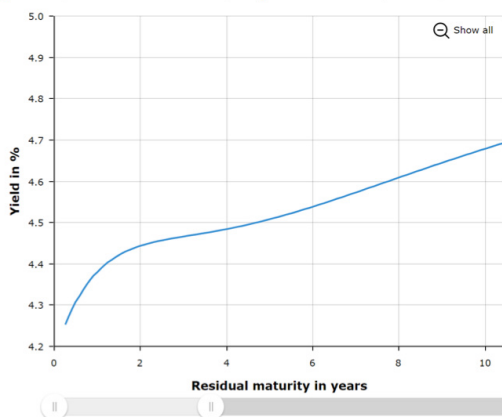
Yield curve collapse of Lehman Brothers

financial crisis

25 July 2008

AAA rated bonds All bonds Select maturity

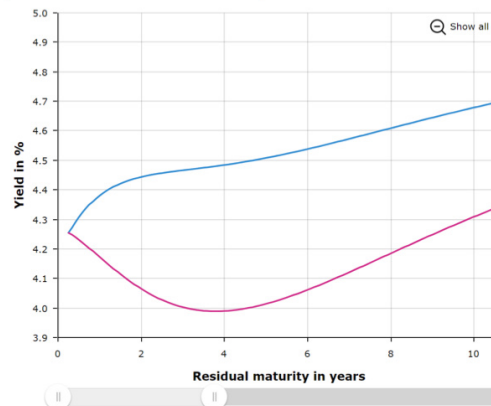
Spot rate Instantaneous forward Par yield Curve Yields Parameters



25 July 2008

AAA rated bonds All bonds Select maturity

Spot rate Instantaneous forward Par yield Curve Yields Parameters



people expect lower interest rate by CB.
o if we expect crisis

if slope is positive: expect tomorrow higher interest rate

expect a crisis: CB reacts decreasing interest rate

$\downarrow r \Rightarrow \uparrow I \Rightarrow \uparrow Z$

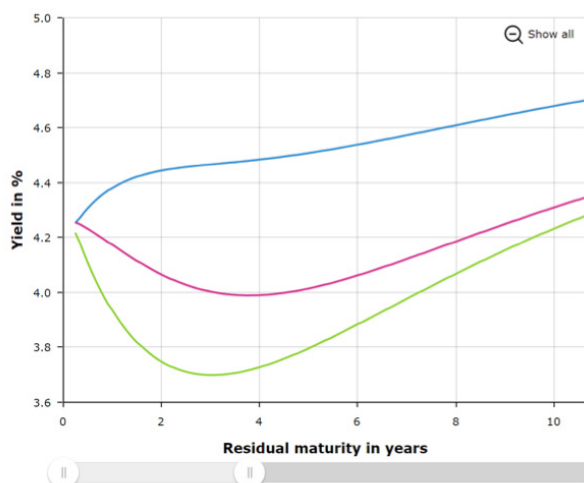
25 July 2008

25 August 2008

16 September 2008

AAA rated bonds All bonds Select maturity

Spot rate Instantaneous forward Par yield Curve Yields Parameters



expect deeper crisis
 $\Rightarrow$ lower r

YIELD curve related to expectations
what agents expect about future

o negative slope: expect lower YIELD (r_t)

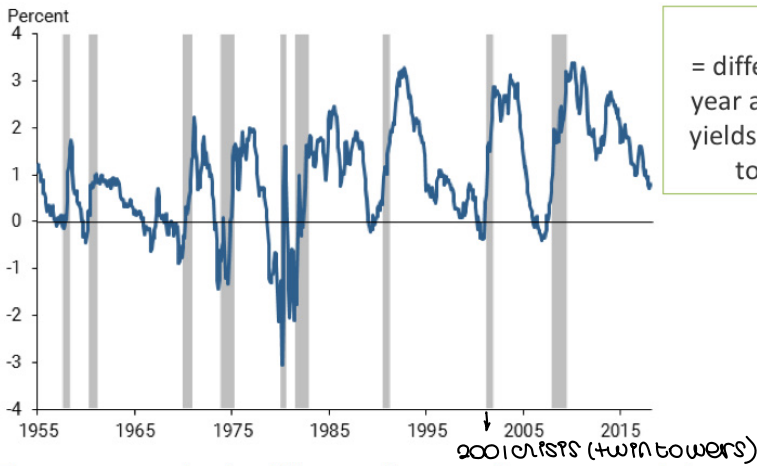
But we are not expecting a crisis.

Goal 2% inflation rate: now it's 3%

we expect CB $\downarrow r$ since today r is lower compared to 2 years ago

Agents expect $\downarrow r$ in future, expect CB $\downarrow r$ because we are close enough to TARGET inflation rate

THE TERM SPREAD AND RECESSION



term spread
= difference between 10-year and 1-year Treasury yields from January 1955 to February 2018

Use yield curve to predict crisis

≠ SR expectations and long run expectation

shadow area all crisis before crisis we have a drop in our expectations (expect lower interest rate)

The term spread—the difference between long-term and short-term interest rates—is a strikingly accurate predictor of future economic activity.
every U.S. recession in the past 60 years was preceded by a negative term spread, that is, an inverted yield curve.

Bond Prices and Bond Yields

Aim Lecture 19

- 1) Derive bond prices for $\neq$ maturities
- 2) Derive bonds' yields and the yield curve
- 3) Yield curve with risky assets

419 Part 2 (03, ch15) Financial Markets and Expectations : BOND PRICES and BOND YIELDS

Part 2

- Bond prices for $\neq$ maturities
- Bonds' yields (to maturity)

BOND PRICES for different maturities

BOND PRICES AS PRESENT VALUES

- o Consider 2 bonds:
 - face value = 100€ $\Rightarrow$ how much I get at maturity
 - discount bonds
 - No risk $\Rightarrow$ get all the money
 - Different maturity
 - o 1-year bond (maturity = 1 year from now) get 100€ next year
 - o 2-year bond (maturity = 2 years from now)
- o what is the price of these two bonds?

Interest is between t and $t+1$

Bonds can have $\neq$ length $\rightarrow$ YIELDING interest rate related to MATURITY of the bond!



BOND PRICES AS PRESENT VALUES

- $\text{€}P_{1,t}$ $\equiv$ price of bond with maturity 1 year
- $\text{€}P_{2,t}$ $\equiv$ price of bond with maturity 2 years

Price as expected present discount value of the payment at maturity

One-year bond

Discounted value = Pays 100€ in $t+1$
 Present value of bond = Get 100€ next year
 ◦ PDV of its face value

$$\text{€}P_{1,t} = \frac{100}{1 + i_{1,t}} \text{€}$$

discount face value by interest rate

Two-year bond

Pays 100€ in $t+2$

$$\text{€}P_{2,t} = \frac{100}{(1 + i_{1,t})(1 + i_{1,t+1}^e)} \text{€}$$

discount for two periods

why? $\text{€}P_{2,t} = \text{A.O. the PDV}$

Let's use another approach to derive the price of a 2-year bond

ARBITRAGE CONDITION

the expected returns of the two assets must be equal

Both in the market! you can buy and trade both of them

- assume you are interested in the amount of € you get one year from now (risk neutral)
 - which bond are you buying?
 - Empirical observation: both types of bonds are traded
- $\Rightarrow$ the two bonds must offer the same expected one-year return

BOND PRICES: Arbitrage condition

Compare the one-year return of the two assets:

today: t 1 year from now: $t+1$ next year, 2-year bond is a 1-year bond

Bond 1: 1-year bond
 1€ $\xrightarrow{1 + i_{1,t}}$ $(1 + i_{1,t}) \text{€}$
 ↓
 Price 1 year bond
 ① $\text{€}P_{1,t+1}$
Bond 2: 2-year bond
 ① $\text{€}P_{2,t}$ $\xrightarrow{\text{value of this}}$ $\text{€}P_{1,t+1}$
 ◦ quantity of 2-year bonds I can buy with 1-year bond

If $(1 + i_{1,t}) < \frac{\text{€}P_{1,t+1}}{\text{€}P_{2,t}} \Rightarrow$ buy bond 2 $\Rightarrow \text{€}P_{2,t} \uparrow \Rightarrow$ expected return on 2-year bond ↓

If $(1 + i_{1,t}) > \frac{\text{€}P_{1,t+1}}{\text{€}P_{2,t}} \Rightarrow$ buy bond 1 $\Rightarrow \text{€}P_{2,t} \downarrow \Rightarrow$ expected return on 2-year bond ↑

Both bonds traded only if the expected one-year return is the same!

$$(1 + i_{1,t}) = \frac{\text{€}P_{1,t+1}}{\text{€}P_{2,t}} \Rightarrow \text{€}P_{2,t} = \frac{\text{€}P_{1,t+1}}{1 + i_{1,t}}$$

◦ what is the price of a one-year bond in $t+1$?

$$\text{€}P_{1,t+1}^e = \frac{\text{€}100}{1 + i_{1,t+1}^e}$$

◦ substituting:

$$\text{€}P_{2,t} = \frac{\text{€}100}{(1 + i_{1,t})(1 + i_{1,t+1}^e)}$$



Arbitrage implies that the price of a 2-year bond is the expected present discounted value of the payments promised

Analogously, we can derive the price of 3-year, 4-year, ..., n-year bonds

Price bond as expected present discounted value

$$\begin{array}{ccc} t & t+1 & t+2 \\ & \frac{100}{(1+i_{1,t})(1+i_{1,t+1}^e)} & 100 \end{array}$$

Price depends on interest rates, that one $\neq$

moving over time a promise of payment

$$\begin{array}{ccc} t & t+1 & t+2 \\ \frac{100}{(1+i_{1,t+1}^e)(1+i_{1,t})} & \frac{100}{1+i_{1,t+1}^e} & 100 \end{array}$$

$\frac{P_{1,t+1}^e}{1+i_{1,t}}$ $\frac{P_{1,t+1}^e}{1+i_{1,t+1}^e}$ $i_{1,t+1}^e$

$$\begin{aligned} \text{€ } P_{2,t} &= \frac{100}{(1+i_{1,t})(1+i_{1,t+1}^e)} = \frac{P_{1,t+1}^e}{1+i_{1,t}} \cdot \frac{100}{1+i_{1,t+1}^e} \\ &\quad \begin{array}{cc} t+1 \rightarrow t & t+2 \rightarrow t+1 \end{array} \end{aligned}$$

$$= \frac{100}{(1+i_{2,t})^2}$$

arg interest rate applied on a 2-years bond today

$$\text{€ } P_{3,t} = \frac{100}{(1+i_{1,t})(1+i_{1,t+1}^e)(1+i_{1,t+2}^e)} = \frac{100}{(1+i_{3,t})^3}$$

$$(1+i_{1,t})(1+i_{1,t+1}^e) = (1+i_{2,t})(1+i_{2,t})$$

Bonds' yields

from bond prices to BOND YIELDS

YIELD (to maturity) of a n-year bond [n-year interest rate]

Constant annual interest rate that makes the price of the bond TODAY = to the expected present value of future payments promised

example: 2-year bond

$i_{2,t} \equiv$ yield (to maturity) or 2-year interest rate

$$\text{€ } P_{2,t} = \frac{\text{€ } 100}{(1+i_{2,t})^2}$$

o If $\text{€ } P_{2,t} = 90 \text{ €}$

$$\Rightarrow (1+i_{2,t})^2 = \frac{100}{90}$$

$$\Rightarrow i_{2,t} = 5.4\%$$

YIELD to maturity

example: a 2-year bond

YIELD definition

$$\text{€ } P_{2,t} = \frac{\text{€ } 100}{(1+i_{2,t})^2}$$

Bond price definition

$$\text{€ } P_{2,t} = \frac{\text{€ } 100}{(1+i_{1,t})(1+i_{1,t+1}^e)}$$



THEY MUST BE EQUAL

$$(1+i_{2t})^2 = (1+i_{1t})(1+i_{1t+1}^e)$$

taking logs: $2\ln(1+i_{2t}) = \ln(1+i_{1t}) + \ln(1+i_{1t+1}^e)$
 approximating: $2i_{2t} \approx i_{1t} + i_{1t+1}^e$

$$i_{2t} \approx \frac{i_{1t} + i_{1t+1}^e}{2}$$

i_{2t} is approximately the average
 between current and future expected
 one-year interest rate

Long-term interest rates reflect current and future EXPECTED

short-term interest rates

generalizing: $i_{nt} \approx \frac{i_{1t} + i_{1t+1}^e + i_{1t+2}^e + \dots + i_{1t+n-1}^e}{n}$

Conclusion:
 • Bond prices for different maturities
 • Bonds' yields

Part 3

way to predict future
 - yield curve
 - risk aversion and the yield curve



YIELD curve: negative slope $\rightarrow$ expected interest rate decreases
 agents expect lower i next year
 i declining over time $\rightarrow$ expect CB to $\downarrow i$

Then positive slope:

agents today expect for the future higher interest rate

expect $\uparrow$ output growth
 $\uparrow$ inflation rate } $\Rightarrow$ CB $\uparrow i$

low i , reduce opportunity to affect economy through monetary policy

YIELD depends on expectations, that affect PRICE of BONDS

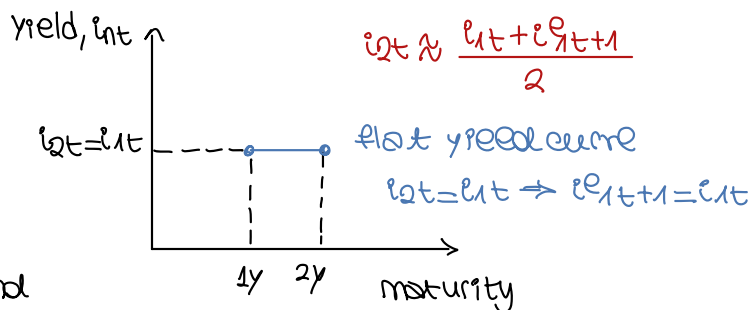
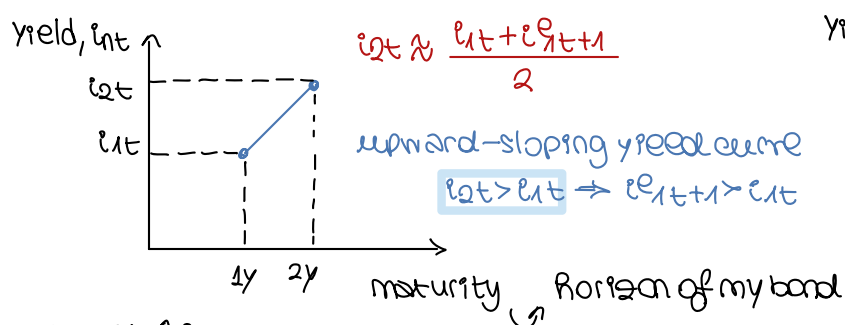
change expectations of future interest rate in USA after trump election

- yield curve

YIELD CURVE and RISK

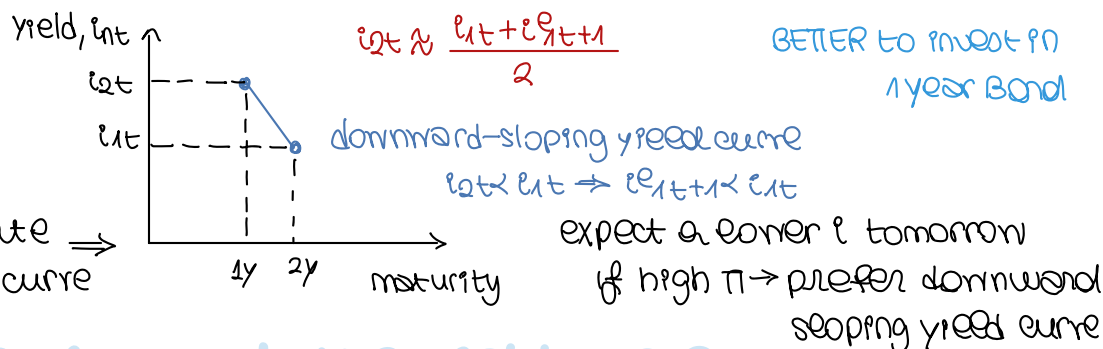
- yield curve with risk aversion

yield curve

expect $\uparrow i$ expected $i >$ actual i

prefer positive slope,

if you are in a recession

High GDP growth rate $\Rightarrow$
prefer flat yield curve

Risk aversion and the yield curve

Introduction

o 1-year bond: NO RISK

- we know with certainty the amount received 1 year from now (face value)

o 2-year bond: RISKY

- we don't know for sure the amount we can get 1 year from now

- uncertainty over the price of the bond 1-year from now

- RISK premium $\times$

ARBITRAGE condition without risk

o if RISK NEUTRAL? $1 + i_{1t} = \frac{E P_{1t+1}}{P_{1t}}$ return 1 year bond $\approx$ o if not risk neutral, under this condition, no one will buy the 2-year bond
o the expected return on a 2-year bond must be higher!- risk premiumreturn of 1 year
of 2 years' bond

risk neutral means

indifferent between buying
a risky and riskless bond $\downarrow$
provide higher return

$$1 + i_{1t} + x = \frac{E P_{1t+1}}{P_{1t}}$$

o expected one-year return on a 2-year bond

- return on a 1-year bond +

- risk premium x 1-year bond are not risky,
you know i of today

$$E P_{2t} = \frac{E P_{1t+1}}{1 + i_{1t} + x}$$

price will be lower

get more money, since I am assuming a **risk**!



consider: $\mathbb{E}P_{1t+1}^e = \frac{\mathbb{E}100}{1 + \mathbb{E}i_{1t+1}^e}$

Price as expected present discounted value: $\mathbb{E}P_{2t} = \frac{\mathbb{E}100}{(1 + \mathbb{E}i_{1t} + x)(1 + \mathbb{E}i_{1t+1}^e)}$

using the definition of yield to maturity: $\mathbb{E}P_{2t} = \frac{\mathbb{E}100}{(1 + \mathbb{E}i_{2t})^2}$

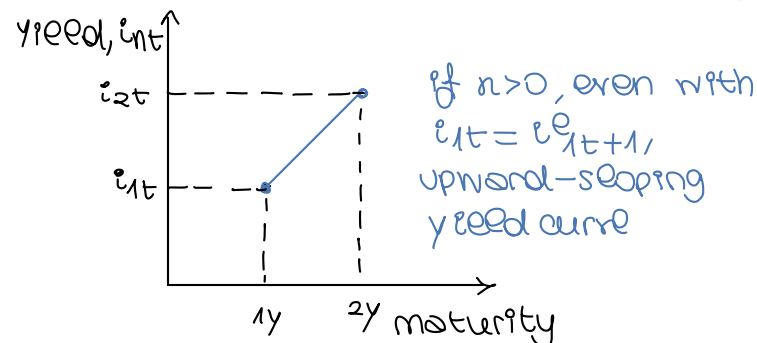
YIELD definition = expected discount value

$$\frac{\mathbb{E}100}{(1 + \mathbb{E}i_{2t})^2} = \frac{\mathbb{E}100}{(1 + \mathbb{E}i_{1t} + x)(1 + \mathbb{E}i_{1t+1}^e)}$$

$$(1 + \mathbb{E}i_{2t})^2 = (1 + \mathbb{E}i_{1t} + x)(1 + \mathbb{E}i_{1t+1}^e)$$

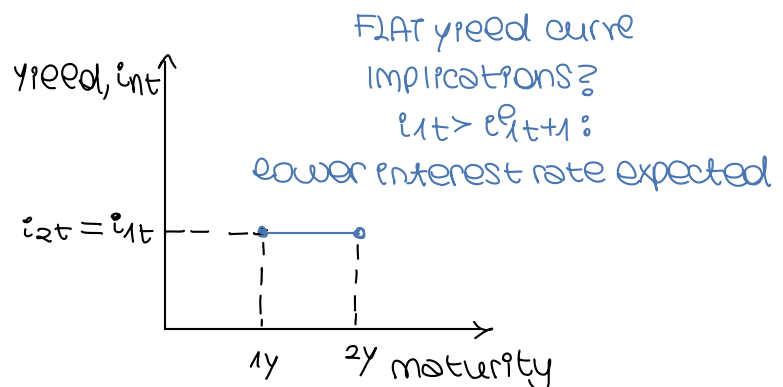
$$\mathbb{E}i_{2t} \approx \frac{\mathbb{E}i_{1t} + \mathbb{E}i_{1t+1}^e + x}{2}$$

Yield curve with risk



YIELD CURVE: interpretation

- Provides information about people's expectations
- Interpreting the yield curves
 - slope
 - position



If downward sloping?

Expected future interest rate is so low that it should compensate x

long run: increase yield curve

longer horizon, riskier bonds. Bonds with longer maturity → higher risk premium

Conclusion

- Bond prices for different maturities
- Bonds' yields
- Yield curve (without and with risk)



stock prices as a
function of expectations

DETERMINATION of STOCK PRICES

Down Jan → index US stock markets → before and after 6th Nov
Stock prices deeply depend on expectations

Introduction

How do firms finance their activities

◦ Internal finance ⇒ earnings

◦ external finance

— Debt

◦ Bank loans

◦ Corporate bonds

— Equity

◦ Stock/shares ⇒ participation to firms' equity
sell shares of my capital

stock prices

STOCKS

◦ participation to firms' equity

◦ Pay DIVIDENDS in an amount decided by the firm

— participation to firms' PROFITS

change profits ⇒ change stock prices

COVID affected stock market

STOCK MARKET - FTSE MIB (ITA)

Market Summary > FTSE MIB

24,562.08

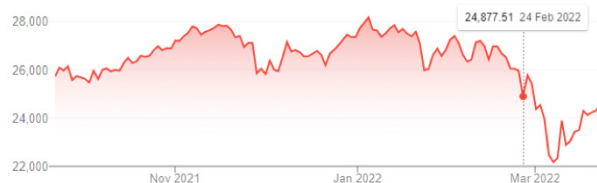
-1,179.70 (-4.59%) ↓ past 6 months

Mar 22, 10:20 GMT+1 • Disclaimer

INDEXBIT: FTSEMIB

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1D 5D 1M 6M YTD 1Y 5Y Max



STOCK PRICES

1) $ED_{t+1}^e \equiv$ expected future DIVIDEND

2) $EQ_t \equiv$ PRICE of a stock in t

ex-dividend price: after the payment of current period dividend

3) $EQ_{t+1}^e \equiv$ expected future PRICE of the stock

◦ stock prices = expected present discounted value of future payments

◦ stock are **RISKY** assets!

same idea Bonds ↗

↳ deeply depends on our expectations

assume you want to invest 1€ for 1 year

have 1€ can invest in 1-year bond or a stock: 2 options

return should be EQUAL, since both are traded in the market

Returns from holding 1-year bonds or stocks for 1 year

	t		$t+1$ → know how much you will get	
1-year bond	1€	→	$(1+r_{1t})€$	
stock	1€	→	$\frac{ED_{t+1}^e + EQ_{t+1}^e}{EQ_t}$	in 1 year you can sell stock, so depends in expected future price ↳ expected return → unknown, depends on expectations

Which asset do you prefer?

◦ Empirical observation: BOTH TRADED

ARBITRAGE condition: expected return must be the same

Note: stocks are RISKY assets. Investors ask for a risk premium, $\times$!



$$\frac{\mathbb{E}D_{t+1}^e + \mathbb{E}Q_{t+1}^e}{\mathbb{E}Q_t} = \underbrace{1 + i_{1t}}_{\text{Return of a risk-free bond}} + \underbrace{x}_{\text{risk premium}}$$

expected return of a stock

solving for $\mathbb{E}Q_t \dots$ STOCK PRICE

expected PDR of future payments

$$\mathbb{E}Q_t = \frac{\mathbb{E}D_{t+1}^e + \mathbb{E}Q_{t+1}^e}{1 + i_{1t} + x}$$

BUT... what are the determinants of the future

expected price we expect will prevail in $t+1$?

- o future price as expected PDR of future (expected) payments: $\mathbb{E}Q_{t+1}^e = \frac{\mathbb{E}D_{t+2}^e + \mathbb{E}Q_{t+2}^e}{1 + i_{1t+1}^e + x}$
- o Substituting in $\mathbb{E}Q_t$: $\mathbb{E}Q_t = \frac{\mathbb{E}D_{t+1}^e}{1 + i_{1t} + x} + \frac{\mathbb{E}D_{t+2}^e + \mathbb{E}Q_{t+2}^e}{(1 + i_{1t} + x)(1 + i_{1t+1}^e + x)}$

But... what determines $\mathbb{E}Q_{t+2}^e$?

o Repeating the intuition, we can write:

$$\mathbb{E}Q_t = \frac{\mathbb{E}D_{t+1}^e}{1 + i_{1t} + x} + \frac{\mathbb{E}D_{t+2}^e}{(1 + i_{1t} + x)(1 + i_{1t+1}^e + x)} + \dots + \frac{\mathbb{E}D_{t+n}^e + \mathbb{E}Q_{t+n}^e}{(1 + i_{1t} + x)(1 + i_{1t+1}^e + x) \dots (1 + i_{1t+n-1}^e + x)}$$

o For n high enough, $\mathbb{E}Q_{t+n}^e$ becomes irrelevant: $\rightarrow$ moving to the future, this

will go to zero

$$\mathbb{E}Q_t = \frac{\mathbb{E}D_{t+1}^e}{1 + i_{1t} + x} + \frac{\mathbb{E}D_{t+2}^e}{(1 + i_{1t} + x)(1 + i_{1t+1}^e + x)} + \dots + \frac{\mathbb{E}D_{t+n}^e}{(1 + i_{1t} + x)(1 + i_{1t+1}^e + x) \dots (1 + i_{1t+n-1}^e + x)}$$

The stock price is the expected PDR of future expected dividends

After Trump elected: expect higher dividends for Tesla, changed expectations

In real terms: $Q_t = \frac{D_{t+1}^e}{1 + r_{1t} + x} + \dots + \frac{D_{t+n}^e}{(1 + r_{1t} + x) \dots (1 + r_{1t+n-1} + x)}$

Implications:

- higher expected future real dividends lead to a higher real stock price: $D^e \uparrow \Rightarrow Q_t \uparrow$
- higher current and expected future one-year real interest rates lead to a lower real stock price: $r \uparrow \Rightarrow Q_t \downarrow$

(stock market depends on the real interest rate)

- a higher risk premium leads to a lower stock price $x \uparrow \Rightarrow Q_t \downarrow$

Dividends discounted also for the risk premium component

MP can affect money stock price, if changes actual or expected interest rate

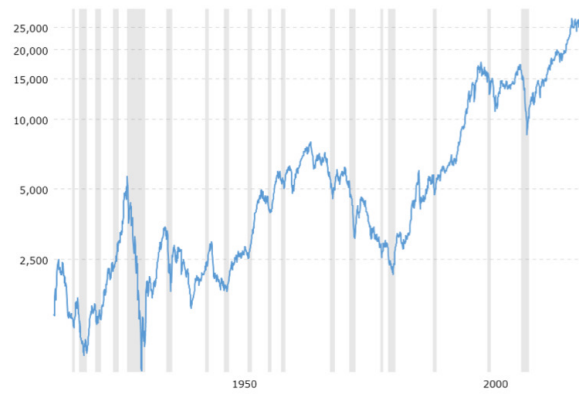
Summary

- o stock prices as expected present discounted value of future payments
- o stock prices are influenced by:
 - current economic conditions
 - expected future economic developments

The stock market and the economy

DOW JONES INDUSTRIAL AVERAGE (DJIA)

stock market index



For the most part, major movements in stock prices are unpredictable

Introduction

stock prices are largely unpredictable

o A good sign of a well-functioning stock market

- correct incorporation of market expectations
- immediate adjustment to any current and future changes in economic prospects
- a signal of expectations

o "What if...?" questions

- analysis of possible impacts of economic shocks/policies on the stock market

A MONETARY CONTRACTION ($\uparrow r$)

In period t the CB reduces M / increases r

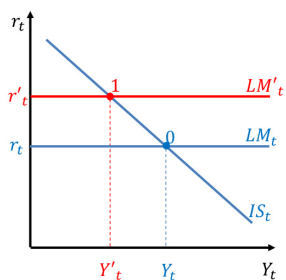
o What is the impact on the stock market?

case 1) unexpected MP (surprise!)

case 2) expected MP expected $e \rightarrow$ no change r

1) a monetary contraction: surprise!

$\uparrow r$: $\downarrow$ investments $\rightarrow \downarrow Z \rightarrow \downarrow GDP \rightarrow \downarrow$ output



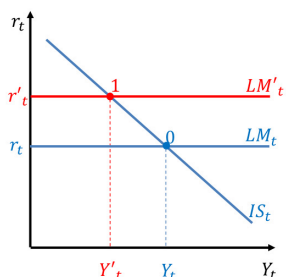
In t : $r \uparrow, Y_t \downarrow$

future? assume no other changes expected

completely unexpected $r \uparrow \Rightarrow Q \downarrow$ $Q_t \downarrow$

The economy today: period t

1) a monetary contraction: expected



In t : $r \uparrow, Y_t \downarrow$

future? assume no other changes expected

fully anticipated/expected $\Delta Q_t = 0$



no variation stock price

Price incorporates expected change discounted in the past the future price (decrease price before)

Announcement of a policy

- In period t the CB announces a monetary contraction to be performed in $t+1$
- What is the impact on the stock market?
 - assume no impact on y and r today
 - the announcement was not expected
 - $r_{t+1} \uparrow \Rightarrow y_{t+1} \downarrow$

Is the CB credible?

Not credible

- agents believe that the (MP) policy will not be implemented
- No change expected
 - $\Delta Q_t = 0$: constant stock price

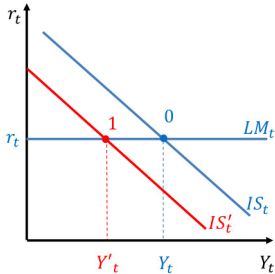
credible

- change in expectations: $y^e \downarrow$; $r^e \uparrow$
- $Q_t \downarrow$! (today price decreases)
- stock prices change, even if nothing happens today !

A demand shock in t

- In t , negative demand shock
- assume it is transitory: impact in t only
- What is the impact on the stock market?
- The answer depends on the expectations about the reaction of economic authorities!
 - case 1) expect the CB keeps r unchanged
 - case 2) expect the CB reacts to keep y unchanged

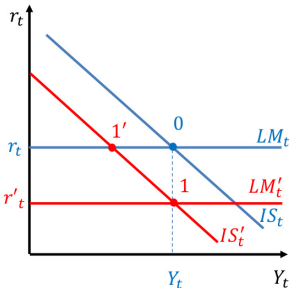
1) Demand shock, constant r



- expectations: CB keeps constant the interest rate
- In t : $r_t =$, $y_t \downarrow$
- $\Delta Q_t = 0$

The economy today: period t

2) Demand shock, CB keeps y constant



- expectations: CB keeps constant the GDP level $\Rightarrow r \downarrow$
- In t : $r_t \downarrow$; $y_t =$ $Q_t \uparrow$
- $\downarrow$ profits, $\downarrow$ dividends today, BUT
- Q_t depends only future expected dividends

Summary

- stock prices as expected present discounted value of future payments
- stock prices are influenced by:
 - current economic conditions
 - expected future economic developments
- Reaction of stock prices depends on:
 - expectations
 - source of the shock
 - credibility of economic policy authorities



Introduction

Standard model (1st part of the course)

consumption depends on DISPOSABLE INCOME $C = C(Y - T)$

Model theory of consumption

- permanent theory of consumption (Friedman)
- Life cycle theory of consumption (Modigliani)
- ⇒ consumer take into account expectations on future income

Introduction

Part 1:

- Intertemporal budget
- Optimal consumption program

The very foresighted consumer

Consumption smoothing assumption

- every year, she/he consumes a fraction of her/his total wealth
- $C_t = c(\text{total wealth})$

total wealth_t

- present discounted value of life-time income
- ↳ look at the future

human wealth

- expected PV of after-tax income over working life
- what you gain (after tax-wage)

Non-human wealth:

- Financial wealth: net value of asset holdings (assets - liabilities)
- Housing wealth: value of house (- mortgage)

add time, so add future

GF ch4, Q7 point a) micro-foundation

assumptions (to derive model to describe INTERTEMPORAL CONSUMPTION CHOICES)

- Two periods: present (t) and future ($t+1$)
- Utility function: $U(C_t, C_{t+1})$
 - increasing and concave in the two arguments
 - prefer to split consumption over time
- access to credit market: interest rate r → can ask money to bank (loan)
- Disposable income: You need to satisfy intertemporal budget constraint
- Present: $Y_t - T_t$
- future (expected): $Y_{t+1}^e - T_{t+1}^e$
- non-human wealth, $NFH_t = 0$



- Write the budget constraint in each period
- Combine them into a SINGLE **intertemporal budget constraint**
- Draw it in a graph
- optimal 'present consumption / future consumption' program?
- What determines whether the individual is a borrower, a lender or a consumer exactly disposable income?

◦ Present, t $C_t + S_t = Y_t - T_t$

- $S > 0$: saver
- $S < 0$: borrower

◦ Future, $t+1$ $\rightarrow$ tomorrow disposable income

$$C_{t+1} = (Y_{t+1}^e - T_{t+1}^e) + (1+r)S_t$$

- $S_{t+1} = 0$ You have greed, prefer to consume everything $\rightarrow$ simplification

solve for S_t $\textcircled{S_t} = \underbrace{\frac{C_{t+1}}{1+r}}_{\text{actual present}} - \underbrace{\frac{Y_{t+1}^e - T_{t+1}^e}{1+r}}_{\text{discounted value}}$

link t and $t+1$ $\rightarrow$ 27

$$C_t + \frac{C_{t+1}}{1+r} - \frac{Y_{t+1}^e - T_{t+1}^e}{1+r} = Y_t - T_t$$

Intertemporal budget constraint

$$C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y_{t+1}^e - T_{t+1}^e}{1+r}$$

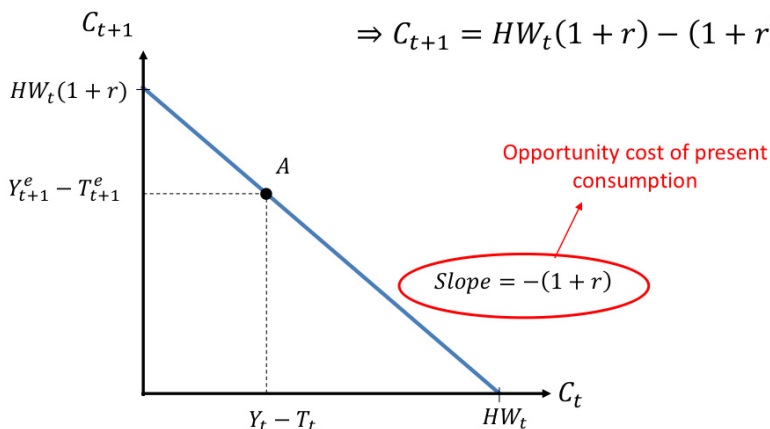
PD of consumption

PD of expected income
human wealth, HW_t

If I consume everything today, tomorrow I will not consume
Today consumption, in terms of tomorrow consumption

$$IBC: C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y_{t+1}^e - T_{t+1}^e}{1+r} = HW_t$$

$$\Rightarrow C_{t+1} = HW_t(1+r) - (1+r)C_t$$



utility function: preference C_t and C_{t+1}

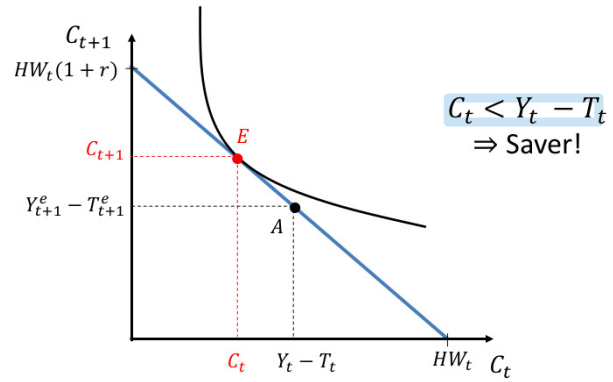
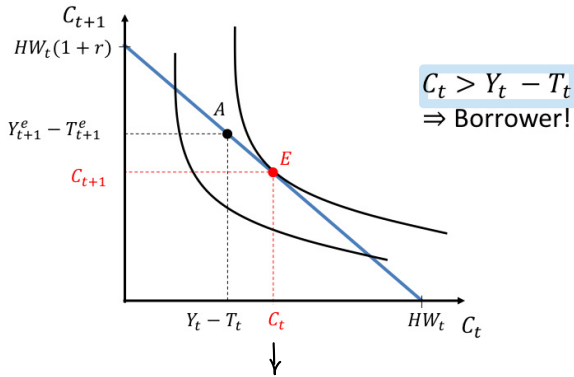
Optimal consumption program



$\neq$ IBC may be because $\neq r$

$$\text{IBC: } C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y_{t+1}^e - T_{t+1}^e}{1+r} = HW_t$$

$$\text{IBC: } C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y_{t+1}^e - T_{t+1}^e}{1+r} = HW_t$$



consumption today

higher than my DISPOSABLE income

I borrow money!

Tomorrow I will repay everything, so I will consume less to repay additional consumption

Tomorrow I will consume more

in t+1 savings = 0

consume less than disposable income

Saver or borrower?

Being a saver or a borrower depends on:

- o preferences $\rightarrow$ structure utility function
- o Disposable income today and tomorrow
- o The interest rate
 - opportunity cost of current consumption

$\uparrow r$ curve is steeper

consume less, since tomorrow I will get more money

$(YD - TD) \uparrow \Rightarrow$ today I have more money

and a share of added money, will be consumed today

$\uparrow r$ and you are a saver, total value DISPOSABLE income will be higher

Conclusion

- o Intertemporal budget constraint
- o Optimal intertemporal consumption choice

after covid, $\downarrow$ taxation

but people did not consume more and preferred to restore savings

Part 2

- what happens when disposable income changes?
- what happens when r changes?

In the reality this assumption doesn't hold if I am a BORROWER

Difficult to be borrower

- transitory and permanent shocks to disposable income
- changes in the interest rate r

GF, ch 4 Q7 point b)

intertemporal consumption choices

TEMPORARY INCREASE IN DISPOSABLE INCOME

o assume a transitory increase in disposable income:

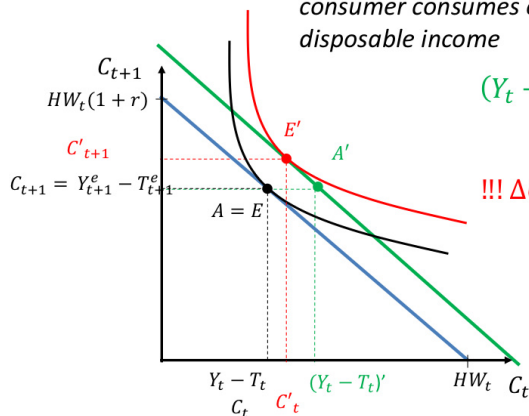
$$\Delta(Y_t - T_t) > 0$$

$$\Delta(Y_{t+1}^e - T_{t+1}^e) = 0$$

- Impact on consumption choices?

Temporary increase in disposable income

Assume that at the beginning the consumer consumes exactly disposable income



$$(Y_t - T_t) \uparrow \Rightarrow A'$$

$$C_t \uparrow; C_{t+1} \uparrow$$

$$!!! \Delta C_t < \Delta(Y_t - T_t) !!!$$

human wealth increases
consume more today
and more tomorrow

REDUCE TAXATION, overall consumption will increase

BUT less than the $\uparrow (Y_t - T_t)$ since people want to save

o transitory increase in disposable income

$$- C_t \uparrow; C_{t+1} \uparrow \quad (\text{save to consume more tomorrow})$$

$$- \Delta C_t < \Delta(Y_t - T_t)$$

consumption smoothing

o part of the current increase in income is saved to increase consumption tomorrow

IBC: today Disposable income + Discounted value of future Disposable income.

$$C_t \uparrow \quad C_{t+1} \quad \text{both increase}$$

↓

even if $\Delta(Y_t - T_t) = 0$

consume more today anticipating higher future disposable income

savings will be negative, I borrow

government: tomorrow ↓ taxation

and you want to anticipate a share of $(Y - T)$ to consume more today

shift budget constraint

prefer to share consumption

consumption depends on your preference

point b) INCREASE IN FUTURE DISPOSABLE INCOME

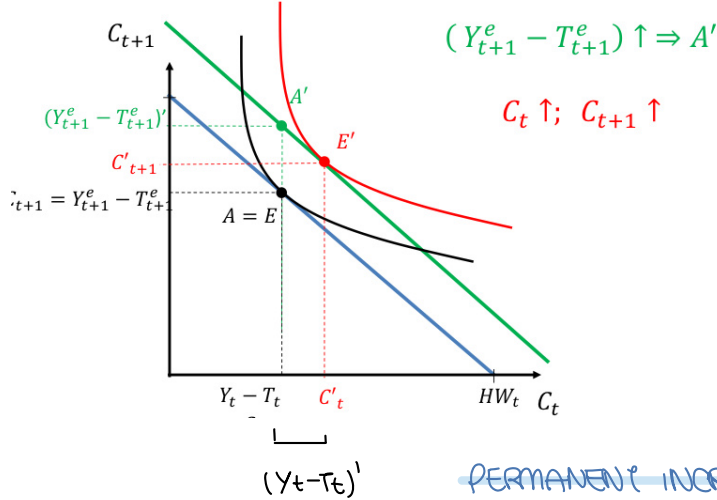
o assume an increase in future disposable income

$$- \Delta(Y_t - T_t) = 0$$

$$- \Delta(Y_{t+1}^e - T_{t+1}^e) > 0$$

Impact on consumption choices?

Assume that at the beginning the consumer consumes exactly disposable income



- increase in future disposable income:
 - $C_t \uparrow, C_{t+1} \uparrow$
 - $\Delta C_t > 0$ even if current disposable income is unchanged

Consumption smoothing!

- Consume more today anticipating higher expected future disposable income

PERMANENT INCREASE IN INCOME

- Assume $\Delta(Y_t - T_t) = \Delta(Y_{t+1}^e - T_{t+1}^e) > 0$
- Impact on consumption choices?
 - C_t and C_{t+1} increase
 - $\Delta C_t = \Delta C_{t+1} = \Delta(Y - T)$

Consumption and expectations

Current consumption depends positively on:

- current disposable income
- expected future disposable income

$$C_t = C(HW_t) +$$

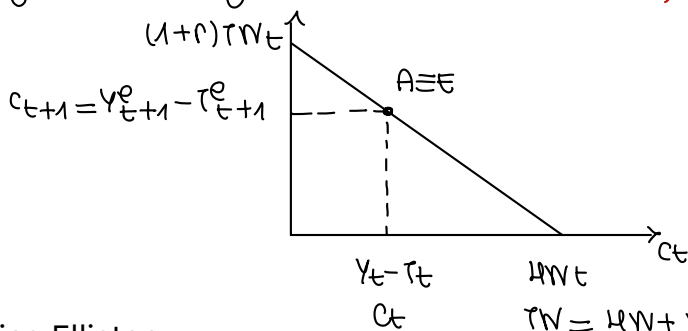
CHANGE IN THE INTEREST RATE

- What happens if r increases?
 - Several channels!
 - opportunity cost of consumption, $(1+r) \uparrow$
 - substitution effect
 - income effect
 - we prefer to neglect this effect
- In general we can capture the impact of r on the economy through:
 - Financial and housing wealth
 - Investment

POSITIVE FINANCIAL AND HOUSING WEALTH

Financial and housing wealth

- What happens if $NFW_t > 0$: Higher total wealth
- NFW_t = expected net present discounted value of assets (bonds/stock) and houses
- generalizing: $C_t = C(\text{total wealth})$



Budget constraint shift right



A MORE REALISTIC DESCRIPTION

Part 1:

- A more realistic description of consumers' behaviour

Part 2:

- expectations and investment

 $(Y-T) \uparrow 10\% \rightarrow C \uparrow$ by less than 10%

The theory of the very foresighted consumer

$$C_t = c(\text{total wealth}_t)$$

Total wealth = ~~human wealth~~ + ~~financial/housing wealth~~

o consumption smoothing

- C_t reacts to ~~expected future changes in income~~
 - C_t reacts ~~less than proportionally to changes in current disposable income~~
- Is the model a good expansion of the real world?

EMPIRICAL EVIDENCE

empirical observation #1

o Predictions

- o C_t reacts less than proportionally to fluctuations in current income } verified!
- o C_{t+1} changes even if current income does not
- Smooth consumption: $\uparrow$ income today $\rightarrow$ split C_t and C_{t+1}
- o we observe consumption smoothing over time! $\rightarrow$ transitory vs permanent shocks

empirical observation #2

- o C_t seems more reactive than predicted to changes in current income

True! split C , but not so big as I expected C_t react to variation in future income, but lower than the model

- o C_t reacts less than predicted to changes in future expected disposable income

How can we reconcile our model with these empirical observations?

A MORE REALISTIC MODEL

- o Do consumers want to consume a constant fraction every period?
- o credit constraints

If $Y_t - T_t < \text{expected future } Y - T$

in reality you have a limit in consumption smoothing

credit constraints

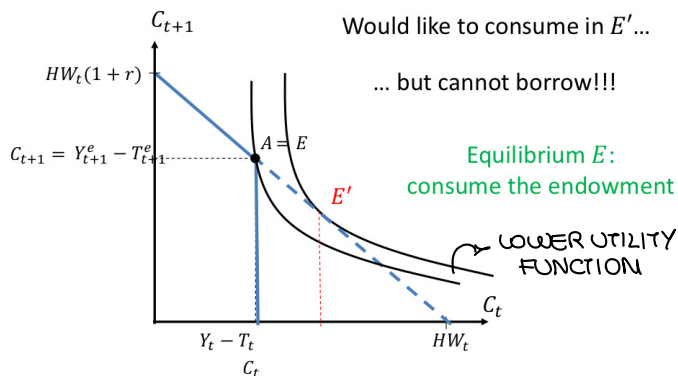
Facts we want to explain:

- o C_t more sensitive than predicted to $\Delta(Y_t - T_t)$
- o C_t less sensitive than predicted to $\Delta(Y_{t+1}^e - T_{t+1}^e)$
- o credit constraints:

- assume consumer cannot borrow
- consider a credit constrained consumer
- I can postpone consumption

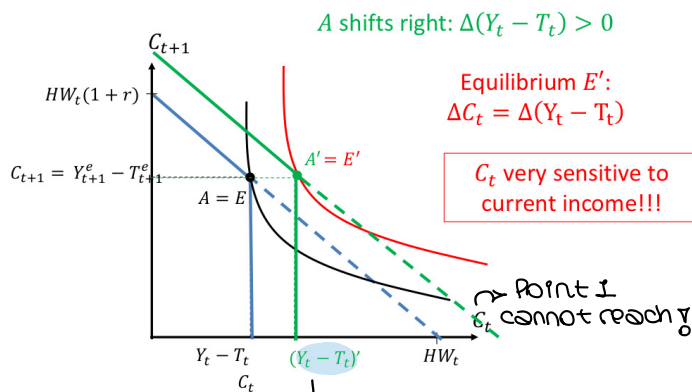


A credit constrained individual



max level consumption today
cannot anticipate C (cannot borrow money)

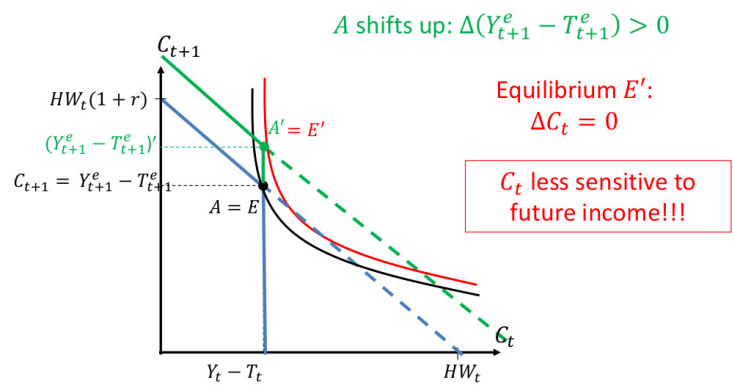
An increase in current income



↑ DISPOSABLE INCOME

consume all additional current income today
to reach ↑ level of UTILITY
Use additional income to compensate the
difference with the optimal level

An increase in future income



↳ NOT affected

need to
borrow money → you can't
Just consume more tomorrow

A MORE REALISTIC MODEL of consumption

- Foresighted consumer
- Consumption smoothing
- higher impact of current disposable income

$$C_t = C(Y_t - T_t, Y_{t+1}^e - T_{t+1}^e, NFI_t)$$

$$LM = \bar{r} \quad Y_t = C(Y_t - T_t, Y_{t+1}^e - T_{t+1}^e, NFI_t)$$

$$IS = C + I + G + NX$$

$$C_t(Y_t - T_t, Y_{t+1}^e - T_{t+1}^e, NFI_t)$$



The IS-IM curve with expectations

Part 1

- expectations and the IS curve

AIM: the IS-IM model with expectations

2 periods:

- Today: t

Notation: $X_t = X$

- Future: $t+1$

Notation: $X_{t+1}^e = X^e$

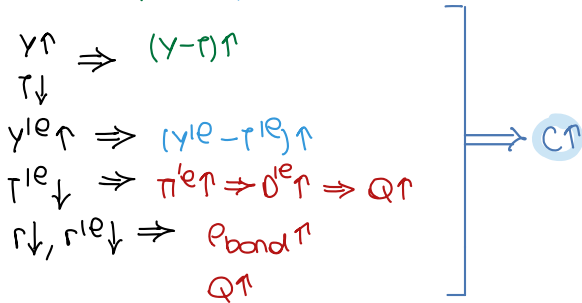
IS curve: equilibrium in the goods market

Stock price depends on dividends

$$Y = C + I + G$$

consumption

$$C = C(\underbrace{Y - \tau}_{+}, \underbrace{y^e - r^e}_{+}, \underbrace{WFH}_{+})$$



Investment

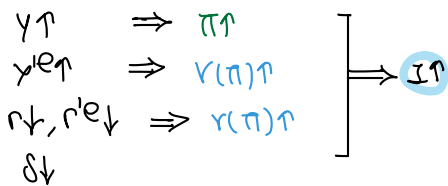
$$I = I(\pi, Y(\pi))$$

$\rightarrow$ today actual value of future profits

$$I = I(\pi, Y(\pi)) = \frac{\pi^e_{t+1}}{\underbrace{(1+r_t)}_{\text{present value}}} + \frac{\pi^e_{t+2}}{(1+r_t)(1+r^e_{t+1})} + \frac{\pi^e_{t+3}}{(1+r_t)(1+r^e_{t+1})(1+r^e_{t+2})} + \dots$$

Depends on expected profits

I will invest if actual value of future profits will be high



The IS curve: standard

no expectations: IS: $Y = C(Y - \tau) + I(Y, r + n) + G$

in a more compact way: IS: $Y = A(Y, \tau, r, n) + G$

$A(Y, \tau, r, n) \equiv C(Y - \tau) + I(Y, r + n) \Rightarrow$ aggregate private spending

The IS curve with expectations

with expectations: IS: $Y = A(Y, \tau, r, n, y^e, r^e, r^e) + G$ G : exogenous

$Y \uparrow, y^e \uparrow \Rightarrow A \uparrow$

$\tau \uparrow, r^e \uparrow \Rightarrow A \downarrow$

$r \uparrow, r^e \uparrow, n \uparrow \Rightarrow A \downarrow$

IS with expectations: slope

$$IS: Y = A(Y, \tau, r, n, y^e, r^e, r^e) + G$$

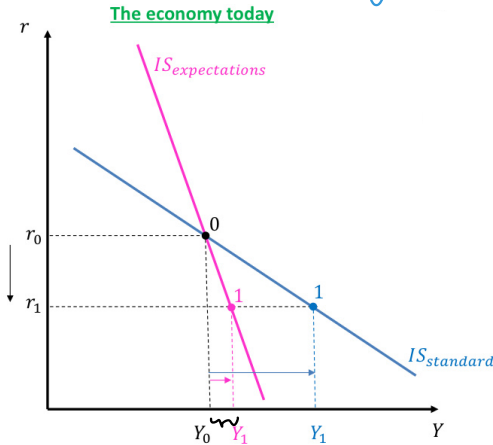
$\Rightarrow$ How is the slope compared to the standard case? $\text{if } r \downarrow \Rightarrow A \uparrow \Rightarrow Y \uparrow$
standard case $\Delta I \Rightarrow \Delta \text{output} \rightarrow$ now depends on overall effect is smaller

now we have more I to take into account

Today i impacts the present I and future one

⇒ But, by how much? A depends on r , but also on r^e

Smaller impact of a reduction in current interest rate ONLY! ⇒ steeper IS



If $r \downarrow \Rightarrow A \uparrow \Rightarrow Z \uparrow \Rightarrow Y \uparrow$

But, if we consider expectations the increase is smaller

IS with expectations: shift!

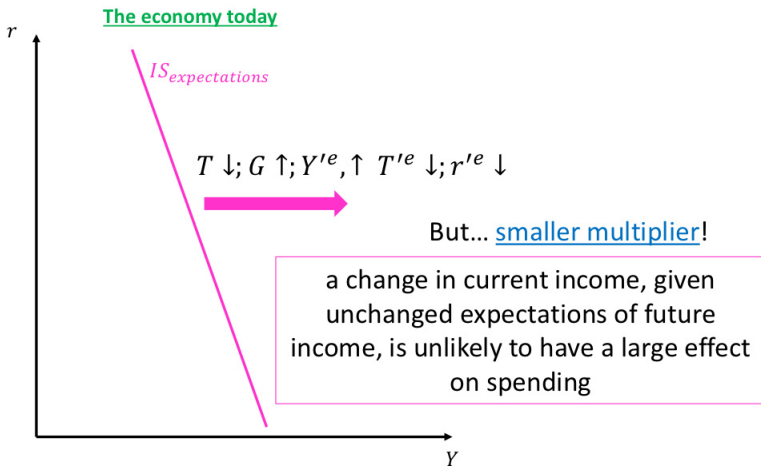
multiplier is smaller → change today income

change today outcome smaller since I save part

↓

split additional income over time

variation future income affects today consumption



LM curve and expectations?

CB decisions are EXOGENOUS, not affected by agents expectations

o The CB sets the interest rate that keeps the money market in equilibrium

o money demand

– current level of transaction

– current opportunity cost of money

$$LM: r = \bar{r}$$

conclusion

o IS curve with expectations:

– slope

– position

o IS-LM model

– present: t

– future: $t+1$ (expectations)

Part 2 Using the model: monetary policy

- How to use the model
- A transitory monetary policy
- A permanent monetary policy

HOW TO USE THE MODEL

① Impact of the shock/policy in $t+1$ (future)

future depends only on variables depending to future $\rightarrow$ not affected by the present

$$- IS_{t+1}: Y_{t+1} = A(Y_{t+1}, r_{t+1}, r_{t+1}) + G$$

$$- LM_{t+1}: \bar{r} = r_{t+1}$$

how this change affect our ^② expectations and then our ^③ present

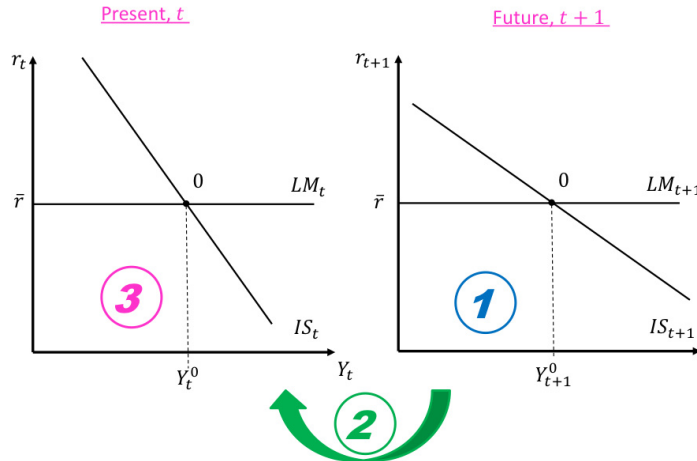
② what is the impact today (t) on expectations?

$$-\Delta Y^e, \Delta r^e, \Delta \pi^e$$

③ Impact today (t) on the policy/shock, incorporating changes in expectations

$$- IS_t: Y_t = A(Y_t, r_t, r_t, \pi, Y^e, r^e, \pi^e) + G$$

$$- LM_t: \bar{r} = r_t$$



TRANSITORY monetary policy

no mp in the future

or $r_t \downarrow$:

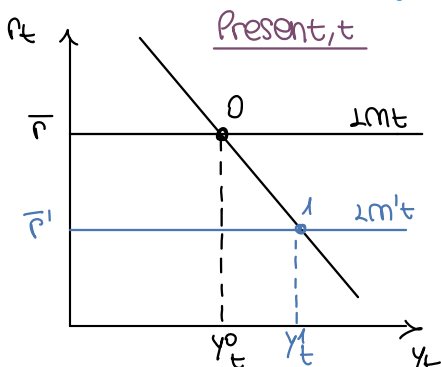
- announced and performed in t : you are SURPRISED! Not expected

- TRANSITORY: no change expected for the future

o IMPACT in the future?

transitory policy: no change expected for the future

o IMPACT in the future?



$$r \downarrow \Rightarrow \pi \uparrow$$

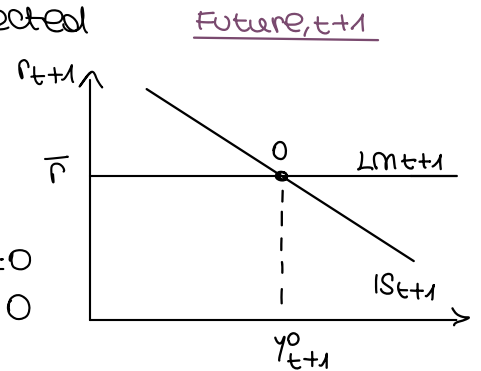
At time t : $r_t \downarrow \Rightarrow LM_t \downarrow$

$$Y_t \uparrow$$

o Smaller impact with expectations: STEEPER IS
so PDR of future profits $\uparrow$
also consumption affected: $WFH \uparrow$

$$\Delta Y^e = 0$$

$$\Delta r^e = 0$$





Add also future expected interest rate

In standard model: consume all today

In reality save some income

ADDING expectations

Δ income is partially absorbed by economy and partially saved for the future

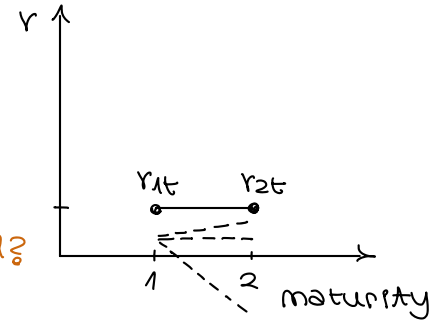
o assume that, before the policy, $r_t = r_{t+1}^e = r$

RISK PREMIUM = 0 $\Rightarrow$ yield curve is HORIZONTAL

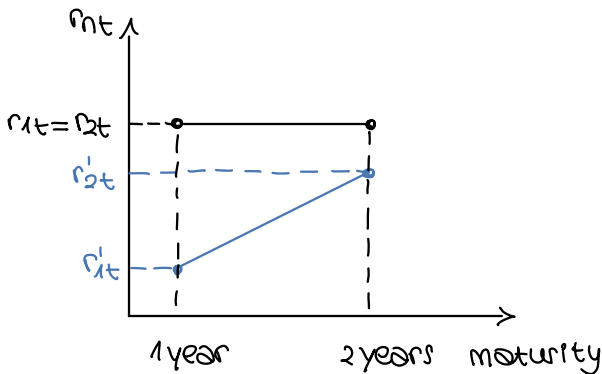
$\downarrow$ actual interest rate

o Draw the yield curve before the policy: $r_{2t} \approx \frac{r_t + r_{t+1}^e}{2} = r$

o what happens to the yield curve after the policy is implemented?



Positive yield curve $\nearrow$: expect to have higher yield curve



with the policy

o $r_t \downarrow$

o $\Delta r^e = 0$

$$\Rightarrow r_{2t} \approx \frac{r_t + r_{t+1}^e}{2}$$

o $r'_{2t} < r_{2t}$

$$\text{o in fact, } \Delta r_{2t} = \frac{\Delta r_t}{2}$$

Individuals expect higher interest rates for the future

PERMANENT MONETARY POLICY

o the CB announces in t an expansionary MP

o the policy is perceived as permanent

- If permanent, EXPECTATIONS about the future are affected

o expected mp in the future

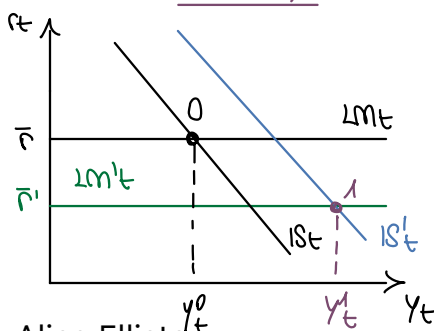
$$\begin{aligned} LM_{t+1} &\downarrow \\ \Rightarrow r_{t+1} &\downarrow, Y_{t+1} \uparrow \end{aligned}$$



$\downarrow$ in future interest rate

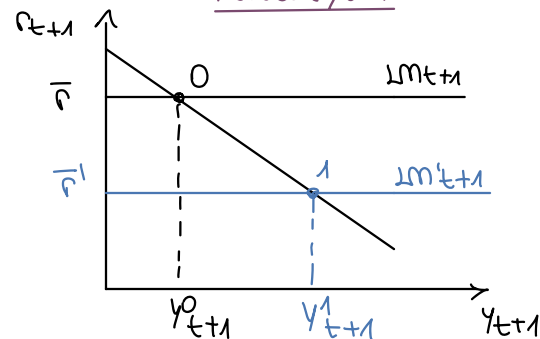
o expectations changes: $r^e \downarrow, Y^e \uparrow$

Present, t



Alice Elliston

Future, $t+1$



Impact in t

o expectations change $\rightarrow$ affect today state of my economy

$$r^e \downarrow, Y^e \uparrow$$

$\Rightarrow C \uparrow, I \uparrow \Rightarrow IS$ right move curve (SHIFT) if variables not on axis

where more along if var. on axis change

IS depends on future disposable income and present + future interest rate

o MP in t : $LM \downarrow$

$$r \downarrow, Y \uparrow$$



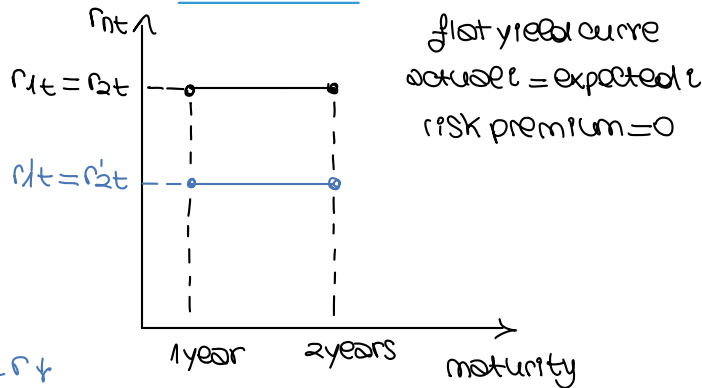
permanent monetary policy

◦ Assume that, before the policy, $r_t = r_{t+1}^e = r$

◦ Draw the yield curve before the policy $\bar{r}_t \approx \frac{r_t + r_{t+1}^e}{2} = r$

◦ What happens if the yield curve after the policy is implemented

yield curve



with the policy:

◦ $r_t \downarrow, r_{t+1}^e \downarrow$

◦ $\Delta r^e = \Delta r$

$$\Rightarrow \bar{r}_t \approx \frac{r_t + r_{t+1}^e}{2}$$

$$\Delta \bar{r}_t = \Delta r$$

actual $r \downarrow$

expected future r

Individuals expect constant interest rates for the future

MONETARY POLICY AND STOCK PRICES

$$Q = \frac{D^e}{1+r} + \frac{D^e}{(1+r)(1+r^e)} + \dots$$

TRANSITORY

$\Delta r < 0 \Rightarrow \Delta Y > 0$ (higher output)

$\Delta Y^e = \Delta r^e = 0$

Small (if any) positive impact on Q

only first element affected, overall effect is very small

If you think (expect) mp transitory:

as r only for a while;

so prefer not to invest in stock market

PERMANENT

◦ $\Delta Y > 0, \Delta r < 0$

◦ $\Delta Y^e > 0; \Delta r^e < 0$

$Q \uparrow$

huge variation in stock market, since all components will be affected

Conclusion

◦ Impact of a monetary policy

- transitory or permanent?

- Impact on expectations is key to determine the impact today of the policy



$$Y = \underbrace{C}_{C(Y_t - T_t, Y_{t+1}^e - T_{t+1}^e, r_t, r_{t+1}^e, W_t)} + \underbrace{I}_{I(r_t, r_{t+1}^e)} + G + \frac{\text{EXP-IMP}}{E} \underbrace{\left[\frac{1}{N^X} \right]}_{\substack{\text{exchange rate} \\ \uparrow \\ \text{my output} \\ \downarrow \\ \text{foreign output}}} [E, Y^*, Y]$$

Real exchange rate

- Relative price of domestic goods
 - price of domestic goods in terms of foreign goods
 - ! Not observable!
 - Depends on:
 - Price of goods/services in both countries
 - Nominal exchange rate** (observable)
- exchange rate changes over time → has a degree of variability because of expectations

Nominal exchange rate

- different currencies in different countries
 - Nominal exchange rate, E** : price of domestic currency in terms of foreign currency
 - Example: $E_{\$/\text{€}} = 1.124$
 - the price of 1€ is 1.124 US\$
 - with 1€ we get 1.124 US\$
 - to buy 1\$ we need $1/1.124 = 0.889$ €
- exchange rate is a market where you can exchange your currency → depends on supply/demand & on expectations
- (nominal) **Appreciation**: an increase in the price of domestic currency in terms of foreign currency, i.e., an increase in the exchange rate, $E \uparrow$
 - E.g. $E_{\$/\text{€}} = 1 \Rightarrow E_{\$/\text{€}} = 1.2$
 - we need fewer € to buy 1 US\$ → the currency is strong, can buy more of the other currency
 - (nominal) **Depreciation**: a decrease in the price of domestic currency in terms of foreign currency, i.e., a reduction in the exchange rate, $E \downarrow$
 - we need more € to buy 1 US\$

FLOATING vs. FIXED exchange rate

- Fixed exchange rate, $\bar{E}$** : a system where two or more countries maintain a constant exchange rate between their currencies
 - In a fixed exchange rate system:
 - Revaluation**: an increase in the exchange rate ($\bar{E} \uparrow$)
 - Devaluation**: a reduction in the exchange rate ($\bar{E} \downarrow$)
- floating exchange rate can change according to demand and supply
 - between € and \$: excess of demand → price € ↑ and price \$ in terms of € ↓

\$/Argentina: fixed exchange rate → decided EX-ANTE
(pesos)

↓
lower uncertainty → for investors UNCERTAINTY in a cost



If you have a shock: Gap supply/demand $\rightarrow$ not fixed exchange rate

$\Rightarrow$ CB will act and fill this gap

Real exchange Rate

Real exchange Rate (ϵ): the price of domestic goods relative to foreign goods
(the price of domestic goods in terms of foreign goods)

- ϵ = nominal exchange rate (price of 1€ in US\$)
- P^* = price of goods in the USA (foreign country)
- P = price of goods in the EU (domestic country)
- ϵP = price of European goods in US dollars

◦ How many US goods can we buy with 1 unit of EU goods?

$$\epsilon = \frac{\epsilon P}{P^*}$$

$\hookrightarrow$ we want to open economy

$\hookrightarrow$ foreign variable $\rightarrow$ level of price in a foreign country

Real exchange Rate

$\hookrightarrow$ Depends on nominal exchange rate and depends on level of price

$\uparrow$ inflation rate $\Rightarrow P^* \uparrow \Rightarrow$ depreciation in real exchange rate

- quantity of foreign goods that can be obtained by exchanging

1 basket of domestic goods $\epsilon = \frac{\epsilon P}{P^*}$

- **Real Appreciation**: an increase in the real exchange rate,

i.e. an increase in the relative prices of domestic goods in terms of foreign goods

- $\epsilon \uparrow$
- $P \uparrow$
- $P^* \downarrow$

- **Real Depreciation**: a reduction in the real exchange rate,

i.e. a decrease in the relative prices of domestic goods in terms of foreign goods

- $\epsilon \downarrow$
- $P \downarrow$
- $P^* \uparrow$

Part 2 (03, ch 17 - part 2 & ch 19 part 2)

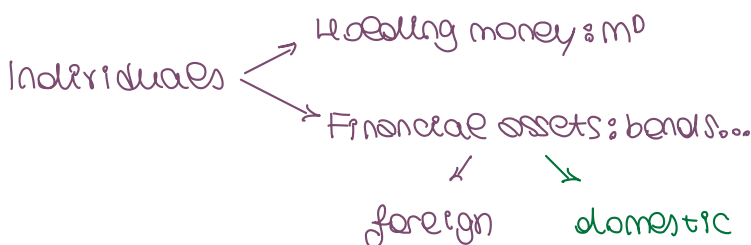
Uncovered interest rate parity

choice between FOREIGN or DOMESTIC Financial Assets

◦ Imports and exports

◦ investment $\rightarrow$ more convenient to invest in another country (i.e. US)

$\uparrow$ interest rate: Buy \$ and buy US bonds



choice between holding Foreign or Domestic Financial Assets

Looking for investment with HIGHER return



assume 2 bonds:

Domestic $\Rightarrow$ pay i_t

Foreign $\Rightarrow$ pay i_t^*

Domestic
Foreign

1€

1€

↓

\$E_t

→

$(1+i_t)€$

$\frac{E_t(1+i_t^*)}{E_{t+1}^e} €$

↑

\$E_t(1+i_t^*)

$E = \# \text{ units of foreign currency for 1 unit of domestic}$

which do we choose between domestic and foreign bonds?

$$(1+i_t) > \frac{E_t(1+i_t^*)}{E_{t+1}^e} \quad \text{we buy domestic bonds}$$

$\Rightarrow$ Investors demand more Euros and sell Dollars: $€^D \uparrow \Rightarrow E_t \uparrow$

$$(1+i_t) < \frac{E_t(1+i_t^*)}{E_{t+1}^e} \quad \text{we buy foreign bonds}$$

$\Rightarrow$ Investors demand more Dollars and sell Euros: $€^D \downarrow \Rightarrow E_t \downarrow$

$$(1+i_t) = \frac{E_t(1+i_t^*)}{E_{t+1}^e} : \text{Uncovered Interest Rate Parity (UIP)}$$

$\Rightarrow$ Investors are indifferent between foreign and domestic bonds

Uncovered Interest Rate Parity : $(1+i_t) = \frac{E_t(1+i_t^*)}{E_{t+1}^e}$

Assume:

- no transaction costs can move freely between 2 markets
- no risk ... but presence of uncertainty

$$(1+i_t) = \frac{(1+i_t^*)}{\frac{E_{t+1}^e}{E_t}} = \frac{(1+i_t^*)}{1 + \frac{E_{t+1}^e - E_t}{E_t}} = \frac{(1+i_t^*)}{1 + \frac{E_{t+1}^e - E_t}{E_t}}$$

expected appreciation of the domestic currency

for small variations, we can approximate to:

$$\Rightarrow i_t \approx i_t^* - \frac{E_{t+1}^e - E_t}{E_t}$$

do not expect any depreciation if 2 interest rates are equal

If not satisfied people will change investments

$\uparrow i \Rightarrow$ Inflow

$\downarrow i \Rightarrow$ Bonds less profitable $\Rightarrow$ outflow of investment from your country affect exchange rate

exchange rate depends on:

- o expectations
- o difference interest rate

UNCOVERED Interest Rate Parity

$$i_t \approx i_t^* - \frac{E_{t+1}^e - E_t}{E_t}$$

example: $i_t = 2\%$ $i_t^* = 5\%$

o which bonds do I buy? Depends on exchange rate EXPECTATIONS

we are indifferent if: $2\% \approx 5\% - \frac{E^e - E}{E} \rightarrow \frac{E^e - E}{E} = 3\%$

- we expect an appreciation of the domestic exchange rate by 3%

get more in term of foreign currency,

but the terms of foreign currency in terms of current currency is lower

o approximate version: $i_t \approx i_t^* - \frac{E_{t+1}^e - E_t}{E_t}$ we use to calculate expectations on the interest rate

o exact version: $(1+i_t) = \frac{(1+i_t^*) E_t}{E_{t+1}^e}$ we use in our extended model

Assume expectations are given: $E_{t+1}^e = \bar{E}^e$

$\Rightarrow (1+i) = \frac{(1+i^*) E}{\bar{E}^e}$ Solving for E : $E = \bar{E}^e \frac{(1+i)}{(1+i^*)}$: current exchange rate

$$E = \bar{E}^e \frac{(1+i)}{(1+i^*)}$$

DETERMINANTS of the exchange rate:

o $i \uparrow$ (domestic i increase): bonds in € become more attractive $\Rightarrow \text{€}^\text{D} \uparrow \Rightarrow E \uparrow$

o $i^* \uparrow$: foreign bonds become more attractive $\Rightarrow \text{€}^\text{D} \downarrow \Rightarrow E \downarrow$

o $\bar{E}^e \uparrow$: lower expected returns on foreign bonds $\Rightarrow \text{€}^\text{D} \uparrow \Rightarrow E \uparrow$

To draw the curve representing uncovered Interest Rate Parity,

we derive it as a function i

$$\bar{E}^e (1+i) = (1+i^*) E$$

$$\Rightarrow (1+i) = \frac{(1+i^*) E}{\bar{E}^e}$$

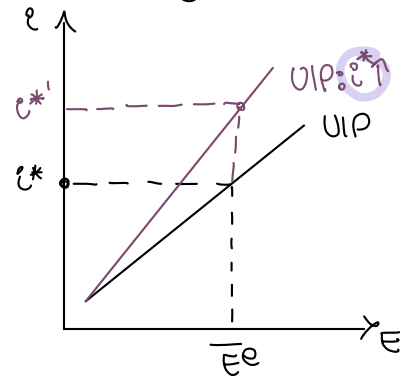
$$\Rightarrow i = (1+i^*) \frac{E}{\bar{E}^e} - 1 = \frac{(1+i^*)}{\bar{E}^e} E - 1$$

UIP: all the equilibrium associated with foreign i and expected exchange rate

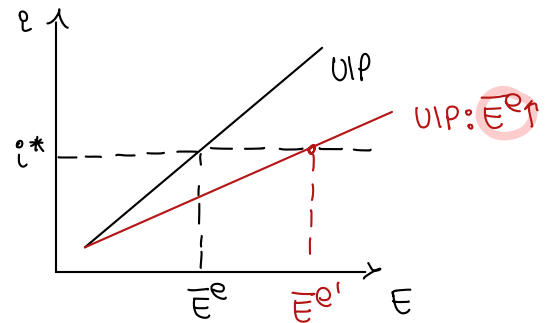
$$i = (1+i^*) \frac{E}{\bar{E}^e} - 1$$

positive slope: $i \uparrow \Rightarrow E \uparrow$

$$\bar{E}^e = E \Rightarrow i = i^*$$



my actual present exchange rate should increase so that $i = i^*$ (constant)

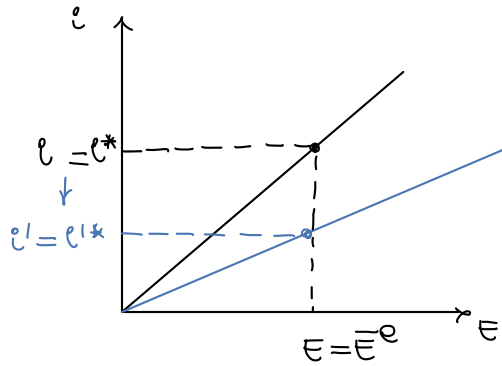


To keep the interest rate constant:

○ $\bar{E}^e = E \Rightarrow i = i^*$

○ $i^* \uparrow \Rightarrow E \downarrow$ $i = (1 + i^*) \frac{E}{\bar{E}^e} - 1$

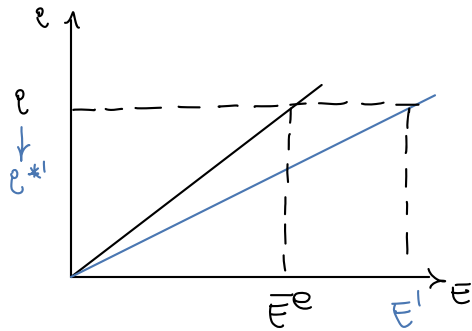
○ $\bar{E}^e \uparrow \Rightarrow E \uparrow$ $i = (1 + i^*) \frac{E}{\bar{E}^e} - 1$



$i = (1 + i^*) \frac{E}{\bar{E}^e} - 1$

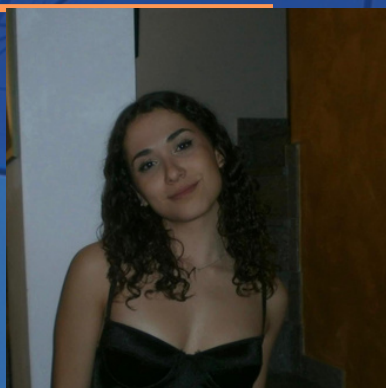
i^*
 $\bar{E}^e$

assumption: $E = \bar{E}^e$



$i = (1 + i^*) \frac{E}{\bar{E}^e} - 1$

FOR DOUBTS OR SUGGESTIONS ON THE HANDOUTS



ALICE ELLISTON

alice.elliston@studbocconi.it

[@alice.elliston_](https://www.instagram.com/alice.elliston_)

+39 3442849243

FOR INFO ON THE TEACHING DIVISION



NICOLA COMBINI

nicola.combini@studbocconi.it

[@nicolacombini](https://www.instagram.com/nicolacombini)

+39 3661052675



MARTINA PARMEGGIANI

martina.parmeggiani@studbocconi.it

[@martina_parmeggiani05](https://www.instagram.com/martina_parmeggiani05)

+39 3445120057



MARK OLANO

mark.olano@studbocconi.it

[@mark_olano_](https://www.instagram.com/mark_olano_)

+39 3713723943



TEACHING DIVISION



OUR PARTNERS

