BEMACC

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B.LAB

HANDOUTS

MACROECONOMICS (MODULE 2)

-SECOND PARTIAL-

WRITTEN BY

ALICE ELLISTON

TEACHING DIVISION

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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.

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L18 part 1 (OB, ch 15)

Financial markets and Expectations: Introduction

- 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
      ↳ share of company

how expectations change overtime

- 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

$i_{1,t}$ ≡ 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

$1€ \longrightarrow 1+i_{1,t}€$

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

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

Today, t $\quad$ $t+1$ $\quad$ $t+2$

$1€ \longrightarrow (1+i_{1,t})(1+i^e_{1,t+1})€$

$\frac{1}{(1+i_{1,t})(1+i^e_{1,t+1})}€ \longleftarrow 1€$

interest rate tomorrow (expected)

⇓ expected present discount value

$i^e_{1,t+1}$ ≡ 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 €z:

$$€V_t = €z_t + \frac{€z^e_{t+1}}{1+i_{1,t}} + \frac{€z^e_{t+2}}{(1+i_{1,t})(1+i^e_{1,t+1})} + \frac{€z^e_{t+3}}{\underbrace{(1+i_t)}_{t \to t+1}\underbrace{(1+i^e_{t+1})}_{t+1 \to t+2}\underbrace{(1+i^e_{t+2})}_{t+2 \to t+3}} + \dots$$

expected present discounted value of today payment (t)

expected present discounted value of a payment tomorrow (t+1)

Expected Present Discounted value of a payment day after tomorrow (t+2)

$t \xrightarrow{i_t} t+1$

$(1+i_t)\cdot 1$ $\quad$ $\boxed{t+2}$

expectations allow me to move from future to PRESENT

move from FUTURE to PRESENT ⇒ expectations !

- the EPDV depends:
  - positively on future expected payments
  - Negatively on current and future expected interest rates

t	$t+1$	$t+2$
$1€$	$1(1+i_t)$	$1(1+i_t)(1+i^e_{t+1})$
$\frac{1}{1+i_t}$	$1€$ ↳ 1€ tomorrow	

t	$t+1$	$t+2$
$\frac{1}{(1+i_t)(1+i^e_{t+1})}$	$\frac{1}{1+i^e_{t+1}}$	1

if ↑i^e today you are poorer (lower value TODAY) → expect to be poorer

look at policy and worried about future interest rate

↳ Bond is a PROMISE of payment

$t \xrightarrow{i_{1,t}} t+1 \xrightarrow{i^e_{1,t+1}} t+2$

1

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

Issuers

- government bond
- corporate bond

Structure of payments

- Coupon bonds

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

∘ Discount bond
- payment at maturity (face value)

RISK

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

∘ Price risk
⇒ UNCERTAINTY about the price if you resell the bond BEFORE maturity

Risk premium!

ROLE OF RATING AGENCIES

spread ≠ interest rate paid between Germany (considered very safe) and Italy

Government Bonds' Ratings → it is a suggestion (expectations)

Sovereign Ratings List	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

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

∘ 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

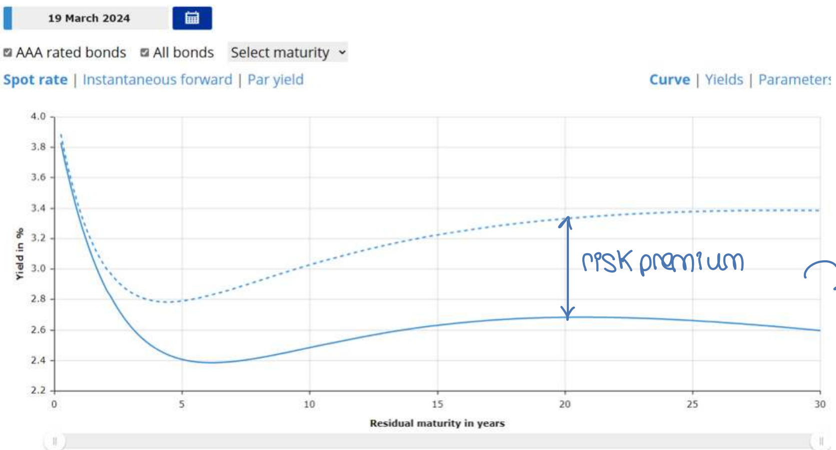
∘ focus on MATURITY
- assume no risk! (risk premium = 0)

Term structure of interest rates or yield curve
the relation between maturity and yield
It contains useful information about people's expectations

ECB YIELD CURVE
relation maturity-yield
info about people's expectations → we can predict the future

YIELD: avg interest rate paid on my bonds

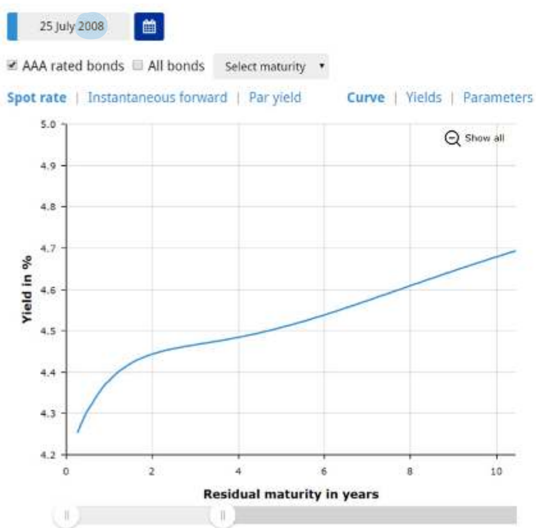
→ evolution of expectations of prices (what agents expect)

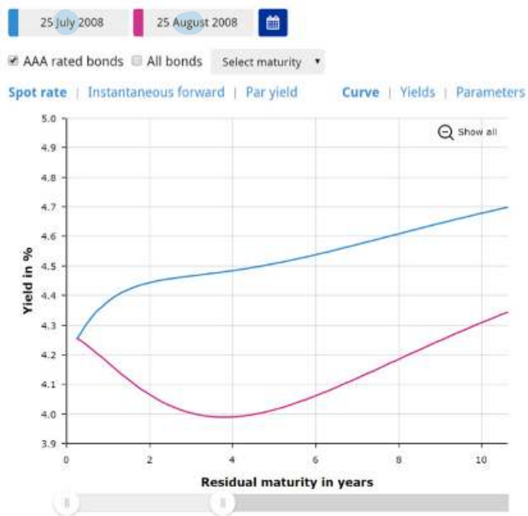


difference two risk curves (risky and riskless bonds)

Yield curve collapse of Lehman Brothers

financial crisis



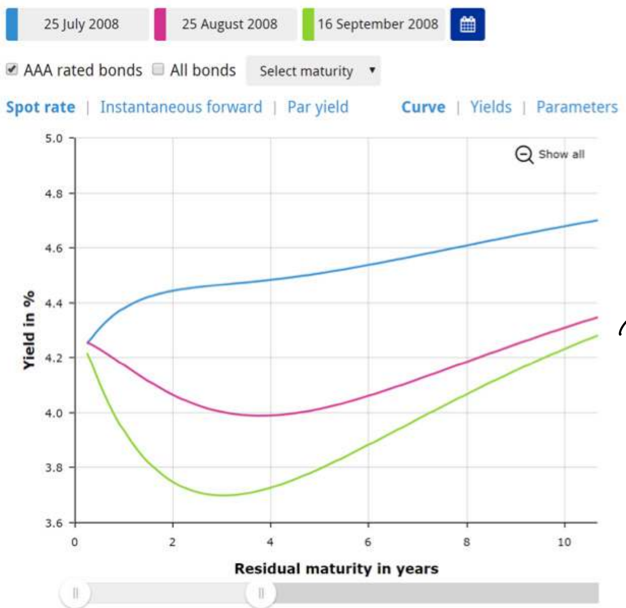


people expect lower interest rate by CB.
• if we expect CRISIS

if slope is positive: expect tomorrow higher interest rate

expect a CRISIS: CB reacts decreasing interest rate

$\downarrow i \Rightarrow \uparrow I \Rightarrow \uparrow Y$



expect deeper CRISIS

⇒ lower i

YIELD curve related to expectations

what agents expect about future

- negative slope: expect lower YIELD ($\downarrow i$)

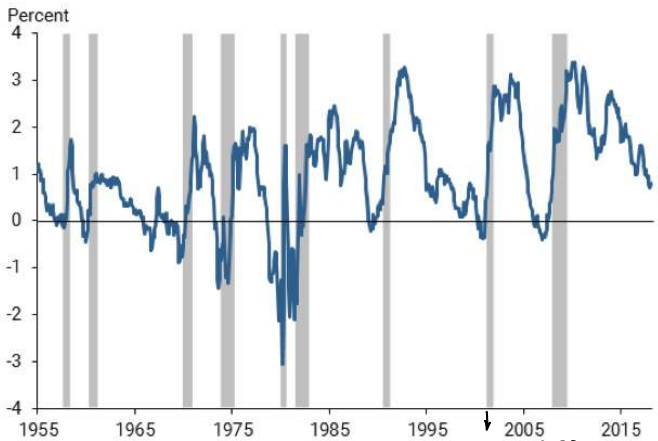
But we are not expecting a crisis.

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

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

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

THE TERM SPREAD and RECESSION



2001 crisis (twin towers)

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 ≠ maturities
2) Derive bonds' yields and the yield curve
3) Yield curve with risky assets

L19 Part 2 (OB, ch15) **Financial Markets and Expectations:**

BOND PRICES and BOND YIELDS

Part 2
- Bond prices for ≠ maturities
- Bonds' yields (to maturity)

BOND PRICES for different maturities
BOND PRICES as PRESENT VALUES

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

interest is between t and t+1
Bonds can have ≠ lenght → YIELD: avg interest rate related to MATURITY of the bond!

Alice Elliston

BOND PRICES as PRESENT VALUES

- $€P_{1t}$ = price of bond with maturity 1 year
- $€P_{2t}$ = price of bond with maturity 2 years

Price as expected present discount value of the payment at maturity

DISCOUNTED value = Present value of bond
- PDV of its face value

One-year Bond

Pays 100€ in t+1

Get 100€ next year

$$€P_{1t} = \frac{100}{1+i_{1,t}} €$$

⇓ discount face value by interest rate

Two-year bond

Pays 100€ in t+2

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

⇓ discount for two periods

why? Is $€P_{2t}$ = to 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

⇒ 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: $1€ \longrightarrow 1+i_{1,t}€$

for the ~~arbitrage condition,~~ they must be EQUAL

↓ Price 1 year bond

Bond 2: 2-year bond: $\frac{1}{€P_{2t}} \xrightarrow{\text{value of this}} \frac{€P^e_{1t+1}}{€P_{2t}} €$

= expected PRICE of a one-year bond in t+1

↳ Return 2-year bond after 1-year

Expected P of 2 year bond after 1 year

- quantity of 2-year bonds I can buy with 1-year bond

If $(1+i_{1t}) < \frac{€P^e_{1t+1}}{€P_{2t}}$ ⇒ buy bond 2 ⇒ $€P_{2t}\uparrow$ ⇒ expected return on 2-year bond ↓

If $(1+i_{1t}) > \frac{€P^e_{1t+1}}{€P_{2t}}$ ⇒ buy bond 1 ⇒ $€P_{2t}\downarrow$ ⇒ expected return on 2-year bond ↑

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

$$(1+i_{1t}) = \frac{€P^e_{1t+1}}{€P_{2t}} \Rightarrow €P_{2t} = \frac{€P^e_{1t+1}}{1+i_{1t}}$$

- what is the price of a one-year bond in t+1? $€P^e_{1t+1} = \frac{€100}{1+i^e_{1,t+1}}$
- Substituting: $\boxed{€P_{2t} = \frac{€100}{(1+i_{1,t})(1+i^e_{1,t+1})}}$

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

$t \quad t+1 \quad t+2$

$$\frac{100}{(1+i_{1,t})(1+i^e_{1,t+1})} \quad 100$$

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

moving over time a promise of payment

$t \quad t+1 \quad t+2$

$$\frac{100}{(1+i^e_{1,t+1})(1+i_{1,t})} \qquad \frac{100}{1+i^e_{1,t+1}} \qquad 100$$

$$\frac{P^e_{1,t+1}}{1+i_{1,t}} \qquad P^e_{1,t+1} \qquad i^e_{1,t+1}$$

$$€P_{2,t} = \frac{100}{\underbrace{(1+i_{1,t})}_{t+1 \to t}\underbrace{(1+i^e_{1,t+1})}_{t+2 \to t+1}} = \frac{P^e_{1,t+1}}{1+i_{1,t}} \quad \left.\right\} \frac{100}{1+i^e_{1,t+1}}$$

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

avg interest rate applied on a 2-years bond today

$$€P_{3,t} = \frac{100}{(1+i_{1,t})(1+i^e_{1,t+1})(1+i^e_{1,t+3})} = \frac{100}{(1+i_{3,t})^3}$$

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

Bonds' yields

from Bond prices to BONDYIELDS

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_{2t} = yield (to maturity) or 2-year interest rate

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

- If $€P_{2t} = 90€$
  $\Rightarrow (1+i_{2t})^2 = \frac{100}{90}$
  $\Rightarrow i_{2t} = 5.4\%$

YIELD to maturity

example: a 2-year bond

YIELD definition	Bond price definition
$€P_{2t} = \frac{€100}{(1+i_{2t})^2}$	$€P_{2t} = \frac{€100}{(1+i_{1t})(1+i^e_{1t+1})}$

Alice Elliston

THEY MUST BE EQUAL!

$$\boxed{(1+i_{2t})^2=(1+i_{1t})(1+i^e_{1\,t+1})}$$

taking logs: $2\ln(1+i_{2t})=\ln(1+i_{1t})+\ln(1+i^e_{1t+1})$

approximating: $2i_{2t}\approx i_{1t}+i^e_{1t+1}$

$$\boxed{i_{2t}\approx\frac{i_{1t}+i^e_{1t+1}}{2}}$$

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: $i_{nt}\approx\dfrac{i_{1t}+i^e_{1t+1}+i^e_{1t+2}+\dots+i^e_{1\,t+n-1}}{n}$

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 → expected interest rate decreases
agent expect lower i next year
i declining over time → expect CB to ↓i

Then positive slope:
agents today expect for the future higher interest rate
expect ↑output growth
↑ inflation rate $\Big\}$ ⇒ CB↑i
low i, reduce opportunity to affect economy through monetary policy

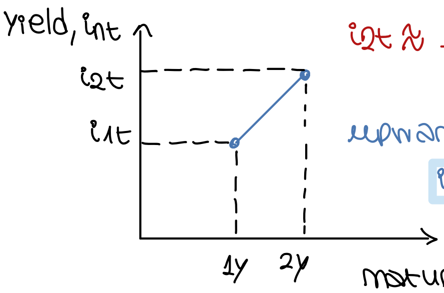
YIELD depends on expectations, that affect PRICE of BONDS
change expectations of future interest rate in USA after Trump election

Financial markets and expectation

- yield curve
- yield curve with risk aversion

YIELD CURVE and RISK

Yield curve

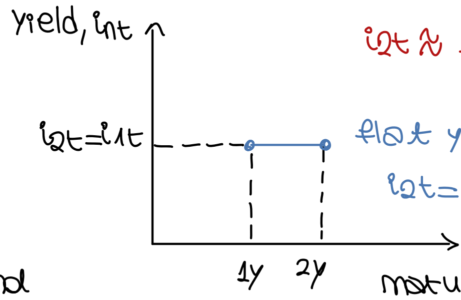


$i_{2t} \approx \dfrac{i_{1t} + i^e_{1t+1}}{2}$

upward-sloping yield curve

$\boxed{i_{2t} > i_{1t}} \Rightarrow i^e_{1t+1} > i_{1t}$

horizon of my bond



$i_{2t} \approx \dfrac{i_{1t} + i^e_{1t+1}}{2}$

flat yield curve

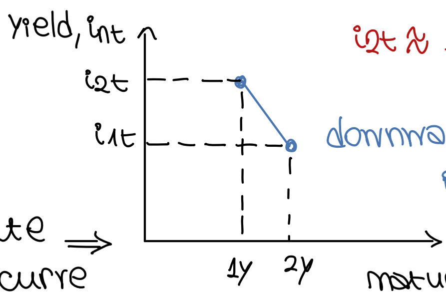
$i_{2t} = i_{1t} \Rightarrow i^e_{1t+1} = i_{1t}$

expect ↑ i

expected i > actual i

prefer positive slope,

if you are in a recession



$i_{2t} \approx \dfrac{i_{1t} + i^e_{1t+1}}{2}$

BETTER to invest in 1 year Bond

downward-sloping yield curve

$i_{2t} < i_{1t} \Rightarrow i^e_{1t+1} < i_{1t}$

High GDP growth rate ⇒ prefer flat yield curve

expect a lower i tomorrow

if high π → prefer downward sloping yield curve

Risk aversion and the yield curve

Introduction

- 1-year bond: NO RISK
  - we know with certainty the amount received 1 year from now (face value)
- 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: x

return of 1 year of 2 years' bond

ARBITRAGE condition without risk

- if RISK NEUTRAL: $1 + i_{1t} = \dfrac{€P^e_{1t+1}}{€P_{2t}}$

return 1 year bond

risk neutral means indifferent between buying a risky and riskless bond

- if not risk neutral, under this condition, no one will buy the 2-year bond
- The expected return on a 2-year bond must be higher!
  - risk premium

↓

provide higher return

$$1 + i_{1t} + x = \frac{€P^e_{1t+1}}{€P_{2t}}$$

- 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

$$€P_{2t} = \frac{€P^e_{1t+1}}{1 + i_{1t} + x}$$

price will be lower

get more money, since I am assuming a risk!

- consider: $E P^e_{1t+1} = \frac{€100}{1+i^e_{1t+1}}$
- Price as expected present discounted value: $E P_{2t} = \frac{€100}{(1+i_{1t}+x)(1+i^e_{1t+1})}$
- Using the definition of yield to maturity: $E P_{2t} = \frac{€100}{(1+i_{2t})^2}$

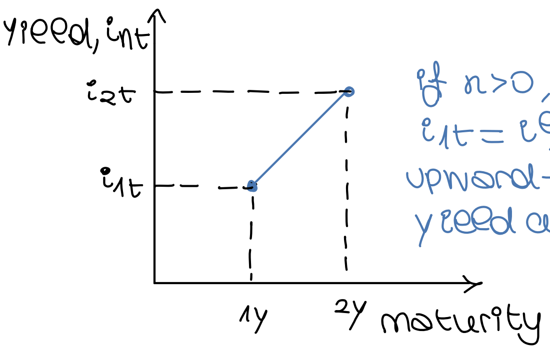
YIELD definition = expected discount value

$$\frac{€100}{(1+i_{2t})^2} = \frac{€100}{(1+i_{1t}+x)(1+i^e_{1t+1})}$$

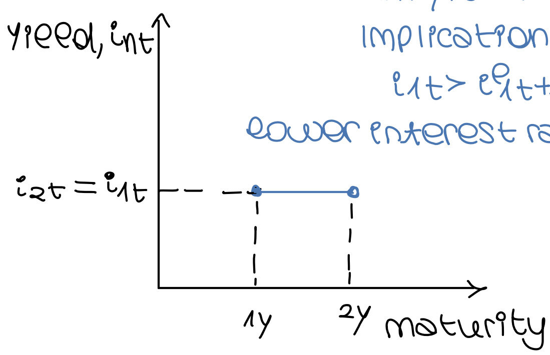
$$(1+i_{2t})^2 = (1+i_{1t}+x)(1+i^e_{1t+1})$$

$$\boxed{i_{2t} \approx \frac{i_{1t}+i^e_{1t+1}+x}{2}}$$

Yield curve with risk



if $x>0$, even with $i_{1t} = i^e_{1t+1}$, upward-sloping yield curve



FLAT yield curve implications?
$i_{1t} > i^e_{1t+1}$:
lower interest rate expected

YIELD CURVE: interpretation
- Provides information about people's expectations
- Interpreting the yield curve:
  - slope
  - position

If downwards 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)

122 Part 1 (OB, ch14)

expectations and stock prices

stock prices as a FUNCTION of expectations

DETERMINATION of STOCK PRICES

Down Jon → 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)

STOCK PRICES

1) $€D^e_{t+1}$ ≡ expected future DIVIDEND
2) $€Q_t$ ≡ PRICE of a stock in t
   ex-dividend price: after the payment of current period dividend
3) $€Q^e_{t+1}$ ≡ 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
1-year bond	1€	⟶	$(1+i_{1t})€$ → know how much you will get
stock	1€	⟶	$\boxed{\dfrac{€D^e_{t+1} + €Q^e_{t+1}}{€Q_t}}$

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, X!

$$\frac{€D^e_{t+1} + €Q^e_{t+1}}{€Q_t} = 1 + i_{1t} + x$$

risk premium

Return of a risk-free bond

expected return of a stock

solving for €Q_t... STOCK PRICE Expected PDV of future payments

$$€Q_t = \frac{€D^e_{t+1} + €Q^e_{t+1}}{1 + i_{1t} + x}$$

BUT... what are the determinants of the future expected price we expect will prevail in t+1?

- future price as expected PDV of future (expected) payments: $€Q^e_{t+1} = \frac{€D^e_{t+2} + €Q^e_{t+2}}{1 + i^e_{1t+1} + x}$
- substituting in €Q_t: $€Q_t = \frac{€D^e_{t+1}}{1 + i_{1t} + x} + \frac{€D^e_{t+2} + €Q^e_{t+2}}{(1 + i_{1t} + x)(1 + i^e_{1t+1} + x)}$

But... what determines $€Q^e_{t+2}$?

- Reapeating the intuition, we can write:

$$€Q_t = \frac{€D^e_{t+1}}{1+i_{1t}+x} + \frac{€D^e_{t+2}}{(1+i_{1t}+x)(1+i^e_{1t+1}+x)} + \ldots + \frac{€D^e_{t+n} + €Q^e_{t+n}}{(1+i_{1t}+x)(1+i^e_{1t+1}+x)\ldots(1+i^e_{1t+n-1}+x)}$$

- For n high enough, $€Q^e_{t+n}$ becomes irrelevant: moving to the future, this will go to zero

$$€Q_t = \frac{€D^e_{t+1}}{1+i_{1t}+x} + \frac{€D^e_{t+2}}{(1+i_{1t}+x)(1+i^e_{1t+1}+x)} + \ldots + \frac{€D^e_{t+n}}{(1+i_{1t}+x)(1+i^e_{1t+1}+x)\ldots(1+i^e_{1t+n-1}+x)}$$

The stock price is the expected PDV of future expected dividends

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

In real terms: $Q_t = \frac{D^e_{t+1}}{1 + r_{1t} + x} + \ldots + \frac{D^e_{t+n}}{(1 + r_{1t} + x)\ldots(1 + r_{1t+n-1} + x)}$

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: $r \uparrow \; r^e \uparrow \Rightarrow Q_t \downarrow$

(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

- stock prices as expected present discounted value of future payments
- 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

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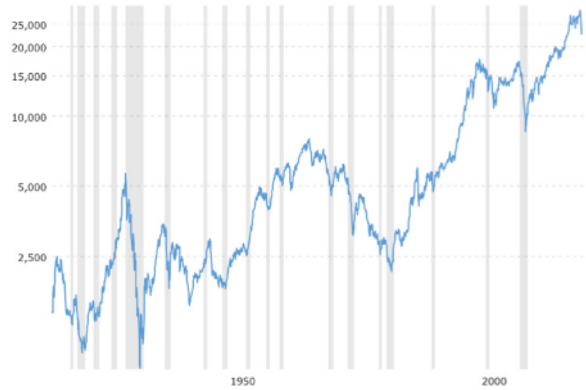


For the most part, major movements in stock prices are unpredictable

Introduction

Stock prices are largely unpredictable

- 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
- "What if...?" questions
  - analysis of possible impacts of economic shocks/policies on the stock market

A monetary contraction (↑r)

In period t the CB reduces M / increases r

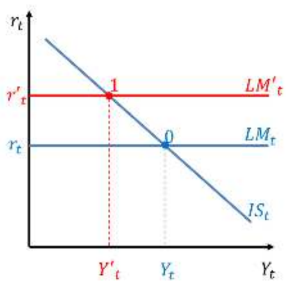
- What is the impact on the stock market?

case 1) unexpected MP (surprise!)

case 2) expected MP expected i → no change r

1) a monetary contraction: surprise!

↑r: ↓ investments → ↓Z → ↓GDP → ↓output



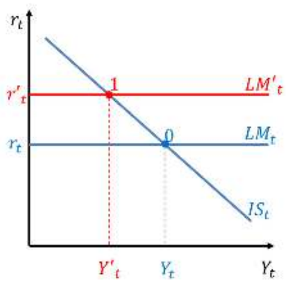
In t: r↑, Yt↓

future? assume no other changes expected

completely unexpected r↑ ⇒ Q↓ Qt↓

The economy today: period t

1) a monetary contraction: expected



In t: r↑, Yt↓

future? assume no other changes expected

fully anticipated/expected $\boxed{\Delta Q_t = 0}$

⇓

no variation stock price

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

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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?

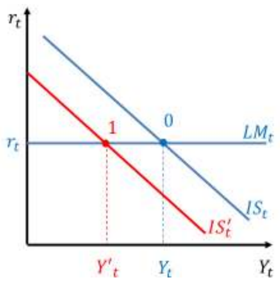
Not credible
- agents belive that the (MP) policy will not be implemented
- No change expected
  $\Delta Q_t = 0$: constant stock price

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

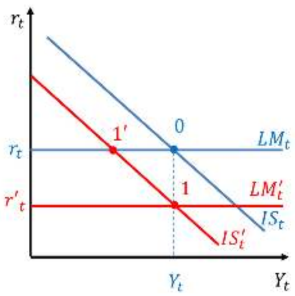
1) Demand shock, constant r



- 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 stock
  - credibility of economic policy authorities

122 Part 1 (OB, ch16+GF ch4, Q7) **expectations and consumption**

Introduction

o standard model (1st part of the course)

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

o 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

o consumption smoothing assumption

- every year, she/he consumes a fraction of her/his total wealth

$C_t = C(\text{total wealth})$

o total wealth$_t$

- present discounted value of life-time income

↳ look at the future

o Human wealth

- expected PDV of after-tax income over working life

what you gain (after tax-wage)

o 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)

o Two periods: present (t) and future ($t+1$)

o utility function: $U(C_t, C_{t+1})$

- increasing and concave in the two arguments

prefer to split consumption over time

o access to credit market: interest rate r → can ask money to bank (loan)

o Disposable income — You need to satisfy intertemporal budget constraint

- Present: $Y_t - T_t$
- future (expected): $Y^e_{t+1} - T^e_{t+1}$

o 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 consumes exactly disposable income?

- Present, t $\quad C_t + S_t = Y_t - T_t$
  - $S>0$: saver
  - $S<0$: borrower
- Future, t+1 $\quad$ tomorrow disposable income

$C_{t+1} = (Y^e_{t+1} - T^e_{t+1}) + (1+r)S_t$

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

solve for S_t $\quad S_t = \underbrace{\frac{C_{t+1}}{1+r}}_{} - \underbrace{\frac{Y^e_{t+1} - T^e_{t+1}}{1+r}}_{}$ $\quad$ 27

link t and t+1

actual present discounted value

$$C_t + \frac{C_{t+1}}{1+r} - \frac{Y^e_{t+1} - T^e_{t+1}}{1+r} = Y_t - T_t$$

intertemporal budget constraint

$$C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y^e_{t+1} - T^e_{t+1}}{1+r}$$

PDV of consumption $\quad\quad$ PDV of expected income

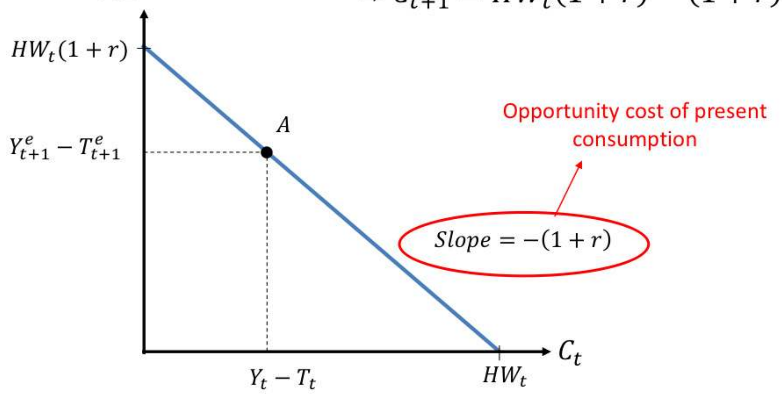
human wealth, HW_t

If I consume everything today, tomorrow I will not consume

Today consumption, in terms of tomorrow consumption

IBC: $C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y^e_{t+1} - T^e_{t+1}}{1+r} = HW_t$

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



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

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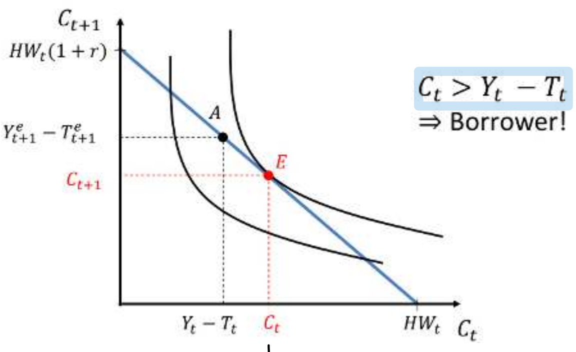
Optimal consumption program

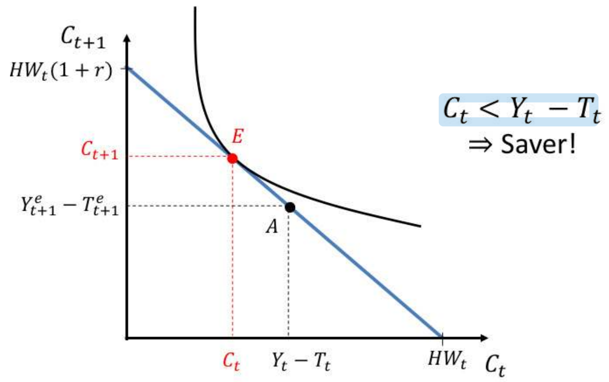
≠ IBC maybe because ≠ r

IBC: $C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y^e_{t+1} - T^e_{t+1}}{1+r} = HW_t$



consumption today higher than my DISPOSABLE income
I borrow money!
Tomorrow I will repay everything, so I will consume less to repay additional consumption

IBC: $C_t + \frac{C_{t+1}}{1+r} = Y_t - T_t + \frac{Y^e_{t+1} - T^e_{t+1}}{1+r} = HW_t$



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:

- preferences → structure utility function
- Disposable income today and tomorrow
- The interest rate
  - opportunity cost of current consumption

↑ r curve is steeper
consume less, since tomorrow I will get more money
(YD - TD)↑ ⇒ today I have more money
and a share of added money, will be consumed today
↑ r and you are a saver, tot value DISPOSABLE income will be higher

Conclusion

- Intertemporal budget constraint
- Optimal intertemporal consumption choice

after covid, ↓ 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

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224 – Part 2 (OB, ch16 + GF, ch. 4 Q7) **expectations and consumption**

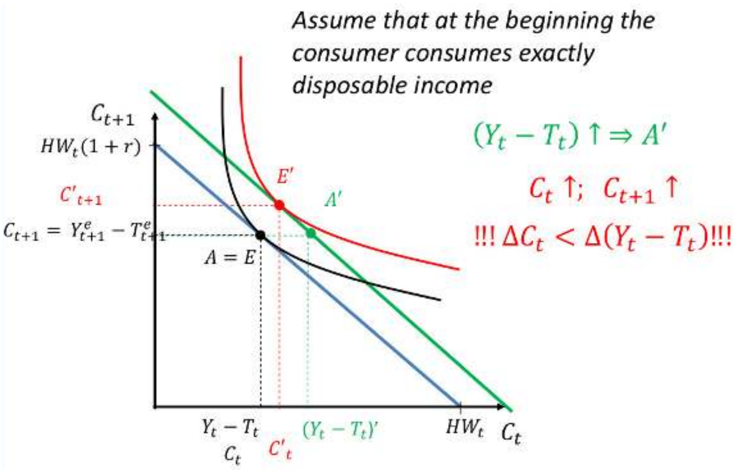
- transitory and permanent shocks to disposable income
- changes in the interest rate r

GF, ch4 Q7 point b) **intertemporal consumption choices**

TEMPORARY INCREASE IN DISPOSABLE INCOME

- assume a transitory increase in disposable income:
  - $\Delta(Y_t - T_t) > 0$
  - $\Delta(Y^e_{t+1} - T^e_{t+1}) = 0$
  - Impact on consumption choices?

Temporary increase in disposable income



human wealth increases
consume more today
and more tomorrow

REDUCE TAXATION, overall consumption will increase
BUT less than the ↑ $(Y_t - T_t)$ since people want to save

- transitory increase in disposable income
  - $C_t \uparrow$; $C_{t+1} \uparrow$ (save to consume more tomorrow)
  - $\Delta C_t < \Delta(Y_t - T_t)$

  consumption smoothing

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

IBC: today Disposable income + Discounted value of future Disposable income.
$C_t \uparrow$ C_{t+1} 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

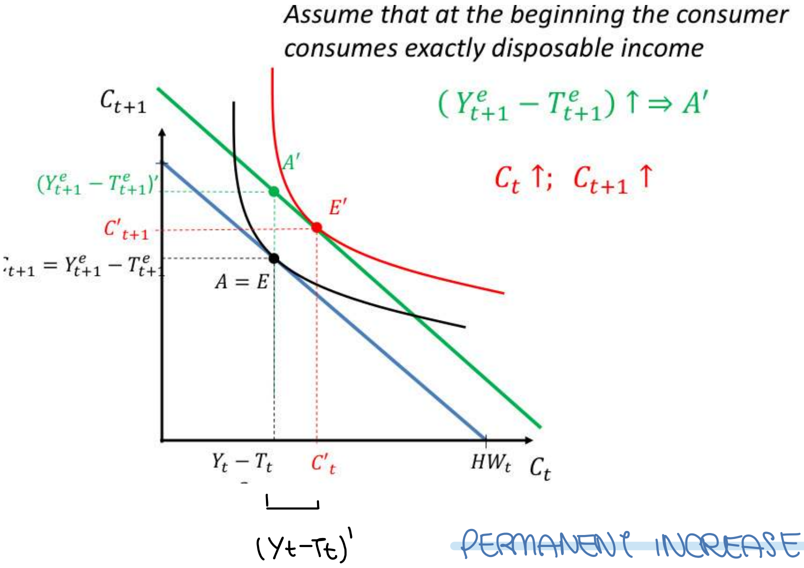
shift budget constraint

prefer to share consumption
consumption depends on your preference

point b) INCREASE IN FUTURE DISPOSABLE INCOME

- assume an increase in future disposable income
  - $\Delta(Y_t - T_t) = 0$
  - $\Delta(Y^e_{t+1} - T^e_{t+1}) > 0$

○ Impact on consumption choices?



○ 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 $\Delta(Y_t - T_t) = \Delta(Y^e_{t+1} - T^e_{t+1}) > 0$

○ 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

$C_t = C(\underset{+}{HW_t})$

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

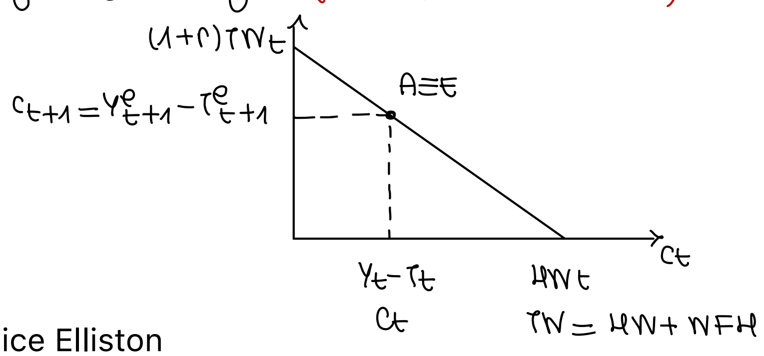
POSITIVE FINANCIAL and HOUSING WEALTH

Financial and housing wealth

□ what happens if $NFH_t > 0$: Higher total wealth

○ NFH_t = expected net present discounted value of assets (bonds/stock) and houses

generalizing: $C_t = C$(total wealth)



Budget constraint shift right

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L25 – Part 1 (03, ch 16) **expectations and consumption**

A MORE REALISTIC DESCRIPTION

Part 1:
- A more realistic description of consumers' behaviour

Part 2:
- expectations and investment

$(Y-T)\uparrow$ 10% → $C\uparrow$ 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

- 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 explanation of the real world?

EMPIRICAL EVIDENCE

empirical observation #1

- Predictions
  - C_t reacts less than proportionally to fluctuations in current income
  - $C_t(\uparrow)$ changes even if current income does not

  } verified!

  Smooth consumption: ↑ income today → split C_t and C_{t+1}
  - we observe consumption smoothing overtime! → transitory vs permanent shocks

empirical observation #2

- C_t seems more reactive than predicted to changes in CURRENT income
  True I split C, but not so big as I expected
  C_t react to variation in future income, but lower than the model
- C_t reacts less than predicted to changes in future expected disposable income

How can we reconcile our model with these empirical observations?

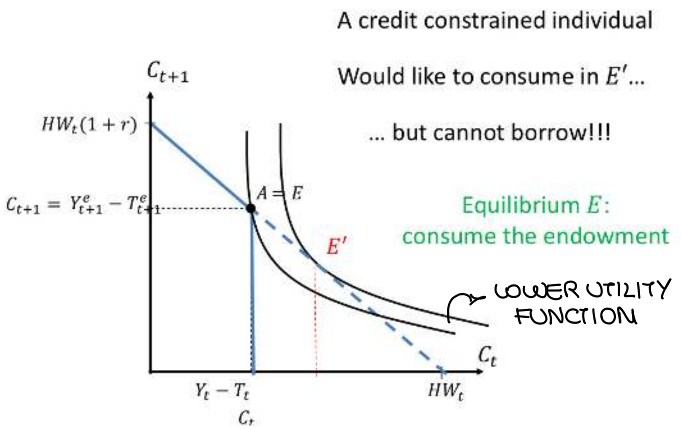
A MORE REALISTIC MODEL

- Do consumers want to consume a constant fraction every period?
- Credit constraints
  If $Y_t - T_t <$ expected future $Y-T$
  in reality you have a limit in consumption smoothing

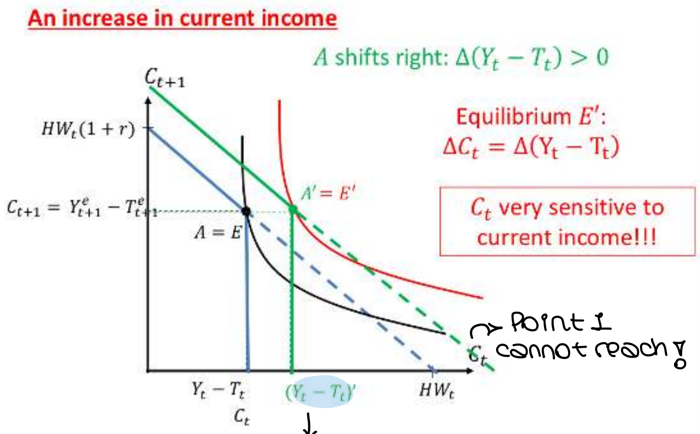
credit constraints

Facts we want to explain:
- C_t more sensitive than predicted to $\Delta(Y_t - T_t)$
- C_t less sensitive than predicted to $\Delta(Y^e_{t+1} - T^e_{t+1})$
- credit constraints:
  - assume consumer cannot borrow!
  - consider a credit constrained consumer

  I can postpone consumption

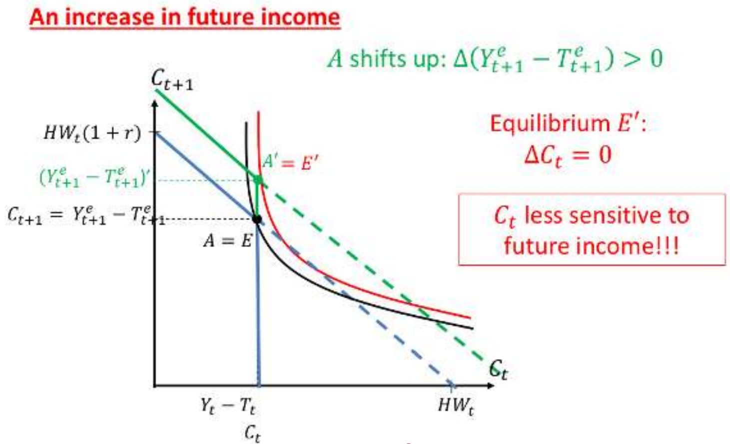


max level consumption today
cannot anticipate C (cannot borrow money)



↑ DISPOSABLE INCOME

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



↳ 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

$C_t = C(Y_t - T_t, Y^e_{t+1} - T^e_{t+1}, NFH_t)$

$LM = \bar{r}$ $\qquad\qquad$ $Y_t = e(Y^e_{t+1})$

$$IS = \underbrace{C}_{} + \overbrace{I}^{(r_t,\, r^e_{t+1})} + G + NX$$

$C_t(Y_t - T_t, Y^e_{t+1} - T^e_{t+1}, NFH_t)$

L26 - Part 1 (OB, ch 16 - par 182) The IS-LM curve with expectations

○ Part 1

– expectations and the IS curve

AIM: the IS-LM model with expectations

○ 2 periods:

– Today: t   Notation: $X_t = X$

– Future: t+1   Notation: $X^e_{t+1} = X'^e$

○ IS curve: equilibrium in the goods market

stock price depends on dividends

○ $Y = C + I + G$

consumption

$C = C(\underset{+}{Y - T}, \underset{+}{Y'^e - T'^e}, \underset{+}{WFH})$

$Y\uparrow$ ⇒ $(Y-T)\uparrow$

$T\downarrow$

$Y'^e\uparrow$ ⇒ $(Y'^e - T'^e)\uparrow$

$T'^e\downarrow$ ⇒ $\pi'^e\uparrow \Rightarrow D'^e\uparrow \Rightarrow Q\uparrow$

$r\downarrow, r'^e\downarrow$ ⇒ $P_{bond}\uparrow$

$Q\uparrow$

⇒ $C\uparrow$

Investment

$\boxed{I = I(\underset{+}{\pi}, \underset{+}{V(\pi)})}$

→ today actual value of future profits

$$\frac{\pi^e_{t+1}}{1+r_t} + \frac{\pi^e_{t+2}}{(1+r_t)(1+r^e_{t+1})} + \frac{\pi^e_{t+3}}{(1+r_t)(1+r^e_{t+1})(1+r^e_{t+2})}$$

present value

Depends on expected profits

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

$Y\uparrow$ ⇒ $\pi\uparrow$

$y'^e\uparrow$ ⇒ $V(\pi)\uparrow$

$r\downarrow, r'^e\downarrow$ ⇒ $V(\pi)\uparrow$

$\delta\downarrow$

⇒ $I\uparrow$

The IS curve: standard

○ No expectations: IS: $Y = C(Y-T) + I(Y, r+x) + G$

○ In a more compact way: IS: $Y = A(Y, T, r, x) + G$

$A(Y,T,r,x) \equiv C(Y-T) + I(Y, r+x)$ ⇒ aggregate private spending

The IS curve with expectations

○ with expectations: IS: $Y = A(\underset{+}{Y}, \underset{-}{T}, \underset{-}{r}, \underset{-}{x}, \underset{+}{Y'^e}, \underset{-}{T'^e}, \underset{-}{r'^e}) + G$ G: exogenous

○ $Y\uparrow, Y'^e\uparrow$ ⇒ $A\uparrow$

○ $T\uparrow, T'^e\uparrow$ ⇒ $A\downarrow$

○ $r\uparrow, r'^e\uparrow, x\uparrow$ ⇒ $A\downarrow$

IS with expectations: SLOPE

IS: $Y = A(Y, T, r, x, Y'^e, T'^e, r'^e) + G$

⇒ How is the slope compared to the standard case? If $r\downarrow \Rightarrow A\uparrow \Rightarrow Z\uparrow \Rightarrow Y\uparrow$

standard case $\Delta I \Rightarrow \Delta$output → now depends on overall effect is smaller

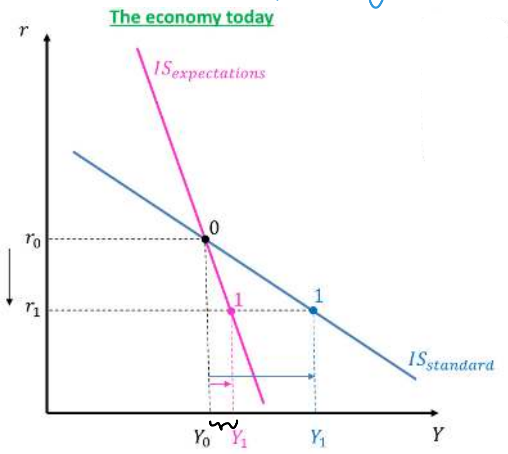
↓

now we have more I to take into account

Today & 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↓ ⇒ A↑ ⇒ Z↑ ⇒ Y↑

BUT, if we consider expectations the increase is smaller

IS with expectations: shifts

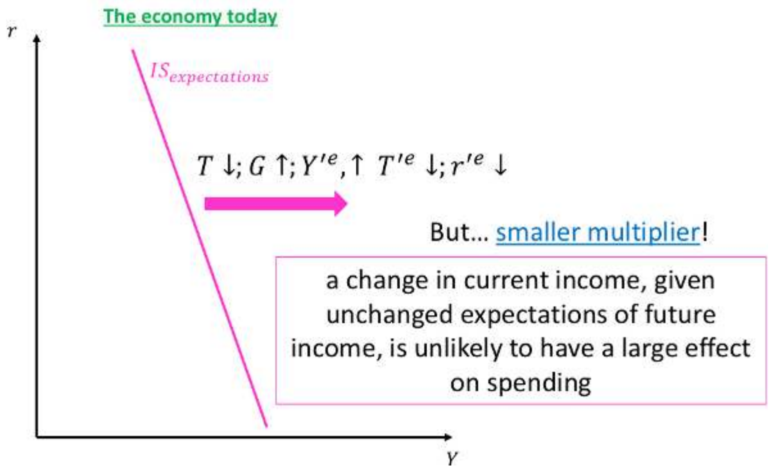
multiplier is smaller → change today income

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

- The CB sets the interest rate that keeps the money market in equilibrium
- money demand
  - current level of transaction
  - current opportunity cost of money

LM: $r = \bar{r}$

conclusion

- IS curve with expectations:
  - slope
  - position
- 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 → not affected by the present

- $IS_{t+1}: Y_{t+1} = A(Y_{t+1}, T_{t+1}, r_{t+1}) + G$
- $LM_{t+1}: \bar{r} = r_{t+1}$

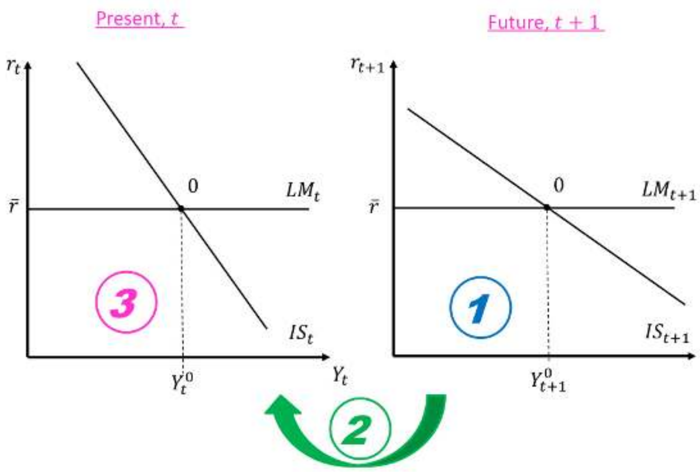
how this change affect our expectations ② and then our present ③

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

- $\Delta Y'^e, \Delta r'^e, \Delta T'^e$

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

- $IS_t: Y_t = A(Y_t, T_t, r_t, \pi, Y'^e, T'^e, r'^e) + G$
- $LM_t: \bar{r} = r_t$



TRANSITORY monetary policy

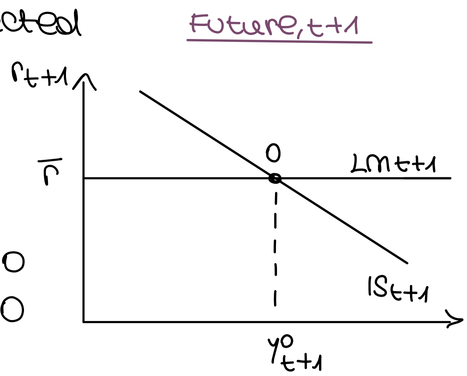
no MP in the future

○ $r_t \downarrow$:

- announced and performed in t: you are SURPRISED! Not expected
- TRANSITORY: no change expected for the future

○ IMPACT in the future?

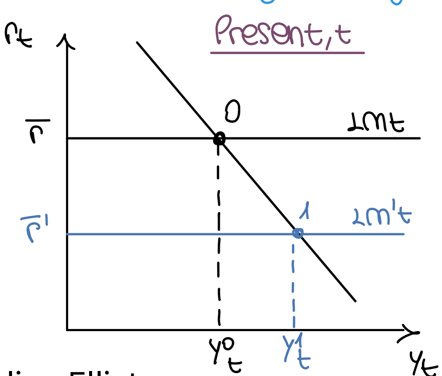
transitory policy: no change expected for the future



$\Delta Y'^e = 0$

$\Delta r'^e = 0$

○ IMPACT in the future?



$r \downarrow \Rightarrow I \uparrow$

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

$Y_t \uparrow$

○ Smaller impact with expectations: STEEPER IS

So PDV of future profits ↑

also consumption affected: WFH ↑

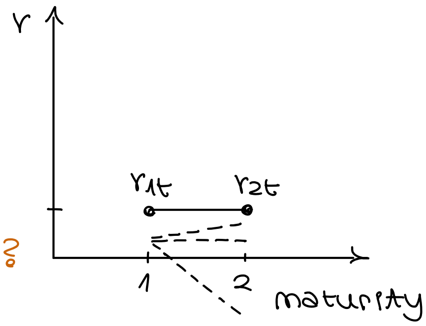
Add also future expected interest rate

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

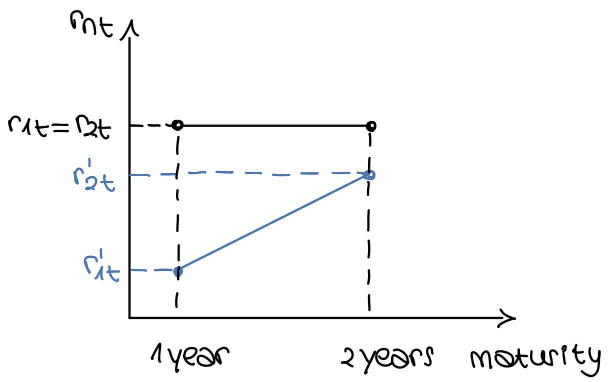


- assume that, before the policy, $\boxed{r_t = r^e_{t+1} = r}$

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

  $\downarrow$ actual interest rate
- Draw the yield curve before the policy: $\boxed{r_{2t} \approx \frac{r_t + r^e_{t+1}}{2} = r}$
- What happens to the yield curve after the policy is implemented?

Positive yield curve $\nearrow$: expect to have higher YIELD curve with the policy



- $r_t \downarrow$
- $\Delta r'^e = 0$

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

- $r'_{2t} < r_{2t}$
- In fact, $\Delta r_{2t} = \frac{\Delta r_t}{2}$

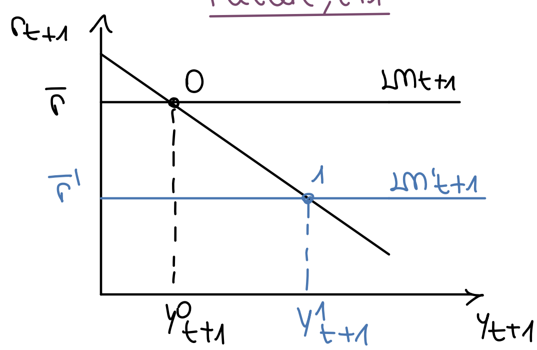
Individuals expect higher interest rates for the future

PERMANENT MONETARY POLICY

- The CB announces in t an expansionary MP
- The policy is perceived as permanent

  – If permanent, EXPECTATIONS about the future are affected

Future, t+1



- expected MP in the future

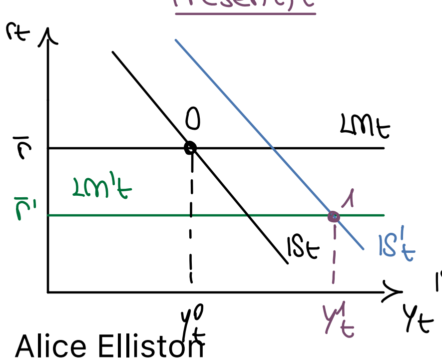
  $LM_{t+1} \downarrow$

  $\Rightarrow r_{t+1} \downarrow, Y_{t+1} \uparrow$

  $\downarrow$

  $\downarrow$ in future interest rate
- expectations changes: $r'^e \downarrow$; $Y'^e \uparrow$

Present, t



Impact in t

- 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 change while move along if var. on axis change

  IS depends on future DISPOSABLE INCOME and present + future interest rate
- MP in t: $LM \downarrow$ $\boxed{r \downarrow \; Y \uparrow}$

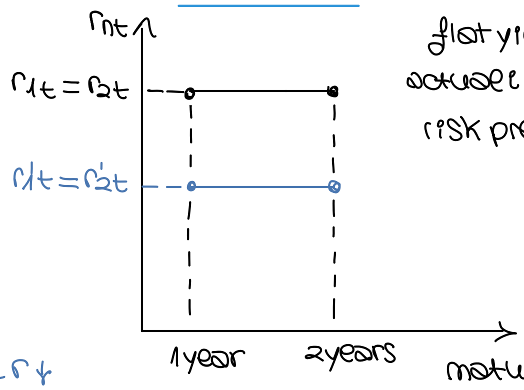
Alice Elliston

Permanent monetary policy

- Assume that, before the policy, $r_t = r^e_{t+1} = r$
- Draw the yield curve before the policy $i_{2t} \approx \frac{r_t + r^e_{t+1}}{2} = r$

- What happens of the yield curve after the policy is implemented

Yield curve



flat yield curve
actual r = expected r
risk premium = 0

With the policy:
- $r_t \downarrow$, $r'^e_{t+1} \downarrow$
- $\Delta r'^e = \Delta r$

$\Rightarrow i_{2t} \approx \frac{r_t + r^e_{t+1}}{2}$

$\Delta i_{2t} = \Delta r$

actual r ↓
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:
$\Rightarrow r$ 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↑
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

Part 1 (OB, ch19 par. 1) exchange rate

$$Y = \underbrace{C}_{} + I + G + NX[\boxed{E}, Y^*, Y]$$

$I(\pi, r(\pi))$ — EXP−IMP/ε — exchange rate — my output

$C(Y_t - T_t, Y^e_{t+1} - T^e_{t+1}, r_t, r^e_{t+1}, WFH)$ — foreign output

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: $E_{€/\$} = 1.124$
    - 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↑
- E.g. $E_{€/\$} = 1 \Rightarrow E_{€/\$} = 1.2$
- we need fewer € to buy 1US\$ → 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↑
- we need more € to buy 1US\$

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 ($\bar{E}$↑)
    - Devaluation: a reduction in the exchange rate ($\bar{E}$↓)

floating exchange rate can change according to demand and supply between € and \$ excess of demand → price €↑ and price \$ in terms of €↓

\$/argentina (pesos): fixed exchange rate → decided EX-ANTE
↓
lower uncertainty → for investors UNCERTAINTY is a cost

If you have a shock: Gap supply/Demand → not fixed exchange rate
⇒ 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)

- E = 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)
- EP = price of European goods in US dollars

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

$$\varepsilon = \frac{EP}{P^*}$$

we want to open economy
↳ foreign variable → level of price in a foreign country

Real exchange Rate
↳ Depends on nominal exchange rate and depends on level of price
↑ inflation rate ⇒ P*↑ ⇒ depreciation in real exchange rate
- quantity of foreign goods that can be obtained by exchanging 1 basket of domestic goods $\varepsilon = \frac{EP}{P^*}$

- 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
  - E↑
  - P↑
  - P*↓
- 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
  - E↓
  - P↓
  - P*↑

Part 2 (OB, ch17 - par2 & ch19 par. 2)

Uncovered Interest Rate parity

CHOOSE BETWEEN FOREIGN or DOMESTIC Financial Assets

- Imports and exports
- investment → more convenient to invest in another country (i.e. US)
  ↑ interest rate: Buy $ and buy US bonds

Individuals → Holding money: M^D
Individuals → Financial assets: bonds...
Financial assets → foreign
Financial assets → domestic

choice between holding Foreign or Domestic Financial Assets
looking for investment with HIGHER return

assume 2 bonds:
Domestic ⇒ pay i_t
Foreign ⇒ pay i^*_t

$$\begin{array}{llcl} \text{Domestic} & 1€ & \longrightarrow & (1+i_t)€ \\ \text{Foreign} & 1€ & & \dfrac{E_t(1+i^*_t)}{E^e_{t+1}}€ \\ & \downarrow & & \uparrow \\ & \$E_t & \longrightarrow & \$E_t(1+i^*_t) \end{array}$$

E = # units of foreign currency for 1 unit of domestic

Which do we choose between domestic and foreign bonds?

$(1+i_t) > \dfrac{E_t(1+i^*_t)}{E^e_{t+1}}$ we buy domestic bonds

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

$(1+i_t) < \dfrac{E_t(1+i^*_t)}{E^e_{t+1}}$ we buy foreign bonds

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

$(1+i_t) = \dfrac{E_t(1+i^*_t)}{E^e_{t+1}}$: Uncovered Interest Rate Parity (UIP)

⇒ Investors are indifferent between foreign and domestic bonds

Uncovered Interest Rate parity : $(1+i_t) = \dfrac{E_t(1+i^*_t)}{E^e_{t+1}}$

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

$$(1+i_t) = \frac{(1+i^*_t)}{\frac{E^e_{t+1}}{E_t}} = \frac{(1+i^*_t)}{1+\frac{E^e_{t+1}}{E_t}-1} = \frac{(1+i^*_t)}{1+\frac{E^e_{t+1}-E_t}{E_t}}$$

expected appreciation of the domestic currency

For small variations, we can approximate to:

$$\Rightarrow i_t \approx i^*_t - \frac{E^e_{t+1}-E_t}{E_t}$$

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 → outflow of investment from your country affect exchange rate
exchange rate depends on:
- expectations
- difference interest rate

Uncovered Interest Rate Parity

$$\boxed{i_t \approx i_t^* - \frac{E^e_{t+1} - E_t}{E_t}}$$

example: $i_t = 2\%$ $\quad i^*_t = 5\%$

- 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

- approximate version: $i_t \approx i_t^* - \frac{E^e_{t+1} - E_t}{E_t}$ we use to calculate expectations on the interest rate
- exact version: $(1+i_t) = \frac{(1+i^*_t)E_t}{E^e_{t+1}}$ we use in our extended model

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

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

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

DETERMINANTS of the exchange rate:

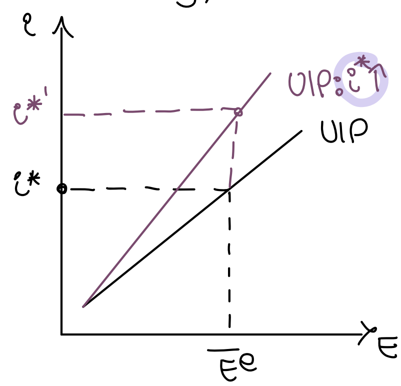
- $i\uparrow$ (domestic i increase): bonds in € become more attractive $\Rightarrow €^D\uparrow \rightarrow E\uparrow$
- $i^*\uparrow$: foreign bonds become more attractive $\Rightarrow €^D\downarrow \Rightarrow E\downarrow$
- $\bar{E}^e\uparrow$: lower expected returns on foreign bonds $\Rightarrow €^D\uparrow \rightarrow E\uparrow$

To draw the curve representing Uncovered Interest Rate Parity, we derive it as a function i

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

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

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

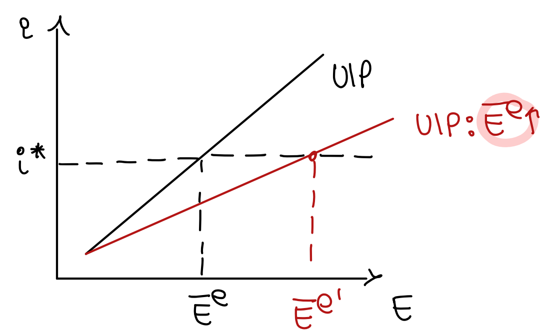


UIP: all the equilibrium associated with foreign i and expected exchange rate

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

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)

Alice Elliston

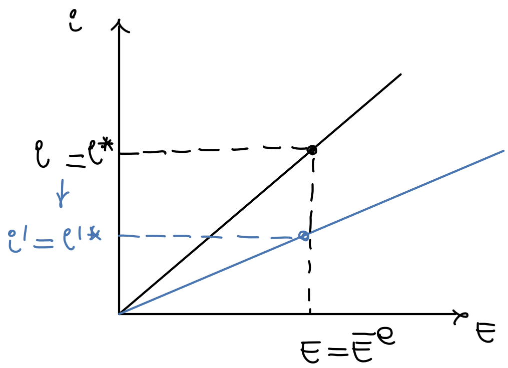
To keep the interest rate constant:

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

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

- $\bar{E}^e \uparrow \Rightarrow E \uparrow$

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

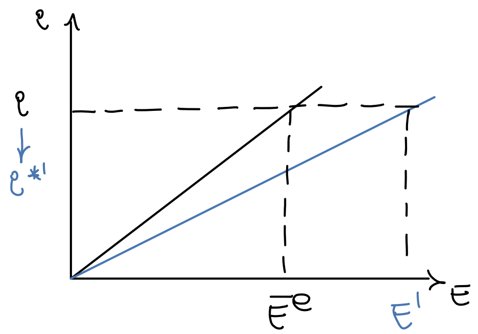


$$\underset{\downarrow}{i} = (1+\underset{\downarrow}{i^*})\frac{\boxed{E}}{\boxed{\bar{E}^e}} - 1$$

i^*

$\bar{E}^e$

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



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

FOR DOUBTS OR SUGGESTIONS ON THE HANDOUTS

ALICE ELLISTON

alice.elliston@studbocconi.it
@alice.elliston_
+39 3442849243

FOR INFO ON THE TEACHING DIVISION

NICOLA COMBINI

nicola.combini@studbocconi.it
@nicolacombini
+39 3661052675

MARTINA PARMEGGIANI

martina.parmegiani@studbocconi.it
@martina_parmegiani05
+39 3445120057

MARK OLANO

mark.olano@studbocconi.it
@mark_olano._
+39 3713723943

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