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B.LAB

HANDOUTS

MACROECONOMICS

-SECOND PARTIAL-

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This handout is written by students with no intention of replacing university materials.

It is a useful tool for studying the subject, but does not guarantee preparation as exhaustive and complete as the material recommended by the University.

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Financial Markets and Expectations

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Bond Prices and Bond Yields

Bonds:

- **Maturity**: the length of time over which the bond promises to make payments to the bondholder
- **Risk**:
  - **DEFAULT risk**: is the risk that the bond issuer (government or company) will not pay back the promised amount.
  - **PRICE risk**: you have this risk if you sell the bond before maturity. You are uncertain about the price you will be able to sell.
- **Yield to maturity / yield**: the interest rate associated with bonds of different maturities.
- **Short term interest rates**: one year usually
- **Long term interest rates**: more than one year

Price of bonds:

Consider a zero-coupon bond= discount bond.

$$i = \frac{payment\ in\ the\ future - price\ of\ the\ bond}{price\ of\ bond}$$

$i\uparrow\ \$P_B\downarrow$

From this we can get $\$P_B = \frac{payment\ in\ the\ future}{1+i}$

Suppose that I buy a bond that promises to pay 100$ in a year and it costs 95$.

$$i = \frac{100-95}{95} = 5\,\%$$

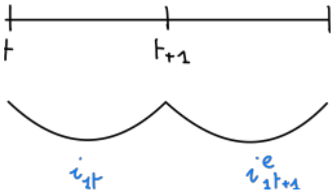
Suppose that you buy today a 1 year bond. The promised payment is 100$. Its price is:

$\$P_{1t}$ =price today (at time t) of a 1 year bond.

Its interest rate is i_{1t} =current (at time t) 1 year nominal interest rate

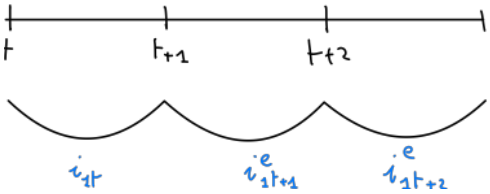
We know that $\$P_{1t} = \frac{\$100}{1+i_{1t}}$

Suppose I want to compute $\$P_{2_t}$ which is the price today of a 2 year bond.



$$\$P_{2_t} = \frac{\$100}{(1+i_{1_t})(1+i^e_{1_{t+1}})}$$

Now $\$P_{3_t}$



$$\$P_{3_t} = \frac{\$100}{(1+i_{1_t})(1+i^e_{1_{t+1}})(1+i^e_{1_{t+2}})}$$

The Arbitrage Condition:

Suppose you have to choose between a **1y** and a **2y** bond. You care only about the **return** and you don't care about risk: **risk neutral**.

- **1y bond**

  For each \$ you put in it you'll get for sure $(1+i_{1_t})\$$ next year

- **2y bond**

  Its price is $\$P_{2_t}$

  With every \$ you put in it you can buy $\frac{1\$}{\$P_{2_t}}$ bonds today.

  Next year it has 1 year before maturity, so it'll be a 1 year bond. If I sell it at time $t+1$, I can sell it at: $\$P^e_{1_{t+1}}$ and this is the expected price of a 2y bond next year.

  For every \$ I put in the 2 year bond, by selling it after 1 year I expect to receive $\frac{1\$}{\$P_{2_t}} * \$P^e_{1_{t+1}}$

  In order for both (1y and 2y bonds) financial markets to exist, the **arbitrage condition** must hold: **the 2 kinds of bonds must have the SAME expected return**. $P_1t

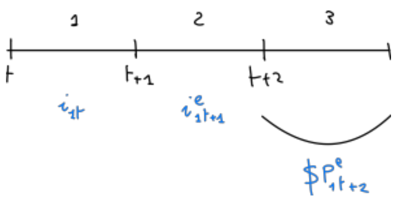
$$1+i_{1_t} = \frac{\$P^e_{1_{t+1}}}{\$P_{2_t}}$$

Return per dollar of holding a 1y bond for 1y | Expected Return per dollar of holding a 2y bond for 1y

From this arbitrage condition we get $\$P_{2_t}$

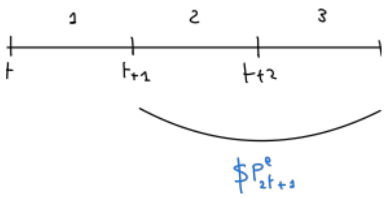
$$\$P_{2_t} = \frac{\$P^e_{1t+1}}{1+i_t}$$

Suppose now you want to compute $\$P_{3_t}$ and you're given $\$P^e_{1t+2}$



$$\$P_{3_t} = \frac{\$P^e_{1t+2}}{(1+i_{1_t})(1+i^e_{1t+1})}$$

Suppose you need to find $\$P_{3_t}$ and you're given $\$P^e_{2t+1}$



$$\$P_{3_t} = \frac{\$P^e_{2t+1}}{(1+i_{1_t})}$$

So we said:

$$\$P_{1_t} = \frac{\$100}{1+i_{1_t}}$$

Moving 1 period further:

$$\$P^e_{1t+1} = \frac{\$100}{(1+i^e_{1t+1})}$$

We also said that:

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

I substitute:

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

The arbitrage condition between 1y and 2y bonds implies that the price of the 2y bond today ($\$P_{2_t}$)= present value of the payment in 2y (100$) discounted using the current (i_{1_t}) and next year expected 1y interest rate (i^e_{1t+1}).

Yield to Maturity

The yield to maturity on an n-year bond (the n-year interest rate) is the constant annual interest rate that makes the bond price today equal to the present value of the future payments on the bond.

Consider a bond that pays 100$ at the end of maturity.

$$\$P_{nt} = \frac{\$100}{(1+i_{nt})^n}$$

Yield to maturity of an n-year bond

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

Yield to maturity of an 2y bond

Before we have obtained

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

I substitute

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

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

We can approximate this to:

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

The current 2y interest rate is equal to the average of the current 1y interest rate (i_{1t}) and next year expected 1y interest rate (i^e_{1t+1}).

Broadly speaking:

$$i_{nt} = \frac{1}{n}(i_{1t} + i^e_{1t+1} + \ldots + i^e_{1t+n-1})$$

$$i_{3t} = \frac{1}{3}(i_{1t} + i^e_{1t+1} + i^e_{1t+2})$$

So to recap:

$$\$P_{3t} = \frac{\$P^e_{1t+2}}{(1 + i_{1t})(1 + i^e_{1t+1})} = \frac{\$P^e_{1t+2}}{(1 + i_{2t})^2}$$

Remind that $(1 + i_{3t})^3 = 1 + 3_{i3t}$

We introduce Risk

Investors care about **risk** as well. They have to choose between a **1y** and a **2y bond**.

2y is more risky => price risk since I don't know at what price I will be able to sell it next year if I want to sell it. So I want to be compensated => I require a RISK PREMIUM (x) so the arbitrage condition becomes:

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

The **expected return** on a **2y bond** that you **hold for 1y** must **EXCEED** the **return of the 1y bond by** x, **RISK PREMIUM**.

From here you can get:

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

We know that:

$$\$P^e_{1t+1} = \frac{\$100}{1 + i^e_{1t+1}}$$

We substitute:

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

We merge the 2 formulas_

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

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

We approximate:

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

The current 2y interest rate is equal the average of the current 1y interest rate, the expected 1y interest rate and x.

The larger x, the more yield on the 2y bond (i_{2t}) exceeds the average of the current (i_{1t}) and expected (i^e_{1t+1}) yields on 1y bonds.

We generalize:

$$i_{nt} = \frac{1}{n}(i_{1t} + i^e_{1t+1} + i^e_{1t+n-1} + x)$$

$$i_{3t} = \frac{1}{3}(i_{1t} + i^e_{1t+1} + i^e_{1t+2} + x)$$

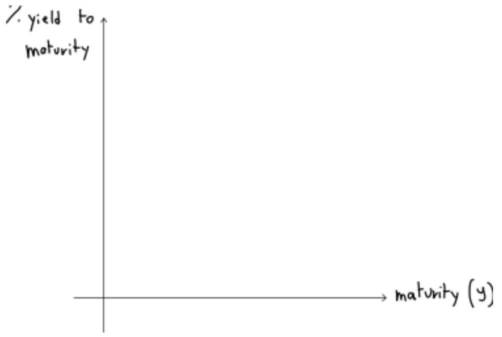
Holding a 2y bond is more risky than a 1y.

- **Without risk**: $i_{2t} = \frac{1}{2} = (i_{1t} + i^e_{1t+1})$
- **With risk**: $i_{2t} = \frac{1}{2} = (i_{1t} + i^e_{1t+1} + x)$

The Yield Curve

It's also called the **term structure of interest rates**.

It's a graphical representation of the relationship between yields (y axis) for bonds of different maturity (x axis).



We don't consider risk:

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

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

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

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

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

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

We reason on the **slope**:

- The yield curve has a **POSITIVE** slope: $i_{2t} > i_{1t}$
  - Financial markets expect an ↑ in (short-term) interest rate so $i^e_{1t+1} > i_{1t}$
  - Investors expect the policy rate to ↑ => **contractionary monetary policy**
- The yield curve has a **NEGATIVE** slope: $i_{2t} < i_{1t}$
  - Financial markets expect a ↓ in (short-term) interest rate so $i^e_{1t+1} < i_{1t}$
  - Financial markets expect an **expansionary monetary policy**
- The yield curve is **FLAT**: $i^e_{1t+1} = i_{1t}$
  - Financial markets expect no change in (short-term) interest rate so $i^e_{1t+1} = i_{1t}$

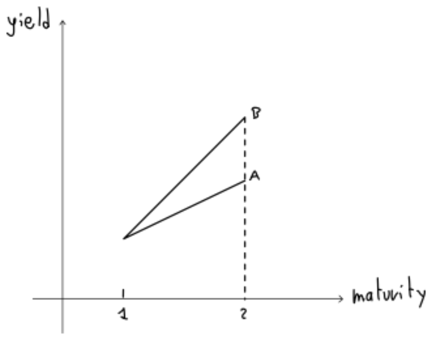
Now we consider risk as well:

- If the yield curve is **DOWNWARD** sloping (rare):

  Investors expect interest rates to go down overtime AND this decrease is stronger than the rising risk premium which is always increasing with maturity.

- The yield curve is **UPWARD** sloping:
  - It might be that interest rates are expected to be constant or even ↓ overtime BUT since the risk premium x ↑ with maturity, then the yield curve is upward sloping.

    OR they expect interest rates to ↑ overtime
    - It doesn't necessarily signal expectations of an ↑ in (Short term) interest rates.
    - If x is high or it ↑, the yield curve becomes steeper.



Interpreting the yield curve (p327)

Consider the yield curve for 1 November 2000.

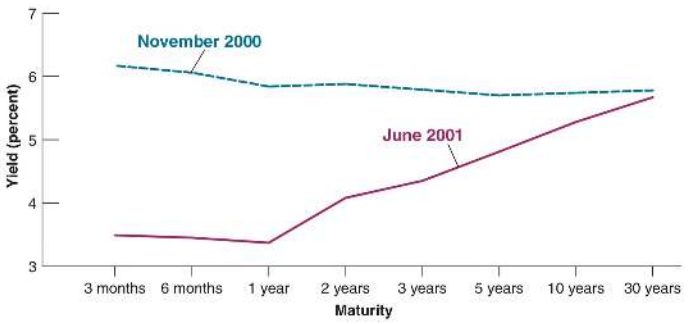


Figure 15.2

US yield curves: 1 November 2000 and 1 June 2001

The yield curve, which was slightly downward sloping on November 1, 2000, was sharply upward sloping seven months later.

Source: FRED. Series DGS1MO, DGS3MO, DGS6MO, DGS1, DGS2, DGS3, DGS5, DGS7, DGS10, DGS20, DGS30.

Recall that, when investors expect interest rates to be constant over time, the yield curve should be slightly upward sloping, reflecting the fact that the risk premium increases with maturity. The fact that the yield curve was downward sloping, something relatively rare, tells us that investors expected interest rates to go down slightly over time, with the expected decrease in rates more than compensating for a rising term premium. And, if we look at the macroeconomic situation at the time, they had good reasons to hold this view. At the end of November 2000, the US economy was slowing down. Investors expected what they called a smooth landing. They thought that, to maintain growth, the Fed would slowly decrease the policy rate, and these expectations were what lay behind the downward-sloping yield curve. By June 2001, however, growth had declined much more than was expected in November 2000 and, by then, the Fed had decreased the interest rate much more than investors had expected. Investors now expected that, as the economy recovered, the Fed would start increasing the policy rate. So, the yield curve sloped upward. Note, however, that the yield curve was nearly flat for maturities up to one year. This tells us that financial markets did not expect interest rates to start rising until a year hence – that is, before June 2002. Did they turn out to be right? Not quite. In fact, the recovery was much weaker than expected, and the Fed did not increase the policy rate until June 2004 – fully two years later than financial markets had anticipated.

Price of Stocks

Stocks: securities that represent the ownership of a fraction of a corporation.

Suppose you have to choose between a 1y bond and a stock held for 1y.

- **1y bond**:

  For every \$ you put in it you'll get $(1 + i_{1t})\$$ next year

- **Stock for 1y**:

  The price of the stock at time t is $\$Q_t$

  The dividend this year is $\$D_t$

  The expected dividend (next year) is $\$D^e_{t+1}$

  We consider the price of the stock after the dividend has been paid this year. This is the **EX-dividend price**.

  - I buy the stock today
  - The first dividend is next year's dividend.
  - Then I sell the stock (next year).

  For each stock I buy, next year I expect to receive $\$D^e_{t+1} + \$Q^e_{t+1}$

  Considering that with 1\$, I can buy at time t $\frac{1\$}{\$Q_t}$ stocks, then for every dollar I put in stocks, I expect to receive:

$$\frac{1\$}{\$Q_t}(\$D^e_{t+1} + \$Q^e_{t+1})$$

amount of stocks with 1$.

For stocks x is the **EQUITY PREMIUM**.

We write the **ARBITRAGE CONDITION** between 1y bond and 1y stock. It must hold for both markets to exists.

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

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

The price of a stock today — The present value of expected dividend next year — The present value of the expected price stock next year

Moving it one period further

$$\$Q^e_{t+1} = \frac{\$D^e_{t+2}}{1 + i^e_{1t+1} + x} + \frac{\$Q^e_{t+2}}{1 + i^e_{1t+1} + x}$$

We substitute:

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

The price of a stock today — The present value of expected dividend next year — The present value of expected dividend 2y from now — The present value of the expected price stock next year

We could go on substituting $\$Q^e_{t+2}$. When n gets large, this part goes to zero.

The **ex-dividend price of a stock** in **NOMINAL terms** or the fundamental value of a stock in nominal terms is:

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

It gives the price in nominal terms of a stock that already paid the dividend. It comes from the arbitrage condition between holding the stock for 1y and another asset (a bond) held for 1y that must have the same return.

In **REAL terms**:

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

Reasoning on $\$Q_t$ and Q_t

- Suppose a contractionary **permanent** monetary policy:
  - Current and expected short-term interest rates will ↑, I↓, Y↓,Revenues ↓, Profits ↓, dividends ↓, Q_t↓
- ↑ in the current 1y real interest rate
  - ↑ r_{1t}, discount rate ↑, present value of expected dividends ↓, Q_t↓
- x↑
  - discount rate ↑, present value of expected dividends ↓, Q_t↓

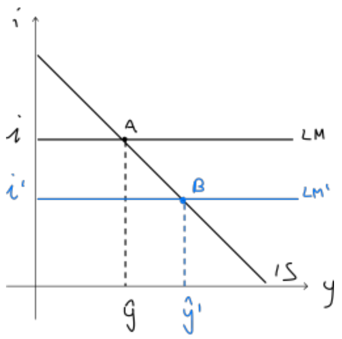
Stock Prices and IS-LM Model

- Standard IS-LM Model

Example 1:

We are in a recession so CB will ↓ the policy rate.

What is the effect on the stock market? (It means on Q_t)



1. **When a policy is announced**, the announcement can be in 2 ways:
   - **Believed/credible**: you'll react before the policy is implemented.
   - **Not believed**: no reaction
2. The **policy** can also be **directly implemented**
   - **The policy was fully anticipated**: no reaction because the stock market has already reacted when it anticipated the policy.
   - **The policy is partly anticipated/unexpected**: reaction
   - **The policy was fully unexpected**: reaction stronger

Going **back to Example 1**:

In this case we have a recession so **expansionary monetary policy.**

- If markets have already fully anticipated => no reaction => Q_t unchanged
- If it is at least partly unexpected then moving from A to B:
  - $Y\uparrow$, higher expected dividends so $Q_t\uparrow$
  - $r\downarrow$, discount rate $\downarrow$, the present value of expected dividend $\uparrow$ so $Q_t\uparrow$

  In the end $Q_t\uparrow$

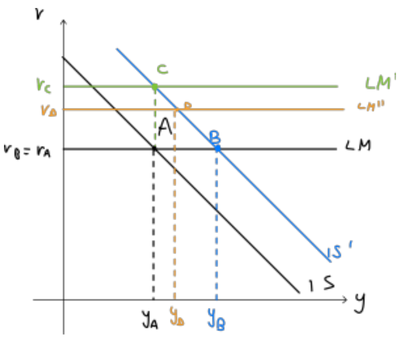
HW 1:

Consider an $\uparrow$ in consumer confidence (an expansionary fiscal policy):

Standard IS-LM model

The effect on Q_t?

- Graph of the model: read Y, r



- If **fully anticipated**: no change
- If at least **partly unexpected**: stock market reacts

  Economy is at B $Y\uparrow$ $r=$

  $r=$ discount rate=

  But $Y\uparrow$ Profits $\uparrow$ $PV\ of\ D^e\uparrow$ $Q_t\uparrow$

  (present value of expected dividends)

- If the CB doesn't intervene: economy stays at B: $Q_t\uparrow$
- If the CB intervenes, suppose because $Y_A = Y_n$ but now at B, $Y_B > Y_n$ so CB might fear inflation. It intervenes and wants to move the economy back to initial Y.

The economy is now at C, LM' and now Y= but r↑ discount rate ↑ $PV\ of\ D^e$↓ Q_t↓

- CB might intervene and move economy to point D, LM'' closer to Y_n but NOT equal to it.

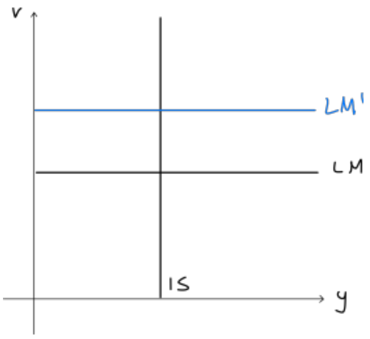
At D: r↑ discount rate ↑ $PV\ of\ D^e$↓ Q_t↓

Y↑ Profits ↑ D^e↑ Q_t↑

The effect is **ambiguous**.

Ex1

a) $I = \bar{I}$ announcement believed: from t onwards there'll be permanent restrictive monetary policy.

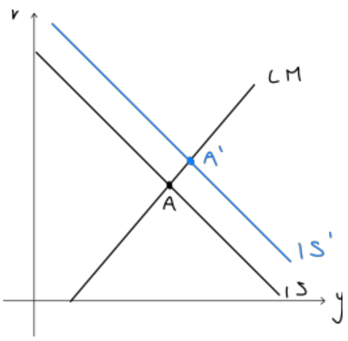


IS vertical because no component depend on r

LM' Y=

r↑ discount rate ↑ $PV\ of\ D^e$↓ Q_t↓

b) non-STD IS-LM Model: effect of an ↑ in consumer spending on stock market



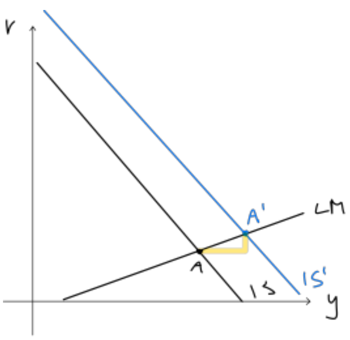
Economy moves from A to A'

Y↑ profits ↑ D^e↑ Q_t↑

r↑ discount rate ↑ $PV\ of\ D^e$↓ Q_t↓

The effect that prevails depends on the SLOPE of the LM.

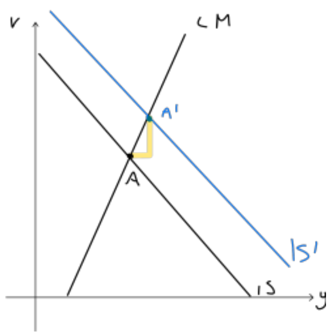
"FLAT" LM



r↑ small

Y↑ more

STEEP LM



r↑ more

Y↑ small

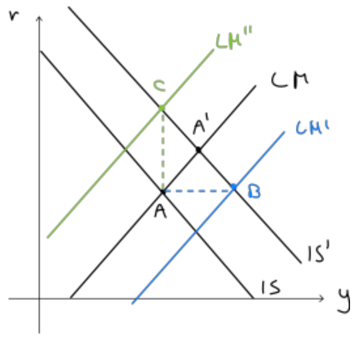
The effect of the ↑Y prevails

Q_t↑

The effect of the ↑r prevails

Q_t↓

c) Refer to b). How will the CB react to the shift of the IS?



1. CB does NOT intervene:

   Economy stays at A' where

   Y↑ … Q_t↑

   r↑ … Q_t↓

   Ambiguous unless we know something about the slope of the LM

2. The CB wants to avoid ↑r that happens from A to A'.

   LM' point B

   Y↑ Q_t↑

   r=

3. Suppose at A Y is close to Y_n

   At A' $Y > Y_n$ => CB might fear inflation and wants output to go back to the initial level of A => LM'', point C

   Y=

   r↑ Q_t↓

HW 2:

Explain how each of the following events affect Q_t

a) financial markets expect a future monetary policy that will ↓ future interest rates
b) Financial markets expect a long-lasting reduction in overall economic activity

Risk Bubbles and Asset Pricing

Movements in stocks usually depend on macro fundamentals but sometimes they do not.

Sometimes stock prices ↑ just because investors expect them to ↑.

Definition of bubble by ***P. Garber***: "Bubble is one of the most beautiful concepts in economics and finance in that it is a fuzzy word lacking a solid operational definition. Thus, one can make whatever one wants of it. The definition of bubble most often used in economic research is that part of asset price movement that is unexplainable based on what we call fundamentals".

Bubble: when the asset price exceeds its fundamental value because the current owner believes that he can resell it at an even higher price in the future.

Suggested reading: "Manias, Panics, Crashes: A history of financial crisis"

EX Ch4 pp106-117

Ex 3

At time t you're considering to buy 1y or 2y (held for 1y) bonds.
You care only about the return (no risk).
You expect the yield on 1y bonds will be at its 0-lower-bound next year ($i^e_{t+1} = 0$)

If the price of the 2y bond at time t ($\$P_{2t}$) is greater than $\dfrac{\$100}{1+i_{1t}}$, then you should buy 1y bonds.

I compare the return on 1y bonds with the one of 2y bonds held for 1y.

- 1y bond: for every \$ you put, next year you have $1 + i_{1t}\$$
- 2y bond: with 1\$ you can buy $\dfrac{1\$}{\$P_{2t}}$ 2y bonds

  Next year the price is $\$P^e_{1t+1}$

  If you sell them next year you expect to get

  $\dfrac{1\$}{\$P_{2t}} * \$P^e_{1t+1}$

  We know that $i^e_{t+1} = 0$

  $$\$P^e_{1t+1} = \frac{\$100}{1 + i^e_{1t+1}} = \frac{\$100}{1} = \$100$$

  If $\$P_{2t} > \dfrac{\$100}{1+i_{1t}}$

  $$1 + i_{1t} > \frac{\$100}{\$P_2 t}$$

  $\dfrac{\$100}{\$P_{2t}} < 1 + i_{1t}$ => TRUE: You buy 1y bond

  Expected return from a 2y bond held for 1y — Return 1y bond

Ex 4:

Country XYZ has only 1y and 2y bonds

$i_{1_t} = 1.44\,\%$

$\$P^e_{1t+1} = \$97.5$

1. Draw the yield curve

To draw it we need i_{1_t} and i_{2_t}

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

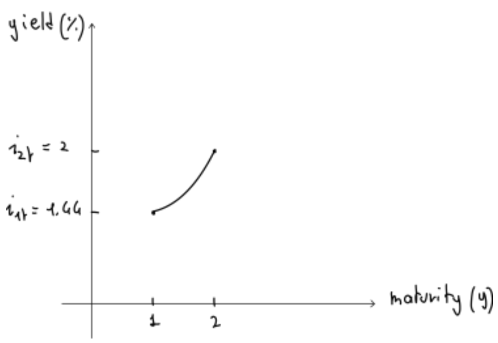
But I have $\$P^e_{1t+1} = \$97.5$

$$\$P^e_{1t+1} = \frac{\$100}{1 + i^e_{1t+1}}$$

$$1 + i^e_{1t+1} = \frac{\$100}{\$P^e_{1t+1}}$$

$$i^e_{1t+1} = \frac{\$100}{\$P^e_{1t+1}} - 1 = 2.56\,\%$$

$$i_{2t} = \frac{1}{2}(2.44 + 2.56) = 2\,\%$$



2. The Gov announces at t that there'll be a contractionary fiscal policy at t+1.

Consumption is ↑ in Y_t and Y^e_{t+1}

We use NON-STD IS-LM Model to explain if and how i_{2_t} will change

Announcement

Credible → I have fully anticipated the policy → No reaction

Credible → The policy is at least partly unexpected → Reaction

Not credible → No reaction

You know that at t+1 IS shifts to the LEFT.

$Y^e_{t+1}\downarrow$

$i^e_{1t+1}\downarrow$

Knowing all this you start shifting your IS to the LEFT at time t.

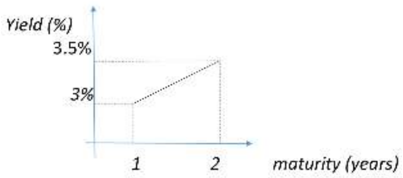
$i_{1t}\downarrow$

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

So $i_{2t}\downarrow$

Ex 5 HW:

In an economy, only 1-year and 2-year bonds exist. People also care about risk. The yield curve is:



The future yield on 1-year bonds is expected to be the same as the current one.

Compute x (the risk premium).

Expectations, Consumption ad Investments

The modern macro theory claims that C depends on **expectations** a lot. This is empirically confirmed.

Around 1950s 2 economists:

- **Friedman**: "the permanent income theory of consumption"
- **Modigliani**: "the life-cycle theory of consumption"

C is strongly affected by expectations. It depends on your future expectations about the income of your entire life=**permanent income**.

People when denoting about C have as a natural planning horizon the **entire life**.

C depends on **total wealth**:

- **FINANCIAL wealth**: value of your **saving account**, **stocks**, **bonds**. It affects C positively
- **HOUSING wealth**: value of the **house(s) owned minus the mortgage due**
- **HUMAN wealth**: present value of **current and expected (future) after tax labour income** considering your working life.

C is a function of total wealth:

$$C_t = C(Total\ wealth_t)$$

Intertemporal Consumption

Ex 8 Ch4 P118-121.

$U(C_t, C_{t+1})$

Individuals borrow/lend at rate r

$Y_t - T_t$= disposable labour income of the first period

$Y_{t+1}^e - T_{t+1}^e$=expected disposable labour income of the second period.

At time t, financial and housing wealth = 0.

1. Write the budget constraint at time t

$$\boxed{Y_t - T_t = C_t + S}$$

$S > 0: \ \ C_t < Y_t - T_t$

$S < 0: \ \ C_t > Y_t - T_t$

$S = 0: \ \ C_t = Y_t - T_t$

2. Write the budget constraint at time t+1

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

>0
<0 Depending on Time t
=0

At t+1 => no borrowing, no lending. You consume all of your resources.

3. **Write the inter temporal budget constraint (IBC):**

At time t: $Y_t - T_t = C_t + S$

$S = Y_t - T_t - C_t$

We substitute this into t+1 budget:

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

$$Y^e_{t+1} - T^e_{t+1} + Y_t - T_t - C_t + rY_t - rT_t - rC_t = C_{t+1}$$

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

IBC for this economy

We divide by $(1+r)$

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

IBC for this economy

Present discounted value of C — Present discounted value of human wealth or after tax labour income

4. **Graph of IBC and equilibrium**

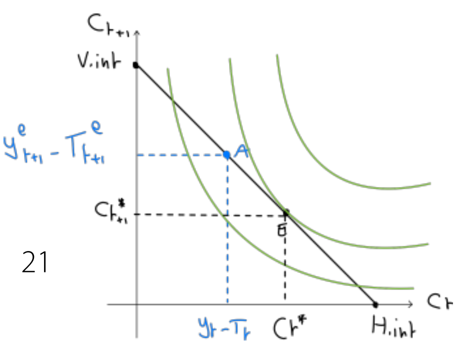
To draw it, I rewrite the IBC as:

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

Now we compute the intercepts: Slope

$$\begin{cases} C_t = 0 \\ C_{t+1} = (1+r)(Y_t - T_t) + Y^e_{t+1} - T^e_{t+1} \end{cases}$$ Vertical Intercept

$$\begin{cases} C_{t+1} = 0 \\ C_{t+1} = = Y_t - T_t + \frac{Y^e_{t+1} - T^e_{t+1}}{1+r} \end{cases}$$ Horizontal Intercept



The IBC goes through A because people might decide to consume in each period all the disposable income of the period.

Now, we draw the equation: => we need a map (3) of **INDIFFERENCE CURVES**, which represent the combination of C_t and C_{t+1} that give the same utility.

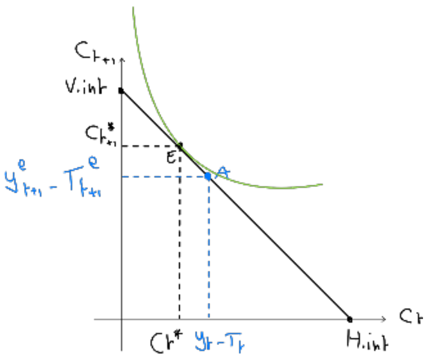
E=equilibrium=**optimal choice**: **tangency point** between the **IBC** and the **highest affordable IC**.

In our graph => individuals are borrowers because $C_t^* > (Y_t - T_t)$

Today they borrow but tomorrow:

$C_{t+1} < (Y_{t+1}^e - T_{t+1}^e)$ because they have to repay.

If on the contrary:



They're lenders.

- Empirical evidence suggests that being a borrower or a lender depends on:
  - r
  - Individual preference
- Some consumers prefer a balanced path of C (no low C_1 and high C_2) => consumption smoothing

Part b) of the exercise

C_t, C_{t+1}**= normal good (when income ↑, C↑)**

Effect on C_t^* of

1. **A transitory (temporary, limited to period t) ↑ in $(Y_t - T_t)$**:

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

   - ↑ Current human wealth, in total human wealth
   - ↑ after tax labour income
   - IBC shifts to the right
   - Since C_t^* is normal, C_t^*↑

2. **↑ in future expected disposable income**:

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

- The present discounted value of disposable income ↑
- C^*_t ↑ , C^*_{t+1} ↑

3. **A permanent (period t and t+1, current + future) ↑ in disposable income**:

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

- Now human wealth ↑ more than in the previous 2 cases
- C^*_t ↑ more than in the 2 previous cases
- C^*_{t+1} ↑

So we can write the C function for this economy

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

Human wealth:

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

The effect of r on C is:

- If r↑ I↓ people tend to save more C↓
- Borrowers: r↑ demand for debt ↓ C↓

Part c) of the exercise

how does the C function change if at time t people have positive nonhuman (financial and housing) wealth (WFH_t)

We write down the new IBC

- At time t: $Y_t - T_t + WFH_t = C_t + S$
- At time t+1: no change with respect to points a) and b) because WFH is only for period t!!!

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

$$S = Y_t - T_t + WFH_t - C_t$$

We substitute:

$$Y^e_{t+1} - T^e_{t+1} + (1+r)(Y_t - T_t + WFH_t - C_t) = C_{t+1}$$

$$Y^e_{t+1} - T^e_{t+1} + Y_t - T_t + WFH_t - C_t + rY_t - rT_t + rWFH_t - rC_t = C_{t+1}$$

$$(1+r)C_t + C_{t+1} = (1+r)Y_t - (1+r)T_t + Y^e_{t+1} - T^e_{t+1} + (1+r)WFH_t$$

IBC for this economy

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

IBC for this economy

From this IBC, we can write the C function:

$$C_t = C(Total\ wealth)$$

EMPIRICAL EVIDENCE ON C

- C is very sensitive to temporary changes in current income, especially for liquidity-constrained people

  BUT

  The marginal propensity to consume (C_1) is HIGHER when the change is perceived as permanent: $C_1 -> 1$

  Consumption is likely to respond less than one-to-one to transitory changes in income.
- C might move even if current income has not changed because of negative/positive expectations, you become optimistic, pessimistic.
- C smoothing is not applied much
- People make C choices in a less forward-looking way than what some theories would suggest (especially for liquidity constrained people).

Exercise

Explain how each of the following events will change the components of total wealth and or current disposable income:

1. **↓ in the demand for houses**

   ↓ price of houses ↓ housing wealth ↓ total wealth ↓ C_t

2. **↓ in stock market**

   ↓ financial wealth ↓ total wealth ↓ C_t

3. **Permanent ↑ in T**

   ↓ current and expected human wealth or disposable income ↓C_t

4. **↑ in expected (future) nominal interest rate**

   ↑ in the discount rate of human wealth ↓ human wealth ↓C_t

Exercise 5 T/F/U

↓ in house prices. According to the C function discussed in class, people now will need to save less money to buy a house and C will ↑.

Housing wealth ↓. Since C depends on total wealth, which also depends on housing wealth, C ↓.

FALSE

Liquidity Constrained People

It means that **they consume less than what they would like to consume**.

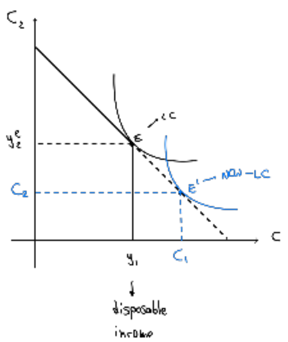
There are 2 cases:

- **You cannot obtain credit**
- **Interest rate** is **too high** and people do not ask for credit

There are 2 kinds of consumers:

- **LC**: liquidity constrained
- **Non LC**: non liquidity constrained

Example 1:



- Y_1, Y_2^e= initial endowment (disposable labour income)
- Straight + dashed line= IBC for non-LC people
- Straight + straight line= IBC for LC people. E is the equilibrium where $C_1 = Y_1$
- Non-LC => equilibrium is E' with $C_1 > Y_1$ and they can consume today an amount that is higher than their current disposable income because, being non-LC, they can have access to credit.

  Then: $C_2 < Y_2^e$ because in the second period they have to repay the debt of the first period.

Example 2:

See graph on the slides. This is the case of an ↑ in income.

LC(liquidity constrained people): consume all of the ↑ in Y: their C_1 becomes closer to the desired level. Their C_2 is unchanged. They react a lot to ↑ in Y.

Non-LC: ↑ C_1 and also C_2, they don't consume all the ↑ in Y in period 1. They react less because they also save.

Example 3:

Suppose that expected future income ↑:

- LC people cannot react: their C_1 is unchanged. Then when income ↑ in period 2, their C_2 will ↑.
- Non-LC people will increase C_1 and C_2

Recap:

Announcement of a future ↓ in T:

- **Not believed/not credible**: nothing happens
- **Believed/credible**:
  - if **fully anticipated**: nothing happens.
  - if it is **at least partly unexpected**:
    - **LC** no reaction
    - **non-LC** they react and ↑C_1

Investment

Ch 5: $I = I(Y, i)$

But in reality **expectations** play a crucial role not only for C but also for I.

How should firms make I decisions?

- Compute the present value of expected profits from the I => $V(\pi^e)$
- Compare it with the full cost of I
  - If $V(\pi^e)$>Cost => Buy => Invest
  - If $V(\pi^e)$<Cost => DON'T buy => DON'T Invest
  - If $V(\pi^e)$=Cost => Indifferent => but it's better to find a more profitable I opportunity.
- How do we compute $V(\pi^e)$?

Suppose you have to decide whether to buy a machine or not.

To compute $V(\pi^e)$, you need to estimate how long the machine will last. => you determine the **depreciation rate** = δ rate at which the machine looses value/its usefulness every year.

Suppose machine lasts 10y. $\delta = 10\,\%$

We assume that the firm buys the machine at time t but it starts to use it at time t+1.

δ starts at t+1 and we see its effects at t+2.

So at time t+2 the machine is worth $(1-\delta)machine$.

$$V(\pi^e) = \pi^e_{t+1}\frac{1}{1+r_t} + \pi^e_{t+2}\frac{1}{(1+r_t)(1+r^e_{t+1})}(1-\delta) + \pi^e_{t+3}\frac{1}{(1+r_t)(1+r^e_{t+1})(1+r^e_{t+2})}(1-\delta)^2 + \dots$$

At time t you get no profits because you don't use it.

You compare $V(\pi^e)$ with the cost (real) of I. We suppose that this cost is 1.

$V(\pi^e)$>1 buy the machine

$V(\pi^e)$<1 don't buy

$V(\pi^e)$=1 indifferent or buy something more profitable.

I_t = aggregate investment in the economy.

π_t= profit per unit of capital of the economy.

The I function is $I_t = I[V(\pi^e), \pi_t]$

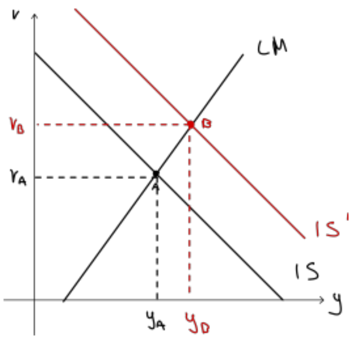
but data tell us $I_t = I[V(\pi^e)]$ **Expectations count more**.

Exercise 6

An economy described by a non-standard IS-LM model. $\bar{I}$ ↑ from t onwards.

Then Q_t will ↑ for sure.

T/F/U ?



$\bar{I}$↑ I↑ Z↑ Y↑

Y↑ profits ↑ D^e↑ Q_t↑

r↑ discount rate ↑ PV of D^e↓ Q_t↓

FALSE: Net effect uncertain

Expectations Output and Policies

- Another version of the IS-LM model.
- 2 periods:
  - **Current period**:
  - **Future period**: expectations

IS

Ch 6:

$Y = C(Y - T) + I(Y, r + x) + G$

$r + x$ is the current borrowing rate

r policy rate

x risk premium.

- We introduce A = **aggregate private spending**.

  $A(Y, T, r + x) = C(Y - T) + I(Y, r + x)$

- I can write the IS as:

  $Y = A(\underset{+}{Y}, \underset{-}{T}, \underset{-}{r} + \underset{-}{x}) + G$

  If $Y\uparrow$ $C\uparrow$ $I\uparrow$

  If $T\uparrow$ $Y_d\downarrow$ $C\downarrow$

  If $r\uparrow$ $I\downarrow$ $Y\downarrow$

  If $x\uparrow$ $I\downarrow$ $Y\downarrow$

- Now we introduce expectations:

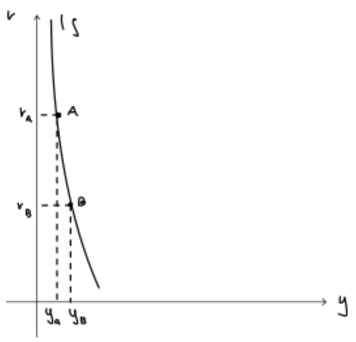
  We assume that the x is **constant**: we ignore it.

- The IS becomes:

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

Expectations Augmented IS Curve

- Graph:



- It's downward sloping as usual: $r\uparrow$ $I\downarrow$ $A\downarrow$ $Y\downarrow$
- It's **STEEPER**.
- If expectations about future values are unchanged, changes in current r have little effect on Y.
- A $\downarrow$ in r from r_A to r_B, $\uparrow$ Y only from Y_A to Y_B.

The IS will shift to the RIGHT if:

- G ↑
- $T^e \downarrow T \downarrow$
- $r'^e \downarrow$
- $Y'^e \uparrow$

The ↓ in r, if expectations on r'^e are unchanged, does not have much effect on I.

The multiplier is smaller: if, for example, expectations about Y'^e are unchanged, then a change in G has limited effects in the economy.

LM

We can have:

- **Standard Expectations-Augmented IS-LM Model**
- **NON-Standard Expectations-Augmented IS-LM Model**

The IS is the same but LM is different.

Standard Expectations-Augmented IS-LM Model

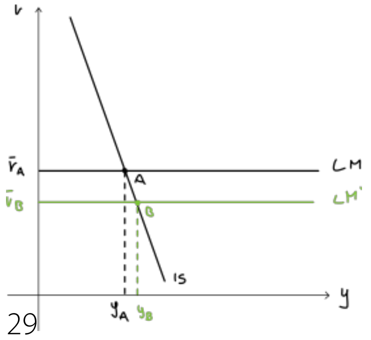
- LM: $r = \bar{r}$ (Ch6 second version) => how much money you want to hold today depends mostly on your current level of transactions => **M^d is myopic**: future interest rates are not very relevant
- The model:

$$\begin{cases} Y = A(Y, T, r, Y'^e, T'^e, R'^e) \\ r = \bar{r} \end{cases}$$

Reasoning on this Standard Model

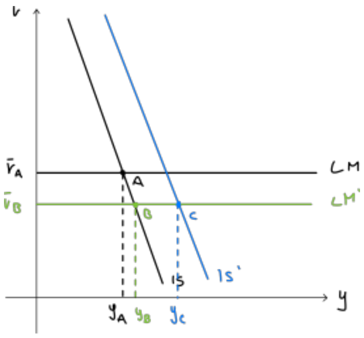
Suppose there is a recession:

Scenario 1:



- The CB steps in: it ↓ r
- We reach point B and the effect on Y is small! This is the case in which expectations do not change.

Scenario 2:



CB intervenes=> point B=> $Y\uparrow$ only from Y_A to Y_B

BUT NOW

Financial markets expect lower interest rates in the future and higher output =>

The IS will react

Lower future interest rates r'^e $I\uparrow$ $A\uparrow$ $Y\uparrow$

Higher future Y $Y'^e\uparrow$ $A\uparrow$ $Y\uparrow$

Point C is reached => large effect on Y

Expectations are crucial in determining the effect of the monetary policy.

If the monetary policy is fully anticipated by financial markets, then expectations do NOT react. => point C.

IS not reach => you stay at B

NON-Standard Expectations-Augmented IS-LM Model

IS is the same

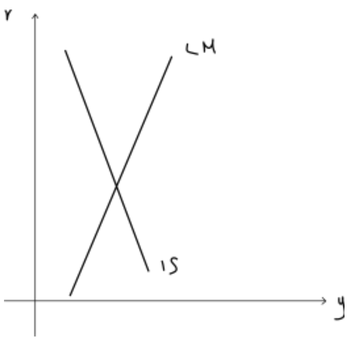
LM: $\dfrac{M}{P} = Y * L(r)$

M/P real money supply

Right part real money demand

$$\begin{cases} IS: Y = A(Y, T, r, Y'^e, T'^e, R'^e) \\ LM: \frac{M}{P} = Y * L(r) \end{cases}$$

- Graph:



LM is upward sloping

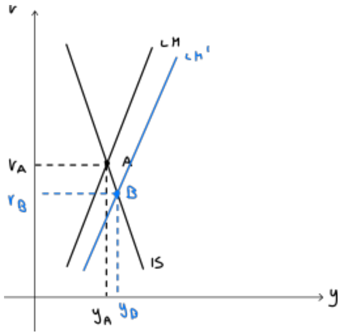
$Y\uparrow$ $M^d\uparrow$ since M^s is =

To bring back the equilibrium, M^d must $\downarrow$, $r\uparrow$ so people demand more bonds.

Reasoning on this NON-Standard Model

We are in a recession

Scenario 1:

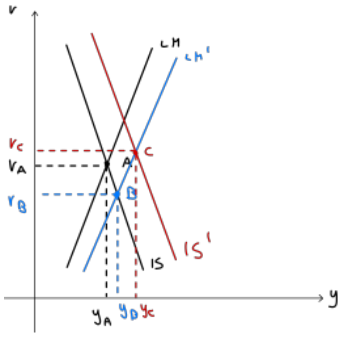


The CB intervenes:

↑ M^s => LM'

We move from A to B but we have no change in expectations of future interest rates or future output => small effect on Y

Scenario 2:



The CB intervenes:

↑ M^s => LM'

Point B with small ↑ in Y

BUT NOW

Financial markets expect future lower interest rates and future higher output

=> IS'

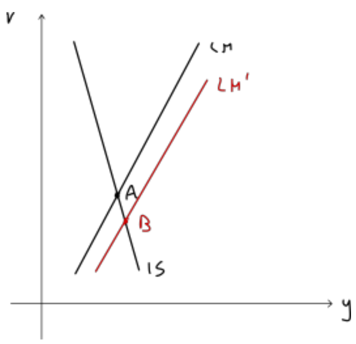
=> point C is the final point. The ↑ in Y is much larger.

We confirm that expectations are crucial for the effects of monetary policy. If expectations are unchanged, then their effect is very limited.

1

Expansionary Monetary Policy implemented only at time t. It's temporary and it's unexpected.

- **t+1**: nothing happens: $i^e_{1t+1}=$ and $Y^e_{t+1}=$
- **t**:



We assume that $\pi_t, \pi^e_t = 0$

$i = r$

LM'

From the graph at time t, I can read

$Y_t\uparrow$

i_{1t}

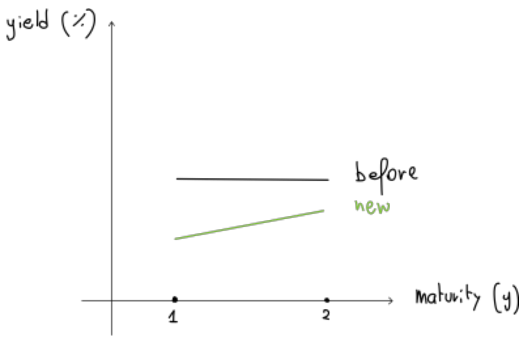
- To draw the **yield curve** I need:

$i_{1t}\downarrow$

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

$\downarrow$ $\downarrow$ = because at t+1 nothing happens

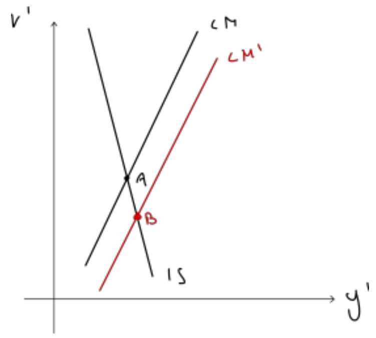
$i_{2t}\downarrow$ by half w/r to i_{1t}



2

At time t, announcement of a (permanent) expansionary monetary policy implemented from t+1 onwards. Believed, unexpected.

- t+1



LM'

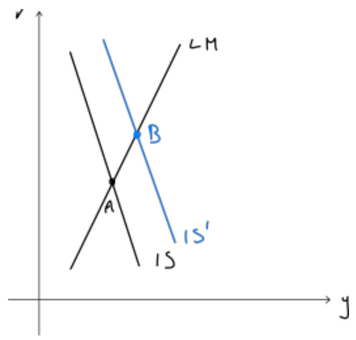
I read the graph:

$Y^e_{t+1}\uparrow$

$i^e_{1t+1}\downarrow$

↓

- t



No policy intervention

At t I know that:

$Y^e_{t+1}\uparrow$ $\quad i^e_{1t+1}\downarrow$

IS to the right because of these expectations

$Y^e_{t+1}\uparrow \quad C_t\uparrow \quad I_t\uparrow \quad Y_t\uparrow$

$i^e_{1t+1}\downarrow \quad I_t\uparrow \quad Y_t\uparrow$

$Y_t\uparrow$

$i_{1t}\uparrow$

- Now we reason on the yield curve:

$i_{1t}\uparrow$

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

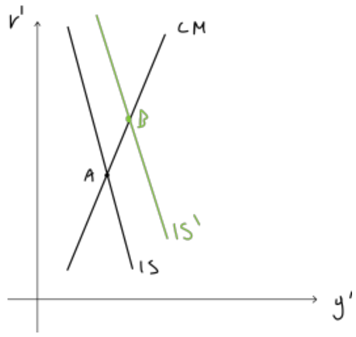
? ↑ ↓

i_{2t} ambiguous

3

Expansionary fiscal policy, announced at t, implemented at t+1 (believed, unexpected).

- t+1

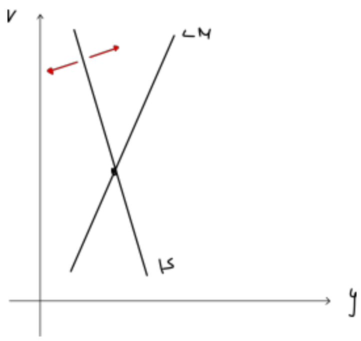


$G' \uparrow \; Z' \uparrow \; Y' \uparrow$

$Y^e_{t+1} \uparrow$

$i^e_{1t+1} \uparrow$

- t



No policy

Expectations:

IS ambiguous

$Y^e_{t+1} \uparrow \;\; A \uparrow \qquad Y_t \uparrow$ (IS to the right)

$i^e_{1t+1} \uparrow \;\; I_t \downarrow \qquad Y_t \downarrow$ (IS to the left)

$Y^e_{t+1} ?$

$i^e_{1t+1} ?$

- Reasoning on the yield curve

$i_{1t} ?$

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

$? \qquad ? \qquad \downarrow$

i_{2t} ambiguous

4

Restrictive fiscal policy, temporary => only t

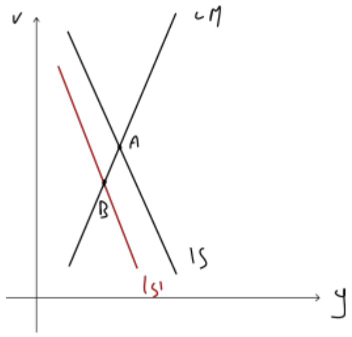
- t+1:

Nothing happens

$Y^e_{t+1} =$

$i^e_{1t+1} =$

- t



$G\downarrow\ Z\downarrow\ Y\downarrow$

$Y_t \downarrow$

$i_{1t} \downarrow$

No expectations

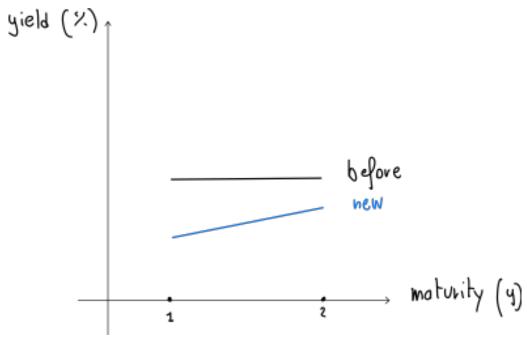
- Reasoning on the yield curve

$i_{1t}\downarrow$

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

$\downarrow \quad \downarrow \quad =$

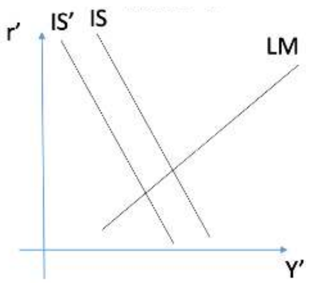
$i_{2t}\downarrow$ by half w/r to i_{1t}



5

Restrictive fiscal policy announced at t and implemented at t+1. Believed, unexpected.

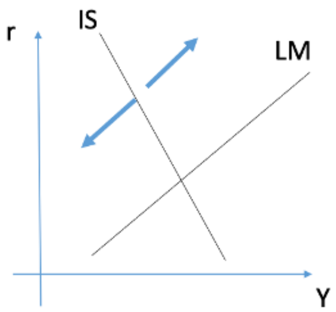
- t+1



$r \downarrow$ and $Y\downarrow$

$i^e_{1t+1}\downarrow$

- t



The effect on the IS at time t is ambiguous, so now i_{1_t} is uncertain.

- Yield curve:

We do not know exactly how the yield curve will look like. i_{2_t} will ↓ for sure if i_{1_t} ↓ or stays the same, while it ↑ if i_{1_t} ↑ by more than the ↓ in i^e_{1t+1}.

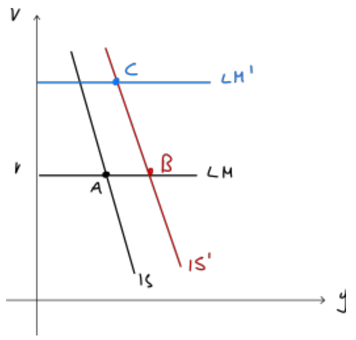
6 - Exercise 12 Ch 4

A)

- **1y and 2y bonds**
- $\pi_t = \pi_t^e$ $(i = r)$
- **t+1 => STD IS-LM Model**
- C **at t+1 depends on disposable income at t+1** $Y_{t+1}^e - T_{t+1}^e$
- I **at t+1 depends on income and interest rate at t+1**
- **t:** C **is ↑ both in current and expected disposable income:** $C_t = C(Y_t - T_t, Y_{t+1}^e - T_{t+1}^e)$
- I **depends on** Y_t, Y_{t+1}^e **and current and future interest rates.**
- $\overline{G}$
- $\overline{T}$
- **At t, announcement that:** $\Delta G_{t+1} > 0$ **AND**

  At the same time the CB announces that it will intervene at time t and t+1 to prevent Y **from changing.**
- **Both announcements are credible, unexpected.**
- **How will** i_{2t} **be affected?**

- t+1



G_{t+1}↑ Z'↑ Y_{t+1}^e↑

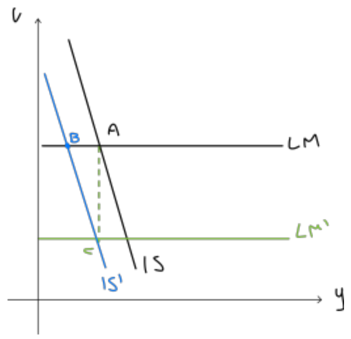
IS to the right => B

Y'↑, the CB doesn't want Y' to ↑ so it will intervene, r'↑

Point C

Y_{t+1}^e=
i_{1t+1}^e↑

- t



No policies implemented

But expectations

Due to expectations (i^e_{1t+1}↑), IS to the left (I_t↓) => B

Where Y is ↓, the CB steps in to ↑ Y, ↓ r => we reach point C.

Y_t

i_{1t}↓

- Reasoning on the yield curve

i_{1t}↓

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

? ↓ ↑

Uncertain

B. Draw the yield curve(s)

- i_{2t} might ↑ ↓ or =
- I have 3 possible yield curves

1. Slope of the yield curve = $i_{2t} - i_{1t}$
   - Since i_{1t} has ↓, if i_{2t} ↑ or =, the slope is POSITIVE
   - If i_{2t} ↓
   - $$i_{2t} = \frac{1}{2}(i_{1t} + i^e_{1t+1})$$
     ↓ ↓ ↑

   For sure, even if i_{2t}↓, we can say that it ↓ by less that i_{1t}

   THE SLOPE OF THE YIELD CURVE IS POSITIVE => expectations of an ↑ in short term rates.
   We can also show that the slope is positive as follows:

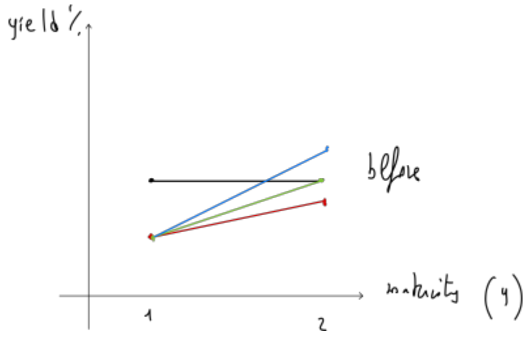
   $$i_{2t} = \frac{1}{2}(i_{1t} + i^e_{1t+1})$$

   $$\Delta i_{2t} = \frac{1}{2}(\underset{<0}{\Delta i_{1t}} + \underset{>0}{\Delta i^e_{1t+1}})$$

$\Delta i_{2_t} - \Delta i_{1_t} > 0$

$i_{2_t} - i_{1_t} > 0$ POSITIVE SLOPE

2. We can draw the 3 possible yield curves:



Red line: i_{2_t}↓

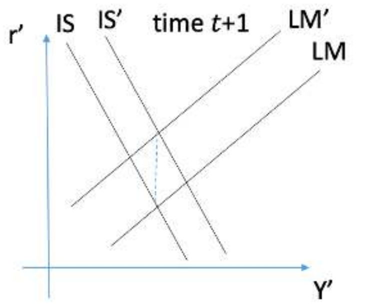
Green line: i_{2_t}=

Blue line: i_{2_t}↑

7

Repeat the same exercise using a NON-STD IS-LM Model.

- t+1



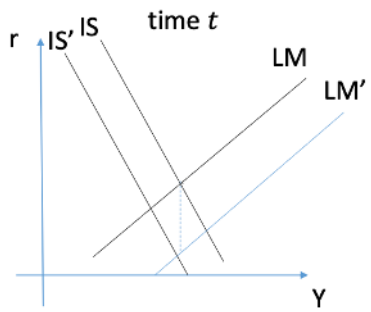
Expansionary fiscal policy: $G\uparrow Z\uparrow Y\uparrow$. The IS shifts to the RIGHT (IS')

Y has ↑. The CB intervenes to prevent this change and since it wants Y to ↓, the CB ↑ r with a contractionary monetary policy: LM', r ↑ and Y is unchanged due to the CB's intervention.

$i^e_{1t+1}\uparrow$

$Y^e_{t+1}=$

- t



Individuals know that in the future:

$i^e_{1t+1}\uparrow$

$Y^e_{t+1}=$

Gov implements no policy at time t.

Expectations about the future: the IS shifts to the LEFT, IS' because I is expected to ↓ and thus Y is expected to ↓ as well.

The CB intervenes to prevent Y from ↓. The LM shifts to the RIGHT to keep Y unchanged.

$i_t\downarrow$

$Y_t=$

- Reasoning on the yield curve

$i_{1t}\downarrow$

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

? ↓ ↑

Uncertain

C. Draw the yield curve(s)

- i_{2t} might ↑ ↓ or =
- I have 3 possible yield curves

1. Slope of the yield curve = $i_{2t} - i_{1t}$
   - Since i_{1t} has ↓, if i_{2t} ↑ or =, the slope is POSITIVE
   - If i_{2t} ↓
   - $i_{2t} = \frac{1}{2}(i_{1t} + i^e_{1t+1})$

     ↓ ↓ ↑

   For sure, even if i_{2t}↓, we can say that it ↓ by less that i_{1t}

   THE SLOPE OF THE YIELD CURVE IS POSITIVE => expectations of an ↑ in short term rates.
   We can also show that the slope is positive as follows:

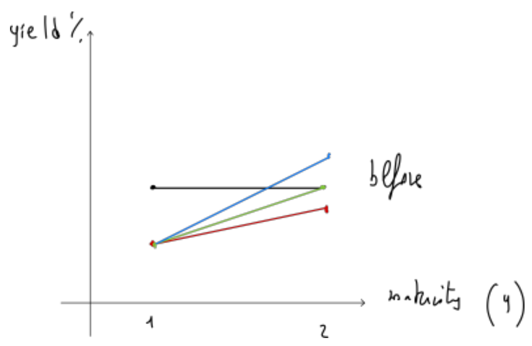
   $i_{2t} = \frac{1}{2}(i_{1t} + i^e_{1t+1})$

   $\Delta i_{2t} = \frac{1}{2}(\underset{<0}{\Delta i_{1t}} + \underset{>0}{\Delta i^e_{1t+1}})$

   $\Delta i_{2t} - \Delta i_{1t} > 0$

   $i_{2t} - i_{1t} > 0$ POSITIVE SLOPE

2. We can draw the 3 possible yield curves:



Red line: i_{2t}↓

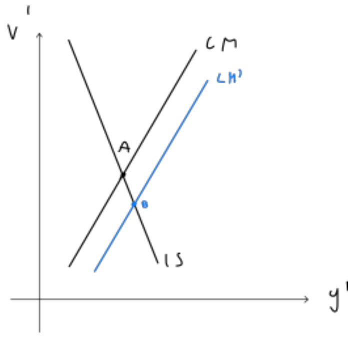
Green line: i_{2t}=

Blue line: i_{2t}↑

8

Expansionary monetary policy announced at t, implemented at t+1. Non-STD IS-LM Model (believed, unexpected).

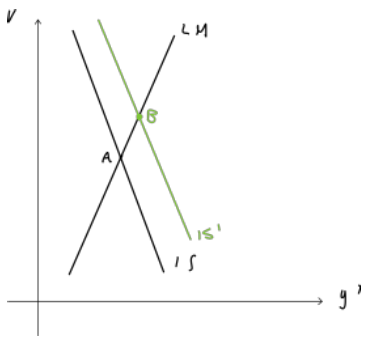
- t+1



$Y^e_{t+1}\uparrow$

$i^e_{1t+1}\downarrow$

- t



$Y_t\uparrow$

$i_{1t}\uparrow$

- Yield curve:

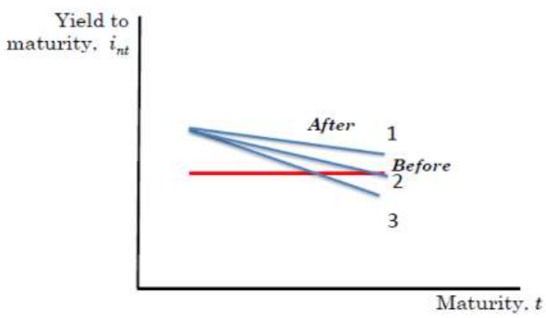
$i_{1t}\uparrow$

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

? $\quad\uparrow\quad\downarrow$

3≠ yield curves

Draw the yields curves and Comment about the slope



The slope is negative because:

- If $i^e_{1t+1}\downarrow$ more than the $\uparrow$ in i_{1t}, i_{2t} will be lower than i_{1t}
- If $i^e_{1t+1}\downarrow$ as much as i_{1t} has $\uparrow$, i_{2t} will be lower than i_{1t}
- If $i^e_{1t+1}\downarrow$ less than the $\uparrow$ in i_{1t}, i_{2t} will still be lower than i_{1t} because, being the average of i_{1t} and i_{1t+1}, i_{2t} will $\uparrow$ by less than i_{1t}

9

A) NON-STD IS-LM Model

Contractionary monetary policy implemented at t+1 and announced at t.

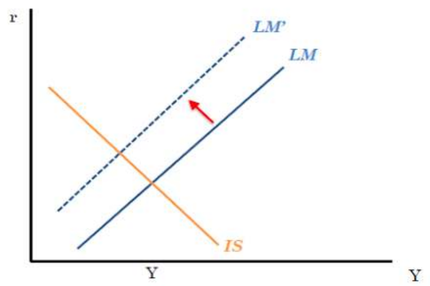
Comment on the yield curve at time t

B) What if the economy is in a LIQUIDITY TRAP at time t but it is expected to get out of it at t+1?

Consider the same scenario as in part A) and draw the yield curve in this case.

A)

- t+1

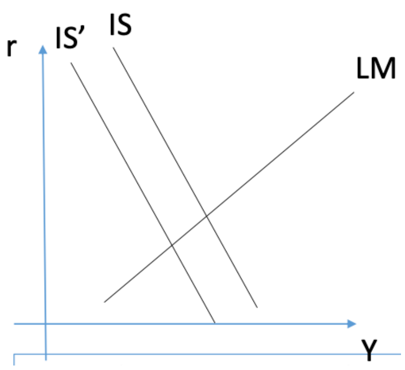


From time t+1 graph, we can see that

i^e_{1t+1} ↑

Y^e_{t+1} ↓

- t



Since i^e_{1t+1} ↑ and Y^e_{t+1} ↓, the IS shifts LEFT.

From the time t graph, we can see that

i_{1t} ↓

Y_t ↓

- Yield curve:

- Reasoning on the yield curve

i_{1t}↓

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

? ↓ ↑

Uncertain

B. Draw the yield curve(s)

- i_{2t} might ↑ ↓ or =
- I have 3 possible yield curves

1. Slope of the yield curve = $i_{2t} - i_{1t}$
   - Since i_{1t} has ↓, if i_{2t} ↑ or =, the slope is POSITIVE
   - If i_{2t} ↓
   - $i_{2t} = \frac{1}{2}(i_{1t} + i^e_{1t+1})$
     ↓ ↓ ↑

   For sure, even if i_{2t}↓, we can say that it ↓ by less that i_{1t}

   THE SLOPE OF THE YIELD CURVE IS POSITIVE => expectations of an ↑ in short term rates.
   We can also show that the slope is positive as follows:

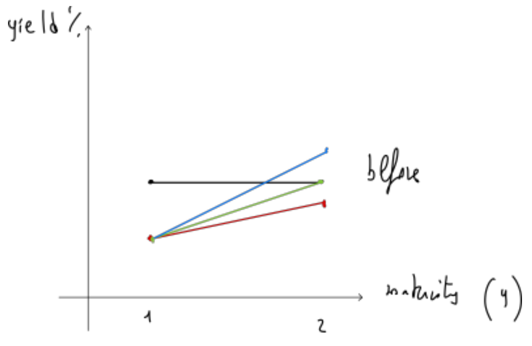
   $i_{2t} = \frac{1}{2}(i_{1t} + i^e_{1t+1})$

   $\Delta i_{2t} = \frac{1}{2}(\underset{<0}{\Delta i_{1t}} + \underset{>0}{\Delta i^e_{1t+1}})$

   $\Delta i_{2t} - \Delta i_{1t} > 0$

   $i_{2t} - i_{1t} > 0$ POSITIVE SLOPE

2. We can draw the 3 possible yield curves:



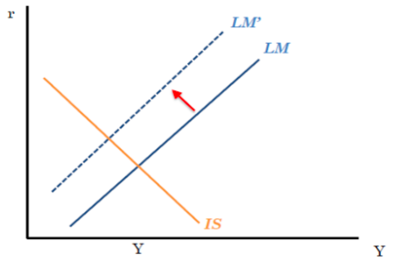
Red line: i_{2t}↓

Green line: i_{2t}=

Blue line: i_{2t}↑

B)

- t+1

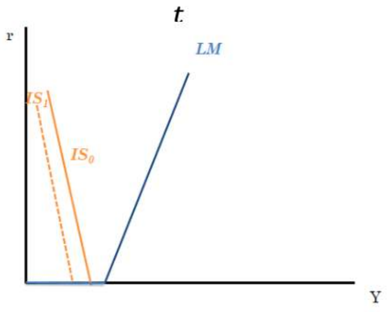


From the time t+1 graph, we can see:

i^e_{1t+1} ↑

Y^e_{t+1}↓

- t

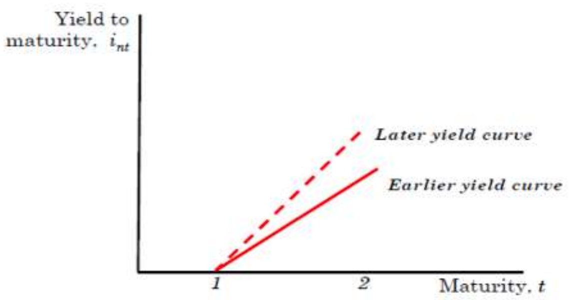


From the time t graph, we can see:

i^e_{1t+1} ↑

Y^e_{t+1} ↓

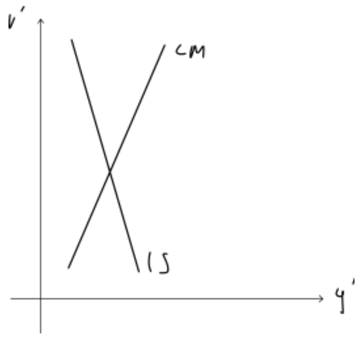
- Yield curve:



10

Consider a transitory ↓ in house prices (only at time t). Use a NON-STD IS-LM Model to discuss what the effect on the yield curve will be.

- t+1

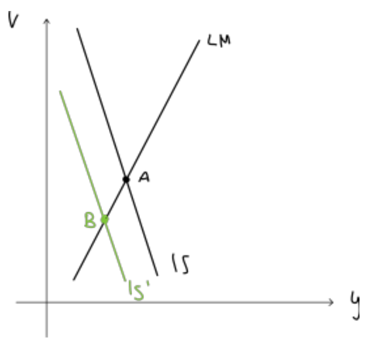


Nothing happens because the change occurs only at time t

$Y^e_{t+1}=$

$i^e_{1t+1}=$

- t



No expectations

Policy/macroeconomic event

↓ house prices at t

Housing wealth ↓

Total wealth ↓

$C\downarrow$ $Z\downarrow$ $Y\downarrow$ IS to the LEFT

$Y_t\downarrow$

$i_{1t}\downarrow$

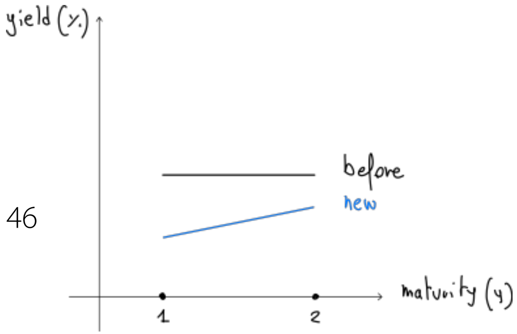
- Yield curve:

$i_{1t}\downarrow$

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

↓ ↓ =

$i_{2t}\downarrow$ by half w/r to i_{1t}



11

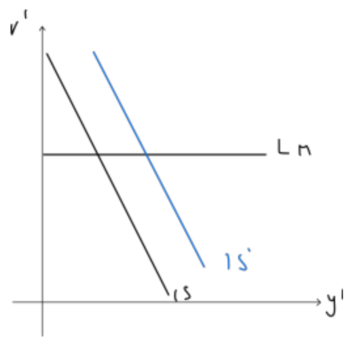
- **Closed economy**
- **1y, 2y bonds**
- **At t+1 => STD IS-LM Model**
  - C_{t+1} **depends on** Y_d **at t+1**
  - I_{t+1} **depends on** r^e_{t+1}**,** Y^e_{t+1}
- **At t**
  - $C_t = C(Y_t - T_t, Y^e_{t+1} - T^e_{t+1})$
    + +
  - $I_t = I(Y_t, r_t, Y^e_{t+1}, r^e_{t+1})$
    + - + -
- **Announcement: both at time t and t+1, expansionary fiscal policy:** $\Delta T_t = \Delta T_{t+1} < 0$

AND

CB announces that it will adjust the policy rate r **to prevent changes in** Y **at** T **only.**

- **All policies are credible and unexpected**
- **What is the effect on current** Y, C, I, S_{nat}**?**

- t+1



$T^e_{t+1}\downarrow$

$Y'_d\uparrow$ $C_{t+1}\uparrow$

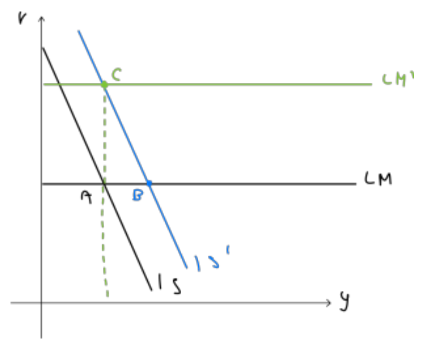
$Y^e_{t+1}\uparrow$

CB: No intervention

i^e_{1t+1}=

$Y^e_{t+1}\uparrow$

- t



- Policy

  $T_t\downarrow$ $Y_d\uparrow$ $C_t\uparrow$ $Y_t\uparrow$ (IS to the RIGHT)

- Expectations future income ↑ ($C_t\uparrow$ $I_t\uparrow$) (IS to the RIGHT)

  => IS to the RIGHT

  So $Y_t\uparrow$

  CB steps in to avoid the change in Y, $r\uparrow$ => LM'

  Point C = final point

  Y_t=

  $i_{1t}\uparrow$

- C_t

  $Y_t =$

  $T_t \downarrow$ => $C_t \uparrow$

  $Y^e_{t+1} \uparrow$

  $T^e_{t+1} \downarrow$

- I_t

  $Y_t =$

  $i_{1t} \uparrow$ => I_t uncertain

  $Y^e_{t+1} \uparrow$

  $i^e_{1t+1} =$

Since $Y = C + I + G$, with $C \uparrow$ and $G =$

I will $\downarrow$

$S_{nat} = I$ so $\downarrow$

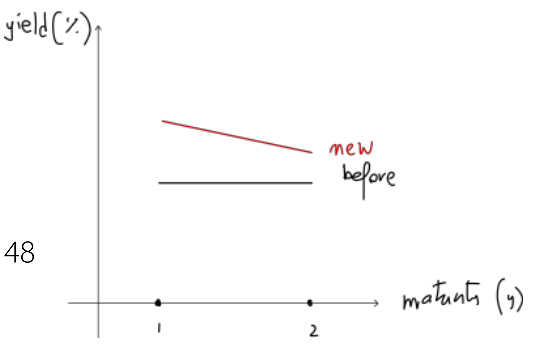
B) How will i_{2t} vary?

$i_{1t} \uparrow$

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

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

$i_{2t} \uparrow$ by half w/r to i_{1t}



12

a) 1y and 2y bonds

$i^e_{1t+1} = i_{1t}$

Draw the yield curve

i_{1t}

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

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

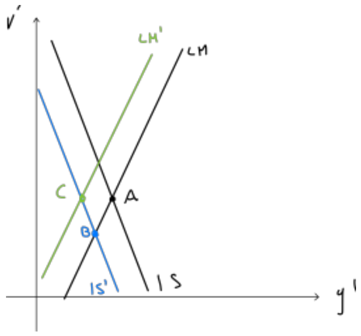
$i_{2t} = i_{1t}$

B) Non-STD IS-LM Model

Gov announces at time t a deficit reduction for t+1. At the same time the CB announces a monetary intervention at t+1 to avoid any change in i.

Comment in detail on the yield curve at time t. Explain.

- t+1



T'↑ and/or G'↓ (IS to the LEFT) => B (↓G, ↓Z, ↓Y)

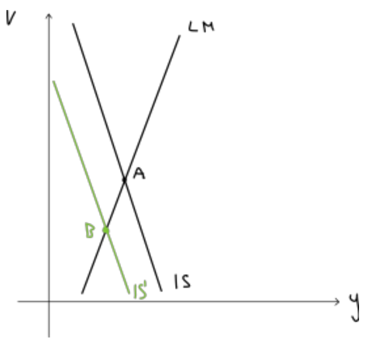
r'↓

So the CB steps in to make it go back to the initial level => point C (contractionary monetary policy)

i^e_{1t+1}=

Y^e_{t+1}↓

- t
  - If neither of the 2 policies is believed: NOTHING HAPPENS
  - If they're fully expected: NOTHING HAPPENS
  - If both credible and at least partly unexpected, then:



No policy at time t

Expectations

Y^e_{1t+1}↓	i^e_{1t+1}=	IS to the LEFT

Y^e_{t+1}↓	C_t↓	I_t↓	Y_t↓

Y_t↓

i_{1t}↓

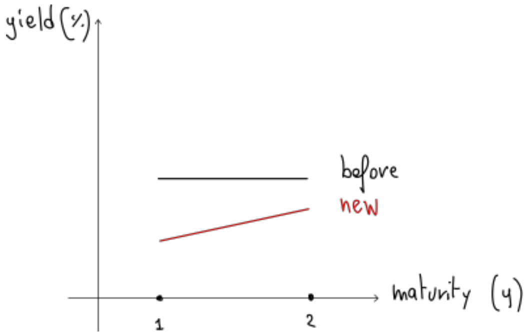
Now the yield curve

$i_{1t}\uparrow$

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

$\downarrow$ $\downarrow$ $=$

$i_{2t}\downarrow$ by half w/r to i_{1t}



The slope is positive:

$i_{2t} > i_{1t}$

Exercise 6

t+1 => STD IS-LM Model

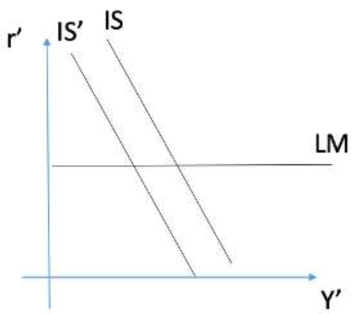
t => Gov announces a future $\downarrow G$ $\Delta G_{t+1} < 0$

a) Will i_{2t} change? If so, how?

b) **Repeat the same scenario but considering a NON-STD IS-LM Model**.

A)

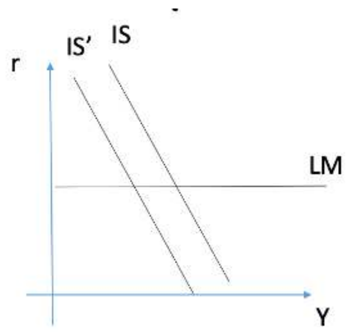
- t+1



$G\downarrow$ $Z\downarrow$ $Y\downarrow$ IS to the LEFT

Interest rates unchanged

- t



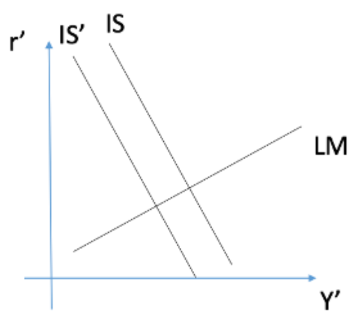
Since I expect future output to $\downarrow$ and future interest rate to be unchanged, $I \downarrow C$ and I, so IS to the LEFT.

Since i_{1t} and i^e_{1t+1} do not change,

i_{2t} that is equal to their average will not change.

B)

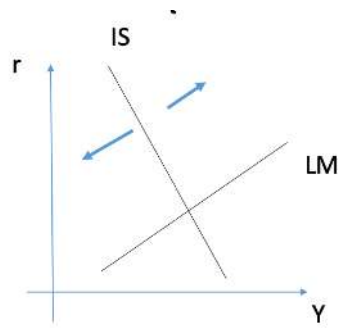
- t+1



$G\downarrow$ $Z\downarrow$ $Y\downarrow$ IS to the LEFT

$i^e_{1t+1}\downarrow$

- t



Since I expect future output to ↓ and future interest rate to ↓, the IS might shift to the LEFT (if the effect of output prevails, $C\downarrow$ and $I\downarrow$) to the right (if the ↓ of the i prevails, $I\uparrow$) or be unchanged if the 2 effects cancel out

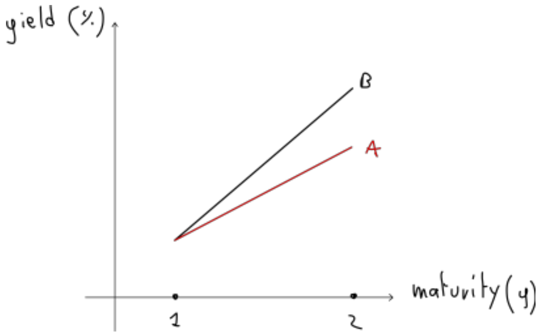
Since i_{1t} is ambiguous and $i^e_{1t+1}\downarrow$, i_{2t} that is equal to their average will be ambiguous.

Exercise 7

In the economy investors care about risk (x)

There are 2 countries: A, B

These are their yield curves:



Can we say that in both countries $i_{1_t} < i^e_{1_{t+1}}$?

If so, where is the yield on 1y bonds expected to ↑ more?

If not, why?

$$i_{2_t} = \frac{1}{2}(i_{1_t} + i^e_{1_{t+1}})$$

Both yield curves are positively sloped.

We cannot say for sure that financial markets expect $i^e_{1_{t+1}} > i_{1_t}$ or future short-term interest rates to be higher, because the positive slope might simply be due to x that is ↑ with maturity.

A positive yield curve DOES NOT necessarily imply a ↑ in (future) short-term expected interest rates. The yield curve with risk may be positively sloped even if

$i_{1_t} = i^e_{1_{t+1}}$

$i_{1_t} > i^e_{1_{t+1}}$

B's yield curve is steeper. This might be due to the larger risk premium prevailing in B rather than to the fact that the yield on 1y bonds is expected to ↑ in B more than in A.

Open Economy

All/most countries are actively engaged in **international trade**.

Openness

We consider 3 kinds of openness:

1. **GOODS markets openness**:
2. **FINANCIAL markets openness**:
3. **FACTOR markets openness**: we're NOT gonna deal with them.

Definitions on the slides

Openness in GOODS Market

IM=**imports**

X=**exports**

- $IM > X$ **Trade Deficit**
- $IM = X$ **Trade Balance**
- $IM < X$ **Trade Surplus**

How do we measure openness?

1. We can use the **volume of trade**:
   - $\frac{X+IM}{GDP}$:
   - $\frac{X}{GDP}$: in the EU is about 50%, in the US only 11%. This is not a good measure.
2. We can consider the **proportion of tradable goods**:

   Goods that compete with foreign goods on the domestic/foreign market.

   It's really difficult to measure it.

   US: 60%

It's **very difficult to measure openness**.

Can exports exceed GDP?

Can a country have **exports larger than its GDP** (export ratio greater than one)?

It would seem that the answer must be **no**: a country cannot export more than it produces, so that the export ratio must be less than one. **Not so**. The key to the answer is to realise that **exports and imports include intermediate goods**.

Take, for example, a country that imports intermediate goods for €1 billion. Suppose it transforms them into final goods using only labour. Say labour is paid €200 million and that there are no profits. The value of these final goods is thus equal to €1,200 million. Assume that €1 billion worth of final goods is exported and the rest, €200 million, is consumed domestically.

Exports and imports, therefore, both equal €1 billion. In this example, GDP equals €200 million, and the ratio of exports to GDP equals 1000 /200 = 5.

Hence, **exports can exceed GDP.** This is actually the case for a number of small countries where most economic activity is organised around a harbour and import-export activities. This is even the case for small countries such as Singapore, where manufacturing plays an important role. In 2017, the ratio of exports to GDP in Singapore was 173%!

Exchange Rates

- **Real**:

  It's the price of domestic (US) goods relatively to foreign (UK) goods.

  The price of domestic goods with respect to foreign goods.

  Notation: ϵ

  It's not observed.

- **Nominal**:

  - **The price of domestic currency in terms of foreign currency**

    Notation: E

    Price of a \$ in terms of £

    $E = 0.65$ means that 1\$ is 0.65£

    WE USE THIS DEFINITION ABOVE

  - **The price of foreign currency in terms of domestic currency**

    Notation: $\frac{1}{E}$

    Price of a £ in terms of \$

    $\frac{1}{E} = 1.55$ means that 1£ is 1.55\$

- **Real and nominal APPRECIATION of the exchange rate**

  $\uparrow \epsilon$ and $\uparrow E$

An increase in the price of the domestic currency in terms of foreign currency

- **Real and nominal DEPRECIATION of the exchange rate**

$\downarrow \epsilon$ and $\downarrow E$

A decrease in the price of the domestic currency in terms of foreign currency

- **Appreciation** and **depreciation** occur with **FLEXIBLE** or variable exchange rates.
- If on the contrary the **exchange rate** is **FIXED** (2 or more countries maintain a constant exchange rate between or among their currencies). Changes are RARE but possible and when they happen, they're called **DEVALUATION and REVALUATION**.

Real Exchange Rate

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

- P=domestic price level, US GDP deflator. It gives the price of US goods in terms of $.
- E=nominal dollar-pound exchange rate
- EP=price of US goods in pounds
- $P*$=foreign price level, GDP deflator for the UK. It's price of the British goods in pounds.
- ϵ is an index number => its rate of change is meaningful.

If $\epsilon \uparrow$ by 5% => the US goods are 5% more expensive relatively to UK goods than they were before.

- To have a real appreciation:

$\uparrow E, \uparrow P, \downarrow P*$

An **increase in the real price of domestic goods** in terms of **foreign goods**

=> **domestic goods** become more **expensive**

=> **foreign goods** become **cheaper**.

- To have a real depreciation:

$E\downarrow, P\downarrow, P*\uparrow$

Empirical evidence: $\frac{P}{P*}$ moves slowly, so the change in ϵ are mainly driven by E.

Bilateral and Multilateral exchange rates

The United Kingdom is just one of many countries the euro area trades with. The euro area does most of its trading with three sets of countries. The first includes neighbouring countries, belonging to the EU, but not to the euro area (precisely as the United Kingdom). Trade with EU member states (not in the euro area) accounts for 33.3% of euro area exports, and 29.5% of euro area imports. The second group includes Asian countries, accounting for 23.7% of euro area exports and 31.3% of euro area imports. The third group includes the United States, with which the euro area trade for 13.7% of its exports and for 10.7% of its imports.

Table 18.2 The country composition of euro area exports and imports, 2015

	Percentage of exports to	Percentage of imports from
European Union (outside euro area)	33.3	29.5
Switzerland	5.6	5.0
Russia	2.7	5.3
Asia	23.7	31.3
Of which: China	6.4	13.7
United States	13.7	10.7
Africa	6.3	6
Latin America	4.6	4.2

Source: European Central Bank.

How do we go from bilateral exchange rates, like the real exchange rate between the Euro area and the United Kingdom, to multilateral exchange rates that reflect this composition of trade?

The principle we want to use is simple, even if the details of construction are complicated. We want the weight of a given country to incorporate not only how much the country trades with the euro area but also how much it competes with the euro area in other countries. (Why not just look at trade shares between the euro area and each individual country? Take two countries, the euro area and country A. Suppose the euro area and country A do not trade with each other – so trade shares are equal to zero – but they are both exporting to country B. The real exchange rate between the euro area and country A will matter very much for how much the euro area exports to country B and thus to the euro area export performance.) The variable constructed in this way is called the **multilateral real exchange rate for the euro area** or the **euro area real exchange rate** for short.

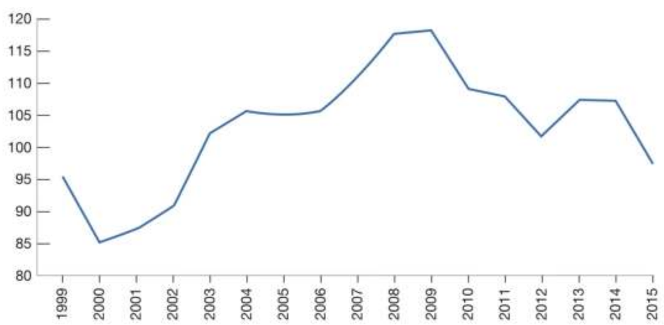
Figure 18.6 shows the **evolution of this multilateral real exchange rate**, the price of euro area goods in terms of foreign goods since 1999. Like the bilateral real exchange rates we saw a few pages earlier, it is an index number and its level is arbitrary. From Figure 18.6 one can see the trend toward a real appreciation of the euro since 1999, followed by a rapid depreciation since 2008. At the time of writing, the price of goods in the euro area in terms of foreign goods is back to levels similar to those observed in 1999.

Figure 18.6

Real effective exchange rate for the euro area since 1999

In 1999, there was a big real appreciation of the euro, followed by a big real depreciation beginning in 2008.

Source: Eurostat.



Openness in Financial Markets

Investors can hold both domestic and foreign assets and/or currencies.

Balance of Payments: set of accounts that summarizes a countries transactions with the rest of the world, including trade and financial flows.

It's made by 2 parts:

- **Current Account Transactions (CA)** (above-the-line transactions): payments to and from the rest of the world.
  - **Exports** (X)
    Imports (IM)
    Trade Balance or **Net Exports** ($NX = X - IM$)
  - **Net Income from abroad** (NI): income received on foreign assets minus income received by foreigners on domestic assets

  Current Account Balance ($NX + NI$): net payments from the rest of the world.
  - >0 CA Surplus
  - <0 CA Deficit
  - =0 CA Balance

  It's usually seen as a % of GDP
  - **Net Capital Transfers (**NT**)**: foreign aid you receive - you give.

  Net Lending to/Net borrowing from the rest of the world ($NX + NI + NT$): NX is the most important driver
- **Financial Account Transactions** (below-the-line transactions): foreign holdings of domestic assets - domestic holdings of foreign assets. It's also the **Net Capital Flows** or **Financial Account Balance**.
  - >0 FA Surplus
  - <0 FA Deficit
  - =0 FA Balance

In principle: ***Net cap flows + Net cap transfers =current account deficits***

In reality: This equation doesn't fully hold because there is **statistical discrepancy**: numbers are constructed by many different sources.

GDP=value added domestically

GNP=gross national product. **Value added by domestic factors of production**.

If the economy is closed: GDP=GNP

If it's open: they're **different**. Some of the income from domestic production will go to foreigners and domestic residents will receive foreign income.

$$GDP + NI = GNP$$

We discuss financial openness more in detail.

Suppose you are a US investor and you want to choose between 1y US bonds and 1y UK bonds.

- i_t= 1y US nominal interest rate on bonds
- Suppose you buy US bonds: for each \$ you put in them you will get $(1 + i_t)\$$ next year.
- Suppose, instead, you buy UK bonds:
  - E_t=nominal exchange rate between \$ and £. For every \$ you get E_t £.
  - i_t^*=1y UK nominal interest rate on bonds

1. You buy £.
2. With these £ you buy UK bonds.
3. For every \$ that you put in UK bonds, you'll get $E_t(1 + i_t^*)£$
4. You convert these pounds back into \$.
   E^e_{t+1}=expected nominal exchange rate next year

   Each pound will be worth $\frac{1}{E^e_{t+1}}\$$

5. You'll get $E_t(1 + i_t^*)\frac{1}{E^e_{t+1}}\$$ next year

We assume that investors care only about the rate of return (we ignore risk)

In order for both markets to exist (US and UK 1y bonds), the **ARBITRAGE CONDITION** must hold.

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

(Uncovered) interest parity relation or condition

Complete equation

However:

- It ignores transaction costs
- It ignores taxation

BUT

- It's a good approximation of reality

If it doesn't hold, people have incentives to switch from domestic to foreign bonds and viceversa.

We know work on this expression:

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

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

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

Expected rate of appreciation of domestic currency

Or the expected rate of depreciation of foreign currency

If the sign + : my currency is appreciating

If the sign - : my currency is depreciating

If $i_t i_t^*, \frac{E_{t+1}^e - E_t}{E_t}$ are less than 20% we can simplify

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

(Uncovered) interest parity condition or relation

The domestic interest rate= foreign interest rate - expected appreciation rate of the domestic currency.

Suppose

$i_t = 2\,\%$ US

$i_t^* = 5\,\%$ UK

- If you expect the pound to **depreciate** by less than 3%, then BUY UK bonds.
- If you expect the pound to **appreciate**, BUY UK bonds.
- If you expect the pound to **depreciate** by more than 3%, then BUY US bonds.

So if the interest parity condition holds, it means that in this case financial markets are expecting on average an appreciation of the $ relative to the £ over the coming year of about 3%.

The Goods Markets in the Open Economy

PP 404-420 (no appendix)

$$ZZ = C(Y-T) + I(Y,r) + G - \frac{IM}{\epsilon}(Y,\epsilon) + X(Y^*,\epsilon)$$ **Demand for domestic goods from residents and foreigners**

$$DD = C + I + G$$ **Domestic demand for domestic and foreign goods**

$$AA = C + I + G - \frac{IM}{\epsilon}$$ **Domestic demand for domestic goods**

If economy is closed: $ZZ = DD$

Imports (IM) = part of demand that falls on foreign goods

- $\underset{}{IM = IM(\underset{+}{Y}, \underset{+}{\epsilon})}$

  If $Y\uparrow$ $IM\uparrow$

  If $\epsilon\uparrow$, since ϵ is the price of domestic goods in terms of foreign goods, domestic goods become more expensive relative to foreign goods (foreign goods are cheaper) $IM\uparrow$

- $\frac{IM}{\epsilon}$ = value of imports in terms of domestic goods because $\frac{1}{\epsilon}$ is the price of foreign goods in terms of domestic goods.

  If $\epsilon\uparrow$ $IM\uparrow$ but $\frac{1}{\epsilon}\downarrow$ so $\frac{IM}{\epsilon}\downarrow$: the effect of the $\uparrow\epsilon$ might seem uncertain. We'll see that it's not uncertain and that in standard cases, if $\epsilon\uparrow$ $IM\uparrow$

Exports (X) = part of demand for domestic goods that comes from abroad.

- $X = X(\underset{+}{Y^*}, \underset{-}{\epsilon})$

  If $Y^*\uparrow, X\uparrow$

  If $\epsilon\uparrow$ $X\downarrow$ because the price of domestic goods $\uparrow$ relative to foreign goods, so the demand for domestic goods $\downarrow$.

At equilibrium: $Y = Z$

$$Y = C(\underset{+}{Y-T}) + I(\underset{+}{Y},\underset{-}{r}) + G + \frac{IM}{\epsilon}(\underset{+}{Y},\underset{+}{\epsilon}) + X(\underset{+}{Y^*},\underset{-}{\epsilon})$$ **IS relation in the Open Economy**

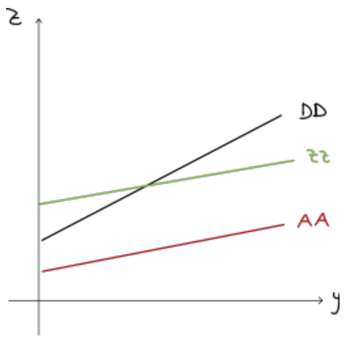
Since net exports: $NX = X - \frac{IM}{\epsilon}$

$Y = C + I + G + NX$

NX depends on:

- Y:
- Y^*:
- ϵ:

Graphical Analysis:



DD **domestic demand**:

- slope positive
- if $Y\uparrow$ $DD\uparrow$ but less than 1 because when $Y\uparrow$ $Z\uparrow$ but less than 1:1.

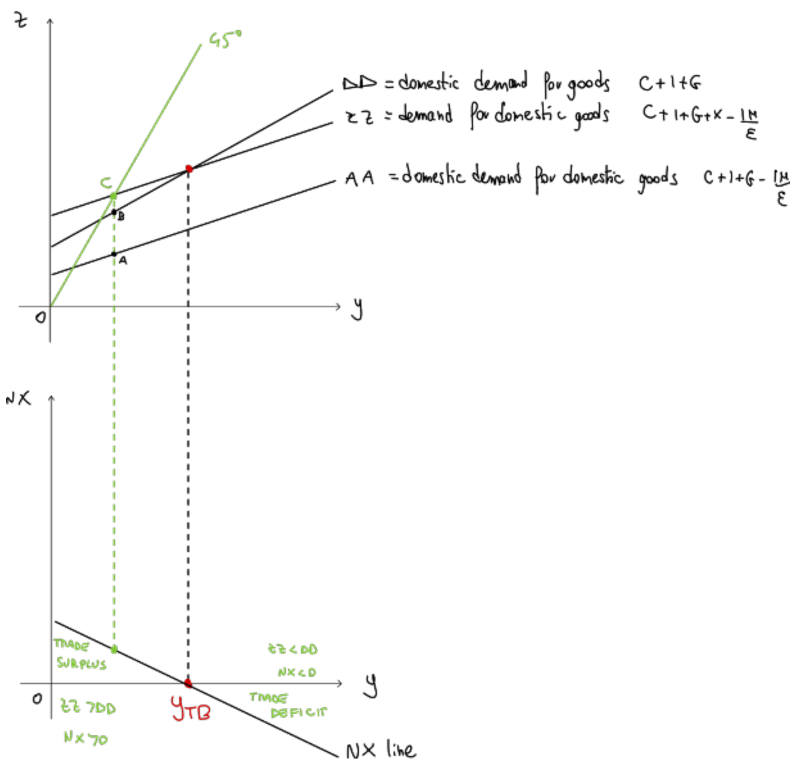
AA **domestic demand for domestic goods**:

- the distance between the AA and DD is $\frac{IM}{\epsilon}$ and it $\uparrow$ as $Y\uparrow$ because when $Y\uparrow$ $IM\uparrow$.

ZZ **demand for domestic goods from residents and foreigners**:

- It's $AA + X$: a parallel line w/r to AA because their distance is constant and equal to X which do not depend on Y.

- Now the complete graph:



DD=ZZ => $NX = 0$ $\frac{IM}{\epsilon} = X$ BALANCED TRADE

This point is given by the intersection between the DD and the ZZ

$Y_{TB} = Y_{TRADE\ BALANCE}$

In the part below, we draw the NX line=the relationship between NX and output when $Y\uparrow$ $IM\uparrow$ $NX\downarrow$

So NX is decreasing

Now we graph, the point where the economy is located, we need the $Y = Z$ line, 45° line.

The intersection between this line and the ZZ gives where the economy is located => we get Y.

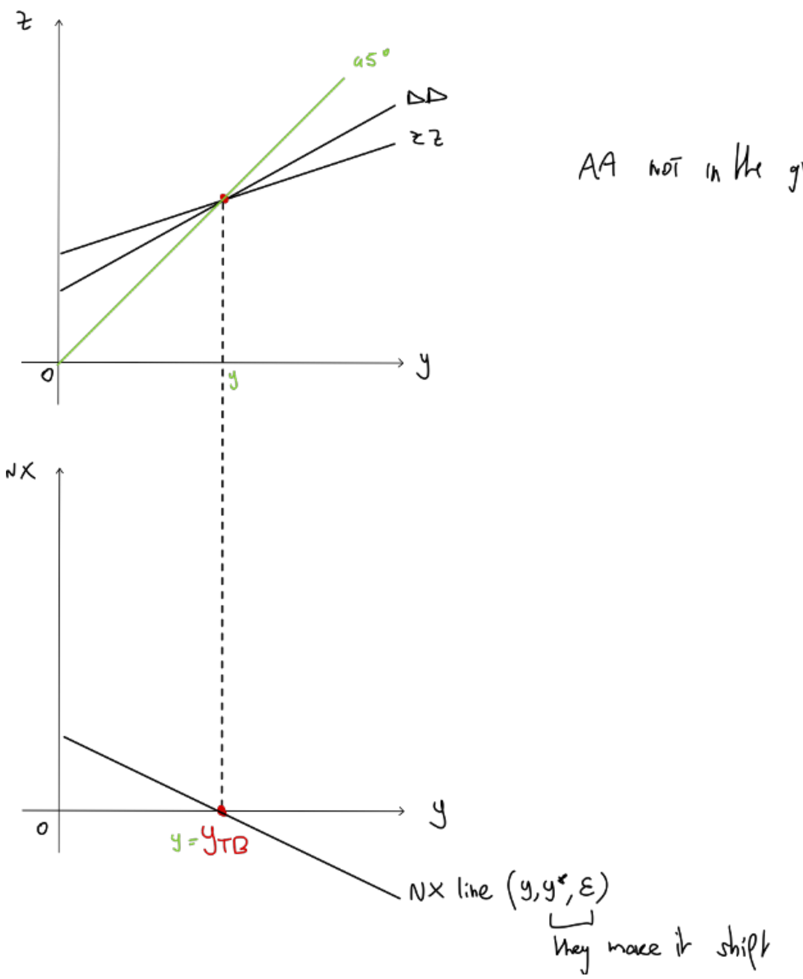
In this example, the economy is in a TRADE SURPLUS because the intersection between $Y = Z$ and the ZZ is on the left of the Y_{TB}.

AC=exports

AB=import

BC=NX>0 trade surplus

Let's graph an economy in TRADE BALANCE



AA not in the graph

Homework: draw the situation of an economy with a trade deficit => the intersection between the $Y = Z$ and the ZZ is to the right of Y_{TB} which is given by the intersection between DD and ZZ.

Fiscal Policy

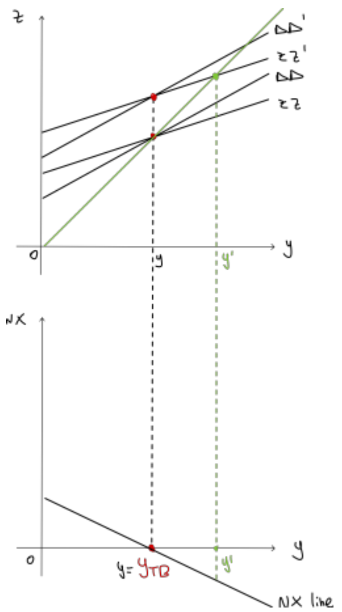
An economy is in a trade balance.

$G\uparrow$ What is the effect on the open economy?

You have to analyze:

1. ZZ
2. DD
3. NX line
4. Y and Y_{TB}
5. NX

If and how they move



$G\uparrow$

- **ZZ** $G\uparrow$ $Z\uparrow$ $Y\uparrow$ ZZ shifts UP
- **DD** $G\uparrow$ $Z\uparrow$ $Y\uparrow$ DD shifts UP as well

Since they shift up by the same amount, their intersection is the old Y_{TB}

- **NX line**: unchanged

The Y of the economy changes

The intersection between the 45° line and the new ZZ' =>

$Y' > Y$ $G\uparrow$ $Z\uparrow$ $Y\uparrow$

Y_{TB}=

NX	Y	$Y*$	ϵ
	$\uparrow$	=	=
	$Y\uparrow$	$IM\uparrow$	$NX\downarrow$

Since the economy started from a trade balance, for sure now it's in a trade deficit, as confirmed by the graph.

In an open economy, the effects of an ↑ G are **SMALLER** than in the closed economy because part of the additional Y you generate is spent on foreign goods.

The multiplier is smaller than in the closed economy.

In the example above, the more open the economy, the **LARGER** the trade deficit.

Suppose you have 2 countries:

- HOME: $Y = C + I + G - \frac{IM}{\epsilon} + X$
- FOREIGN: $Y* = C* + I* + G* - \frac{IM*}{\epsilon} + X*$

$X = IM* = m*Y*$

m = marginal propensity to import of the foreign country.

$X* = IM = mY$

$Y = C + I + G - \frac{mY}{\epsilon} + m*Y*$

$C = C_0 + C_1 Y$

A = autonomous spending = $C_0 + I + G$

$Y = A + (C_1 - \frac{m}{\epsilon})Y + m*Y*$

$Y(1 - C_1 + \frac{m}{\epsilon}) = A + m*Y*$

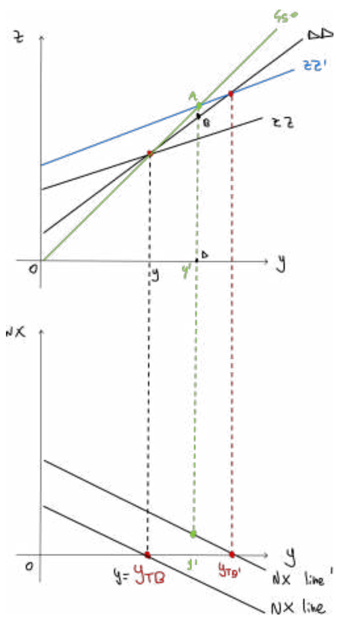
$$Y = \frac{1}{1 - C_1 + \frac{m}{\epsilon}} A + m*Y*$$

This is the **FISCAL multiplier** of the open economy. It's smaller than the one of the closed economy ($\frac{1}{1 - C_1}$)

In an open economy, an ↑ in domestic demand (↓G ↓T ↑ consumer confidence) has a SMALLER effect on output than in a closed economy and a NEGATIVE effect on the trade balance.

Increase in Foreign Demand/Output

Start from a trade balance.



Y^*↑

- **ZZ**: depends on $Y, T, G, r, Y^*, \epsilon$

  Y^*↑ X↑ and IM= ZZ shifts UP

- **DD**: depends on Y, T, G, r so UNCHANGED

- **NX line**: depends on Y, Y^*, ϵ

  Y^*↑ X↑ IM= NX↑ NX line shifts UP

Since ZZ shifts UP and DD is =, we have a new Y_{TB} given by the intersection between ZZ′ and the old DD.

We identify the new $Y = Y'$ given by the intersection between the 45° line and ZZ′.

$Y' > Y$ because Y^*↑ X↑ (so you need to produce more so $Y' > Y$)

NX	Y	Y^*	ϵ
	↑	↑	=

Y↑ IM↑

Y^*↑ X↑

NX seems ambiguous BUT

DB=domestic demand

DA=demand for domestic goods

BA=NX = is positive distance

(**Empirical evidence confirms**)

=> improvement of the trade balance and ↑ in domestic output. => in this case we end up in a surplus

PP 412-413

- Shocks to demand in one country affect all other countries.
- When there is a recession, countries should coordinate their fiscal policies and $\uparrow G$ and/or $\downarrow T$. So doing $Y\uparrow$ in all countries and countries exports will benefit from the $\uparrow Y$ of the other countries.

BUT

There is the free rider problem: you might prefer to wait for the other countries to $\uparrow G$ and just benefit in terms of X leaving your G unchanged.

Real Exchange Rate and Real Depreciation

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

If we take $P, P*$ for given, then when your $E\downarrow, \epsilon\downarrow$.

$$NX(Y*, Y, \epsilon) = X(\underset{1}{Y*, \epsilon}) - \frac{IM}{\underset{3}{\epsilon}}(\underset{2}{Y, \epsilon})$$

What is the effect of the $\downarrow \epsilon$ (real depreciation) on NX?

1. $\downarrow \epsilon$

   US goods are relatively cheaper abroad, foreign demand for US goods ↑

   $X\uparrow \quad NX\uparrow$

2. $\downarrow\epsilon$

   UK goods are relatively more expensive for US people

   $IM\downarrow NX\uparrow$

3. $\downarrow\epsilon$

   $\frac{1}{\epsilon}\uparrow$ the relative price of foreign goods in terms of domestic goods.

   Now the same quality of IM has a higher value in terms of domestic goods: this is the **PRICE EFFECT OF DEPRECIATION**. It leads to a $\downarrow NX$ because the price of foreign goods in terms of domestic goods ↑.

What is the net effect on NX of $\downarrow\epsilon$?

The answer is given by **MARSHALL-LERNER CONDITION (M-L)**.

When $\downarrow\epsilon, NX\uparrow$ because the $\uparrow X$ and the $\downarrow IM$ are more than enough to compensate for the price effect. (1)+(2)>(3)

A real depreciation leads to an $\uparrow NX$.

IT HOLDS WHEN X DEPENDS ON $Y*, \epsilon$ and IM on Y, ϵ

We analyze the effect of the ↓ ϵ

ZZ: depends on $Y, T, G, r, Y*, \epsilon$

↓ ϵ, according to the M-L NX↑ ZZ shifts UP

DD: depends on Y, T, G, r so UNCHANGED

NX line: depends on $Y, Y*, \epsilon$

↓ ϵ, according to the M-L NX↑ NX line shifts UP

So real depreciation has the same effect as the ↑$Y*$ => same graph

but

From the macroeconomic point of view, the effect is different.

↓ ϵ: foreign goods are more expensive. Citizens relying heavily on IM are worse off => **redistributive effects** if poor people rely heavily on IM => ↑ inequality.

If ↑ ϵ (real appreciation) loss in price competitiveness of domestic goods

NX↓ X↓ IM↑

Then overtime X↓ Y↓ IM↓

Suppose ↑ $\bar{I}$, starting from a trade balance.

ZZ: $\bar{I}$↑ Z↑ Y↑ ZZ goes up

DD: the same DD goes up by the same amount

NX line: unchanged

Y↑

Y_{TB}=

NX	Y	$Y*$	ϵ
	↑	=	=
	IM↑		

X= => so $NX\downarrow$

Trade deficit

- Your m is high

$G\uparrow$ NX?

$G\uparrow$ $Z\uparrow$ $Y\uparrow$

NX	Y	|	$Y*$	ϵ
	$\uparrow$	|	=	=
	$IM\uparrow$ a lot since high m	|		
	$NX\downarrow$ a lot	|		

4th Policy

Suppose an economy is at $Y = Y_n$ but has a large trade deficit. The gov wants to

1. $\downarrow$ trade deficit
2. But leave Y unchanged

Policy mix

$\downarrow$ trade deficit $\downarrow NX$

NX depends on Y,$Y*$,ϵ

We need a $\downarrow\epsilon$ (M-L condition) (we cannot touch the other 2 elements)

$\downarrow\epsilon$ $\uparrow X$
$\downarrow IM$ so $NX\uparrow$ (M-L condition)

But $\uparrow X$ $\uparrow Y$

So Fiscal contraction: $G\downarrow$ and/or $T\uparrow$

$G\downarrow$ $Z\downarrow$ $Y\downarrow$

Homework: graph this situation

M-L condition $\downarrow\epsilon \uparrow NX$

Empirical evidence: It holds in the medium run but not much in the short run.

Ex 8 T/F/U:

In an economy IM don't depend on ϵ. The M-L condition is still met ($\downarrow\epsilon \uparrow NX$).

$$NX(Y, Y^*, \epsilon) = \underset{1}{X(Y^*, \epsilon)} - \underset{3}{\frac{IM}{\epsilon}}(Y)$$

1. $\epsilon\downarrow X\uparrow$ my goods more convenient for foreigners

   IM= $NX\uparrow$

3. $\epsilon\downarrow \frac{1}{\epsilon}\uparrow$ price effect: the same amount of IM now costs more. $NX\downarrow$

UNCERTAIN: The M-L does not hold for sure.

Ex 9 HW T/F/U

In an economy where NX do not depend on ϵ, the M-L still holds.

Suppose an economy has a large trade deficit and a low Y (or high u). Policies to be implemented?

1. NX must $\uparrow$

   $\epsilon\downarrow$ real depreciation. (M-L condition)

2. $X\uparrow Y\uparrow$

   - If $Y\uparrow$ is enough, then you don't need any other policy
   - If the $\uparrow$ in Y is large, so that now your $Y >>> Y_n$ => contractionary fiscal policy. $G\downarrow$
   - If your Y is still $<<< Y_n$, expansionary fiscal policy. $G\uparrow$

BOOK p416 table with 4 scenarios and policies: make sure you understand it perfectly.

Suppose you want to $\uparrow Y$ but leave NX unchanged.

1. Expansionary fiscal policy

   $G\uparrow Z\uparrow Y\uparrow$

2. $Y\uparrow$ X= $IM\uparrow$ $NX\downarrow$

   We need $\downarrow\epsilon$ because M-L condition, $NX\uparrow$ and in the end unchanged.

Suppose $\Delta G = \Delta T > 0$

ZZ,DD,NX line, Y,Y_{TB},NX

ZZ: the ↑ in G prevails over the ↑ in T

   $G\uparrow$ $Z\uparrow$ $Y\uparrow$ ZZ up

DD: the same

NX line: unchanged

$Y\uparrow$

NX	Y	Y^*	ϵ
	↑	=	=

X=

$IM\uparrow$

$NX\downarrow$

M-L condition in the Short and Medium Run

$\downarrow\epsilon$

- Short run:

  M-L condition tends not to hold

- Medium run:

  M-L, unless NX (X and/or IM are insensitive to ϵ holds)

<u>Intuition</u>:

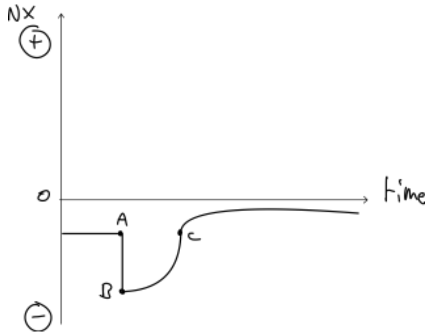
$$NX(Y^*, Y, \epsilon) = X(Y^*, \epsilon) - \frac{IM}{\epsilon}(Y, \epsilon)$$

$\downarrow\epsilon$ data tell us that the quantities of IM and X react slowly.

=> consumers and firms need time to react

=> M-L condition holds in the medium run.

We use a graph to understand this intuition better.



- A= initial point for the economy => it's in a trade deficit
- $\downarrow\epsilon$

  In the short run, price effect (3) prevails, so the economy moves to B where $NX\downarrow$

- Then overtime the $\downarrow\epsilon$ leads to $\uparrow X$ and $\downarrow IM$ => NX improve, you go back to point C where you reach the initial level of NX.
- Then overtime X keep on $\uparrow$.

IM keep on $\downarrow$, NX improve w/r to point A

In our example the economy comes closer to a trade balance.

The curve is called **J-Curve** (because of its shape).

M-L doesn't hold in the short run because $\downarrow\epsilon\ NX\downarrow$. Only in the medium run $\epsilon\downarrow$ and $NX\uparrow$.

Saving, Investment and Current Account Balance

$$Y = C + I + G - \frac{IM}{\epsilon} + X$$

$$Y - C - T = I + G - \frac{IM}{\epsilon} + X - T$$

$$Y - C - T = I + (G - T) - \frac{IM}{\epsilon} + X$$

1 $$S = I - S_{pub} + NX$$

$$S + S_{pub} = I + NX$$

2 $$S_{nat} = I + NX$$

Goods Market Equilibrium Condition in the Open economy

Let's start again from

$$Y - C - T = I + (G - T) - \frac{IM}{\epsilon} + X$$

We add NI (income received from holdings of foreign assets - income received by foreigners on domestic assets)

$$(Y + NI - T) - C = I + (G - T) + (NX + NI)$$

Disposable income CA=Current Account

3 $$S = I + (G - T) + CA$$

4 $$CA = S + (T - G) - I$$

$CA = NX + NI$ but NI moves slowly

5 $$CA = S + S_{pub} - I$$

6 $$CA = S_{nat} - I$$

- If $S_{nat} > I$ => CA surplus (CA>0)

You're a lender to the rest of the world.

- If CA deficit => the country saves (overall) LESS than what it invests => this implies NET BORROWING from the rest of the world.

- If $I\uparrow$

  $CA = S + S_{pub} - I$

  To keep the equality:

  $CA\downarrow$ or/and $S\uparrow$ or/and $S_{pub}\uparrow$

- If $G\uparrow$ $(T - G)\downarrow$ $S_{pub}\downarrow$

  To keep the quality: $CA\downarrow$ or $S\uparrow$

  When $CA\downarrow$, its main component is NX, it means that $NX\downarrow$

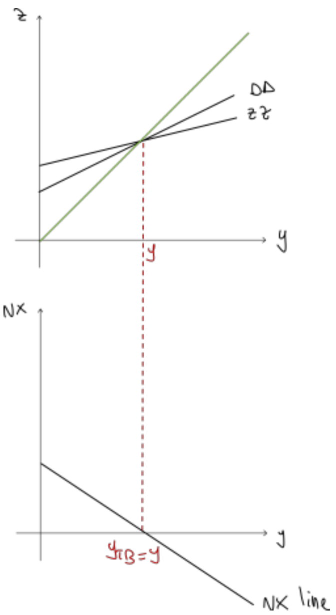
  Twin Deficit= deterioration in gov budget and in the trade balance.

  Ex 10: TXT Solutions

  EB Ch 5 Ex1-8a)+9+10.

Ex 11

An economy where no financial markets exist and the M-L condition is met, the initial equilibrium is given by point (1,1')



a. Goals: NX**= and** $Y\uparrow$

what policy mix is needed?

Describe how the DD, ZZ, NX line will move

- The economy is in a trade balance.
  - Expansionary fiscal policy: $G\uparrow$ and/or $T\downarrow$

$$G\uparrow\ Z\uparrow\ Y\uparrow$$

But

  - $Y\uparrow\ IM\uparrow$ (X=) so $NX\downarrow$ so trade deficit

    We need to make $NX\uparrow$ => $\epsilon\downarrow$.

    Because M-L condition: $\epsilon\downarrow\ X\uparrow$ and $IM\downarrow$ => $NX\uparrow$ (it's more convenient for foreigners to buy our goods and foreign goods are for us more expensive).

    NX will ↑ as much as needed to bring them back to the initial level.

$G\uparrow$

- **ZZ**: $G\uparrow\ Z\uparrow\ Y\uparrow$ ZZ shifts upward

$$ZZ = Y = C + I + G + NX$$

- **DD**: $Y = C + I + G$ same as ZZ

They shift up by the same amount => Y_{TB} is unchanged.

- **NX line**: unchanged.

$\epsilon\downarrow$

- **ZZ**: upwards because M-L condition says $X\uparrow, IM\downarrow$ $NX\uparrow$
- **DD**: nothing

  Y_{TB} changes

- **NX line**: shifts up because of M-L condition.

Recap:

- **ZZ**: up
- **DD**: up but less than ZZ
- **NX line**: up

b) Suppose now that the M-L condition is not met.

NX depend positively on ϵ

Will this affect the slope of the DD,ZZ and NX line?

The slopes are not affected because the graph represents how demand for goods depends on Y.

Would you propose the same policy mix as point a)?

Policy mix:

Goals: NX= and $Y\uparrow$

- $Y\uparrow$ expansionary fiscal policy

  But

- $Y\uparrow$ $IM\uparrow$ $(X=)$ $NX\downarrow$

To have NX=, NX must $\uparrow$ but now we need a real appreciation because now when $\epsilon\uparrow$,$NX\uparrow$.

The lines move as point a)

ZZ up, NX line shifts up but now because of the appreciation.

Output, Interest Rate and Exchange Rate

PP 425-439 - Appendix included

We put the 3 markets together.

- Goods Market (IS) (1)
- Financial Market (LM) (3)
- Uncovered Interest Parity (UIP) (2)

The Goods Market

$$IS : Y = C(Y - T) + I(Y, r) + G - \frac{IM}{\epsilon}(Y, \epsilon) + X(Y^*, \epsilon)$$

Demand for Goods

We make some assumptions to simplify

1. P, P^* as given $P = P^*$

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

2. $\pi^e = 0 \; r = i$

We now rewrite the IS

$$IS : Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, E)$$

IS in the Open Economy with these assumptions

Uncovered interest parity (UIP)

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

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

We simplify notation even more.

$$E = \frac{1 + i}{1 + i^*}\overline{E}^e$$

we take the expected exchange rate as given.

The current exchange rate E depends on:

- Current domestic interest rate i
- Current foreign inters rate i^*
- Expected (future) exchange rate

If the Government wants an appreciation:

$$E = \frac{1+i}{1+i^*}\overline{E}^e$$

$i\uparrow$

$\overline{E}^e\uparrow$

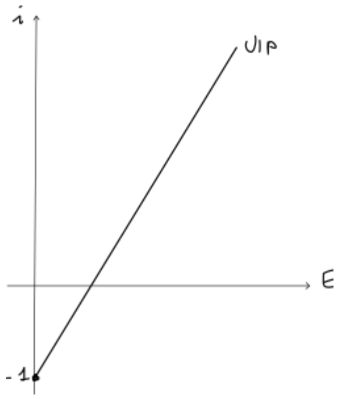
$i^*\downarrow$

Why is it that when the nominal $i\uparrow$ $E\uparrow$

When $i\uparrow$ domestic assets become more convenient => capital inflow => demand for domestic currency ↑ => so the domestic currency appreciates. $E\uparrow$

For you: HW, PS and MC, EB

Graph of UIP



Slope: positive

$i\uparrow$ $E\uparrow$

The UIP ROTATES when $i^*, \overline{E}^e$ change

$$E = \frac{1+i}{1+i^*}\overline{E}^e$$

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

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

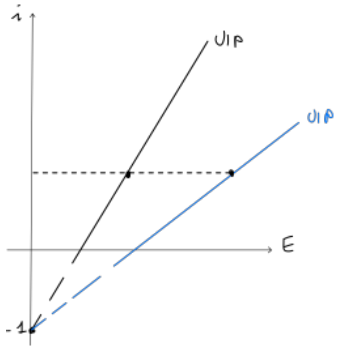
$$i = \frac{E(1+i^*) - \overline{E}^e}{\overline{E}^e}$$

Slope: $\frac{1+i^*}{\overline{E}^e}$

Vertical intercept: $E = 0$ $\quad i = -\frac{\overline{E}^e}{\overline{E}^e}$ $\quad i = -1$

Horizontal intercept: $i = 0$ $\quad E = \frac{\overline{E}^e}{1+i^*}$

Suppose $i^* \downarrow$



Slope: flatter

H. int: ↑

V. Int: =

$i^* \downarrow$ demand for domestic assets ↑

Demand for domestic currency ↑

$E \uparrow$

Suppose θ (reserve ratio) ↓

What happens to the UIP?

$\theta \downarrow$ banks more loans to give $M^s \uparrow$ $i \downarrow$

You move along the SAME UIP.

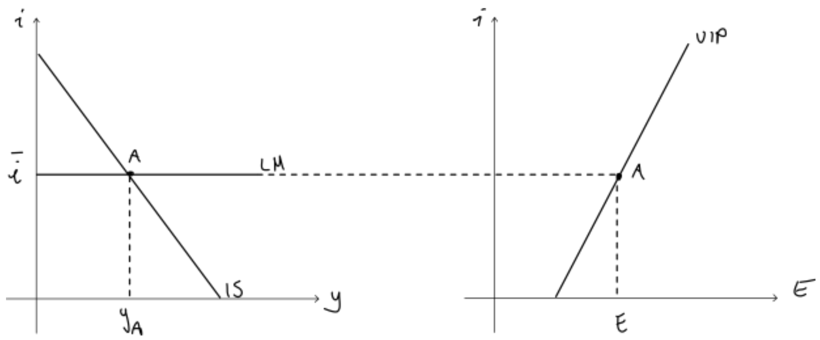
LM (Standard Model)

$i = \bar{i}$

We can put IS, UIP and LM together and obtain a model: the **Mundell-Fleming Model**

$$\begin{cases} IS: Y = C(Y-T) + I(Y,i) + G + NX(Y, Y^*, \frac{1+i}{1+i^*}\overline{E^e}) \\ LM: i = \bar{i} \end{cases}$$

Graph of the Model



The i now affects the IS in 2 ways:

1. $i\uparrow$ $I\downarrow$ $Z\downarrow$ $Y\downarrow$

2. $i\uparrow$ return on domestic assets $\uparrow$

   demand for my currency $\uparrow$

   my currency appreciates

   $E\uparrow$

   $E = \epsilon$

   so $\epsilon\uparrow$

   According to the M-L condition

   $\epsilon\uparrow$ $X\downarrow$ ($IM\uparrow$) $NX\downarrow$

   If $X\downarrow$ $Y\downarrow$ (you produce less)

So $i\uparrow$ $Y\downarrow$ for the 2 effects: the IS is still downward sloping.

- So if I is fully exogenous $I = \bar{I}$, the IS is still downward sloping because of effect 2).

  The IS is vertical if I is exogenous and ϵ or E do not depend on i (if NX do not depend on ϵ)

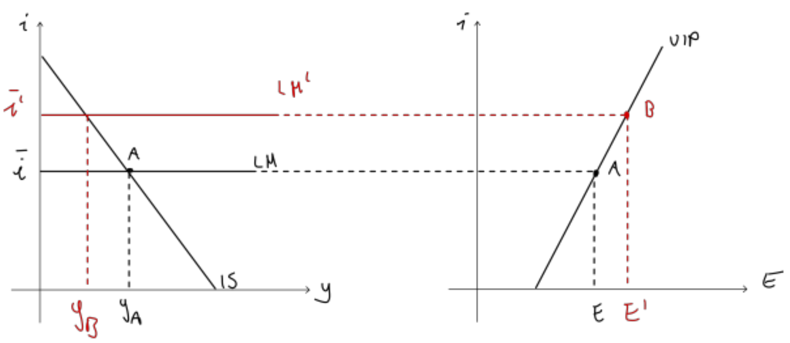
Examples:

1. **Monetary Policy**:

   The CB sells bonds: **monetary contraction**

   $i\uparrow$

   Comment on what happens to Y, i, C, I, E, NX



   - A = initial situation

- LM goes up because of the CB intervention

  IS doesn't move

  UIP doesn't rotate

- $Y\downarrow$ $i\uparrow$ $I\downarrow$ $Z\downarrow$ $Y\downarrow$

  AND

- $i\uparrow$ return on my assets ↑

  demand for my currency ↑

  $E\uparrow$ $\epsilon\uparrow$

  M-L condition: $X\downarrow$ ($IM\uparrow$) $NX\downarrow$

  $X\downarrow$ $Y\downarrow$ we produce less

- $i\uparrow$ because of CB's intervention
- $C\downarrow$ because $Y\downarrow$ T=
- $I\downarrow$ because $Y\downarrow$ and $i\uparrow$
- $E\uparrow$ (see explanation for second effect of $i\uparrow$)

NX	Y	Y^*	E
	↓	=	↑

$Y\downarrow$ $IM\downarrow$ (X=) $NX\uparrow$

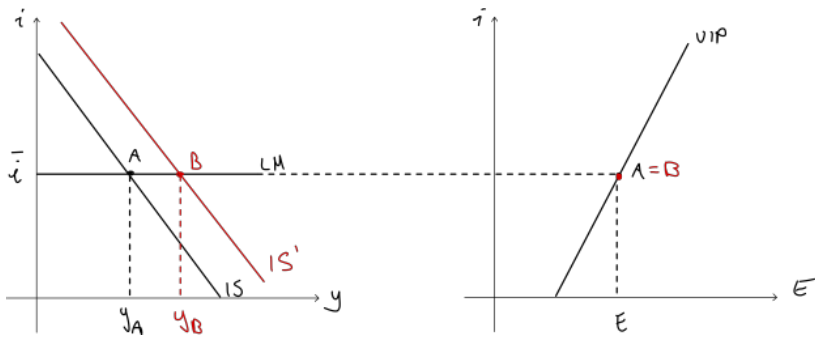
$E\uparrow$ M-L condition $X\downarrow$ ($IM\uparrow$) $NX\downarrow$

NX Ambiguous

2. Fiscal Policy

A balanced government budget. Then $G\uparrow$

Effect on Y, i, C, I, E, NX



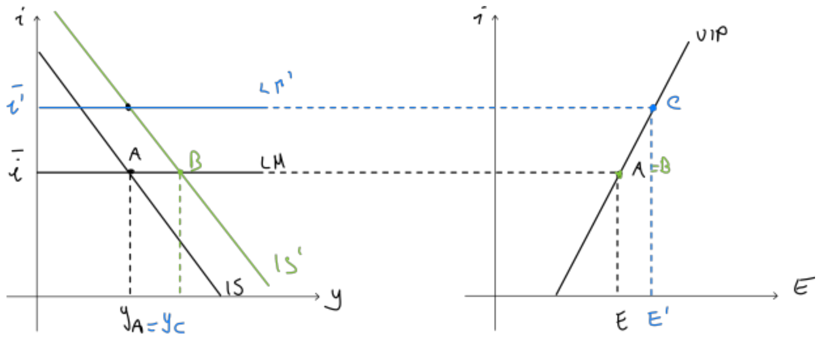
Scenario A)

- Before the $G\uparrow$, $Y < Y_n$
- $G\uparrow$ $Z\uparrow$ $Y\uparrow$
- Now Y becomes closer to Y_n, so the CB won't be worried about inflation.
- LM is unchanged.
- UIP is unchanged
- $Y\uparrow$
- i = (CB no intervention)
- $C\uparrow$ because $Y\uparrow$ and T=
- $I\uparrow$ because $Y\uparrow$ and i=
- E depends on i, i^*, $\overline{E^e}$ all unchanged.
- NX $Y\uparrow$ Y^*= E= so $IM\uparrow$ X= and finally $NX\downarrow$

Scenario B)

Before the ↑ G, Y was close to Y_n

This might happen when the Government needs to face an emergency (earthquake) or when political elections approach.



G↑ Z↑ Y↑ IS′=> point B where $y_B > Y_n = Y_A$

Cb might be worried about increasing inflation: so it ↑i because it wants Y_B to go back closer to Y_n. We assume that the CB wants to bring Y_B exactly equal to Y_A => We reach point C.

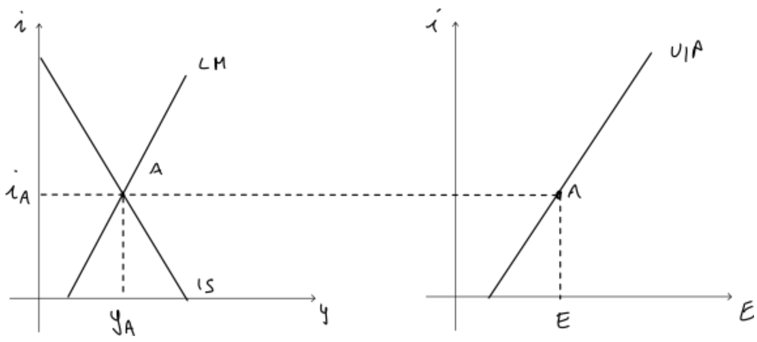
We compare A and C

- Y=
- i ↑ because of the CB's intervention to fight inflation
- C= because Y= and T=
- I↓ because Y= and i↓
- G↑ by assumption
- E depends on i, i^*=, $\overline{E^e}$ = because demand for my assets ↑, demand for my currency ↑ E↑
- NX Y= Y^*= E↑ so IM↑ X↓ and finally NX↓

$Y = C + I + G + NX$
= = ↓ ↑ ↓

The NON-STD IS-LM-UIP Model

$$\begin{cases} IS: Y = C(Y-T) + I(Y,i) + G + NX(Y, Y^*, \frac{1+i}{1+i^*}\overline{E^e}) \\ LM: \frac{M}{P} = YL(i) \end{cases}$$

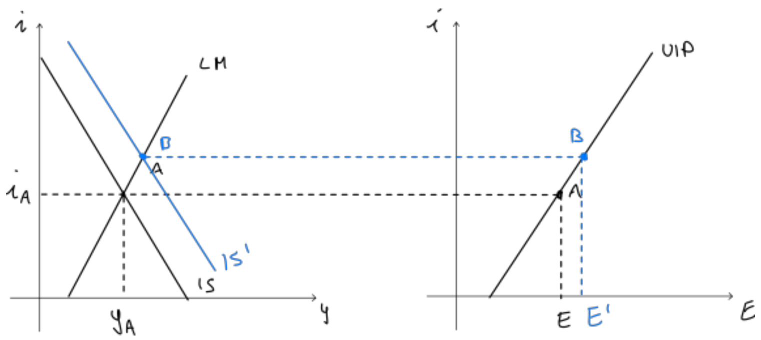


Examples

Fiscal Policy

Balanced budget but $G\uparrow$.

Comment on Y,i,C,I,G,E,NX



$G\uparrow$ $Z\uparrow$ $Y\uparrow$ IS to the right

- $Y\uparrow$
- $i\uparrow$ because $Y\uparrow$ $M^d\uparrow$, in order to go back to equilibrium and make $M^d\downarrow$, $i\uparrow$ so bonds become more convenient
- $C\uparrow$ because $Y\uparrow$ and T=
- I? because $Y\uparrow$ and $i\uparrow$
- $G\uparrow$ by assumption
- $E\uparrow$ because $i\uparrow$ i^*= $\overline{E}^e$= demand for domestic assets and currency $\uparrow$ $E\uparrow$

- NX because $Y\uparrow$ $Y^{*}=$ $E\uparrow$

  $Y\uparrow$ $IM\uparrow$ $X=$ $NX\downarrow$

  $E\uparrow$ M-L condition $X\downarrow$ $IM\uparrow$ $NX\downarrow$

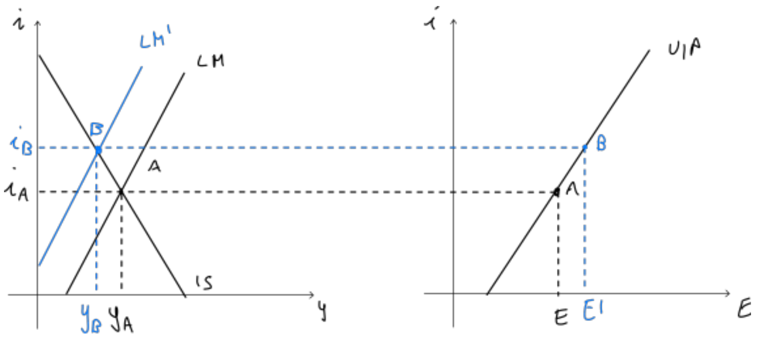
In this case the economy has a **TWIN DEFICIT**:

- The Government Budget Deficit
- NX Deterioration

Be careful with the fiscal policy: as we saw for the STD model, if after the policy $Y > Y_n$, CB intervenes.

Monetary Policy

Monetary contraction.



$M^s\downarrow$ $i\uparrow$ LM up to LM'

$Y\downarrow$

1. $i\uparrow$ $I\downarrow$ $Z\downarrow$ $Y\downarrow$
2. Demand for domestic currency ↑ $E\uparrow$

   M-L condition $X\downarrow$ $IM\uparrow$

   When $X\downarrow$ $Y\downarrow$ you produce less

Remember that since we are in the OPEN economy we need to do the 2nd point here, if we just do the 1st one is not a full answer and so no full points

- $i\uparrow$ because of CB's intervention
- $C\downarrow$ because $Y\downarrow$ and T=
- $I\downarrow$ because $Y\downarrow$ and $i\uparrow$
- G=

- $E\uparrow$ because $i\uparrow$ $i^*=$ $\overline{E}^e=$ demand for domestic assets and currency $\uparrow E\uparrow$
- NX because $Y\downarrow$ $Y^*=$ $E\uparrow$

  $Y\downarrow$ $IM\downarrow$ $X=$ $NX\downarrow$

  $E\uparrow$ M-L condition $X\downarrow$ $IM\uparrow$ $NX\downarrow$

Composition of demand in the open economy

C	I	G	NX
			Y
			Y^*
			E: i,i^*,$\overline{E}^e$

Exchange Rate Regimes

1. **Flexible exchange rates**:
2. **Fixed exchange rates (central peg)**: a fixed exchange rate is maintained in terms of some foreign currency. You **PEG**
   I. To a **foreign currency**
   II. To a **basket of foreign currencies**. The weights mirror the composition of trade.

   The fixed exchange rate can change: **REVALUATION** and **DEVALUATION**.
3. **Crawling Peg**: it's between 1 and 2. It is typically used by countries with high inflation rates.

   If you peg your currency your E against the \$: $\epsilon = \dfrac{EP}{P^*}$

   If your $P\uparrow$ faster than P^*, then => steady real appreciation

   To avoid this, you can choose a predetermined exchange rate against the \$ => you crawl w/r to the \$ by allowing the fixed exchange rate to fluctuate within a band of rates.

Fixed Exchange Rates

We start from the interest rate parity condition

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

If you peg your exchange rate, $E_t = E_{t+1}^e$

$$(1+i_t) = (1+i_t^*)$$

$i_t = i_t^*$

Under FIXED EXCHANGE RATE and PERFECT CAPITAL MOBILITY => DOMESTIC interest rate must be equal to the FOREIGN interest rate.

The CB gives up monetary policy as a policy instrument.

To maintain the equality between i and i^*, the CB must be very ready to intervene:

- If domestic currency tends to appreciate: the CB must buy foreign currency and/or sell domestic currency.
- If domestic currency tends to depreciate: the CB must buy domestic currency / sell foreign currency.

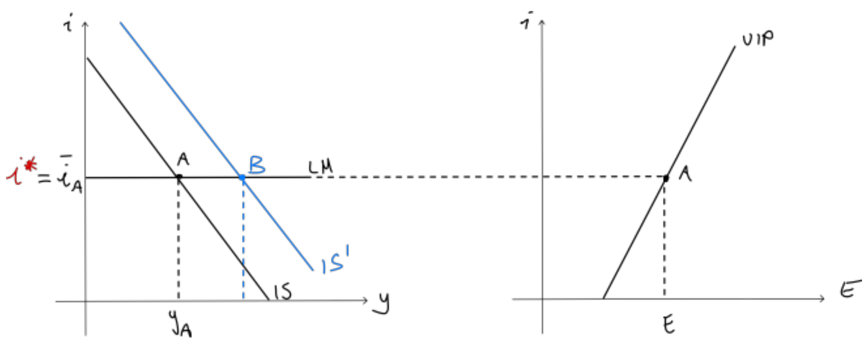
Monetary policy becomes endogenous.

LM: $\frac{M}{P} = L(Y, i^*)$

If $i^*\downarrow$, the CB must lower i by the same amount by which i^* has $\downarrow$.

Fiscal policy under Fixed Exchange Rates and STD IS-LM-UIP Model

$G\uparrow$



The effect is similar to the flexible exchange rates

BUT

The difference is the ability of the CB to respond. If Y_A was close to Y_n and now $Y_B > Y_A$ so $Y_B > Y_n$, under flexible exchange rates, to avoid inflation the CB would intervene by $\uparrow i$.

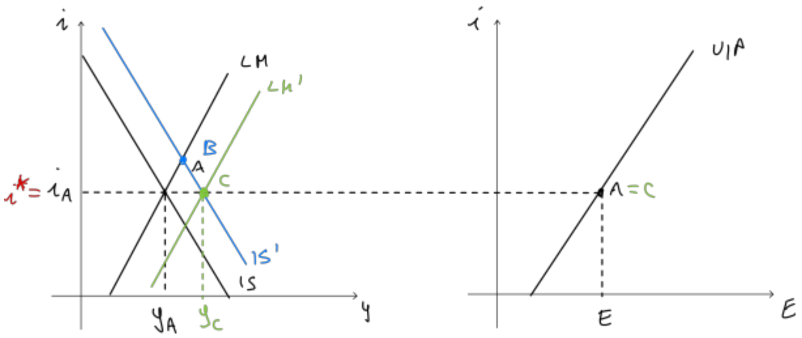
NOW the CB CAN'T INTERVENE because $i = i^*$

Fixed exchange rates

Disadvantages	Advantages
Loss of monetary policy as a tool: you give up the control of the policy rate	It facilitates I and trade

Fiscal policy under Fixed Exchange rates, NON-STD IS-LM-UIP Model

$G\uparrow$



$G\uparrow$ IS to the right. We reach point B

BUT

i has $\uparrow$, this cannot happen under fixed exchange rates => CB is FORCED to intervene.

Point C where i is back to the initial level and E is obviously unchanged.

When we move from A to B, $Y\uparrow$ $M^d\uparrow$, the CB must accomodate this $\uparrow$ in M^d by $\uparrow$ M^s to maintain the same i.

From Y_A to Y_C => fiscal policy is more powerful under fixed exchange rates because now it triggers a monetary accommodation.

Appendix

- **Perfect Capital Mobility**: it exists in developed countries but it's not fully true for less developed countries.
- **Open economy**:

  CB:

  - **Assets**:
    - Domestic bonds
    - Foreign exchange reserves / foreign assets/currency

- **Liabilities** (monetary base, CB money):

CB changes the monetary base by:

- Selling and buying bonds on the bonds market
- Moving foreign currency on the foreign exchange market

Scenario 1:

Fixed exchange rates => $i = i^*$

Perfect capital mobility

CB now buys bonds by an amount ΔB

Monetary base ↑

i↓

Investors prefer foreign bonds, so they buy foreign currency and they sell domestic currency.

Domestic currency ↓ in value but

Since we have fixed exchange rate this can't happen => CB will intervene by selling foreign currency for domestic currency.

Monetary base ↓ up to the point where your i is back to $i = i^*$

The composition of the CB's balance sheet changes but in the end the monetary base and i will be unchanged.

Assets	Liabilities
Bonds ΔB	Monetary base ΔB-ΔB
Reserves -ΔB	

Monetary Policy CAN'T BE USED under PERFECT CAPITAL MOBILITY (that allows investors to react immediately) and under fixed exchange rates.

Scenario 2:

Fixed exchange rates

Imperfect capital mobility:

- It takes some time to shift between domestic and foreign bonds.

- There might be capital controls: limits to the flow of foreign capital

Suppose again that the CB implements an expansionary monetary policy: buy bonds.

$i\downarrow$ now $i < i*$

OVERTIME the demand for foreign currency will ↑, not immediately.

=> when this happens, then our domestic currency will ↓ in value if the CB doesn't intervene =>

CB intervenes and buys domestic currency up to the point where $i = i*$, back to the initial level.

The CB can use monetary policy for a while (until investors are able to shift to foreign bonds).

Scenario 3:

Fixed exchange rates

Financial markets are very imperfect

As before $i\downarrow$

Now investors are unable/unwilling to shift to foreign bonds

CB's intervention might be even 0 if investors never shift.

Despite fixed exchange rates the CB has some freedom to move i.

Key aspects:

The level of development of financial markets

Investors willingness to shift from domestic to foreign assets

Capital controls

Ex 12

Open economy

$P = P* = 1 \quad E = \epsilon$

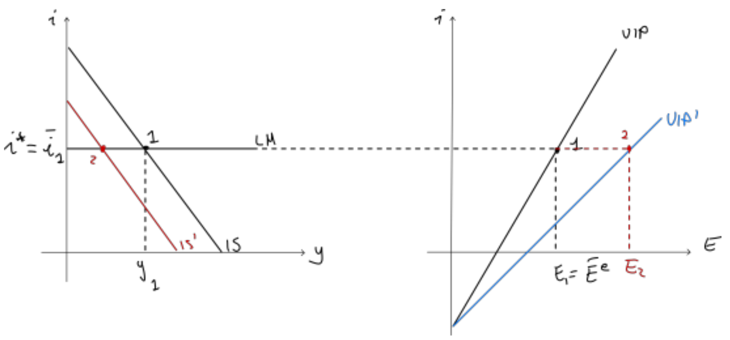
Use the pair of graphs "Open economy IS-LM - interest parity condition"

CB chooses the interest rate (STD Model)

Flexible exchange rates

A. **Show the initial equilibrium and call it 1**.

   Call $\bar{i}_1, Y_1, E_1$ the other associated values and assume that at the initial equilibrium $i_1 = i*$, $\overline{E}^e = E_1$



$i^*\downarrow$ $\bar{i}_1 > i^*$

investors demand domestic bonds

my currency appreciates

$E\uparrow$ $\epsilon\uparrow$

UIP rotates.

slope: $\dfrac{1+i^*}{E^e}$ $i^*\downarrow$ flatter

H int: $\dfrac{\bar{E}^e}{1+i^*}$ so it $\uparrow$

$\uparrow\epsilon$ M-L condition $X\downarrow$ $IM\uparrow$ $NX\downarrow$ You produce less: IS to the left

i= because the CB doesn't intervene

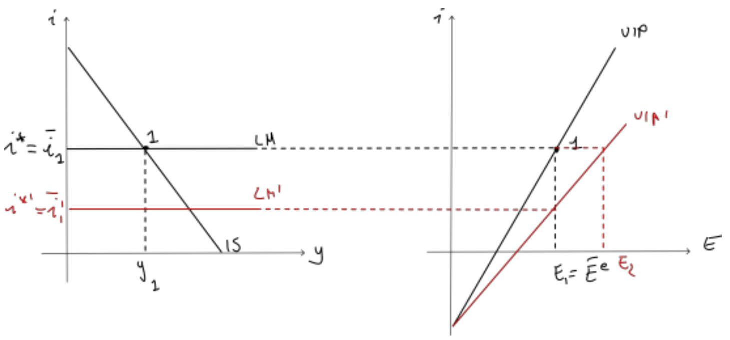
M^s: $Y\downarrow$ $M^d\downarrow$

To keep i unchanged at $\bar{i}_1$, the CB needs to lower M^s by the amount by which M^d has changed.

B. **now we are under fixed exchange rates**.

Start from the same equilibrium.

$i^*\downarrow$ **discuss the effect on** Y, i, E, M^s



$i^*\downarrow$ same reasoning as point A)

UIP rotates to the RIGHT.

If the CB doesn't intervene, $i^*\downarrow$

Demand for domestic assets and currency ↑

E would appreciate up to E_2

BUT This can't happen under fixed exchange rates.

The CB needs to ↓ i to $\bar{i}'_1$ by the same amount by which i^* has ↓

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

E= fixed

M^s: $Y\uparrow$ $M^d\uparrow$ so M^swill ↑

Ex 13

Consider Gamma, an economy with constant prices under a fixed exchange rate regime described by a standard open economy "IS-LM-interest parity" model. Delta's central bank is determined to keep the exchange rate constant at the chosen level $E = E_1$, and individuals expect it to do so also in the future, so that $E = E_1 = E^e$. Having explained which value the domestic interest rate will necessarily take on in this economy, suppose that, starting from an equilibrium position, government purchases of goods and services and net taxes are cut in Gamma by the same amount, so that $\Delta\overline{G} - \Delta\overline{T} < 0$·

Which of the three curves – IS, LM, interest parity – will be affected by this change, and why? In the move from the initial equilibrium to the new one that the economy will reach, how will Gamma's equilibrium levels of production, interest rate, exchange rate, consumption, investment and net exports will change? And what about money supply? Explain.

SKETCH OF ANSWER

- Under a fixed, and credible, exchange rate ($E = E_1 = E^e$), from the interest parity condition follows that $i = i^*$ – the domestic interest rate must be equal to the foreign one.
- The IS curve shifts to the left, since – for any given Y – the simultaneous cut in $\overline{G}$ and $\overline{T}$ lowers aggregate demand by $(1 - C_1)\Delta\overline{G} < 0$.
- The curve that, in the (E, i), plane, represents the interest parity condition is not affected by the change under consideration.
- Since, to make sure that the exchange rate remains fixed, the central bank keeps the domestic interest rate equal to the foreign one, the LM curve remains horizontal at $i = i^*$.

- In the new equilibrium, income is lower (due to the decrease in demand that has disturbed the initial equilibrium), and E unchanged, I lower (because of the decrease Y), NX higher (Y has gone down). The sign of the change in C is however uncertain (Y is lower, but net taxes have gone down).
- As the economy goes from the initial to the new, final equilibrium, money demand falls (i unchanged; Y lower); it follows that money supply will have to be decreased by the same amount money demand has gone down. The central bank will have to lower M to prevent the exchange rate from falling below E_1 - absent this central bank intervention, the decrease in money demand would lower the domestic interest rate below the level (i^*) it has to take on if the exchange has to remain constant at the chosen level.

Exchange Rate Regimes

- **Short Run**:
  - Flexible and fixed exchange rates are different
  - If the CB wants to have a real depreciation ($\downarrow \epsilon$) under flexible exchange rate it will $\downarrow i$, under fixed it can't.
- **Medium Run**:
  - The exchange rate system does not matter much => you reach the same Y under fixed and flexible exchange rates.

Real Exchange Rate

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

- **Short Run**:
  - **Flexible exchange rate**: E can change. we assume that $P = P* = constant$. ϵ depends on E
  - **Fixed exchange rate**: E= by definition, $P = P* = constant$, ϵ=
- **Medium Run**: $P, P*$ are not constant. Even with fixed exchange rates, ϵ can change through P and $P*$

2

Flexible	Fixed
Variable	You give up monetary policy if you have perfect capital mobility
You can use monetary tool	It facilitates trade and I

IS under Fixed Exchange Rates

- $r = i - \pi^e$
- $\epsilon = \frac{EP}{P*}$
- $i = i*$ and $E = \overline{E}$

The IS is: $Y = C(Y - T) + I(Y, i* - \pi^e) + G + NX(Y, Y*, \frac{\overline{E} * P}{P*})$

We can write it in a **more compact** way:

$Y = Y(\frac{\overline{E}P}{P*}, G, T, i* - \pi^e, Y*)$

- + - - +

$\frac{\overline{E}P}{P*} = \epsilon$ if $\epsilon\uparrow$ $X\downarrow$ $IM\uparrow$

Since $X\downarrow$, you produce less $Y\downarrow$

If $Y*\uparrow$ $X\uparrow$ $Y\uparrow$ (you produce more).

Reasoning on the Medium Run

Suppose a country with a high ϵ and a trade deficit.

- **Short Run**:
  - **Flexible exchange rates**:

    $\downarrow E$ $(i\downarrow)$

    $\downarrow\epsilon$ $(P*, Pconstant$ so $\epsilon = E$

    M-L condition $X\uparrow$ $IM\downarrow$ so $NX\uparrow$ and $Y\uparrow$
  - **Fixed exchange rates**:

    i can't decrease

    The trade deficit remains and $epsilon$ is high.
- **Medium Run**:

  NOW PRICES CAN ADJUST.
  - The behaviour of prices is by the PC:

    $\pi - \pi^e = \frac{\alpha}{L}(Y - Y_n)$ $Y - Y_n$ is the output gap.
  - We assume that $\pi^e = \overline{\pi}$

    $\pi - \overline{\pi} = \frac{\alpha}{L}(Y - Y_n)$
  - $\pi*$ foreign inflation rate
  - Suppose that if $Y = Y_n$ then domestic inflation $\pi = \pi*$.

    This means that when $Y = Y_n$ and $Y* = Y_n$ then inflation rates are the same, $\frac{P}{P*}$ is the same

Under fixed exchange rates => ϵ is the same

- If $Y < Y_n$, then $\pi\downarrow$

If at the beginning we had

$$Y = Y_n$$
$$Y^* = Y_n$$
$$\pi = \pi^* = \overline{\pi}$$

Now $\pi < \pi^*$

Domestic prices ↑ more slowly than P^*.

$\epsilon = \frac{EP}{P^*}$ now $\epsilon\downarrow$

M-L condition

$X\uparrow\ IM\downarrow\ NX\uparrow$

so $X\uparrow$ you produce more $Y\uparrow$

$Y\uparrow$ back to Y_n

$\pi = \pi^* = \overline{\pi}$

ϵ is constant again

Recap:

- **Short Run**: fixed nominal exchange rate => fixed real exchange rate
- **Medium Run**: no! ϵ can move through prices when $P \neq P^*$

BUT Adjustments through prices are long and painful.

So is there a better way to move ϵ under fixed exchange rates in the medium run?

1. **You go for a ONE-TIME DEVALUATION**: $\downarrow\epsilon\downarrow\ X\uparrow\ IM\uparrow\ NX\uparrow\ Y\uparrow$
   You can achieve in the short run what before you could achieve only in the medium run through prices.
   This must NOT be abused.
   It might trigger exchange rate crises.
2. **You FLOAT**: you move from fixed to flexible.

Exchange Rate Crisis under Fixed Exchange Rates

Consider an economy with fixed exchange rates.

Investors start to expect an exchange rate adjustment.

They expect:

1. **Devaluation**:
2. **Floating**:

These expectations might arise because:

1. ϵ **is too high**: This happens when you peg to a currency with a **lower** inflation rate

   => Danger of a steady real appreciation. $NX\downarrow$ $Y\downarrow$ so markets expect an exchange rate adjustment.

2. **Of internal condition**: economy may need a ↓ in i

   Investors may expect a devaluation or a decision to float to be able to $\downarrow i$

When this happens, maintaining the parity is a problem.

- Recall the UIP condition

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

  Under fixed exchange rates

$$E_{t+1}^e = E - t = \overline{E} => i_t = i_t^*$$

- BUT now there are expectations of devaluation

$$E_{t+1}^e < E_t$$

$$\frac{E_{t+1}^e - E_t}{E_t} \neq 0$$

$$i \neq i^*$$

  This is a problem for the parity.

- What can the **Government** do to face this expectations of devaluation?
  1. Gov can try to convince investors that their expectations are wrong and that it has no intention to devaluate or float.

     The Gov can make **announcements**, BUT typically this is not the solution

2. You ↑ i to convince investors to hold domestic assets rather than foreign despite the expectations of devaluation.

   - If the ↑i is too small (it is lower than the one necessary to maintain the exchange rate fixed considering the expectations of devaluation), the problem is not solved.
   - i is higher but not enough to compensate for the perceived risk of devaluation => capital outflows => foreign assets are preferred to domestic assets.

   => depreciation

   Now the CB if it wants to keep the fixed exchange rate, must buy domestic currency and/or sell foreign to ↑ the power of domestic currency.

   i is higher, I↓ Y↓

Summing up: either the CB ↑ i enough to fight expectations of devaluation and brings $i = i^*$ again, or the situation gets worse.

So 2) must be done when the required ↑ in i is small and well known.

3) You give in, you devaluate or you float

Notice that a devaluation or a floating can occur just because financial markets expect it to happen.

Exchange Rates under Flexible Exchange Rates

UIP condition:

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

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

E_t depends on i_t, i_t^*, E_{t+1}^e

In reality the situation is more complex.

$$\boxed{E_{t+1}^e} = \frac{(1 + i_{t+1}^e)}{(1 + i_{t+1}^{*e})}E_{t+2}^e$$

$$E_t = \frac{(1 + i_t)}{(1 + i_t^*)}\frac{(1 + i_{t+1}^e)}{(1 + i_{t+1}^{*e})}E_{t+2}^e$$

I could go on and substitute.

We get in the end

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

- E_t depends on many expectations!
- Any factor that moves E_{t+n+1}^e moves E_t as well!
- Every time future interest rates move in either country, E_t moves.

=> This is why E_t is volatile and difficult to predict.

The consensus today is for flexible exchange rates because monetary policy is an essential tool.

So we have:

1. Flexible exchange rates
2. Fixed exchange rates
3. **Common currency area (CCA)** (€,$)

Robert Mundell studied the characteristic that make a CCA good/optimal.

It must have one of the 2 following features:

1. Countries should experience similar shocks and have similar monetary and fiscal policies.
2. If they have different shocks, then they must have a high factor mobility.

US	EU
1. No	1. No
2. Yes	2. Not really but improving

Exchange rates are complex.

- Suppose a country where the CB is NOT credible => this can be a good reason for fixed exchange rates.
- Suppose a country with a large budget deficit and large inflation. The Gov wants to ↓ inflation. One way of convincing markets is to fix the exchange rate because in this way you will be forced to keep $i = i^*$. =>

  1. You can fix the exchange rate and then implement policies to reduce the budget deficit.

  OR

  2. You can take a strong form of fixed exchange rates called: **HARD PEG**.

- **Currency Board**: monetary authority supplies domestic currency maintaining a fixed exchange rate BUT domestic currency can be issued only if it is fully covered by the CB's holdings of foreign reserves.
- **Dollarization**: it's extreme because you replace your domestic currency with a foreign currency and typically is the dollar.

In the end policy makers have a **TRILEMMA** (an on BB optional handout):

- **Fixed exchange rates and monetary policy**: you can't have perfect capital mobility.
- **Fixed exchange rates and perfect capital mobility**: no monetary policy.
- **Monetary policy with perfect capital mobility**: no fixed exchange rates.

You can't have the 3 of them together. You can have ⅔.

EB: Ch 5 - PS - MC.

Government Debt

Government Budget Constraint

- G Government spending
- T taxes collected

G is financed through T and issuing bonds.

The Government Budget Constraint is:

$$B_t - B_{t-1} = rB_{t-1} + G_t - T_t$$

Change in debt deficit = interest payments + primary deficit

B_t = public debt in year t = sum of all deficits until time t.

B_{t-1} = public deb t at the end of year t-1 = at the beginning of year t.

r = real interest rate. We assume it is constant.

G_t = does not include transfer payments.

T_t = taxes minus transfers during year t.

rB_{t-1} = interest payments on previous debt.

$G_t - T_t$ = **primary deficit**

$T_t - G_t$ = **primary surplus**.

We can rewrite it:

$$B_t = (1 + r)B_{t+1} + G_t - T_t$$

The debt at the end of year t is $(1 + r)$ times the debt at the end of year t-1 + primary deficit during year t.

The Evolution of Debt-to-GDP ratio

To evaluate id debt is sustainable or not, we need to compare it to GDP.

=> **RATIO OF DEBT TO GDP**

RATIO OF DEBT TO OUTPUT

DEBT TO GDP RATIO

DEBT RATIO.

Our budget constraint becomes:

$$\frac{B_t}{Y_t} = (1+r)\frac{B_{t+1}}{Y_t} + \frac{G_t - T_t}{Y_t}$$

$$\frac{B_t}{Y_t} = (1+r)\frac{B_{t-1}}{Y_{t-1}}\frac{Y_{t-1}}{Y_t} + \frac{G_t - T_t}{Y_t}$$

Now we consider g = growth rate of GDP

$$g = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

$$gY_{t-1} = Y_t - Y_{t-1}$$

$$Y_t = (1+g)Y_{t-1}$$

$$\frac{Y_t}{Y_t} = (1+g)\frac{Y_{t-1}}{Y_t}$$

$$\frac{Y_{t-1}}{Y_t} = \frac{1}{1+g}$$

I substitute

$$\frac{B_t}{Y_t} = (1+r)\frac{B_{t-1}}{Y_{t-1}}\frac{1}{1+g} + \frac{G_t - T_t}{Y_t}$$

$$\frac{B_t}{Y_t} = \frac{B_{t-1}}{Y_{t-1}}\frac{1+r}{1+g} + \frac{G_t - T_t}{Y_t}$$

We can approximate $\frac{1+r}{1+g}$ as $1+r-g$ (we don't care why)

$$\frac{B_t}{Y_t} = (1+r-g)\frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$$

This equation gives the evolution of debt-to-gdp ratio

$$\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = (r-g)\frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$$

Change in the debt ratio overtime. | The difference between the real interest rate and the growth rate times the initial debt ratio | The ratio of primary deficit to GDP

- Suppose $G_t = T_t$ => when primary deficit is zero.

  r = rate of growth of debt.

  g = growth rate of GDP.

- **Intuition**:

  If $r\uparrow$

  $g\downarrow$ => ↑ in the ratio go debt-to-GDP

  $\frac{G_t - T_t}{Y_t}\uparrow$

The Debt Ratio in the Long Run

To understand long run dynamics of the debt ratio, we need a math tool => **difference equations**.

They are equations that relate a variable to its past value.

They are used to study dynamics.

We'll use only **1st order difference equations**, equations that relate 1 variable to just one single lagged value.

(On BB optional handout on difference equations)

A first order difference equation is:

$$Y_t = \beta Y_{t-1} + A$$

A general dynamic variable that depends on its past value and on an exogenous variable (A).

β is a parameter, a constant as well as A.

Our equation

$$\frac{B_t}{Y_t} = (1 + r - g)\frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$$

Y_t β Y_{t-1} A

It's a first order difference equation.

We use lower cases to indicate variables in terms of GDP.

$$b_t = (1 + r - g)b_{t-1} + d$$

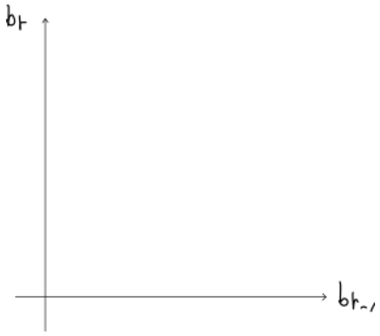
$d = \frac{G_t - T_t}{Y_t}$ = ratio of primary deficit to GDP

This is the equation we use to solve this first order difference equation.

To solve it we use the graph.

In the graph this is a line and we call it **DEBT-to-GDP line**. It's a straight line

We represent it in the space



Slope: $1 + r - g$ for realistic values of r and g, the slope is >0. => we assume this.

V. Int: d

H. Int: is given $B_t = 0$

$$0 = (1 + r - g)b_{t-1} + d$$

$$b_{t-1} = -\frac{d}{1 + r - g}$$

We are going to analyze **4 scenarios**:

- $d > 0$ $\quad \frac{G_t - T_t}{Y_t} > 0$ **Primary Fiscal Deficit**
  - $r > g$
  - $r < g$
- $d < 0$ $\quad \frac{G_t - T_t}{Y_t} < 0$ **Primary Fiscal Surplus**.
  - $r > g$
  - $r < g$

Important Remark:

$b_t = (1 + r - g)b_{t-1} + d$

$\underbrace{b_t - b_{t-1}}_{} = (r-g)b_{t-1} + d$

$\Delta b = \Delta b_t$

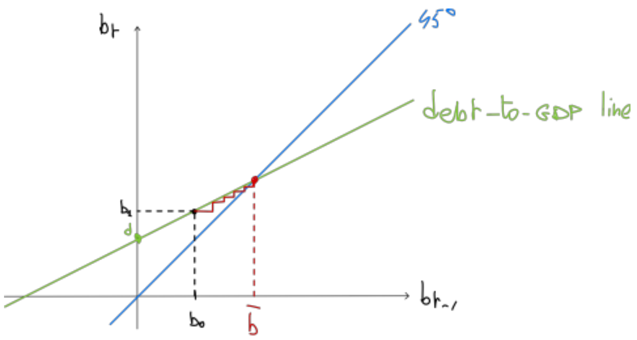
$\Delta b = 0 \Rightarrow b_t = b_{t-1} \Rightarrow$ in this case, we say that the economy has reached a **STEADY STATE (SS)** and we denote it by $\overline{b}$.

$0 = (r-g)\overline{b} + d$

$$\overline{b} = \frac{d}{g-r}$$

1st Scenario

$d > 0$ and $r < g$



1. We draw the 45° line => this is the line of all possible steady states (SS)
2. We draw the debt-to-GDP line

   Slope: (1+r-g)

   >0 (we know it)

   <1 here because $r < g$ so flatter than the 45° line.

   V. Int: $d > 0$

   H. Int: $-\dfrac{d}{1+r-g} < 0$

3. Identify $\overline{b}$
4. Suppose initial debt b_0 which is the debt ratio at time zero.

   The debt ratio today (time 1) is b_1

   At time 2, b_1 is the debt ratio inherited from the previous period and determines b_2.

Debt ratio ↑ but a decreasing rate and it'll converge to the constant value of $\overline{b}$.

$\overline{b} > 0 \qquad \overline{b} = \dfrac{d}{g - r}$

$b -> \overline{b}$ the gov is a debtor but since the debt ratio converges to $\overline{b}$, then debt is sustainable.

***

Primary deficit that is balanced ($d = 0$) and $g > r$.

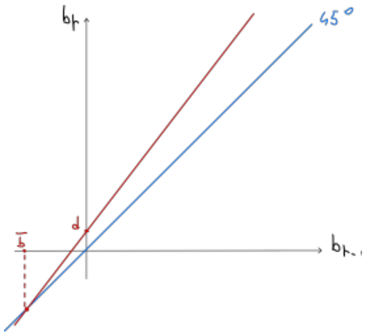
$\overline{b} = 0$ since $d = 0$

Debt will converge to $\overline{b} = 0$

2nd scenario

$d > 0$ primary deficit

$r > g$



Slope:

$(1 + r - g) > 0$

Slope always >0 and here even >1 because $r > g$, so it's steeper

V. Int: $d > 0$

H. Int: $-\dfrac{d}{1 + r - g} < 0$

The debt ratio ↑ overtime at an increasing rate and diverges from the steady state equilibrium ($\overline{b}$)

If no action is taken, debt is UNSUSTAINABLE for any positive b_0 inherited from the past.

$\overline{b} < 0$

If the Government wants to stabilize the debt ratio it needs to run an adequate primary surplus.

***

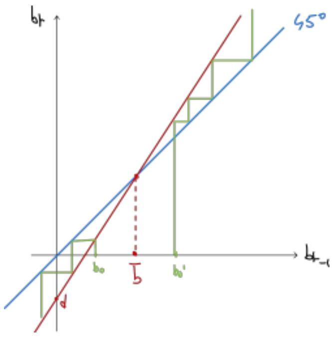
$d = 0$ and $r > g$ b will ↑ even if $d = 0$ with an initial $b_0 > 0$

$b -> +\infty$ for any positive values of b_0 inherited from the past.

NO CONVERGENCE, UNSTABLE EQUILIBRIUM

3rd scenario

$d < 0$ and $r > g$



Slope:

$(1 + r - g) > 0$ and even > 1 $(r > g)$

V. Int: $d < 0$

H. Int: $-\dfrac{d}{1 + r - g} > 0$

$$\overline{b} = \frac{d}{g - r} > 0$$

We have 2 competing forces

$r > g$ tends to ↑ the debt ratio overtime

$d < 0$ tend sto ↓ the debt ratio overtime.

Empirical evidence says the following:

It all depends on the b_{t-1} inherited from the past.

- **Suppose the debt ratio is $b_0 < \overline{b}$:**

  debt ratio keeps on shrinking overtime due to the effect of $d < 0$ (primary surplus) that prevails over $r > g$.

$b \downarrow$ overtime and $b -> -\infty$

- **Suppose the debt ratio is $b_0' > \overline{b}$:**

  debt ratio keeps on ↑ overtime due to the effect of $r > g$ prevails over the effect of $d < 0$

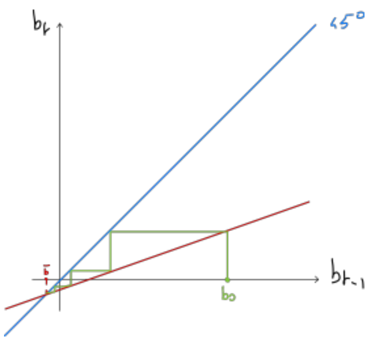
  $b -> +\infty$

In BOTH CASES we don't reach $\overline{b}$. The equilibrium is UNSTABLE

- If the magnitude of the primary surplus is enough, b will ↓ overtime $b -> -\infty$ => the Government is a creditor.
- $b -> +\infty$ (debtor)

4th Scenario

$d < 0$ and $r < g$



Slope:

$(1 + r - g) > 0$

V. Int: $d < 0$

H. Int: $-\dfrac{d}{1 + r - g} > 0$

b_0 debt ratio, inherited from the past

Notice: $\overline{b} < 0$

Noe overtime b will converge to $\overline{b}$

The Government ends up being a creditor, no matter what b_0 is!!!

Default Risk

It's the risk that the Government will not repay its debt.

If investors perceive it: they ask an ↑x to be compensated for risk.

x↑ because the perceived risk ↑.

Interest rate on debt ↑

The primary surplus needed to stabilize b is now higher.

You need to ↓↓G and or ↑ ↑ T

This is costly and creates uncertainty. The risk of default ↑.

THIS HAPPENS EVEN IF THE INITIAL ↑ IN PERCEIVED RISK IS NOT CORRECT.

Bad cycle: r↑ deficit ↑ r↑

What happens if a debt spiral?

1. **DEBT RESTRUCTURING or RESCHEDULING**:

   = interest payments are deferred, not cancelled.

2. **PARTIAL DEBT DEFAULT**:

   = creditors get a **HAIRCUT**.

   Example: they get 70% of their credit, their cut is 30%.

3. **DEBT DEFAULT**:

   Government is unable to pay its outstanding debt.

During **crises**: b↑

Great Recession: fear of some Government insolvency. The return on some bonds ↑ because investors asked for a higher risk premium to be compensated for risk.

Rule of thumb: if the return on a gov bond is **>6 or 7%**, investors have some fear.

The return on bonds issued in a country is benchmarked against that of the most creditworthy country in the area (Germany). **Spread** is the difference in return.

In **2012**: 10y Greek gov bond return was 25%. (23 percentage points higher than Germany).

We can compute the expected probability of default.

$$2\,\% = (1-p)25\% + p * 0$$

$$p = 0.92 = 92\,\%$$

EB Ch. 6 PP188-203, EX1,8.

NO PP 204-215.

PS and MC.

Ex 15 HW

$r = g$

$d > 0$

Draw the graph, analyze this case

Will b converge or not?

Ex 16

$r = 3\% = 0.03$

$g = 0.05$

$d > 0$

($r < g$ and $d > 0$ First Scenario)

b will ↑ but at a ↓ rate and will converge to the SS.

The Government wants to stabilize b so that it is equal to 1 in t=1 and all periods.

A. What d will allow the Gov to reach its goal?

   $b_t - b_{t-1} = (r - g)b_{t-1} + d$

   $b_1 - b_0 = (r - g)b_0 + d$

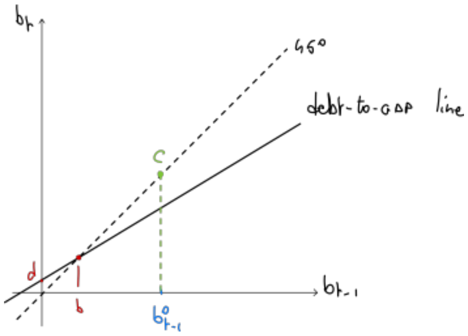
   Stabilizing means $b_1 - b_0 = 0$

   $0 = (0.03 - 0.05) + d$

   $d = 0.02 = 2\%$

B. Before d was 5%. What kind of policy should be implemented to bring it to the value computed above.

Ex 17



- Is g >, = or < r?

  $(1 + r - g) > 0$ and <1 from the graph, flatter than the 45° line.

  $r - g < 0$

  $g > r$

- Is the economy in a primary budget surplus, deficit or balance??

  From the graph: $d > 0$ so

  $$\frac{G_t - T_t}{Y_t} > 0$$

  $$G_t > T_t$$

  primary deficit

- How can policy makers stabilize at b^0_{t-1} the debt ratio prevailing at time t=2? Suggest at least 2 ways.

  To do so b^0_{t-1} becomes the SS => this means that the 45° line and the debt-to-GDP line must intersect at point C.

  - The **debt ratio line** can **ROTATES UP**:

    The slope must change.

    Steeper, slope ↑

    r should↑. **Contractionary monetary policy** (SELL BONDS)

    Or g should ↓. (Discourage the use of technology)

  - The **debt ratio line** can **SHIFT UP:**

    slope=

d must ↑

$$d = \frac{G_t - T_t}{Y_t}$$

So G_t↑ and/or T_t↓ => expansionary fiscal policy => so that primary deficit to GDP ↑.

Or a combination of the 2 can be applied.

Ex 18

Open economy

$NI = 0$

Constant prices

Flexible exchange rate

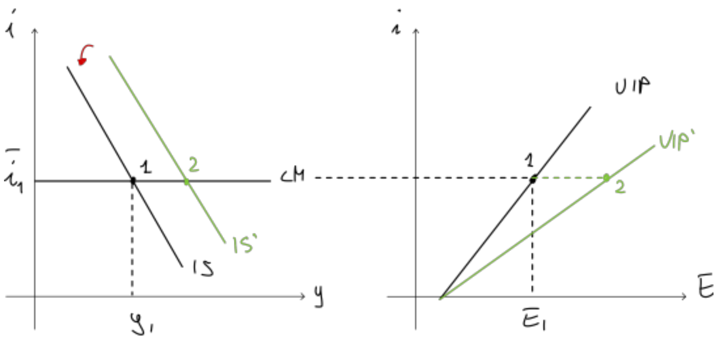
M-L is not met

STD IS-LM-UIP Model

$\Delta i^* < 0$ and at the same time the Gov changes G to prevent Y from changing.

Will the IS-LM-UIP move? Why?

How an by how much will S_{nat}, S_{pub}, S change?



$\Delta i^* < 0$

If i^*↓ demand for domestic assets ↑

demand for domestic currency ↑

E↑ => UIP'

$\epsilon = \frac{EP}{P^*}$ Since P, P^* constant, E↑, ϵ↑

Since M-L not met, $\epsilon\uparrow, NX\uparrow$ => IS RIGHT

Since the Gov wants Y=, it will $\downarrow G$ by the amount needed to go back to the original IS.

LM doesn't move.

Composition of Demand:

Y	C	I	G	NX
Unchanged	$Y =$	$Y =$	$\downarrow$	$\uparrow$
	$T =$	$i =$		

ALWAYS USE THIS ONE: $CA = S + S_{pub} - I$

Since $NX + NI = 0$

$NX = S + S_{pub} - I$

$NX = S_{nat} - I$
$\uparrow \quad \uparrow \quad =$

$S_{nat}\uparrow$ by there same amount by which NX have gone $\uparrow$.

$S = Y - C - T$
$= \quad = \quad =$ S is unchanged

$S_{pub} = T - G$ $S_{pub}\uparrow$ by there amount of the cut in G

Ex 19

At time t=1 $r = -0.04$

$g = 0$

$d = 0.04$

The debt-to-GDP ratio is $\overline{b}$ in the figure.

Compute $\overline{b}$

Suppose the CB ↑ the policy rate:

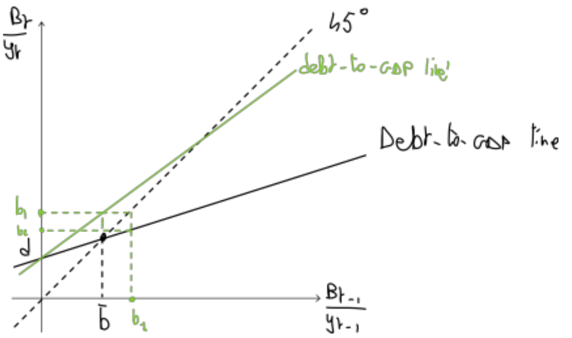
$r' = -0.01$ at time 1 only

The real interest rate (r) will be brought back and kept at the initial level from t=2 onwards.

Assume that this ↑ in r has no effect on d, g.

Show in the figure the new levels of the debt ratio at time t=1 and t=2. (b_1, b_2)

If no other policy occurs, and g and d no change, will the debt ratio converge to a SS? Which one? Why not?



$$\overline{b} = \frac{d}{g - r} = \frac{0.04}{0 + 0.04} = 1$$

You don't need to do this in the brackets but its useful (in the initial part $r < g$ and $d > 0$ debt converges to a SS. It it ↑ but sustainable)

- **At time 1**:

The ↑ in r leads to a new debt-to-GDP line:

$1 + r - g$ slope:

Slope ↑, Steeper

d is unchanged.

Green line

The new debt ratio is b_1 (ordinate of the point on the new debt-to-GDP line with abscissa $\overline{b}$)

($b_1 > \overline{b}$ => new debt will be issued to finance the higher interest payments on outstanding debt)

- **At time 2**:

r is brought back to the original value and the debt-to-GDP line goes back to the original position.

The debt ratio is b_2 (ordinate of the point on the initial debt-to-GDP line with abscissa b_1)

Overtime the debt-to-GDP ratio will keep on falling and will converge to $\overline{b}$, SS original value.

Ex 20

$g = 0.01 = 1\,\%$

$r = 0.06 = 6\,\%$ $\quad r > g$

$$\frac{B_{t-1}}{Y_{t-1}} = 1.2$$

$$\frac{G_t - T_t}{Y_t} = -\,0.03$$

A. Compute the value of the debt ratio at time t

$$b_t = (1 + r - g)b_{t-1} + d$$

$$b_t = (1 + 0.06 - 0.01) * 1.20 - 0.03$$

$$b_t = 1.23$$

B. Compute the value of g that, given r and d would stabilize $\dfrac{B}{Y}$ at 120% at time t.

$$b_t - b_{t-1} = (r - g)b_{t-1} + d$$

$b_t = 1.23$ we are 3 percentage points higher than b_{t-1}.

I expect g to ↑

$$b_t = b_{t-1} = 1.2$$

$$0 = (0.06 - g)1.2 - 0.03$$

$g = 0.035 = 3.5\,\%$

To stabilize the debt, g must ↑ up to 3.5%

Ex 21 HW

The current period is t=1. At t=0 the debt-to-GDP ratio was 100%, $r = 3\,\%$ and $g = 0\,\%$. The primary deficit to GDP is $3\,\%$. Suppose that at time t=2 the Gov decides to stabilize the debt-to-GDP ratio b at the value prevailing at t=1. Compute the value of d that will allow the Gov to achieve its goal.

Solutions:

$b_1 = (1 + r - g)b_0 + d$

$b_1 = (1 + 0.03 - 0)1 + 0.03$

$b_1 = 1.06$

$b_2 = (1 + r - g)b_1 + d'$

$b_2 - b_1 = (r - g)b_1 + d'$

$0 = (0.03 - 0)1.06 + d'$

$d' = -0.0318$

Ex 22 HW

At time 1, an economy in which $r = -0.02$, $g = 0$ and $d = 0.03$ has the debt-to-GDP ratio equal to $\overline{b}$. Hence, it coincides with the steady state. Compute the value of b. Suppose now that the Gov ↓ T at time 1 only. Show in a figure the new level that debt-to-GDP ratio will have at time 1 and at time 2.

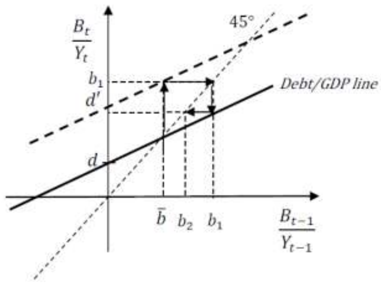
Absent further policy interventions, or changes in the values of r and/or g, will the debt-to-GDP ratio converge to a steady state? If so, which one? If not, why?

Solutions:

In this economy, $r < g$ and $d > 0$. Therefore the slope of the debt-to-GPD line $(1 + r - g) < 1$, the vertical intercept is positive (d) and the horizontal intercept ($-\dfrac{d}{(1 + r - g)}$) is negative.

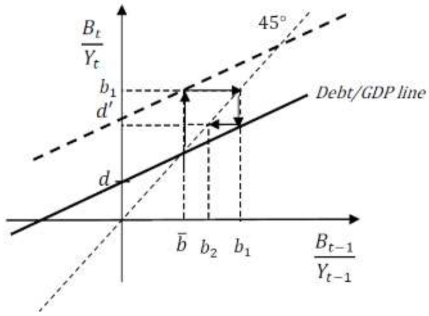
We can now draw the debt-to-GDP line.

We now compute $\overline{b} = \dfrac{d}{g - r} = \dfrac{0.03}{0.02} = 1.5$



At time 1, ↓T, ↑d, thus leading to a parallel upward shift of the debt-to- GDP line with vertical intercept $d' > d$. The new debt-to-GDP ratio becomes b_1, ordinate of the point on the new debt/GDP line with abscissa $\bar{b}$.

At time 2, T are brought back to their initial level, the primary deficit is once again d and the debt-to-GDP line shifts downwards in a parallel way, going back to its initial position.



The debt-to-GDP ratio becomes b_2, ordinate of the point on the initial debt/GDP line with abscissa b_1.

The graph shows that over time the debt-to-GDP ratio will ↓, converging to the initial steady state $\bar{b}$, hence to a stable equilibrium.

The Great Recession

It is one of the deepest recessions since WWII.

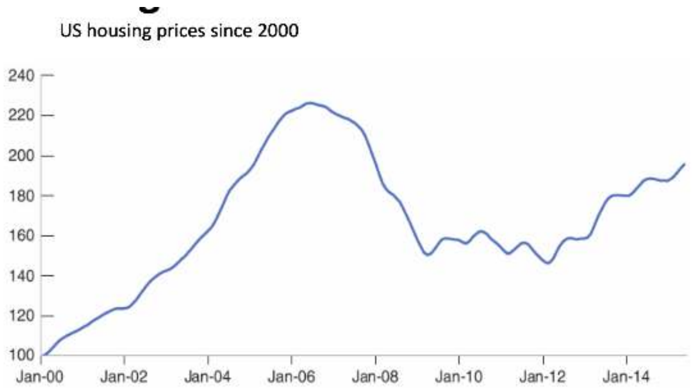
The **origins** were:

- The **financial crisis** in the summer of 2007 in the US
- **Subprime mortgage market** (loans for high risk borrowers)

Housing problem => financial crisis => macro crisis

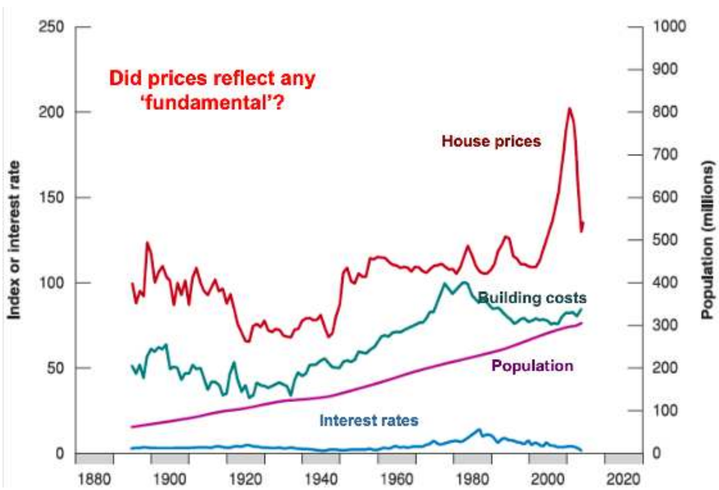
The ***Case-Shiller index*** is an index of housing prices. It is normalized to 100 in January 2000.

Around 2006/7 house prices started to ↓



Source: Case-Shiller Home Price Indices, 10-city home price index, http://www.standardandpoors.com/indices/main/en/us

interest rate low => demand for houses ↑ house prices ↑



From a housing problem to a financial crisis

The 2000s were a period of unusually low interest rates, which stimulated housing demand.

Mortgage lenders was increasingly willing to make loans to risky borrowers with **SUB-PRIME MORTGAGES**.

Basically:

- Borrowers were **asked to pay a high** i
- **Expectations** that housing **prices** would keep on ↑

But then house P ↓

From 2006 on, many mortgages went underwater => their value left was > than the value of the house.

Many borrowers defaulted; banks => large losses

This is when t**he housing problem becomes a financial problem**.

Let's see how it is a **balance Sheet of a Bank**:

Assets		**Liabilities**	
Reserves	100	Deposits	80
Loans		Capital	20

Capital Ratio: $\frac{Capital}{Assets} = 20\,\%$

Leverage ratio (LR): $\frac{Assets}{Capital} = 5\,\%$

If **LR is HIGH**: the bank is **risk lover** => **HIGH EXPECTED PROFIT but HIGH RISK OF INSOLVENCY**

If LR ↑, risk ↑

To **reduce the leverage ratio** banks can do:

1. ↑**Capital**: asking funds to other investors
2. Call **some loans back**

When one of these happens, **investors** start to become **uncertain** about the **bank's assets**. => they take money out => the bank has to repay these investors

2) is very difficult

=> You can go for 1) but it's difficult as well to ask other banks for loans => the bank might sell its loans at **FIRE SALE PRICES** (The price of loans <<< the value of the loan).

The value of your assets ↓

You might become insolvent especially if investors ask for funds at a short notice.

This can happen **even if investors' expectations are wrong**.

The lower the liquidity of your assets, the more difficult to sell them, the higher the risk of fire sales.

The more liquid liabilities, the higher the risk of fire sales

So, why did the housing problem become a financial crisis?

- **High LR**
- **Underestimation of risk**
- **Incentives to bank managers to take risk**

Banks found **ways to avoid regulations**

1. The required minimum capital ratio but banks created the **SIVs (structured investment vehicles)** = a pool of investment assets where the bank borrows short term and invests long term expecting higher yields.

   SIVs didn't appear in the bank's balance sheet.

2. **Securitization**: creation of securities based on a bundle of assets. An example is **MBS** (**Mortgage Based Securities**) securities made of a bundle of mortgages.
   - Investors are willing to buy them because they perceive a lower risk
   - Banks had little incentive to control borrowers

From a financial crisis to a macroeconomic crisis

In September 2008 **Lehman Brothers bankrupted**. That's when it becomes **a macroeconomic crisis**.

CONFIDENCE ↓ $C\downarrow$ $Z\downarrow$ $Y\downarrow$

Monetary policy response

$i\downarrow$ $i = 0$ => unconventional monetary policy => **quantitive easing**

$r + x$ borrowing rate

If the demand for bonds $\uparrow, x\downarrow$

The CB bought a huge amount of bonds to $\downarrow x$

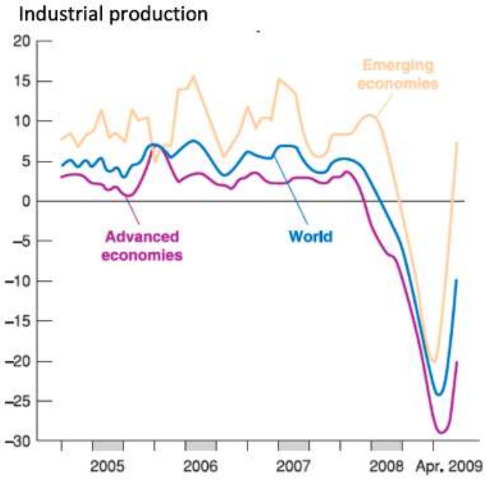
$$\downarrow borrowing\ rate$$

to stimulate the economy even further

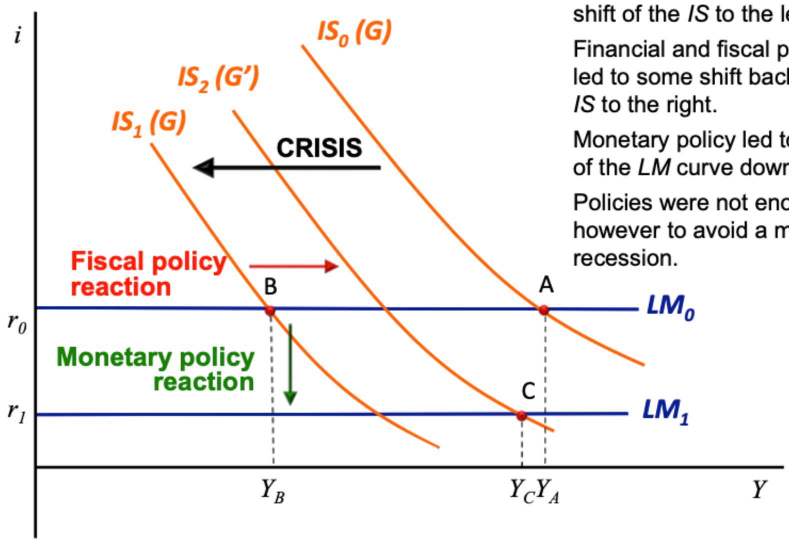
Policy response in Europe

- **Financial Policies**:
  - Europe started to clean up the balance sheets of its banks much later than the US.
  - UK: started to put public capital into banks in 2008 and some banks were de facto nationalized because the government became the largest shareholder.
  - Other countries delayed the process.
  - Banks have the problem of non-performing loans (loans that will never be repaid) that force the bank to put capital aside to face the losses → banks have less capital to make new loans.
- **Fiscal Policy:**
  - Countries that entered the crisis with a high debt level implemented a low fiscal stimulus (for example Italy; opposite situation: Denmark and Austria).
- **Monetary policy**:
  - When interest rates reached the zero lower bound, the Bank of England implemented unconventional monetary policy, buying private assets and government bonds.
  - The ECB started unconventional monetary policy only in March 2015.
  - The ECB, Swedish and Swiss Central Banks lowered interest rates below zero: when banks deposit reserves at the Central Bank they collect no interest rate. They pay a deposit fee! The aim is to encourage them to expand loans and reduce deposits at the Central Bank.
  - In 2017 the European Central Bank decided to scale back, starting April 2017, the amount of bonds purchased every month from €80bn to €60bn.
  - On October 26, 2017, the ECB announced that, from January 2018, its net asset purchases were going to continue, albeit at the reduced monthly pace of €30 billion, until the end of September 2018 - or beyond, if necessary.

Response to policy



The crisis in the STD IS-LM Model



The financial crisis led to a shift of the *IS* to the left.

Financial and fiscal policies led to some shift back to the *IS* to the right.

Monetary policy led to a shift of the *LM* curve down.

Policies were not enough however to avoid a major recession.

Monetary policy and financial stability

What can be done to ↑ financial stability?

- Guarantee deposit insurance
- Act as a lender of last resort: a function of the CB that provides a bank the liquidity it needs to pay the depositors without having to sell its assets but against some collateral
- The crisis has forced CBs to consider whether they want to provide liquidity to institutions they do not regulate.

The consensus is:

- It is risky to wait for a bubble to build up and burst.

- To deal with bubbles or dangerous behavior in the financial system, rather than the interest rate, the right instruments are **macroprudential tools**—rules that are aimed directly at any financial institutions involved.

Macro prudential tools

- **Macroprudential tools aimed at borrowers**:
  - Maximium loan-to-value ratio (LTV): put a ceiling on the size of the loan borrowers can take relative to the value of the house they buy.
  - Reducing the maximum LTV is likely to decrease the demand for housing and thus slow down the housing price increase.
- **Macroprudential tools aimed at lenders**:
  - Basel II and Basel III agreements among countries imposed on their banks minimum capital ratios in order to limit bank leverage.
  - Imposing capital controls on inflows.
  - Lowering taxes on foreign direct investment.

FOR DOUBTS OR SUGGESTIONS ON THE HANDOUTS

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TEACHING DIVISION

OUR PARTNERS

700+ CLUB

ETHAN SUSTAINABILITY

DELIVERY VALLEY
NO GENDER KITCHEN

LA PIADINERIA