Macroeconomics – Political Science Forlì

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Website of the course: http://macroeconomics-forli.weebly.com/

Password: macroSID2019

Exercise Lesson:
5 March
12 March
9 April
30 April
14 May
28 May

Mid-term exams:
19 March
11 April
16 May

Macroeconomics
Exercise 1
(Ch. 1, 2 and 3)

Dott.ssa Vitali Beatrice

Key-concepts (I)

- Ch. 1
  - Economic models: exogenous vs. endogenous variables
  - Shifting the curve vs. moving along the curve

- Ch. 2
  - GDP: What is it? How can we measure it? What are the components?
  - Price indices and inflation
  - Unemployment rates and other measures related to the labor market

Key-concepts (II)

- Ch. 3
  - Production functions and returns to scale (increasing /constant/ decreasing)
  - Marginal productivity and factor payments (Euler's theorem and income distribution)
  - Aggregate demand: components
  - The model of loanable funds and the equilibrium interest rates

GDP (I)

The Gross Domestic Product (GDP) is a monetary measure of the value of all final goods and services produced in a period (quarterly or yearly)

3 equivalent definitions:

1. the sum of primary incomes distributed by resident producer units.
2. the sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices
3. the sum of the gross values added of all resident, institutional units engaged in production

GDP (II)

What kind of transactions do enter the GDP computation?

- **Used good? No**: this is transfer of wealth that has been already created
- **Inventories? Yes**: they represent newly created wealth, regardless of the fact they will be consumed in the future
- **Intermediate goods? No**: their value is already embedded in the value of the final goods, so a double counting would arise (e.g. we account for the value of the bread, not for that of the flour used in its production)

GDP (III)

Alternative Indicators: GNP vs GDP

- **Gross National Product** (**GNP**):
  Total income generated by the national production factors, even though located abroad

- **Gross Domestic Product** (**GDP**):
  Total income generated by the production factors located in the country, including those owned by foreigners

  GNP = **GDP** + residents' incomes from abroad – national incomes paid to non-residents

(GDP is «preferable» as an indicator, as far as we want to quantify the amount of goods and services produced in a given economy)

GDP (IV)

GDP = Final Aggregate Expenditure

Main Components of the Aggregate Expenditure:

- Consumption (C)
- Investments (I)
- Public Spending (G)
- Net Exports (NX)

Multiple choices

1) Endogenous variables…

a) are parameters of an economic model.
b) are those for which the value is taken as given.
c) are those for which the value is explained by the model.
d) National saving is the sum of the bank deposits across individuals.

2) The marginal propensity to consume…

a) is what people would like to consume, even though their income is zero.
b) is some value between -1 and 1.
c) Is the additional amount of consumption, induced by an extra unit of disposable income.

3) If the disposable income rises, then….

a) Consumption level rises more than proportionally.
b) Saving rises, but less than proportionally.
c) Both of the above two answers are correct.

Multiple choices

4) The level of investment is equal to…

a) the difference between production and disposable income.
b) the sum of private saving and disposable income.
c) the sum of private saving and public saving.
d) the difference between national saving and taxes.

5) What are net exports?

a) The difference between the value of production and the value of imports.
b) The difference between the value of production and the value of exports.
c) The difference between the value of exports and the value of imports.
d) The difference betwen the value of imports and the value of production.

Multiple choice

6) Which of the following transactions <u>does not</u> enter the computation of the GDP of a given country?

A. An haircut at the barber shop.

B. The sale of a laptop to a resident of the San Marino Republic.

C. The purchase of a newly constructed house by a resident family.

D. The sale of some of the stock of tires from the warehouse of Pirelli S.p.A.

E. A government investment aimed at building a new highway.

Multiple choice

7) Again… which of the following transactions <u>does not</u> enter the computation of the GDP of a given country?

A. An increase of the stock of tires in the warehouse of Pirelli S.p.a.

B. The purchase of a completely new car by a resident family.

C. The purchase of new laptops, scanners and printers by some local public administation.

D. The purchase of a flat in an old-fashioned and historical building by a resident family.

E. The sale of strawberry icecream to a French tourist in Rimini.

Multiple choice

8) What is excluded from the computation of the Italian GDP of this year?

A. The purchase of copy-machines by the University of Bologna, in favor of the Secretary of the School of Political Science in Forlì.

B. The sale (operated by Feltrinelli) of the textbook of the course of Macroeconomics to an Erasmus student coming from Bulgaria.

C. The purchase by the University of Bologna of the service of repairing and maintenance of the air conditioning system of the General Service Office.

D. The building of a new terraced house in Porto Rotondo.

E. The purchase of a Ferrari Testarossa, built in 1990, by the Professor of Macroeconomics.

Multiple choice

9) The Italian GDP of this year increases if :

A. A rich British gentleman buys an old castle in the landscape nearby Trento.

B. The Professor of Macroeconomics replaces the tires of his motorbike "BMW R-GS 80" by going to some tire dealer in Cesena.

C. A student of this course goes on vacation to Cuba, buying a holiday package from a foreign travel agency.

D. Ducati Motor Holding S.p.a. sells, making use of its old inventories, a set of old motorcycles to a group of fans of historical models.

E. Two students of this course of Macro exchange toys received as a gift when they were kids.

GDP Deflator

Definition: it is a measure of the level of prices of all new, domestically produced, final goods and services in an economy

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} =$$

$$= \frac{\text{GDP in current prices}}{\text{GDP in constant prices}}$$

Inflation Rate

Definition: it is a measure of the percentage change in the general price level, along a given time span (e.g. 1 year)

By using the GDP deflator as a measure of the price level in a given economy, the inflation rate can be computed as follows:

$$\pi(t) = \frac{\text{GDP deflator}(t) - \text{GDP deflator}(t-1)}{\text{GDP deflator}(t-1)}$$

N.B. GDP deflator (t) = deflator computed in period t

GDP deflator (t-1)= deflator computed in the previous period

GDP deflator in the base-year is always 1, since the GDP in current prices corresponds to the GDP in constant prices for this particular year, as the two prices coincide

Consumer price index (CPI)

Definition: it is an alternative measure of the general price level in a given economy

More specifically, it measures the price level only of the goods and services purchased by the consumers, which define a representative consumption bundle for that economy.

$$CPI = \frac{\text{Cost of the bundle in the current period}}{\text{Cost of the bundle in the base-period}}$$

The inflation rate measured at time t, based on the CPI, is:

$$\pi(t) = \frac{CPI(t) - CPI(t-1)}{CPI(t-1)}$$

Exercise 1

	PIZZA		CD	
	Q	P	Q	P
2004	110	€10	90	€15
2005	112	€12	95	€18
2006	125	€15	98	€15

Suppose the economy consists of only two goods: pizza and CDs.

For each year, let's compute :

I. Nominal GDP and Real GDP
II. Rate of inflation
III. CPI assuming: (*i*) year 2004 as the base-year and (*ii*) a representative bundle of consumption made of 20 pizzas and 10 CDs.

Solution (I)

- Nominal GDP (= P·Q from the same year)

2004: $P(pizza)_{04}Q(pizza)_{04} + P(cd)_{04}Q(cd)_{04} = 10 \times 110 + 15 \times 90 =$ **€ 2450**
2005: $P(pizza)_{05}Q(pizza)_{05} + P(cd)_{05}Q(cd)_{05} = 12 \times 112 + 18 \times 95 =$ **€ 3054**
2006: $P(pizza)_{06}Q(pizza)_{06} + P(cd)_{06}Q(cd)_{06} = 15 \times 125 + 15 \times 98 =$ **€ 3345**

- Real GDP (= P in base year · Q in the current year)

2004: $P(pizza)_{04}Q(pizza)_{04} + P(cd)_{04}Q(cd)_{04} =$ **€ 2450**
2005: $P(pizza)_{04}Q(pizza)_{05} + P(cd)_{04}Q(cd)_{05} = 10 \times 112 + 15 \times 95 =$ **€ 2545**
2006: $P(pizza)_{04}Q(pizza)_{06} + P(cd)_{04}Q(cd)_{06} = 10 \times 125 + 15 \times 98 =$ **€ 2720**

Solution (II)

- $Defl._{2004} = 2450/2450 = 1$

  $Defl._{2005} = 3054/2545 = 1.2$

  $Defl._{2006} = 3345/2720 = 1.23$

- $\pi_{2005} = (1.2 - 1)/1 = 0.2 = 20\%$

  $\pi_{2006} = (1.23 - 1.2)/1.2 = 0.025 = 2.5\%$

Solution (III)

- **Cost of the representative bundle in the base-year (2004):**

  20 x 10€ + 10 x 15€ = 200 + 150 = € 350

- **Cost of the representative bundle in year 2005:**

  20 x 12€ + 10 x 18€ = 240 + 180 = € 420

- **Cost of the representative bundle in year 2006:**

  20 x 15€ +10 x 15€ = 300 + 150 = € 450

- $CPI_{2004} = 350/350 = 1$
- $CPI_{2005} = 420/350 = 1{,}2$
- $CPI_{2006} = 450/350 = 1{,}286$

- $\pi_{2005} = (CPI_{2005} - CPI_{2004})/ CPI_{2004} = (1{,}2 - 1)/1 = 0{,}2 = 20\%$
- $\pi_{2006} = (CPI_{2006} - CPI_{2005})/CPI_{2005} = (1{,}286 - 1{,}2)/1{,}2 = 0{,}07 = 7\%$

GDP deflator vs CPI

The **GDP deflator** reflects the price of all goods and services which are **domestically produced** whereas the **CPI** considers all goods and services **purchased by domestic consumers**. Hence…

a) The price of productive capital goods is:

- included in the GDP deflator (if produced domestically)
- excluded from the CPI (only consumption)

b) The price of consumption goods imported from abroad (e.g. clothes made in China) is:

- excluded from the GDP deflator
- included in the CPI

c) The **bundle of goods and services** used in computing:

- the GDP deflator varies year by year
- the CPI is fixed (i.e. year-invariant)

Exercise

Using labor statistics for Italy (ISTAT)

Italian labor market statistics, Dec 2014

Number employed	=	22,279 (in thousands)
Number unemployed	=	3,236 (")
Adult population (15-64)	=	39,123 (")

Use the above data to calculate

- the labor force
- the number of people not in the labor force
- the labor force participation rate
- the unemployment rate

Solution

- $Labour\ Force = Employed + Unemployed = 22{,}279 + 3{,}236 = 25{,}515$
- $Number\ of\ people\ not\ in\ the\ labour\ force = Adult\ Population - Labour\ Force = 39{,}123 - 25{,}515 = 13{,}608$
- $Labour\ Force\ Participation\ Rate = \frac{Labour\ Force}{Adult\ Population} = \frac{25{,}515}{39{,}123} = 0{,}65$
- $Unemployment\ Rate = \frac{Unemployed}{Labour\ Force} = \frac{3{,}236}{25{,}515} = 0{,}13$

Ch. 3: Production Function

The **production function** is typically denoted as:

$$Y = F(K, L)$$

- It represents the technology available, used to convert capital and labor units into goods and services
- The production function specifies how many units of output Y can be obtained by combining **K** units of capital and L units of labor, given the level of technology available at the moment of the production

Cobb-Douglas production function

$$Y = F(K,L) = AK^{\alpha}L^{(1-\alpha)}$$

A>0 is a parameter which summarizes the overall productivity of the technology of production

Properties:

- Under this specific function, the share of the generated income that goes to any factor of production is constant (i.e. the share of income representing the reward of labor -or capital- services is constant)
- Moreover, inputs are rewarded according to their marginal productivity at the level of production:

$$MPK \cdot K = \alpha Y \qquad MPL \cdot L = (1-\alpha)Y \qquad 0<\alpha<1$$

Returns to scale (I)

Returns to scale describes what is the change in the amount of output induced by an <u>equi-proportional</u> increase in the quantity of all inputs

Consider an initial level of capital, say K_1, and an initial quantity of labor, namely L_1.

The level of the overall production is given by $Y_1 = F(K_1, L_1)$

Let's multiply all the inputs by a given positive number γ, so that:

$$K_2 = \gamma K_1 \text{ and } L_2 = \gamma L_1$$

The new level of production is now $Y_2 = F(K_2, L_2)$

Suppose $\gamma = 1.5$, so that the amount of all inputs is increased by 50%

Returns to scale (II)

What is the extent to which production increases, compared to the increase in the quantity of inputs?

(put it differently, does it increase by less or more than 50%?)

Returns to scale can be:

- **Constant** if $Y_2 = \gamma Y_1$ (e.g. all inputs rise by 50%, and output as well)
- **Increasing** if $Y_2 > \gamma Y_1$ (e.g. all inputs rise by 50%, and output rises by more than 50%)
- **Decreasing** if $Y_2 < \gamma Y_1$ (e.g. all inputs rise by 50%, and output rises by less than 50%)

Aggregate demand

The components of the **aggregate demand** are:

C = Domand for consumption goods and services by the private sector

I = Domand of investment goods

G = Domand of goods and services by the Government

For the moment, consider a closed economy, in which net exports are zero, i.e. ***NX = o***

Equilibrium is attained when aggregate demand
is equal to aggregate supply, i.e.:

Y = C + I + G

Consumption

Households consumption depends on the income available, after paying taxes to the Government.

Disposable Income: $(Y - T)$

The **consumption function** specifies how much of the disposable income is used to finance consumption:

$$C = c\,(Y - T)$$

C denotes the level of consumption (in monetary units), whereas c is the **marginal propensity to consume**, which tell us by what extent consumption rises for each extra unit of available income.

Investments

The demand of investment goods by firms and households depends on the cost of borrowing the funds needed for undertaking the investments

The cost of borrowing boils down to the ***real interest rate***, namely r , which is the nominal interest rate, adjusted for inflation

The **investment function** relates the overall level of investments to the level of the real interest rate on the loanable funds market:

$$I = I(r)$$

Public Spending and Taxes

- ***Public Spending***, namely ***G***, includes all the expenditure made by the Public Administration for the purchasing of goods and services, but it excludes the payments for transfers.
- ***Taxes***, denoted by ***T*** , represent the revenue of the Government
- ***Government budget balance*** is the difference between Public Spending and Taxes (e.g. ***G*** - ***T***) which leads to one out of these three cases:

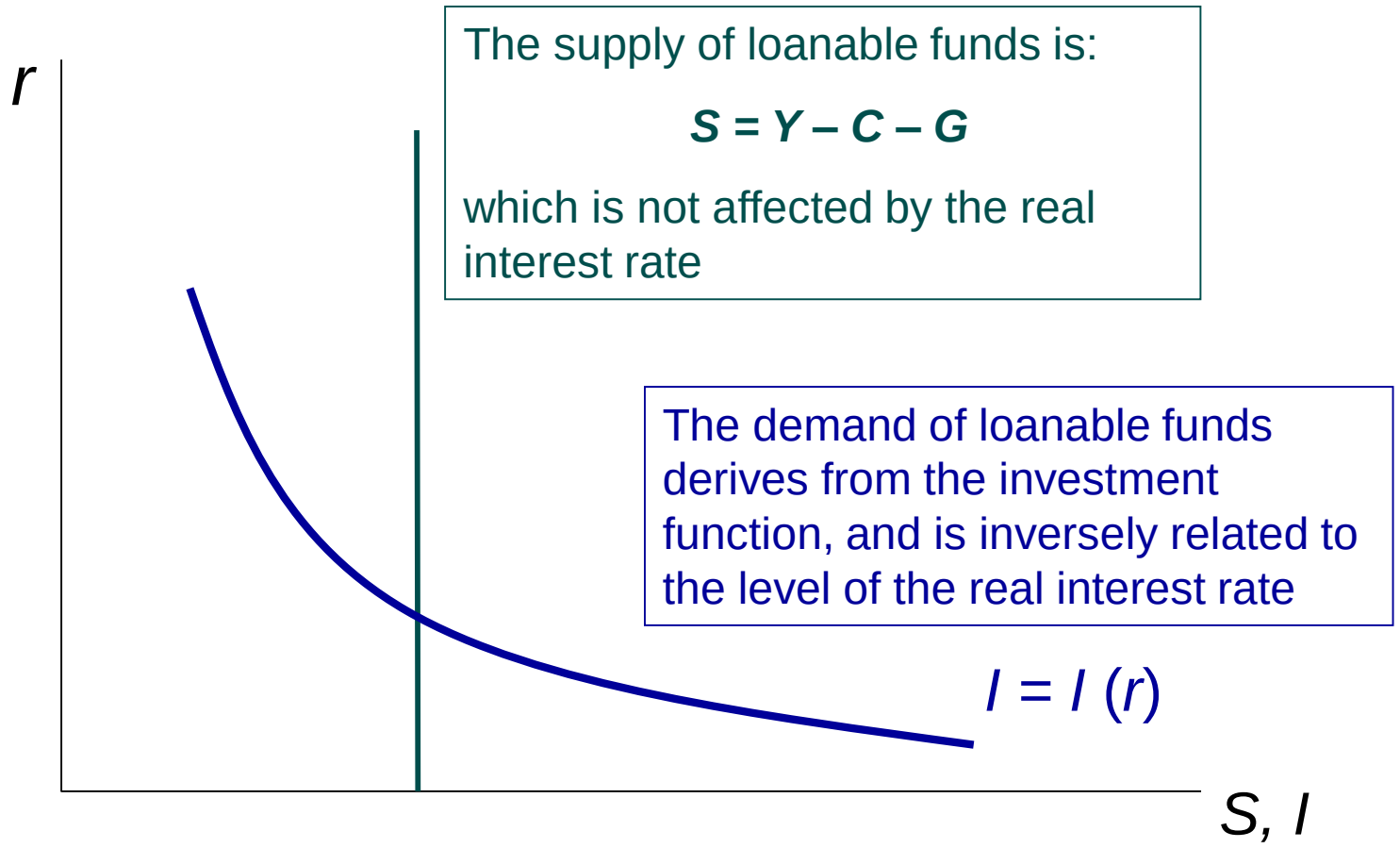
  - Perfect balancing if $G = T$
  - Public surplus if $G < T$ **or** $T > G$
  - Public deficit if $G > T$

The loanable funds market

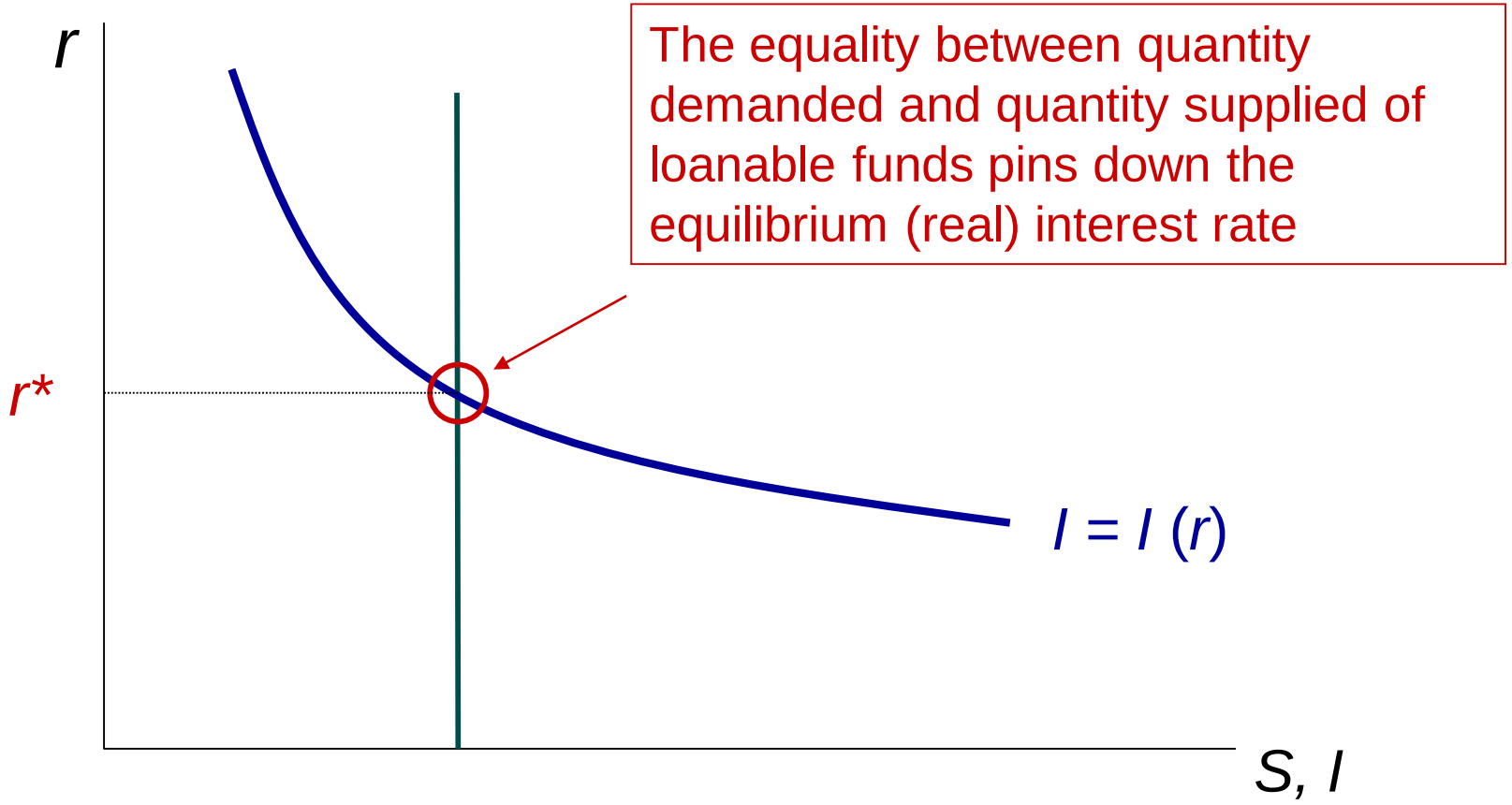
- This is a market in which agents trade loanable funds
- The price in this market is represented by the real interest rate ***r*** which is the remuneration for those who lend capital, and the cost for those who need to borrow.
- At the aggregate macroeconomic level:
  - The overall **supply of loanable funds** is given by total National saving
  - The **demand of loanable funds** corresponds to the aggregate investment function

What is the equilibrium in the loanable funds market?

Equilibrium in the loanable funds market



Equilibrium interest rate



Multiple choice:

10) Which of the following statements regarding national saving is FALSE?

a) National saving is the sum of private and public saving.

b) National saving is the residual of the product, after the demand of consumption goods by the private and public sectors have been satisfied.

c) National saving equals the level of investment, at the equilibrium interest rate.

d) National saving is the sum of the bank deposits across individuals.

11) If the level of output is fixed and national saving does not depend on the interest rate, an increase in public spending will raise:

a) National saving;

b) public saving;

c) the equilibrium interest rate;

d) private saving.

Multiple choice:

12) If the level of output is fixed and national saving does not depend on the interest rate, an increase in taxation will lead to:

a) A shift of the (vertical) supply curve of loanable funds towards the left.
b) A reduction in the level of investment.
c) An increase in the level of consumption.
d) A reduction of the equilibrium interest rate and an increase in the level of investment.

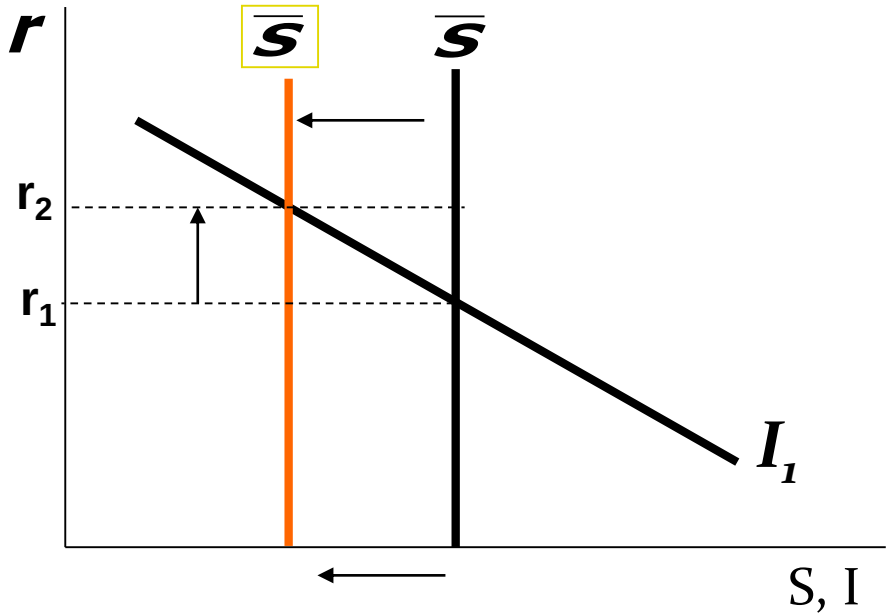
13) If national saving is positively affected by the interest rate, an improvement in technology (which leads to an increase in the demand for investment goods) will…

a) have no effects on the level of National saving;
b) shift the curve of the demand for loanable funds towards left;
c) generate an increase in both the investment level and the equilibrium interest rate.
d) have no effect on the level of consumption.

Exercise 2

1) Draw a graph of the market of loanable funds, before and after a fiscal expansionary policy by the Goverment (e.g. an increase in G)

After the policy is implementd, the level of investment is lower: Public spending crowds out private investment, when Y is fixed



Solution

An increase in public spending (G↑) implies that *the curve of supply of loanable funds shifts towards the left*.

Public saving reduces in the same proportion as public spending rises, whereas **private saving may increase**, but anyway less than proportionally (extra public spending generates extra income for individuals, but only part of it is saved, as the rest goes to consumption)

As a result, **National saving is reduced**

At the level of the original interest rate, namely r_1, we observe an excess demand, thus the «price» of loanable funds (the interest rate) **must increase** until r_2 in order to restore the equilibrium between demand and supply.

In order for *Y* to stay unchanged, after the rise in G another component of the aggregate demand has to reduce correspondingly.

At the new equilibrium, indeed, **investment turns out to be lower**, whereas public spending is increased: **Y = C + I(↓) + G(↑)**

Hence… same income level in equilibrium, but different composition!

Exercise 3

Consider now an economy in which consumption is given by :

$$C = c_0 + c_1(Y - T),$$

where c_0 is an exogenous consumption level, while c_1 is the marginal propensity to consume, assumed to be equal to 0.6

In case Government raises taxes by 100 million euros, what is the change in the level of:

- public saving?
- private saving?
- National saving?
- investments?

Solution (I)

(Nota bene: ***Y*** and ***G*** are not affected by the tax rise)

$$\mathbf{S_{national} = S_{public} + S_{private} = (T\text{-}G) + ((Y\text{-}T)\text{-}C)}$$

Change in S_{public} :

Change in T – Change in G = (+100) – (0) = **+100**

Change in $S_{private}$:

Change in (Y – T) – Change in C = - Change in (T) – Change in (c_1(Y – T)) =

– 100 – change in (-c_1T) = (– 100) – (– 0.6 · (100)) = –100 + 60 = **– 40**

Hence, the **overall change in the level of national saving** is:

Change in S_{public} + change in $S_{private}$ = (+100) + (– 40) = + 60

Solution (II)

What about investment?

Equilibrium in goods market (in closed economy):

$$\mathbf{Y = C + I + G = } \boldsymbol{c}\mathbf{(Y-T) + I(r) + G}$$

After some manipulation, we obtain: $\mathbf{Y - } \boldsymbol{c}\ \mathbf{(Y-T) - G = I(\ r),}$

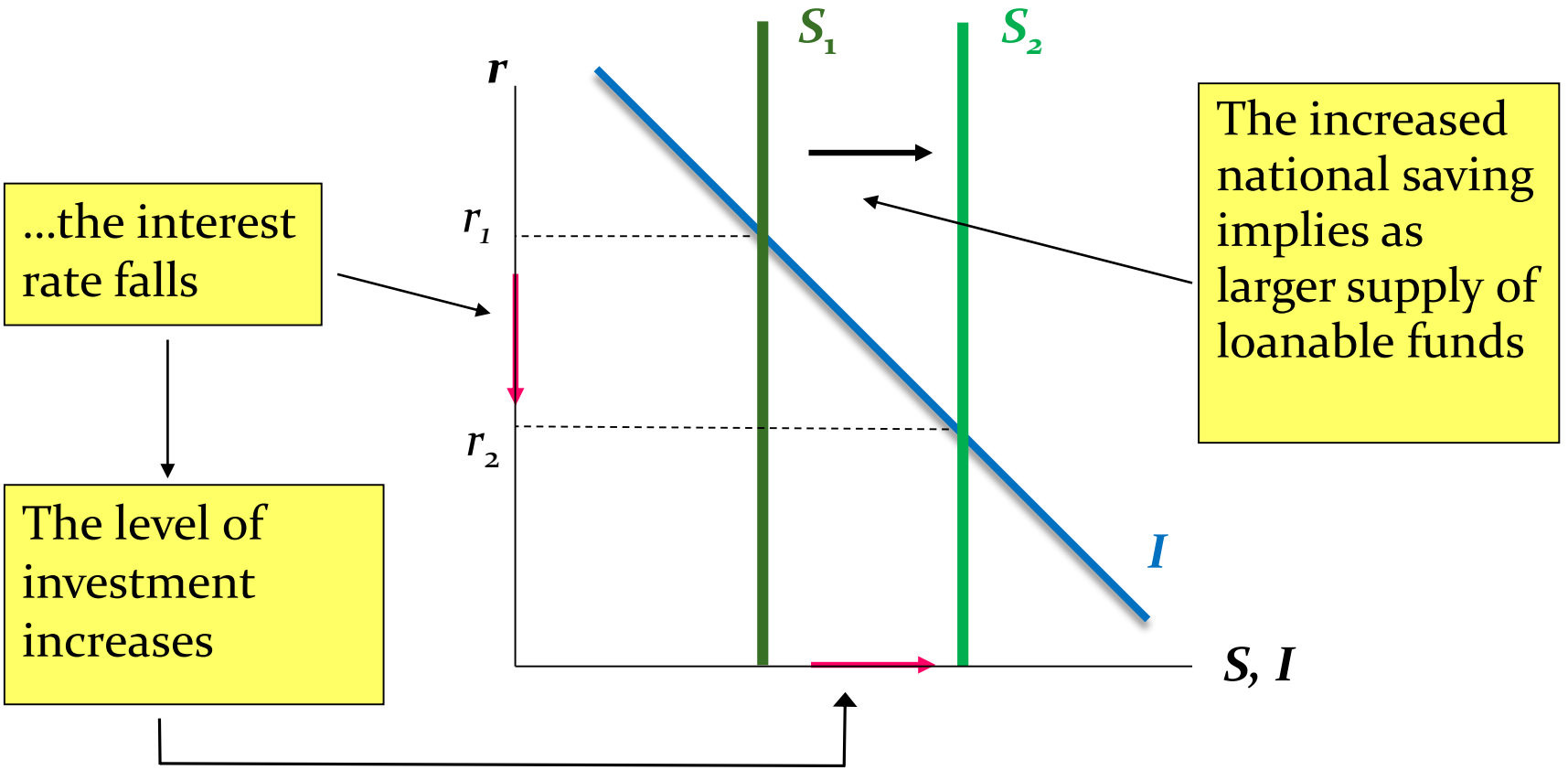
which means :

- National Saving = Investment

The aggregate level of investment has to increase, in order to match the increased national saving.

In order to get this result, the intererst rate(r) has to fall

Solution (III)



Exercise 4

loanable Funds Model and Macroeconomic Equilibrium

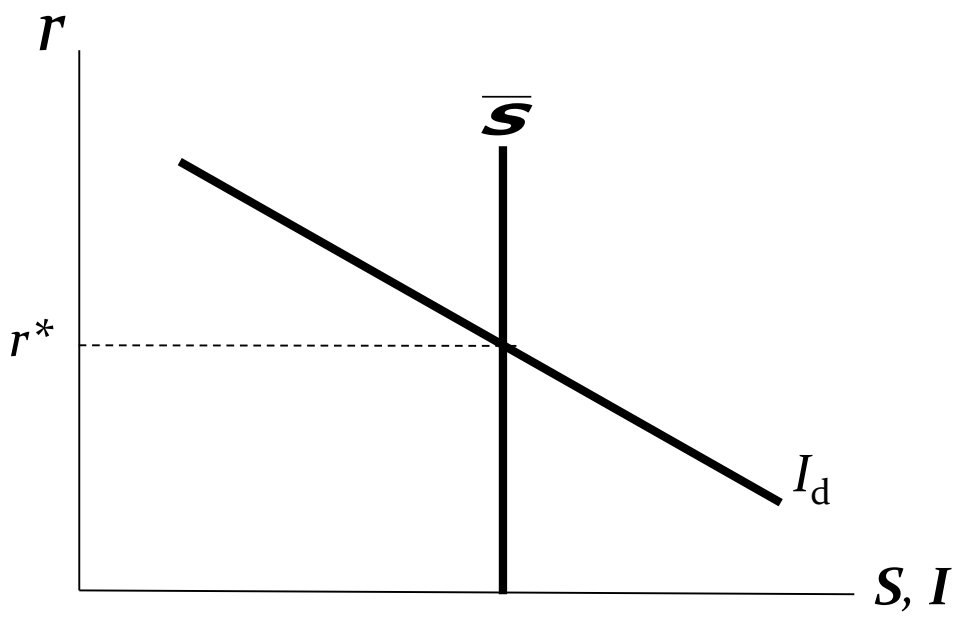
I) Draw the complete graph of this model, identify each curve and the underlying equation. Provide an economic interpretation for each curve.

II) What is the effect on the equilibrium level of investments and interest rates of a public spending reduction? Discuss the economics behind this effect.

III) What is the combined effect of a tax cut and a simultanous reduction in the demand for investments (possibly due to a sharp change in firms' expectations about the future)? Provide an economic explanation for the matter.

Solution (I)

The supply of loanable funds is represented by National saving, namely S, which is exogenously given, as it only depends (positively) on the level of national income, denoted by Y, and (negatively) on consumption and public spending, respectively C and G, that are exogenous variables. Since it does not depend on *r*, the loanable funds supply is represented as a perfectly vertical curve.



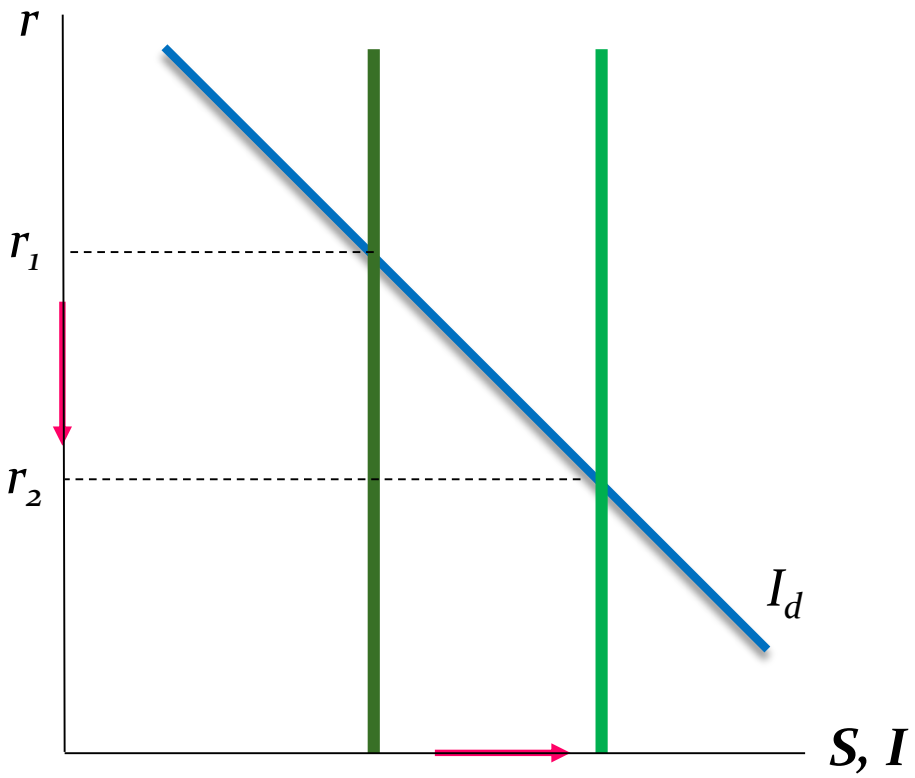
The demand of loanable funds is represented by I_d=I(*r*), i.e. the investment function, which depends negatively on the real interest rate, *r*: this means that if *r* increases, then investment decreases, as its financing becomes more costly.

Solution (II)

If **G** decreases, public saving (=T-G) rises and leads to an increase in national saving.

At the original interest rate level (r_1), the supply of loanable funds is higher than the demand; thus the price of loanable funds (the interest rate) will fall.

This will enhance investment (as its financing will be less costly) until ***I*** = ***S***'.



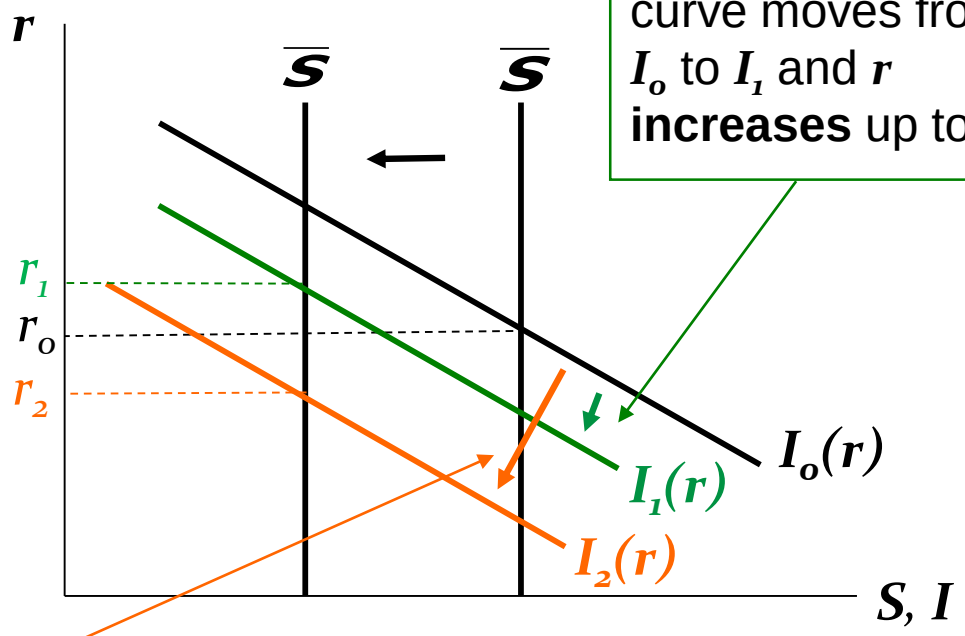
G falls and I rises; income Y is fixed, but the composition of aggregate spending has changed

Solution (III)

Combined effect of a decrease in ***T*** and ***I(r)***

The tax cut reduces public saving and therefore national saving : the supply curve shifts towards the left

What happens next depends on the relative magnitude of the two reductions… 2 cases…



Case 1: the reduction in *I*(r) is relatively small
The demand curve moves from I_0 to I_1 and ***r*** **increases** up to r_1

Case 2: the reduction in *I*(r) is relatively large
The demand curve moves from I_0 to I_2 and ***r*** **decreases** until r_2

Solution (III) - bis

Ambiguous effect on the interest rate

The tax reduction raises disposable income and stimulates private consumption, so private saving rises but to a lower extent than the change in taxes.

In contrast, public saving falls exactly by the same amount as taxes.

As a result, national saving, on aggregate, is decreased, which implies a reduction in the supply of loanable funds.

To restore the equilibrium in the market, the interest rate tends to rise, in such a way to lower the demand for investments.

At the same time, however, the demand curve independently shifts downwards, due to the firms' lower propensity to invest: this creates a downwards pressure on the interest rate.

Hence, on one side, r tends to rise (because of the decreased supply), but, on the other side, r tends to decrease (because of the decreased demand)

It is impossible to determine which effect prevails, without quantifying the relative size of the drop in demand.

Solution (III) - ter

Not ambiguous effect on investments

Although it is not possible to determine (a priori) the new equilibrium level of the interest rate, we can claim that the investment level will be decreased for sure in the new equilibrium.

Indeed, a lower national saving necessarily implies a lower amount of investment.

Exercise 5

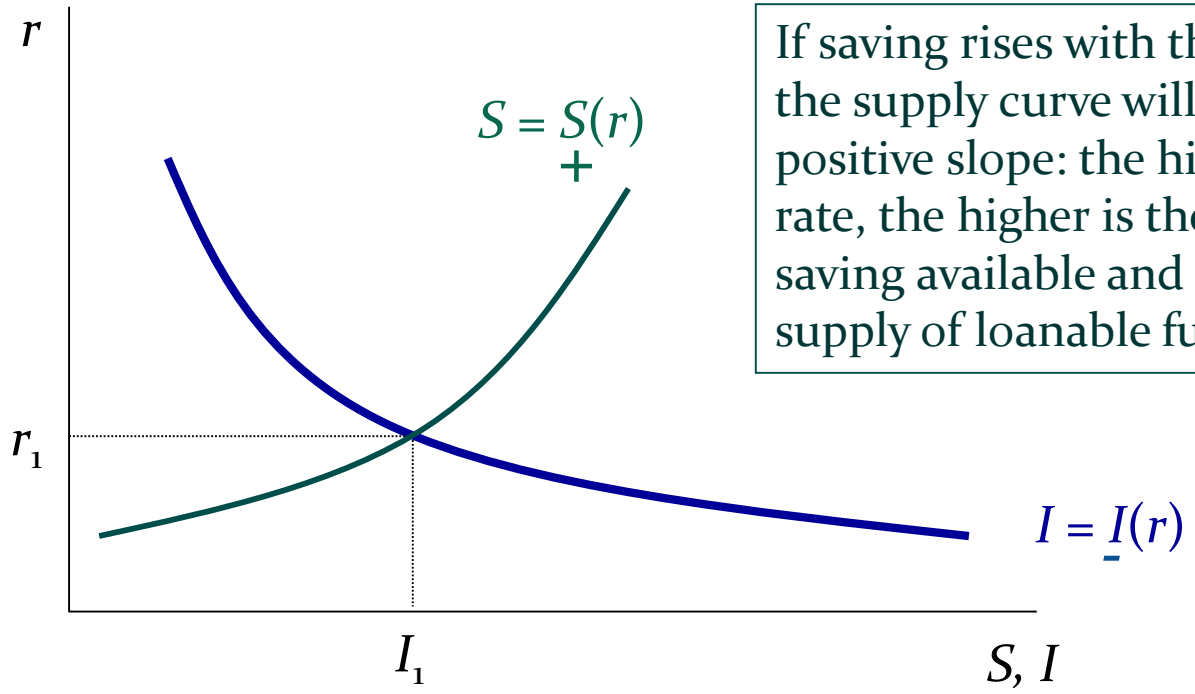
Change in the assumptions of the model and subsequent change in the model predictions about policy.

Consider a model of the loanable funds in which saving (and therefore consumption as well) depends on the level of the real interest rate.

Describe how the predictions of the model changes with respect to the former exercise (in which saving was assumed to be exogenous), considering again the case in which the government implements an expansionary fiscal policy (e.g. a tax cut) and explain why we get the obtained result.

Solution (I)

Saving is positively related to the interest rate (as plausible in everyday life): a higher reward for savings makes individuals more willing to save



If saving rises with the interest rate, the supply curve will feature a positive slope: the higher the interest rate, the higher is the amount of saving available and therefore the supply of loanable funds

Solution (II)

- An increase in the interest rate has a positive effect on saving, and a negative effect on consumption: C is inversely related to the real interest rate, *r*.
- S is an increasing function in *r*, which means that saving is no longer an exogenous, but an endogenous variable: that explains why the loanable funds supply is not represented as a vertical line anymore, but as a curve with a positive slope.
- An expansionary fiscal policy (such as an increase in public spending or a reduction in taxes) reduces national saving for each possible level of the interest rate, exactly as before (i.e in the model of loanable funds with exogenous saving)
- The two models bring the same preditions about the new equilibrium level of investments and interest rates

Solution (III)

As in the model with exogenous saving (n.b. Here saving is endogenous), expansionary fiscal policy leads to a decreased level of investment, but in this case the crowding out effect is only partial:
$\Delta I < \Delta G$