Macroeconomics Preparatory Course
Lecture notes

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Course information

This document contains a set of lecture notes meant for the students in the Master of science in European Economy and Business Law at the University of Rome "Tor Vergata". These notes aim to facilitate the understanding of the main concepts of the prep-course Macroeconomics, though they do not perfectly substitute the program of the classes.

- **Description**: This preparatory course overviews the principal concepts of Macroeconomics, from the basics to more advanced topics, which will gradually allow to understand the functioning of today's Macroeconomy, also in light of the recent world financial crisis.
- **Schedule**: Thursday 10/09 (10:00-13:00 / 14:00-17:00); Friday 11/09 (10:00-13:00 / 14:00-17:00); Saturday 12/09 (10:00-13:00).
- **Office hours**: by appointment.
- **References**
  - Blanchard, O., Amighini, A. & Giavazzi, F. *Macroeconomics: a European perspective.* (2017), Pearson, 3rd Edition (Chapters: 2-5, 6.3, 6.5, 17, 22, 23);
  - Joyce, M., Miles, D., Scott, A., & Vayanos, D. (2012). *Quantitative easing and unconventional monetary policy–an introduction.* The Economic Journal, 122(564), F271-F288.
  - Kahou, M. E., & Lehar, A. (2017). *Macroprudential policy: A review.* Journal of financial stability, 29, 92-105.

What is Macroeconomics?

It is hard to find a definition of macroeconomics which makes all economists agree on, but, let us try give one for us to at least have a narrow understanding of what we are going to deal with. Macroeconomics is a branch of the economic studies which deals with the aggregate, assuming that the behaviour of the whole system follows rules which are not exactly equal to the sum of the ones of all the micro agents part of it. John Maynard Keynes was one of the first economists to state the need of studying the economy as a whole, as his 1936 masterpiece *The General Theory of Employment, Interest and Money* is almost unanimously considered the father of the macroeconomic thought.

Before proceeding, two disclaimers are due: *first*, the course is structured in order to give you a basic understanding of the functioning of the macroeconomy, hence we will only cover a small fraction of what the state of the art of macroeconomic theory actually is, and *second*, and most importantly, we are going to deal with only the mainstream strand of macroeconomics, the one going under the name of *neoclassical* or, equivalently, *marginal* theory, being the one central banks and institutions mostly rely on (as a matter of fact, many other non-hortodox strands exist, which will not be part of this course, but which you are highly encourage to research on and which will possibly boost your critical thought).

1 Some preliminary definitions

This section covers some of the main variables we use in macroeconomics: such as gross domestic product, unemployment and inflation.

1.1 Gross domestic product

GDP is a measure of a country's aggregate output. There are three equivalent definitions of it:

- It is the value of the final goods and services produced in the economy during a given period;
- It is the sum of the value added in the economy in a given period;
- It is the sum of incomes in the economy during a given period.

Nominal GDP at year t, indicated with $\mathbf{€Y_t}$ (nominal variables usually have the euro symbol in front), is computed using the quantities of goods times their current price. This measure of aggregate tends to increase over time both because production and prices of most goods increase over time. Therefore, it is usually used **real GDP**, indicated with $\mathbf{Y_t}$, computed at constant prices. In assessing the performance of an economy it is usually used **GDP growth**, namely its yearly (or quarterly) rate of growth, computed as $(Y_t - Y_{t-1})/Y_{t-1}$. Periods of positive (negative) GDP growth are called *expansions* (*recessions*).

1.2 The unemployment rate

Let us define **employment** (N) as the number of people who have a job, **unemployment** (U) as the number of people who do not have a job but are looking for one, and the **labour force** (L) as the sum of the two previous variables, such that $L = N + U$. The **unemployment rate** is $\mathbf{u = U/L}$. The people who do not have a job and are not looking for one are not counted in the labour force and are known as **discouraged workers**. An important measure of the state of the economy which is typically inversely related with the unemployed rate is the **participation rate**, defined as the ratio of the labour force to the total population at working age.

1.3 The inflation rate

Inflation is defined as a sustained rise in the price level. The **inflation rate** is the rate at which the price level increases. A sustained decline in the price level is called *deflation* (do not confuse it with *disinflation*, which on the contrary corresponds to a slowdown of an increase in the price level!). Two variables are used to measure the inflation rate:

- The **GDP deflator**, defined as the ratio of nominal GDP to real GDP: $P_t = €Y_t/Y_t$;
- The **consumer price index**, or **CPI**, measuring the average change over time in the prices paid by households for a specific and regularly updated basket of consumer goods and services.

1.4 Important relations

Part of what macroeconomists do, not surprisingly, is trying to define and understand the interconnectedness of various variables in order to extrapolate the laws depicting the functioning of the economy. Among the most famous ones there are:

- **Okun's law**, stating that periods of expansion will lead to a decrease in the unemployment rate;

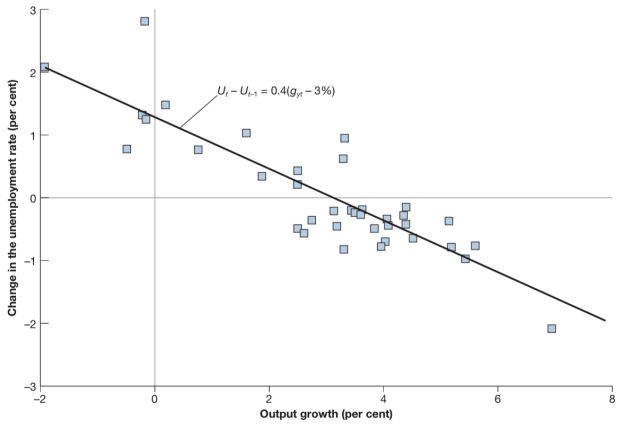

Figure 1: *Empirical Okun's law in the EU15, 1981-2015.* *Source: Blanchard et al. (2017).*

- The **Phillips curve**: inverse relation between the change of inflation rate and the unemployment rate.

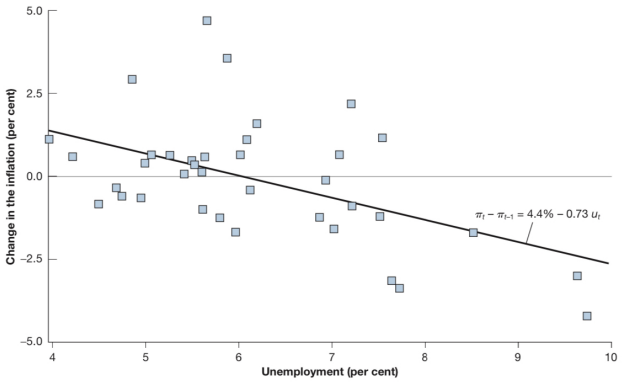

Figure 2: *Empirical Phillips curve in the euro area, 1981-2007* *Source: Blanchard et al. (2017).*

In fact, the two relations above are much linked. In particular, while Okun's law states the possibility of reaching very low levels of unemployment rate by means of output growth, the Phillips curve suggests that the cost of doing so is increasing inflation rate.

2 The Goods Market

This part describes the interactions among production, income and demand. In particular, changes in demand for goods lead to changes in production, which lead to changes in income, which lead to changes in the demand for goods, in turns leading to, again, changes in production. Let us see in detail how that works.

2.1 The composition of GDP

Apart from its definitions, the computation of GDP consists of the sum of very specific components. Its decomposition is used to determine the total demand of goods Z, following the identity:

$$Z \equiv C + I + G + X - IM \tag{1}$$

where:

- C is **consumption**, i.e. all the goods and services purchased by consumers;
- I is **investment**, specifically equal to the sum of *non-residential investment* (purchase of new machines or plants by firms) and *residential investment* (purchase of new houses or apartments);
- G is **government spending**, that is purchase of goods and service by the federal, state and local governments.
- X is **exports**, i.e. purchase of goods and services by foreigners;
- IM is **imports**, i.e. the purchase of foreign goods and services by national consumers, firms or governments.

Sometimes we refer directly to $NX = X - IM$ as net exports, or **trade balance**. A positive (negative) trade balance is defined as **trade surplus** (**trade deficit**). In order to make the model for the goods market tractable, we simplify it by considering the production of only one good, hence the presence of only one price, in a closed economy ($X = IM = 0$). Therefore we consider $Z \equiv C + I + G$.

Let us define consumption as an increasing function of disposable income Y_d such that:

$$C = c_0 + c_1 Y_d$$

where c_0 is what people would consume if their disposable income in the current year was equal to zero, and $c_1 \in [0; 1]$ is called **propensity to consume**, giving the effect of an additional euro of disposable income on consumption. Disposable income can be defined as $Y_d = Y - T$, i.e. income (Y) minus taxes plus government transfers received by consumers (T), so that:

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

As you have seen, in this model consumption is treated as an *endogenous* variable, as it depends on other variables. On the contrary, investment and government spending will be treated as *exogenous*. Moreover let us take investment as given such that $I = \bar{I}$. We can now write (1) as:

$$Z = c_0 + c_1(Y - T) + \bar{I} + G \tag{2}$$

Equation (2) is the equation for the demand for goods.

Equilibrium in the goods market requires production Y to be equal to the demand for goods Z. Whence:

$$\begin{aligned} Y &= c_0 + c_1(Y - T) + \bar{I} + G \\ &= \frac{1}{1 - c_1}\left[c_0 + \bar{I} + G - c_1 T\right] \end{aligned} \tag{3}$$

where,

- $(c_0 + \bar{I} + G - c_1 T)$ is the part of the demand for goods not depending on output, called **autonomous spending**;
- $\frac{1}{1-c_1} > 1$ and is called the **keynesian multiplier**, causing a more than proportional variation on output than its direct effect on consumption, investment or government spending.

Suppose c_0 increases. This increases demand, leading to an increase in production, leading to an equivalent increase in income. However, the effect does not stop here, as the increase in income will lead to a further increase in consumption, which further increases demand, and so on and so forth. This ongoing effect is led by the multiplier. We can describe the mechanism above also with a graph, as in figure 3. The ***ZZ* line**

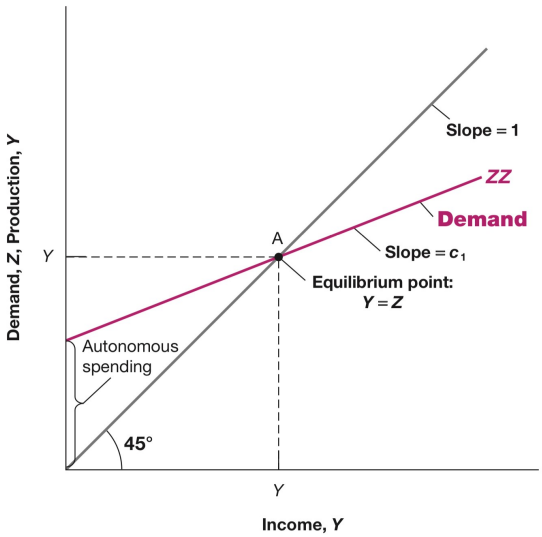

Figure 3: *Equilibrium in the goods market.* *Source: Blanchard et al. (2017).*

corresponds to the **demand function**. The equilibrium point A is reached when the ZZ line intersects the 45-degree line (demand=income), when production equals demand. Figure 4 describes what happens if autonomous spending increases. The increase in c_0 leads to an increase in demand, which shifts the ZZ line upward. After a series of instantaneous adjustments as outlined previously, the new equilibrium point will

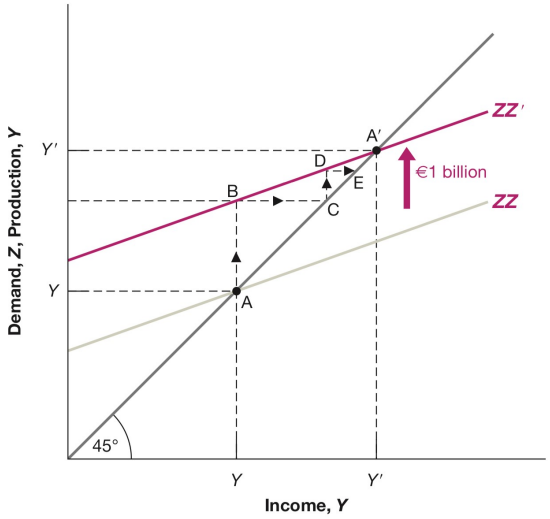

Figure 4: *The effects of an increase in autonomous spending on output.* *Source: Blanchard et al. (2017).*

be at A', where production and demand are again equal, though, greater than the initial increase of c_0, due to the effect of the multiplier.

The instantaneous adjustments we have seen are not really plausible in reality. A firm facing increasing demand for its good is very likely to take some time to adjust its production, as well as a worker getting higher income will not adjust her consumption schedule immediately. In order to account for those adjustments economists use models which take into account the so called *dynamics*, issue that goes beyond the scope of this course.

3 Financial markets

This section will outline the functioning of financial markets, understand the role of money and central banks in the economy, starting from the very basics.

3.1 Demand and Supply of money

Suppose you only have the choice between two assets, money and bonds:

- **Money** pays no interest, and you can use it for transactions. In reality there are two types of money: *currency* (the one you have in your wallet) and *deposit accounts*, which you can write cheques or use a debit card with.
- **Bonds** pay a positive interest rate, but cannot be used for transactions. We will assume only one type of bond, having i as *interest rate*.

The choice between the two assets depends on both your level of transactions, as the higher it is, the greater the amount of money you will want to hold, and on the interest rate paid by the bonds, as the higher it is, the higher will be your willingness to invest in one. The **demand for money** can then be written as:

$$M^d = €\underset{-}{YL}(i) \tag{4}$$

being equal to the nominal income times a decreasing function of the interest rate. Now suppose in the economy there is only one type of money: currency. If the central bank decides to supply a certain amount of money $M^s = M$, given the **equilibrium condition** such that the demand for money must be equal to its supply, we get:

$$M = €\underset{-}{YL}(i) \tag{5}$$

Therefore, the interest rate i must be such that, given their income $€Y$, people are willing to hold an amount of money equal to the one existing in the economy. Graphically, this is explained by figure 5. Suppose the

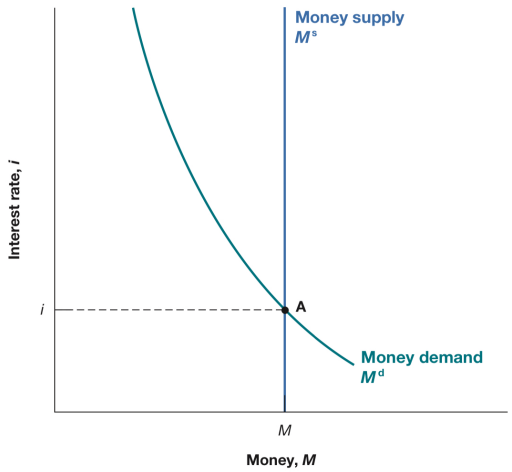

Figure 5: *Interest rate determination.* *Source: Blanchard et al. (2017).*

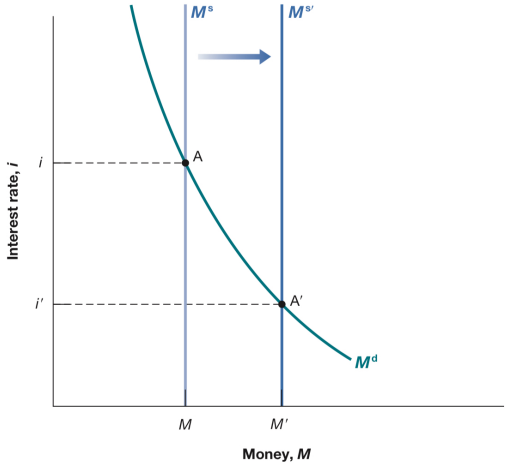

Figure 6: *The effects of an increase in the money supply on the interest rate.* *Source: Blanchard et al. (2017).*

central bank decides to increase the **money supply**. Figure 6 shows that the vertical line (money supply, indeed) will shift to the right and the equilibrium point will be reached at a lower level of the interest rate. In modern economies, the supply of money is changed by the central bank by buying or selling bonds in the bond market. Such actions are called **open market operations**, as they take place in the open market for bonds. As a matter of fact, the previous figure shows the effect of bond purchases by the central bank, operating an **expansionary monetary policy** by increasing the amount of money in the economy. On the contrary, if the central bank were to sell bonds in the market, such operation would be called **contractionary monetary policy**. However, modern central bankers rarely think in terms of money supply, but rather in terms of the level on interest rate they aim to achieve by changing the money supply.

3.2 Financial Intermediaries and the central bank

Now let us consider the presence of money in the economy both in form of *currency* and of *deposit accounts*. Thus, we also have **financial intermediaries** whose assets are the assets they own and the loans they have made, while their liabilities are what they owe to people or firms from whom they have received funds, i.e. deposit accounts. Moreover, banks keep as reserves some of the funds they receive, held partly in cash and partly in an account at the central bank (indeed while on the asset side of the central bank we see bonds, on the liabilities figure both currency and reserves). See figure 7 for more details.

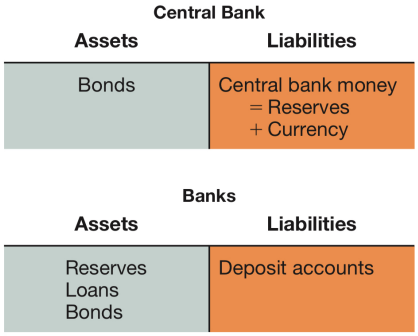

Figure 7: *Central bank's and banks' balance sheets.* *Source: Blanchard et al. (2017).*

Adding reserves to the economy does not change qualitatively our previous analysis, as shown in figure 8. In the Eurosystem, the interest rate is set directly by the **European Central Bank** (**ECB**), and it

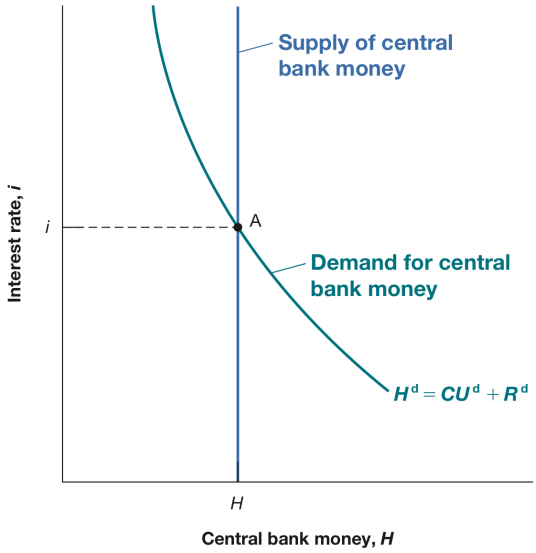

Figure 8: *Equilibrium in the market for central bank money and the determination of the interest rate.* *Source: Blanchard et al. (2017).*

is called "*refi rate*", short for "refinancing rate", that is the interest rate that the euro area banks pay if they wish to borrow from the ECB when they are short of funds. The refi rate in turns affects the decision of financial intermediaries upon their interest rates, reason why the ultimate control of the rates at which people and firms borrow money is on the central bank's hands.

3.3 The Liquidity Trap

There is an important caveat to what we have outlined until now: the interest rate cannot go below zero, as it is constrained by what is known in the literature **zero-lower bound**, issue that very much impinged upon the capability of central banks to stimulate economic growth (which we will see in a later section). When the interest rate is equal to zero, it means that people hold enough money for their transactions, hence they are indifferent between holding the rest of their financial assets in the form of money or bonds, as the latter pay no interest. Figure 9 shows the effect of an expansionary monetary policy when the economy hits the

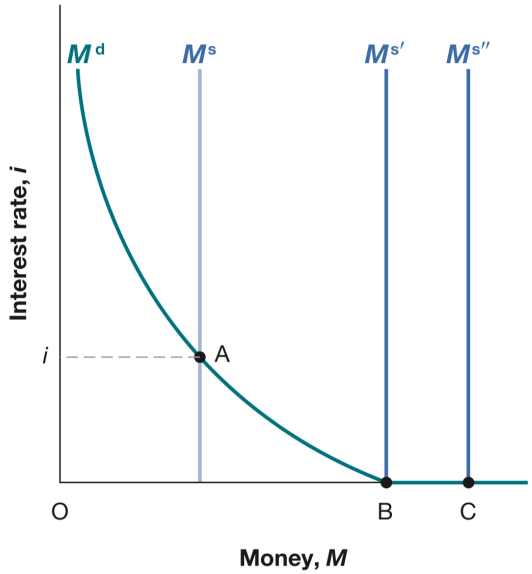

Figure 9: *The liquidity trap.* *Source: Blanchard et al. (2017).*

zero-lower bound on the interest rate. In this type of environment the policy has no effect on the interest rate, which remains equal to zero, but money supply do increase, and so we are likely to see an increase in deposit accounts and in bank reserves.

4 The IS-LM model

We now look at goods and financial markets through a very well-known model developed by *John Hicks* and *Alvin Hansen* in the 1940's: the **IS-LM model**. Their aim was to formally summarize what they believed was Keynes's contribution on the General Theory. Even though, since then, macroeconomics has made several steps ahead, this model represents an essential building block, which captures much of what happens in the economy in the short run.

4.1 The Goods market and the IS relation

Consider the equilibrium condition in the goods market $Y = C(Y - T) + \bar{I} + G$.
Previously we supposed investment was given. In fact, it depends positively on the level of sales, as a firm facing increasing sales may need to buy additional machines, and negatively on the interest rate, as a lower interest rate may push firms in need to borrow to buy more machines to do so. The latter can be expressed as: $I = \underset{(+,-)}{L(Y, i)}$. The condition for equilibrium then becomes:

$$Y = C(Y - T) + I(Y, i) + G \tag{6}$$

Equation (6) is called *Investment - Savings (IS) relation.* We can now look at what happens to output when the interest rate changes.

Consider the demand for goods ZZ, and suppose the interest rate increases from its initial value i to a new higher value i'. Investment decreases, leading to a decrease in output, which further decreases consumption and investment, through the multiplier effect, leading to the downward shift of the ZZ as in figure 10, panel (a). The resulting relation between equilibrium output and the interest rate is depicted in figure 10 panel (b), captured by the downward-sloping **IS curve**.

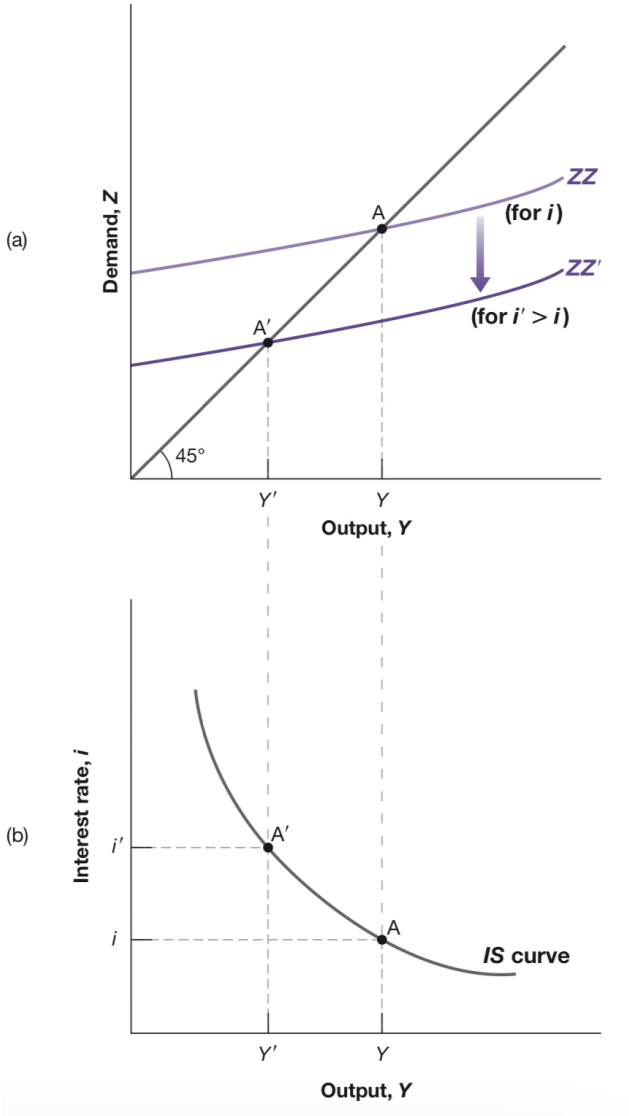

Figure 10: *The IS curve.* *Source: Blanchard et al. (2017).*

Now suppose that, for a given level of the interest rate, government spending changes such that taxes (T) increase. What happens to the IS curve? Disposable income will decrease, leading to decreasing consumption, which in turns leads to decreasing demand for goods, ultimately lowering aggregate output. This effect is explained graphically by figure 11, where the IS curve shifts to the left. Keep in mind that the very same effect would be exerted, for instance, also by a decrease in government spending or a decrease in consumer confidence (which decreases consumption given disposable income).

4.2 Financial markets and the LM relation

Given equation (5), it will be more convenient to express it in terms of real money, real income and interest rate, such that:

$$\frac{M}{P} = YL(i) \tag{7}$$

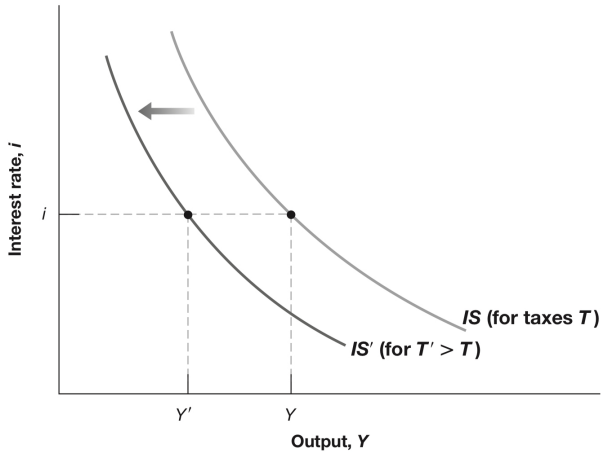

Figure 11: *The effect of an increase in taxes on the IS curve.* *Source: Blanchard et al. (2017).*

Thus we can restate the equilibrium condition of financial markets such that the real money supply equals the real money demand, which depends positively on income and negatively on the interest rate. Equation (7) is the **LM relation**. Intuitively you may expect this relation to be an upward sloping line on the output-interest rate plane. However, as modern central banks do, we are going to focus directly on the interest rate, rather than on money supply. Therefore, considering the choice of i by the central bank as given, it will not be adjusted as the level of output changes, namely $i = \bar{i}$, and the LM curve will be a horizontal line as in figure 12.

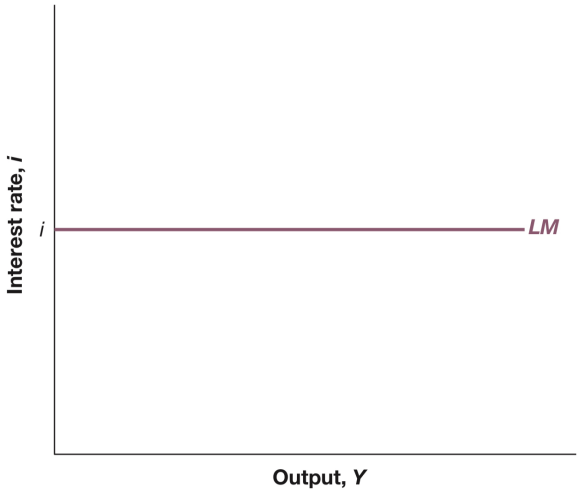

Figure 12: *The LM curve.*

4.3 The IS-LM relations together

In order for both the equilibrium in the goods and the financial markets to be satisfied, both IS and LM relations must be satisfied. At point **A** of figure 13 both markets are in **equilibrium**.

Now suppose the government wants to run a *fiscal contraction*, hence reduce its budget deficit by increasing

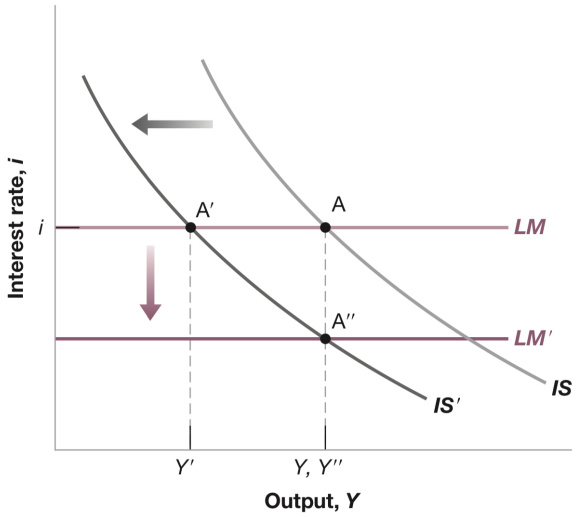

Figure 13: *The effects of a combined fiscal consolidation and a monetary expansion.* *Source: Blanchard et al. (2017).*

taxes while keeping government spending unchanged. The IS curve will shift to the left and the new equilibrium will be reached at A', corresponding to a lower level of output Y'. Suppose the government is not willing to increase government spending to restore the previous level of output. Are there any other options to do so? The central bank can run a *monetary expansion* by reducing the interest rate, which will increase investment, hence production, leading to an increased output. The new equilibrium point is A'', corresponding to a lower interest rate and to a restored level of output $Y'' = Y$. This combination of fiscal consolidation and monetary expansion is called **policy mix**.

4.4 Instantaneous adjustments?

Of course, in reality, adjustments are not instantaneous, as consumers are likely to take some time to adjust their consumption following a change in disposable income, as well as firms their investment decisions and production. This model is not able to grasp the dynamics of adjustments, however it still remains a very useful tool to understand the functioning of a closed macroeconomy (remember, we are assuming the existence of only one country). To answer questions related to the dynamics, we can do it by looking at the data and use econometrics.

5 Openness in goods and financial markets

Now it is time to relax our closed economy assumption, earlier made to keep things simple. Openness has three distinct dimensions:

- Openness in **goods markets**: the ability of consumers and firms to choose between domestic and foreign goods.
- Openness in **financial markets**: the ability of investors to choose between domestic and foreign assets.
- Openness in **factor markets**: the ability of firms to choose where to locate production and of workers to choose where to work.

All three aspects of openness are the result of increased globalisation in the world. We are going to analyse only the first two levels of openness.

5.1 Openness in goods markets

Now consumers face two spending decisions: *save or buy*, and *buy domestic or buy foreign*. Central to the latter is the price of domestic goods relative to foreign goods, called the **real exchange rate**. But let us go step by step.

Nominal exchange rates between two currencies, denoted by E, can be defined either as the price of domestic currency in terms of foreign currency, or as the price of foreign currency in terms of domestic currency. Henceforth we shall adopt the first definition, and assume our domestic currency is Euro. An increase (decrease) in the price of domestic currency in terms of a foreign currency is called **appreciation** (**depreciation**).

Now suppose you want to purchase a British good. What you are interest in will be the real exchange rate, namely the price of euro area goods in terms of British goods. Let P be the GDP deflator for the euro area, P^* the GDP deflator for the UK and E the euro-pound nominal exchange rate. So, EP gives the price of euro area goods in pounds. Therefore, the *real exchange rate* is given by:

$$\varepsilon = \frac{EP}{P^*} \tag{8}$$

Given how ε is constructed, it is an index number, therefore its level is arbitrary and uninformative, because the GDP deflator itself is an index number. However, the rate of change of the real exchange rate is informative about how more expensive euro area goods are relative to British goods now than they were before. This changes are called **real appreciation** and **real depreciation**.

5.2 Openness in financial markets

Given that buying or selling financial markets implies buying or selling foreign currency - called foreign exchange - the volume of transactions in foreign exchange markets gives us a sense of the importance of

international financial transactions. For a country, this level of openness is crucial, because it allows to borrow from the rest of the world, hence finance its trade deficit. It borrows by making it attractive for foreign financial investors to increase their holdings of domestic assets, which corresponds to lending to the country.
A country's transactions with the rest of the world are summarised by the **balance of payments**, set of accounts containing both trade flows and financial flows.

Moreover, now that markets are open, we can define another measure of aggregate output: the **gross national product** (**GNP**). While GDP measure value added domestically, GNP measures value added by domestic factors of production, including also the **net income** (**NI**), i.e. income received by the rest of the world minus income paid to the rest of the world, such that $GNP = GDP + NI$. However, in most countries the difference between these two measures is small, hence the practice of using mostly GDP.

5.3 Domestic or foreign assets?

Now suppose you face the decision of whether to buy domestic or foreign assets. If you buy a one-year German bond, for every euro you invest, you will receive $(1 + i_t)$ euros next year. Suppose instead you decide to buy UK bonds. To buy some, you must first buy pounds, so for every euro you invest, next year you will get $E(1+i_t^*)$ pounds. However, you might want to have euros to make transactions in your country, and not pounds. If you expect the nominal exchange rate next year to be E_{t+1}^e, then each pound will be worth $1/E_{t+1}^e$ euros. So the expected return of your investment next year will be $E_t(1 + i_t^*)(1/E_{t+1}^e)$ euros. If we assume that both domestic and foreign investors ignore differences in risk and care only about the expected rate of return, if both bonds are to be held, they must have the same expected rate of return. Arbitrage implies that it should hold that $(1 + i_t) = E_t(1 + i_t^*)(1/E_{t+1}^e)$ which, rearranging:

$$(1 + i_t) = (1 + i_t^*)\left(\frac{E_t}{E_{t+1}^e}\right) \tag{9}$$

Equation (9) is called **interest parity condition**. After some arithmetical adjustments, a good approximation of equation (9) is:

$$i_t \approx i_t^* - \frac{E_{t+1}^e - E_t}{E_t} \tag{10}$$

Equation (10) says that arbitrage by investors implies that the domestic interest rate must be equal to the foreign interest rate minus the expected appreciation rate of the domestic currency. So, coming to the previous example, the choice between holding German or British bonds depends on whether you expect the pound to depreciate relative to the euro more or less than the difference between the Italian interest rate and the British interest rate. So if, for instance, $i_t = 2\%$ and $i_t^* = 5\%$, and you expect the pound to depreciate by more than 3%, despite the higher interest rate, it will be less convenient to invest in UK bonds rather than in German bonds.

6 The World Financial crisis

Before exploring and understanding the series of events which led to the recent world financial crisis, an introduction upon the role of financial intermediaries and of some key variables is due.

6.1 Leverage and lending

We start with two definitions. The **capital ratio** of a bank is defined as the ratio of its capital to its assets, whereas the **leverage ratio** is its inverse, i.e. the ratio of its assets to its capital. Therefore, a bank having a balance sheet as in *table 1*, with a value of assets equal to 100, liabilities equal to 80 and capital equal to 20, will have a leverage ratio equal to $100/20 = 5$. Let us understand the role of the leverage ratio by means of a simple example.

Table 1: Bank's balance sheet

Assets 100	Liabilities 80
	Capital 20

Suppose the expected rate of return on assets is 5%, while on liabilities is 4%. The expected profit is equal to $(100 \times 5\% - 80 \times 4\%) = 1.8$. The expected profit per unit of capital is $1.8/20 = 9\%$. Now suppose the banker decides to put only 10 of their funds and borrow 90, hence increasing the leverage ratio from 5 to $100/10 = 10$. The expected profit this time is equal to $(100 \times 5\% - 90 \times 4\%) = 1.4$, which, per unit of capital is $1.4/10 = 14\%$. We have seen how higher leverage ratios may lead to higher profit per unit of capital. Of course, all that glitters is not gold: a higher leverage ratio also implies a higher risk that the value of the assets become less than the value of its liabilities which, turn, implies a higher **risk of insolvency**.
Suppose that the bank chooses its preferred leverage ratio equal to 5 but, as a result of bad loans, the value of the assets decreases from 100 to 90. Then its capital will be equal to 10 and the leverage ratio increases to $90/10 = 9\%$. The bank now can either increase its capital by asking some investors to provide funds, or decrease the size of its balance sheet, for example by calling back some loans for an amount of 40, thus reducing its assets to $90 - 40 = 50$ and restore its leverage ratio to its preferred value equal to $50/10 = 5\%$. However the effect is to lead to sharp *decrease in lending* by the bank. If the decrease in asset value of the bank had been equal to 70 in the first place, the bank would have become insolvent and gone bankrupt. As a matter of fact, whether banks remain solvent and cut lending or become insolvent, the decrease in lending may well trigger major adverse macroeconomic effects.

6.2 Liquidity

As often happens in economics, expectations have an important role. Indeed, whether the value of the assets of a bank has actually gone down or not, if investors have doubts about it, they will be likely to take their funds out of the bank. However, the bank might not have the necessary liquidity to repay its investors,

which, in turns, might be forced to sell quickly its assets at **fire sale prices** i.e. prices far below the true value of the loans, as they lack the time to properly evaluate them. This situation gets worse the faster investors can withdraw their money, as with **demand deposits**, which may trigger **bank runs**, forcing them to close.
Therefore, the *lower the liquidity* of the assets, the higher the risk of fire sales, hence the risk of insolvency and bankrupt. But also the *higher the liquidity* of assets, the easier is for investors to go get their funds and the higher - again - the risk of fire sales, insolvency and bankrupt due to bank runs. These events may have huge macroeconomic consequences.

6.3 House prices and subprime mortgages

In the United States, from the year 2000, *house prices* experienced a large increase, surely not entirely justified, although interest rates were very low. Mortgage rates were very low, increasing the demand for housing and thus pushing up the price. Mortgage lenders became increasingly willing lend to *riskier borrowers*, especially through **subprime mortgages**, and borrowers, believing that the growth on house prices would have continued, believed they were increasing their wealth thanks to a decreased mortgage value with respect to their house. As in 2006 house prices started to fall, many borrowers defaulted and lenders found themselves with large losses. Although in mid-2008 losses on mortgages were estimated around $300 billion, around 2% of US GDP, its effects were enormously amplified. *Banks were highly levered* as they found new ways of avoiding the regulation requiring their capital ratio to be above a certain threshold. Moreover, the banking system experienced a massive growth of **securitisation** i.e. creation of securities based on a bundle of assets (loans, mortgages), which increased banks' supply of funds and in turns, their cost of borrowing. If the bank sold the mortgage it had given as part of a securitisation bundle, and thus did not keep it on its balance sheet, it had fewer incentives to make sure the borrower could repay. Furthermore, rating agencies had largely missed the risk of such bundles. Lastly, from the 1990's banks had started relying on other sources of finance rather than demand deposits, such **wholesale funding**, consisting of getting short-term loans from other banks or institutions to finance the purchase of their assets. On the contrary of demand deposits, these other investors were not protected by deposit insurance and thus, when they worried about the value of their assets held by the bank, they asked for their funds back. In terms of what discussed in the previous paragraph, banks had liquid liabilities, much more than their assets.

The combination of *high leverage*, *illiquid assets* and *liquid liabilities* resulted in a major **financial crisis**. When house prices fell and some of their mortgages went bad, high leverage resulted in a sharp decline of capital of banks, which forced them to sell some of their assets, but as some of them were hard to value, they had to sell them at fire sale prices. This decreased the value of similar assets remaining on their balance sheet, leading to a further decline of capital ratios and forcing further sales of assets and further fall in prices. Moreover, some securities were so complex that their solvency became even harder to assess. Wholesale funding came to a stop as investors started becoming averse to lend to banks and even the latter

became reluctant to lend to each other. As on 15 September 2008, Lehman Brothers, which had more than $600 billion in assets, declared bankruptcy, all financial participants felt they were also at risk, leading to a paralysed financial system where banks basically stopped lending anyone else. Quickly, the large financial crises started to show its *macroeconomic implications*.

6.4 Macroeconomic implications

The immediate effects of the financial crisis were a large *increase in the interest rates* at which both people and firms could borrow, together with a dramatic *decrease in confidence*, due to confusion and fear about what was happening to the financial system. Borrowing became extremely expensive for most firms, if not impossible, especially for the smaller ones, which could not even issue bonds for financing purposes. Confidence decreased both on firms' and consumers' sides, which resulted on a sharp decrease in consumption.

Moreover, the sharp contraction in the US economy rapidly translated to the rest of the world mainly through three channels:

- Some European banks had bought securities whose underlying assets were US housing mortgages;
- As US consumer confidence fell and banks started supplying less credit, also trade flows contracted;
- The increase in US interest rates translated to European interest rates, making difficult also for European firms to access credit.

Furthermore, also European house prices had increased and when, after the US crisis, they also started to decrease, the effect of the fall was amplified for the same reasons that amplified it in the United States.

6.5 Policy responses in the United States

With regard to **financial policies**, federal deposit insurance was increased from $100,000 to $250,000 in order to prevent bank runs. Moreover, the Federal Reserve (the American central bank), put in place several liquidity facilities, allowing not only banks to borrow from it, also by increasing the set of assets that financial institutions could use as collateral when borrowing by the Fed. The aim of this facilities, and so it happened, was to allow banks to pay back investors without selling their assets. Ultimately, the government introduced the *Troubled Asset Relief Program (TARP)* for a total of $360,000 billion, which consisted in increasing banks' capital by buying shares in order to decrease their leverage and avoid bankruptcy. Regarding the **monetary policy**, the interest rate shortly reached the zero-lower bound, which forced the Fed from late 2008 to implement unconventional monetary policy measures, such as *quantitative easing* and *forward guidance* (more in detail in a later section). Lastly, the US government also turned to **fiscal policy**, designing a scheme called the *American Recovery and Reinvested Act* for the amount of $ 780 billion in the form of both tax reduction and government spending. US budget deficit increased from 1.7% of GDP in 2007 to 9.0% in 2010.

In terms of $IS - LM$ model, figure 14 shows that the financial crisis led to a large shift of the IS curve to

the left to IS', but fiscal policy offset some of the shift so that the curve shifted again to IS''. Monetary policy led to a shift from LM to LM', so the resulting equilibrium was A'. At that point, the zero-lower bound was reached, and both fiscal and monetary expansion were not enough to restore the previous level of output which, indeed, decreased from Y to Y'.

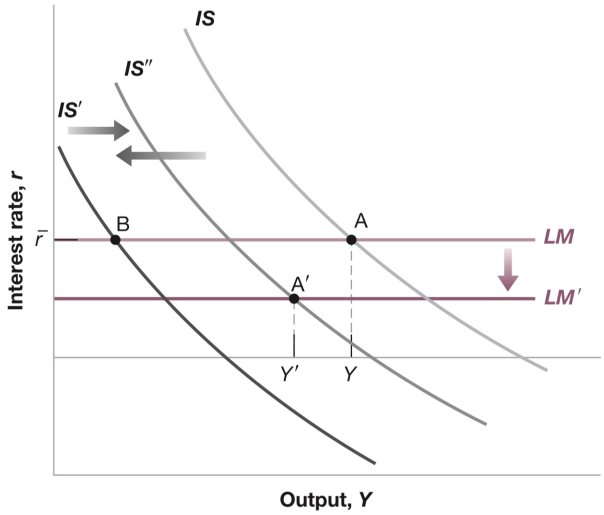

Figure 14: *The financial crisis and the use of financial, fiscal and monetary policies.* *Source: Blanchard et al. (2017).*

6.6 Policy responses in Europe

The type of response that Europe implemented was somewhat different from that in the US, as well as the actions of countries in the euro area were different from those of countries outside, such as Sweden or Denmark. Regarding **financial policies**, Europe started cleaning the balance sheets of its banks much later and did not undertake a solid unified response. Only the UK government started in 2008 to put capital in some banks but when in 2015 the government started selling back its bank shares to start the process of returning fully private for the investors, everything was put on hold in the wake of Brexit referendum in June 2016. With regard to **monetary policy**, the ECB took much longer to come to the decision to implement unconventional measures, which did not start until early 2015, two and a half years later that the interest rate had reached the zero-lower bound. Turning to **fiscal policies**, the European countries implemented diverse fiscal stimuli, but, as a matter of fact, countries that entered the crisis with higher debt levels, such as Greece, Italy and Spain, had much more difficulties to stimulate recovery. As we will see later, a higher government debt leaves less margin to implement powerful fiscal policies.

7 Unconventional Monetary policy

As the outbreak of the world financial crisis made clear that the possibility of reaching the zero-lower bound on the short-term interest rate was anything but a pure theoretical event, central bankers faced the necessity of implementing a set of unconventional measures able to stimulate the economy. The object of these policies is to influence financial prices beyond the short-term interest rate which, as explained previously, is the mainstream approach. The objective of these policies is to lower **long-term interest rates** in order to compress the *term spread*, i.e. the difference between long and short-term rates, in turn affecting risk premia, namely the difference between the expected return of risky and safe assets (e.g. the difference in expected return between bank lending rates to customers with different riskiness). Though, the attempt of these policies is still to *stimulate aggregate demand* (we will see later in detail how).

7.1 Some non-standard measures

As a central bank can exert a good control over short-term rates, one way to affect longer-term rates is to tell market participants that it will keep future short-term interest rates at a certain level. Commitments as such are called **forward guidance**. If long-term rates are the expectation of future short-term rates, then forward guidance should be effective in driving long-term rates towards the level communicated. The central bank can either commit to its statement "no matter what", or given future economic developments, such as conditional to a future level of unemployment rate. Anyways, the way forward guidance is expected to work is by *removing sources of uncertainty* on future course of policy.

Another unconventional measure heavily dependent on market expectations is **helicopter money**, i.e. the transfer of central bank money to the private sector. In more actual terms: government spending financed by the central bank. In particular, agents' belief on future commitments on inflation are the key here, as printing money as such may be abused and create hyperinflation. However, unlike forward guidance, which has been sometimes used throughout the post-financial crisis period, helicopter money still remains on the set of quite exotic central bank instruments very unlike to be implemented.

7.2 Quantitative Easing

Probably the most famous unconventional monetary policy adopted by central banks to overcome the world financial crisis is *quantitative easing* (QE), also known as *large-scale asset purchase* ($LSAP$). It essentially consists of a massive purchase of long-term maturity assets, especially government bonds, in order to reduce the spread between longer and shorter-term interest rates. Doing so, the central bank increases its balance sheet with long-term assets, in turn reducing the quantity of long-term bonds of the market, which become less risky for the investors, as the overall duration risk of the market also decreases. As investors become more willing to purchase them, their price rises and their yield decreases. This produces an increase in the wealth of the owner of long-term assets, usually households and firms, which, by means of an increased value of collateral, will have much more access to credit, leading to increasing consumption and investment and,

ultimately, output. Both the Fed and ECB have implemented QE to overcome the financial crisis, though the former launched the purchases very fast in 2009 throughout late 2015 in 3 separate programs, whereas the latter only in 2015 until late 2018 under the former ECB president *Mario Draghi*. With regard to its effectiveness, in both cases QE proved to be able to mitigate the damages of the crisis, although in the EU it is harder to disentangle its effects, given the level of diversification of the fiscal policies each country of the euro area implemented.
The recent *Covid-19* pandemic forced both the Fed and ECB to implement additional QE programs after that the zero-lower bound on the short-term interest rate was reached again in early 2020, and hence made impossible the use of standard monetary policy measures.

8 Financial stability and Macroprudential policies

Before the outbreak of the financial crisis it was believed that monetary policy alone was enough to ensure financial stability. In particular two measures have been traditionally adopted to limit bank runs:

- **Deposit insurance**, giving investors the confidence they will get their funds back.
- And, in case the run happens, the central bank could act as **lender of last resort** by providing massive liquidity to the banks against some collateral (usually their assets).

However, as the crisis made then clear, not only banks but all financial institutions faced the same problem, and central banks provided liquidity basically to every institution in need, also those they do not regulate. New instruments were needed, indeed.

8.1 Macroprudential policies

In the last paragraph we have seen how a central bank can act *ex-post* to alleviate the effect of a financial crisis by means of unconventional measures. Nevertheless, there was no reliable macro-based financial regulation framework able to safeguard *ex-ante* the financial system. **Macroprudential policies** are tools designed for this very reason: restrain the spread of **systemic risk** (related to the propagation of one agent's financial distress to other agents) to avoid in the first place events such as the last world financial crisis. Prior to 2008, it was believed that the risk was given by the market, regardless of the decisions made by individual financial institutions (*microprudential approach*). Afterwards, policymaker and scholars realised the need of considering risk as an endogenous variable, hence dependent of the collective behaviour of financial institutions (*macroprudential approach*). This happened in conjunction with the address of both academics and policymakers of the **pro-cyclical** behaviour of risk in the financial sector, i.e. the fact that, over time, the financial sector and the real economy reinforce each other, increasing both the amplitude of fluctuations in the business cycle.

Tools	Risk Dimensions	
	Time dimension	Cross-sectional dimension
Category I. Instruments developed specifically to mitigate systemic risk		
	• Countercyclical capital buffers • Through-the-cycle valuation of margins or haircuts for repos. • Levy on non-core liabilities • Countercyclical change in risk weights for exposure to certain sectors • Time-varying systemic liquidity surcharges	• Systemic capital surcharges • Systemic liquidity surcharges • Levy on non-core liabilities • Higher capital chares for trades not cleared through CCPs
Category II. Recalibrated instruments		
	• Time-varying LTV, Debt-To-Income (DTI) and Loan-To-Income (LTI) caps • Time-varying limits in currency mismatch or exposure (e.g. real estate) • Dynamic provisioning • Time-varying limits on loan-to-deposit ratio • Time-varying caps and limits on credit or credit growth • Stressed VaR to build additional capital buffer against market risk during a boom. • Rescaling risk-weights by incorporating recessionary conditions in the probability of default assumption (PDs)	• Power to break up financial firms on systemic risk concerns • Capital charge on derivative payables • Deposit insurance risk premiums sensitive to systemic risk • Restrictions on permissible activities (e.g. ban on proprietary trading for systemically important banks)

Figure 15: *Macroprudential instrument.* *Source: Kahou & Lehar (2017).*

Figure 15 shows some of the macroprudential instruments outlined by the International Monetary Fund. Inter alia *countercyclical capital buffers*, time-varying *loan-to-value (LTV)* and *debt-to-income (DTI)* ratios are the most used worldwide. In a series of agreements known as **Basel III**, many countries agreed, for example, to impose the same minima on certain ratios, such as a *minimum capital ratio* so that banks do not incur in too high leverage.

As far as the euro area is concerned, the ECB has created in 2013 the *Single Supervisory Mechanism* (*SSM*), a committee designed with the objective of controlling European financial institutions. Nonetheless, as regards the implementation of new macroprudential instruments, national governments are still in charge of it and to the present date (late 2020) the SSM lacks the power to enforce new instruments for all the countries, resulting in a high diversification of policies within the euro area.

9 Fiscal Policy: main concepts

This section overviews some key concepts related to how a government implements fiscal policy and its decision making. It will also help you understand the reasoning behind the diversification of economic development of some countries after the last financial crisis.

9.1 Deficit and Debt

Let us define the **budget deficit** in year t as:

$$deficit_t = rB_{t-1} + G_t - T_t \tag{11}$$

where, B_{t-1} is *government debt* at the end of year $t-1$ and r the real interest rate, such that rB_{t-1} corresponds to real interest payments on debt in year t. G_t is *government spending* on goods and services and T_t is *taxes minus transfers* in year t.
$(G_t - T_t)$ is called **primary deficit**. $(T_t - G_t)$ is instead defined as **primary surplus**.
The **government budget constraint** states that the change in government debt during year t is equal to the deficit during year t, such that:

$$B_t - B_{t-1} = deficit_t$$

If debt increases (decreases) then the government is running a deficit (surplus). Using the two previous equations and rearranging:

$$B_t = (1+r)B_{t-1} + (G_t - T_t) \tag{12}$$

Equation (12) states that the debt at the end of year t equals $(1+r)$ times the debt at the end of year $t-1$ plus the primary deficit during year t.
Suppose the government decides to fully repay the debt during year 2. So we have $B_2 = (1+r)B_1 + (G_2 - T_2)$ and, since the debt at the end of year 2 is zero, then $B_2 = 0$, and by replacing B_1 by 1, we get:

$$T_2 - G_2 = (1+r) \tag{13}$$

which means that to repay the debt fully in *year 2*, the government must run a primary surplus equal to $(1+r)$, and it can do so by either decreasing public expenditure or increasing taxes by such amount.
Now suppose the government decides to wait until *year t* to repay the debt, while keeping from *year 2* to $t-1$ a primary deficit equal to zero. Then, after some calculations we get:

$$B_{t-1} = (1+r)^{t-2} \tag{14}$$

Despite the fact that taxes are cut only in year 1, debt keeps increasing over time at a rate equal to the interest rate. The reason is because, even though the government is running a zero primary deficit, debt is positive and so are the interest payments on it, which in turns forces the government to issue more debt to pay the interest on existing debt. Given that $B_t = 0$, by putting equation (14) into the government budget constraint and rearranging we get:

$$T_t - G_t = (1+r)^{t-1} \tag{15}$$

which means that *the longer the government waits to repay its debt, or the higher the interest rate, the higher the primary surplus it will be forced to run, hence the higher the increase in taxes will be.* So, if government spending is unchanged, a decrease in taxes today must eventually be offset by an increase in taxes in the future. Furthermore, it can be proved that, if on the contrary the government only wants to stabilise its debt, i.e. changing taxes and spending so that it remains constant, it must run every year a primary surplus equal to the real interest payments on the existing debt r until the year it decides to fully repay the debt.

9.2 The *Debt/GDP* ratio

Given that an economy grows over time, it makes more sense to focus on the ratio of debt to output. After some calculations and rearrangements, we can rewrite equation (12) as:

$$\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = (r-g)\frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t} \tag{16}$$

where $g = (Y_t - Y_{t-1})/Y_{t-1}$ is the growth rate of output. The equation above states that the change in the **debt to GDP ratio** (or **debt ratio**) over time is equal to the sum of two terms:

- The difference between the real interest rate and the growth rate times the initial debt ratio;
- The ratio of the primary deficit to GDP.

The equation shows how governments should act in order for their debt ratio to decrease over time, in particular considering that increase in the debt ratio will be larger:

1. the higher the real interest rate (r)
2. the lower the growth rate of output (g),
3. the higher the initial debt ratio ($\frac{B_{t-1}}{Y_{t-1}}$);
4. the higher the ratio of the primary deficit to GDP ($\frac{G_t - T_t}{Y_t}$).

Let us give a brief historical perspective of how the *debt ratio* changed over the years.
The 1960's were a decade of so strong growth throughout Europe that on average ($r-g$) was negative (growth rate exceeded the real interest rate) and the countries were able to reduce their debt ratio without generating large primary surpluses. The same applied for the 1970's but mostly due to the very low real interest rate, but as from the 1980's growth rates started to decrease and interest rates to rise, as the countries did not respond with large primary surpluses, the debt ratios sharply increased. As the financial crisis hit, from 2007 to 2011 the debt ratio increased on average by 20% in the euro area, with Spain, Portugal and Ireland experiencing the largest increases (see figure 16). However, the reasons which led the debt ratio to increase are quite diverse in the euro area. For instance, in Belgium, Germany and Italy it was due to unfavourable interest rates compared with the growth rates of their economies, whereas in the Netherlands and Finland it was due to the bailout (even purchases) of banks, which increased the primary deficit.

			due to:				
Country	*B/Y* in 2011	Increase in *B/Y* from 2007 to 2011	Primary balance of which:	Cyclical components	Discretionary increase in the primary deficit	Interest rate and growth	Public interventions in the financial system
Ireland	87	62	36	30	6	15	12
Greece	134	38	20	25	−5	15	3
Spain	73	36	26	20	6	7	3
Portugal	91	28	16	15	1	9	2
France	89	25	16	16	6	6	3
Netherlands	70	24	7	7	6	6	11
Slovenia	45	22	12	12	4	4	6
Finland	55	20	0	−4	4	3	17
Belgium	100	17	2	0	2	9	6
Italy	119	16	−1	−2	1	15	2
Germany	82	16	2	2	1	8	6
Slovakia	44	15	15	2	13	1	−1
Austria	73	13	2	4	1	6	5
UK	87	42	28			5	9

Figure 16: *Breakdown of the increase in the debt-to-GDP ratio between 2007 and 2011.*

Sources: European Commission (2010) and Eichengreen et al. (2011).

9.3 The dangers of high debt

We have seen how the debt ratio can be changed over time and what are the variables directly influencing it. However, when the debt ratio is very high, the *expectations* of market participants may well have an important role. If, for instance, a country has a high level of debt, the interest rate at which it borrows on the market may increase if the investors perceive a higher risk of default on debt. As we have seen, an increase in interest rate can be compensated by decreasing public expenditure or increasing taxes, i.e. by decreasing primary deficit. As we have learnt, also a sharp fiscal contraction can lead to a recession, decreasing growth rate, which in turns increases $(r - g)$, leading to even higher debt ratio. Therefore, the larger the debt ratio, the larger the likelihood of catastrophic *debt dynamics*. During the crisis, this is exactly the dynamics experienced by the countries that increased the most their debt to GDP ratio to overcome the recession or already had a large value, whose increased riskiness was reflected by the increased **spread** between the interest rate on their bonds and the one on the German bond (Bund).

What if a government is not able to stabilise its debt and enters a debt spiral? Two things can follow: either it **defaults on its debt** or it relies heavily on **money finance**.

9.3.1 Debt default

This is what happens if the government is not able to repay its outstanding debt, and it usually consists of a partial default, with creditors taking a **haircut**, i.e. just a portion of what the government owes them. It may be unilaterally decided by the government, or may be the result of a deal with the creditors, as it happened to Greece in 2012, when private creditors accepted a haircut of about 50%. When debt is very high, declaring default and paying a haircut might seem a good way of escaping many troubles, with the prospect of needing lower taxes for fiscal consolidation. However, if the debt is heavily owned by domestic households, firms or banks, default triggers major adverse effects on the economy, as well as, if it is own by foreign investors, the country international reputation may be lost, and borrowing in the near future might

be difficult. Either cases, default is anything but a decision to take lightly.

9.3.2 Money finance

The government could also finance its debt by issuing bonds and forcing the central bank to buy them in exchange of money. This is also known as **fiscal dominance of monetary policy**, as the fiscal authority (the government) decides the rate of money creation. The revenue coming from money creation is called **seignorage**. Nevertheless, debt monetisation is typically harmful for the economy, as it leads to high inflation, which reduces the demand for money and, in turn, the demand for central bank money. Hence, the real money balances that people want to hold decrease and so, to achieve the same revenues, the government needs to increase further money growth, which leads to further inflation. Soon, inflation becomes **hyperinflation**, terms which is usually used for inflation in excess of 30% per month.

9.4 What to do, then?

The answer is that, when debt is very high, there is no easy solution. Though, we can learn from the past. Regarding how the crisis was handled in Europe, there is a high consensus that the strong fiscal consolidation which took place from 2011, known as **fiscal austerity**, was not able to sustain the economies of the most fragile countries. Today, scholars and policymakers agree on the fact that, although debt stabilisation is necessary, possibly it is better to wait until the economy exits the zero-lower bound on the short-term interest rate, and standard monetary policy can be used in conjunction with fiscal policy to offset the effects of a severe crisis.