



# **3. Aggregate Supply and Aggregate Demand. Internal Balance. Stabilization Policy. Goals of Macroeconomic Policy.**

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### 3.1 AS-AD Model

We introduce now a "modified" or "advanced " Keynesian Model AS - AD, where instead of price level inflation figures plays the role of exogenous variable, which better reflects the actual functioning of the world. We leave the initial assumption of a stable price level. Using AD-AS model, we analyze the causes of fluctuations in economic growth in short-run and potential output changes in long-run. We will also discuss the ways of re-establishment of macroeconomic balance.

#### 3.1.1 Aggregate demand

Aggregate demand is the total quantity of goods and services that households, businesses, governments and foreign buyers want to buy at a given rate of inflation. In our Keynesian model is AD equal to **planned aggregate expenditure** (total planned spending on final goods and services), so unplanned inventory investment is therefore zero. AD can be written as the sum of private consumption (C), public consumption (G), investment (I) and in the case of an open economy net exports (NX):

$$AD = C + I + G + NX. \quad (3.1)$$

The total planned spending is crucial for deciding all businesses especially the producers. Aggregate demand (AD) sets the volume of production in the short term. If planned expenditure are low, low will be also production volume. Conversely, if the expenditure is high, production will be high as well. Thus, the equilibrium output is equal to AD in the short term:

$$AD = Y \quad (3.2)$$

#### Construction of AD

There is a direct relationship between AD and the aggregate production: the higher AD means higher production. This relationship holds vice versa. If the economy produces more goods and services, employee compensation and corporate profits increase, and then private consumption and aggregate demand go up as well. This relationship is described by the so-called **Keynesian consumption function**:



$$C = C_a + cY_d \quad (3.3)$$

where  $C$  is private consumption,  $C_a$  is an independent (autonomous) consumption on disposable income,  $c$  the marginal propensity to consume and  $Y_d$  disposable income. Marginal propensity to consume is the amount by which consumption rises when current disposable income rises by one. The remaining part of  $Y_d$  will be saved. Disposable income is equal to the product (income) less tax income and plus the transfers.

### **Box 1 Alternative Consumption Theories - The permanent income hypothesis**

**The permanent income hypothesis (PIH)** is a theory of consumption that was developed by the American economist Milton Friedman. In its simplest form, the hypothesis states that the choices made by consumers regarding their consumption are determined not by current income but by their longer-term income expectations. The key conclusion of this theory is that transitory, short-term changes in income have little effect on consumer spending behavior.

Measured income and measured consumption contain a permanent (anticipated and planned) element and a transitory (windfall gain/unexpected) element. Friedman concluded that the individual will consume a constant proportion of his/her permanent income; and that low income earners have a higher propensity to consume; and high income earners have a higher transitory element to their income and a lower than average propensity to consume. In Friedman's permanent income hypothesis model, the key determinant of consumption is an individual's real wealth, not his current real disposable income. Permanent income is determined by a consumer's assets; both physical (shares, bonds, property) and human (education and experience). These influence the consumer's ability to earn income. The consumer can then make an estimation of anticipated lifetime income. Transitory income is the difference between the measured income and the permanent income.



Besides disposable income, the aggregate demand also dependent on **real interest rates**. The real interest rates affect investment and consumption. Higher real interest rates mean higher borrowing costs of investment acquisition or even higher required minimum return on investment, hence lessen overall investment. The same is true for consumption. Higher real interest rates mean higher debt payments for the purchasing goods, services or housing, or greater loss of profit, as higher real interest rates increase the return on savings and encourage households to save more. So we might assume that AD is a function of disposable income (positive correlation) and interest rates (negative correlation):

$$AD = f(Y_d, r) \quad (3.4)$$

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### Box 2 Interest rates

In economic theory and practice, it is important to distinguish between nominal interest rates and real interest rates. Nominal interest rates are the interest rates quoted in contracts or loan agreement. Real interest rates we obtained by the so-called deflation of nominal interest rates. In other words, we adjust the nominal interest rate by the price growth (inflation), which reduces the purchasing power of money that we borrow or lend. If we use the actual inflation, we'll get **ex post real interest rates**. If we use the expected inflation, we'll get **ex-ante real interest rates**.

For one-digit numbers, we can simply subtract the inflation rate from the nominal interest rate. This calculation give as a roughly outcome. For any value of nominal interest rates and inflation, we calculate real interest rate using the following formula:

$$r = [(100 + i) / (100 + \pi) - 1] * 100 \quad (3.5)$$

where  $r$  = real interest rate (in %),  $i$  = nominal interest rate (in %)

$\pi$  = expected or actual inflation (in %).



Since we already know that AD is dependent on (disposable) income and real interest rates, we have to yet divide the relation between the real interest rates and inflation to capture the aggregate demand as a function of output ( $Y$ ) and inflation ( $\pi$ ). Generally, we assume that the central bank aiming to keep inflation stable serves as a mediator between inflation and real interest rates. In nowadays, many central banks have the task to maintain price stability and to achieve this goal, they use interest rates. The central bank adjusts the key interest rate (in CR it is 2W repo rate), through which influences the level of interest rates on the money and bond market. The central bank need to affect not only nominal market interest rates and yields but it need to adjust the real interest rates. Only a change in real interest rates does affect the behavior of economic agents. Therefore, in the case of imminent inflation, the central bank raises nominal interest rates by more than the corresponding actual and expected inflation.

The relationship between real interest rates, inflation and the output is reflected in so-called the **monetary policy reaction function** (MP). The monetary policy reaction function is a combination of real output (more precisely, the output gap) and real interest rates for given inflation rate (more precisely the gap between real interest rates and long-term equilibrium real interest rates for the given inflation gap between inflation and inflation target):

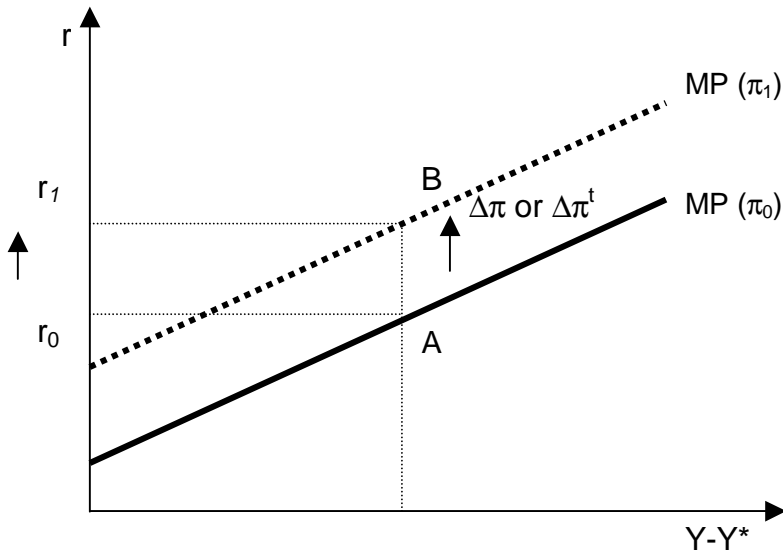
$$r = f(Y). \quad (3.6)$$

The logic behind the monetary policy reaction function is as follows: the central bank that tries to keep inflation rate stable has to drive real interest rates up when output (or income) goes up.

The below graph shows you the shift in the monetary policy stance to more hawkish one for example in the case of an external inflation shock (sudden increase in inflation) or lowering of the inflation target (for example from 3% to 2%). The shift of the MP means that for any combination of output gap you need higher real interest rate to keep inflation stable or close to the new inflation target.



**Graph 1 Monetary Policy Reaction Function**



The position of the reaction function determines the rate of inflation. If inflation goes up, the reaction function is shifted upward (north). The slope of reaction function reflects the sensitivity of real interest rates to the output gap. It says, by how many percentage points the central bank is required to raise real interest rates to keep inflation stable if the output gap widens by 1pp. If the curve is flatter, just a small change in real interest rates is needed to keep inflation stable, while the output gap enlarges. One simple numerical example of the monetary policy reaction function is followed:

$$r - r^* = \beta(y - y^*), \quad (3.7)$$

where  $\beta$  is the slope of the MP line.

Or if we divide real interest rates into nominal interest rates and inflation, we get another form of the monetary policy reaction function:

$$i - i^* = \alpha(\pi^e - \pi^T) + \beta(y - y^*), \quad (3.8)$$

where  $i$  is the central bank's key interest rate,  $i^*$  long-term (equilibrium) CB's key interest rate and  $\alpha$  is the sensitivity of the CB's key interest rate on the inflation gap.

The monetary policy reaction function clearly shows that change in output gap causes a change in real interest rates along the MP line. Higher output might



increase inflation and thus real interest rates have to be higher. Higher real interest rates through its negative impact on planned consumption and investment will reduce aggregate demand and real product. As a result, planned aggregate expenditure or aggregate demand decreases with rising inflation rate, as shown in the below chart of the AD curve.

The negative relation between aggregate demand and inflation could be explain also by **real money balance effect**. This effect describes the impact of inflation on the real value of money. If the prices increase, consumers can with the original amount of money buy smaller quantities. Inflation reduces the purchasing power of money, and as a result consumption in an economy. In other words, entities are willing to hold less and less cash in the case of rising inflation and prefer to invest free funds into securities. Savings is growing at the expense of consumption. Higher inflation leads to a decline in real money balances, and then through real money balance effect to a decline in real output.

The third reason why AD falls with inflation is the **redistribution effect**. Poorer people who spend most of their disposable income on consumption of essential goods and services, they are forced to reduce their consumption, when inflation goes up. More affluent consumers may either reduce or redeem savings and they do not need reduce consumption immediately. However, most of the population is affected by rising inflation, so the total consumption expenditures would go down.

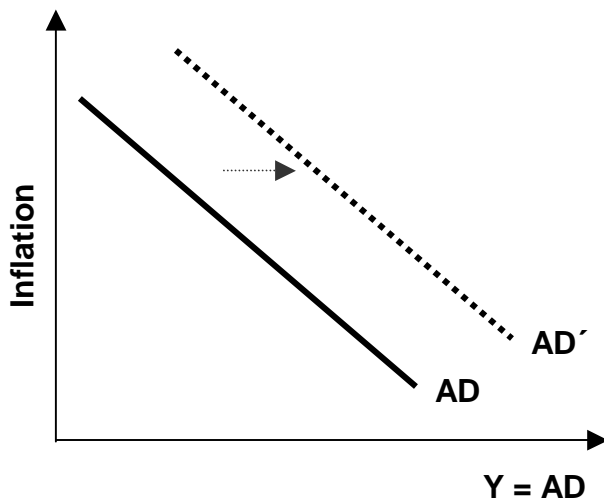
And fourth, higher domestic inflation makes domestic product less attractive on foreign markets and thus export from the domestic market is to decline. At the same time, the attractiveness of foreign goods for local consumers increases since they get relatively cheaper compared to domestic goods, and import into the economy goes up. As a result, net export deteriorates and aggregate demand of local economy decreases. This is called the **international substitution effect**. This case is similar to so-called real appreciation of the domestic currency<sup>1</sup>, which has a negative impact on net exports.

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<sup>1</sup> We will discuss this in more details in Ch 6.



## Graph 2 Aggregate Demand



Move along the AD curve: inflation is changing and affecting the expenditure volume.

Shifts of the AD curve are caused by exogenous factors outside the model of AD, such as changes in consumption of essential goods (autonomous consumption), change in autonomous investment independent of the real interest rates. Also, the change in net exports caused by foreign demand shift. The second group of factors leading to a shift in AD curve is a change of the monetary policy reaction function. The central bank can move into a dovish stance (because of lower inflation risks) and thus real interest rates decrease without a change in output gap. The shift of the curve means that for the same level of inflation we get different total expenditure level, or product in a short-run. Thus, in this case, the AD would shift to the right up.

The slope of the AD curve is determined by the slope of the monetary policy reaction function ( $\beta$ ), the marginal propensity to consume ( $c$ ) and the marginal rate of taxation ( $t$ ).

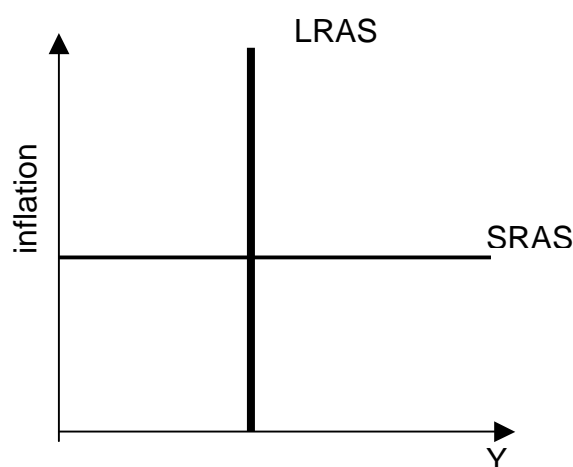


### 3.1.2 Aggregate Supply

In our model, the aggregate supply (AS) is characterized as a curve that shows any combination of inflation and the real output, which companies will be ready to offer given the production cost. In the short-run, we assume that firms will meet the demand for their output at previously determined prices. Or, **the short-run aggregate supply (SRAS)** is perfectly price elastic: at the current rate of inflation, producers offer any amount of production. The SRAS is the horizontal line showing the current rate of inflation, as determined by past expectations and pricing decisions of firms.

In the long-run, we assume that firms produce at their maximum sustainable production rates. In other words, the economy operates at a potential. Output gap is zero, firms are satisfied with their production level. As a result, firms have no incentive either to reduce or increase their prices relative to the prices of other goods and services. So, the inflation remains the same (but not necessary zero!). The long-run aggregate supply (*LRAS*) corresponds to potential output and its independent on inflation. The prices of inputs and outputs are fully flexible and are determined by aggregate demand level. The LRAS line is a vertical line showing the economy's potential output  $Y^*$ .

**Graph 3 Aggregate Supply**



Reasons why we might assume that the SRAS is perfectly price elastic:

1. inflation expectations are tend to be influenced by the recent past (or we assume **adaptive inflation expectations**) and are self-perpetuating via the price/wage spiral.
2. long-term wage and price contracts
3. and prices are sticky because of menu costs, money illusion, imperfect information and implicit price contracts. **Menu costs:** Firms change prices when the benefit of changing a price becomes larger than the menu cost of changing a price. Price changes may be bunched or staggered over time. **Money illusion** refers to the tendency of people to think of currency in nominal, rather than real terms. In other words, the face value (nominal value) of money is mistaken for its purchasing power (real value). **Imperfect information** might cause **the coordination failure** that occurs when a group of firms could achieve a more desirable equilibrium but fail to because they do not coordinate their decision making. For example, firms do not react immediately on a change in price level. Instead, when production becomes cheaper, firms take the difference as profit, and when demand decreases they are more likely to hold prices constant, while cutting production, than to lower them. Therefore, prices are sometimes observed to be sticky downward, and the net result is one kind of inflation. **Implicit price contracts**, sometimes called client markets (customer markets) between the producer and the customer can pay the "unwritten" agreement on price stability for some period, the producer would risk violation of client trust. If clients are sensitive to changes in prices, producers prefer to choose marketing and other non-price instruments to influence demand. Talking about client markets, we assume that the producers reflect the consumers' ways of thinking and their decision-making process.

As a result of all above, **inflation is inertial** (or sticky) or inflation tends to change relatively slowly from year to year.



### **Movements along the AS lines and shifts of the AS lines**

First, we explain the causes of the shift of the SRAS line. It also means that we explain the reasons for the changes in inflation rates. The reason for the shift of SRAS is usually change in expected inflation. If it raises, it shifts the SRAS to north, if it declines, it shifts the SRAS line south. The SRAS might shift because of a temporary supply shock (e.g. short-term increase in input prices).

The shift may also occur in the LRAS lines when the economy is hit by permanent shocks such as natural disasters, dramatic changes in raw material prices, or find a rich source of raw materials, the discovery of new more efficient technologies, etc. These fundamental changes have a significant impact on the performance of the economy and shift the LRAS lines either the left (a negative supply shock into potential) or right (positive long-run supply shock into potential).

### **3.1.3 The AS-AD model – goods and services market equilibrium**

The equilibrium on the goods and services market is depicted by the AD-AS diagram. The diagram has three elements: downward-sloping AD curve, the short-run aggregate supply and the long-run aggregate supply. The AD-AS diagram can be used to determine the level of output prevailing at any particular time (particularly in short- and long run). The intersection of the AD curve and the SRAS line is called **short-run equilibrium** of the economy. The inflation equals the value determined by past expectations and past pricing decisions and output equals the level of short-run equilibrium output. The **long-run equilibrium** of the economy occurs when the AD curve, the SRAS line, and the LRAS line all intersect at a single point (in our graph the point *E*). In the long-run, the economy is operating at potential output and inflation is stable (not necessarily zero). While the long-run equilibrium of the economy is stable, the short-run equilibrium is unstable and the economy tends to adjust to reach the stable long-run equilibrium.

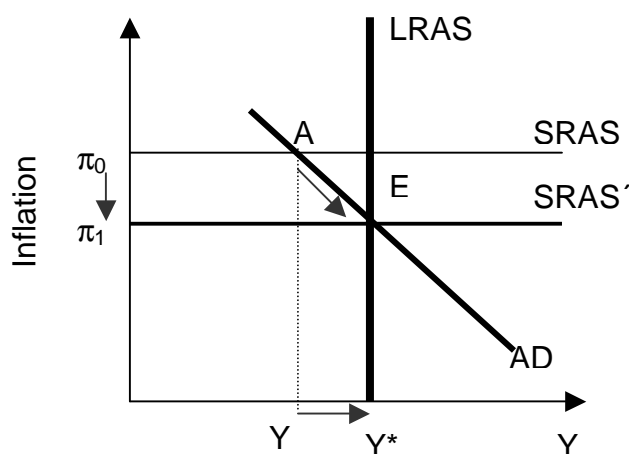
### **Self-correcting economy**

In our model we assume that the economy tends to be self-correcting in the long-run. Given enough time, output gaps tend to disappear without changes in monetary or fiscal policy.



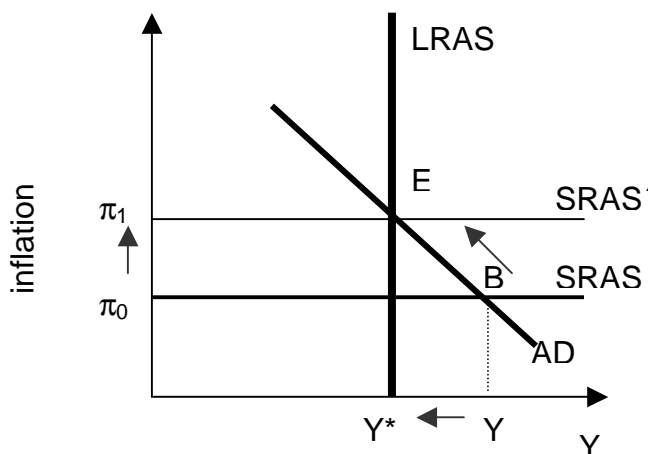
For example, the economy may be in short-run equilibrium at point A in our graph. But it will not remain there. The actual output is less than potential output, the **recessionary gap** exists. Firms are not selling as much as they would like to and so they slow down the rate at which they increase their prices. How they do this? Firms do not fully reflect in the product prices the growth in input cost. So, the price of their products relative to the prices of other products will grow more slowly, so their **relative price** falls. Since other firms are likely to follow, the drop in relative prices spreads across the economy and the overall inflation rate starts declining step by step. There would be no rapid decline in inflation, because, as we have explained, inflation tends to be inertial. The rate of inflation and hence the SRAS line will gradually decline, until the recessionary gap is closed. Once the economy reaches the point E, the long-run equilibrium, where the AD curve intersects the SRAS line and the LRAS line at the potential output, the inflation and output will reach both the stable point. There is no pressure on economy to adjust, the economic variables reach long-run equilibrium, in which production level meets the current demand and its own potential level, and inflation is stable. Notice that the restoration of long-term equilibrium was associated with a decline in inflation and an output growth to the potential output. The production expansion was supported by the behaviour of the central banks assumed in our model. The CB had lowered the key interest rate with falling inflation. Higher aggregate spending expenditure allowed firms to increase production up to the level of full capacity - the production potential. The production also increases employment.

**Graph 4 Recessionary gap**



What happens if the economy has an expansionary gap, with the output greater than potential output (see point *B* in below graph)? An expansionary output would cause the rate of inflation to rise, as firms respond to high demand (planned aggregate expenditure are greater than the potential output) by raising their prices more rapidly than their cost is rising. As a result, rising relative prices start flooding the economy. In the graph, the SRAS line moves step by step upward. The short-run equilibrium output falls, since the CB aims to increase real interest rates when inflation goes up. The economy goes through the self-correction process until the long-run equilibrium output is reached. Then, inflation and output stabilize at point *E*, where the economy reaches the long-run equilibrium output (output gap is closed).

**Graph 5 Expansionary (inflationary) gap**

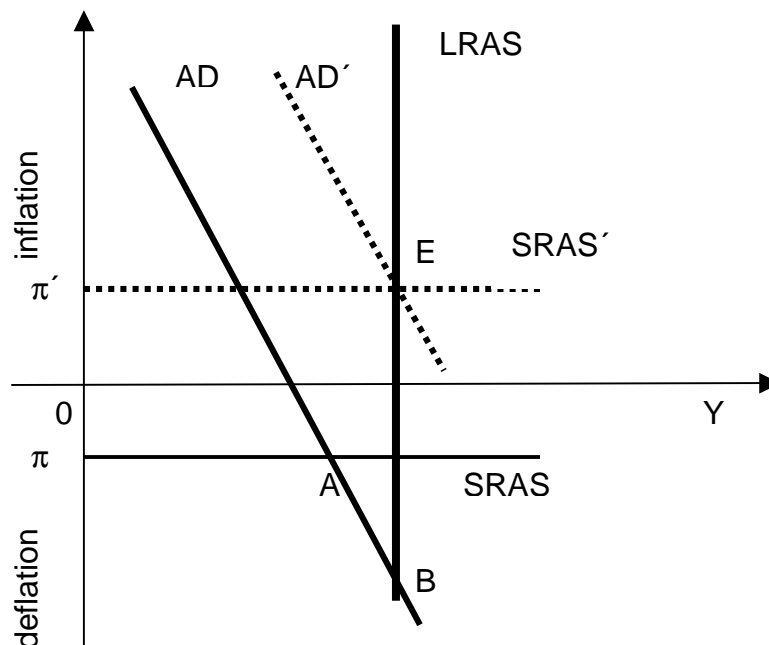


The ability of the economy to adjust itself does not mean that the fiscal and monetary policies are not needed to stabilize output. If the self-correction is rapid, then active stabilization policies are probably not justified in most cases, given the lags and uncertainties that are involved in policymaking in practice. But if the self-correction takes place very slowly, so that actual output differs from potential for protracted periods, then active stabilization policies can help to stabilize output. The speed of self-correction depends on a variety of factors, including the prevalence of long-term contracts and the efficiency and flexibility of product and labour markets. A reasonable conclusion is that the greater the initial output gap, the longer the process of self-correction will take. This suggests using the stabilization policies when the output gap is large and unemployment rate exceptionally high.



The practical example of the situation that requires some kind of stabilization policy is certainly the so-called **deflationary gap** when the production drops deeply below the potential output and the price level decreases (or inflation rate is negative). In the 1990s Japan went through deflation that was triggered by the collapse of stock prices. The fall in stock prices caused a contraction of aggregate demand. Aging population and historically high saving rate in Japan prevented self-correction of the economy. The fall in share prices caused a radical shift of AD to the southwest (planned spending declined for all levels of inflation). The dramatic decline in consumption and aging population in Japan led to a decline in the price level (deflation). And inflation expectations fell as well. The SRAS line fell down into the deflation quadrant. The short-run equilibrium shifted at point A. The self-correction would lead the economy to point B, into even deeper deflation. And there is a considerable room for the active stabilization policy that should help the economy to cope with this shock. The following section shortly deals with the stabilization policy.

**Graph 6 Deflationary gap**



## 3.2 Macroeconomic Stabilization Policy

A (macroeconomic) stabilization policy is a package or set of measures introduced to stabilize the economy or to promote the long-run economic growth.

Stabilization can refer to correcting the normal behavior of the business cycle. In this case the term generally refers to demand management by monetary and fiscal policy (two most popular macroeconomic policies) to reduce normal output fluctuations, sometimes referred to as "keeping the economy on an even keel." The policy changes in these circumstances are usually countercyclical, compensating for the predicted changes in employment and output, to increase short-run and medium-run welfare.

Besides the macroeconomic stabilization policy we distinguish the **microeconomic policy** that focuses on certain goods markets and seeks to eliminate the market failures.

Since the economic cycle occurs in short and mid-term horizon, the economic theory tends to assume that the active economic policy might help in short-run. In long-run it is expected that the economy is able to achieve the equilibrium without the active policy measures. This assumption follows the lead of the neoclassical school and we used to denote it as **liberal concept of economic policy**. The laissez-faire economics limit the role of a government only in creating an institutional framework for the functioning economy (or the rules of the game), and in defining property rights. With the exception of the extreme case, liberals accept the role of the government in the situations, when the market process does not work as it should, for example, when the self-correction of the economy would take very long and be very painful. Slow or incomplete self-correction is taken as the market failure, which put obstacles to the self-correction of the economy. The liberal conception does not give much room to an active government interventions, because it fears that the government interventions could undermine the ability of economies to deal with the imbalance. The liberals believe that the government failures might cause more damage than the market failures.



The opposing concept is the **economic intervention concept**. Economic intervention can be aimed at a variety of political or economic objectives, such as promoting economic growth, increasing employment, raising wages, raising or reducing prices, promoting equality, managing the money supply and interest rates, increasing profits, or addressing market failures – the inability to restore the equilibrium or at high economic/social cost.

### **Government failures**

Government failure (or non-market failure) occurs when a government intervention causes a more inefficient allocation of goods and resources than would occur without that intervention. The term, coined by Roland McKean in 1965, became popular with the rise of public choice theory in the 1970s. The idea of government failure is associated with the policy argument that, even if particular markets may not meet the standard conditions of perfect competition, required to ensure social optimality, government intervention may make matters worse rather than better.

The government failure should be taken as problem which prevents the market from operating efficiently, a government failure is not a failure of the government to bring about a particular solution, but is rather a systemic problem which prevents an efficient government solution to a problem. Government failure can be on both the demand side and the supply side. Demand-side failures include preference-revelation problems and the illogics of voting and collective behavior. Supply-side failures largely result from principal/agent problems.

Examples of the government failure:

- Crowding out - crowding out occurs when the government expands its borrowing more to finance increased expenditure or tax cuts in excess of revenue crowding out private sector investment by way of higher interest rates. Government spending is also said to crowd out private spending
- Horse trading/Logrolling - the process by which legislators trade votes
- Pork barrel spending - the tendency by legislators to encourage government spending in their own constituencies, whether or not it is efficient or even



useful. They "bring home the bacon", may be reelected for this reason, even if their policy views are at odds with their constituency.

- Rational ignorance - because there are monetary and time costs associated with gathering information.

According to mainstream economic analysis, a market failure (relative to Pareto efficiency) can occur for four main reasons:

- Imperfect competition - agents in a market can gain market power, allowing them to block other mutually beneficial gains from trades from occurring. This can lead to inefficiency due to imperfect competition.
- Externalities - the actions of agents can have externalities. For example, if the firm pollutes the atmosphere when it makes steel, however, if it is not forced to pay for the use of this resource, then this cost will be borne not by the firm but by society. Hence, the market price for steel will fail to incorporate the full opportunity cost to society of producing. In this case, the market equilibrium in the steel industry will not be optimal. More steel will be produced than would occur were the firm to have to pay for all of its production cost.
- Public goods: some markets can fail due to the nature of certain goods, or the nature of their exchange. A public good is a good that is nonrival, non-excludable and inseparable. Non-rivalry means that consumption of the good by one individual does not reduce availability of the good for consumption by others; and non-excludability that no one can be effectively excluded from using the good. Inseparability means that it is hard to clearly define the level of individual consumption.
- Informational asymmetry – it relates to decisions in transactions where one party has more or better information than the other. This creates an imbalance of power in transactions which can sometimes cause the transactions to go awry. Examples of this problem are adverse selection and moral hazard. Most commonly, information asymmetries are studied in the context of principal-agent problems.



Stabilization policy involves couple of initial steps:

1. the identification and diagnosis of the problem
2. the determination of the policy objective, and, given some conflict between objectives, their ranking in order of importance
3. the formulation of policies and instruments which are consistent with the objectives.
4. the functioning of the measures
5. Cost-benefit calculations of policy effectiveness

There are several policy lags that limit the effectiveness of stabilization policies designed to correct business-cycle fluctuations:

- I. cognitive lag – the time lag between the emergency of a shock and its identification
- II. decision lag – it corresponds to the time that the government needs to define the objectives, instruments and policies including the process of approving the measure
- III. action lag – it takes time to launch the policy; the implementation lag is usually shorter for monetary policy than fiscal policy.
- IV. application lag – the final impact of the policy is seen with a time delay.

### **The main types of macro-economic policy**

- **Monetary policy:** the goal is to maintain price stability, mostly through changes in the key interest rate, carried by an independent central bank
- **Fiscal policy:** it decides on the amount and the structure of government revenues and expenditures; fiscal policy is applied by the government (central and local) and its established institutions.
- **Structural policy:** it aims to change the existing structure of the economy and its institutions; it can be implemented by the government and its institutions, the central bank or legislative bodies, trade unions etc.
- **External policy:** this is primarily the external trade policy, it addresses the external economic relations including foreign exchange, migration, capital and credit policy; The implementation bodies: government and its institutions.

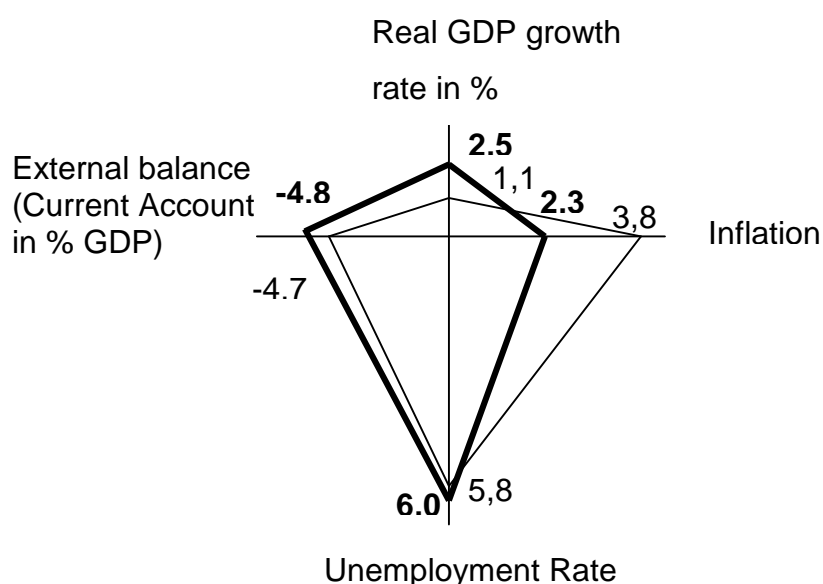


The objective of macroeconomic policy is generally so-called **dynamic equilibrium** or balanced economic growth. It means the goods market equilibrium (in other words low and stable inflation), labor market equilibrium (low unemployment rate), and external balance (stable foreign exchange rate or foreign reserves).

We can evaluate the country's economic policies and general economic situation on the basis of four (or five) standards, which are known as a the **magic tetragon** (or pentagon). The corners of the polygon represent the targeted or the long-run equilibrium values of the corresponding objectives: the GDP growth rate closed to its potential, the current account balance; unemployment rate at natural level; stable and low inflation rate (and balance government budget). The objective of government policies is to keep some of those measures as closed as possible to their long-run equilibriums.

The below graph shows the magic tetragon drawn for the U.S. economy. A strong line corresponds to the U.S. economy equilibrium (the potential product, the natural rate of unemployment, low inflation and the equilibrium current account deficit). For comparison, the graph shows also the situation of the U.S. economy in 2008.

**Graph 7 Magic tetragon of the U.S. economy**



Source: OECD. OECD Economic Outlook No. 85. OECD. June 2009.

In practice, the macroeconomic objectives can be complementary, or eliminating, negated, conflicting, identical or independent. The most popular goals that are mutually negated is the goal of price stability and high employment rate (see Phillips curve). In the case of conflicting goals we have to set the priority.

In addition to these horizontal relations between the objectives we distinguish vertical relationship: superiority and inferiority.

### 3.3 Self-study

- FRANK, R.H. – BERNANKE, B.S. (2007) *Principles of Economics*. McGraw-Hill, 3th edition. 2007. Ch 27-29, p.759-791, 795-860 & Appendix p.857-860. ISBN-13: 978-0-07-312567-1.

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### 3.5 Exercises

1. Calculate the real interest rate ex-ante and ex post, if you know that the nominal interest rate was 15% per annum, the average annual rate of inflation for the corresponding period was 10% annually. However, the economic agents had expected lower inflation at 8% annually. Make precise and approximate calculation of the real interest rate.
2. What could happened if the inflation is higher-than-expected? How does it affect the real interest rates and the economy through real interest rates?
3. The economy fell into the deflationary gap. How can be this situation addressed in the AS-AD model?

