Factors determining price developments

1. What monetary policy can and cannot do

How can monetary policy influence what we pay for our goods and services, that is to say the price level? This question touches upon what economists call the “monetary transmission mechanism” (or MTM), i.e. the process through which actions of the central bank (such as changes in the policy rates) are transmitted through the economy and, ultimately, to prices. This process is extremely complex, it changes over time, and differs somewhat from one economy to another. Monetary policy influences the economy as follows: the central bank is the sole issuer of base money. This takes the form of banknotes and coins in circulation and banks’ holdings of deposits with their central bank (bank reserves), that is to say, it is the monopolistic supplier of the so-called “monetary base”. By virtue of this monopoly, the central bank can influence money market conditions and steer short-term interest rates.

What are the basic features of the MTM? In the short run, a change in interest rates made by the central bank triggers a number of mechanisms. Why? Mainly because this change has an impact on the spending and saving decisions taken by households and firms. For example, higher interest rates will make it less attractive for households and firms to borrow money in order to finance their consumption or investment. Instead, higher rates will make it more attractive for them to save rather than spend. Finally, changes in interest rates may also affect the supply of credit. These developments, after a delay of one or two years, then influence developments in real economic variables such as output.

The sequence of reactions to a change in the interest rate outlined above involves a number of different mechanisms and actions taken by various economic agents at different stages. Furthermore, the size and strength of the different effects can vary according to the state of the economy. As a result, monetary policy usually takes a considerable time to affect prices. However, in the economics profession, it is widely accepted that, in the long run, i.e. after all adjustments in the economy have worked through, a change in the quantity of money supplied by the central bank will only be reflected in a change in the general level of prices and will not cause permanent changes in real variables such as real output or unemployment. A permanent change in the quantity of money in circulation brought about by the central bank is ultimately equivalent to a change in the unit of account (and thereby in the general price level), which leaves all other variables stable, in much the same way as changing the standard unit used to measure distance (e.g. switching from kilometres to miles) would not alter the actual distance between two locations.

This general principle, referred to as the “long-run neutrality” of money, underlies all standard macroeconomic thinking and theoretical frameworks. A monetary policy which credibly maintains price stability has a significant positive impact on welfare and real activity. Beyond this positive impact of price stability, real income or the level of employment in the economy are, in the long run, essentially determined by real (supply side) factors, and cannot be enhanced by expansionary monetary policy.¹

These main determinants of long-run employment and real income are technology, population growth and all aspects of the institutional framework of the economy (notably, property rights, tax policy, welfare policies and other regulations determining the flexibility of markets and incentives to supply labour and capital and to invest in human resources).

¹ Supply-side factors are factors driving the supply of goods and services in an economy, in particular the amount and quality of capital and labour, as well as technological progress and the design of structural policies.
Inflation is ultimately a monetary phenomenon. As a number of empirical studies confirm, prolonged periods of high inflation are typically associated with high monetary growth (see the chart below). While other factors (such as variations in aggregate demand, technological changes or commodity price shocks) can influence price developments over shorter horizons, over time their effects can be offset by some degree of adjustment of monetary policy. In this sense, the longer-term trends of prices or inflation can be controlled by central banks.

Money and Inflation

2. Money and interest rates – how can monetary policy influence interest rates?

A central bank can determine the short-term nominal interest rates which banks have to pay when they want to borrow from the central bank. And banks need to turn to the central bank for liquidity when they need banknotes for their clients and need to fulfil minimum reserve requirements in the form of deposits with the central bank. As central banks are monopolistic suppliers of base money, they can determine the policy rates, e.g. the short-term nominal interest rates on loans given to the banks. The expectations regarding the future development of policy rates in turn influence a wide range of longer-term bank and market interest rates.

Why can central banks influence (ex ante) real interest rates? The role of “sticky” prices

Borrowing and investment decisions by households and firms greatly depend on the real interest rate. For example, the ex ante real interest rate is the real return which a financial asset is expected to deliver. It is defined as the nominal interest rate minus expected inflation over the maturity for which the interest rate is fixed. The impact of monetary policy on short-term real interest rates is related to two issues: i) monetary policy controls the short-term nominal interest rate and ii) prices are sticky in the short run.

What is the meaning of “sticky prices”? Empirical evidence tells us that most prices are fixed for some time; very often firms do not instantly adjust the prices they charge in response to changes in supply or demand conditions. In reality, some prices are adjusted very often (e.g. petrol prices), while other prices are adjusted perhaps once a month or once a year. There can be various reasons for this. First, prices are sometimes set by long-term contracts between firms and customers to reduce the uncertainties and costs associated with frequent negotiations. Second, firms may hold prices steady in order not to annoy their regular customers with frequent price changes. Third, some prices are sticky because of the way markets are structured; once a firm has printed and distributed a catalogue or price list, it is costly for it to alter prices. Finally, the calculation of new prices is costly as well. In the long run, however, prices have to adjust to new supply and demand conditions. Put another way, prices are fully flexible in the long run.²

Now assume that the central bank increases the supply of money. For example, it prints new money and buys government bonds with it. People are only prepared to hold a higher amount of money and reduce their holdings of bonds if the return on these bonds, i.e. the interest rate, falls. Thus, if the central bank increases the supply of money, the nominal interest rate must fall in order to induce people to hold a higher amount of money. And as prices are sticky in the short run, this implies that short-term inflation expectations remain largely unchanged. As a consequence, a change in short-term nominal interest rates translates into a change in the ex ante expected real interest rate. Therefore, monetary policy can influence expected or ex ante short-term real interest rates.

² With the exception of administered prices, which can only be expected to change very rarely.
3. How do changes in interest rates affect the expenditure decisions taken by consumers and firms?

From the perspective of an individual household (e.g. a family), a higher real interest rate makes it more attractive to save, since the return on the savings in terms of future consumption is higher. Therefore, higher real interest rates typically lead to a fall in current consumption and an increase in savings. From a firm's standpoint, a higher real interest rate will deter investment, because fewer of the available investment projects will offer a return sufficient to cover the higher cost of capital.

To sum up, an interest rate rise will make current consumption less desirable for households and discourage current investment by firms. The effects on individual households and firms show that an increase in real interest rates brought about by monetary policy will lead to a reduction in current expenditure in the economy as a whole. Economists say that such a policy change causes a drop in aggregate demand and is thus often referred to as a “tightening” of monetary policy.

It is important to understand that there are time lags in this process. It might easily take months for firms to put a new investment plan in place; investments involving the construction of new plants or the ordering of special equipment can even take years. Housing investment also takes some time to respond to changes in interest rates. Also, many consumers will not immediately change their consumption plans in response to changes in interest rates.

Indeed, it is generally agreed that the monetary transmission mechanism takes time. Monetary policy cannot, therefore, control the overall demand for goods and services in the short run. Expressed in another way, there is a significant time lag between a change in monetary policy and its effect on the economy.

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How do changes in aggregate demand affect economic activity and price developments?

An easy way of illustrating how changes in aggregate demand affect price developments is to use a simple model focusing on aggregate supply and demand in the whole economy. The model basically attempts to describe the relationship between the real quantity of goods and services supplied and demanded in an economy and the aggregate price level.

Short-run equilibrium of aggregate supply and demand

The chart below illustrates aggregate supply (AS) and aggregate demand (AD), with the price level on the vertical axis and real output on the horizontal axis.

![Aggregate demand and short-run aggregate supply](chart.png)

Aggregate demand and the price level

To understand the slope of aggregate demand, we have to analyse what happens to real expenditure decisions when the price level changes, assuming all other economic variables remain the same. It can be shown that the aggregate demand curve has a negative slope. If prices for goods and services increase, people will suffer a decline in their “real income”, which reflects the amount of goods and services that their incomes will buy. This implies that they can only finance a lower volume of transactions. Conversely, if the price level falls, their real income will allow for a higher volume of purchases, meaning that there will be a greater demand for real output.

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3 The real interest rate is defined as the nominal interest rate minus expected inflation over the maturity for which the interest rate is fixed.
Aggregate supply and the price level in the short run
Aggregate supply deals with the supply of goods and services produced by firms. We first need to understand how the overall level of prices is related to the overall level of output in the short run, i.e. assuming that all other factors (production technology, nominal wages, etc.) remain the same. How does a change in the price level affect the real production or the real output of firms? In essence, if nominal wages are given, a higher price level will lead to a decline in real wages. With lower real wages it becomes more profitable for firms to hire more workers and to increase production. Conversely, if some additional goods and services can be sold at a higher price, this might encourage firms to hire more workers (even at a higher salary) and expand their supply. The short-run aggregate supply curve, therefore, is upward sloping.

The intersection of the two curves determines what economists call the “equilibrium”. The concept of equilibrium is crucial in economics. This is because, in such a situation, the wishes of both market sides coincide and, therefore, there is no tendency for further change. In this case, the equilibrium determines the price level and the level of real output prevailing in an economy at the same time.

What happens if the economy faces a state of disequilibrium? Suppose the economy is facing a price level which is higher than the equilibrium level. In such a situation aggregate supply is too high and aggregate demand too low compared with equilibrium. What happens? If the price level is higher than in equilibrium, buyers will want to buy less than producers want to sell. Therefore, some suppliers will lower their prices, which in turn leads to an increase in aggregate demand. At the same time, the lower prices will raise real wages (as nominal wages are fixed in the short run) and – as real wages represent a cost factor for firms – they will cut back production and tend to lower aggregate supply. This process will go on until an equilibrium situation is reached, i.e. a situation where the wishes and plans of buyers and sellers coincide at a certain price and output level.

Aggregate supply in the long run
Why do we speak above of the short-run supply curve? The positive impact of a higher price level on real output will only last as long as nominal, and therefore also real, wages remain unchanged. In reality, nominal wages are normally fixed for about one year, and in some cases for up to two years. If workers or unions do not accept the lower real wages caused by higher prices they will use the next wage negotiations to demand compensation in the form of higher wages. If real wages return to the level they were at before the increase in the price level (and if production technology is unchanged), firms will no longer find it profitable to maintain production and employment at the higher level and will thus make cuts. In other words, if real wages cannot be reduced by higher inflation in the long run, employment and production will also be independent of price developments in the long run. This means that the long-term aggregate supply curve will be vertical.

The long-run equilibrium

Aggregate demand and long-run aggregate supply

The intersection of the aggregate supply (AS) curve with the horizontal axis (see AS* in the chart above) is what economists call the potential level of output. This level represents the value of final goods and services produced when the economy’s resources are fully employed, given the current state of technology and structural features of the economy (such as labour market regulations, welfare and tax systems, etc.).

So far we have discussed movements along the curves, with all other factors but prices and real output remaining unchanged. We now need to understand what happens if these other factors change. In essence, such changes shift the curves to the right or the left.
Factors affecting aggregate supply and aggregate demand

According to the simple model we have been using, the combination of prices and real income that an economy is experiencing is obviously determined by the interplay of aggregate supply and demand. This raises questions regarding the factors leading to shifts in the two curves.

The factors leading to an increase in aggregate demand (i.e. a shift in AD outwards or to the right) include an increase in government expenditure, a reduction in taxes, a depreciation of the home currency, and an increase in real wealth (e.g. higher stock and land prices), which in turn lead to higher private consumption and investment expenditure.

Private consumption and investment may also be driven by expectations. For example, if firms expect higher future profits, they will tend to increase investment expenditures. And if households expect higher real income as a result of higher expected labour productivity, consumer expenditure will increase. For this reason, an improvement in consumer and investor confidence is normally related to an increase in current aggregate demand. With regard to the impact of monetary policy, we can observe that a lower policy rate and an increase in money supply will cause aggregate demand to increase, thus shifting the demand curve to the right. If these variables change in the opposite direction, aggregate demand will fall (i.e. AD will shift to the left).

Regarding aggregate supply, we can see that increases in the prices of production factors, such as wages, or increases in oil prices will lead to a shift to the left in aggregate supply. On the other hand, technological progress or increases in productivity will shift aggregate supply to the right, as this allows for more production at the same cost with a given quantity of labour input. This analysis shows that changes in the general price level can be brought about by shifts in either the supply curve or the demand curve or in both. For instance, if all other factors remain stable, a decline in aggregate supply (i.e. a shift of AS to the left) will be accompanied by a short-term fall in real output and an increase in prices, whereas an increase in demand (i.e. a shift of AD to the right) will manifest itself in higher short-term real activity and higher prices.

The long-run model illustrates that the behaviour of aggregate demand is crucial in determining the general price level that an economy experiences in the long run. If the aggregate supply curve is vertical, changes in aggregate demand will affect prices but not output. If, for instance, money supply were to increase, the aggregate demand curve would shift to the right and the economy would thus, in the long run, shift to a new equilibrium where real production has remained the same but prices have risen.

Shifts in aggregate demand and long-run aggregate supply

Inflation was defined as a general, or broadly-based, increase in the prices of goods and services. Therefore, a process of lasting inflation can only be brought about by a continuing increase in aggregate demand over time. This, in turn, is only possible if monetary policy accommodates such a development by keeping interest rates low and money growth high.

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4 Economists note that often a decline in money demand is associated with an increase in the velocity of money. The latter variable can be defined as the speed with which money is transferred between different money holders and thus determines how much money is required for a particular level of transaction. In fact, these two phenomena must be regarded as two sides of the same coin. If people want to hold less money, the available stock of money will, given a constant money supply, have to change hands more often and so circulate more. This is equivalent to a higher velocity of money.
4. Factors driving price developments over shorter-term horizons

Inflation (i.e. a sustained increase in the price level) can be caused in either one or two ways. Prices in general will rise if, on average, either aggregate demand increases or supply decreases. To put it differently, inflationary pressures can result if there are changes (economists often speak of “shocks” if there are unexpected changes in economic developments) which lead consumers to increase their expenditure or firms to reduce their production. The first instance, where demand increases, resulting in inflation, is often described as “demand-pull inflation” in the economic literature. The second instance, where costs increase and supply therefore decreases, thus also resulting in inflation, is often called “cost-push inflation”. The opposite happens, i.e. deflationary pressures emerge, if aggregate demand falls or aggregate supply increases. In general, monetary policy often has to respond to such developments in order to ensure price stability. In cases of inflationary pressure, the central bank would normally increase (real) interest rates to prevent that pressure from translating into more persistent deviations from price stability.

Examples of potential shocks:

a) Energy price shock
   - demand persistently outpaces the supply of energy, e.g. as occurs when emerging markets’ demand for energy develops faster than the supply available
   - supply declines rapidly, e.g. as a result of geopolitical tensions and, say, an oil blockade
b) Food price shock
   - demand persistently outpaces supply, e.g. on account of population growth and rising incomes
   - disruptions occur in the food chain
c) Financial turmoil
   - the stock exchange crashes
d) Technological breakthroughs
   - productivity goes up, thereby influencing prices
e) Structural reforms
   - product and labour market flexibility is enhanced, which can have an impact on prices
f) Natural disasters

Price increases that arise because of an increase in aggregate demand may result from any individual factor that increases aggregate demand, but the most significant of these factors, besides monetary policy (lower interest rate and an increase in money supply), are increases in government purchases, depreciation of the exchange rate and increased demand pressures for domestic goods from the rest of the world (exports). Changes in aggregate demand can also be caused by increased confidence and an improved economic outlook. It is likely, for example, that firms will invest more if higher profits can be expected in the future. Changes in aggregate demand will normally increase the price level and, temporarily, aggregate production.

What factors are likely to lead to a reduction in aggregate supply and thus to higher prices in the short run? The main sources of falling aggregate supply are decreases in productivity, increases in production costs (for instance, increases in real wages and in the prices of raw materials, notably oil), and higher corporate taxes imposed by governments. If all other factors remain the same, the higher the cost of production, the smaller the amount produced at the same price. For a given price level, if wages or the costs of raw materials, such as oil, rise, firms are forced to reduce the number of people they employ and to cut production. As this is the result of supply-side effects, the resulting inflation is often referred to as “cost-push inflation”.

Various circumstances could cause the price of inputs to rise, for instance, if the supply of raw materials such as oil falls short of expectations, or if the worldwide demand for raw materials rises. Increases in real wages (which do not happen to be matched by increased productivity) will also lead to a decline in aggregate supply and lower employment. Such wage increases may result from a decline in the labour supply, which in turn may have been caused by a government regulation which has the effect of reducing the incentives to work (e.g. higher taxes on labour income). An increase in the bargaining power of trade unions can also result in higher real wages. If the factors described above work in the other direction, we will see an increase in aggregate supply. For example, an increase in productivity (e.g. based on new technologies) would, all things being equal, lead to lower prices and higher employment in the short run as it becomes more profitable to hire labour at given wages. However, if real wages were to increase in line with productivity, employment would remain unchanged.
The role of expected inflation

When firms and employees negotiate wages and when firms set their prices, they often consider what the level of inflation may be in the period ahead, for example, over the following year. Expected inflation matters for current wage settlements as future price rises will reduce the quantity of goods and services that a given nominal wage can buy. So, if inflation is expected to be high, employees might demand a higher nominal wage increase during wage negotiations. Firms' costs increase if wage settlements are based on these expectations and these costs can be passed on to customers in the form of higher prices. A similar case can be made for price-setting on the part of firms. As many individual prices remain fixed for a particular period, firms which had planned to publish a new price list may increase their individual prices with immediate effect if they anticipate increases in the general price level or in wages in the future. So if people expect inflation in the future, their behaviour can already cause a rise in inflation today. This is another reason why it is very important for monetary policy to be credible in its objective of maintaining price stability – in order to stabilise longer-term inflation expectations at low levels, in line with price stability.

Taken together, a variety of factors and shocks can influence the price level in the short run. Among them are developments in aggregate demand and its various components, including developments in fiscal policy. Further changes could relate to changes in input prices, in costs and productivity, in developments in the exchange rate, and in the global economy. All these factors could affect real activity and prices over shorter-term horizons. But what about longer-term horizons?

This brings us to another important distinction in economics. Economists generally draw a distinction between the short run and the long run.

5. Factors driving price developments over longer-term horizons

What is the relative importance of these factors on inflation over longer-term horizons? Or in other words: are they all of equal relevance as regards inflationary trends? The answer is clearly "no". We shall see that monetary policy plays a crucial role here.

As already mentioned, there is a time lag of about one to two years between changes in monetary policy and the impact on prices. This implies that monetary policy cannot prevent unexpected real economic developments or shocks from having some short-run impact on inflation. However, there is widespread agreement among economists that monetary policy can control price developments over the longer term and therefore also the "trend" of inflation, i.e. the change in the price level when the economy has fully incorporated short-term disturbances.

In the long run, prices are more flexible and can respond to lasting changes in demand and supply (think, for example, of the spread of smartphones and netbooks, whose prices have declined over time). However, as already mentioned, in the short run many individual prices are sticky and will remain at their current levels for some time. How does this distinction influence our results? Without going into too much detail, it can be argued that output does not depend on the price level in the long run. It is determined by the given stock of capital; by the labour force available and the quality of that labour force; by structural policies which influence incentives to work and to invest; and by any technological developments in the field of production. In other words, the long-term level of output depends on a number of real or supply-side factors. These factors determine the exact position of the aggregate supply curve.

The other curve that determines the state of equilibrium of the economy is the aggregate demand curve. As we have seen, a number of factors can lead to increases in aggregate demand. Among them are increases in government expenditures, in external demand for exports, and in improved expectations of future productivity developments which might have an impact on current consumption and investment. It is obvious, however, that although many of these factors can increase even for a protracted period, a sustained increase in the general price level can, in the long run, only be driven by a sustained and ongoing expansionary monetary policy. This point is often made in terms of the famous statement – "inflation is always and everywhere a monetary phenomenon". Indeed, a number of empirical studies have provided evidence in favour of this hypothesis. The ultimate reason for an inflationary process in the longer run is, therefore, a sustained increase in money supply which is equivalent to a sustained expansionary monetary policy. In a longer-term perspective, monetary policy actions thus determine whether inflation is allowed to rise or is kept low. In other words, a central bank that controls the money supply and the short-term interest rate has ultimate control over the rate of inflation over longer-term horizons. If the central bank keeps short-term interest rates too low and increases the money supply by too much, the price level will ultimately also increase. This basic result is illustrated by the fundamental economic concept which addresses in more detail the relationship between money and prices, namely the quantity theory of money.
The quantity theory of money

According to an identity which is widely known as the quantity equation, the change in the money stock ($\Delta M$) in an economy equals the change in nominal transactions (approximated by the change in real activity ($\Delta Y_R$) plus the change in the price level ($\Delta P$)), minus the change in velocity ($\Delta V$). The velocity can be defined as the speed with which money is transferred between different money holders and thus determines how much money is required to serve a particular level of nominal transactions. In short:

$$\Delta M = \Delta Y_R + \Delta P - \Delta V$$

This relationship is a so-called identity, i.e. a relationship that can obviously not be falsified. It therefore does not provide any statements about causality. A sense of causality can only be inferred if further assumptions regarding the determinants of the variables are taken into account. In particular, the following two assumptions allow the quantity equation to be transformed into the quantity theory. First, output can, in the long run, be regarded as being determined by real-side factors like the productive opportunities of the community and its tastes and preferences. Second, in the long run, velocity is regarded as being determined by payment practices, financial and economic arrangements for effecting transactions and costs of and returns from holding money instead of other assets. It then follows that the quantity of money supply – which is determined by the decisions taken by the monetary authorities – is, in the long run, linked to the price level. Put another way, over the longer-term horizons, the price level is determined directly by changes in the quantity of money and it moves proportionally to the latter. One implication of this is that the institution which determines the supply of money, namely the central bank, is ultimately responsible for longer-term trends in inflation.

For more on inflation:

For more on euro area data:
http://sdw.ecb.europa.eu/

6. Summary

The central bank, as the sole issuer of banknotes and bank reserves, can influence money market conditions and steer short-term interest rates. In the short run, a change in money market interest rates sets in motion a number of mechanisms and actions by economic agents. Ultimately this change will influence developments in economic variables, such as output or prices. In the long run – after all adjustments in the economy have worked through – a change in monetary policy will only be reflected in a change in the general level of prices. All real variables, such as real output or unemployment, will remain unaffected. These variables are essentially determined by real factors, such as technology, population growth or the preferences of economic agents. This also means that the effects of changes in the real factors on price developments in the short run, can, over time, be offset by a change in monetary policy. In this respect, the longer-term trends of prices or inflation can be controlled by central banks.

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5 This reflects the fact that the left-hand side of the equation sums up the amount of money used, whereas the right-hand side reflects the value of the transaction.