

# Inflation: Theories, history and forecast

May 2022

# Overview

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- ❑ Strong increase in inflation in recent months. With regard to the causes and from a capital market perspective, our focus in this report is on the analysis of developments in the US.
- ❑ Due to statistical properties, inflation is far less predictable than, for example, economic growth.
- ❑ Historical developments: Inflation in the past 100 years. Phenomena: Hyperinflation, Phillips curve. Structural break in the 1990s due to globalisation?
- ❑ Monetarism: The theory has done little to understand and predict inflation over the past 30-40 years. In contrast, the relationship between interest rates and economic activity and ultimately inflation is well documented, with monetary policy driving economic activity and inflation with a considerable lag.
- ❑ Best, theoretically sound explanatory model over decades: Capacity bottlenecks in the economy as cause of inflation.
- ❑ Current inflation: Indirectly a result of the pandemic. Persistent inflationary pressure due to little spare capacity (full employment in Europe, overheated labour market in the US). Possible dampening factors: Stabilising energy prices, easing of the enormously high demand for goods in the US. 2-3 year forecast: Central bank targets of 2% a reasonable best guess.

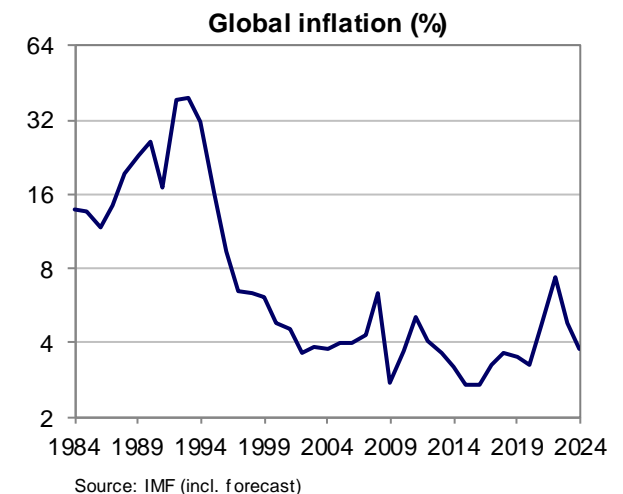
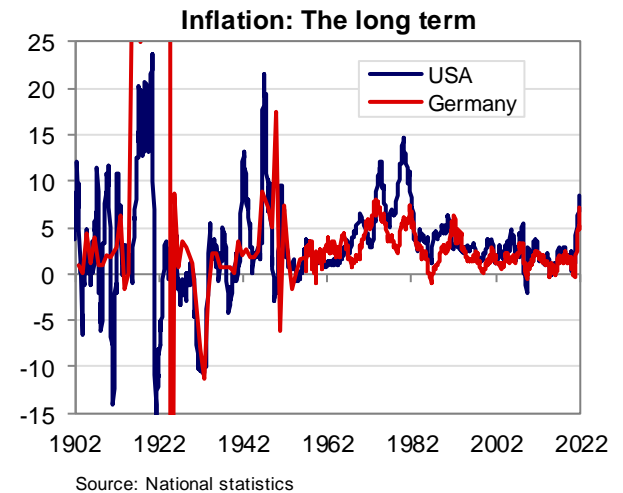
# Statistical characteristics and forecasts

The charts show inflation rates in the USA and Germany over the past 120 years and global inflation since the mid-1980s. Notable inflationary periods are the two World Wars (incl. the hyperinflation of the Weimar Republic after World War I), the 1970s and the recent sharp rise in inflation.

The charts also illustrate that inflation is not a stationary variable in the statistical sense: Inflation (unlike the unemployment rate, for example) does not oscillate over time around a roughly constant mean with a constant variance. This property makes an inflation forecast more difficult for statistical reasons than a forecast of real economic activity as non-stationary variables follow a random walk process without an anchor in the form of an ex-ante defined mean.

Simply put, the best forecast for stationary variables are their historic mean, whereas the best forecast for non-stationary variables is their latest value (i.e. when inflation is 10% or a million percent, the best forecast is 10% or a million percent, irrespective of the forecast horizon). Naturally, as stationary variables return, by definition, to their mean, forecasts for stationary variables (such as real economic growth) are much better over time than forecasts for non-stationary variables (such as inflation).

These properties illustrate that central bank inflation targets are highly important. If these targets are credible, inflation gets a stationary element, at least over the medium term.



# Structural break: Low inflation since the 1990s

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Around 1990: Structural break towards low and comparatively stable inflation. Well documented in the literature.

Reasons (overall only weak empirical evidence):

- ❑ Central banks: The number of independent central banks has increased worldwide; more central banks introduced inflation targets since the late 1980s. Inflation targets may have helped stabilise inflation expectations at low levels.
- ❑ Globalisation: China's entry into the World Trade Organisation (WTO) in 2001 as a milestone. Globally tradable goods and services mean global competition and little local pricing power (price increases by companies, wage negotiations).
- ❑ Technological progress: Deflation in the goods sector (e.g. computers, semiconductors). Sharing economy (e.g. Airbnb, Uber). Price transparency through e-commerce. Industrialisation of retail trade (examples are Walmart, Zara and IKEA).
- ❑ Moreover, in an ageing society, more and more employees with high wages retire at the end of their working lives, while those entering the labour force have lower wages (the argument is particularly compelling when the productivity gap between older and younger workers is smaller than the wage gap). According to the Fed, this demographic effect is statistically verifiable in the USA.

The fact that leading central banks have inflation targets is a key structural feature since the 1990s. Globalisation and other inflation-dampening factors that may have been at work likely will continue to have a moderating effect, even though these effects are hard to prove empirically.

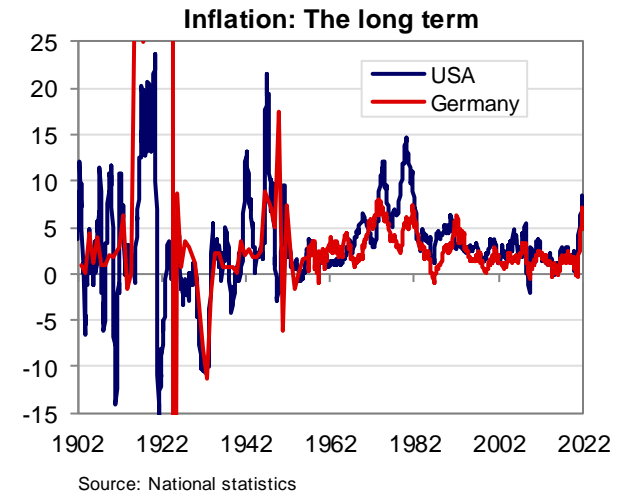
# Phillips Curve: Misguided Economic Policy

A special historical case is the inflation phase of the 1960s and 1970s.

After the 1958 discovery of the Phillips curve, which shows a negative correlation between wage increases (or inflation) and unemployment, it was soon interpreted, primarily in the US, in a way that the unemployment rate could be lowered (and thus prosperity increased) by accepting higher inflation.

The economic policy experiment of the 1960s based on the Phillips curve ended in a marked rise in inflation. In the 1970s, oil price shocks were an additional factor that drove inflation higher.

Eventually, massive monetary tightening in the US (under then Fed chairman Paul Volcker) ended the inflation phase of the 1970s.



# Central banks used as “printing press”

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## Hyperinflation

Episodes of extremely high inflation or even hyperinflation are often found in a constellation where high government financing needs coincide with insufficient financing from the private sector. If the central bank is used to finance government spending (which requires the central bank to be controlled by the government), such a process can indeed lead to hyperinflation. This pattern is evident in the hyperinflation episode of the Weimar Republic. Another example is Zimbabwe in the 2000s.

The (modest – when compared to the episodes described above) rise in inflation in the USA after World War II can be linked to the government interfering with monetary policy. Despite the Federal Reserve's statutory independence since 1913, US monetary policy between 1933 and 1951 was effectively set by Congress and the federal government.

Governments using the “printing press” essentially means that the government crowds out the private sector in goods and services markets. Ensuing capacity bottlenecks lead to higher prices.

## Bond purchases: A monetary policy tool

The high bond purchases (quantitative easing) by leading central banks in industrialised countries since the financial crisis may at first glance appear to have parallels to historical phases of high inflation, when central banks were exploited by cash-strapped governments. The motivation behind the current bond purchases, however, is quite different. Quantitative easing has been widely used by central banks as a monetary policy tool since the financial crisis. The key difference is that central banks buy government bonds at their own discretion and not on the instructions of governments that face difficulties in accessing private sector funds.

# Monetary policy: Milton Friedman's monetarism

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## **Friedman and Schwartz (1963): A Monetary History of the United States, 1867-1960**

1. "Changes in the behavior of the money stock have been closely associated with changes in economic activity [...] and prices.
2. The interrelation between monetary and economic change has been highly stable.
3. Monetary changes have often had an independent origin; they have not been simply a reflection of changes in economic activity.
4. In monetary matters, appearances are deceiving; the important relationships are often precisely the reverse of those that strike the eye."

Friedman (1963): **"Inflation is always and everywhere a monetary phenomenon."**

Friedman argued that nowhere in the world would one find inflation that was not caused by a previous increase in the supply of money.



**These hypotheses have done little to understand and predict inflation in the past 30-40 years.**



**Alternatives?**

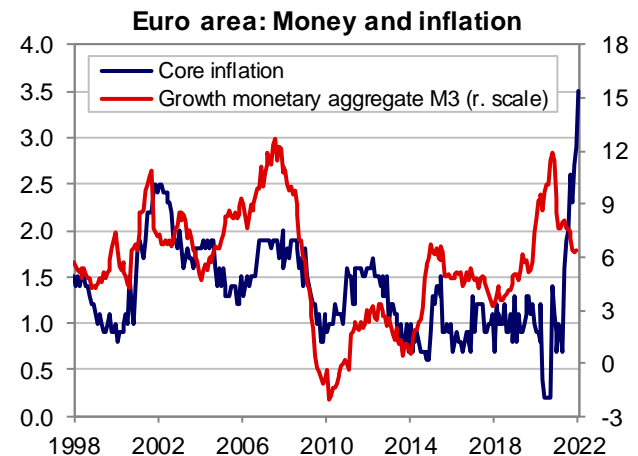
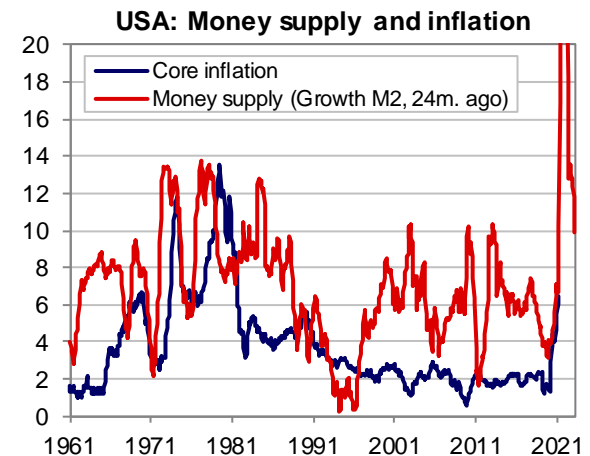
# Money supply and inflation: No clear relationship

## USA

- ❑ 1960s and 1970s: Money supply (M2) very good leading indicator of inflation. Since the mid-1980s: No correlation between money supply and inflation, i.e. money supply is unsuitable as a forecasting instrument.
- ❑ Correlation coefficients:
  - 1960-1985 = +0.36
  - Since 1985 = -0.04 (i.e. no correlation)

## Eurozone

The chart indicates a certain positive correlation between the money supply and inflation. However, the temporal causality is unclear: At times, money supply growth follows inflation, at other times it is the other way round.





# Fisher equation: Not a theory

## Fisher equation

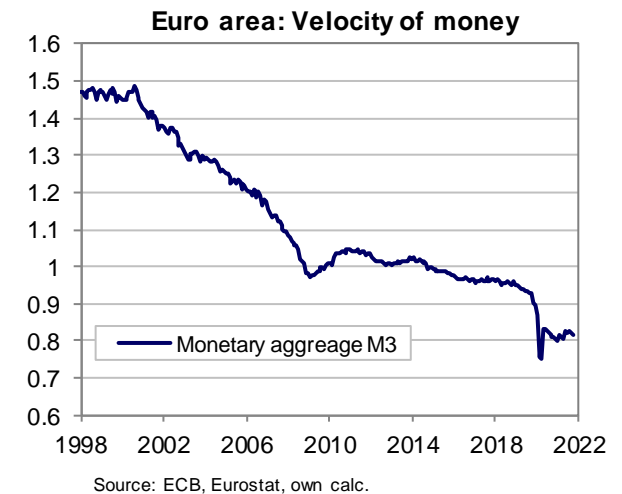
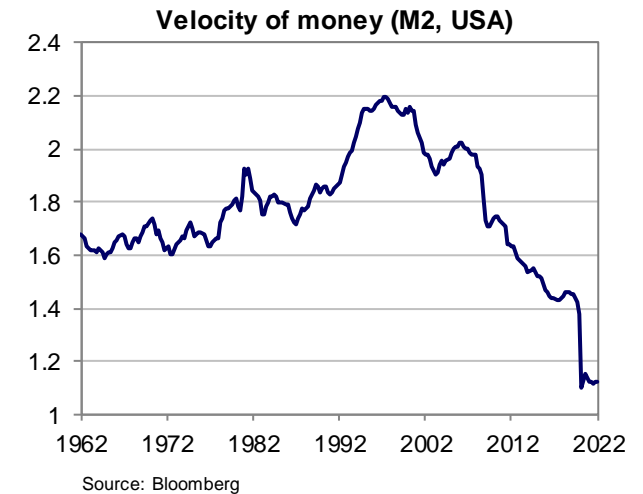
$$M \cdot v = P \cdot y$$

The money supply  $M$  multiplied by the velocity of money  $v$  equals, by definition, the value of all transactions, i.e. the price level  $P$  multiplied by the volume of transactions  $y$  (the roots of the Fisher equation go back to the 16th century).

Special case (theory): If  $v$  and  $y$  are constant, then  $M$  and  $P$  move synchronously. The charts show that the velocity  $v$  is by no means constant over time.

Even if  $v$  and  $y$  were roughly constant, the Fisher equation says nothing about causality, i.e. whether  $M$  is caused by  $P$  (rising demand for money due to an increased price level) or vice versa. The latter would presuppose that  $M$  is controllable by an actor (state or central bank).

Simple statistical analyses of temporal causality for the USA with data from 1880 to 2020 show that  $M$  is determined somewhat more by  $P$  than  $P$  by  $M$  (with the usually assumed to be the exclusive causality).



# Money stock: Demand determines the quantity

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## Definition of the European Central Bank

M0: Banknotes and coins outside the central bank (including cash holdings of commercial banks) plus the central bank money holdings of credit institutions on accounts at the central bank

M1: Currency in circulation at non-banks (i.e. excluding cash holdings of commercial banks) plus sight deposits of non-banks

M2: M1 plus deposits with agreed maturity of up to two years and deposits redeemable at notice of up to three months;

M3: M2 plus shares in money market funds, repo liabilities, money market paper and bank debt securities with a maturity of up to two years.

## Conclusions

- ❑ M0 can only be controlled by the central bank to a limited extent (directly, in particular through reserve requirements).
- ❑ The remaining aggregates (M1 to M3) reflect the demand for money of the non-bank sector. Increased cash holdings, for example, may occur in a crisis (i.e. for safety reasons) or when the economy is booming (rising deposits reflect rising bank loans and rising transaction volumes).

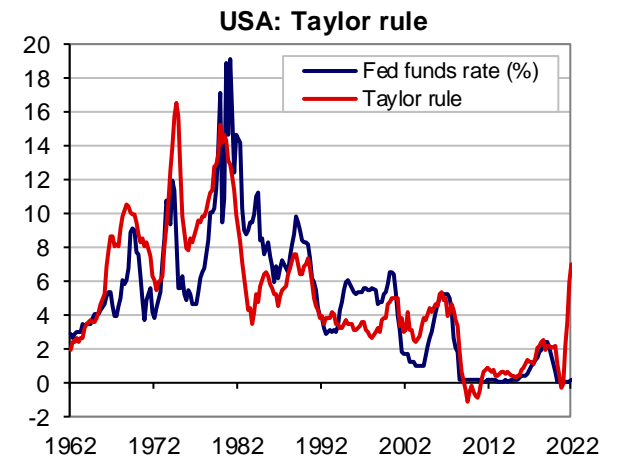
# The price of money may explain inflation

To assess whether a central bank's policy rate is in line with the economic environment, the Taylor rule can be used (input variables are inflation, the inflation target of the central bank, the business cycle and the neutral real interest rate, with the latter driven by demographics and labour productivity growth).

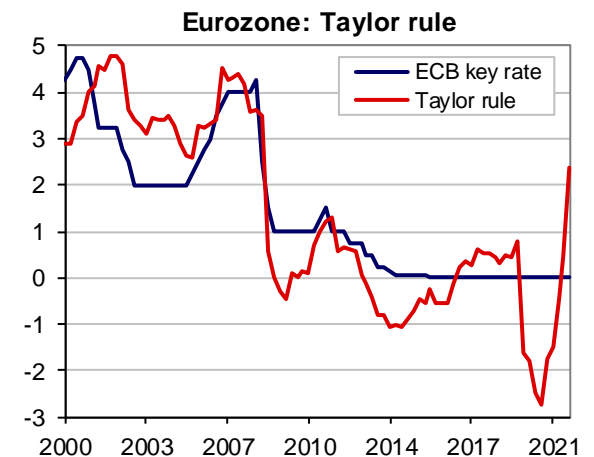
Indeed, the US example shows that monetary policy was too loose in the 1960s and 1970s. The Federal funds rate (the key US central bank key interest rate) was lower on average than the level indicated by the Taylor rule in that period. Cheap money in the 1960s and 1970s could thus explain the rise in inflation in that period – and too expensive money the decline in the 1980s and 1990s.

The chart for the euro area shows that since the financial crisis of 2008, the key ECB interest rate has been higher on average than indicated by the Taylor rule. In the US, the policy rate has been almost perfectly in line with the Taylor rule over the past fifteen years. This means that monetary policy has not been too loose in the past fifteen years (currently, due to the surge in inflation in recent months, monetary policy is too loose for the first time in over fifteen years).

Another interpretation of the excessively low interest rates in the 1970s would be that this circumstance caused the economy to overheat more strongly and for longer than in later decades, suggesting more pronounced capacity constraints and thus higher inflation in the 1970s (see the section on productive capacity and its role as an inflation driver).



Source: Fed, CBO, own calculations



Source: ECB, IMF, own calculations

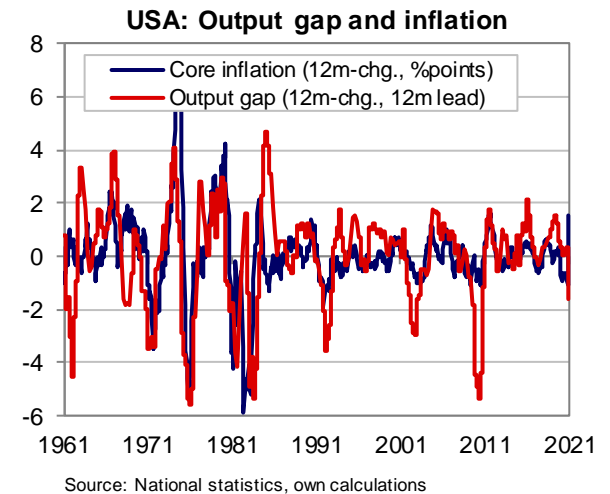
## Best explanatory model: Capacity constraints

The chart shows the year-on-year change in inflation (in percentage points) and the output gap (the 12-month change, 12 months ahead). A positive output gap means that there are capacity constraints. In such an environment, firms are more inclined to raise prices than when demand is weak. Likewise, wage pressures emerge. The output gap determines inflation with a lag of about one year. The relationship is surprisingly stable over the last six decades – quite different from money supply and inflation.

The chart also shows that both the output gap and inflation recorded larger swings in the period from 1960 to the mid-1980s than after 1990, which means that the volatility of inflation correlates with that of the real economy. Our simple output-gap model thus explains the lower inflation since the 1990s to a good extent. Therefore, moderating inflationary factors such as globalisation may not even be needed to explain the structural break in inflation around 1990.

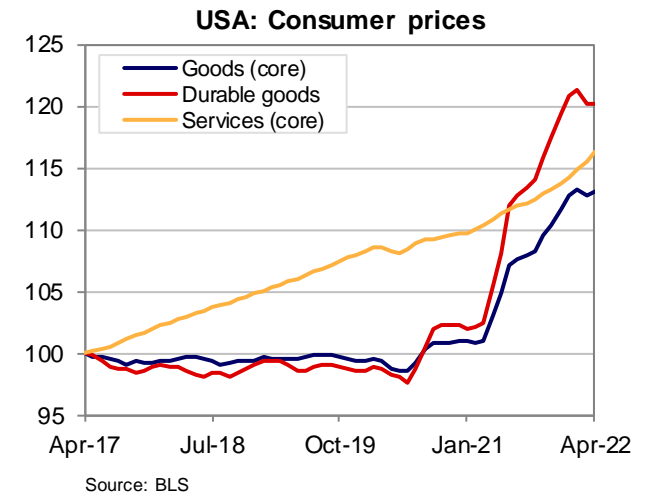
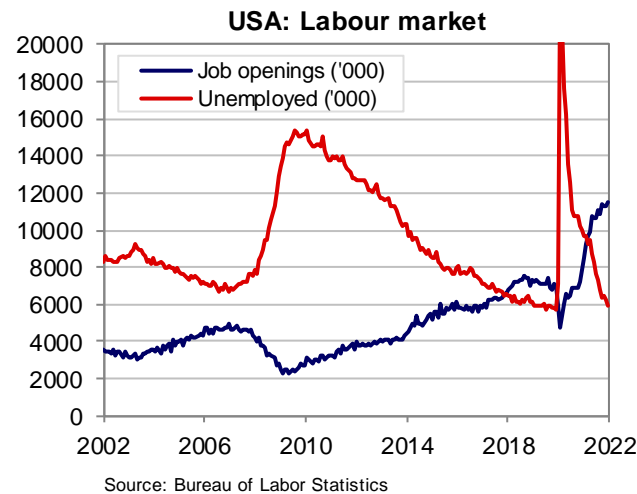
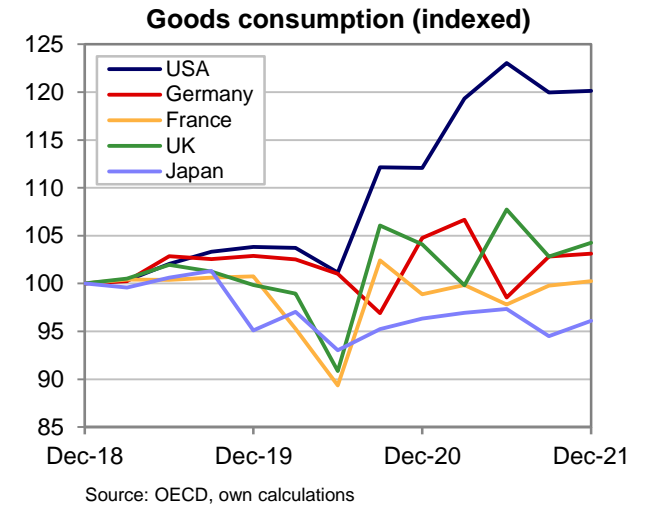
Correlation coefficients (variables in the chart): 1960-1985 +0.48, since 1985 +0.45 (this compares with the correlation coefficient of money supply growth and inflation since 1985 of -0.04).

This analysis suggests that the business cycle is a good indicator of changes in inflation. We also note that the inflation spike in the 1970s can be well explained by economic trends, with the oil price shocks of the 1970s only driving inflation higher when the economy was already overheating.



# Pandemic: Bottlenecks on the goods markets

Measured against the short-lived collapse in demand (primarily the lockdowns in 2020), there was oversized government support for households, the unemployed and businesses in the US, amounting to some 25% of GDP in government aid, a large part in the form of direct cash payments. In addition restrictions in the consumption of services (especially travel, restaurants and events) caused a shift in spending towards goods, driving an outsized rise in goods demand. This in turn led to considerable frictions and bottlenecks in the supply chains and a strong rise in goods prices. While all industrialised countries supported their economies during the pandemic, no country has experienced a major rise in goods demand (see the chart). The US labour market in particular now shows signs of overheating: There are two job openings for every unemployed person – a ratio not seen before.

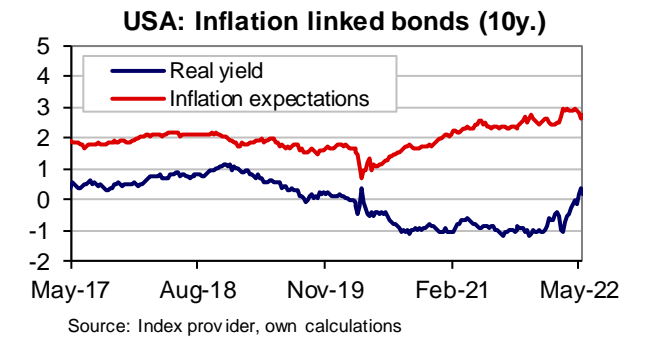
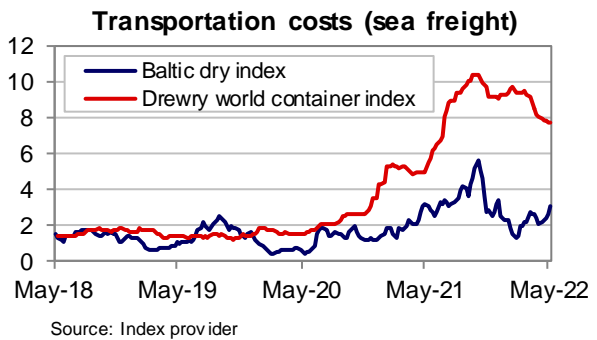
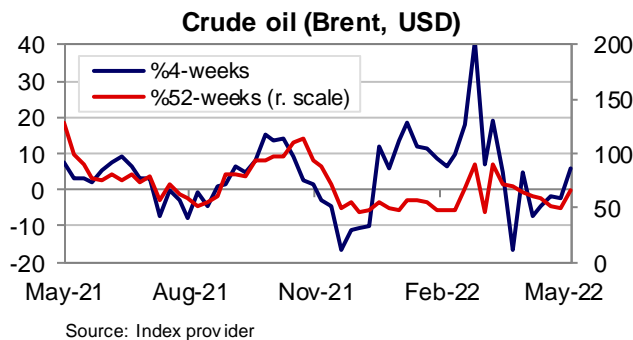
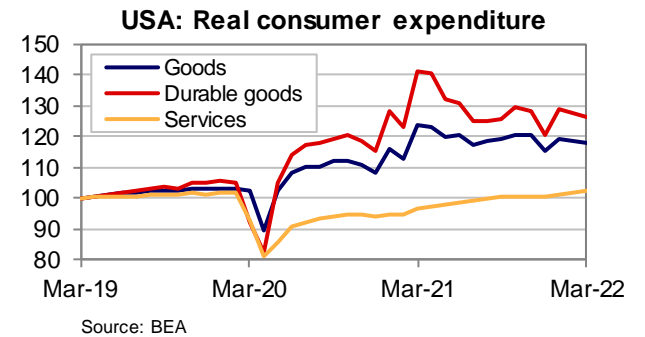
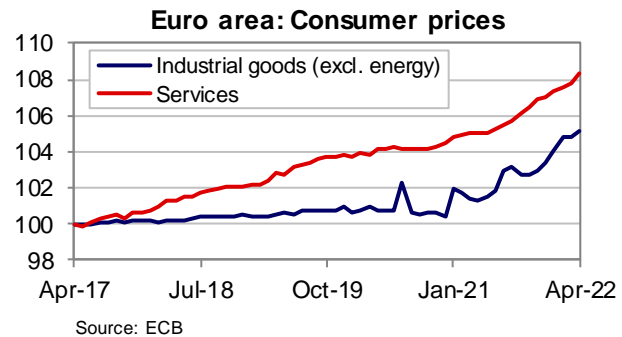
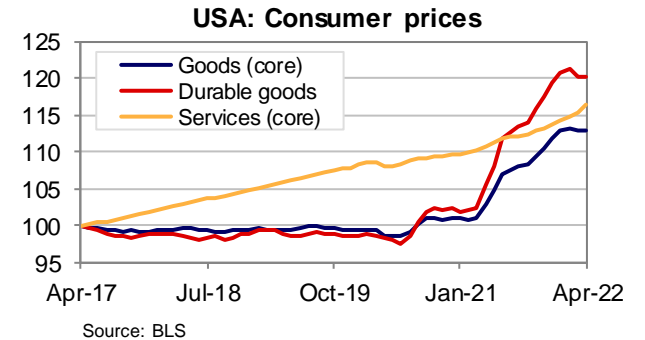
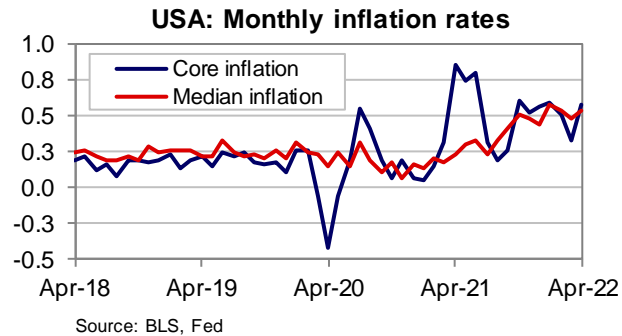


# Current trends: Inflation indicators

Monthly median inflation in the US – a measure of broad inflationary pressure – has remained high (see the corresponding chart).

Goods markets do not show conclusive evidence of inflation pressures easing.

Stabilising energy prices likely will contribute to lower total inflation rates in the months ahead (with trends in core inflation, which excludes energy, remaining unclear).



# Headline inflation gradually declining

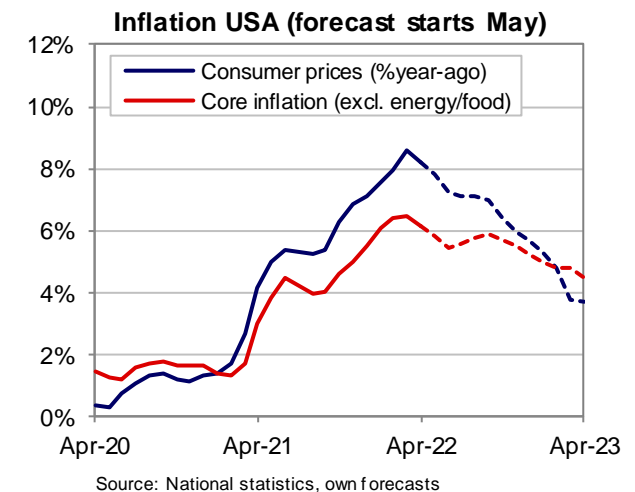
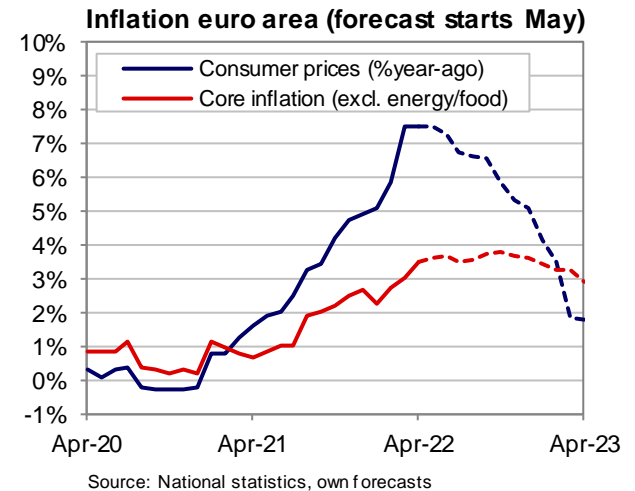
Behind the surge in inflation in recent months are a strong increase in energy prices and a strong upward trend in goods prices (excluding energy products).

With energy prices roughly stable as of late, an easing in the energy component of inflation is taking place. Some easing of pressure on goods prices is a possibility in the second half of the year (reduced supply chain disruptions, increased capacity and a shift in demand towards services).

The economy is robust overall, however, and unemployment rates are historically very low in both Europe and the US. Such an environment favours rising wages and the pass-through of cost inflation from companies to consumers. Some persistence of inflation can therefore be expected, especially in the US.

The charts show our baseline scenario for the inflation path (consumer price index year-on-year). Based on the baseline scenario (which, however, remains subject to unusually high uncertainties), core inflation would still be above the central bank targets of 2% in 12 months' time.

Despite some decline in headline inflation, monthly inflation rates, especially core inflation, will remain the key focus of the capital markets and central banks.



# Summary: Explaining and fighting inflation

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## Causes of inflation

- ❑ Clearly the best theory to explain changes in inflation is capacity constraints resulting in a shift in pricing power towards companies and wage earners. In addition, data show that economic momentum affects inflation with a lag of about 12 months.
- ❑ There is a thesis of structural breaks in the 1990s. Indeed, a key structural change was that leading central banks have introduced inflation targets since the 1990s.
- ❑ Monetary policy: The level of interest rates (not the money supply) helps to explain inflation. These results are statistically hard to prove, however, as there are not enough long phases during which interest rates were markedly below or above the fair level as indicated by the Taylor rule.
- ❑ There are instances and phases in which economic policy was misguided (i.e. when states used their central banks as their printing press; the exploitation of the Phillips curve in the 1960s and 1970s).

## Fighting inflation

As the years following the financial crisis have shown, it is sometimes difficult for central banks (the most prominent example is the ECB) to raise inflation from below the 2% target rate to the target rate. Conversely, central banks have the option to lower inflation if it is deemed too high. Our analysis suggests that lowering inflation requires fewer capacity constraints. Since productive capacity (especially labour) is largely fixed, central banks need to reduce demand (consumer and investment demand) to lower capacity pressures. The main tool to achieve this goal is higher interest rates. As inflation is currently partly caused by excessive demand for goods, a normalisation of goods demand in the US later this year could partly, but not completely, take over the task of central banks.



# Building blocks of our inflation forecast

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Policy mistakes were made in the US during the pandemic. These mistakes helped to trigger the current rise in inflation, even though these factors are no longer present:

- ❑ Excessive fiscal packages during the pandemic (although fiscal policy is no longer expansionary, the impact of the 2020/21 packages is still being felt).
- ❑ The Powell Fed has had a strong focus on full employment until 2021. Inflation risks are now recognised and in the fore.

Capacity constraints: Record low unemployment rates mean persistent inflationary pressure. Relief could come from stabilising energy prices and later in the year once goods demand in the US has shown signs of easing (unclear: supply chains – relief or continued disruptions, especially due to China lockdowns). The fact that there are long lags before rising interest rates affect the economy and inflation, the inflation theme likely will keep the capital markets busy until at least through 2023.

Conversely, there are no indications that a structurally too loose a monetary policy would have triggered the current spate of inflation.

## Conclusion

- ❑ Forecast for the coming 12 months: There are opposing effects, with underlying inflationary pressures pointing to a continued rise in inflation, while stabilising energy prices and a drop in goods demand (likely later in the year) point to lower inflation. Overall, our best guess is that headline inflation will be lower in a year from now, with the US likely having seen peak year-on-year inflation in March this year. Core inflation likely will be above 2% in the US and in Europe.
- ❑ Medium-term (starting no later than 2025): 2% inflation targets of the Federal Reserve and the ECB are a reasonable best guess.

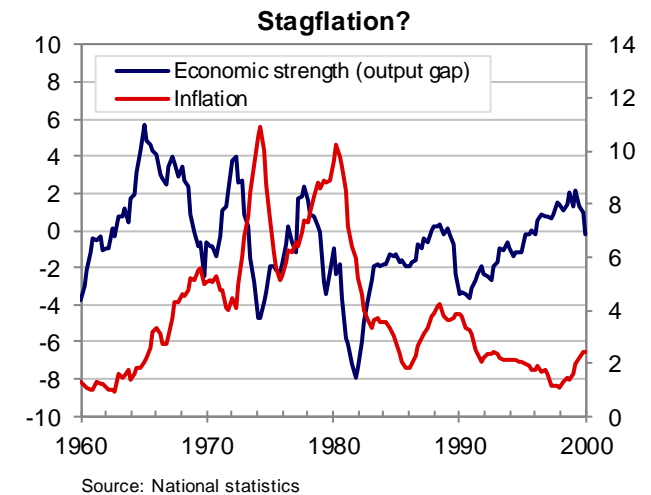
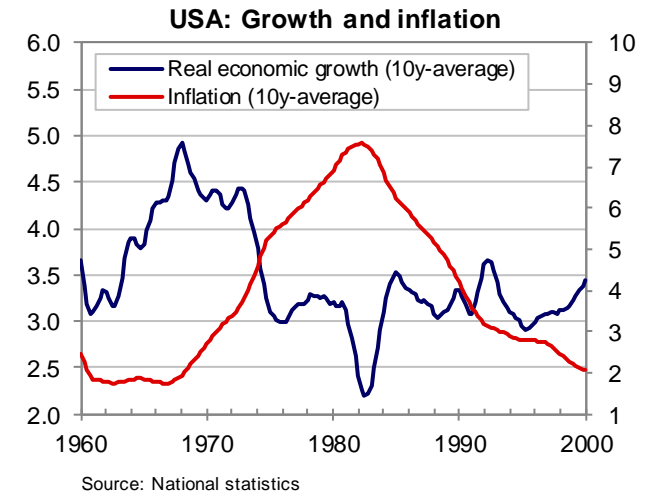
## Annex: Stagflation – an overused term

Stagflation is the simultaneous occurrence of economic weakness and inflation. The phenomenon of stagflation became an issue in the 1960s in the UK and especially in the wake of the oil price shocks of the 1970s.

Looking back at the 1960s in the 1970s (top chart), economic growth was indeed lower and inflation markedly higher. However, the 10-year average growth rate was no lower in the 1970s than in the following decades.

Bottom chart: It is easy to see (and empirically confirmed over long periods) that inflation follows the business cycle with a lag of about one to two years. Impression of stagflation: 1974 and 1980.

Stagflation is thus not a persistent state in an economy but a snapshot of growth and inflation, with these two variables moving asynchronously in the economic cycle. The concept of "stagflation" is therefore unlikely to be useful in analysing and forecasting the economies of industrialised countries.



## Annex: Wage-price spiral concept

In connection with inflation, a so-called wage-price spiral often comes into play. The concept suggests that an increase in wages triggers companies to raise sales prices (to pass on higher costs to customers, thereby preserving profit margins), which in turn leads to higher wage demands in response to increased goods prices. The mechanism works when there is full employment and employees have the power to negotiate higher wages and companies enjoy pricing power. In a phase of economic weakness, such as when a central bank slows the economy by raising interest rates, the mechanism works in the opposite direction and inflation falls.

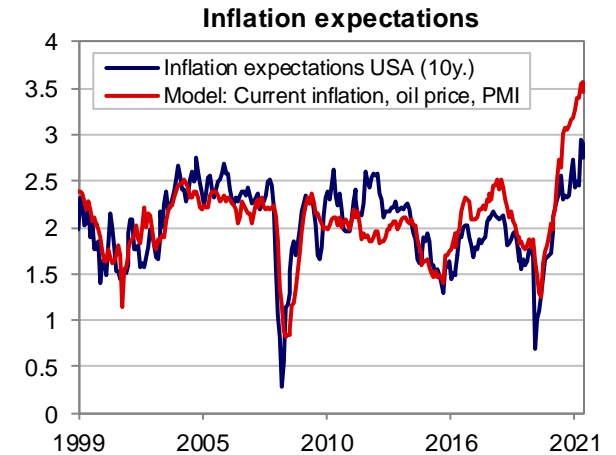
While a wage-price spiral may reinforce inflationary and deflationary tendencies, it is not an independent mechanism driving inflation outside the control of central banks.



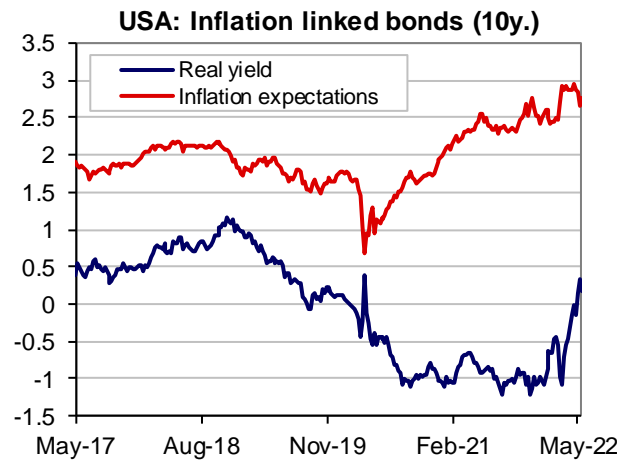
# Annex: Inflation expectations – Not a long-term forecast

Inflation expectations can be derived from market prices and surveys. The expectations derived from inflation linked bonds can be explained surprisingly well with current data (see "Model" in the top chart). For the model estimation we used the current inflation as well as changes in the oil price and the economy (represented by the PMI, i.e. the industrial purchasing managers index).

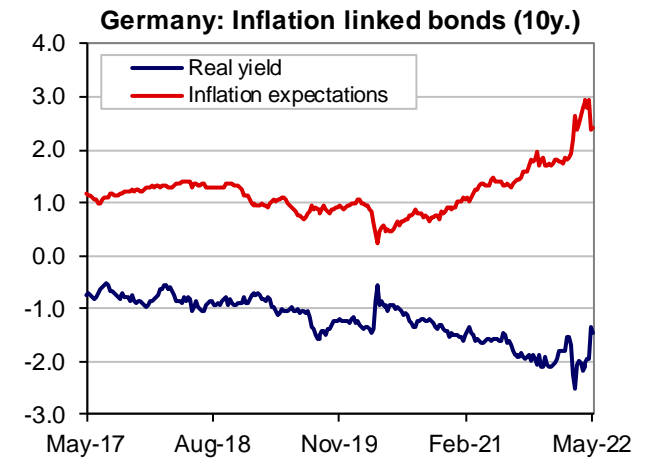
It is doubtful that current economic data are a good predictor of inflation over the following ten years.



Source: Index provider, own calculations



Source: Index provider, own calculations



Source: Index provider, own calculations

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