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**Research Report**

The new inflationary environment: How persistent are the current inflationary dynamics and how is monetary policy expected to respond?

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# The new inflationary environment

How persistent are the current inflationary dynamics and how is monetary policy expected to respond?

Markus Demary / Anna-Lena Herforth / Jonas Zdrzalek

Köln, 13.04.2022

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## **JEL-Classification**

E31 – Price Level, Inflation, Deflation

E32 – Business Fluctuations, Cycles

E52 – Monetary Policy

## Summary

We argue that the period of low inflation has come to an end based on six structural factors, which define the new inflationary environment:

- **De-Globalization** gained momentum with the Zero-Covid policies in Asia which have caused disruptions in international shipments and thereby contributed to higher food prices as well as to higher prices for raw materials and intermediate products. It has further accelerated with the Russian invasion in Ukraine. As countries have started to lessen their energy-import dependency on Russia, the pandemic-related higher energy prices are expected to rise even further. Since a rise in oil prices is found to have an effect on the CPI for over 12 months, longer lasting effects are likely.
- **Decarbonization** is fostered through the introduction of CO<sub>2</sub>-prices and this price increase is necessary for the economy to transform away from fossil-fuels towards carbon-neutral energy. Because of adjustment costs for households in adapting to the higher energy prices by energy saving investments, the transition period is accompanied with rising energy expenditures for households.
- **Demographics** affect the labor markets globally in the longer term by enhancing the scarcity of workers and thereby increasing the competition to find skilled personnel. The tighter labor market offers the possibility to demand higher wages. This tightness can already be observed in the US. While short-term work schemes in the EU have prevented that a larger fraction of labor contracts have to be renegotiated, the situation is different in the US, where a large fraction of labor contracts has to be renegotiated, while the labor market has become tighter due to the reduction in the employment ratio.
- **Digitalization** has contributed to lower inflation. But due to temporary supply-side frictions, the scarcity of semi-conductors has led to increases in the prices of electronics. Given a higher demand for electronics during the digital transformation, the prices are expected to rise, thereby possibly ending the price decreasing effect of digital innovations on inflation.
- **Fiscal policy** in the US has led to an overheated economy with demand-driven inflation, while fiscal policy in Europe was more focused on shielding companies from the negative consequences of the pandemic by means of short-time work schemes and liquidity measures. However, the EU has to spend heavily on military equipment. Moreover, it has to invest in the transformation away from fossil-fuels in order to lessen its dependency on Russia. The fiscal response could probably lead to demand-driven inflation.
- **Monetary policy** has created a low interest rate and high liquidity environment, in which governments and companies have experienced favorable financing conditions. This environment was not inflationary for a longer time since governments and companies were in a process of debt consolidation. But this process has come to an end, since necessities to invest in carbon-neutrality and increases in military spending have emerged. While Eurozone inflation is predominantly energy-price driven, US inflation is mainly demand-driven. These different inflation causes yield different monetary policy responses which could lead to a positive interest rate differential between the US and the Eurozone. A weaker Euro would reinforce the energy-driven inflation in the Eurozone.

How high will inflation rise? How long will the new inflationary environment last? How challenging is it for central banks to counteract these inflationary pressures? A stagflation like in the 1970ies seems possible given these trends. The energy-crisis made the transformation of our energy systems necessary, which is, however, progressing slowly, thereby contributing to a longer lasting energy-triggered inflation. The highest risk will be an energy embargo, resulting in a deep recession together with high inflation. In this case monetary policy might be forced to inject high amounts of liquidity into markets despite high inflation.

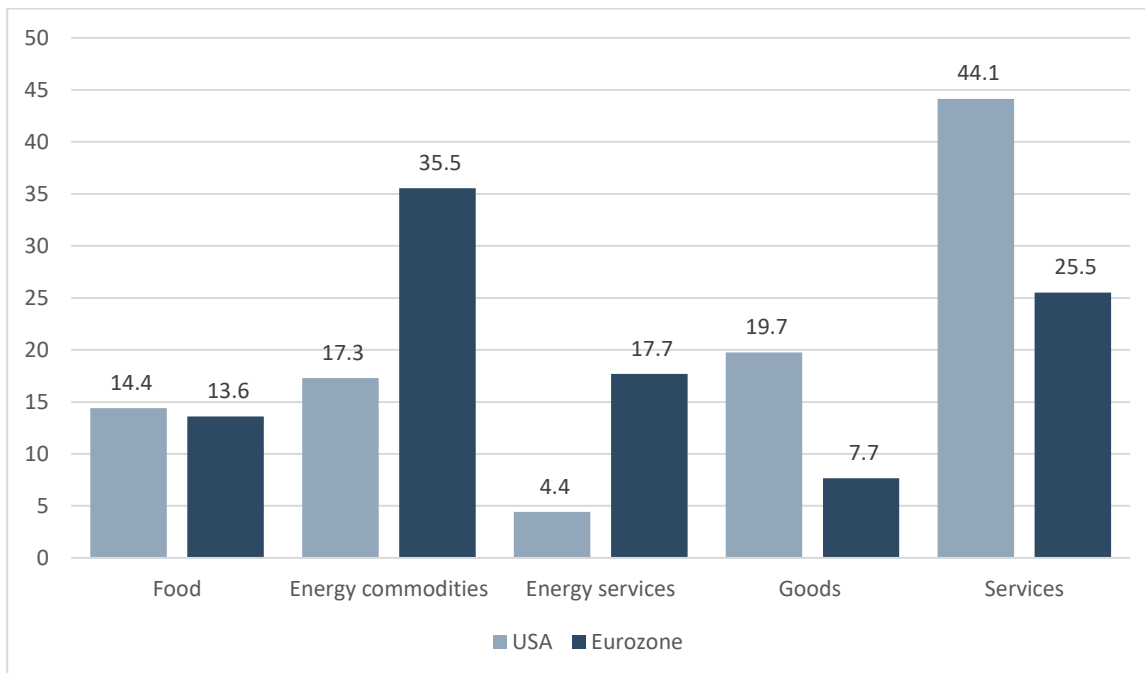
# 1 The current situation

After a longer period of low inflation – way below the inflation targets of most central banks - inflation has started to rise during the Covid-19 pandemic and has accelerated with beginning of the invasion of Russia in Ukraine. What looked like a combination of many one-off effects at first sight is now gaining persistency. The energy crisis and the expected food crisis triggered by the war are further strengthening the persistency of high inflation. Although authors like Charles Goodhart and Manoj Pradhan warned early about higher inflation in the longer term through demographic change (Goodhart / Pradhan, 1997), these factors seemed to be more of a future threat leaving inflation expectations to be anchored for a long time. But the direction seems to be clear: the low inflation environment has ended and tackling high inflation is the new challenge for policymakers.

What are the drivers of the new inflationary environment? As can be seen from figure 1-1, higher inflation in the US and in Europe might be caused by different factors. While rising food prices affect the inflation rates in both economies in a similar way, price increases of goods and services tend to drive the US inflation rate, while energy prices tend to drive the Eurozone inflation rate. It can be observed that service inflation can explain 44.1 percent of the current US inflation rate, but it can only explain 25.5 percent of the current EU's inflation. A similar picture emerges for goods inflation, which explain 19.7 percent of US inflation, but only 7.7 percent of Eurozone inflation. Energy commodity prices, like the prices of oil and gas, explain 35.5 percent of the EU's inflation rate, but only 17.3 percent of the US inflation rate. Energy services, like electricity, explain 17.7 percent of the Eurozone inflation, but only 4.4 percent of US inflation.

**Figure 1-1: Factors contributing to inflation in Europe and the USA**

Inflation contributions in percent of the inflation rate, February 2022



Source: own calculations based on Bureau of Labor Statistics and Eurostat

This picture gives rise to the hypothesis that the causes of inflation have shifted between the Eurozone and the US. While inflation started with pandemic related supply-side bottlenecks in both jurisdictions, Eurozone

inflation is now mostly driven by supply-side factors, while the US inflation is mostly driven by demand-side factors, leaving different conclusions for monetary policy.

The different causes of inflation in the EU and the US make it necessary to analyze the different channels through which inflation is expected to hike further. We therefore analyze the persistency of what we call the new inflationary environment along the following six factors:

- **The trend towards de-globalization:** The Zero-Covid-strategies of many Asian countries have led to delays in international shipments and caused increasing maritime transportation costs leading to disruptions in international supply-chains and a scarcity of raw and intermediate products as well as of food. The disruptions in supply-chains through Zero-Covid-policies and the Russian war with Ukraine have led to a rethinking about international labor division. As a response to the war, many firms have quit business in and with Russia and the firms are re-orientating towards new markets. This re-orientation might have severe consequences for the supply of energy, food and raw materials.
- **The green transition of the economy:** Rising CO<sub>2</sub>-prices will increase the costs of using fossil-fuel energy, which is intended for mastering the climate-neutral transformation. However, there is a transition period, in which these higher prices rise the cost of living since households need some time to adapt and replace their fossil-fuel dependent homes and vehicles. In addition to that, the pandemic and the war have dramatically increased the prices of all forms of energy except sun and wind.
- **The role of digitalization for inflation:** In the past, high-tech consumer goods, like smartphones, have experienced extreme quality increases accompanied with little price increases, so that their quality-adjusted prices have fallen significantly. Due to disruptions in supply-chains, the prices of these goods have now increased, too, and thereby not only contributed to inflation by non-existent negative contributions to inflation, but also by positive contributions.
- **The role of demographic change for inflation:** Charles Goodhart and Manoj Pradhan introduced the idea that there are fewer younger people entering the labor force so that labor shortages will lead to higher wages (Goodhart / Pradhan, 2017). The aging of societies can be seen in most countries of the world together with a scarcity of young people entering the labor force. However, this effect seems to gain momentum in the future leading also to higher inflation as other factors might calm down. The pandemic related responses of the labor market are different in the US and the EU with a lower employment ratio in the US, which leads to different risks for the emergence of price-wage-spirals.
- **Fiscal policy:** In the US fiscal expansion has contributed to an overheated economy with demand-driven inflation, while fiscal policy in Europe was more focused on shielding companies from the negative consequences of the pandemic by means of short-time work schemes and liquidity measures. The European Union, however, has to increase its military spending and fasten its transformation away from Russian fossil-fuels as a response of the Russian invasion in Ukraine.
- **Monetary policy:** Central banks have increased their balance sheets in response of many crises ranging from the Global Financial Crisis in 2008/09 to the Banking and Sovereign Debt Crisis in the Eurozone to the Covid-19 pandemic from 2020 on. Low policy interest rates and low funding costs in capital markets have not spurred inflation for a long time since households, companies and governments were in a process of deleveraging for many years. The transition to climate-neutrality and the need for more defense spending as a response to the Russian aggression in Ukraine might lead to a new inflationary growth based on low funding costs. A distinction between the US and the EU is necessary here, since both jurisdictions can be differently affected by supply-side and demand-side inflation.



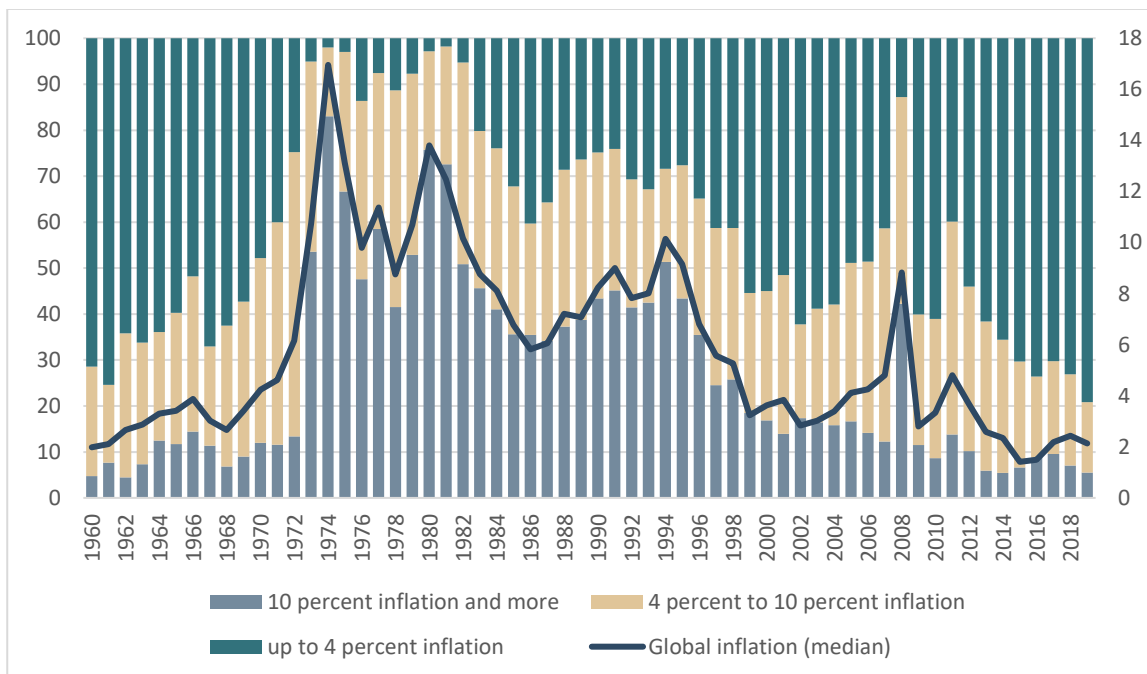
We start by an overview of traditional theories of inflation and apply their predictions to the new inflationary environment. We then analyze the six trends as drivers of high inflation. After that we conclude our analysis and present our recommendations for policy makers.

## 2 Traditional theories of inflation

The different inflation theories gained momentum or lost momentum with the height and the persistence of inflation. Figure 2-1 shows the development of inflation until 2019. The 1970ies mark a high inflation period in which up to 83 percent of all countries faced double-digit inflation rates. With the disinflationary policies of many central banks in the 1980ies the number of high inflation countries (with double-digit inflation rates) was declining, while the number of low inflation countries (with inflation rates of up to four percent) was rising. This was the time in which the monetary inflation theories gained momentum. Until the year 2019 close to 80 percent of a countries became low inflation countries, while only 5.5 percent of all countries still experienced double-digit inflation rates. During the time, which is called the Great Moderation, up to 38 central banks adopted the inflation targeting strategy (Jahan, 2003). The median inflation rate in 2019, the year before the Covid-19-pandemic, was 2.2 percent marking approximately the inflation target of most central banks. During this time, the new secular stagnation theory of Lawrence Summers and the balance sheet recession hypothesis of Richard Koo were the dominant theories of explaining the low inflation environment after the Global Financial Crisis (Summers, 2015; Koo, 2011).

**Figure 2-1: Global Inflation**

Inflation rate (right scale): in percent per year, shares of countries with low, medium and high inflation (left scale): in percent of all countries



Source: Own calculations based on World Bank

As the Covid-19 pandemic has led to disruptions in supply-chains beginning in 2020, inflation started to increase, ending the period of low and stable inflation. In the euro area, the inflation rate was 5.0 percent in December 2021 and rose to 5.9 percent in February 2022. In the US the inflation rate is currently at 7.9

percent. In this environment, inflation theories are coming back into focus to provide a basis for the causes of current inflation.

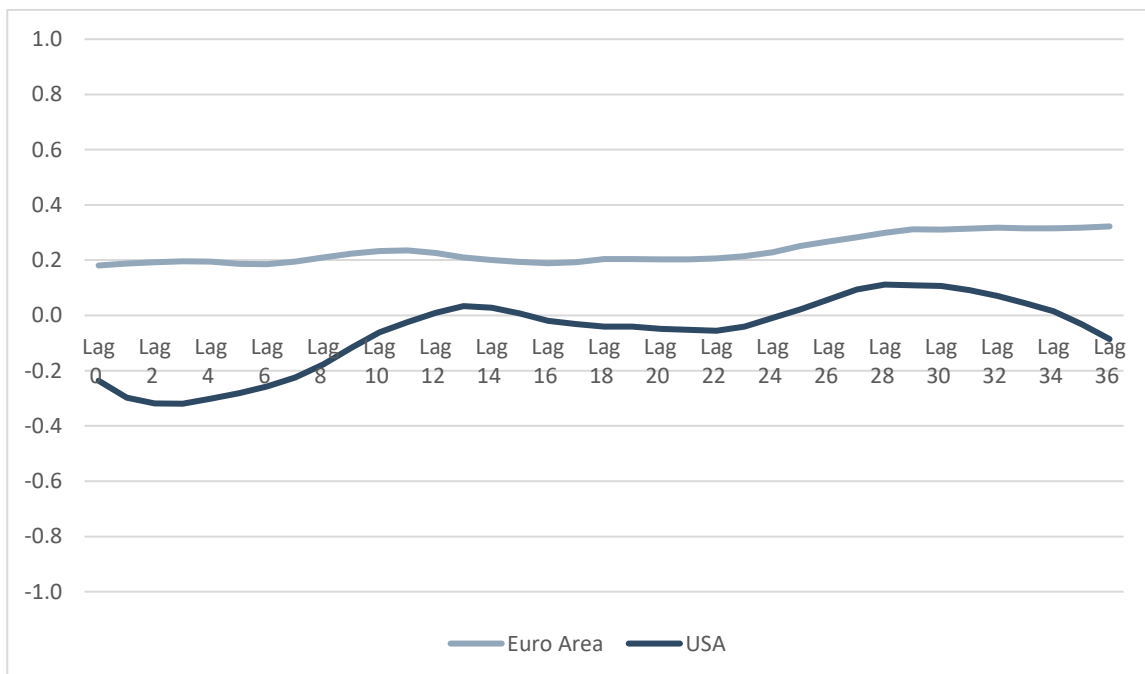
The different periods of high and low inflation were caused by different factors, which has led to the emergence of different inflation theories. These theories can be broadly divided into two groups: monetary and non-monetary. While the former explain inflation by an excessive expansion of money supply, the latter attribute inflation to supply- or demand-side pressures.

## 2.1 The quantity theory of money

The quantity theory of money is one of the most influential and best-known theories of monetary economics. It states that changes in the money supply are translated into a proportional change in the price level. The inflation rate thus equals the growth rate of money supply (for a discussion of the quantity theory see for example Samuelson / Nordhaus, 2009a; Mishkin, 2012a; Mankiw, 2019). This perception becomes particularly clear in the famous quote by Milton Friedman (1956): “Inflation is always and everywhere a monetary phenomenon.” While the original version of the quantity theory predicts immediate reactions of the price level to an increase in the money supply (which presupposes a constant velocity of money and full employment), the modern version relaxes these assumptions and assumes only a long-run relationship between the money supply and the price level (Sievering, 2018).

**Figure 2-2: Correlation between money growth and inflation**

Correlation coefficients for different lags (in months) of the money growth rate of M2 on CPI inflation



Source: Own calculations based on Macrobond

According to the quantity theory of money, the transmission mechanism behind changes in the price level is as follows. Suppose that, at the current price level, money supply equals money demand. An exogenous increase in money supply will therefore cause the money holdings of firms and consumers to exceed their money demand. Thus, the economy will enter a state of disequilibrium. Firms and consumers will respond to

this disequilibrium by increasing purchases of raw materials, goods and services or by lending money to other consumers in order to reduce their money surplus, which overall increases aggregate demand. Since the output level of the economy is assumed to remain unaffected by the expansion of the money supply (at least in the long run), prices will rise one to one with the money stock. The higher price level then leads to a higher demand for money, which facilitates a new equilibrium on the money market. The quantity theory of money thus views the adjustment of the price level as a mechanism for keeping the money market in equilibrium (Mankiw / Taylor, 2018). Under these assumptions, the money growth rate determines the inflation rate.

Although the quantity theory is predominantly applied to the argumentation that money growth shall be kept at low levels in order to prevent inflation to destabilize, Milton Friedman argued in favor of a large-scale expansion of the monetary base of the Central Bank of Japan by means of purchases of sovereign bonds in order to fight Japanese deflation (Friedman, 1997). While the quantity theory can explain the causes of the hyperinflationary episodes in Venezuela and Zimbabwe, it has limitations in giving advice for fighting deflation. The inability of the Bank of Japan to increase inflation and the inability of the European Central Bank and the Federal Reserve to bring the low inflation rates after the Global Financial Crisis back to their target values by large-scale asset purchases reveal the limitations of the quantity theory of money. While there is evidence supporting the quantity theory in phases of extremely high inflation, the relationship between money supply and inflation appears to be weak or even non-existent for countries with low inflation (see for example De Grauwe / Polan, 2005; Teles et al., 2015; Gertler / Hofmann, 2018).

Figure 2-2 stresses this finding. It shows the correlation coefficients between the growth rate of the monetary aggregate M2 and the consumer price inflation rate for different monthly lags of the money growth rate. It can be inferred that the correlation is higher in the Eurozone than in the US, albeit it is not very large in the Eurozone either. While the contemporaneous correlation between money growth and inflation is in the vicinity of 0.2, it rises after two years to a value of more than, but close to 0.3. For the US, in contrast, the correlation is negative for the first year, becoming positive then and then becoming negative again. For the third year, a small correlation of 0.1 can be found. Although there are long and variable lags in the transmission mechanism, this correlation analysis does not provide us with any evidence for a stronger relationship between money growth and inflation. One reason for the low explanatory power of money growth for inflation lies in the different functions of money. While the quantity theory has a sole focus of money as a means of payment, where additional transaction balances lead to additional demand which increases prices for a given supply of goods and services, it neglects that money is also a store of value, that is why an increase in the monetary aggregate can also reflect an increase in savings which are allocated in highly liquid financial instruments, like demand deposits in a bank, which do not add to aggregate demand.

## 2.2 Demand-pull inflation

Demand-pull inflation occurs when aggregate demand exceeds the economy's production potential. When all resources are fully utilized, excess demand cannot be accommodated by an increase in output, resulting in a situation where there is "too much money chasing too few goods". This causes the excess demand to drive up the prices of the limited output until the equilibrium between aggregate demand and supply is restored (McConnell, 2008; Samuelson / Nordhaus, 2009b; Schiller, 2016).

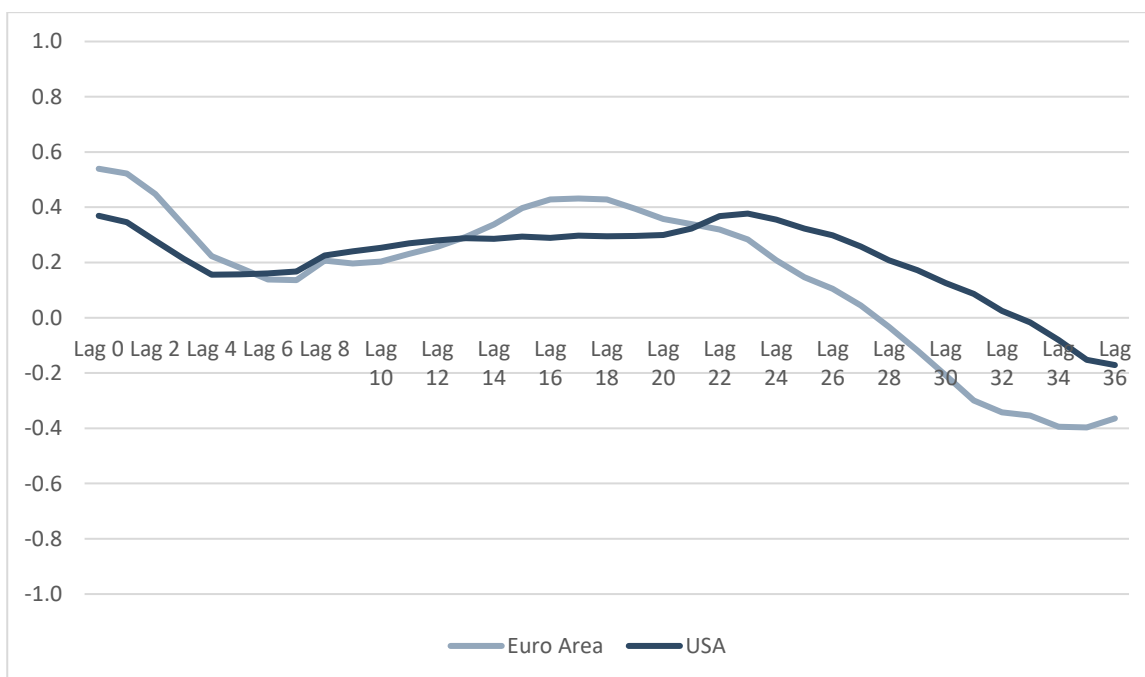
An increase in any component of aggregate demand can lead to inflation. These include household consumption, corporate investment, government spending as well as foreign demand. An increase in demand can be

caused, for example, by a decline in the savings rate, an increase in investment during an economic boom, or increased foreign demand due to a good economic situation abroad (Budzinski et al., 2018). Likewise, higher inflation abroad can lead to an increase in foreign demand. As the inflation differential reduces the relative price of domestic goods, exports become more favorable (Sievering, 2018).

Figure 2-3 shows the cross-correlations between CPI inflation and the output gap for different lags of the output gap. The output gap is defined as the percentage deviation of GDP from potential GDP often modelled by a trend growth measure. While a negative output gap indicates slack in the economy, a positive one is a signal for the overheating of the economy, i.e. inflationary growth. In contrast to the analysis of the money growth rate above, we find much larger and longer lasting correlations between CPI inflation and the output gap. The contemporaneous correlation between inflation and the output gap is 0.52 for the Eurozone and 0.35 for the USA. The correlation is above 0.2 for up to 24 months in the Eurozone and 28 months in the US indicating that the output gap has a longer lasting effect on inflation, given rise to the hypothesis that slack in the economy tends to lead to a low inflation period, while the overheating of the economy tends to rise inflation.

**Figure 2-3: Correlation between the output gap and inflation**

Correlation coefficients for different lags (in quarters) of the output gap on CPI inflation



Source: Own calculations based on Macrobond

## 2.3 Imported inflation

Imported inflation is a term for the pass-through of exchange rate changes to the domestic prices of imported consumer goods (Dwyer / Lam, 1994). In modern economies with globalized value-added-chains inflation can also be imported via the rising costs of imported energy, raw materials and intermediate products. Since this effect leads to cost-push inflation, we tackle it in the subsequent subsection and focus in this subsection on the original definition of imported inflation.

Katz (1973) notes that the outpouring of US-dollars from the US in the early 1970ies was evidence that the US was exporting inflation to other countries. Especially European economies faced problems with their stabilization policies through imported inflation due to US balance of payments deficits. During this period of fixed exchange rates, European central banks had to buy US-Dollars and were forced to finance the US deficits.

Under flexible exchange rates, however, an increased foreign demand would only push up the exchange rate (Katz, 1973). With the appreciation of the currency, foreign imports become more expensive for domestic residents, leading to imported inflation. However, there is no one to one relation between the appreciation of the currency and domestic inflation because of two possible effects (Pyo / Yoo, 1981):

- **Demand-shift effect:** The higher prices for imports lead to a substitution for domestic goods. The size of the effect is dependent on the degree through which foreign goods can be substituted. In modern globalized economies, with a high degree of specialization, some foreign goods are hard to substitute. For resource-scarce countries, a rise in the price of natural resources, like crude oil, cannot be substituted, so the demand-shift effect is low. The same could also be true for specialized electronics subcomponents, which are produced predominantly in certain parts of the world, e.g. Asia.
- **Balance of payments effect:** A rise in import prices can, on the one hand, lead to a lower demand for foreign goods and thereby to an improvement of the balance of payments. The effect can, on the other hand, also lead to a deterioration of the balance of payments, when the economy's export sector is to a large degree dependent on foreign inputs. Thus, the net effect depends upon the structure of the export sector.

Since many central banks have switched to inflation targeting, the central banks can focus on achieving low and stable inflation without the need to stabilize the nominal exchange rate (Svensson, 1997). Kara / Ögünç (2008) find in an empirical framework that the pass-through of imported inflation to domestic inflation was weakened after the adoption of the inflation targeting framework in Turkey. They argue that the enhanced credibility of the central bank, the changing behavior of the exchange rate and the shift in expectation formation has contributed to this effect. Gillizer / Simon (2015) argue that the variability of the domestic component of inflation has declined and that much of the variation of CPI inflation is caused by import shocks, i.e. commodity prices and exchange rates, which increases the risk of an inappropriate tightening of monetary policy in response to imported price shocks. The ECB made this experience in 2011, when it increased its policy interest rates twice with the effect that several Euro member states went into recession and inflation turned into deflation, which forces the ECB to lower interest rates in December 2011.

## 2.4 Cost-push inflation

Inflationary pressures can also arise on the supply side of the economy. When costs increase more rapidly than productivity gains, companies face higher per-unit costs of production. Subsequently, they will seek to pass these on to their consumers by raising prices, leading to inflation (Sievering, 2018).

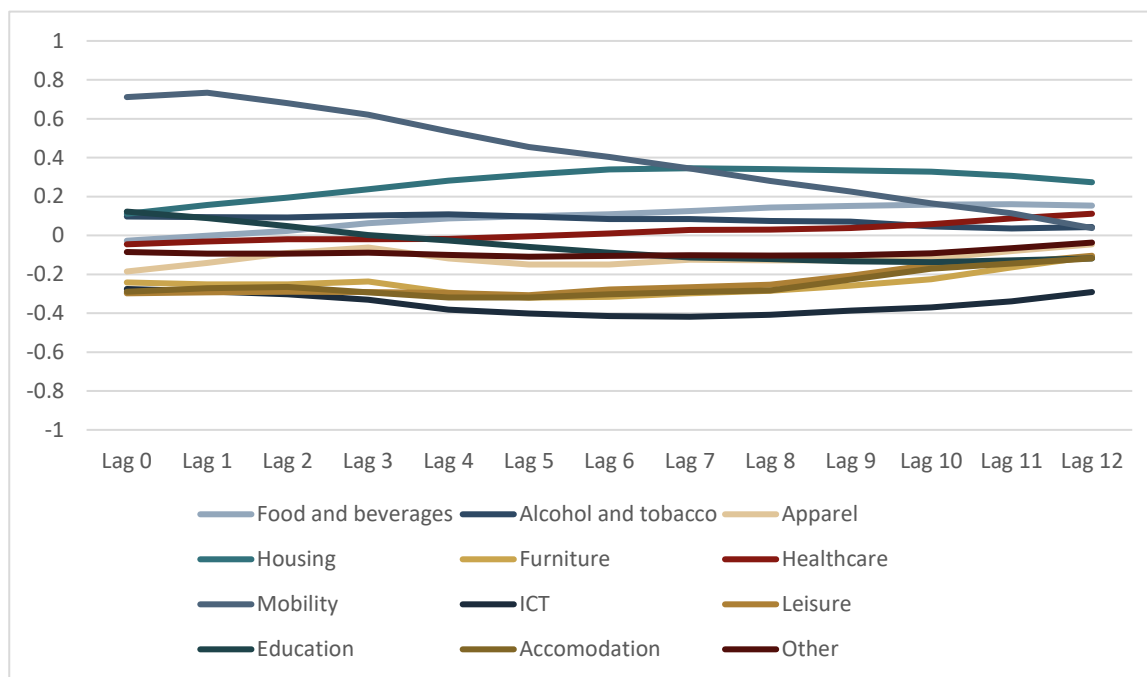
A rise in per-unit costs can be triggered by an increase in any cost component of production. One typical cause of cost-push inflation caused by a rise in labor costs. This is the case, for example, when a shortage of skilled labor increases wage pressures when companies compete for workers in tight labor markets. Similarly, labor costs can rise when trade unions successfully enforce wage increases, either because they expect a high inflation rate and want to adjust wages accordingly or to raise real wages by imposing wage increases

exceeding the inflation rate (Mishkin, 2012b). This cause of inflation is often associated with the so-called price-wage spiral. When companies compensate for higher labor costs by raising their prices, unions may demand higher wages in response to the higher cost of living, which in turn increases companies' costs, and so on. The alternating adjustment reactions of companies and workers can thus lead to persistent inflation.

Moreover, price increases of raw materials or energy inputs can lead to cost-push inflation, since these are important input factors for companies. This was particularly evident during the oil crises of the 1970s as well as in the current situation, as the price increase of imported crude oil leads to rising domestic production and transportation costs (McConnel, 2008). This type of inflation is of special relevance when a good cannot be easily substituted, which is often the case in advanced economies which have a high level of labor sharing and specialization and deep value chains. In this case, price increases of imported goods are directly passed on to the domestic market (Rothengatter / Schaffer, 2008).

**Figure 2-4: Correlation of components of the consumption basket with oil prices**

Correlation coefficients for different lags (in months) of crude oil price changes on CPI inflation, Germany



Source: Macrobond

Many industrialized economies are to a large degree oil dependent and thereby prone to cost-push inflation caused by rising crude oil prices. Changes in crude oil prices feed back to the different kinds of consumer prices either immediately or with a time lag. Figure 2-4 highlights the lag structure of oil prices and different consumer prices in form of a cross-correlation-function. It is not surprising that the cost of mobility is responding immediately and with a very high correlation coefficient. The correlation of mobility costs to raw oil price changes is slowly dying out, but it stays positive for twelve months after the oil price change. The cost of housing is not responding immediately, but the correlation is increasing over time which is an effect of the heating period. In addition to that, food prices are responding to oil price changes because higher oil prices increase the transportation cost of food which translates to higher food prices for the consumer. While essential goods like food, housing and mobility costs are oil dependent, less essential goods are less oil

dependent, i.e. do not significantly respond to raw oil price changes. The long-lasting lag structure of oil price shocks show that these have persistent effects on the overall inflation rate.

Choi et al. (2017) estimate the effects of fluctuations in global oil prices on domestic inflation in a panel of 72 advanced and developing countries. The authors find that a 10 percent increase on global oil prices increase inflation by about 0.4 percentage points and that the effect is vanishing after two years. Moreover, they find that positive oil price shocks have a larger effect than negative oil price shocks. The cross-country variation thereby depends on the following factors:

- The effect of oil price increases on domestic inflation is larger for countries with a higher level of oil imports and a lower level of oil exports.
- Firms in a high inflation country tend to perceive global oil prices shocks as more persistent than firms in low inflation countries.
- Inflation targeting, i.e. the anchoring of inflation expectation at a pre-specified inflation target, reduces the impact of oil price shocks on domestic inflation. This effect is strengthened under central bank autonomy, which gives the central bank credibility in fighting inflation (IMF, 2015; Furceri et al., 2016).
- Countries with a higher share of energy subsidies as a share of GDP tend to have a lower inflationary impact from oil price shocks (Caceres et al., 2012).

From this we can derive a higher proneness of the Eurozone to oil prices shocks in contrast to the US. While most European countries have to import oil as well as gas, the US is extracting oil and gas and exporting then as well as importing oil and gas.

## 2.5 The fiscal theory of the price level

The fiscal theory of the price level (FTPL) claims that changes in the price level are due to fiscal policy, whereas monetary policy plays an indirect role in the way that an accommodative monetary policy can only increase inflation, when fiscal policy makes use of low interest rates by increasing expenditures. It thereby strongly contradicts the quantity theory of money (Bassetto, 2008). According to the FTPL, "the equilibrium price level is that level that makes the real value of nominally denominated government liabilities equal to the present value of expected government budget surpluses" (Woodford, 1995). Thus, the FTPL implies that there is no need for the government to adjust expenditures and tax rates to adhere to an intertemporal budget constraint. Rather, the market clearing mechanism will cause the price level to adjust accordingly (Christiano / Fitzgerald, 2000).

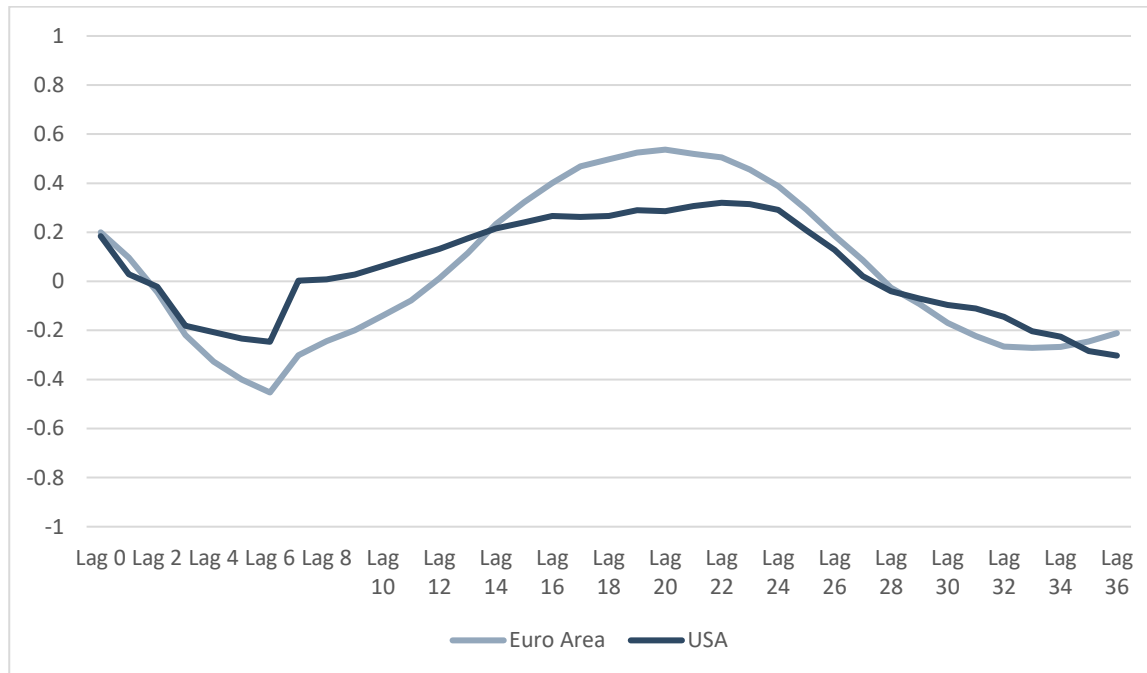
Fiscal policy can have significant effects on inflation. Sargent (1982) concludes that high inflation periods can be ended by fiscal reform. While budget deficits have contributed to the high inflation periods in Austria, Germany, Hungary and Poland with the help of the central banks, the creation of independent central banks together with an alteration of fiscal policy normalized aggregate demand and thereby inflation.

The figure 2-5 shows that there are longer and variable lags of the effects of government deficits on inflation. The contemporaneous correlation between the government deficit and inflation starts with a value around 0.2 for both the Eurozone and the US. The correlations then become negative and become positive after around 12 months. For the Eurozone the correlation reaches a maximum of 0.54 at lag 20, the maximum for

the US is 0.32 at lag 22. The lagged correlations show that past deficits can have a significant effect on current inflation.

**Figure 2-5: Correlation between the government deficit and inflation**

Correlation coefficients for different lags (in quarters) of the government deficit on CPI inflation



Source: Own calculations based on Macrobond

Inflation was low after the Global Financial Crisis, since governments had to consolidate their debt levels and engaged in a saving behavior. The FTPL now predicts that the fiscal response to the Covid-19 pandemic can contribute to higher inflation. The US implemented large stimulus programs to fight the pandemic-induced recession. In contrast to the European stimulus programs, the US programs had a larger effect on aggregate demand. While the focus in Europe was to shield companies of the negative effects of lockdowns through the European short-working theme and liquidity measures for companies that allowed them to cover their costs, the US had a large program focusing on stabilizing consumption expenditures. The fiscal theory of the price level explains the current demand-driven inflation in the US, which was facilitated by an accommodative monetary policy. Lawrence Summers and Olivier Blanchard expect the US government spending in response to Covid-19 to lead to an overheating economy (Summers, 2021; Blanchard, 2021). Summers expects inflationary pressures from the 1.9 trillion US-Dollar COVID-19 relief plan of the Biden administration by comparing it to the 2009 stimulus package under the Obama administration. While the stimulus package under the Obama administration was half the size of the output gap, the COVID-19 relief plan is three times the output gap (Summers, 2021).

## 2.6 The Taylor-Principle

John Taylor proposed a simple reaction function to describe how the Federal Reserve Bank sets its policy interest rate (Taylor, 1993). The Taylor-Principle is not an inflation theory, since it does not explain how inflation emerges, but it is a description of how inflation targeting central banks are assumed to react to inflation. Since the Taylor-rule is an integral part of New Keynesian models that aim at explaining inflation, it is therefore briefly introduced in this chapter.



The proposed reaction function of Taylor with which the Fed reacts to inflation and the unemployment rate seemed to track policy interest rates very well (Taylor, 1993). The New Keynesian Literature developed monetary policy reaction functions further, by making the policy interest rate a function of the deviation of inflation from the central bank's inflation target, the inflation gap, and the output gap. This type of reaction function is an important building block of the inflation targeting framework developed by Svensson (1990) and then applied by most central banks.

In the inflation targeting framework the reaction coefficient of the inflation gap has to be larger than one in order to bring inflation back to target, which is called the Taylor principle (Galí, 2008). If the reaction coefficient is less than one, then inflation destabilizes, since the interest reaction of the central bank is too small to curb aggregate demand, since the real interest rate does not increase. If, however, the central bank raises the policy interest rate by more than the rise in inflation, the real interest rate rises, thereby decreasing inflation and thereby introducing a negative output gap which brings inflation back to target.

What if the central bank changes its preferences and intends not to react to inflation in order to avoid a recession? In this case inflation expectations become unanchored and an inflationary dynamic kicks in, which results in self-fulfilling expectations. Since these models are based on the New Keynesian Phillips Curve a trade-off between a positive inflation gap and a positive output gap arises (Galí, 2008).

Summing up, in the inflation targeting framework the central bank has to react symmetrically to deviations of inflation from the inflation target without a differentiation between supply-driven and demand-driven inflation. This agnostic behavior rests on a pass-through of supply-driven inflation on inflation expectations which cause second-order effects, like a price-wage-spiral. If the central bank allows inflation expectations to become unanchored, a price-wage-spiral can emerge which gives the central bank a hard time in stabilizing inflation expectations.

### 3 The new inflationary environment

We describe the new inflationary environment by its six underlying trends: de-globalization, demographics, decarbonization, digitalization, fiscal policy and monetary policy. We argue that the period of low inflation has come to an end and that an inflationary environment has started, which has parallels to the 1970ies high inflation period.

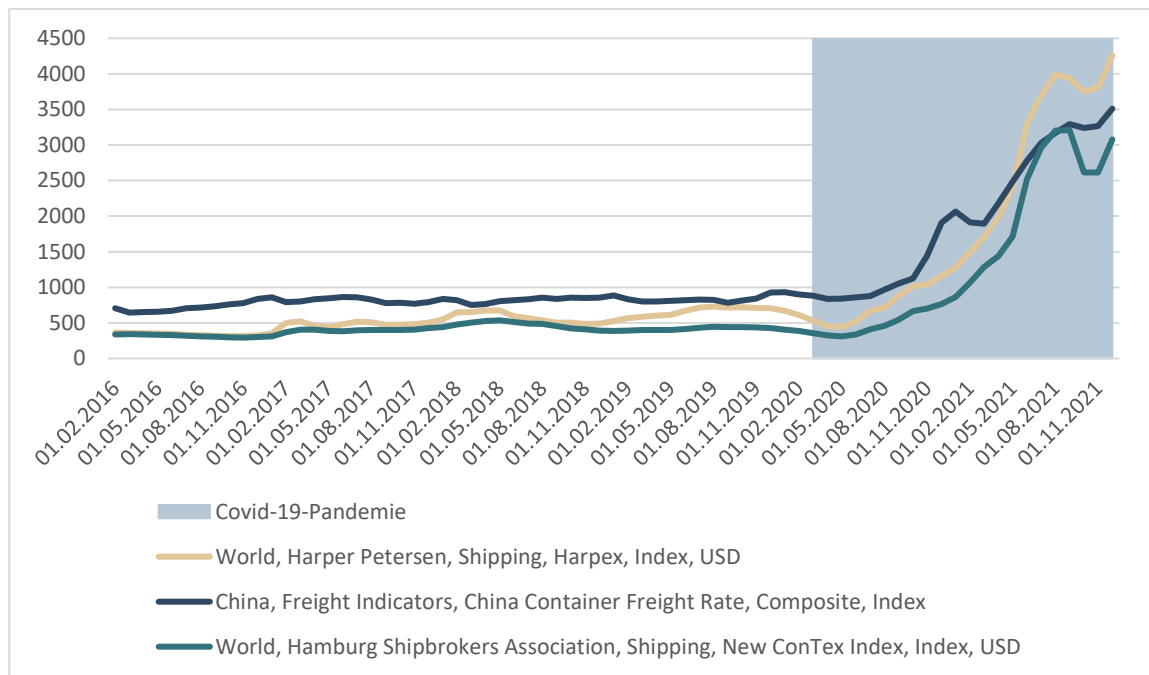
#### 3.1 De-Globalization: The Pandemic and the Russian invasion in Ukraine

During the outbreak of the Covid-19 pandemic, especially Asian countries engaged in Zero-Covid-policies that applied complete lockdowns even under a small number of Covid cases, while the countries in Europe and the US relied on vaccination campaigns instead. These lockdowns caused container congestions in Asian harbors. The huge number of containers congested in harbors led to an overburdening of these harbors and harbors needed several weeks to ease congestions resulting in weeks of delays for just-in-time production. Thus, freight rates have increased during the Covid-19-pandemic (figure 3-1)

As China's pandemic policies are focused on containment and less on vaccination, the current Omicron-wave is again counteracted with lockdowns which again disrupt the already stressed supply-chains. Since vaccination rates are low in Asia (Silver, 2022), more disruptions due to lockdowns can be expected. From this we cannot conclude that freight rates will certainly decrease in the distant future as we have to expect that Covid and its lockdown restrictions will prevail. This leads the with Asia tightly connected countries in Europe and the US into a situation, in which the price advantages from globalization are currently absent. Instead, higher inflation is likely to be imported through raw material prices and the prices for intermediate goods.

**Figure 3-1: Freight rates**

In US-Dollar

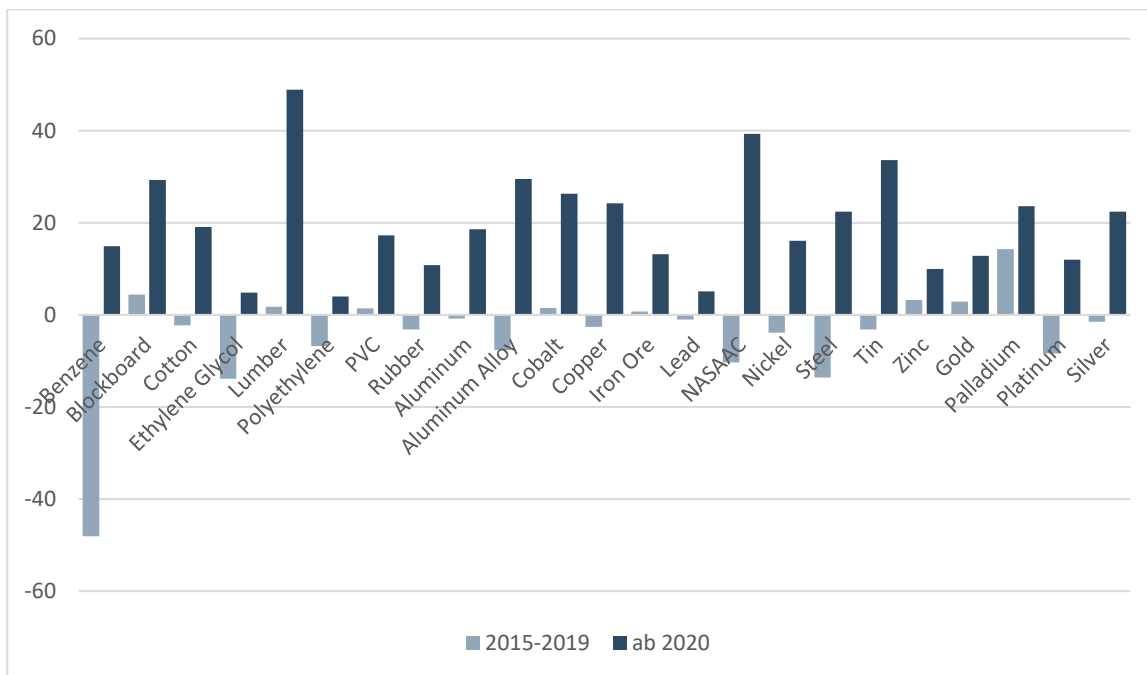


Source: Macrobond

The congestions in harbors have already led to rising prices for raw materials and intermediate products for industrial production at global exchanges. As can be observed from the figure 3-2, most raw materials experienced a downward price trend in the pre-pandemic period from 2015 and 2019. This trend no longer exists. With the beginning of the pandemic, all prices for raw materials and intermediate products have increased sharply, ranging from the prices of wood to the prices of chemicals to the prices of precious metals. Since the pandemic has started in 2020 wood prices have increased on a year-on-year average of 48.9 percent. The price of cotton has increased by 19.1 percent. The prices of metals, like NASAAC or zinc, have risen by more than 30 percent.

**Figure 3-2: Raw material and intermediate product prices**

Average yoy-increase, in percent



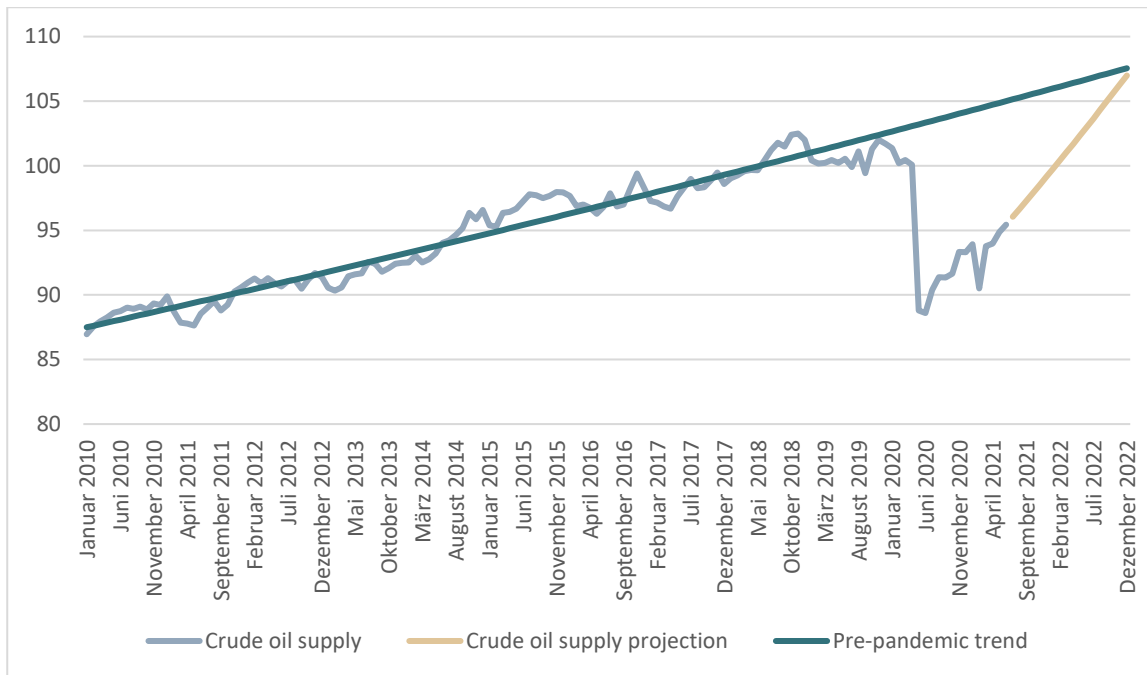
Source: own calculations based on Macrobond

In addition to that, the pandemic also left its scars at oil markets. The demand for oil declined sharply during the first COVID-wave in April 2020 as most people responded to the at that time unknown risks of infection and illness by staying at home. Due to the low demand for fossil-fuels the oil producers reduced their supply sharply (figure 3-3). As mobility and thereby the demand for fossil-fuels increased for more than expected after the end of the first wave which coincided with the summer holiday season in Europe, oil supply did not meet oil demand. As can be recognized from the figure, the oil supply is expected to meet its long-term trend at the end of the year 2022. Thus, there is upward pressure on oil prices due to the first pandemic wave that could not be mitigated in the following months.

The pandemic did not affect the gas market as much as the oil market. Gas storage was mainly influenced by the cold winter and currently by the Russian aggression and the sanction-based conflicts between the EU and Russia. Gas storage has a cyclical pattern, and it correlates very well with the temperature, i.e. in the warmer months gas storage increases, while it decreases in the colder months during the heating period (figure 3-4). After a very cold and longer winter in 2021 and lower refill rates in the months before the Russian invasion in Ukraine, the European gas storage was at a low level which caused a high demand for gas in the upcoming months. This upward pressure on the gas price could be lasting for the next year since gas storage levels are very low at the moment. One of Germany's gas storage facilities was sold to the Russian company Gazprom, which approved that the storage emptied (Sheppard et al., 2021). These developments can become more severe as tensions with Russia exacerbate and either Russia stops the supply of gas, or the European economies refrain from buying Russian gas.

**Figure 3-3: Oil supply**

In million barrel per day



Source: own calculations based on Macrobond

The Russian war against Ukraine will further drive the increase in oil and gas prices, as Russia is Germany's most important supplier of crude oil and natural gas. In 2021, about 31 percent of oil imports and about 35 of natural gas imports came from Russia. Likewise, hard coal is mainly imported from Russia. In 2021, imports from Russia accounted for about 52 percent of total hard coal imports.

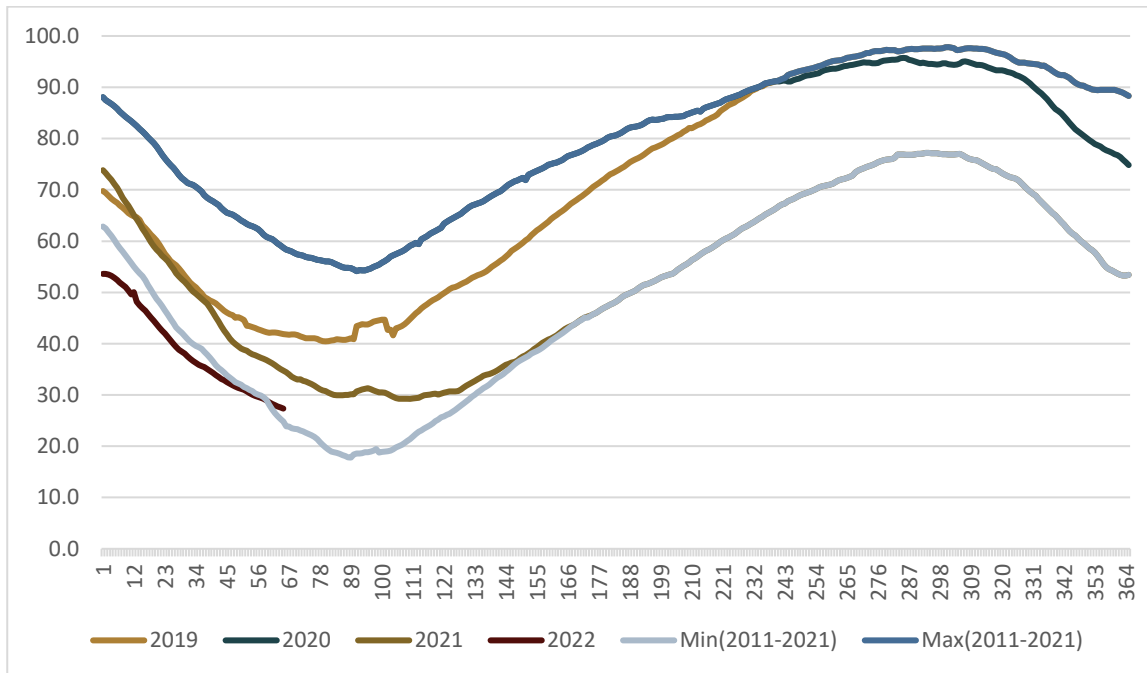
Prices for German energy imports have risen significantly. In February 2022, gas prices stood 256.5 percent higher than in February 2021, crude oil prices were up 70.3 percent and hard coal prices increased by 190.9 percent. This surge in energy prices is clearly reflected in the import prices. While export prices recorded a 12.4 percent year-on-year increase in February 2022, import prices rose by 26.3 percent. However, prices had already risen prior to the attack due to uncertainty in international trade (Federal Statistical Office of Germany, 2022).

The Russian war against Ukraine is expected to contribute to the price increases of all energy forms, which have already been rising due to the pandemic (figure 3-5). By looking at the energy prices one can see that all energy forms showed a positive trend growth during the COVID-19 pandemic, while most energy forms showed a negative average price growth in the pre-pandemic years 2015 to 2019. The price increases are not only caused by rising crude oil prices. In addition to that, also price increases in uranium can be noticed, which is used for nuclear energy creation. Thereby the price increase in uranium is much higher than the price increases of the carbon-based energy forms. Since Russia supplies not only oil and gas, but also coal and uranium, all forms of energy will become more expensive. Given that the state of energy creation by sun and wind is not sufficiently developed in Europe in order to achieve an acceptable degree of energy independence from Russia, it cannot be excluded that with the further exacerbation of the Russian aggression

and the hardened sanctions and retaliation policies between the EU and Russia, that an energy crisis in Europe will result. Such a crisis could result in a stagflationary environment in Europe.

**Figure 3-4: Gas supply from 1.1. to 31.12.**

In percent of the maximum storage capacity in the European Union



Source: own calculations based on Macrobond

The extent to which German companies are affected by higher energy and intermediate product prices can be seen in survey studies. The survey IW Zukunftspanel, for example, found that just under 70 percent of the German companies surveyed expect great or very great burdens from higher energy prices. Just over a third of the companies anticipate problems due to gas supply shortfalls and 35 percent expect great or very great burdens on their production due to supply shortfalls of other intermediate inputs (Bardt et al., 2022). It is to be expected that this burden on companies will also be reflected in consumer prices.

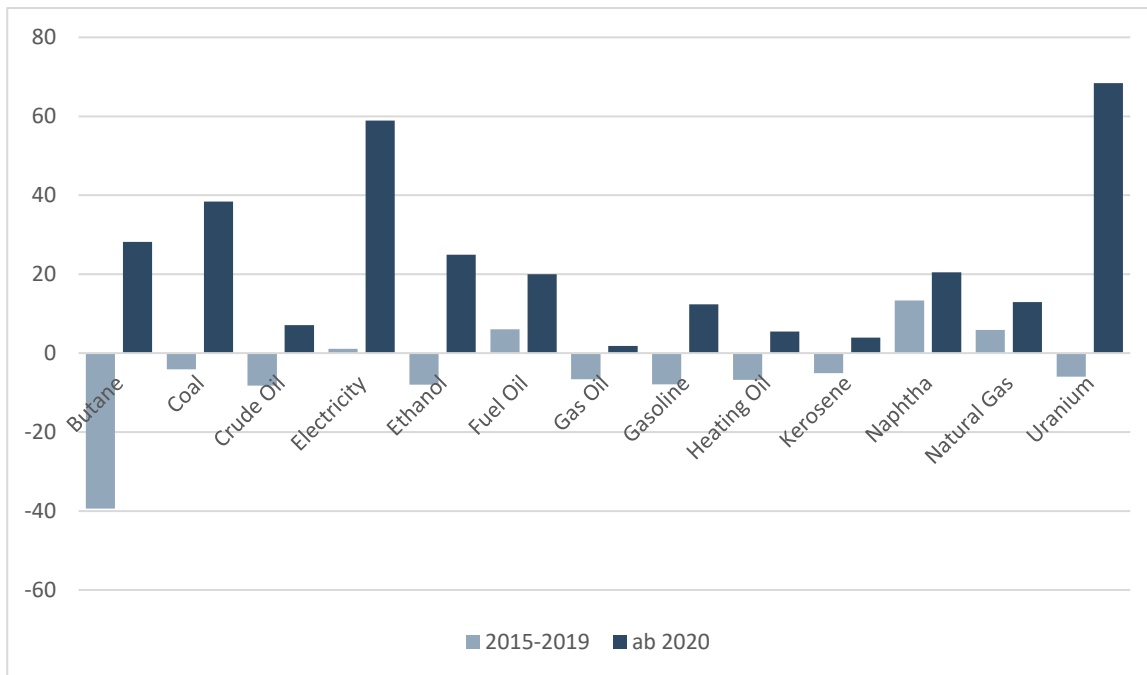
Due to rising energy prices and rising freight rates, the global prices of food have already increased (figure 3-6). The picture is again very similar to the figures before. In the pre-pandemic period from 2015 to 2019 most food prices fell on average, and they increased sharply during the pandemic since 2020. As can be seen from the figure essential food, like wheat, rice, corn, oats, and soybeans, have experienced significant price increases. Prices of Black Sea wheat rose substantially because of the pandemic and it is expected to become even more expensive when the Russian war against Ukraine endures longer, since both Ukraine and Russia are important producers of wheat. Since wheat is also used for hog and cattle production, it is expected that the prices for meat will rise further. The rising global prices of food have already translated to higher consumer prices for food, since food is an essential good that cannot be substituted. Therefore, rising global food prices will most likely transmit into higher prices for consumers and not so much into declining margins for producers. Increasing food prices for consumers can already be observed.

Figure 3-7 summarizes the developments described with the previous figures. Goods and services can be classified as either “tradable” or “non-tradable” depending on the aspect if prices are determined locally or

globally in an open market. The concept of tradable and non-tradable inflation was developed by both, the statistical agencies of Australia and New Zealand (Dwyer, 1992; Dixon et al., 2004; Jacobs and Williams, 2014). The figure shows the inflation rate relative to the month of the previous year of both categories since January 2009 until February 2022.

**Figure 3-5: Energy prices**

Average yoy-increase, in percent



Source: own calculations based on Macrobond

The challenge is to determine which item falls into each category. Afterwards inflation data within each category is aggregated to calculate price changes of tradable and non-tradable items. Input- and output-tables contain information on the total output of each commodity additional to information about the imports and exports, which measure international trade. Therefore, we can determine the proportion of imports and exports relative to the total output. We follow the suggestion of Statistics New Zealand in using 15 percent as the threshold of classification. Goods and services which imports, or export are above the threshold are designated as tradable, while items below the threshold were considered as non-tradable. The only exception which we made is energy. Even though it was slightly below the threshold (14,5 percent imports), we still classify it as tradable due to the integrated European energy market.

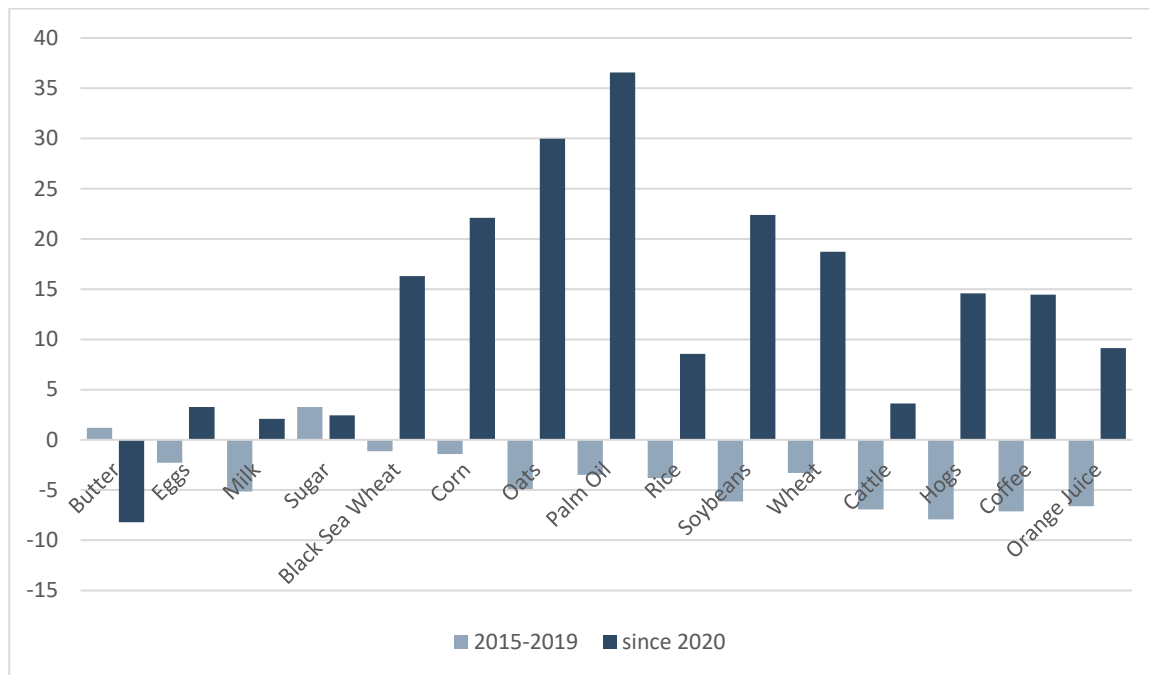
Although the categories from the IO-tables and the CPI do not perfectly match, a classification is rather straightforward. Especially goods named previously in this chapter such as oil, gas, food, and other raw materials are categorized as tradable items while services are predominantly considered as non-tradable items. The share of tradable items in the consumption basket, used to calculate the CPI, is around 47 percent and non-tradable items account for 53 percent.

The figure displays the fact that prices of tradable items undergo higher price changes compared to non-tradable items, which are rather stable around 1,5 percent inflation. The CPI inflation rate is a weighted average of both categories and hence lies between them. Nonetheless, the volatility pattern of the CPI is

governed by the inflation dynamics of tradable items. Furthermore, the figure shows the facts which has been discussed previously by showing that the inflation of tradable items in Germany has increased massively since the beginning of 2021. Due to this aspect CPI inflation rates are also spiking. Additionally, price changes of non-tradable items are much lower. Nonetheless, the inflation rates of these items are also experiencing their highest rates within the last 12 years in the end of 2021 and the beginning of 2022. This is not yet a proof that the increased inflation has reached the labor market, but we will discuss this further in subsequent sections.

**Figure 3-6: Global food prices**

Average yoy-increase, in percent



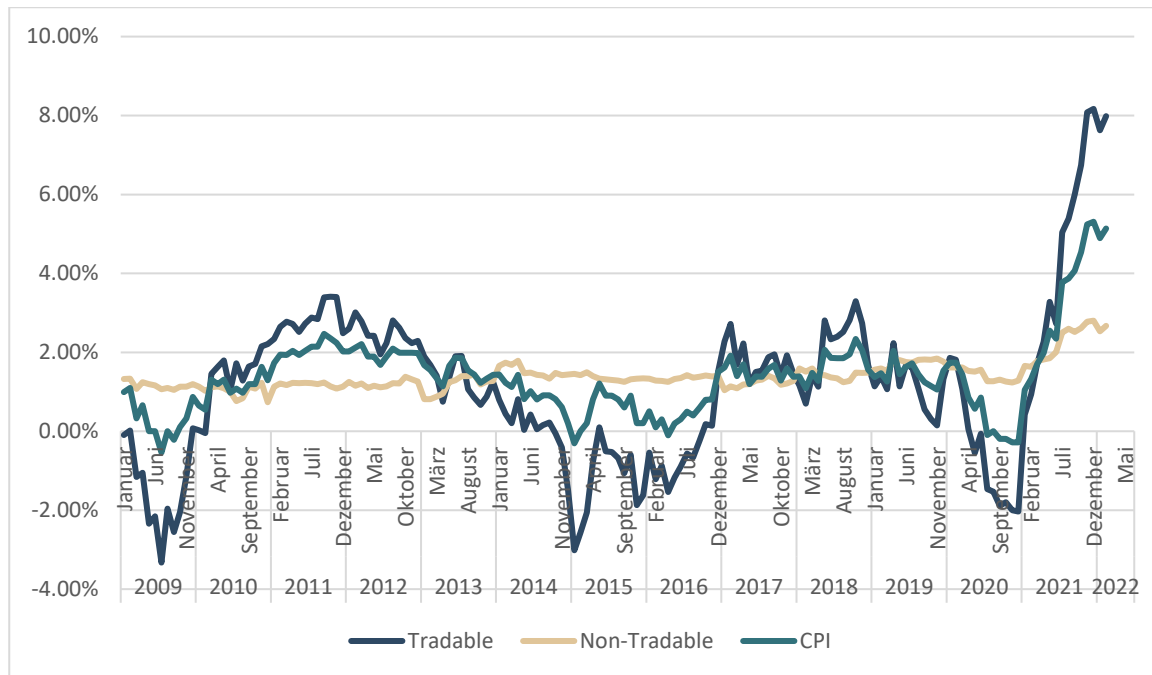
Source: own calculations based on Macrobond

The effects of rising prices in the tradable sector will exacerbate further when the Euro will depreciate against the currencies of the Eurozone major trade partner countries. As can be seen from the figure 3-8, the Euro has already depreciated against other currencies like the US-dollar, the Swiss CHF and the Chinese Yuan. Tensions in Europe based on the sanction and retaliation conflict between the EU and Russia have led to a capital outflow from the Euro Area. Due to the depreciation of the Euro, imports have become more expensive, leading to an imported inflation. This adds to the overall trend that energy prices have increased due to fundamental factors. While the Rubel depreciated against the Euro and the US-Dollar after sanctions have started, it already appreciated in the last weeks.

Although the ECB does not have a mandate for exchange rate stabilization, the depreciation of the Euro should be monitored with caution, since it will contribute to imported inflation. The depreciation will come to a next round when the Federal Reserve Bank will start its tightening cycle. Since the US inflation is mostly determined by inflation in goods and services and less driven by energy prices, it will be natural for the Fed to tighten its policy in order to curb aggregate demand. A widening interest rate differential between the US and the Eurozone will therefore make imported goods from the US more expensive.

**Figure 3-7: Tradable and non-tradable goods inflation in Germany**

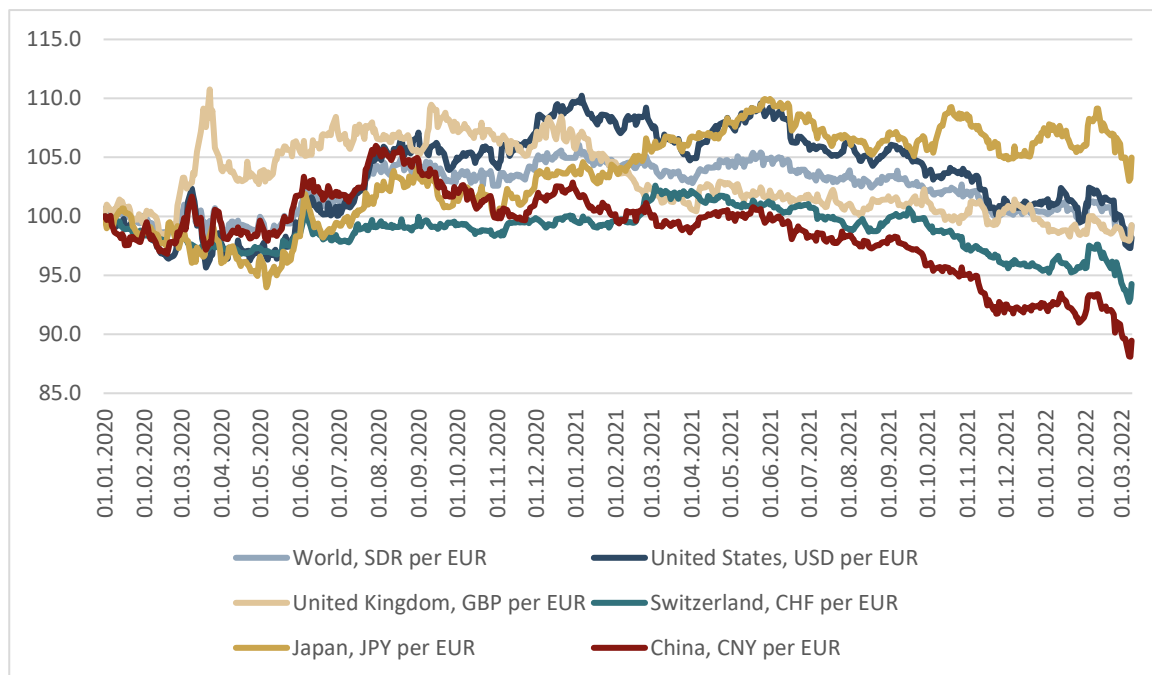
Percentage change relative to the same month in the previous year



Source: Own calculations based on German Federal Office for Statistics

**Figure 3-8: Exchange rates vis-à-vis the Euro**

Index: 1.1.2020 = 100



Source: own calculations based on Macrobond

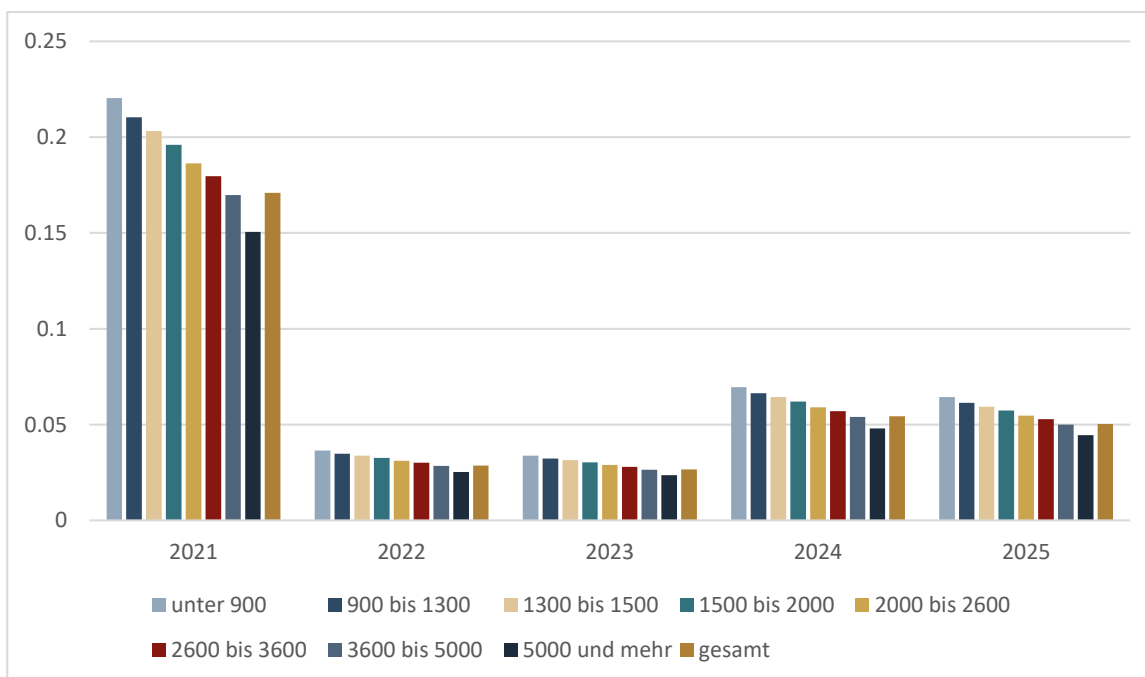


### 3.2 The green transformation

One building block of the green transformation is the incentivization by the introduction of CO<sub>2</sub>-prices. Higher CO<sub>2</sub>-prices include the costs of the externalities and set incentives to move away from fossil-fuels which become more expensive, so that the expenditure of using carbon-heavy vehicles or heating is such that their usage becomes uneconomical. By doing this, these prices enhance the benefit of carbon-neutral alternatives, which become economic in their usage. Thus, under higher CO<sub>2</sub>-prices, people decide to buy a less fossil-fuel dependent car or a less fossil-fuel dependent heating for their flat or house and begin to incorporate the external costs in their investment and consumption behavior.

**Figure 3-9: The impact of CO<sub>2</sub>-prices**

Change in the cost of living due to changes in CO<sub>2</sub>-prices, in percent



Source: Macrobond

Although the introduction of CO<sub>2</sub>-prices was announced and thereby expected by households, the transformation of their mobility behavior and their heating behavior has been very slow. As a result, households did not switch to carbon-neutral alternatives before the introduction of CO<sub>2</sub>-prices. Therefore, during the adjustment period the introduction of CO<sub>2</sub>-prices increases the costs of living for many households which can be inferred from the simulation in figure 3-9. We generated these numbers by mapping the CO<sub>2</sub>-emissions of each consumption good to the expenditures for the different consumption goods. Based on the CO<sub>2</sub>-emissions we calculated the carbon taxes for each consumption good and added it to the cost of living. CO<sub>2</sub>-prices are regressive, i.e. they increase the cost of living of poorer households to a larger percentage degree than the cost of living of households with a higher monthly income. We estimate an initial effect of 0.2 percent for 2021 and a later effect of 0.05 percent for the years 2024 and 2025 each. However, there are studies that estimate a much larger effect.

The increase in the cost of living can be counteracted by households, by investing in carbon-neutral heating systems and carbon-neutral cars. This is also intended by policymakers. However, the transition needs some

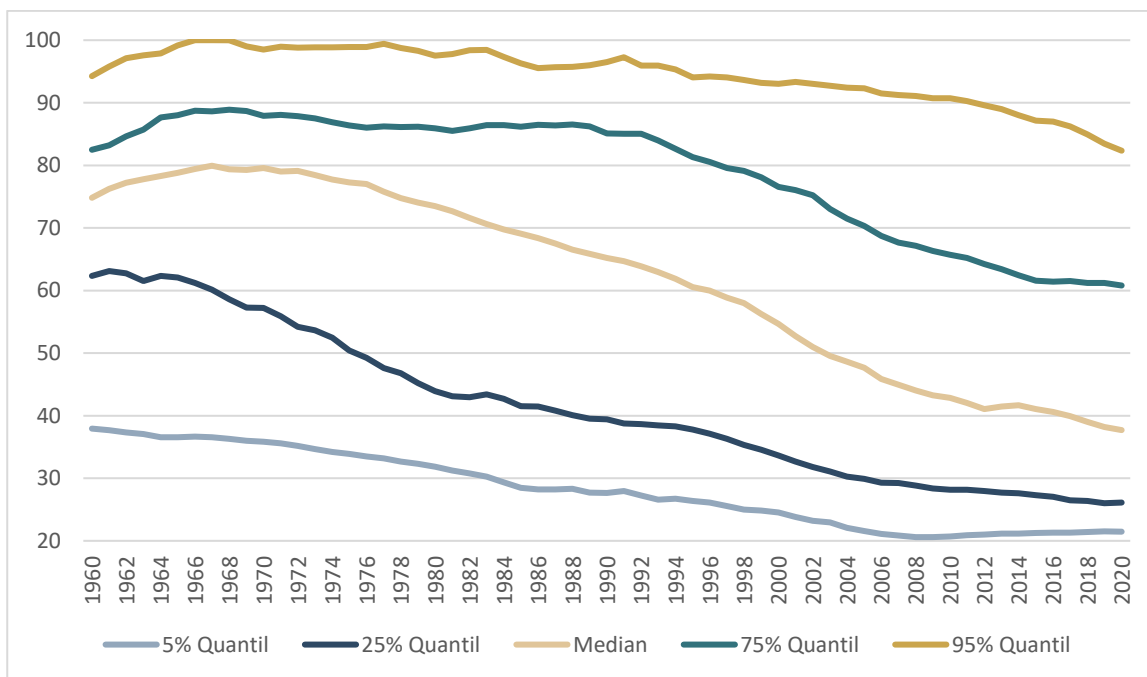
time and might have very high adjustment costs for some households. During that period, in which households have not switched to carbon-neutral alternatives, the CO<sub>2</sub>-prices add to inflation.

### 3.3 Demographics and labor markets

Figure 3-10 shows the effect of demographics on the labor market. The lines are the quantiles of the youth-employment-ratio for 200 countries. While some countries have a high ratio indicating that many young people are entering the labor force in the next years, other countries have a low ratio, indicating that only a few young people will enter the labor force in the next years. What all countries have in common is that the ratio has declined over time. There is a trend that less young people will be available to the labor force in the next years. If not every retiree can be replaced by a young person entering the labor force, the labor shortages will arise which introduce more competition in the labor market for the best talents. This increased competition will lead to upward pressure on wages since firms have to set higher wages in order to attract young people. The higher entry-level wages will then translate to higher wages in the whole wage distribution.

**Figure 3-10: The youth-employment-ratio**

Number of persons under 15 in percent of the number of persons between 15 and 65.



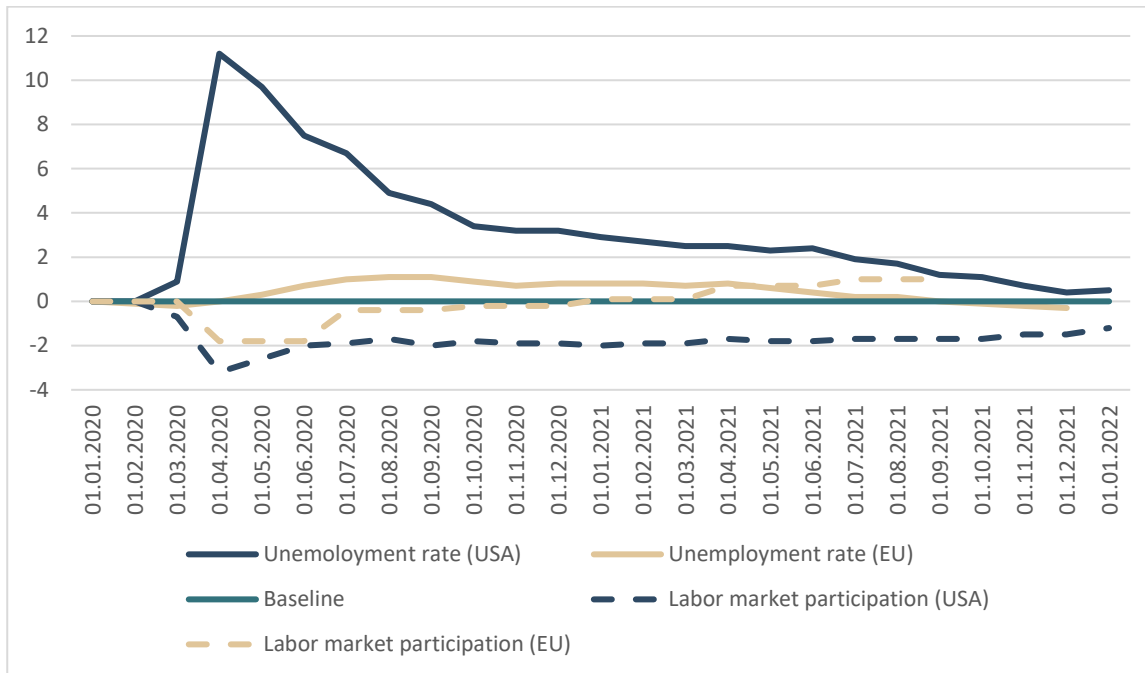
Source: Own calculations based on Worldbank

According to Goodhart and Pradhan (2017), the demographic change could lead to inflation if productivity does not increase sufficiently. When skilled workers are in short supply, they have more bargaining power and wage demands are more likely to be met. Additionally, Goodhart and Pradhan highlight the finding by Juselius and Takáts (2018) that a decrease of the share of the working age population caused by the demographic change can lead to inflationary pressures. Goodhart and Pradhan explain this result by arguing that the non-working population are net consumers, while only the working population can produce goods and services to meet the demand. If the share of the working population becomes smaller, higher demand meets lower supply, which leads to inflation. The ECB Survey on the Access to Finance of Enterprises (SAFE) shows that companies perceive the shortage of skilled staff as increasingly pressing. While in 2012, the problem was

perceived as less acute than the problems of finding customers, cost of production or labor, competition, and regulation, it moved to the top of the list in 2021.

**Figure 3-11: Labor markets during and after the pandemic**

Index: 1.1.2020 = 0



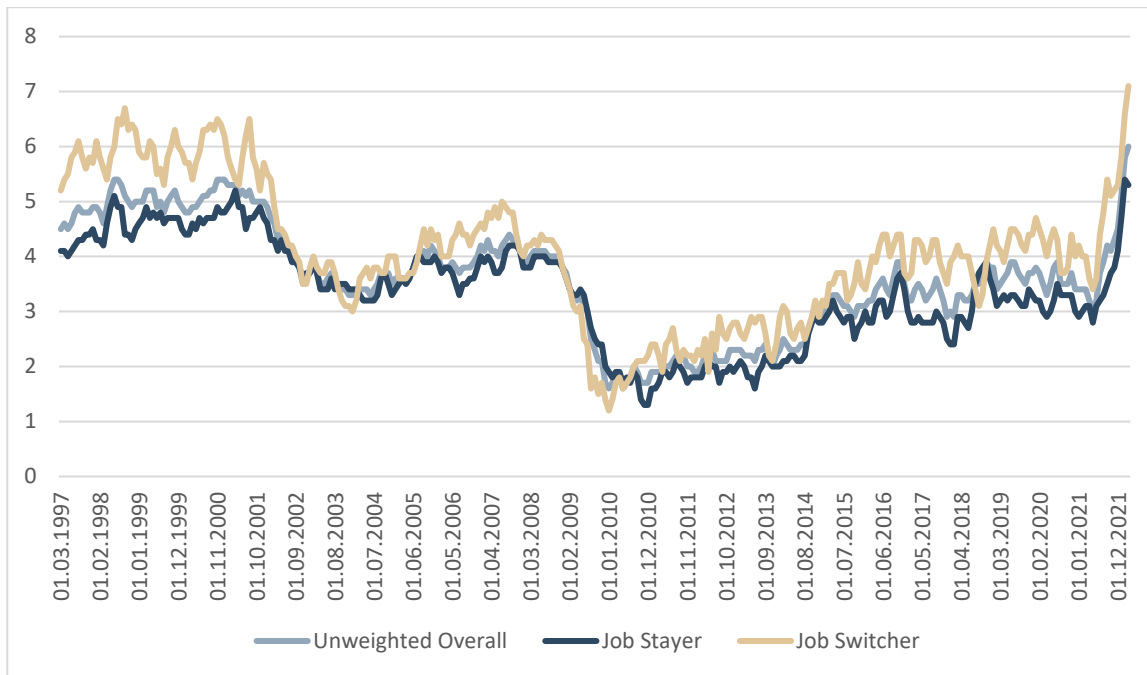
Source: Macrobond

Although demographics do not explain the most recent trend in inflation, it will add to inflation in the distant future, thus limiting the possibilities of central banks to bring inflation down to levels in line with their inflation targets.

However, we can already see an immediate response of labor markets to the pandemic which has accelerated demographic trends. This effect can especially be found in the US. Here, the labor market response to the Covid-19 pandemic was very different compared the response in the European Union due to the application of short-term work schemes in the European Union and to the trend towards retirement in the US (figure 3-10). In the US the unemployment rate increased by 11 percentage points in comparison to its pre-pandemic value and it needed two years to return to the pre-pandemic value. The response of the EU unemployment rate was minimal compared to the severeness of the output loss. Since firms could apply to short-term work schemes, they were not forced to terminate contracts during the recession and renegotiate contracts after the recession. At the same time the employment-ratio showed a different response in the US and the EU. While the European employment ratio is currently higher than its pre-pandemic value, the one in the US never returned to its pre-pandemic value because a lot of older workers preferred to retire during the pandemic (Fry, 2021). Thus, in the US labor markets have become tight because a lot of contracts have to be renegotiated and there is more competition in the labor market due to the many people who have started to retire. This tightness will translate into upward pressure on wages in the US, since workers have better conditions to demand higher wages. This development might give rise to a price-wage-spiral in the US, thereby exacerbating the inflationary dynamics via second-round effects.

**Figure 3-12: Wage growth in the US**

3-month moving average, in percent per year



Source: Bureau of Labor Statistics and Federal Reserve Bank of Atlanta

Wage pressures can already be observed in the US as can be seen in figure 3-11. Wage growth accelerated from 2.8 percent in May 2021 to 6.0 percent in February 2022. While the wage increases are normally higher for job switchers than for job stayers, the wages of job stayers yield a significant increase given rise to the emergence of a price-wage-spiral in the US.

In the EU, however, the possibility that a wage-price-spiral will emerge are less severe. Due to the application of short-work schemes, companies were not forced to terminate labor contracts as the pandemic turned their profits to losses. Instead, they simply reduced the number of working ours which was subsidized by the short-work scheme. Due to the limited number of layoffs, only a smaller number of labor contracts have to be negotiated in the EU member countries. Moreover, the employment-ratio has exceeded its pre-pandemic level, which indicates that labor markets in the EU are less tight compared to the US ones. Thus, less wage-pressure is expected in the EU compared to the US from labor market tightness.

However, price pressures in the EU could arise from collective wage bargaining. If unions have a large bargaining power and can demand a very high wage increase, this could contribute to wage-price spirals in the EU. One factor that determines wage negotiations is the expectation of inflation. The situation is complicated because there is no single inflation expectation but a wide range of different inflation expectations. Household inflation expectations normally exceed those of professional forecasters. While the latest round of the ECB's Survey of Professional Forecasters in January 2022 yielded a median one-year forward estimate of 1.8 percent (ECB, 2022), the Survey of Consumer Expectations by the Deutsche Bundesbank stood at a median one-year forward estimate of 4.3 (Deutsche Bundesbank, 2022).

In addition to the collective wage bargaining, there will also be a rise in the minimum wage in Germany. In October 2022, the minimum wage will be raised to 12 Euro. Compared to the minimum wage of 10.45 as of July 1, 2022, this represents a wage increase of approximately 15 percent. In a December 2021 press release, the Federal Statistical Office of Germany stated that approximately 7.2 million workers would benefit from a minimum wage increase to 12 Euro (Federal Statistical Office of Germany, 2021). The higher minimum wage could contribute to a shift in the whole wage distribution since workers normally compare their wages to other peers and try to maintain a wage differential to less qualified workers. This effect of the increase in the minimum wage on the entire wage distribution is theoretically possible, but the size of the effect is an empirical question. Burauel et al. (2020) find in a causal analysis with a differential trend adjusted difference-in-differences (DTADD) strategy to identify the extent to which the changes in wages and earnings can be attributed to the minimum wage introduction. The authors find that the minimum wage introduction can account for hourly wage growth in the order of roughly 6.5 percent or 0.45 Euro/hour and an increase in monthly earnings of 6.6 percent or 53 Euro/month. The rise in the minimum wage could, therefore, in addition to a compensation for higher food and energy prices be one factor which determines collective wage bargaining in Germany.

This year there will be several collective bargaining rounds in Germany. The printing industry demands a wage increase of 5 percent for 125 000 employees. The chemical industry representing 580 000 employees also demands remote working and shift allowances besides higher wages. The metal and electro industry represents 3.9 million workers and bargaining will start in September (Lesch / Winter, 2022). The outcome cannot be precisely predicted. But it seems that there are also non-wage factors that will determine the bargaining process, like home-office hours.

All in all, the risk of a price-wage-spiral seems to be higher in the US than in Europe. However, it cannot be ruled out, as pressures on households increase by rising prices of food and energy, i.e. for goods and services which are hard to substitute.

### 3.4 Digitalization

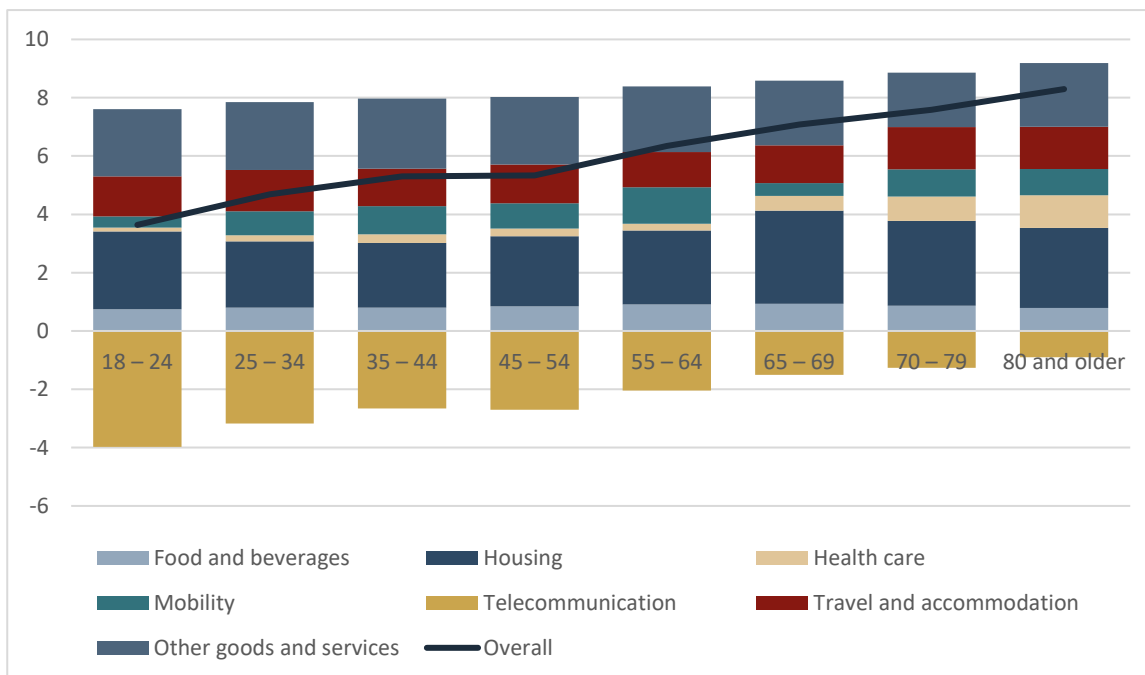
While the price dynamics of a lot of goods and services tend to contribute to higher inflation, there are also goods and services that tend to contribute negatively to inflation. These are normally goods that experience price drops due to quality adjustments. Take the mobile phone for example. In the year 2000 these devices were big and heavy with an antenna, and they could only supply the two services phone calls and SMS. Twenty years later mobile phones are light, have a touch screen and they can supply services like YouTube functioning like small computers. Thus, the quality has improved immensely. At the same time the price of an average mobile phone has not increased much. Higher prices can be found among the newest high-end luxury phones, but the average smartphone can be bought for 200 Euros, which is comparable to the price of a mobile phone of the year 2000. Since the quality has improved so much, one can get more services for each Euro, which means that the purchasing power of the Euro with respect to mobile phones has increased. That is why, the prices of mobile phones have a negative inflation contribution in the calculation of the inflation rate. Since mobile phones and related products only have a small weight in the consumption basket their huge negative inflation contribution must be due to large price decreases.

There are also other goods which have improved, like cars for example. Their price, however, has also risen due to the quality improvement. Information and communication technology as well as other electronic

devices, have improved much more compared to their price increases, that the quality-adjusted prices have dropped a lot. The gains in purchasing power are normally higher for a younger person than for older persons, since older persons have a lower weight in their consumption basket for information and communication technology. For a person aged between 18 and 24 years, these price decreases add to their inflation rate with a contribution of 2 percentage points on average in 5 years during the last 30 years. In the same time horizon, a person between 55 and 64 experienced only half of this negative contribution to his or her cost of living (figure 3-12).

**Figure 3-13: Inflation contributions of different products for different age groups**

Overall inflation rate in percent over a 5-year period, inflation contributions in percentage points. Numbers were calculated as averages over the years 1995 to 2022.



Source: Own calculations based on German Federal Office for Statistics

These large price decreases for information and communication technology can be found in the data until recently, when supply chain disruptions led to a shortage of computer chips which has increased the production costs of mobile phones and computers. Thus, large negative contributions are not only missing, but they have also turned to positive inflation contributions most recently.

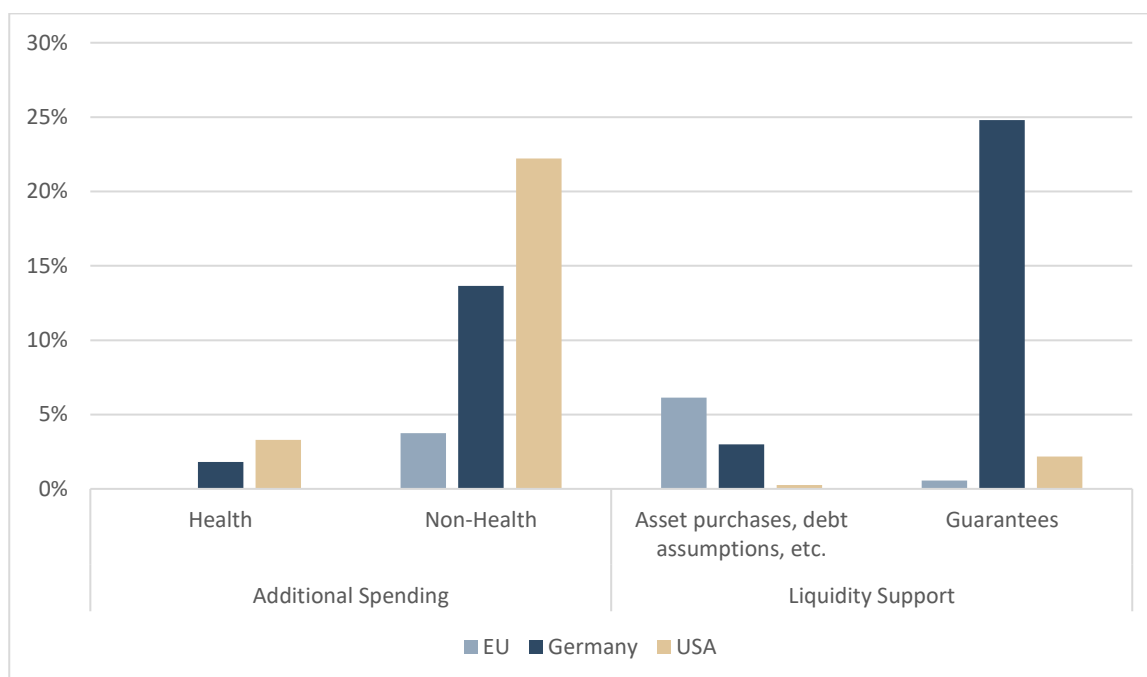
### 3.5 Fiscal policy

The fiscal policy stance in Europe was not expansionary during the pandemic. Most of the fiscal policy measures were aimed at shielding the economy from the adverse consequences of the pandemic. Instruments like the short-time work schemes or the liquidity measures for companies were not sized so that they could lead to additional demand. Workers who got short-time work pay received less money than their pre-crisis wage and companies which received liquidity measures used them for covering costs rather than for new investment. The US fiscal policy stance, however, is more expansionary, causing the overheating of the economy. The American Jobs Plan (AJP) and American Families Plan (AFP) will according to the International Monetary Fund increase spending and tax expenditures by 4.3 trillion US-Dollar over the next decade, which corresponds to about 18.7 percent 2021 GDP in 2021. The spending would be partly financed by raising taxes

on corporate profits and high-income households. The IMF estimates that the AJP and AFP will add a cumulative 5.3 percent to the level of US GDP during 2022-24 (Hodge / Lin, 2021). Lawrence Summers argues in an interview that the current US economy is running hot because of fiscal policy. While income was running short by 50 billion US-Dollar a month because of the pandemic, the fiscal policy response was to inject between 150 billion to \$200 billion US-Dollar a month into the economy. From Summers view it is therefore not surprising that this policy led to an overflow of demand, which has generated inflation of 7 percent (The Harvard Gazette, 2022). Figure 3-13 summarizes these findings by showing that the fiscal response to the Covid-19 pandemic of the US was aimed towards additional spending especially to non-health related sectors. Germany and the EU on the other hand were mainly offering liquidity support.

**Figure 3-14: Fiscal Measures in Response to the COVID-19 Pandemic**

In percent relative to GDP 2020.



Source: IMF DATABASE OF FISCAL POLICY RESPONSES TO COVID-19

The fiscal policy stance in Europe could, however, become more expansionary as a response to the Russian invasion in Ukraine:

- Europe has to increase its defense spending. Germany has announced to increase its military spending by 100 billion Euro (Marksteiner, 2022). to purchase 35 US F15 fighter jets and 15 Eurofighter jets as part of its plan to increase spending by 100 billion Euros. The huge investment volume can be tackled thanks to low interest rates. It can be expected that this rises the demand for steel and electronics, thereby accelerating the increase in raw material and intermediate product prices.
- Europe has to accelerate its green transformation in order to lessen its energy dependency especially on Russia. In addition to that it has to speed up its digital transformation in order to become more robust against cyber-attacks. The investment volumes of the transformation were already high before the Russian invasion in Ukraine. Thanks to low interest rates, the speed-up of the investment path can be financed easily. The huge demand for raw materials and intermediate products will increase their prices even further and contribute to inflation.

- The migration flows from Ukraine into Europe increases the demand for housing and new homes have to be build. Since interest rates are still low, these projects can easily be financed. The demand for lumber and construction materials will probably increase and thereby its price.

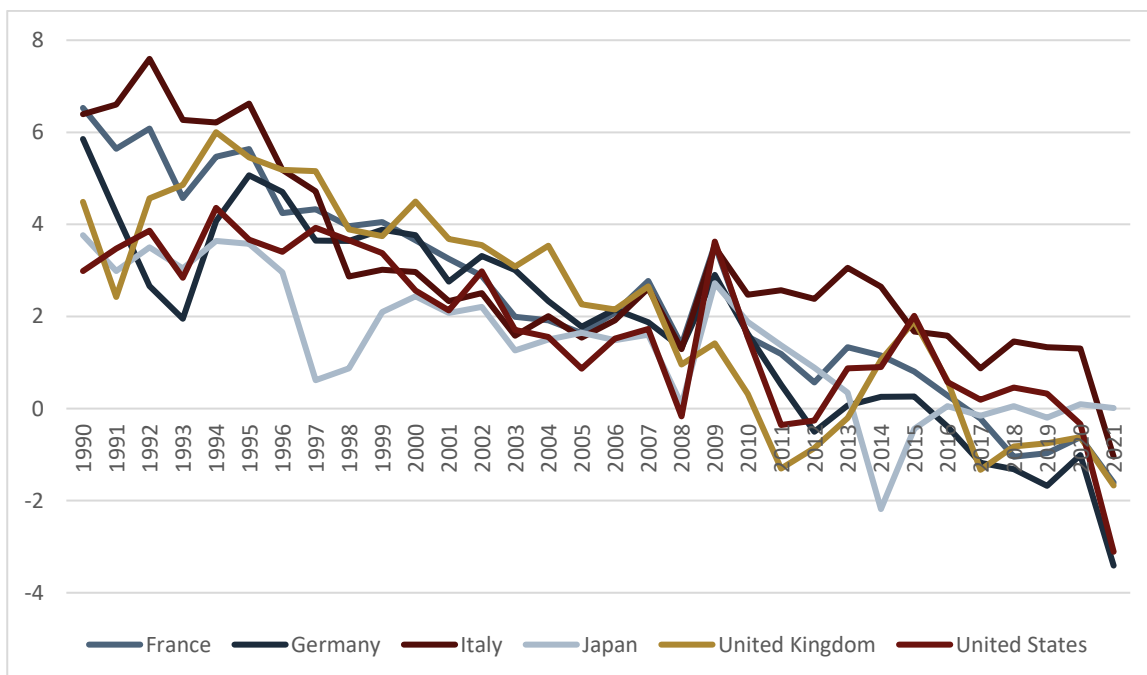
Given that, there seems to be a fiscal expansion in Europe ahead which likely contributes more inflation.

### 3.6 Monetary policy

The accommodative monetary policies since the Global Financial Crisis are reflected in the inflation-adjusted yields for sovereign bonds with ten-year maturity, i.e. yields minus current inflation, which proxy the long-term real interest rate on capital markets (figure 3-14). For Germany, the real rate is currently -3.4 percent indicating very ease financing conditions although yields have risen in the last weeks. The lower interest rates were not used to level up investment for many years, since government and companies were in a process of consolidation after the Global Financial Crisis which contributed to low inflation. The tackling of the consequences of the Covid-19-pandemic has spurred higher indebtedness at low interest rates. These additional funds, however, were not per se used for investment, since a large share of the loans were used to compensate for pandemic-related losses rather than for new investment.

**Figure 3-15: Real interest rates**

In percent.



Source: Own calculations based OECD

In the US, however, the low interest rates enabled government measures that have targeted the increase of household consumption. That is why we see that US inflation is predominantly driven by the inflation of goods and services and less by energy inflation. Moreover, we see that wage growth is reacting to inflation which gives rise to the emergence of a price-wage-spiral. In contrast to this, the European pandemic measures were focused on shielding companies, e.g. with liquidity measures and the short-term work



scheme. These measures were not intended to increase consumption, thus, we see that Eurozone inflation is less driven by price development in goods and services.

The accommodative monetary policies could, however, trigger inflation in the near future because they enable a higher investment demand and thereby a higher demand for raw materials and intermediate goods. Based on the change in investment behavior the low interest rates can contribute to higher inflation now. Thus, it can be expected that monetary policy has to become more restrictive in the US based on the demand-driven inflation there, but also in the Eurozone, since the investment demand to facilitate the economic transformation will lead to an inflationary growth. The ECB might indicate a toughening first by communication followed by reduced asset purchases and then by hiking interest rates.

The first hint of a changing monetary policy stance came in the ECB's March 10 monetary policy statement, in which the Governing Council announced that net asset purchases under the Asset Purchase Programme (APP) will be gradually reduced in April, May and June and that "If the incoming data support the expectation that the medium-term inflation outlook will not weaken even after the end of its net asset purchases" net asset purchases will be concluded in the third quarter of the year (ECB Governing Council, 2022). Moreover, the statement expressed that the key ECB interest rates will remain unchanged and will be gradually adjusted some time after the end of net asset purchases under the APP. With regard to the Pandemic Emergency Purchase Program (PEPP), the Governing Council reiterated that it will discontinue net asset purchases under the PEPP at the end of March.

From the higher inflation numbers that clearly violate the ECB's and the Federal Reserve's inflation targets, a monetary tightening seems warranted. While the demand-driven inflation in the US does not provide the Fed with a trade-off between stabilizing inflation and stabilizing the business cycle, the ECB is clearly facing this trade-off because of the energy-dependency of the European economies as noted by Demary / Hüther (2022). If the supply-side factors become persistent and wage policy tries to pass the price effects on, monetary policy will be forced to become restrictive. Thus, if inflation stays persistent in the Eurozone, the ECB's only option is to bring inflation back to its target value by causing a recession, something that the ECB tried to circumvent in the last years due to fragilities in the Eurozone. Since the ECB could support the economy with favorable financing conditions because of low inflation, this time might be different, since the ECB's overriding objective is to keep inflation low and stable. It will become very difficult, if not impossible, for the ECB to support the economy without violating its primary objective. From this one can conclude, that Christine Lagarde will be in a similar difficult position as Paul Volcker in 1979.

## 4 Outlook

Based on our analysis we have argued that the period of low inflation has come to an end based on six structural factors, which define the new inflationary environment:

- **De-Globalization** gained momentum with the Zero-Covid policies in Asia which have caused disruptions in international shipments and thereby contributed to higher food prices as well as to higher prices for raw materials and intermediate goods. It has further accelerated with the Russian invasion in Ukraine. As countries start to lessen their energy-import dependency on Russia, the pandemic-related higher energy prices are expected to rise even further which could lead to an energy crisis in Europe. Since a rise in oil prices is found to have an effect on the CPI for over 12 months, one can expect longer lasting effects.

- **Decarbonization** is fostered through the introduction of CO<sub>2</sub>-prices and this price increase is necessary for the economy to transform away from fossil-fuels towards carbon-neutral energy. Because of adjustment costs for households in adapting to the higher energy prices by energy saving investments, the transition period is accompanied with rising energy expenditures for households.
- **Demographics** affect the labor markets globally in the longer term by enhancing the scarcity of workers and thereby increasing the competition to find skilled personnel. The tighter labor market offers the possibility to demand higher wages. The labor market in the US might already be prone to a wage-price spiral. While short-term work schemes in the EU have prevented that a larger fraction of labor contracts have to be renegotiated, the situation is different in the US, where a large fraction of labor contracts has to be renegotiated, while the labor market has become tighter due to the reduction in the employment ratio.
- **Digitalization** has contributed to lower inflation. But due to temporary supply-side frictions, the scarcity of semi-conductors has led to increases in the prices of electronics. Given a higher demand for electronics during the digital transformation, the prices are expected to rise, thereby possibly ending the price decreasing effect of digital innovations on inflation.
- **Fiscal policy** in the US has led to an overheated economy with demand-driven inflation, while fiscal policy in Europe was more focused on shielding companies from the negative consequences of the pandemic by means of short-time work schemes and liquidity measures. However, the EU has to spend heavily on military equipment and the transformation away from fossil-fuels in order to lessen its dependency on Russia. The resulting fiscal response could probably lead to additional demand-driven inflation.
- **Monetary policy** has created a low interest rate and high liquidity environment, in which governments and companies have favorable financing conditions. This environment was not inflationary for a longer time since governments and companies were in a process of debt consolidation. But this process has come to an end, since necessities to invest in carbon-neutrality and increase military spending have emerged. While Eurozone inflation is predominantly energy-price driven, US inflation is mainly demand-driven. These different inflation causes yield different monetary policy responses which could lead to a positive interest rate differential between USA and Eurozone and thereby a weaker Euro, which exacerbates the energy-driven inflation in the Eurozone.

How high will inflation rise? How long will the new inflationary environment last? How challenging is it for central banks to counteract these inflationary pressures? A stagflation like in the 1970ies seems possible given these trends. The energy-crisis made the transformation of our energy systems necessary, which is, however, progressing slowly, thereby contributing to a longer lasting energy-triggered inflation. The highest risk will be an energy embargo, resulting in a deep recession together with high inflation. In this case monetary policy might be forced to inject high amounts of liquidity into markets despite high inflation. From this one can conclude, that Christine Lagarde will be in a similar difficult position as Paul Volcker in 1979.

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