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Global energy price inflation with a European twist

Policy Department for Economic, Scientific and Quality of Life Policies
Directorate-General for Internal Policies
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Abstract

Inflation has always had a strong global component, driven mostly by volatile energy prices. However, the unprecedented levels of inflation reached now cannot in all cases be explained by energy prices – except for the euro area, where gas prices have had a special impact. The international spill over effects of national monetary policy are uncertain. US tightening has negative repercussions abroad, especially on emerging economies, because of the dominant role of the US dollar in global financial markets. Euro area tightening might have a positive impact on the US economy because a stronger euro helps, even if only marginally, other exporters.

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LIST OF ABBREVIATIONS

CPI	Consumer Price Index
ECB	European Central Bank
EU	European Union
HICP	Harmonised Index of Consumer Prices
KWH	Kilowatt-hour
LNG	Liquified natural gas
PCE	Personal Consumption Expenditures Price Index
US	United States
USD	United States dollar

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EXECUTIVE SUMMARY

- **Inflation has been a global phenomenon for a long time.**
- **The global shock that now dominates inflation is evidently the increase in energy prices.**
- **During most of the last two decades the main source of energy price shocks has been the price of crude oil; however, 'this time is different' because of the extraordinary increase in the price of natural gas, which has had a differential and very strong impact on the euro area.**
- **The energy price surge is far more extreme in the euro area, compared with that in the US, due to the relative isolation of the US gas market and the electricity market design of the EU.**
- **A large part of the energy price component in the harmonised index of consumer prices, which is based on gas and electricity, is likely to stay elevated as high gas prices feed gradually through to utility rates.** This in turn is likely to introduce a transatlantic asymmetry that might last for some time.
- **The literature on the coordination of monetary policy concludes generally that the gains in terms of better macroeconomic outcomes are small.** The case for coordination is thus weak.
- **Synchronised (parallel) global tightening does not necessarily imply a stronger or excessive negative impact on economic activity, as the spill over effects of monetary policy are of uncertain sign.**
- **Empirical evidence suggests that US monetary tightening has a negative impact on demand and inflation abroad, especially on emerging markets.** But the opposite could be true for other countries and for the euro area. Tightening by the ECB might support other countries' exports via a stronger euro.
- **This asymmetry does not prima facie constitute a case for global policy coordination given that policymakers are aware of these asymmetric mechanisms.**

1. INTRODUCTION

Inflation has been a global phenomenon for a long time. This applies to both the long-term trends and the short-term fluctuations around the long-term trends at the business cycle frequency. The latter phenomenon has been extensively studied.

The role of global factors, including oil and commodity prices, in driving short-term inflation dynamics in advanced economies have been confirmed by several empirical studies (Ciccarelli and Mojon, 2010). Although to a lesser extent, these factors are also found to have an impact on core inflation (Forbes, 2019).

While the impact of energy prices on inflation in the short run is well established, the impact of higher energy prices on core inflation is a priori difficult to determine. On the one hand, higher energy prices mean higher input prices for a range of goods that make up the core consumption basket, driving the core consumer price index (CPI) upwards. The direct effect of higher energy prices on core inflation could thus be positive.

On the other hand, one should expect an inflation-targeting central bank to stabilise overall CPI inflation, which implies that a higher energy contribution to inflation requires a lower contribution from core prices. This mechanism could only work indirectly via the central bank's policy reaction weakening demand and hence lowering price pressures overall. Yet that might take more time and not be immediately visible in the short-term, e.g. in quarterly data.

Putting aside energy prices and their potential direct and indirect impacts on core inflation, the New Keynesian Phillips Curve framework, which dominates central banks, implies that domestic factors such as the output gap and inflation expectations should be the main determinants of core inflation. But thanks to globalisation more goods are imported, which has led to research looking at the relative significance of the global versus the national output gaps in determining domestic inflation (usually in a Phillips curve framework). That research initially found global factors to play an important role (i.e. mainly the global output gap). But their importance has weakened over time. Forbes (2019) considers this pattern to be more evident for advanced economies outside the euro area.

A related, but somewhat different issue concerns the medium-term evolution of inflation. For example, an analysis of euro area inflation attributes the persistent low core inflation during 2014–2017 to spillovers of the second-round effects of falls in energy and oil prices, besides the economic slack (KOF, 2017).

If one takes a longer view, one can discern two distinct periods in the trends of inflation in advanced economies over the past four decades.

The first was a period of disinflation during the 1980s and 1990 when the common challenge was to bring inflation down. The second was a period of low inflation starting around the turn of this century. The low inflation period can be subdivided again, first into the 'peak great moderation' that lasted until the financial crisis, during which central banks were able to hit their inflation targets with notable precision. The Great Financial Crisis put an end at this. It was followed by more than a decade of "lowflation", during which the task for most advanced countries was to bring inflation back up to the target (mostly of 2%).

Demographic shifts, globalisation and digitalisation have been considered to be the main causes of subdued aggregate demand and inflation during the last two decades, underlining the prominent role of global factors, rather than domestic factors, in inflation dynamics. The global financial crisis

deepened the pre-existing weakness in domestic demand (and productivity), putting further downward pressure on prices and wages.

Inflation has thus been a common feature for a long time.

The data suggest that there are strong common trends in inflation across advanced economies. Correlation does not mean causation – especially in this case, where one just observes that advanced countries tend to show a similar trend. But this close correlation would be highly unlikely if inflation was driven mainly by idiosyncratic domestic shocks. Similar reactions to common shocks constitute a much more likely cause of these waves in inflation. However, the modern inflation-targeting framework makes sense only if one assumes that central banks have policy instruments which are strong enough to neutralise in the medium run any global factors affecting domestic inflation in the short run. This is the task of the European Central Bank (ECB) right now.

This paper deals with the challenge the ECB faces by providing a comparative framework for the present energy shock.

2. GLOBAL SHOCKS AND THE CO-MOVEMENT OF INFLATION AT BUSINESS CYCLE FREQUENCIES

This short discussion of how global factors influence inflation and what kinds of common elements one would expect shows that energy prices play a key role: when they move by a large amount they have a strong influence on headline inflation. When energy prices move to a lesser extent and when one looks at core inflation, business cycle indicators like the output gap become more important. The significance of global factors in influencing inflation is bound to vary over time.

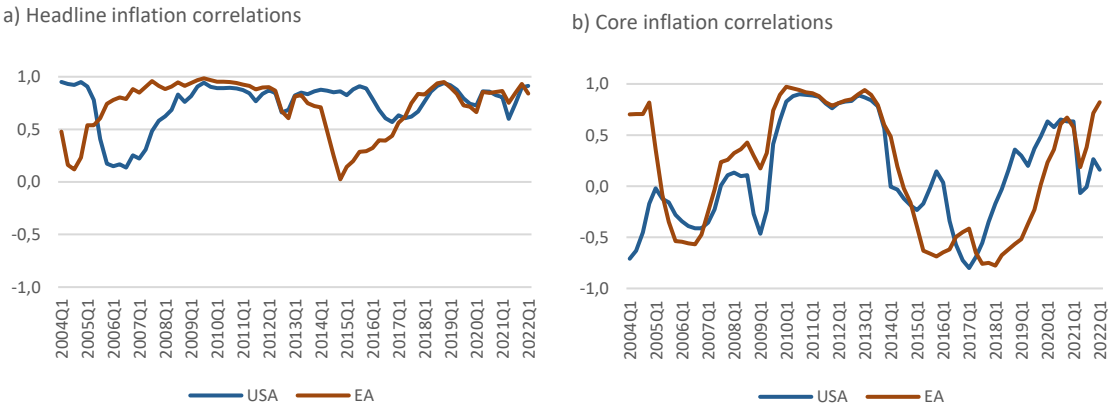
Figure 1 shows the changing nature of global co-movements over time for the United States (US) and the euro area. It illustrates the correlation of the domestic inflation rate with the average for developed countries (excluding the home country itself) for headline and core inflation respectively. The period taken into consideration is 2004Q1–2022Q1. The correlation coefficient is calculated for a rolling window of the previous 12 quarters (3 years), corresponding roughly to a business cycle.

The graphs show periods when inflation correlations were very high, interspersed with other periods of low or even negative correlation coefficients. For headline inflation, the correlation coefficient is always positive and often above 80%. The low values for the euro area in 2004 and 2015 are probably due to the impact of the largest swings in the exchange rate of the euro during the three preceding years. (That is, a weak euro in 2001 and a strong euro until 2015 coupled with the fallout from the euro sovereign debt crisis, which influenced the three preceding years.)

The correlations of core inflation rates, which reached similar peaks (close to 100% during 2011–2013), are on average much lower (16% compared with 70% for headline inflation) and even turned negative over extended periods. High correlations in core inflation seem to be the exception rather than the rule. These high correlations are observed during periods coinciding with major events in the global business cycle, such as the Great Financial Crisis and the Covid-19 crisis.

We concentrate here on the euro area and the US – two continental-size, diversified economies. Other countries, including large ones like Japan, would show a more divergent pattern with lower correlation coefficients.

Figure 1: Correlations with global inflation

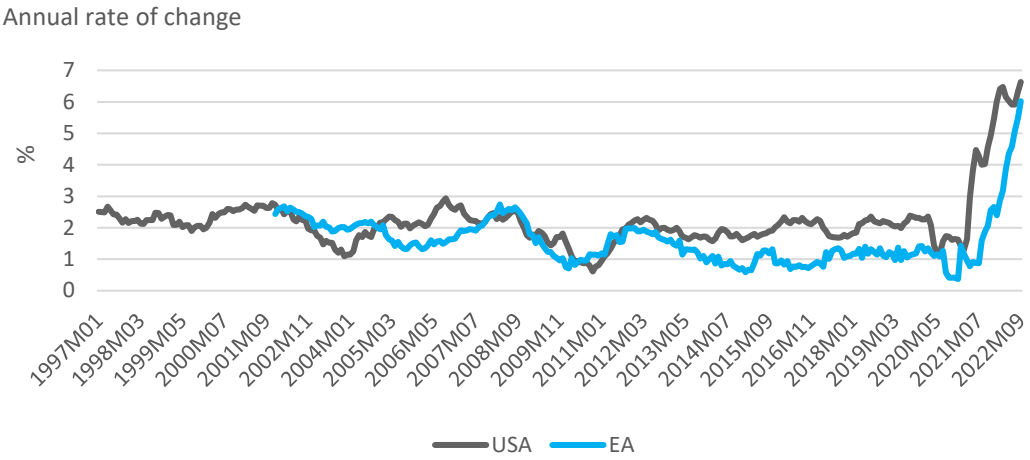


Source: Authors' calculations based on Eurostat, FRED and World Bank data.

Note: The correlations are computed on a rolling 3-year (12-quarter) basis.

The correlations in Figure 1 illustrate the changing pattern over the last two decades of low and stable inflation. That period has ended for now, with inflation (including core inflation) reaching unprecedented levels as shown in Figure 2, which depicts the level of core inflation for the US and the euro area.

Figure 2: Core consumer price index, the US and euro area



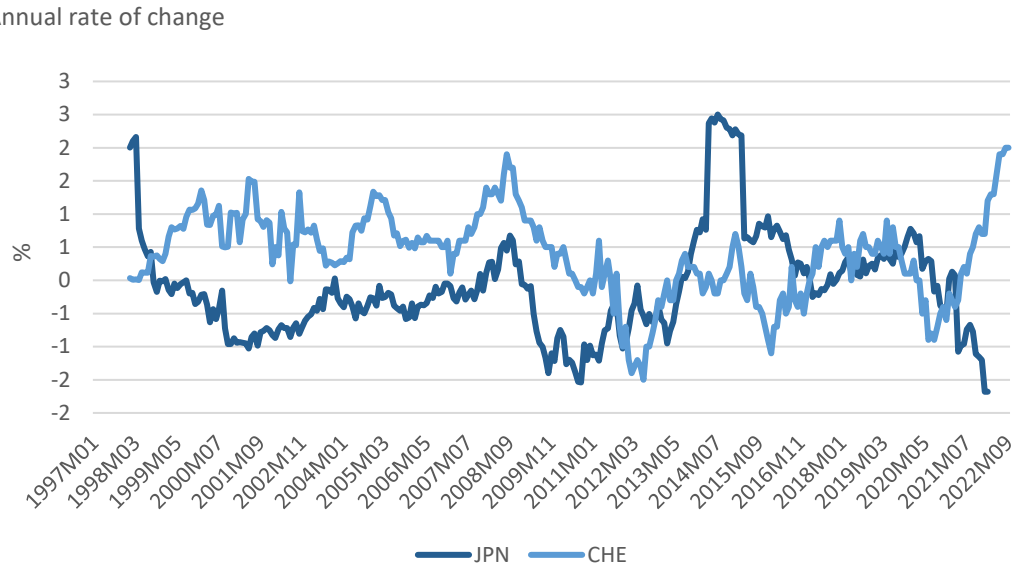
Source: Authors' calculations based on FRED and Eurostat.

It is interesting to note that while the US and euro area show great similarity in recent data, which is several standard deviations outside the bounds observed during the past two decades, one finds a very different pattern in two traditionally low-inflation economies, Switzerland and Japan. In Switzerland, core inflation has increased rapidly. Even so, starting from negative values in 2020, it has only reached the level last seen in 2007 (the euro area is more than two times above the value of 2007). In Japan, core inflation has even gone negative, as it should do if the central bank is to keep overall inflation under control in the face of increasing energy prices (Figure 3).

Energy prices make up about a tenth of the harmonised index of consumer prices (HICP). This implies mechanically that an increase in energy prices of 40% translates into a contribution of 4 percentage points to the HICP. Non-energy (core) prices would have to fall by about 2.2% (-0.02 / 0.9) in order to keep overall HICP inflation at 2%.

The ECB (and other central banks) argues convincingly that the cost of achieving such a fall in core prices would be prohibitive. That is why the ECB (and most other central banks around the world) did not immediately try to achieve their price stability target in the face of rapidly rising energy prices. Initially, they hoped that, provided core inflation remained stable, headline inflation would return on its own to 2% once energy prices stabilised. However, that hope was misplaced. Core inflation has shot up as well (except in Japan), leaving central banks little choice.

Figure 3: Core consumer price index, Switzerland and Japan



Source: Authors' calculations based on World Bank and Eurostat.

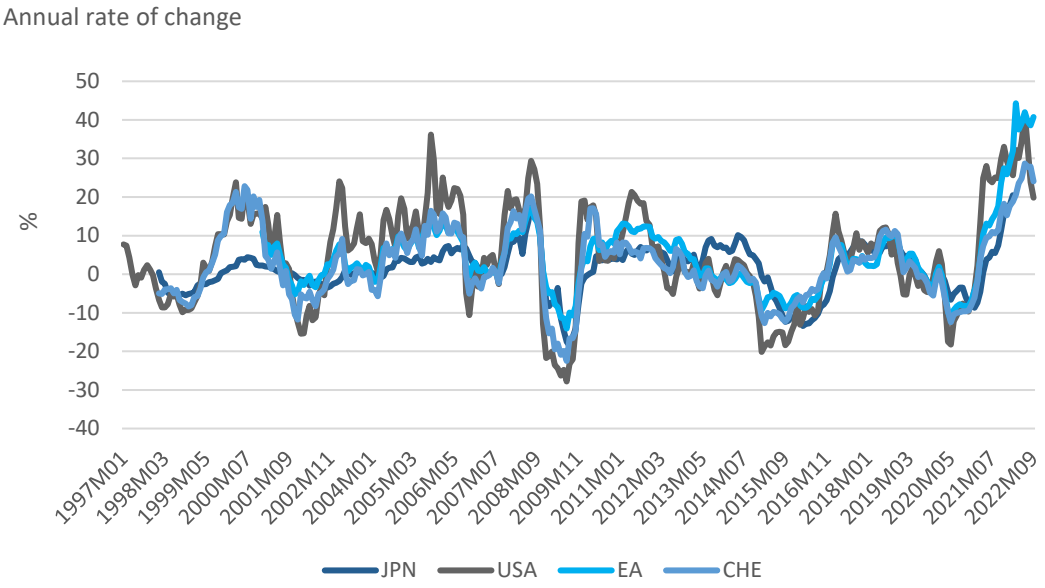
3. ENERGY PRICES AS THE MAIN DRIVER OF INFLATION

The global shock that now dominates inflation is of course the increase in energy prices. An initial question is whether today's energy price movements are unprecedented.

3.1. Is today's situation special?

Figure 4 shows the energy component of inflation in the national CPI of the US, Japan, Switzerland and the euro area. It is apparent that energy prices have been highly correlated across countries for a long time. Furthermore, energy prices have varied far more than headline and core inflation. The scale in Figure 4 is about 10 times larger than that in Figure 3.

Figure 4: Energy price component of the national consumer price index



Source: Authors' calculations based on World Bank, FRED and Eurostat.

The scale of Figure 4 hides large differences that have recently arisen. By September 2022, in the euro area the energy price component was 40% higher than the year before, against about 20% in the US and a little more than that in Switzerland and Japan. Energy has clearly been a much stronger driver of inflation in the euro area than elsewhere[1].

Table 1 shows that energy price inflation has usually been above the 2% inflation target. Over the last 20 years, prices have increased on average by over 3% in the euro area and 4.5% in the US.

The second row of the table also shows large differences in the variability of different inflation measures. Core inflation is, unsurprisingly, the most stable one, with a standard deviation of only 0.6% (per annum) in both the US and the euro area. Headline inflation has a variability that is about twice as high (1.3 and 1.0%). The variability of energy inflation, however, is an order of magnitude higher, at 12.4% in the US and 7.1% for the euro area.

The last row in Table 1 gives an indication of how large the latest observed value (Q32022) is from the previous pattern by dividing the difference between the latest observed value and the average by the

[1] These values constitute a clear break with the previous transatlantic proportions. As mentioned above, the energy component of the HICP had moved by only half the value of its US counterpart. Today the euro area value is double that of the US.

standard deviation. This procedure creates a standardised variable for which one can determine the likelihood of the occurrence of values much above 1. Assuming a normal distribution, any value above 2 indicates that it would be highly unlikely (only about a 5% chance) to find such a discrepancy.

The values of between 4.5% and over 6.9% observed for US headline and core inflation suggest that the recent values represent an extreme deviation from the pattern over the last 20 years. By contrast, US energy price inflation does not seem extreme (with a value below 2%). But for the euro area, one finds again an extreme value. For the US, a high but not totally unprecedented increase in energy prices is associated with an unprecedented surge in inflation. For the euro area, the energy price increase is much more extreme and hence a better candidate for explaining the behaviour of inflation. The reason for this difference will be explored below.

Table 1: Inflation volatility across the Atlantic

	Headline Inflation		Core Inflation		Energy Inflation	
	US	**Euro area**	**US**	**Euro area**	**US**	**Euro area**
Mean (2000–2021)%	2.2	1.7	2.1	1.5	4.5	3.2
St. dev. (2000–2021)%	1.3	1.0	0.6	0.6	12.4	7.1
Dispersion relative to long-term mean (2022Q3)%	4.5	7.6	6.9	7.3	1.7	5.1

Source: Authors' calculations based on FRED and Eurostat.

Note: Core inflation excludes the prices of unprocessed food and energy products.
Dispersion is calculated as inflation rate in Q32022 (on a year-on-year basis) minus the long-term mean (2000Q1-2021Q4) divided by standard deviation over the same period (2000Q1-2021Q4).

3.2. Transatlantic differences in energy price shocks (until 2021)

Over most of the last two decades the main source of energy price shocks has been the price of crude oil. During this period the variability of the energy component of the CPI (or personal consumption expenditures price index, PCE) has generally been higher in the US than in the euro area or most other advanced economies, because the price at the pump (which is the relevant price entering the CPI) is much lower in the US. In most other advanced economies, over half the price paid by consumers consists of taxes and other fees, which are fixed[2]. This implies that a 10% increase in crude oil translates into an approximately 10% increase in the price at the pump in the US, but much less elsewhere.

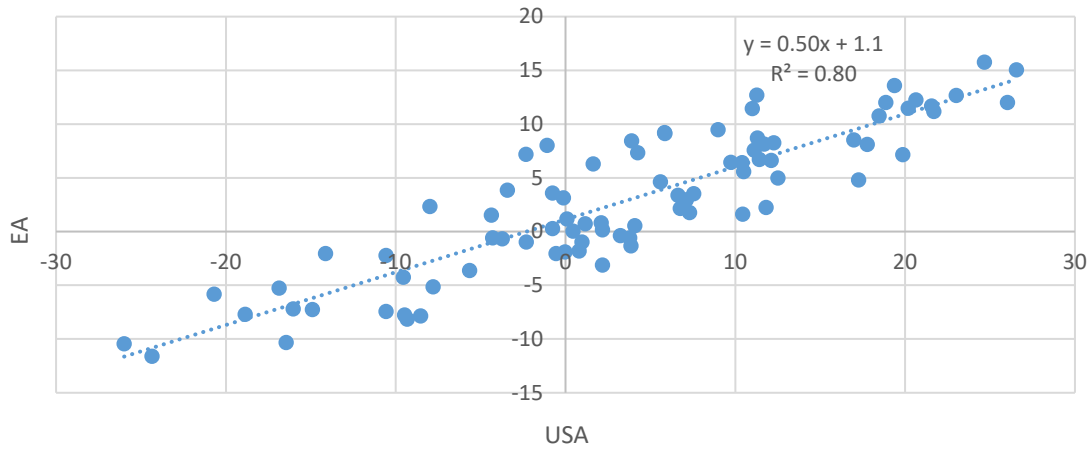
A crude calculation can illustrate the importance of this effect. A 10% increase in crude oil prices translates into only a 5% increase in the price at the pump if one assumes that in the euro area only half the price at the pump consists of the input price (i.e. the price of fuel oil). That is the reason why the

[2] Some taxes increase with the input price. But euro area governments have often lowered those taxes that are proportional to the price (like VAT) when the oil price spikes.

energy price component has been more variable in the US than in the euro area (or Japan and Switzerland).

Figure 5 shows the energy price component of the US CPI and the HICP in the euro area. There is a very tight correlation between the two over these 20 years (with a correlation coefficient close to 80%)[3]. Moreover, the line of best fit has a slope of only 0.5, which implies that, for the reasons explained above, euro area energy prices have on average increased by only half the US value.

Figure 5: Scatter plot of US and euro area energy price inflation, 2001–2021



Source: Authors' calculations based on FRED and Eurostat.

3.3. The special case of natural gas and its importance for Europe

However, "this time is different" because of the extraordinary increase in the price of natural gas, which has had a differential and very strong impact on the euro area. Over the past 20 years gas prices have been much more stable than oil prices, but this changed in the course of the second half of 2021 (Gros, 2022).

There are two reasons why natural gas prices have had a differential impact on the euro area compared with other advanced economies. First, (wholesale) natural gas prices have risen much less in the US than in the euro area as shown in Figure 6. That is because supply in the US has not been affected, thus keeping the domestic supply-demand equilibrium largely unchanged. Moreover, the export capacity of liquefied natural gas (LNG) by the US is limited in the short run (about 10% of total domestic supply), which explains why the huge price differential has not been narrowed by a boost in exports.

Second, in the euro area wholesale electricity prices are linked to the price of natural gas via the merit order system for the electric power market, under which the price of electrical power is determined by the most expensive source (i.e. its marginal cost)[4]. This is one of the reasons why electricity prices have escalated in Europe, while remaining constant in the US. Price increases in the wholesale market usually do not translate one-to-one into higher prices for consumers because electricity tariffs for households are regulated, but at the national level, which implies that even within the euro area there are considerable differences in the CPI component of electrical power. In some countries, consumer tariffs were indexed on wholesale prices. In these countries there was of course a much tighter link between

[3] Somewhat surprisingly for Japan the energy price component of the CPI is much less correlated with either the US or the EU, illustrating the considerable effect of national regulations on retail energy prices.

[4] https://fsr.eui.eu/event/electricity-prices-and-market-design-2/

wholesale and retail prices. The latest Eurostat survey of retail electricity prices shows several countries with prices in the first half of 2022 above 30 cents per kilowatt-hour (kWh) and some below 10 cents per kWh[5].

Electric power is not in principle a good that is tradeable across continents. Yet via the price of gas (or coal), which is a tradeable commodity, power prices in Europe are much more influenced by global developments than those in the US (or most of Asia, where household prices for gas and electricity are highly regulated and decoupled from global prices).

The fact that utility rates for gas and electricity are only gradually adjusted in reaction to the higher purchase costs of the utilities themselves implies that the response of the energy component of the euro area HICP is likely to follow a moving average of wholesale gas prices.

It differs for motor fuel (petrol) prices, which tend to very quickly follow global spot prices. This is one reason why inflation in the euro area might continue to increase or at least stay at elevated levels for some time after wholesale gas prices have come down and stabilised.

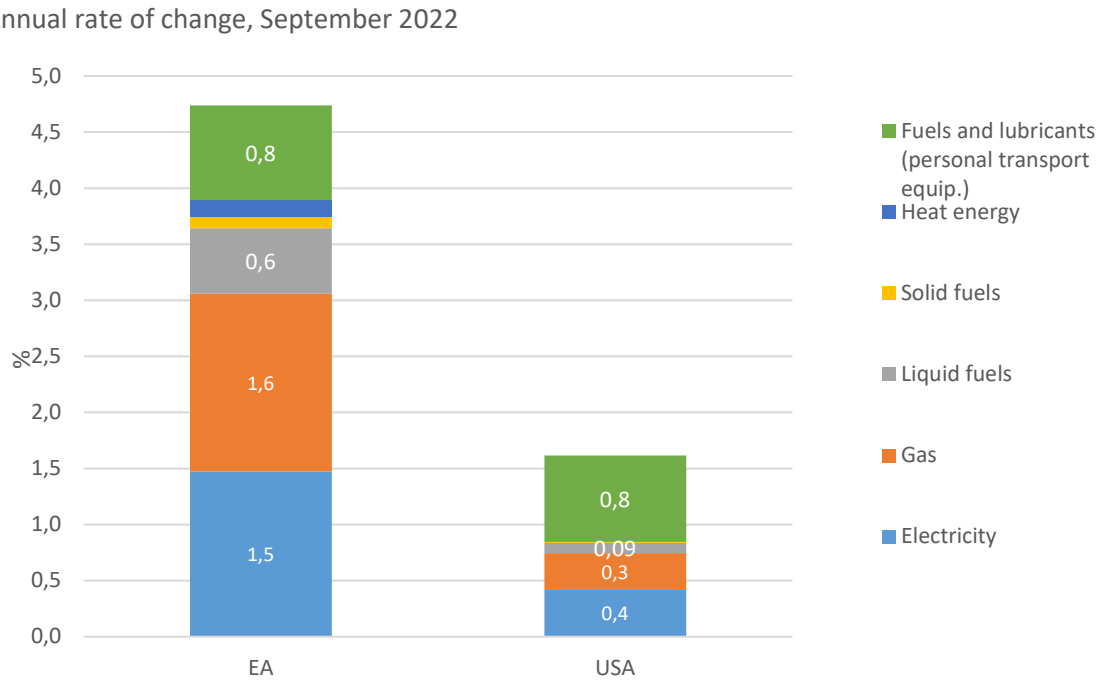
In the US, the fuel component of energy has already turned negative (but not in Europe because of the depreciation of the euro). Even so, the two thirds of the energy price component in the HICP based on gas and electricity are likely to stay elevated, as high gas prices feed gradually through to utility rates (unless the government intervenes in utility rates, like in France). That is likely to introduce a transatlantic asymmetry that might last for some time. In the US, energy prices might soon become a deflationary contribution, with the opposite in Europe.

Figure 6 shows the contributions of the energy price component – including petrol (motor fuel), electricity and natural gas prices – to consumer price inflation in the US and the euro area. The contribution from higher oil prices is exactly the same (0.8%). But there are important differences in the other components.

Two differences stand out: the total contribution of energy prices to inflation is much higher in the euro area (in September it was 4.5% for the euro area versus 1.5% for the US). What is more, the individual components are very dissimilar. In the US, natural gas for heating and electricity provide only a small contribution (much smaller than for motor fuels), whereas in the euro area these two factors contribute two thirds of the overall energy price index.

[5] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics

Figure 6: Contribution of energy prices to inflation, the US and the euro area



Source: Authors' calculations based on FRED and Eurostat.

In the case of electric power and gas used by households, one needs again to take into account that the pure energy content makes up only a fraction of the price charged to consumers, not only because of taxes, but also because of other charges, including network fees. This explains why the gas price component of the HICP has increased much less than wholesale gas prices. Even after the recent fall from the peaks reached in the summer, wholesale gas prices still remain several times higher than the average of previous years, whereas natural gas prices charged to households have "only" doubled.

As an aside, we note that the fixed charges (especially for the network) are usually much higher in richer Member States. That underlies the higher percentage increase in household gas and electricity prices in poorer Member States, particularly in some countries of Central and Eastern Europe which have a tradition of subsidising household energy costs. For example, the reported annual increase in the gas price as of the first half of 2022 was 110% in Lithuania versus 40% in Italy, although in both countries the absolute increase in the price was 3 cents per kWh[6].

The depreciation of the euro is another factor driving energy prices higher in Europe. But the extent of the depreciation of the euro against the US dollar (USD) (less than 20%) means that this factor is of secondary importance (at least compared to the huge increase in natural gas prices). The exchange rate of the euro usually has only a limited impact on HICP inflation because the prices of imported consumer goods tend to be sticky; they are not adjusted every time the exchange rate moves (Ortega and Osbat, 2020). The impact differs for imported commodities, including energy, where the exchange rate passes immediately through to wholesale prices (for gas, for example, and also for petrol).

[6] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Natural_gas_price_statistics#Natural_gas_prices_for_household_consumers

4. AN INTERNATIONALLY COORDINATED APPROACH TO MONETARY POLICY

Gains from the coordination of national monetary policies have been widely studied. Most research finds that among the larger developed economies these gains in terms of better macroeconomic outcomes (lower output losses for achieving inflation target) would be small (Obstfeld and Rogoff, 2002). Mohand and Kapur (2014) document once more that developed economies might gain more.

While the literature has concentrated on better macroeconomic outcomes, there are other reasons why coordination might be beneficial: *"Policy coordination may also produce welfare gains if the international financial markets are incomplete, if policymakers have imperfect information, and if domestic shocks are not perfectly correlated across countries."* (Frieden and Broz, 2013).

Nevertheless, these conditions are unlikely to be satisfied today. Financial markets are working well and policymakers have good information on what their colleagues around the world are doing and planning to do. Furthermore, shocks are highly correlated in that some global shocks impinge on all advanced economies at the same time (e.g. high energy prices, supply chain disturbances).

4.1. The likely impact of global synchronised tightening

The size and sign of the spill over effects have been extensively researched. As summarised briefly in the previous section, the size has generally been found to be small.

Standard macroeconomic modelling suggests that monetary policy tightening in one country could lead to higher inflation abroad, as the national currency is likely to appreciate (implying that the rest of the world depreciates). An isolated case of tightening could thus be more effective (for any single country) than synchronised tightening, which has little impact on exchange rates.

There is also strong evidence of an asymmetry: US monetary policy is widely taken to have strong spill over effects on the rest of the world, in particular emerging economies and especially those with foreign debt denominated in USD. This effect operates via financial markets, not the aggregate demand effects prevalent in macroeconomic models. Research by the ECB itself has also documented that the euro area and the US influence each other, but the strength and the sign of the spill over effects differ markedly: US monetary policy has a strong influence on the euro area, but the effect is rather weak the other way round. The sign also diverges: US monetary tightening has a negative impact on output (and thus presumably also on inflation) in the euro area because higher US rates lead to more constrained financial conditions in the rest of the world. By contrast, tightening by the ECB does not have an impact on financial conditions in the US (or much of the rest of the world). Still, via an appreciation of the euro, it has a positive (albeit very small) impact on demand in the US (Ca' Zorzi et al., 2020).

There are two reasons for these asymmetries. First, the fact that the impact of the US on the euro area is much stronger could already be guessed from the difference in size. The US economy is at present exchange rates almost 70% larger than that of the euro area (USD 24 trillion for the US and USD 14 trillion for the euro area). Second, the disparity in the nature of the cross-border impact (i.e. the opposite sign) is due to something else, namely the role of the US dollar as the dominant global currency. Tightening by the Federal Reserve usually increases the risk premium paid by borrowers in USD in general. This can put many emerging markets (which depend on dollar financing) in a difficult position, as their foreign debt service obligations increase and the rollover or refinancing of existing debt becomes harder (Danninger et al., 2022; Hoek et al., 2021).

Synchronised global tightening could thus have asymmetric effects as well. The US aspect of the tightening would tend to depress demand in the rest of the world, helping to keep inflation down. However, the tightening by the rest of the world (the euro area and most other advanced countries, except Japan so far) would limit the appreciation of the USD and sustain demand in the US.

This asymmetry does not prima facie make a case for global policy coordination given that policymakers are aware of these asymmetric mechanisms.

5. CONCLUSION

Several points emerge from this analysis.

Inflation has always been a global phenomenon, often driven in the short run by volatile energy prices and at times by closely synchronised business cycles (like during the Great Financial Crisis of 2008–2009 or the Covid-19 recession of 2020).

The current increase in energy prices at first sight fits a recurring pattern. Yet gas prices today play a special role in Europe, driving components of the HICP (mainly heating and electric power), which in the past had been little affected by gyrations of the oil price. This effect does not operate in the US, thus rendering the inflationary pressure much stronger in the euro area than in the US or other countries with regulated utility prices.

Explicit coordination of monetary policies is unlikely to bring large benefits because central banks are aware of one another's actions. Moreover, explicit coordination would have to rely on secure knowledge of the global spill overs of national monetary policy. These spill overs, however, are difficult to determine a priori. Also, the available models are probably not suitable to guide policymaking in the present environment, in which a number of supply and demand shocks interact in an unprecedented way. At any rate, central bankers are very aware of the actions of their counterparts abroad. They can act in the full knowledge of what is being done globally, but cannot be certain at this point how tightening abroad will impact their own economy.

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Inflation has always had a strong global component, driven mostly by volatile energy prices. However, the unprecedented levels of inflation reached now cannot in all cases be explained by energy prices – except for the euro area, where gas prices have had a special impact. The international spill over effects of national monetary policy are uncertain. US tightening has negative repercussions abroad, especially on emerging economies, because of the dominant role of the US dollar in global financial markets. Euro area tightening might have a positive impact on the US economy because a stronger euro helps, even if only marginally, other exporters.

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