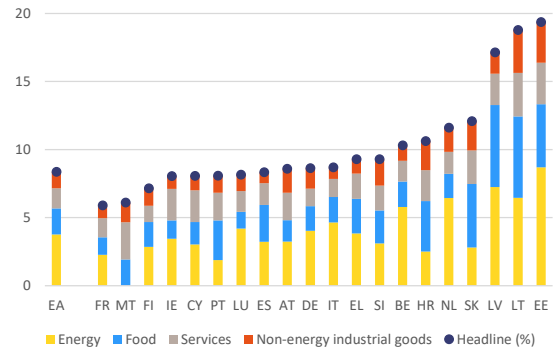
I. The great dispersion: euro area inflation differentials in the aftermath of the pandemic and the war

By Christian Buelens ([1])

Abstract: *Differences in inflation levels between euro area countries have risen sharply to previously unseen levels. This has come alongside the recent surge in inflation in the euro area following the pandemic and the energy price shock triggered by Russia's aggression of Ukraine. This article reviews the recent evidence on why inflation rates have differed so much across countries and discusses the potential implications for the euro area. Most of the differences are attributed to global factors, essentially commodity prices and supply disruptions, that led to inflation patterns that were on the one hand highly synchronised, but on the other hand very uneven in magnitude, reflecting structural differences in energy intensity. As the impact of these factors gradually fades, the impact of domestic country-specific drivers of national inflation is now increasing. The extent of future dispersion in inflation will thus largely depend on households' and firms' efforts and ability to safeguard purchasing power and profits by raising wages or prices. If inflation persists at national level, it could give rise to asymmetric inflation patterns across the euro area, depending on domestic institutions such as wage or price indexation mechanisms, or the tempering effect of income support provided in response to the various real income shocks on wages. Persistent and significant asymmetries could give rise to costly macroeconomic imbalances.*

I.1. Introduction

Graph I.1: **Inflation by euro area country, 2022**



Source: Eurostat, own calculations

The recent historical surge in euro area inflation has attracted considerable attention and has been a source of preoccupation for euro area citizens and policymakers alike. Their counterparts in other advanced economies share similar concerns about high inflation. However, in a monetary union, such as the euro area, it is also natural to ask whether inflation in some countries is higher than in others and, if so, why and what it could mean. Indeed, alongside aggregate inflation, inflation differentials have also recently widened to previously unseen levels (Graph I.1). The underlying factors and potential implications are discussed below.

I.2. Are inflation differentials in a monetary union a problem?

In a monetary union such as the euro area, it is natural to focus on the area-wide inflation rate, which is the target of the single monetary policy. But different levels of inflation across constituent parts of monetary unions are a natural phenomenon, in particular the larger and more heterogeneous they are (see Box I.1) ([2]). They are natural for several reasons ([3]): structural differences, for example because regions specialise in different sectors of the economy; differences in their regulatory environments; or population differences in terms of people's preferences or income levels. The resulting differences in regional supply- and demand-side factors behind price formation, and related to this, the potential asymmetric impact of union-wide shocks, explain why price levels and price dynamics may differ across a monetary union ([4]).

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([2]) That said inflation differentials are not limited to large economic areas. Recent analysis shows that inflation cycles and pricing behaviour across five cities in Lithuania – a country with about 2.9 million inhabitants and accounting for about 0.4% of euro area GDP in the first quarter of 2023 – also still lack full synchronisation (Cevik S. (2022). Mind the Gap: City-Level Inflation Synchronization. IMF Working Paper WP/22/166).

([3]) For a literature review on inflation differentials see Coutinho and Licchetta (2023, forthcoming). Inflation differentials and energy dependency in the EU Directorate General Economic and Financial Affairs (DG ECFIN), European Commission

([4]) The HICP tracks prices over time in a country but does not appraise differences in price levels across countries, which can be substantial.

Although differences in inflation levels are a natural occurrence, they matter in any monetary union composed of different regions. They have consequences for policy and ultimately for the cohesion and social welfare across regions. With a single monetary policy, different regional inflation rates mean that real interest rates diverge, and that monetary policy will affect demand across the monetary union in different ways.

Literature on the optimum currency area ([5]) indicates that the more heterogeneous the constituent regions are, as captured by dissimilar inflation dynamics, the less optimal the currency area is, unless other mechanisms are used to correct asymmetries and internal imbalances, such as intra-regional fiscal transfers, labour mobility or structural agility. The latter notably depend on the degree of nominal and real rigidities in product and labour markets. If the level of rigidities is low, a region will react to a negative demand shock by reducing prices and wages relative to the rest of the monetary union, thereby stimulating net exports and activity. In that case, different levels of inflation would indicate the functioning of a correction mechanism.

The ability to correct for structural and cyclical heterogeneity is crucial because monetary policy is inherently not able – and consequently not designed - to react to regional disparities. Monetary policy must instead be set for the union as a whole. The necessary focus on the 'average picture', however, could risk delivering a policy that is inadequate for each individual constituent region.

Different levels of inflation within monetary unions mean that cross-regional relative prices change, i.e., the inter-regional real exchange rates fluctuate ([6]). They also indicate that the cost of living – and possibly the costs of production – evolves at different rhythms. The implications of such changes depend on underlying factors and initial price-level differences. Productivity convergence in the tradable sectors would explain, for example, why catching-up regions may experience higher inflation, a phenomenon known as the Balassa-Samuelson effect. Essentially, price equalisation for traded goods on international markets and wage equalisation across domestic sectors (producing traded and non-traded goods, respectively) mean higher prices for non-tradable items in countries with higher productivity levels in the traded good sector. So, productivity convergence will lead to higher prices in the non-traded sectors in the converging region, typically over the longer term. Inflation differentials would then be a 'benign' by-product of convergence. By contrast, local price (and cost) increases that are not driven by productivity convergence imply a drop in price competitiveness. Even short-term inflation differentials may therefore have lasting implications by facilitating the emergence of macroeconomic imbalances that may be destabilising, and costly to correct.

I.3. The euro area: united in heterogeneity

As noted above, all monetary unions are to some extent characterised by cyclical and structural differences between their constituent regions. The euro area, in which 'heterogeneity is part of the DNA' ([7]) and where fiscal and other economic policies are mostly decentralised, is clearly no exception. Differences are evident in terms of sectoral structures, income levels, social safety nets, public and private debt levels, regulation, etc. They are even more pronounced in terms of cultural characteristics such as languages, or preferences, including attention and attitudes to inflation. After all, in the euro area, monetary policy and central bank traditions were still national not so long ago.

([5]) See Mundell, R. A. (1961), A theory of optimum currency areas, *The American Economic Review*, 51(4), 657-665.
([6]) The common currency implies that nominal exchange adjustments are not possible.
([7]) Cœuré, B. (2019). Heterogeneity and the ECB's monetary policy, Speech 29 March 2019

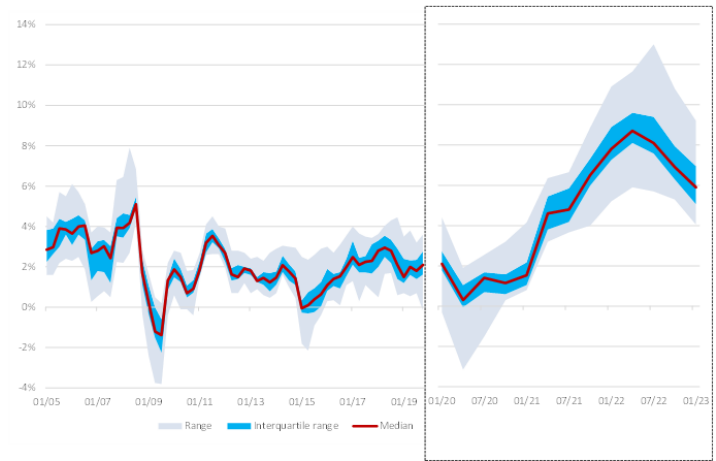
Box I.1: **Inflation differentials across US metropolitan areas**

Inflation differentials are not an exclusive characteristic of the euro area; they are also a natural feature in other monetary unions, such as the United States. ([1]) This box looks at inflation differentials across US metropolitan areas. Graph A shows that the overall US inflation pattern during the pandemic was very similar to that of the euro area, although the relative contribution of the different drivers varies, reflecting different designs in the policy support provided during the pandemic and levels of exposure to the energy shock. ([2]) After a disinflationary period at the outset of the pandemic, inflation rapidly picked up to a multi-decade peak in the second half of 2022 before easing, also in a context of monetary policy tightening by the Federal Reserve.

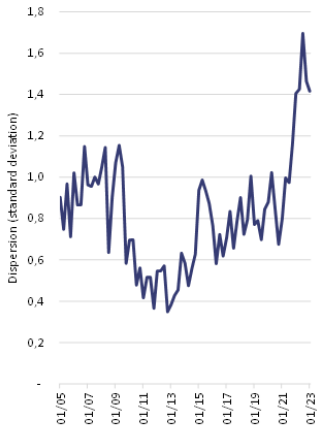
Inflation in the metropolitan areas followed this pattern but there were differences in inflation levels. For example, in Phoenix-Mesa-Scottsdale (Arizona), inflation peaked at 13% in Q3 2022, while in San Francisco-Oakland-Hayward (California), inflation peaked at 5.9% in Q2 2022. These ranges are not as extreme as in the euro area and no US metropolitan areas are outliers as the Baltic countries are in the euro area.

Comparisons between euro area and US inflation dispersion have limitations as measurement may differ, e.g. regarding the inclusion of housing in the price index. Housing inflation appears to be the key driver of inflation differentials across metro areas in both geographies. ([3]) That said, inflation dispersion also clearly picked up and reached new highs (Graph B). Like in the euro area, inflation dispersion seems to increase as inflation rises or when there are abrupt changes to inflation, as happened following the global financial crisis in 2009.

Graph A: **Inflation range, US metropolitan areas**



Graph B: **Inflation dispersion, US metropolitan areas**



Notes: Bands show range (grey) and interquartile (blue) range across US metropolitan areas. The red line shows median inflation. The analysis is based on 23 US metropolitan areas. Last observation: Q1 2023.
Source: Bureau of Labor Statistics, own calculations.

([1]) Gupta and McGranahan (2023), *What is driving the differences in inflation across U.S. regions?* Chicago FedLetter May 2023, Number 478.
([2]) Ball et al (2022), *Understanding U.S. Inflation During the COVID Era*, IMF Working Paper WP/22/208.
([3]) Gascon and Fuller (2022), Variations in Inflation across U.S. Metro Areas, Federal Reserve Bank of St. Louis, 1 December 2022.

Heterogeneity does not need to be a 'bad' characteristic *per se*. It can reflect the situation that risks are diversified and the economies are complementary, which in aggregate has the potential effect of making the monetary union more resilient to external shocks. However, this is conditional on there being risk-sharing mechanisms in the form of fiscal transfers, integrated capital markets, a high adjustment capacity

or a high degree of factor mobility. Otherwise, common shocks will have asymmetric effects with potentially lasting adverse consequences (see above).

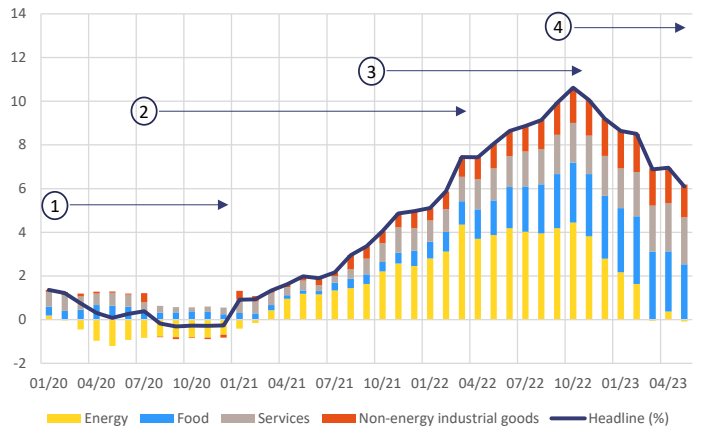
Inflation differentials resulting from a common external shock are hence primarily symptoms of underlying heterogeneities. While real and cyclical convergence may be an outcome of closer economic integration ([8]), it is not an automatic consequence of joining a monetary union and will depend on policies implemented in its regions ([9]). In the euro area, the principle of monetary dominance requires that other, predominantly national, policy domains support and complement the ECB's euro area mandate to maintain price stability, by reducing nominal and real rigidities and being fiscally prudent ([10]).

I.4. The four phases of euro area inflation since 2020

I.4.1. Inflation in the euro area

The two defining global events of the past 3 years – the COVID-19 pandemic and Russia's aggression of Ukraine – have had a fundamental impact on worldwide inflation patterns ([11]). The unprecedented and extraordinary inflation developments recorded in all four corners of the world, including in the euro area, have been commensurate with the scale of the impact that these two events have had on global society and international politics. The aggregate euro area inflation path in the years since the outbreak of the pandemic, which stands in stark contrast to the low inflation years preceding the pandemic, can be split into four partly overlapping phases (Graph I.2) ([12]) as follows:

Graph I.2: **Euro area inflation in four phases, January 2020– May 2023**



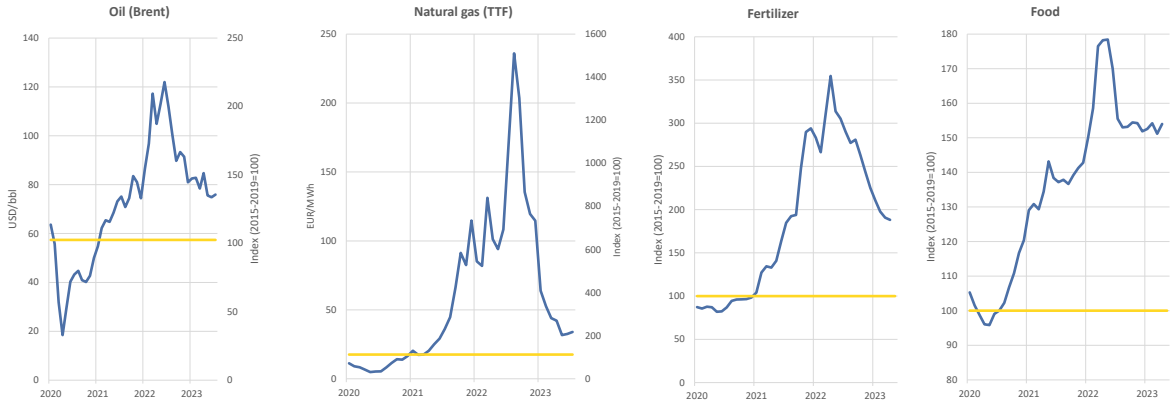
Note: The arrows indicate the four phases of inflation described in the text.
Source: Eurostat, own calculations

- The Great Lockdown phase, following the outbreak of COVID-19 in early 2020 and roughly spanning the remainder of that year, initially triggered an economic collapse accompanied by falling prices and inflation turning negative. The economic impact of the pandemic was uneven across euro area countries. It depended on the strength of the outbreak, the stringency of lockdowns, the extent of compensatory and job retention schemes for households and firms, and in particular the country's economic structure, with the share of contact-intensive sectors being a key scaling factor ([13]).

([8]) Frankel, J. A., & Rose, A. K. (1998). The endogeneity of the optimum currency area criteria. Economic Journal, 108(449), 1009-1025.
([9]) Even when convergence criteria are met, which is a formal requirement for joining the euro area, this is not a guarantee that the degree of convergence will be sustained.
([10]) Cœuré, B. (2019). *op cit.*
([11]) BIS (2022). Inflation: a look under the hood. Annual Economic Report June 2022.
([12]) Buelens, C. and V. Zdarek (2022), Euro area inflation shaped by two years of COVID-19 pandemic, Quarterly Report on the Euro Area (QREA); Ascari et al. (2023), The Euro Area Great Inflation Surge, DNB Analyse.
([13]) Buelens, C. (2021). Lockdown Policy Choices, Outcomes and the Value of Preparation Time A stylised model (No. 143). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

- The subsequent rebound phase was characterised by the combined effects of lockdowns and supply bottlenecks ([14]), and an unwavering and coordinated global fiscal and monetary policy response, implemented swiftly after the outbreak of the pandemic ([15]). While the primary aim of the lockdowns was to mitigate the spread of the virus, the primary aim of policy support was to prevent hysteresis effects resulting from stalled production by maintaining business viability and safeguarding jobs (via job retention schemes). The schemes also maintained income prospects and reduced the need for precautionary savings. The outlook brightened further with the arrival of COVID vaccines, which charted a credible path to exit the pandemic and move towards recovery. Mismatches between robust demand, rotating from services towards goods, and constrained supply, exacerbated by setbacks caused by new infection waves or lockdowns, led to a surprisingly vigorous acceleration in inflation as of early 2021. Euro area inflation matched the previous 2008 peak of 4.1% in October 2021 and continued to rise thereafter.

Graph I.3: **Selected commodity prices relative to pre-pandemic average, 2020-2023**



Note: Pre-pandemic average refers to the 2015-2019 period. Last observation: April (Food, Fertilizer), July (Oil, Natural Gas) 2023.
Source: IHS, World Bank, own calculations

- Commodity prices were already boosted by the strong recovery, before surging in the run-up to Russia's aggression of Ukraine that started in February 2022, reflecting the high global market shares of Ukraine and Russia for many commodities. The price surge was particularly pronounced for natural gas, which Russia started to withhold as from the second half of 2021. This led to prices surging in August 2022 by 14 times their pre-pandemic average, including prices of agricultural commodities (Graph I.3). Exposure and geographic proximity to Russia played a central role in this third inflation phase, both at global level (euro area versus other advanced economies) and in the euro area (countries bordering Russia or with stronger economic ties to Russia versus others), in determining the severity of the energy price shock. The surge in energy prices had both a direct impact on retail prices and an indirect cost effect on virtually all other items of spending. Energy inflation peaked at 44.3% in March 2022 and headline inflation peaked at 10.6% in October 2022. While commodity prices have since abated from these peaks, they all remain significantly above pre-pandemic levels (Graph I.3).

([14]) Celasun et al. (2022), *Supply Bottlenecks: Where, Why, How Much, and What Next?* IMF Working Paper 22/31, International Monetary Fund, Washington, DC.
([15]) In the euro area, this notably includes the ECB's launch of the pandemic emergency purchase programme (PEPP) and, for all EU member states, the Support to mitigate Unemployment Risks in an Emergency (SURE) programme and the Next Generation EU (NGEU) instrument to support the post-pandemic economic recovery.

Box I.2: Stylised facts on inflation dispersion in the euro area

Standard measures of regional inflation dispersion, such as the (interquartile)-range or standard deviation do not control for inflation at area level. This box examines the statistical relationship between inflation dispersion across the euro area, and the level and volatility of headline inflation of the euro area. The main aim is to detect empirical regularities based on the following regression model:

$$\sigma_t^{ea} = c + \beta_1 \sigma_{t-1}^{ea} + \beta_2 \pi_{t-1}^{ea} + \beta_3 Vol_{t-1}^{\pi\_ea}$$

where σ_t^{ea} refers to inflation dispersion measured by the standard deviation of national inflation rates (variable euro area composition), π_t^{ea} refers to year-on-year euro area headline inflation and $Vol_t^{\pi\_ea}$ is inflation volatility measured as the rolling 12-month standard deviation of euro area inflation. The sample ranges from January 1997 to April 2023. The regressions are also run over a restricted sample ending before the pandemic.

Table A: Regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				Pre-pandemic sample			
Inflation (lagged)	0.37***		0.24***	0.03***	0.04**		0.06***	0.01+
	(28.37)		(20.51)	(4.32)	(3.07)		(5.08)	(1.71)
Volatility (lagged)		1.64***	0.96***	0.20***		0.31***	0.36***	0.07*
		(25.37)	(18.09)	(6.27)		(6.20)	(7.47)	(2.24)
Dispersion (lagged)				0.86***				0.83***
				(36.21)				(24.74)
Constant	0.37***	0.39***	0.21***	0.01	0.85***	0.81***	0.68***	0.11***
	(11.09)	(10.36)	(8.13)	(1.19)	(33.81)	(39.71)	(21.93)	(3.74)
R-squared	0.72	0.68	0.87	0.98	0.03	0.13	0.21	0.76
Prob>F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	315	303	303	303	275	263	263	263

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Notes: Dependent variable is inflation dispersion measured by the standard deviation of national inflation rates (variable euro area composition).
Source: Eurostat, own calculations

The results are shown in Table A. Three broad findings emerge. The first is that inflation dispersion increases as the level of inflation rises, i.e. the higher inflation is in the euro area, the higher the rate of dispersion. This has been visible in 2008 and 2022. It suggests that the drivers of inflation and intra-euro area inflation dispersion are likely to be the same. Secondly, inflation dispersion increases in inflation volatility. This has been visible in the aftermath of the financial crisis, at the outset of the euro area sovereign debt crisis in 2009 and 2010, and again in 2022. This suggests that rigidities differ across countries. Even similar adjustments to a common shock would generate inflation differentials if the pace of adjustment differed. Thirdly, inflation dispersion is persistent, a characteristic that in general applies to the inflation rate too.

These stylised facts became more pronounced with the pandemic, but they are also reflected in the restricted sample of pre-pandemic data. Generally speaking, the coefficients on inflation level and volatility are significant when including lagged dispersion. This applies to the pre-pandemic sample too, although with a lower confidence level.

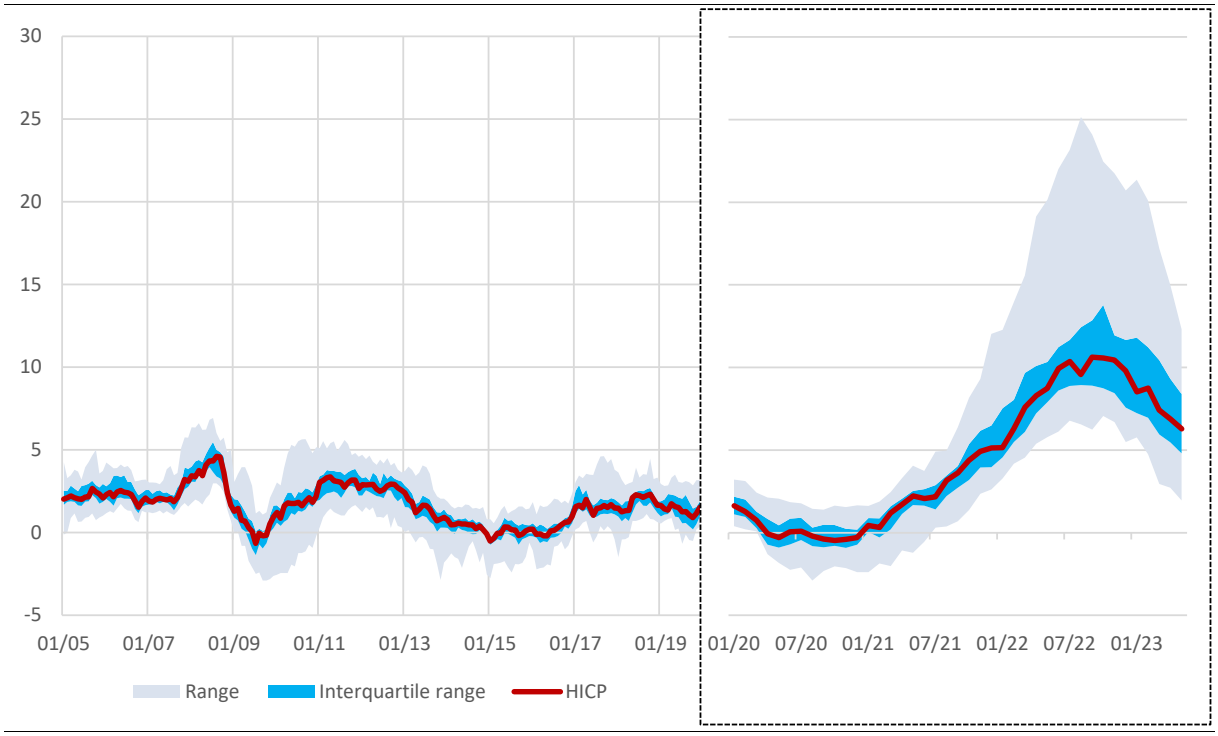
- The fourth phase, which began after inflation peaked and is ongoing at the time of writing, is characterised by the broadening of inflation across consumption categories an improvement in terms of trade and the eventual fading of energy as the main headline inflation driver. This reflects the fact that the direct effects of the energy commodity price shock are fading out and the indirect effects, which typically come in after a time lag, are becoming apparent. A second related characteristic is the

inflation drivers ([16]). This is partly a consequence of strong and often untargeted policy support to help households and firms manage the fallout of the energy price shock, which shores up aggregate demand. It is also a result of efforts by households and firms to offset past drops in purchasing power or profit margins by negotiating higher wages or setting higher prices. Inflation has progressively fallen from its October 2022 peak to 6.1% in May 2023 but it remains high, with the risk of falling only slowly.

I.4.2. Inflation at national level

Given the pervasiveness of the global shocks and coordination of policy responses, national inflation patterns also follow these four phases in euro area inflation dynamics. Inflation soared to multi-decade highs in all countries, initially fuelled by the recovery following the first wave of the pandemic and later by energy and other commodity prices. The inflation peaks seen in different countries were, however, very far apart. The lowest peak was seen in France at 7.3% in February 2023 and the highest peak at 25.2% in Estonia in August 2022. Together with the two other Baltic countries, Latvia and Lithuania, Estonia has been a consistent outlier, recording inflation rates above 20% for a large part of 2022.

Graph I.4: **Inflation range across euro area countries (%), January 2005 – May 2023**



Note: Bands show range (grey) and interquartile (blue) range across euro area Member States (variable composition). The red line shows median inflation.
Source: Eurostat, own calculations

Inflation differentials remained in their historic range during the pandemic and for most of the recovery (Graph I.4 and Graph I.5). Large differences mostly appeared in the second of the four phases identified above. Although different fiscal responses and other government policies to respond to the pandemic have affected national inflation dynamics during the first phase (e.g. temporary changes in value added tax rates or shifts in seasonal sales periods), the asymmetries started to become visible around the fourth quarter of 2021 and during the run-up to Russia's aggression of Ukraine.

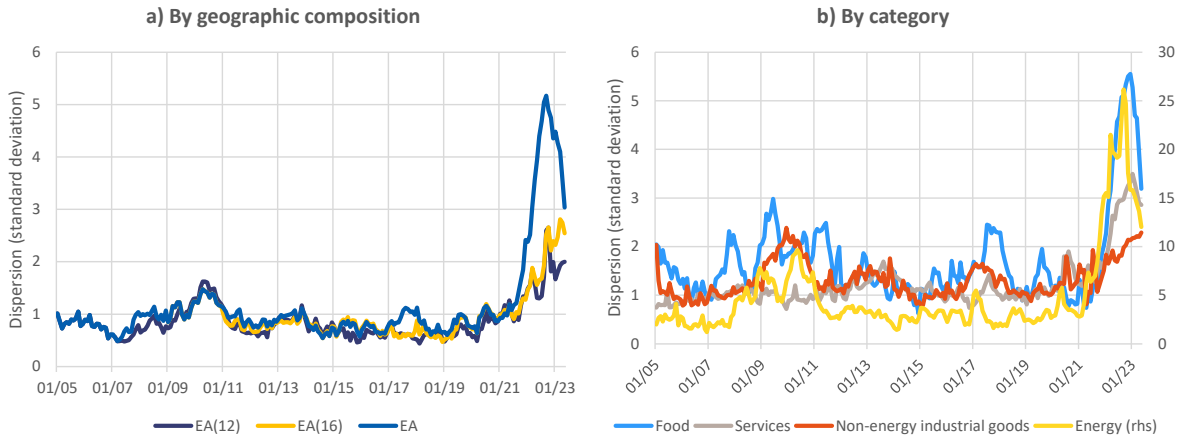
([16]) Binici, M. et al. (2022), Here Comes the Change: The Role of Global and Domestic Factors in Post-Pandemic Inflation in Europe, IMF Working Papers, 2022(241).

This fits with the stylised empirical regularities that characterise inflation dispersion, i.e. it increases both with the level and the volatility of euro area inflation (see Box I.2). In line with this, inflation differentials have narrowed again since euro area inflation passed its peak, but they nonetheless remain high.

Headline inflation dispersion has been primarily driven by dispersion in energy inflation (Graph I.5), which has been particularly pronounced. The range between the lowest and highest national energy inflation rate exceeded 100 percentage points over the summer of 2022. Nevertheless, inflation dispersion has spread across the consumption basket and has been clearly visible in inflation differentials in food and services. Their dispersion levels represent only a fraction of the energy equivalent but here too differentials have surged to unprecedented levels. While this is likely to partly reflect the indirect effect of different energy prices on firms' production costs, it may also indicate other sources of divergence, such as domestic wage and markups or the pace of reopening.

The structural nature of many of the current shocks means that they primarily affect price levels. The effects of the repricing process on inflation should therefore be transitory. Consequently, inflation differentials should fade once the new costs are priced in. Indeed, dispersion appears to have peaked around the turn of the year in all categories. Only manufactured goods, which were particularly hard hit by supply bottlenecks, are an outlier from the other categories. Although the inflation differentials for manufactured goods picked up, they have remained within their historical range. A possible explanation is that in the single market, arbitrage opportunities for goods, in particular, may ultimately limit price differences beyond what can be justified by structural cost differences, such as transport or local costs (taxes or administrative), or market barriers.

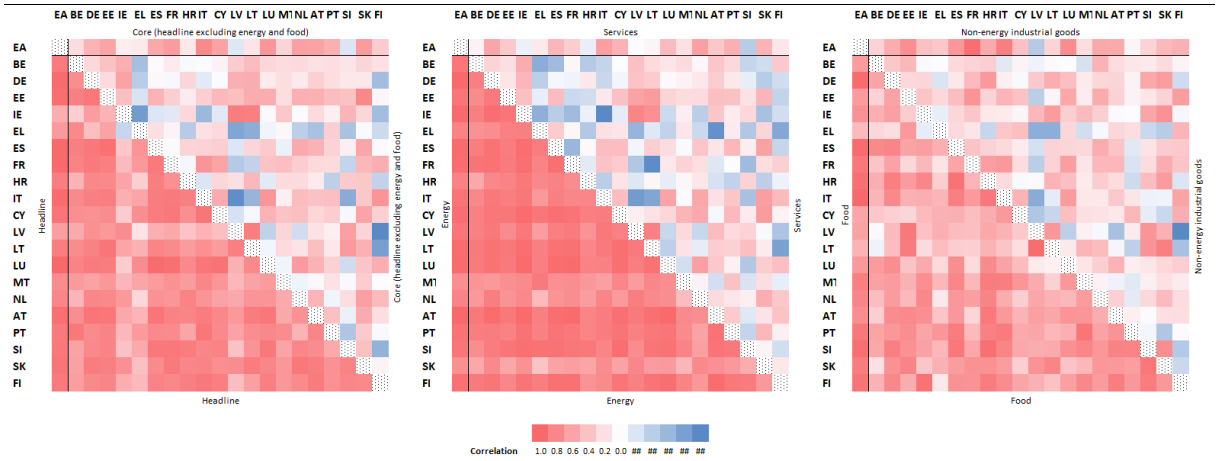
Graph I.5: **Inflation dispersion in the euro area, January 2005-May 2023**



Note: (1) In panel a), EA shows the euro area in variable composition. EA(16) corresponds to the current composition, excluding the Baltic countries and Croatia. EA (12) corresponds to the original euro area configuration (including Greece). Panel b), shows the euro area in variable composition.
Source: Source: Eurostat, own calculations

Graph I.6 shows the synchronisation of inflation across euro area countries in the decade before the pandemic. It is measured by the inflation correlation for each country pair (with red and blue squares indicating whether the correlation is positive or negative). The first block highlights the contrast between the correlation of headline and core inflation (headline inflation excluding energy and food) among euro area countries, which indicates that idiosyncratic factors are driving core inflation. Looking at aggregates of the main consumption categories, the level of inflation synchronisation (correlation) is indeed highest for energy, reflecting the rapid pass-through of crude oil prices in particular. It is somewhat lower for food, where domestic costs, spending habits or production (including weather) conditions are likely to play a bigger role. Global commodity prices are hence key common factors of inflation in the 'non-core' categories. Meanwhile for services, and to a lesser extent for manufactured items, inflation among country pairs often moves in opposite directions (as evidenced by the high prevalence of blue squares). Again, this highlights the important role played by domestic economic fundamentals in driving the price of services.

Graph I.6: **Cross-country synchronisation of inflation, January 2010-February 2020**



Note: Red (blue) marks a positive (negative) correlation between inflation for each country pair. The depth of colour increases in the strength of correlation, i.e., two inflation series are more likely to move up and down at the same time (albeit possibly to different levels). The lower and upper triangles refer to different aggregates. The left column and upper row show the inflation correlation between a country and the euro area aggregate.
Source: Eurostat, own calculations

I.5. The drivers behind dispersion

The analysis above indicates that a high degree of inflation synchronisation and high inflation dispersion are not mutually incompatible. Indeed, the categories with the strongest inflation co-movement across countries (energy and food) are also those that contributed most to the great inflation dispersion. The reconciling driver therefore seems to be underlying heterogeneities across euro area countries leading to an asymmetric pass-through of common inflation drivers, despite prices moving in the same direction.

I.5.1. Euro area composition

To some extent, the great dispersion documented above may be driven by inflation in only a few outlier countries. Graph I.5 (panel a) confirms that a high share of the increase in euro area inflation dispersion is the result of a composition effect brought by successive enlargements of the euro area, notably to the three Baltic countries. Estonia (2011), Latvia (2014) and Lithuania (2015) account for the lion's share of the increase in dispersion. This indicates the important role of geography in the fallout of the war. These are also countries with lower per capita income than the euro area average (Graph I.7, panel a) and which, together with Slovakia, also have the highest share of non-core components (energy and food) in their consumption baskets. This makes national inflation structurally more sensitive to (external) commodity price shocks (see next sub-section). However, the recent euro area inflation dispersion is not simply a 'Baltic story'. The level of dispersion among the twelve countries already in the euro area in 2005 also reached new highs in 2022, exceeding its previous peak reached during the euro area sovereign crisis in April 2010.

I.5.2. Income heterogeneity

Income heterogeneity in the euro area is considerable, with the highest GDP per capita (Luxembourg) more than six times higher than the lowest (Latvia). This divergence matters for spending patterns, as can be illustrated by cross-country Engel curves, which relate income level to the proportion of income spent on a given item. Engel curves for food and energy are shown in Graph I.7, which uses GDP per capita and weights in the HICP consumption basket as proxies for income and expenditure share. The distribution of food consumption weights closely follows Engel's law, which suggests that the share of

food expenditure falls as income rises. There is a similar negative relationship for energy, another necessary good ([17]).

The high income dispersion across euro area countries thus entails considerable variation in the composition of national consumption baskets. The combined weight of energy and food (excluding alcohol and tobacco) ranges from 21.6% in Austria to 45.4% in Latvia. That implies that even a similar change in food and energy prices – in response to a common shock in food commodities or energy, say – would mechanically have a larger effect on headline inflation in countries with lower income levels ([18]). Different spending patterns resulting from structural income differences thus imply that common shocks have very different effects on the cost of living. Since food and energy prices are traditionally volatile ([19]) and dependent on commodity prices set on international markets, another upshot is that the countries with lower income per capita are likely to experience more volatile inflation. Large movements in commodity prices and divergent income levels should thus naturally give rise to inflation differentials. This is consistent with the findings that global factors have an asymmetric effect on domestic prices that is higher in eastern European countries ([20]).

Graph I.7 (panel b) illustrates the implications of different national weights in the HICP composition by breaking down the difference in the effect of energy and food prices on headline inflation between individual countries and the euro area aggregate, into a weight and a price effect. It shows that in 2022, the energy contribution to headline inflation in the Baltic countries exceeded the euro area aggregate both due to a higher share of spending and higher price growth. At the other extreme, headline inflation in France, Portugal and Malta ([21]) was limited both by the lower weight and lower price increase relative to the euro area aggregate. Likewise, food prices significantly pushed up headline inflation in the Baltic countries and Slovakia, in particular, both due to the higher weight in overall spending and to stronger price increases.

I.5.3. National markets, policy support and non-linear pass-through effects of costs

Different spending patterns (weights) are only a partial explanation for the differences in headline inflation. So why were actual price changes so different across countries?

Differences in the energy production mix are one explanation. Energy firms in countries that rely less on natural gas from Russia, or have a higher share of renewables, generally face lower cost increases. Furthermore, retail prices include distribution costs, taxes, market (and price) regulation as well as profit margins, which depend on factors that are mostly determined nationally ([22]). The higher these additional price factors, the lower the actual 'commodity content' of the retail product and as a result, a lower pass-through effect can be expected.

National inflation patterns have also been affected by national policy measures taken to mitigate the impact of the energy shock for households and firms. Governments have implemented a wide-ranging set of measures in response to the energy price shock and the 'cost of living' crisis more broadly ([23]). These measures have often substantially affected national price and inflation dynamics, depending on how each measure is designed. They have included incentives to reduce energy consumption, changes to the price-setting mechanism or transfers to households, in particular vulnerable ones, and to firms under financial pressure as a result of the energy crisis, enabled by the Temporary Crisis Framework of State Aid measures ([24]). Through their effect on supply and demand patterns, the impact of the measures on prices

([17]) Countries with high energy weights typically also have high energy intensity (Coutinho and Licchetta, 2023 (forthcoming), *op cit.*).
([18]) Similar distributional effects also hold for households.
([19]) They are often excluded from headline inflation to obtain measures of underlying inflation.
([20]) Baba C. et al. (2023). The Inflation Surge in Europe. IMF Working Paper No. WP/23/30. Washington DC; Coutinho and Licchetta, 2023 (forthcoming), *op cit.*
([21]) Energy inflation in Malta was 0%, a consequence of a long-term fixed-price contract for liquefied natural gas.
([22]) Hernnäs et al. (2023), *Pass-through in EU electricity and gas markets*, Quarterly Report on the Euro Area (QREA).
([23]) Note that many governments have tackled the costs of living more broadly and policies to cushion the impact of the energy price shock have also focused on other expenditure items, such as transport or housing.
([24]) Communication from the Commission of 24 March 2022 – Temporary Crisis Framework for State Aid measures to support the economy following the aggression against Ukraine by Russia (2022/C 131 I/01). The Framework has subsequently been amended and prolonged.

over time may be more or less direct, depending on their design and duration ([25]). Direct interventions in the pricing mechanism, e.g. price reductions by reducing energy taxes or limiting price increases, have significantly reduced the sectoral contribution to inflation in some countries ([26]). While such measures limit inflation in the short term, they however mute price signals, thereby decreasing the speed of structural adjustment and prolonging the period of repricing. Depending on their design, that may also lead to delayed price increases ([27]). By contrast, broad-based lump-sum transfers, which support disposable income have a less distortive impact on relative prices. But they do have income or wealth effects (as do price-based measures), which shore up aggregate demand and add to general price pressures. The more targeted the transfers, the less pronounced these effects are. The impact of national measures on inflation differentials within the euro area is *a priori* ambiguous and depends on the types of measures taken and their timing.

Graph I.7: **Impact of income and weight differentials on inflation dispersion**

Note: In panel a) GDP for Ireland is replaced by Modified Gross National Income. In panel b), the percentage point contribution to headline inflation by item i in country c is approximated as $pp_i^c \approx \pi_i^c w_i^c = (\pi_i^{ea} + \Delta^{c-ea}\pi_i)(w_i^{ea} + \Delta^{c-ea}w_i)$, where w_i^c is the average weight of item i in 2021 and 2022. is the difference operator between a country and a euro area variable. This expression can be rewritten as $pp_i^c - pp_i^{ea} = \pi_i^{ea}\Delta^{c-ea}w_i + w_i^{ea}\Delta^{c-ea}\pi_i + \Delta^{c-ea}w_i\Delta^{c-ea}\pi_i$, i.e. the difference in the contribution to headline inflation in country c and the euro area is split into a weight effect, a price effect and a residual.
Source: Eurostat, own calculations

Finally, in a context of unusually large shocks, the price-setting behaviour of firms is likely to be different from behaviour in regular times. Large shocks may reveal non-linear effects in how costs are passed through to consumer prices, whereby the impact on the latter depends on the magnitude of the input cost increase. This may, for example, be the case if firms adjust prices whenever input cost changes exceed a certain threshold, hence accelerating the degree of pass-through ([28]). Even slight changes to input costs across countries or different thresholds may explain why common cost shocks would exacerbate inflation differentials. This would also be consistent with the stylised fact indicating that inflation dispersion generally increases as the rate of inflation rises.

I.6. Implications of the great inflation dispersion

I.6.1. Price level adjustments

Inflation differentials imply that relative national price levels change. The first panel of Graph I.8 displays national price levels for consumer goods and services relative to the euro area average. In 2021, Ireland

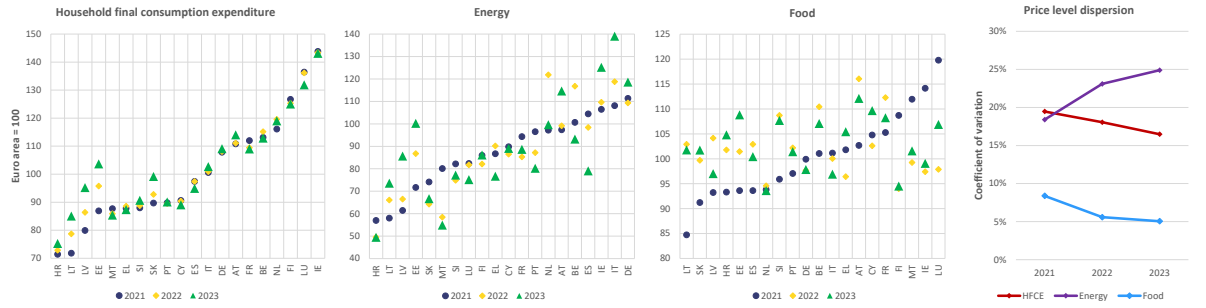
([25]) The price impact may also pose methodological challenges for statistical institutes (Eurostat, 2022, Treatment of energy prices compensation measures in the Harmonised Index of Consumer Prices (HICP)).
([26]) See for example: Insee, 2022, Insee Analyses No 75, September 2022; Banca d'Italia, 2023, Economic Bulletin No 1 - 2023; Banco de España,2022, Macroeconomic projections for Spain 2022-2025; Bundesbank, 2022, Monatsbericht Dezember 2022, December 2022.
([27]) For example, price caps only have an effect when they are binding. Price increases could only occur once a binding cap is lifted. The binding character in turn depends on the price fluctuations of the underlying commodity.
([28]) In such an environment, the role of adjustment costs ('menu costs'), which would otherwise be a factor of price stickiness, is less significant.

had the highest price level for household final consumption expenditure (44% above the euro area average) and the lowest was in Croatia ([29]) (29% below) and Latvia (28% below). As price level indices (PLI) for 2022 and 2023 are not available, they are extrapolated from the 2021 PLI based on HICP data. While the general price levels in the two polar countries – Croatia and Ireland – have remained stable relative to the euro area average, they rose sharply in the Baltic countries and Slovakia. The extrapolation exercise suggests that Estonia's price level, which in 2021 was 13% below the euro area average, exceeded it by 4% in April 2023. Relative price levels also moved significantly for individual items, such as energy and food (middle panels).

A consequence of the great inflation dispersion, which may seem counterintuitive at first, is that it appears to have fostered some convergence in overall consumer prices (fourth panel), at least temporarily. This also applies to categories such as food. Meanwhile, energy prices levels seem to have become more dispersed since 2021, but divergence metrics may be distorted by the (temporary) government measures taken that affected prices.

What is the upshot of this price level convergence? Essentially, price convergence in the absence of income (and productivity) convergence exacerbates inequalities in the cost of living across euro area countries. A resulting risk is that such inequalities potentially boost centrifugal forces of fragmentation. This could happen, for example, if pressure to offset past losses in purchasing power are commensurate to that loss and spill over to domestic production costs. Countries that have experienced higher inflation would consequently become less cost-competitive, and vice versa (see next sub-section). Inflation differentials would then also contribute to misalignments in countries' real effective exchange rates, as the latter would depart from the rates implied by country's economic fundamentals ([30]).

Graph I.8: **Comparative price levels across the euro area (extrapolated), 2021-2023**



Note: The price level indices (PLI) for 2022 and 2023 are extrapolated from the 2021 PLI based on annual HICP data in corresponding categories: $PLI_i^{2022} = PLI_i^{2021} \times (1 + \pi_i^{2022}/1 + \pi_{ea}^{2022})$. Inflation in 2023 corresponds to the average annual inflation rates between January and April.
Source: Eurostat, own calculations

I.6.2. National cost patterns and risks of inflation dispersion persistence

A major general risk of high inflation periods - irrespective of what causes them in the first place and whether they originated in the labour market - is that inflation begets inflation, and that in the extreme, self-reinforcing dynamics generate so-called wage-price spirals ([31]). The current institutional framework, with an independent central bank pursuing an explicit inflation target that also provides an expectations anchor, is expected to be less permissive of the emergence of inflationary spirals than the framework used in the 1970s, the period to which they are typically associated. Also, since 2022, the ECB has decisively tightened its monetary policy stance, as have other major central banks, which is contributing to easing

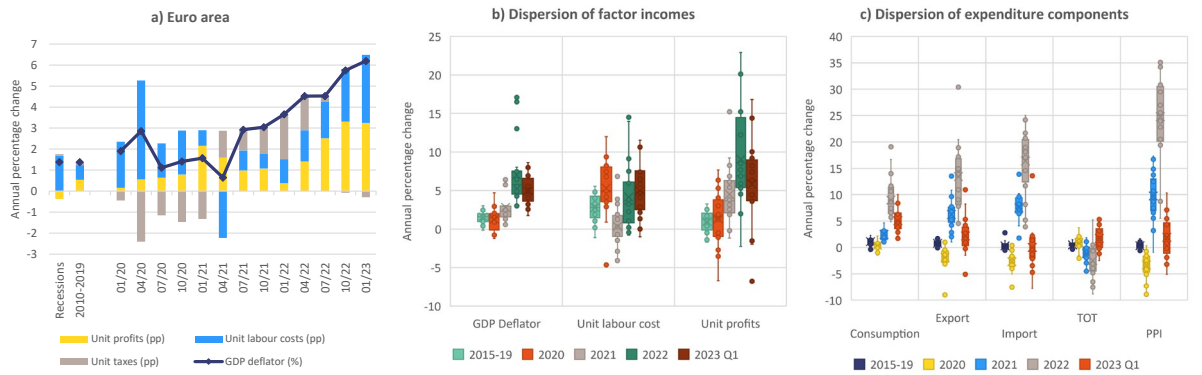
([29]) Croatia joined the euro area in 2023.
([30]) On the concept of equilibrium real exchange rates see Coutinho, L., Garcia, N. M., Turrini, A. andVukšić, G. (2021). "Methodologies for the Assessment of Real Effective Exchange Rates", European Commission Discussion Paper No 149.
([31]) International Monetary Fund (2022). Wage Dynamics Post-COVID-19 and Wage-Price Spiral Risks. Chapter 2 in World Economic Outlook, October 2022, International Monetary Fund, Washington, DC; Boissay et al (2022). Are major advanced economies on the verge of a wage-price spiral?. BIS Bulletin No. 53, May 2022.

inflationary pressure. Nonetheless, even if the broad-based easing of inflation across euro area countries now makes the more extreme spiral scenarios appear remote, the risk of inflation persisting through second-round effects seems plausible in the current phase of inflation ([32]).

Inflation persistence requires that prices spill over to domestic production costs. The GDP deflator provides a measure of prices of domestically produced goods and services. Using the income approach to calculate GDP, the GDP deflator can be broken down into labour costs, gross operating surplus (often referred to as profits or capital cost) and taxes. It therefore shows how each domestic factor is related to domestic price pressures (Graph I.9). Generally, as the 'wage-price' qualifier suggests, the focus is how it affects the cost of labour. Indeed, the losses in purchasing power that workers have experienced have led to higher wage demands and, also in a context of tight labour markets, to an acceleration in unit labour cost growth.

Recently, there has been a lot of emphasis on the price-setting reaction by firms and their possible attempts to maintain or increase profits, given a combination of special (and *a priori* temporary) factors that has been deemed conducive to price hikes ([33]). The reason is the rise in unit profits in 2022 and their atypical behaviour in the recession phase of the pandemic, when they increased rather than playing a buffer role, as they did in previous recessions ([34]).

Graph I.9: **GDP deflator composition and dispersion of factor incomes and expenditure components**



Note: Unit labour cost and unit profits are adjusted for self-employment (panels a and b). In panel c, TOT refers to the terms of trade. PPI refers to the producer price index.
Source: Eurostat, own calculations

The rapid recovery of aggregate demand in the aftermath of the COVID-19 crisis, facilitated by policy support and high household savings, was indeed favourable for the corporate sector overall ([35]). Another factor behind the price hikes was the supply shortages for many goods and commodities, caused by lockdowns and the war ([36]). Finally, the high inflation environment itself may have become conducive to retail price increases. Strategic complementarities in pricing, i.e. the response to competitor pricing, may provide an explanation for simultaneous increases in profit margins in an environment of accelerating

([32]) European Commission (2023). European Economic Forecast Spring 2023.
([33]) European Commission (2023), Profit margins and their role in euro area inflation, Thematic box in European Economic Forecast Spring 2023.
([34]) Some qualifiers are necessary. The decomposition is an accounting exercise that does not reveal the uses that firms make of their higher operating surpluses. While they may distribute some surplus to their shareholders, firms may have other uses, including precautionary ones, for example in view of possible future investment, tax or wage increases. Moreover, the combination of adverse shocks and subsidies and other policy interventions are likely distorting the measurement of certain components.
([35]) There are clear sectoral differences. For example, the initial rotation of demand towards goods, amid lockdowns and severe mobility restrictions, enabled firms in the manufacturing sector to raise their mark-ups. The services sector benefited most when restrictions were lifted in 2022. Meanwhile, in the energy sector, infra-marginal electricity producers benefited strongly from rising natural gas prices.
([36]) For recent evidence for the US, see Weber, I. and E. Wasner (2023). 'Sellers' Inflation, Profits and Conflict: Why can Large Firms Hike Prices in an Emergency?' *Economics Department Working Paper Series*, University of Massachusetts Amherst.

inflation ([37]). Separately, the prevalence of cost shocks has blurred price signals and may have led consumers to both expect and 'accept' short-term price increases, meaning they may have been less inclined to view the increases as idiosyncratic decisions by firms and so they would not warrant 'punishment' by switching to a competitor.

Differentials in the GDP deflator and in its two main components – unit profits and unit labour costs – have significantly widened since the outbreak of the pandemic (Graph I.9, panel b), although they narrowed somewhat in early 2023. As the deflator captures purely domestic sources of production costs (i.e. labour and capital costs), this suggests that differences in domestic conditions (labour market and firm behaviour) play a central role in explaining the dispersion in some core inflation categories (goods and services), beyond the indirect effect of the energy and food price shocks ([38]). The asymmetric exposure to and pass-through of common shocks (see dispersion of the import deflator in Graph I.9) has been the main source of dispersion so far. But the recent widening suggests that this may be progressively replaced by asynchronous and diverse developments in national factor costs reflecting different degrees of labour market tightness.

Is there a risk that inflation dispersion will persist across the euro area? The answer notably hinges on how strong inflation will persist at national level, as price and wage stickiness are likely to differ and determine how far second-round effects keep inflation high. The sensitivity of inflation to cyclical conditions also matters and could drag out inflation differentials ([39]). Examples of features that are likely to matter in this regard are domestic institutions, such as wage or price indexation mechanisms and the degree of coordination in wage bargaining, or the tempering effect of income support provided in response to real income shocks on wage demands. However, possible protracted distributional conflicts, which could emerge at local level, would delay the process of national disinflation ([40]) and feed inflation dispersion.

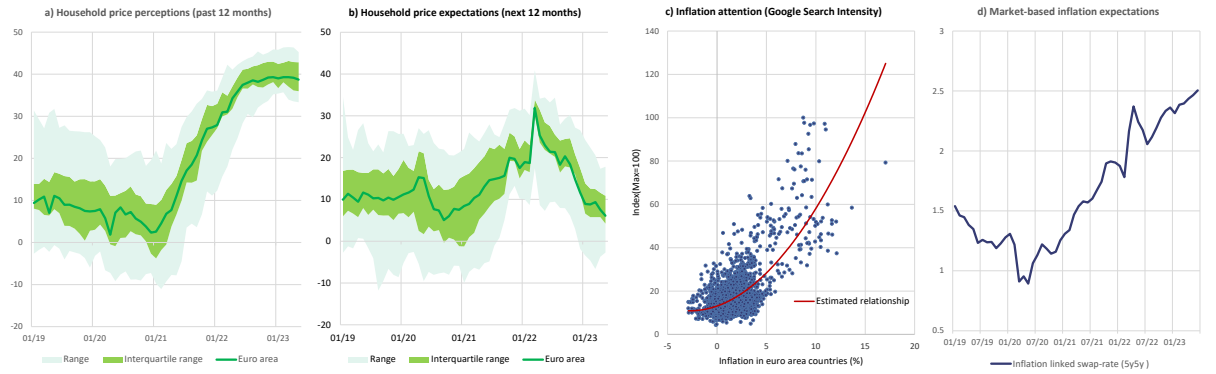
Stable inflation expectations would provide a safeguard against the spillover of high inflation to costs. However, the duration of high inflation means that the risks of de-anchoring cannot be dismissed, despite the turning point and ongoing easing of headline inflation. Different reasons for de-anchoring risks can be found in the literature on subjective inflation expectations. For example, the frequency and size of price changes of items such as groceries, fuel or utility bills have been shown to affect households' expectations of inflation ([41]) – and while the nature of the shocks driving price changes matters for economic policy (in particular, in deciding whether or not to 'look through' a shock), it is less likely to for consumers.

Separately, the ubiquity of 'inflation' has raised consumer's attention to inflation (Graph I.10, panel c) ([42]). While consumers in low inflation environments have been shown to be relatively inattentive to inflation and its drivers, this is not the case in high inflation environments. A switch in the inflation attention-regime could indeed affect how inflation expectations are formed and by extension inflation dynamics. Related to this, living through a high inflation period has been shown to bias individuals' inflation expectations upwards ([43]). While this now applies to virtually all euro area citizens, the recent inflation experiences and changes in salient prices have differed strongly, which may have implications for how the inflation mechanism is understood in different countries. So far, household perceptions of inflation are not tracking the actual falls in inflation, as household opinion is generally that price increases have continued in recent months (Graph I.10, panel a). However, they expect price increases to start decelerating (Graph I.10, panel b). The dispersion around households' price expectations has narrowed around its peak but is widening again, reflecting differences in national contexts. Nonetheless, the country

([37]) Andler, M. and A. Kovner (2022), 'Do Corporate Profits Increase when inflation increases?' *Liberty Street Economics* (NY Fed), 13 July.
([38]) Note, however, that the comparatively lower dispersion rate for the GDP deflator suggests that dispersions in ULC and unit profits appear to offset, rather than to reinforce, each other.
([39]) Baba C. et al. (2023), *The Inflation Surge in Europe*, IMF Working Paper No. WP/23/30. Washington DC.
([40]) Arce, O. et al. (2023), 'How tit-for-tat inflation can make everyone poorer.' ECB blog, 30 March.
([41]) See for example: D'Acunto et al (2019). Exposure to Daily Price Changes and Inflation Expectations, NBER Working Paper No 26237; Kilian and Zhou (2020). Oil Prices, Gasoline Prices and Inflation Expectations: A New Model and New Facts, Federal Reserve Bank of Dallas Working Paper.
([42]) Buelens, C. (2023). Googling "Inflation": What does Internet Search Behaviour Reveal about Household (In)attention to Inflation and Monetary Policy?. European Commision Discussion Paper 183, March 2023.
([43]) Malmendier and Stefan (2016), *Learning from inflation experiences*, The Quarterly Journal of Economics 131.1 (2016): 53-87.

dispersion implicit in short- and medium-term inflation forecasts may also indicate a reconvergence of inflation rates (44). The steady upward movements in market-based inflation expectations (panel d), which include risk premiums and remain within the historical range, indicates that it may take quite some time to before inflation is back to its target level.

Graph I.10: **Inflation expectations and attention**



Note: Household perceptions and expectations are balance statistics centred around 0. Panel c plots national inflation rates between 2004 and September 2022 for the 12 countries that were part of the euro area in 2004 against the google search-intensity (seasonally adjusted) for the term "inflation". Panel d: inflation linked swap-rates include both inflation expectations and risk premia.
Source: European Commission Business and Consumer Survey (a, b), Buelens (2023) (c), Bloomberg (d).

A prolonged period of inflation dispersion is likely to be costly for the euro area, as it could set off destabilising mechanisms that could lead to imbalances, which in turn would require costly adjustments. Indeed, even short-lived inflation differentials may have permanent implications in terms of relative national price levels and purchasing power. If these asymmetries spill over to domestic costs, it would erode cost competitiveness and could result in increased external imbalances over time. The cost of this would be even higher for countries with existing macroeconomic imbalances, including high stocks of private and public debt, high unemployment, overvalued real exchange rates, or past credit misallocation (45). Macroeconomic imbalances accumulated by euro area countries before the euro area sovereign debt crisis have been found to be associated with a lower speed of convergence (46).

An aggravation of imbalances would also complicate common monetary policy, which would ultimately be powerless to resolve imbalances, requiring correction by structural polices. Energy prices are a case in point: once energy inflation dissipates, the price of energy is expected to remain permanently higher than it was before the pandemic, even though prices fallen from the 2022 peaks. Indeed, part of the EU's structural response to the new geopolitical situation resulting from Russia's invasion of Ukraine is to make Europe independent from Russian fossil fuels (and from fossil fuels more generally). The required structural adjustment will hence be proportionate to each country's level of energy intensity.

That said, in line with the stylised facts above, inflation differentials can be expected to narrow as euro inflation falls. A look into the pipeline corroborates this (Graph I.9). Improvements in supply chains and factors that have limited business activity (such as the scarcity of material and equipment, and stabilising energy prices) have eased producer price pressures. Also, upstream price dispersion, which leads headline inflation dispersion, (47) has narrowed significantly in the year to date. The broad-based easing of household inflation expectations implies that the risks of prolonged inflation dispersion, mainly as a result of domestic factors (domestic price and wage setting), remain contained.

(44) e.g. European Commission (2023), European Economic Forecast Spring 2023.
(45) European Commission (2023), Inflation Differentials in Europe and Implications for Competitiveness, Thematic Note to Support In-Depth Review, Institutional Paper 198, April 2023.
(46) Coutinho L. and A. Turrini (2020), Real Convergence Across the Euro Area, Intereconomics, Volume 55, September/October 2020.
(47) The correlation of monthly headline inflation dispersion is highest (0.83) with the fifth lag of producer inflation dispersion, using a sample from 2002 until April 2023. Restricting the sample to the pre-pandemic (pre-2020) yields a much weaker correlation and shifts the peak correlation to a lag of 22 months (0.43).

I.7. Conclusion

This article has documented the exceptional character of euro area inflation differentials after the COVID-19 pandemic and the energy price shock unleashed by Russia's war against Ukraine. Most of the dispersion thus results from global factors, essentially commodity prices and supply disruptions. These global factors have led to inflation patterns that were highly synchronous and yet uneven in magnitude, notably reflecting different levels of energy intensity. As the pandemic-related supply bottlenecks ease and energy prices stabilise above pre-pandemic levels, the level of dispersion has narrowed. With national inflation increasingly being driven by domestic factors, the result may be more asymmetric inflation patterns. Even if the levels of dispersion return to lower levels, they may well reveal a range of idiosyncratic drivers rather than asymmetric short-term reactions to a common shock.

While the great inflation dispersion in the euro area thus appears to be a temporary phenomenon directly related to global surge in inflation, its consequences may not be temporary. They are likely to shape the dynamics of inflation differentials in the future. The impact of high inflation on household purchasing power and firms' profits may determine the extent of second-round effects at national level. The income shock and the loss of purchasing power has been substantial in some euro area countries. Meanwhile, attempts to restore pre-pandemic purchasing power may give rise to spillover effects to domestic costs, which could affect cost competitiveness and could risk producing macroeconomic imbalances.

Moreover, a series of other structural challenges differ across euro area countries. The change to Europe's energy supply following Russia's invasion of Ukraine may well be permanent. The structural impact of severing the reliance on Russian energy imports is compounded by the ongoing need to reduce the use of fossil fuels in order to decelerate climate change. Other structural challenges have come to the fore with the pandemic, such as the vulnerability of cross-border supply chains. Others still persist, such as the impact of demographic shifts and climate- or weather-related disruptions. The necessary structural adjustments may significantly affect relative prices and inflation volatility. Heterogeneity in the euro area, different levels of exposure and structural adjustment needs also imply that national inflation trends may follow quite different paths. This may mean that inflation differentials persist, depending on the pace of adaptation of the Member States to these structural changes.