



A possible new indicator to measure core inflation in the euro area

Inflation for the euro area as a whole is measured using the Harmonised Index of Consumer Prices (HICP). This index faithfully reflects the changes in the average price of the entire household consumption basket, but is notorious for being disrupted by high variability in the prices of certain goods. Consequently, core inflation, which is more stable, also needs to be monitored. This is usually measured in the euro area as the change in prices excluding energy and food. However, this indicator too is sometimes subject to erratic movements, which can complicate economic analyses. Therefore, other indicators, such as trimmed mean HICP, are also used. Fine core HICP, presented in this article, aims to further this analysis. Monitoring several indicators of core inflation allows central banks to capture trends in inflation in the most comprehensive manner possible.

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Three measurements of core inflation in March 2020 (year-on-year change) for the euro area

2.9%

the standard indicator
(HICP excluding energy and food)

3.9%

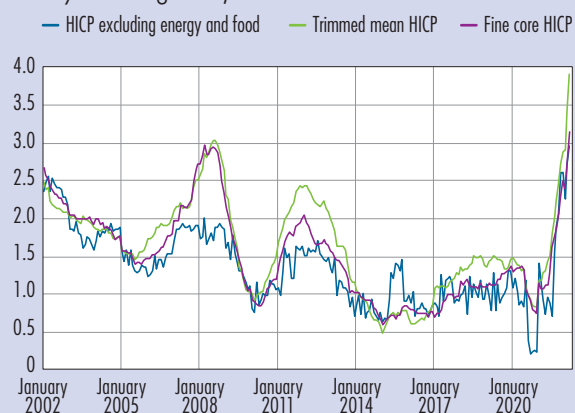
trimmed mean HICP

3.1%

fine core HICP

HICP excluding energy and food, trimmed mean HICP and fine core HICP in the euro area

(year-on-year change in %)



Sources: Eurostat, authors' calculations.

Notes: HICP, Harmonised Index of Consumer Prices.

Trimmed mean HICP excludes at each observation the most volatile items at that time.

Fine core HICP applies a fixed exclusion of the historically most volatile items.



The Harmonised Index of Consumer Prices (HICP) acts as the reference for the monetary policy inflation target for the euro area (ECB, 2021). However, this measure can be disrupted by significant movements in certain components of the index. These disruptions, which are often exogenous and short-lived, are not necessarily an indication of a shift in price formation mechanisms that would justify a monetary policy intervention to stabilise prices. For example, in 2020-21, changes in the price of oil first pushed the year-on-year rate of the headline index below 0%, before an upturn in the oil price triggered a sharp increase in consumer price inflation. In order to avoid overreacting, central banks analyse developments in so-called “core inflation” indices in parallel with the HICP.

1 HICP excluding energy and food remains sensitive to price disruptions, which can complicate its economic interpretation

Core inflation is taken to be the rate of inflation that would occur in the absence of exogenous disruptions unrelated to the economic cycle (Eckstein, 1981). In other words, it serves to map the fundamental inflationary trend of the economy, excluding short-term disturbances. The concept of core inflation is simple to understand. However, the technical aspects of its calculation are not universally agreed and several approaches exist.

HICP excluding energy and food is constructed through the fixed exclusion of certain categories of goods

The core inflation index usually applied in the euro area is defined as the inflation of a consumption basket made up of HICP products excluding energy and food (two categories of goods that are mainly imported and for which the prices are fixed on global markets and are volatile). The goods and services that remain in the

core index account for around 70% of the total weighting of the index as a whole. The advantage of this definition is that the index is technically simple to construct and easy to analyse as it excludes two entire categories of consumption items that relate to primary sector production and that are held to be subject to international price fluctuations.

HICP excluding energy and food remains sensitive, however, to one-off phenomena that are unrelated to the underlying trends in inflation

Core HICP is easy to construct. However, the flipside of its simplicity is that certain items kept in the index’s basket are still sensitive to one-off phenomena that are unrelated to the underlying trends in inflation. In particular, some services and non-energy manufactured consumption items may behave erratically in such a way as to sometimes contribute to a significant volatility in the core inflation rate that seems unrelated to the fundamental price setting tendency in the economy. For example, clothing, footwear and (particularly in Germany) package holidays,¹ which are subject to seasonal variations and severe shocks, contribute significantly to the volatility of the core price index (see Chart 1 below). Indeed, these three items are usually identified among the most influential drivers of instability in the core price index in the euro area.

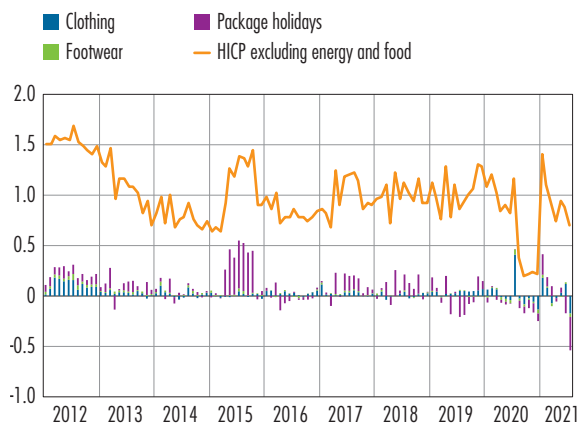
Other phenomena, independent of the underlying mechanisms of price formation, can also affect certain items of manufactured goods (excluding energy) and services. For example, the sharp decline in the cost of higher education (tuition fees) in Italy in October 2017 brought down the year-on-year rate of core HICP in Italy by 0.2 percentage point for 12 months, even though this change, made to a regulated price, should not be interpreted as an indication of a general slowdown in prices in the country.

¹ Clothing and footwear prices fluctuate greatly partly due to the scheduling of sales periods (if the dates change slightly from one year to another, the index’s year-on-year change is affected) and also, more generally, different promotion periods. Furthermore, these goods are also subject to sometimes significant adjustments linked to international trade conditions. There are also major shocks to the category of package holidays due to deals being offered at different times of the year. The air transport component of these holidays is also subject to significant fluctuations that are indirectly linked to international oil prices.



C1 HICP excluding energy and food and the contribution of particularly volatile sectors of activity in the euro area, 2012-21

(year-on-year change in %, sectors of activity in percentage points)



Sources: Eurostat, authors' calculations.

Notes: HICP, Harmonised Index of Consumer Prices.

The three sectors of activity considered particularly volatile for the purposes of this bulletin are clothing, footwear and package holidays.

The combination of specific historical phenomena affecting certain volatile items within the core index can give the false impression that the economic cycle and the formation of core prices are insufficiently correlated. In particular, the stable low rate of core inflation between 2014 and 2020 may seem inconsistent with the economic recovery in the euro area since that date, which was mainly evident in the increase in the output gap.

2 Other measures of core inflation in the euro area can make up for the shortcomings of the standard indicator

Several methods can be used to make up for the shortcomings of the standard core price series. What they all have in common is that they refer to the statistics in order to exclude the most volatile items from the price index.

Variable exclusion indices: trimmed mean HICP

An approach has been available for several years² that involves generating a price index for each period that excludes the most volatile items at that time (see Table below).

The advantage of this indicator is that it addresses the need for a core price index that excludes those components identified as statistically most volatile from the headline index, whereas the standard index excluding energy and food applies a theme-specific exclusion. This "trimmed mean" approach thus substantially reduces index volatility and seemingly correlates more closely with the economic cycle, for example during the period of economic recovery in the euro area between 2013 and 2018.

Its main disadvantage is the difficulty involved in interpreting this index from an economic perspective. First, as numerous consumption items move in and out of the index basket each month, it would be futile to try to analyse any changes based on the contribution of its different components (such as services or manufactured goods, etc.), as we do with headline HICP or the standard core HICP index. It therefore acts purely as a statistical signal and cannot be subject to descriptive analysis.

Second, while it is possible to produce trimmed mean indices for the euro area as a whole and for each euro area country, the individual country values will not add up to the overall euro area value. In other words, the euro area trimmed mean index is not the weighted average of the countries' trimmed mean indices. The index for the euro area is generated by applying an algorithm that selects the items with the least extreme variations in the aggregate index. It is not a result of an aggregation of the indices produced for each country. Additionally, not only does the composition of national trimmed mean indices change from one period to another,

² See, in particular, Bryan and Cecchetti (1993), Bryan, Cecchetti and Wiggins (1997), Dolmas (2005), Silver (2007), Ehrmann, Ferrucci, Lenza and O'Brien (2018), and Dolmas and Koenig (2019).



but it also varies from one country to another, meaning that any aggregation of the indicators would be of little use.

Alongside the trimmed mean inflation index, **median inflation**,³ another strictly statistical indicator, can be thought of as an extreme type of trimmed mean approach. Each period, the individual item with a monthly variation situated at the weighted median of the index item variations is selected. This produces a price index (again without a fixed composition, as each time a different item represents the median) whose year-on-year change corresponds to median inflation. We can thus consider the median measurement to be a trimmed mean index from which the 50% most volatile and 50% least volatile items are excluded each month. Despite being simpler, median inflation still shares the same drawbacks as the trimmed mean index.

A permanent exclusion index: the fine core HICP indicator

The fine core HICP indicator has the same statistical advantages as the trimmed mean approach while also rectifying the latter's methodological problems. It is a core indicator with a fixed composition, i.e. the basket used is identical over time and across countries. It differs from the standard core indicator in that it excludes individual items selected on the basis of minimising the variance of monthly change over a fixed reference period, rather than excluding entire groups of consumption categories (energy and food). In reference to the standard core HICP, the items that are excluded must correspond to 30% of the weight of the headline index. This new core index, which we call fine core HICP, thus represents

70% of the weight of the index as a whole, just like the standard core HICP and the trimmed mean index.

An individual price series with a monthly evolution that is stable over time (be it constant or exhibiting a marked upward or downward trend) will have a low variance and a higher probability of being included in the fine core index. Conversely, items whose prices are subject to severe shocks have a higher possibility of being excluded.

The table below shows the items that are included and excluded from the fine core HICP basket for the euro area and compares them with those included in the standard core HICP. Many food items are included in euro area fine core HICP, whereas certain services and manufactured goods are excluded because their prices are more volatile than the food items. Therefore, the main feature that the standard core HICP and fine core HICP have in common is that they both exclude energy products.

The composition of the fine core index can be updated periodically to take into account new information gathered on the monthly variations of HICP items. However, any update to the composition would likely be based on extending the reference period rather than changing it completely. Therefore, with regard to the results of the analysis of price stability, we can assume that the composition of the fine core index would change only marginally if the reference period was extended. The highly stable composition of the fine core index over time is a marker of stability that is advantageous for a core inflation index.

³ See, in particular, Bryan and Cecchetti (1993), Silver (2007), and Ehrmann, Ferrucci, Lenza and O'Brien (2018).



Individual items included in fine core HICP (calculated on the 2001-19 period) and in standard core HICP in the euro area

Item	Inclusion in standard core	Inclusion in fine core (calculated on 2001-19)	Item	Inclusion in standard core	Inclusion in fine core (calculated on 2001-19)
Bread and cereals	No	Yes	Hospital services	Yes	Yes
Meat	No	Yes	Dental services	Yes	Yes
Fish and seafood	No	No	Motor cars	Yes	Yes
Milk, cheese and eggs	No	Yes	Motorcycles and bicycles	Yes	Yes
Oils and fats	No	No	Spare parts and accessories for personal transport vehicles	Yes	Yes
Fruit	No	No	Fuels and lubricants for personal transport vehicles	No	No
Vegetables	No	No	Maintenance and repair of personal transport vehicles	Yes	Yes
Sugar, jam, honey	No	Yes	Other transport equipment	Yes	Yes
Food products n.e.c.	No	Yes	Passenger transport by railway	Yes	Yes
Coffee, tea and cocoa	No	Yes	Passenger transport by road	Yes	Yes
Non-alcoholic beverages	No	Yes	Passenger transport by air	Yes	No
Spirits	No	Yes	Passenger transport by sea and inland waterway	Yes	No
Wine	No	Yes	Combined passenger transport	Yes	Yes
Beer	No	Yes	Postal services	Yes	No
Tobacco	No	No	Telephone and telefax equipment and services	Yes	Yes
Clothing	Yes	No	Equipment for recording sound and image	Yes	Yes
Other articles of clothing	Yes	No	Photographic and cinematographic equipment	Yes	No
Cleaning of clothing	Yes	Yes	Information processing equipment	Yes	No
Footwear	Yes	No	Recording media	Yes	No
Actual rentals for housing	Yes	Yes	Other major durables for recreation and culture	Yes	No
Materials for the maintenance and repair of the dwelling	Yes	Yes	Games, toys and hobbies	Yes	Yes
Services for the maintenance and repair of the dwelling	Yes	Yes	Equipment for sport	Yes	No
Water supply	Yes	Yes	Plants and flowers	Yes	No
Refuse collection	Yes	Yes	Pets and related products	Yes	Yes
Sewerage collection	Yes	Yes	Recreational services	Yes	Yes
Other services relating to the dwelling	Yes	Yes	Cultural services	Yes	Yes
Electricity	No	No	Books	Yes	Yes
Gas	No	No	Newspapers and periodicals	Yes	Yes
Liquid fuels	No	No	Miscellaneous printed matter	Yes	Yes
Furniture and furnishings	Yes	Yes	Package holidays	Yes	No
Carpet and rugs	Yes	Yes	Education	Yes	Yes
Household textiles	Yes	No	Restaurants and cafés	Yes	Yes
Household appliances	Yes	Yes	Canteens	Yes	Yes
Repair of household appliances	Yes	Yes	Accommodation services	Yes	No
Glassware, tableware and household utensils	Yes	Yes	Hairdressing salons	Yes	Yes
Tools and equipment for house and garden	Yes	Yes	Electrical appliances for personal care	Yes	Yes
Non-durable household goods	Yes	Yes	Clocks and watches	Yes	Yes
Domestic services and household services	Yes	Yes	Other personal effects	Yes	No
Pharmaceutical products	Yes	Yes	Social protection	Yes	Yes
Other medical products	Yes	Yes	Insurance	Yes	Yes
Medical services and paramedical services	Yes	No	Financial services	Yes	Yes
			Other services	Yes	Yes

Sources: Eurostat, authors' calculations.

Note: HICP, Harmonised Index of Consumer Prices.



BOX 1

Calculation methods for the trimmed mean and fine core HICP indices

Trimmed mean HICP is calculated by referring to the distribution of monthly variations for the components of the Harmonised Index of Consumer Prices (HICP) and excluding those items with the most extreme changes each month. Items in the HICP index are ordered on the basis of their monthly growth rate and a weighted proportion is “trimmed” from the beginning and the end of the distribution. It is possible to exclude different proportions from the beginning and from the end, but generally 15% is taken from both extremes in order to have an index that represents 70% of the HICP, in the same way as the standard core HICP. The growth rate of the index for the month under review in year-on-year change is thus calculated solely on the basis of the items retained. The trimmed mean index can be calculated for the euro area as a whole and for each individual euro area country. However, the index calculated for the euro area using aggregates of each item will not necessarily match that obtained by aggregating the trimmed mean indices calculated for each country.

Fine core HICP takes a reference period during which the average inflation volatility for the euro area is observed for each item, measured on the basis of the variance in the monthly change over the specified period. The chosen reference period is 2001-19.¹ Other periods were tested with little difference in results. Based on the results for the reference period, 70% of the items in the HICP index with the lowest variance of monthly change are retained and used in the calculation of fine core HICP. The basket of items included in fine core HICP is determined for the euro area, and applied to each euro area country, meaning that the fine core index for the euro area is equal to the weighted average of the national fine core indices.

¹ In order to ensure that the choice of reference period has a limited effect on the composition of fine core HICP, a sensitivity study was carried out comparing the composition of the index over three timeframes: (A) 2001-19; (B) 2001-07; and (C) 2001-13. Of the 70% by weighting of the HICP that should make up fine core HICP, 66% was present in each of the baskets for the three samples. The bulk of the index is therefore common to all three periods. Of the 30% of the weighted items that had to be excluded, 28% were excluded from all three samples. Ultimately, items whose inclusion in the fine core basket is disputable concern only 6% of the weighting, which is very limited.

3 The advantages of fine core HICP, a fixed-composition core indicator

An analysis of past figures shows that the alternative core inflation indicators – trimmed mean and fine core HICP – are stable and responsive to the economic cycle, making them particularly valuable as a complement to the standard core HICP index. However, unlike the trimmed mean approach, fine core HICP also allows headline inflation to be broken down in such a way that is meaningful for the analysis of economic conditions and the definition of monetary policy.

The fine core and trimmed mean HICP indices seem more consistent with variations in the economic cycle than HICP excluding energy and food

In retrospect, movements in fine core HICP have been quite similar to those of the trimmed mean index

(see Chart 2 below). In particular, they both signal an acceleration in the price index (increase in inflation) during the period of economic recovery that began in 2015. Both indices are less volatile than the standard core HICP inflation. They are thus more consistent with the idea of a core index that is stripped of short-lived movements in inflation and that would indicate medium-term inflationary pressures. At the moment, all three core inflation indices point to a sharp increase in inflation.

Moreover, it is important to note that the fine core and trimmed mean HICP indices would have reacted more responsively than the standard core HICP during the inflation surges in 2008 and then in 2011-12. This is partly because both indicators incorporate certain food products (the least volatile, which respond to changes in international food prices as well as the economic cycle) whereas core HICP excludes them entirely.

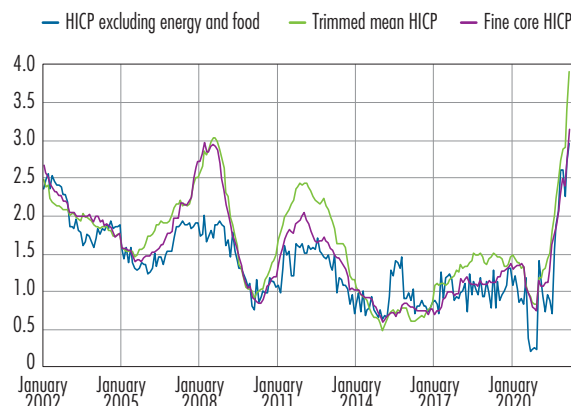


In 2020, during the Covid-19 crisis, the fine core and trimmed mean indicators showed a less pronounced decline in core inflation than the drop reflected in HICP excluding energy and food. This is because the latter was especially affected by a few items (notably transportation, package holidays, and accommodation and food services) which behaved in very specific ways that were largely unrelated to core inflation trends. However, from 2021 onwards, all three indices simultaneously show a marked acceleration.

Lastly, the fine core and trimmed mean HICP indices generally seem to be more responsive to variations in the economic cycle than the standard core HICP (excluding energy and food). Indeed, the correlation between inflation indicated by the alternative indices and the economic cycle, measured by the output gap or unemployment rate, is significantly greater than that between the standard core HICP inflation and the economic cycle. This result would suggest that fine core and trimmed mean HICP are both good measures of the underlying mechanisms of price formation (see Box 2).

C2 HICP excluding energy and food, trimmed mean HICP and fine core HICP in the euro area, 2002-22

(year-on-year change in %)



Sources: Eurostat, authors' calculations.

Notes: HICP, Harmonised Index of Consumer Prices.

Trimmed mean HICP excludes at each observation the most volatile items at that time.

Fine core HICP applies a fixed exclusion of the historically most volatile items.

BOX 2

Analysis of the econometric correlation with the economic cycle

The link between inflation and the state of the economy (measured by the output gap or the unemployment rate, for example) is known as the "Phillips curve", which is generally interpreted as the transmission of economic tensions to inflation.

In order to check that the relationship hypothesised by Phillips is maintained and even reinforced with the alternative core inflation measures (trimmed mean and fine core HICP), the alternative approaches were tested in Phillips curves (Berson et al., 2018). A comparison of the linear correlation coefficients (adjusted R^2 , see table below) shows a far stronger cycle correlation with the two alternative measures than with the standard core HICP.

Therefore, with fine core and trimmed mean HICP it is possible to establish a stronger correlation between inflation and the economic cycle. This result further strengthens the view that the hypothesis of a deterioration of the Phillips curve is not borne out. The limitations in the construction of HICP excluding energy and food may have contributed to this impression. According to the criterion of correlation with the economic cycle, the alternative indices are good measures of core inflation.

.../...



Inclusion of individual items in fine core HICP and core HICP for the euro area

Inflation indicators	Economic indicator		
	Output gap	Unemployment rate	NAIRU gap ^{a)}
Standard core HICP	0.34	0.27	0.30
Trimmed mean HICP	0.65	0.56	0.58
Fine core HICP	0.69	0.60	0.62
GDP deflator	0.37	0.26	0.26

Sources: Eurostat, European Commission and authors' calculations.

a) NAIRU gap: the difference between the real unemployment rate and the structural part of the real unemployment rate referred to as the non-accelerating inflation rate of unemployment (NAIRU).

The fine core index provides useful breakdowns of headline HICP inflation

The standard core HICP can clearly be improved to take into account the dynamics of the price formation of consumption goods. Nonetheless, its advantage is that major item categories' contributions to headline inflation can be simply represented. This type of breakdown is not feasible with a trimmed mean index because its composition changes. However, it is possible with the fine core index. Consequently, just as we break down headline HICP into a core index (services and manufactured goods excluding energy) and an index of volatile components (energy and food), we can break down headline HICP into a new core index – the fine core index – and a new index of volatile prices.

This breakdown shows the categories of goods and services that shape the economic trajectories of headline and core HICP in a precise and graphic manner. Chart 3 below compares the usual breakdowns performed using the standard concept of core inflation (Charts 3a and 3c) with the fine core HICP concept (Charts 3b and 3d). The first two graphs show the breakdown of year-on-year change in headline inflation between core inflation and volatile components (Charts 3a and 3b)

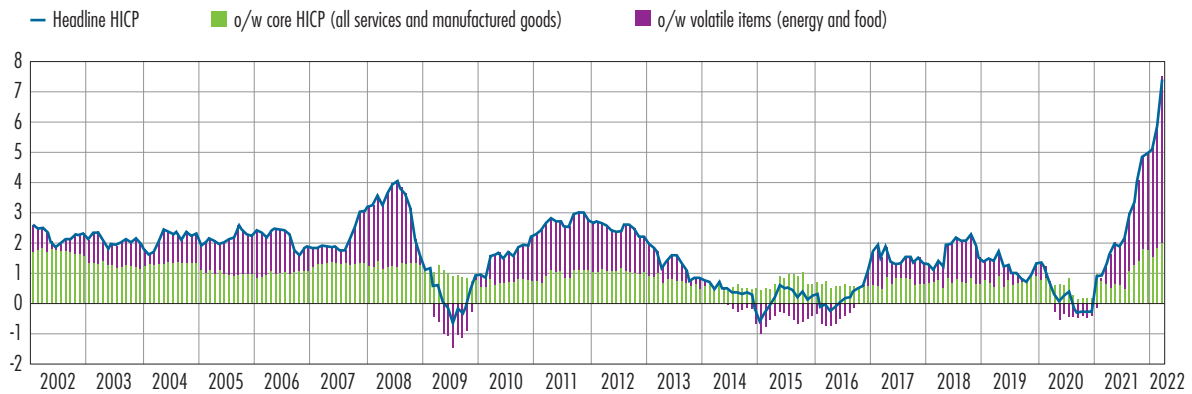
while the last two break down core inflation (Charts 3c and 3d). Chart 3 shows that the standard concept of core inflation certainly facilitates the comparison of the relative dynamism of inflation in services and in manufactured goods, but these two components are still distorted and subject to statistical noise due to items linked to international prices (air transport, package holidays) and therefore provide little information on price formation mechanisms. The breakdown allowed by the fine core index is comparable, but the items it breaks down into (the least volatile services, manufactured goods and food items) are more stable than the two main components (all services and all manufactured goods) in the breakdown of the index excluding energy and food.

Moreover, as the basket of items that make up the fine core HICP index is constant, not only over time but also across countries, fine core HICP for the euro area is equal to the weighted sum of the fine core HICP indices of the countries in the euro area. Consequently, euro area fine core HICP can be broken down geographically and the countries that contribute most to the acceleration or slowdown of the index can be identified. In Chart 4, the year-on-year change in fine core HICP is broken down by country. As discussed above, this is not possible with trimmed mean HICP.



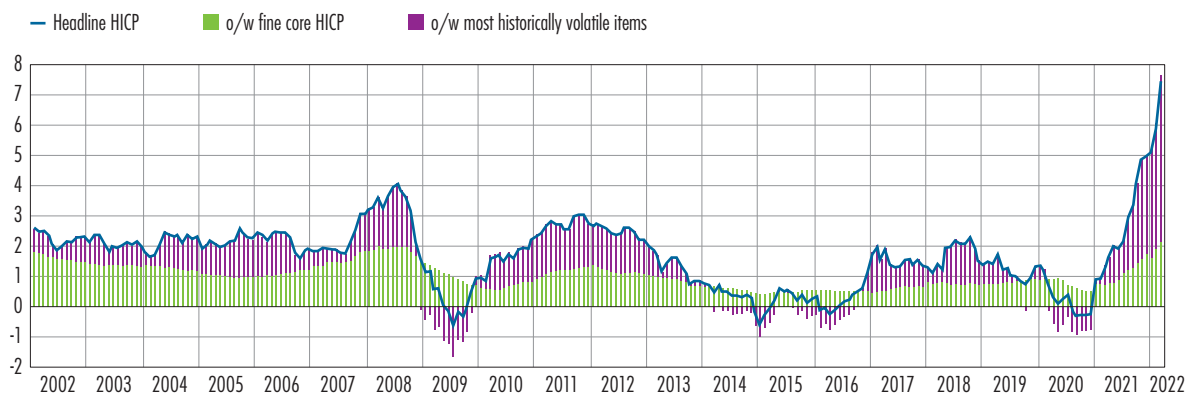
C3 Breakdown of inflation in the euro area: comparison between the standard definition of core inflation and the fine core HICP approach (year-on-year change in %)

a) Breakdown of the year-on-year change in headline HICP: HICP excluding energy and food



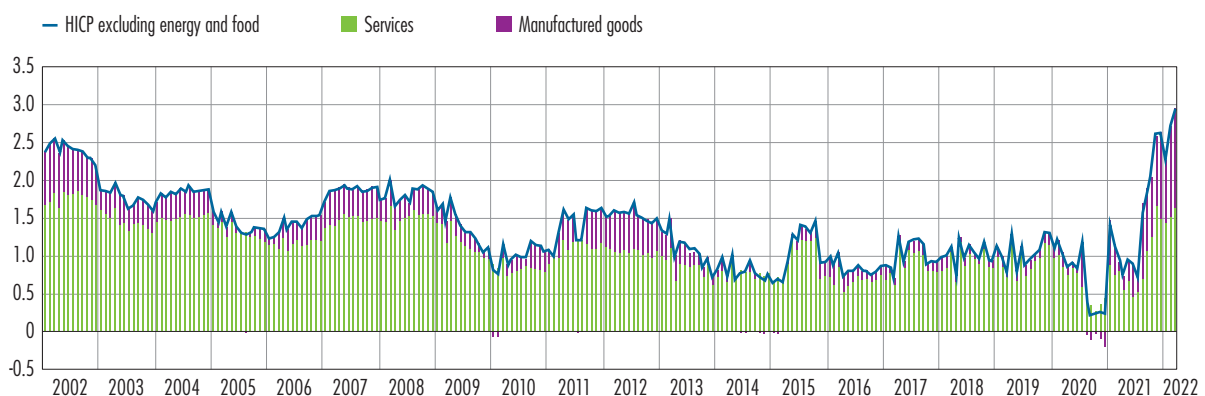
Note: HICP excluding energy and food is used here as the measure of core inflation.

b) Breakdown of the year-on-year change in headline HICP: fine core HICP



Note: Fine core HICP is used here as the measure of core inflation.

c) Breakdown of the year-on-year change in HICP excluding energy and food



Sources: Eurostat, authors' calculations.

Note: HICP, Harmonised Index of Consumer Prices

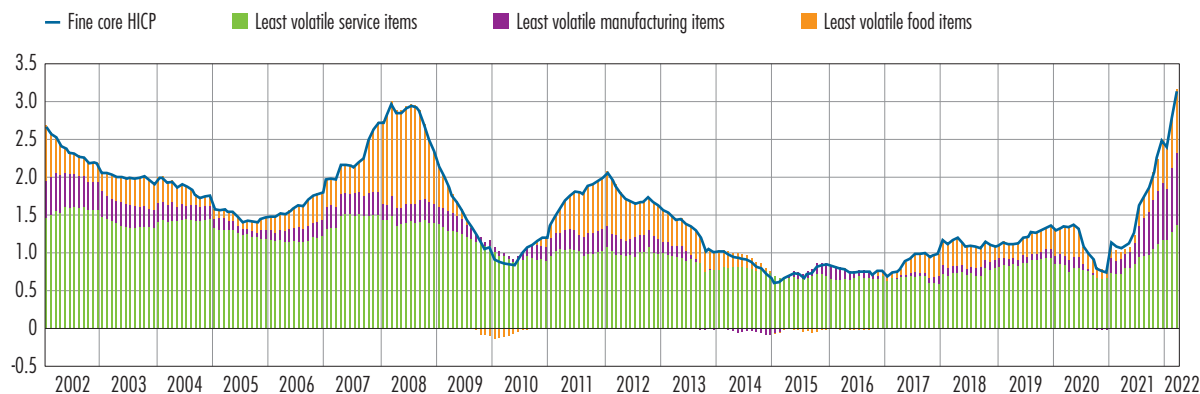
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C3 Breakdown of inflation in the euro area: comparison between the standard definition of core inflation and the fine core HICP approach (continued)

(year-on-year change in %)

d) Breakdown of the year-on-year change in fine core HICP



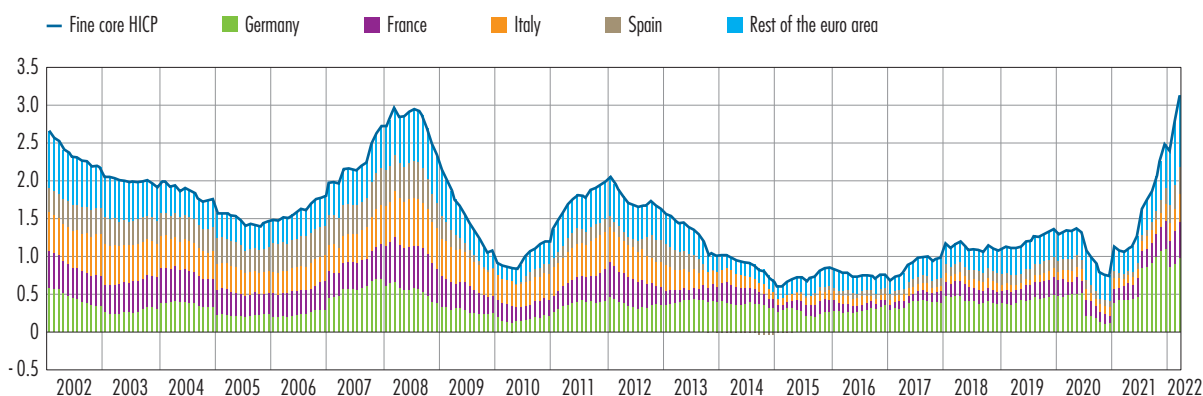
Sources: Eurostat, authors' calculations.

Notes: HICP, Harmonised Index of Consumer Prices.

Fine core HICP applies a fixed exclusion of the historically most volatile items.

C4 Breakdown of the year-on-year change in fine core HICP in the euro area by country

(year-on-year change in %)



Sources: Eurostat, authors' calculations.

Note: HICP, Harmonised Index of Consumer Prices.

Chart 4 shows that part of the acceleration in 2021 comes from a particularly sharp surge in Germany, echoing the successive changes in the VAT rate in July 2020 and January 2021.

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Due to price disruptions that are unrelated to the economic cycle and that can have a one-off effect on the year-on-year change in headline HICP, it is important to monitor several indicators of core inflation in order to have the most

complete possible analysis of inflation trends. HICP excluding energy and food is a well-known indicator of core inflation and has the advantage of being conceptually and methodologically very simple. As for trimmed mean HICP, it allows the most volatile individual items to be stripped out in real time and thus makes it possible to reliably monitor core inflation trends. Fine core HICP, which is relatively straightforward to calculate, also permits detailed breakdowns and easy statistical analyses, while effectively eliminating the majority of one-off phenomena that complicate economic analyses of the underlying trends.



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