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How Different is Euro Area and US Inflation?

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Larger and more sustained energy and commodity price shocks as a result of the war in Ukraine are contributing to higher headline inflation in the euro area (EA), when compared with the US. Underneath the headline numbers, trend inflation – something monetary policy-makers pay close attention to in order to get a sense of persistence in inflation dynamics – is still lower in the EA, mainly due to lower services inflation. However, this gap in trend inflation is gradually closing and even slightly reversed recently when owner-occupied housing services costs are excluded from US inflation.

Both in the EA and the US, inflation is at its highest level in for decades (Figure 1). [2] In July 2022, inflation in the euro area surpassed US inflation for the first time in almost seven years. Up until then, EA inflation during and after the pandemic tended to lag those in the US. Inflation first turned negative in the US in the second quarter of 2020, and in the EA during the fourth quarter. US inflation reverted relatively quickly to around pre-crisis levels in early 2021, due to both supply bottlenecks in specific sectors and the easing of the restrictions (Ricarte et al., 2022). In the EA, it reached pre-pandemic levels somewhat later, around 2021:Q2, partly due to a later re-opening up of economies. Following the Russian invasion of Ukraine in February 2022, EA inflation rate climbed by 1.5 percentage points in a month and continued to increase in the following seven months. It has only started to ease in recent months after reaching 10.6 per cent in October 2022. US inflation peaked earlier in June 2022, followed by a decline in the subsequent months.

In this *Economic Letter*, I compare both headline and trend inflation in these two economies up to the end of 2022:Q4. I estimate trend inflation using disaggregated sector-level data that enables us to trace the source of changing dynamics in the aggregate rates. The main empirical findings show that:

- Trend inflation estimates for food, energy, and non-energy industrial goods are higher in the EA. On the other hand, services trend inflation is higher in the US.
- Trend inflation estimates are well above the 2 per cent target in both economies.
- The estimates for trend inflation in the EA are still below those of the US. However, this gap is getting smaller over time. If the inclusion of owner-occupied housing is controlled for US inflation, the gap disappeared entirely in 2022:Q3 and even reversed in the last quarter of 2022.

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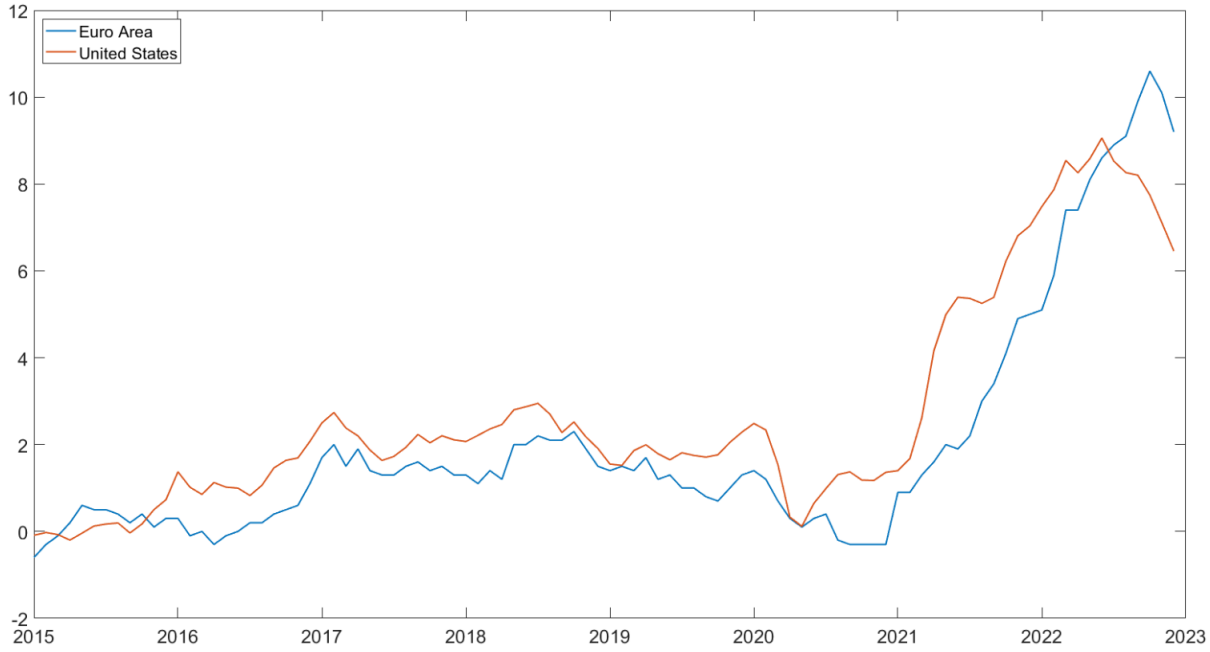
[2] The rates are based on the CPI for the US and the HICP for the euro area (EA). I used the US CPI rather than the PCE due to better comparability with the HICP. See Garriga and Werner (2022) for the differences between the two measures. On international and domestic drivers of inflation prior to the pandemic, see Peersman (2022) and Bobeica and Jarocinski (2017) respectively.

Figure 1 | Headline inflation (YoY, percentage changes)



Source: OECD and Eurostat, 2015:M01-2022:M12.

A deeper dive into sectors

Inflation rates are calculated based on changes in the price index which is the weighted average of sectoral prices. These weights are computed according to the expenditure shares of different products in the consumption basket of the representative household.[3] Thus, the change in price index can come from the changes in both sectoral weights and prices.

Figure 2 shows the sectoral weights by consumption purposes and product type in 2019.[4] The most striking difference is in the housing and fuels sector's weight, around 38 per cent in the US and 17 per cent in the EA. Unlike the EA, housing and fuels category includes imputed rentals for owner-occupied housing in the US. The share of this item is approximately two-thirds of the housing sector's share. The relative importance of other larger items like food and transportation is similar for both economies. On the other hand, the US health and the EA apparel and recreation sectors receive greater weights relative to each other. Concerning the product types, the food and energy sectors together comprise nearly a third of the basket in the EA and only two-fifths in the US. The non-energy industrial goods (NEIG), such as cars, household appliances, and apparel, which were affected dramatically by the supply chain problems during the pandemic, had slightly higher importance (27 per cent) in the EA compared to the US (20 per cent).[5] Services is the largest category for both countries, with a difference in weights driven mainly by the housing component.

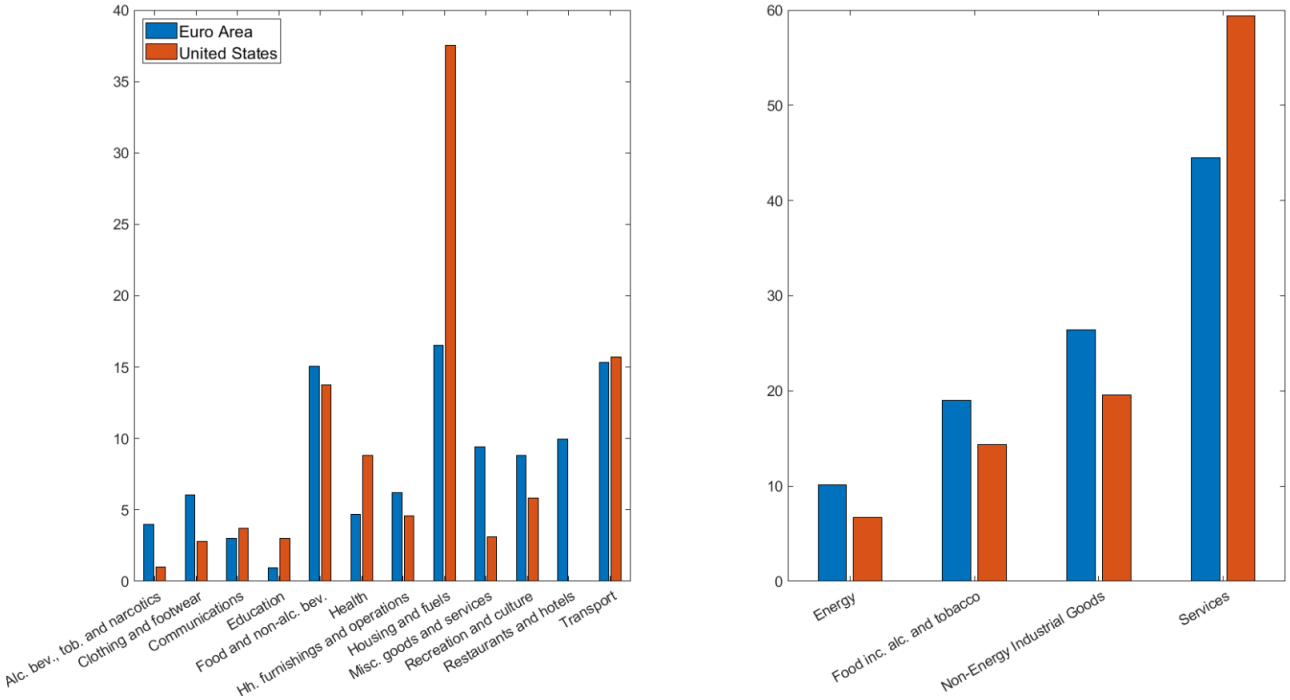
Figure 3 shows the sector contribution by product type to the headline inflation rate from 2015 onwards. The contribution of services less housing is presented to provide a better comparison for both economies. As clearly shown in the graph, the recent upturn in inflation in the EA is mainly from food and energy, whereas the upward pressures are more

[3] See the EA and the USA for details.

[4] For the US, there is no category called restaurant and hotels, but they are included in the food and housing sectors.

[5] See Cuquerella Ricarte et al. (2022) for details.

Figure 2 | Item weights in 2019 (annual, adding up to 100) by consumption purposes (left) and product type (right)



Source: BLS and EuroStat.

widespread across the sectors in the US. Compared to pre-pandemic levels, the combined contribution of these two sectors to headline inflation increased from 0.59 (0.56) percentage points in January 2020 to 7.18 (2.22) percentage points in October 2022 for the EA (US). Although the contribution of the energy sector has started to ease in the last two months, it is still very strong.

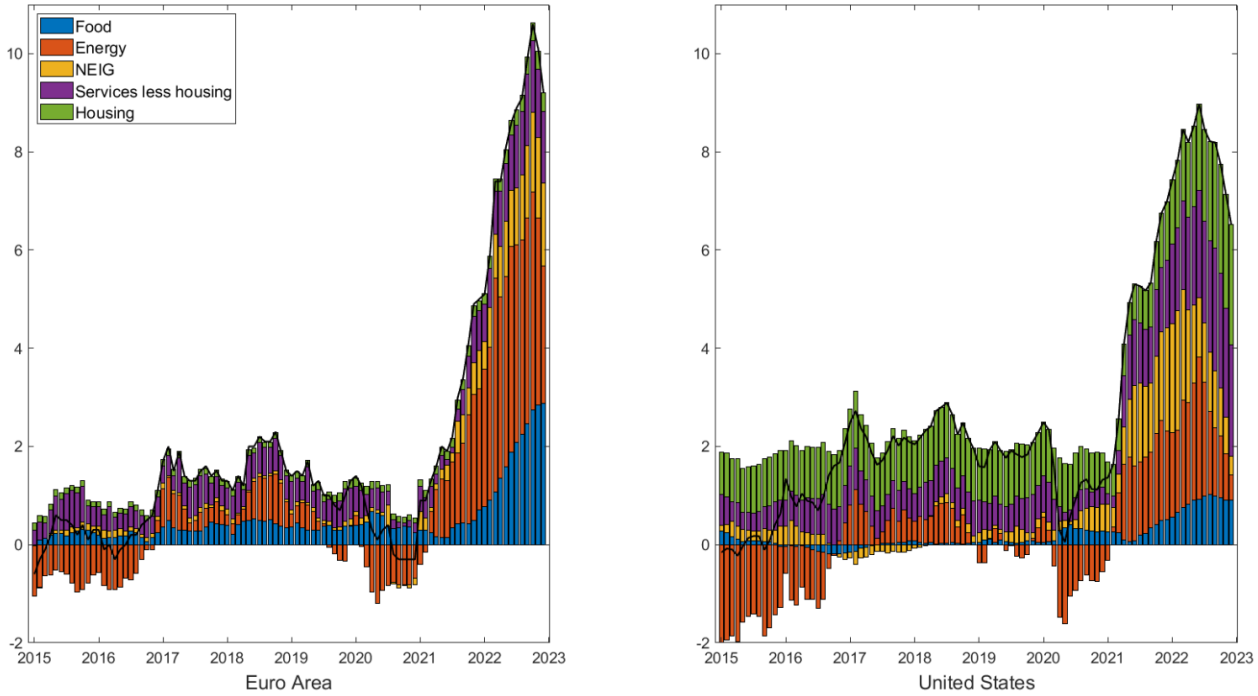
The slightly negative contribution of NEIG to EA inflation during the second half of 2020 returned to pre-crisis levels around 2021:Q2. By contrast, in the US, the impact of the pandemic on NEIG is large and only started to ease in early 2022. The contribution of NEIG to EA inflation has increased gradually over 2022 and stood above one and a half percentage points in the last quarter of 2022.[6] Regarding the services (less housing) sector, in the US the contribution increased sharply following the lifting up of the pandemic-related measures. More specifically, it went above one percentage point as early as the second quarter of 2021. In the EA, services' contribution increased more gradually and exceeded that threshold only in 2022:Q2. The most recent data show that the contribution of services to EA inflation is still way below that of the US. Overall, the descriptive evidence suggests that inflation in the EA is substantially driven by energy and food. On the contrary, in the US, the largest contributing sector is the services followed by NEIG.

Estimating trend inflation

Although the headline inflation rates provide a general basis for the comparison, they suffer from the well-known signal-noise problem. In particular, it is challenging to understand

[6]The rise in the most recent quarter is heavily driven by non-durable industrial goods i.e. electronic goods for personal care, pharmaceutical products, cleaning and maintenance products etc.

Figure 3 | Contribution of sectors to the annual headline inflation (percentage points)



Source: OECD, EuroStat, and the author's calculations, 2015:M01-2022:M12.

the long-term dynamics of inflation as the headline rates are driven by both temporary and seasonal price changes, in addition to persistent movements. To guide policy decisions, it is crucial to gauge trend inflation in order to better understand the persistence dynamics of inflation.

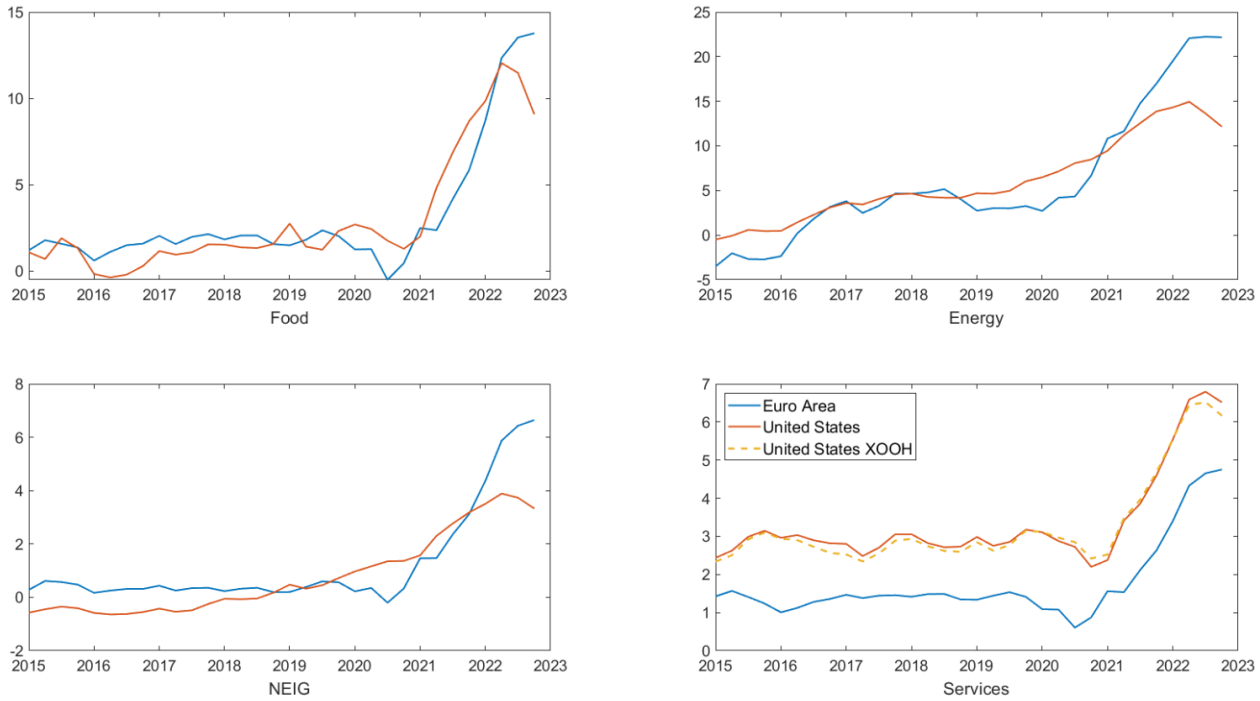
Conventional methods to estimate trend inflation rely on the cross-sectional exclusion of volatile sectors such as food and energy, trimmed mean/median measures, or time-series methods that extract particular frequencies of interest. Although simple to implement and easy to explain, these methods need to be caveated. For example, the standard core inflation measure that excludes food and energy sectors omits 30 per cent of the goods in the EA's consumption basket, based on the assumption that these sectors are highly volatile with little persistence. Contrary to that, Ehrmann et al. (2018) show that some energy components such as gas, heating and electricity exhibit high persistence *and* volatility. Moreover, the cross-sectional aggregation of time series with different characteristics is not without its problems, as discussed by Altissimo et al. (2006) and may give result in 'washing out' some of the underlying dynamics that we are interested in.

More recent studies (Stock and Watson, 2016; Bobeica and Banbura, 2020; Nir et al., 2021[7]) combined cross-sectional and time-series dimensions by utilizing *granular data* and *factor models*. Following this recent literature, I provide an empirical analysis of the EA and US inflation rates using the unobserved components model with stochastic volatility and outliers proposed by Stock and Watson (2019).[8] The empirical strategy enables us to in-

[7] Please see Scally and Walsh (2022) for a recent application of this method to the Irish inflation rates.

[8] As shown by the seminal paper of Stock and Watson (2007), inflation series are better specified with changing volatility over time. Morevoer, it is important to allow for outliers in the model since the main interest is sector-level data which can be heavily affected by infrequent and extreme changes. To illustrate, a tax change on apparel prices in a certain year can be detected as an outlier in the model and will allow us to have a more precise trend estimate.

Figure 4 | Sector trend estimates



Source: Author's own calculations based on the data from BLS, FRED, and Eurostat. 2015:Q1-2022:Q4.

corporate a broader information set relative to that used by conventional methods, which exclude volatile sectors on an *a priori* basis. Understanding the dynamics of food and energy prices is critical since they are highly likely to affect consumer expectations more with their greater importance in the consumption basket.[9] The analysis covers the period from 2001:Q2 to 2022:Q4 based on data availability. The data details and econometric model are summarised in the Appendix.

Sector Trends

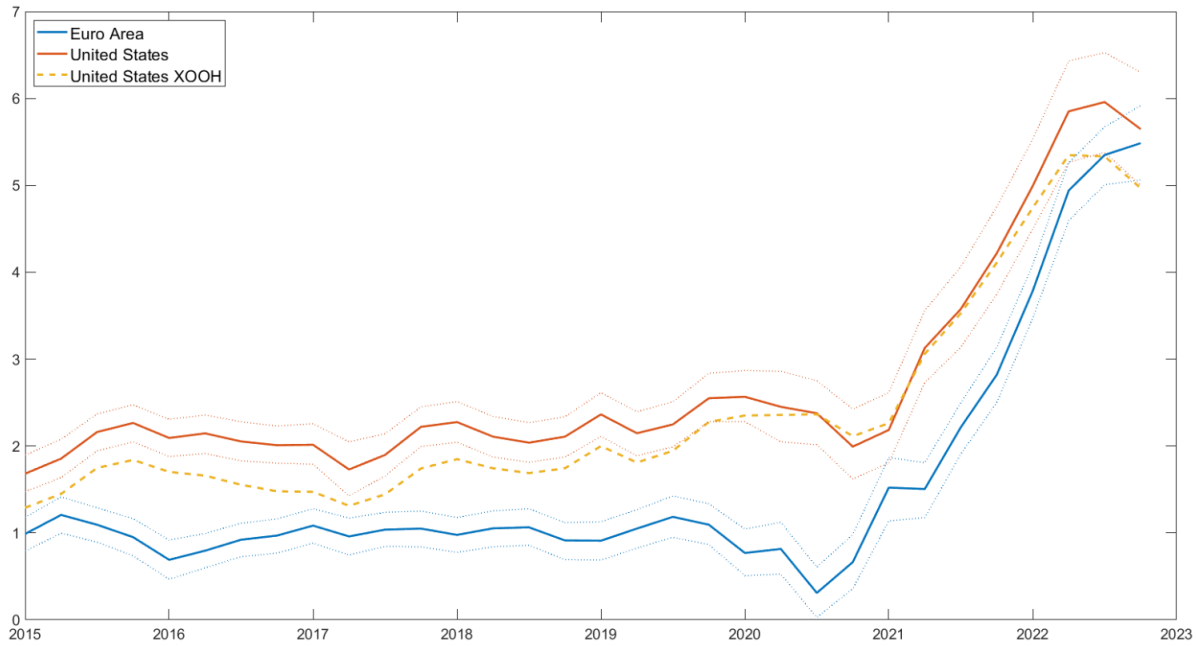
Figure 4 shows the trend inflation estimates in the four sectors for the EA and the US. The trend in the food sector[10] of the US tends to display greater volatility, on average, of 1.7 per cent, compared to 1.2 per cent in the EA. The EA's food trend inflation reached a trough point in 2020:Q3 but increased rapidly in the following two quarters. On the other hand, its trend in the US showed a smoother decline over time but reverted even quicker than the EA in 2021. Already rising food trends seem to be pushed above single-digit numbers in both economies due to the adverse impact of the war in Ukraine on international food prices. From the first to the second quarter of 2022, it increased by around 35 per cent in the EA and 20 per cent in the US, respectively. After peaking in 2022:Q2, the US food trend inflation started to decline in the second half of the year. In the EA, it is still on the rise despite of slowing pace recently.

The trend in energy inflation, on the top right panel, demonstrates that the EA trend was

[9] See Campos, McMain, and Pedemonte (2022) for a recent example.

[10] This sector includes food away from home for the US but not for the EA as a result of classification differences.

Figure 5 | Trend inflation estimates with 68 per cent credible intervals



Note: The surrounding dotted lines show two-sided 68 per cent error bands.

Source: Author's own calculations based on the data from BLS, FRED, and Eurostat.

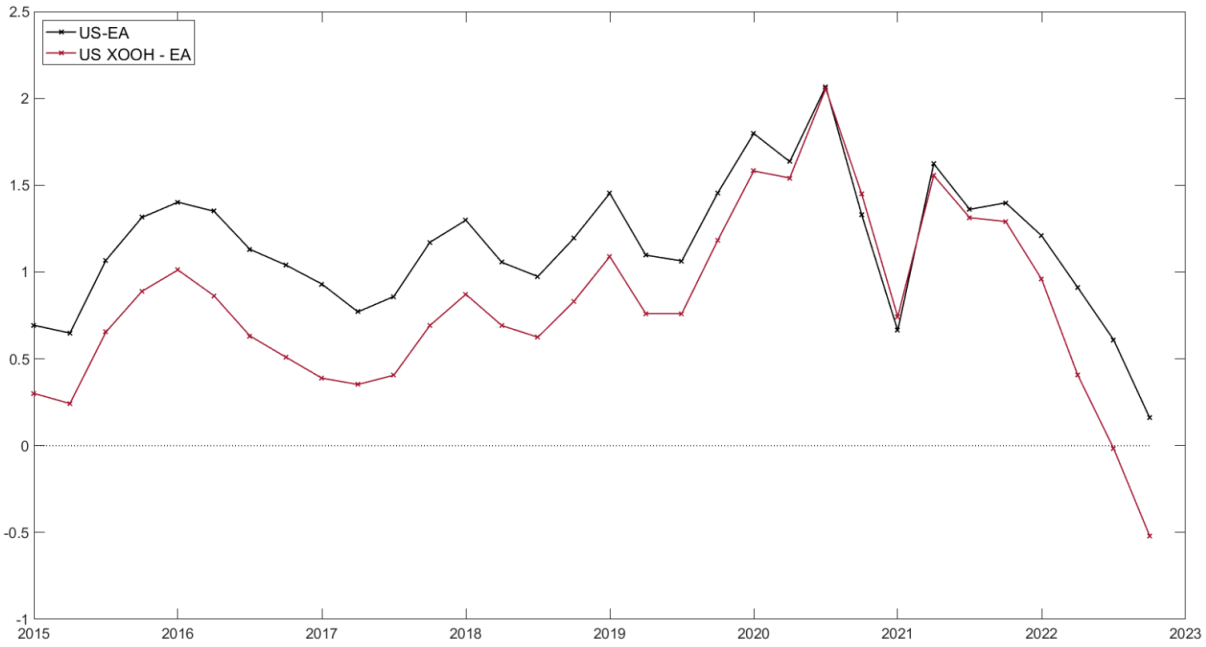
relatively weak and declining from mid-2018 to the pandemic, unlike the US which moving up gradually in this period. Despite the already rising trend in the US, the EA energy trend has accelerated as of the second half of 2020 and exceeded the US around 2021. In 2022:Q1, the model produces an outlier estimate in the cyclical component of energy in the EA. The estimated volatility is six times higher than the average volatility of the transitory energy inflation component. The empirical finding reflects that the asymmetrical impact of the war on the energy trend of the two economies is treated as temporary. The estimates suggest that the US energy trend started to decline in the second half of 2022 and the EA trend probably reached a plateau. In 2022:Q4, there was a ten percentage point difference in the estimated energy trend of the two economies.

The trend component of NEIG (bottom-left) displayed a rising trend from 2017 onwards in the US and went above its EA counterpart before the pandemic. Following a stagnation around the second half of 2020, it increased considerably from 2021, which is likely to be related to the supply-side constraints, combined with a rapid re-opening up of the economy. It seems to be reached a peak in 2022:Q2 and has declined since then. Similarly, the NEIG trend in the EA increased considerably from the second half of 2021, yet it surged beyond that of the US.

The EA services trend inflation is below the US.[11] Pre-pandemic differences especially can be attributed to the weaker inflation in the EA and the inclusion of the owner-occupied housing in the US services inflation. In the EA, the services trend declined during the pan-

[11] Perfectly harmonized series for the US and the EA are not available so I make a simple adjustment to the US CPI by taking owner-occupied housing prices out. The index matches well with the US HICP estimates of EuroStat that are available until 2022:M04. It is important to note that the recent ECB strategy review recommended to account for owner-occupied housing (OOH) costs in the HICP and a roadmap was designed for a multi-year project. Thus, a more comparable measure of inflation may become available in the future. In the meantime, the ECB has calculated a new internal quarterly index of such a measure.

Figure 6 | Difference between the trend inflation estimates



Source: Author's own calculations based on the data from BLS, FRED, and Eurostat.

demic, before accelerating from the summer of 2021 onwards. On the other hand, the US services trend increased rapidly from the beginning of 2021 and more than doubled its pre-pandemic levels in 2022. Although the services trend seems to be easing recently in the two economies, the US trend is still above the EA.

Aggregate Trends

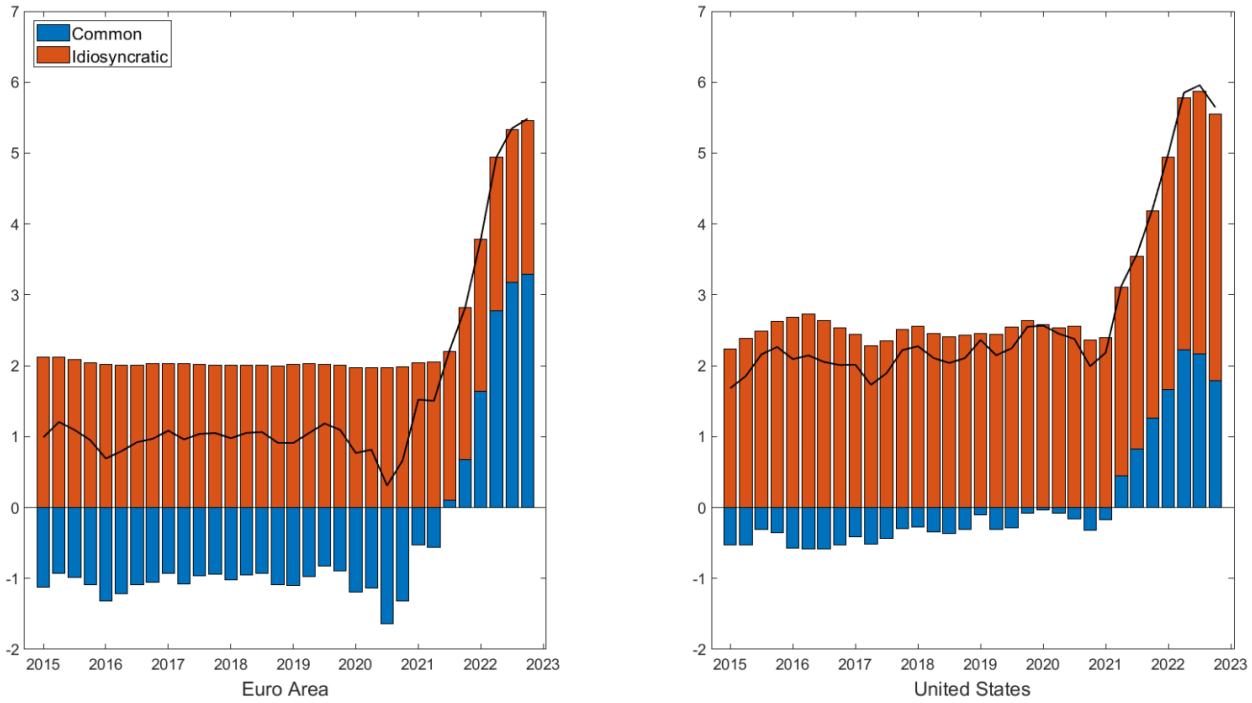
As displayed in Figure 5, trend inflation is constructed by excluding food and energy sectors after estimating all sectors in a dynamic factor model. The dashed line shows trend inflation based on the alternative CPI that excludes imputed rent for owner-occupied US households. Although it is not free of limitations, it gives a sense of the difference driven by the owner-occupied housing prices in these two economies. The empirical results have several implications, including:

1. The trend inflation estimate in the EA was below the US trend inflation before the pandemic. Therefore, the initial conditions of these two economies receiving the pandemic shock were already quite dissimilar, in the first instance.

2. The responses of the trend inflation to the pandemic were different. In the US, the initial response (in 2020:Q2) was limited, compared to the EA, which experienced a greater downward movement. However, from early 2021, the US trend increased very rapidly. The adjustment in the EA was relatively gradual but intensified in the second half of 2021.

3. Although the US trend is above the EA, the difference between the two measures narrowed since 2021:Q4 as shown in Figure 6. If the comparison is based on the trend measure without owner-occupied housing in the US (red line), then the most recent

Figure 7 | Common versus sector-specific components of the trend inflation rates



Source: Author's own calculations based on the data from BLS, FRED, and Eurostat.

estimate implies that they look more similar.[12]

4. The credible intervals got wider in both economies since the pandemic.[13] They become considerably wider following the war in Ukraine for the EA, whereas they are stabilized recently in the US. The result is consistent with the uncertainty surrounding the estimates has considerably increased in the EA.

The econometric model allows us to decompose common and sector-specific components of the trend inflation, as presented in Figure 7. Different from the sector-specific component showing only individual price changes, the common component reflects the widespread pressures shared across the sectors i.e. weak demand in the economy, pass through of energy prices etc.[14] The figure suggests that the sector-specific component is stable with a 2 per cent average in the EA and 2.5 per cent in the US before 2020. In the most recent period, the sector-specific part of US inflation increased from 2.7 per cent in 2021:Q2 to 3.8 per cent in 2022:Q4. In contrast, the increase of the sector-specific component in the EA during this period was rather limited. The common component, on the other hand, contributing to the trend is estimated as negative and acted as the force driving the trend inflation down until recently, especially in the EA. The negative common component can be thought of as in line with the missing inflation puzzle and the relatively muted reaction of prices in this period.[15] Although it is not possible to identify the factors contributing to the common component from the empirical analysis in this *Letter*, the relatively lower and

[12] One important caveat of this method is that since owner-occupied housing component is excluded from services sector manually, the relative weights sectors are changed, accordingly. They are just provided to understand the potential impacts due to the difference in inflation measurement in these two economies.

[13] 90 per cent equal-tailed bands are one and a half times wider than 68 per cent bands.

[14] See Stock and Watson (2016) for details.

[15] Please see Del Negro et al. (2020), Bobeica and Jarocinski (2019) for details.

even sometimes negative price changes in energy and food in the last decade, the weak demand in the economy, or more structural factors, such as globalization may worth to consider. Recently, the common components of inflation turned positive both in the EA and US. Despite starting to rise later, the common component of the EA trend went above that of US in 2022:Q2 which can be potentially explained by the greater energy pass through to the other sectors. In the US, the common component seems to peak up around the second quarter although the sector-specific component has not reached a peak yet. In the EA, the rising pace of the common component slowed in the last quarter of 2022.

Conclusion

The descriptive analysis of the headline inflation shows that the main sectors contributing to rising inflation rates in the EA are energy and food, whereas, in the US services played an important role. The trend inflation estimates show that underlying US inflation is greater than the EA, but it started to decrease recently. The difference in the trend rates between the two economies decreased since the second half of 2021. When owner-occupied housing in the US inflation is controlled, they became more alike. Given the higher energy contribution to EA inflation and the reversal of increasing energy prices around 2022:Q4, the most recent EA trend estimates suggest that a plateau has been reached.

Although it is essential to be aware that the sectors contributing to inflation differ in the EA and US, the fact that the aggregate trend is far above target in both countries justifies the increases in central bank policy rates that we have seen over the last year. As emphasised by Lane (2023), the sectoral differences related to the nature of shocks translate into "the scale of monetary policy tightening" being different in these two economies.

The empirical results depend on a purely statistical yet flexible model. The estimates of trend inflation are reliant on the incoming data that has also become more volatile recently. In interpreting the results, it is important to emphasize that the model does not explicitly take into account the likely impact of the recent monetary policy tightening by central banks. The estimates of trend inflation are most informative about current inflation persistence, based on the latest available data.

Appendix

Data

The price data set is retrieved from Eurostat and Fred, consists of monthly harmonized consumer price indexes and consumer price Index for all urban consumers: U.S. city average, for the EA and the US, respectively. Monthly price indices are converted into quarterly indices by taking the averages over the months. The data are not seasonally adjusted. The analysis covers the period from 2001:Q2 to 2022:Q4. There are four sectors by product type as food, energy, NEIG, and services. The annual sector weights are retrieved from Eurostat and BLS. They are converted to quarter frequency by Kalman smoother.

Econometric Model

The multivariate model consists of two set of equations:

Measurement Equation:

$$\pi_{i,t} = \underbrace{\tau_{i,t} + \alpha_\tau \tau_{c,t}}_{\text{Trend}} + \underbrace{\epsilon_{i,t} + \alpha_\epsilon \epsilon_{c,t}}_{\text{Cycle}} + \underbrace{s_{i,t} + \alpha_s s_{c,t}}_{\text{Seasonal}}$$

where inflation rate of each sector i at time t, $\pi_{i,t}$ is the sum of a trend, cycle and seasonal component. Each of these components are consists of a sector-specific i, and common c element.

State Equations:

$$\tau_t = \tau_{t-1} + \sigma_{\Delta\tau,t}\eta_{\Delta\tau,t}$$

$$s_t + s_{t-1} + s_{t-2} + +s_{t-3} = \sigma_{s,t}\eta_{s,t}$$

$$\epsilon_t = \sigma_{\epsilon,t} o_t \eta_{\epsilon,t}$$

where o accounts for potential outliers in cyclical component, and volatilities evolve as logarithmic random walks. outlier. volatilities Please see the online appendix of Stock and Watson (2016) for estimation details. Following the estimation of inflation trends for each sector, the trend is constructed as the weighted average of traditionally included sectors as in the application by Almuzara and Sbordone (2022).

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