BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

The drivers of market-based inflation expectations in the euro area and in the US

by Christian Hoynck and Luca Rossi

June 2023

Number 779

BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

The drivers of market-based inflation expectations in the euro area and in the US

by Christian Hoynck and Luca Rossi

Number 779 – June 2023

The series Occasional Papers *presents studies and documents on issues pertaining to the institutional tasks of the Bank of Italy and the Eurosystem. The* Occasional Papers *appear alongside the* Working Papers *series which are specifically aimed at providing original contributions to economic research.*

The Occasional Papers *include studies conducted within the Bank of Italy, sometimes in cooperation with the Eurosystem or other institutions. The views expressed in the studies are those of the authors and do not involve the responsibility of the institutions to which they belong.*

The series is available online at www.bancaditalia.it .

ISSN 1972-6643 (online)

Designed by the Printing and Publishing Division of the Bank of Italy

THE DRIVERS OF MARKET-BASED INFLATION EXPECTATIONS IN THE EURO AREA AND IN THE US

by Christian Hoynck* and Luca Rossi*

Abstract

In this paper, we propose a methodology to assess the structural drivers of inflation expectations, as measured by inflation-linked swaps. To this end, we estimate a Bayesian Vector Autoregressive (BVAR) model for the euro area (EA) and the United States (US) on daily asset price movements in the two economies. Shocks are identified using sign and magnitude restrictions, also taking into account international spillovers. The inclusion of inflation expectations helps to clearly distinguish between supply and demand innovations. The findings suggest that over the course of 2021-23 inflation expectations in the US were steadily sustained by domestic demand, while in the EA they mostly reflected supply shocks, and only more recently a growing strength of demand factors. Our evidence also indicates that monetary policy shocks gradually contributed to lowering inflation expectations in both jurisdictions, although with different timing and vigour.

JEL Classification: C32, C54, E31, E44, E52.
Keywords: inflation expectations, international transmission, monetary policy, high-frequency identification.
DOI: 10.32057/0.QEF.2023.0779

Contents

* Bank of Italy, Economic Research and International Relations.

1. Introduction[1]

In the post-Covid high inflation environment, the assessment of inflation expectations – and in particular of the risk of their possible de-anchoring – plays a crucial role for central banks. In this paper, we propose a methodology that exploits daily financial data to identify domestic and global structural drivers of inflation expectations, as measured by inflation-linked swaps (ILS). The model is then used to study the different causes of elevated inflation expectations in the euro area (EA) and in the United States (US) between 2021 and 2023, focusing in particular on the role of supply and demand shocks.

Our modelling framework is a Bayesian Vector Autoregressive (BVAR) applied on daily EA and US asset prices. Identification of the structural shocks originating in these two economies and globally is achieved using sign and magnitude restrictions, a standard approach in empirical macroeconomics in recent years (Arias et al., 2018). In particular, identification builds on theoretical insights, which suggest that asset prices, including ILS rates, react with a specific pattern to each of the different shocks that may hit the economy. Favourable demand and supply shocks, for example, tend to exert a positive effect on equity prices but opposite ones on both long-term yields and inflation expectations. The use of daily data also offers a real time narrative that allows circumventing the issues of publication lags and infrequent availability that plague macroeconomic data.

Interconnected financial markets transmit shocks across economies; this makes accounting for spillovers important when identifying structural shocks. In particular, it has been documented that the US economy plays a central role in financial markets and that developments in that country affect the rest of the world through financial linkages (Rey, 2016; Farhi and Werning, 2014; Bruno and Shin, 2015). To tackle this issue and accurately identify domestic, foreign and global shocks, Brandt et al. (2021) use a two-country BVAR that includes yields and stock prices for both the EA and the US as well as the USD/EUR exchange rate.

We build on Brandt et al. (2021) enriching the set of asset prices by including ILS rates, which allow us to additionally separate demand from supply shocks both in the EA and in the US. We use in particular two symmetric two-country BVARs – one for each country – containing 6 variables.[2]

The literature that exploits the co-movement of asset prices at high frequency to extract macroeconomic shocks is already broad. Two main strands of analysis have emerged. The first one focuses on the co-movement of asset prices in narrow time windows around particular announcements. The second one, instead, does not concentrate on particular events nor on a particular shock, but identifies a broader class of shocks.

The first group includes, among the others, Jarocinski and Karadi (2020) who disentangle the effects of central bank announcements into monetary policy news and central bank's information about the economy using the co-movement of interest rates and stock prices. In a related approach, Cieslak and Schrimpf (2019) use stock prices and different bond yields to identify monetary policy, economic growth, and risk premium shocks. Similarly, Degasperi (2021) uses the co-movement of oil price futures with stock prices around OPEC announcements to identify shocks to oil demand and oil supply expectations. The second one, to which also our work belongs, is populated by analyses like those of Cieslak and Pang (2020) and Venditti and Veronese (2020). The former identifies shocks to monetary policy, economic growth and the risk premium from daily stock returns and treasury yield

[1] We thank Martina Cecioni, Stefano Neri, Pietro Rizza, Massimo Sbracia, Alessandro Secchi and Fabrizio Venditti for useful comments and suggestions. Fabrizio Venditti kindly shared MATLAB codes.

[2] Two BVARs with 6 variables have been chosen instead of one BVAR with 7 variables because of the much larger computational burden required to estimate the latter.

changes, while the latter provides a real time decomposition of oil price fluctuations into risk sentiment, the state of the business cycle and stagflationary shocks.

Our results suggest that while the elevated inflation expectations observed in the US between 2021 and 2023 were steadily sustained by domestic demand, in the EA they were mostly associated to supply shocks and only recently have started to reflect a growing contribution of demand factors. Our results also show how monetary policy shocks, including their international spillovers, have progressively contributed in delivering the desired soothing effects on inflation expectations, although with a different timing and size in the two jurisdictions. The exercise confirms the usefulness of exploiting high frequency financial markets data to assess in real time the underlying sources of economic dynamics and the effects of monetary policy.

The rest of the paper first describes how inflation linked swaps can be used to measure inflation expectations in the EA and in the US (Section 2). Section 3 outlines the model used to decompose inflation expectations into domestic and international shocks. Sections 4 and 5 respectively present the main results and the cumulated historical decompositions since early 2021, dividing the sample into four sub-periods. The robustness of the results to alternative estimation periods and identification assumptions is shown in Section 6. Finally, Section 7 concludes.

2. Inflation-Linked Swaps in the EA and in the US

We use daily fixed rates on ILS contracts as a measure of inflation expectations. In the zero-coupon version of these contracts, two counterparties swap at maturity the overall inflation rate that materialized during the entire period (the so-called floating leg) against the fixed rate cumulated over the same period.[3] The fixed rate, which is set at the beginning of the contract, reflects genuine inflation expectations plus a time-varying unobservable inflation risk premia.[4] This signals that, technically speaking, ILS rates are a more accurate measure of inflation compensation rather than inflation expectations. In what follows for the sake of expositional ease we will in any case use the two terms as interchangeable.

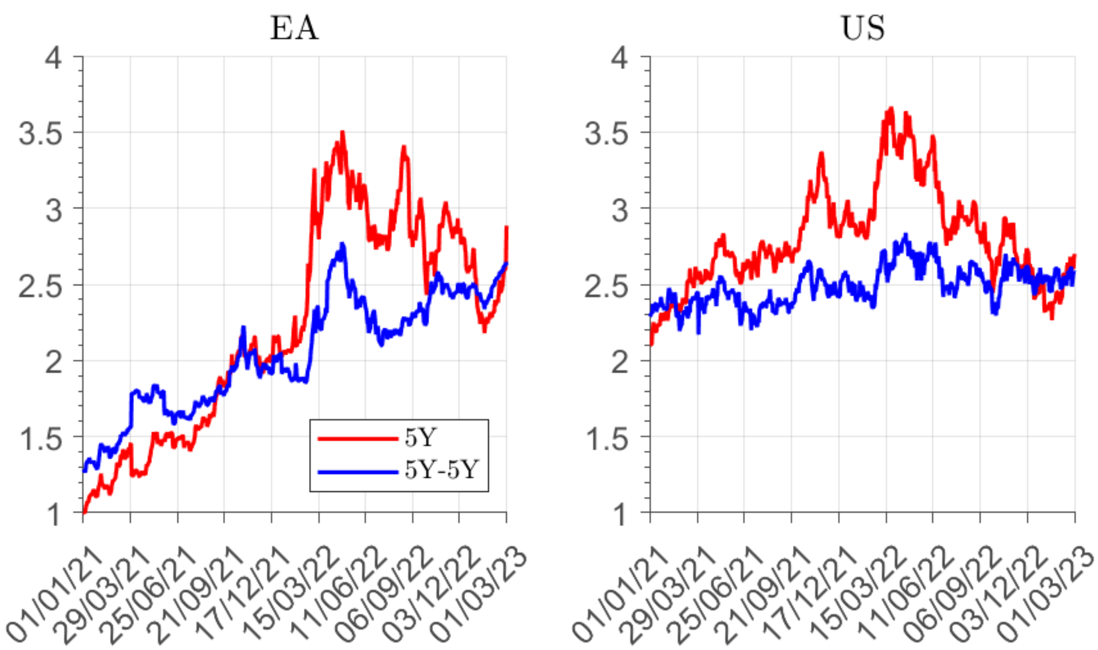
The underlying index used to compute variable payments in euro-area ILS is the harmonized consumer price index (HICPxT), net of tobacco, published by Eurostat, while in the US it is the headline consumer price index (CPI) published by the Bureau of Labor Statistics. ILS are available for a wide range of maturities up to 30 years. In this paper we focus on the 5-year (5Y) and 5-year, 5 years ahead (5Y5Y) horizons, which provide non-overlapping information over a joint 10-year horizon. The first segment (5Y) gives in particular information on expected inflation over typical business-cycle frequencies, whereas the latter (5Y5Y), which depurates expectations from the effects of temporary shocks that subside within the first 5 years, gives insights on expected medium- to long-term inflation outcomes.

Figure 1 shows the time series of ILS since the beginning of 2021 for the EA and the US.[5] At the start of this period both 5Y and 5Y5Y inflation expectations in the EA were at historically very low levels reflecting the prolonged deflationary phase that led the ECB first to bring key rates to negative levels in 2014 and then to adopt a series of other unconventional measures, including the Asset Purchase

[3] As consumer price data is usually available only with a lag, a contract signed in a given month will typically use as a reference the consumer price index of few months earlier.
[4] See Cecchetti et al. (2022).
[5] The US ILS series contains very few instances, where quoted prices show extreme falls that are completely reabsorbed immediately after. These movements most likely do not represent changes in expectations. Therefore, we linearly interpolate prices where the first daily change exceeds 15 times the full sample standard deviation.

Programme in early 2015 and the Pandemic Emergency Purchase Programme at the height of the 2020 Covid crisis. During 2021, a mix of post-pandemic recovery, supply chain bottlenecks and rising energy prices led both measures to gradually rise to levels closer to the 2% target. The results of the ECB strategy review published in July 2021 may also have contributed to these dynamics. The Russian aggression of Ukraine on February 24 2022 triggered a sharp and prolonged increase in ILS rates: at the 5Y horizon they peaked in late April 2022 at an unprecedented 3.5% level, and the 5Y5Y measure also overshot the 2% target, raising concerns about the possibility of a de-anchoring of medium- to long-term inflation expectations.[6] Since then the increases in ILS have been partly reabsorbed. Both 5Y and 5Y5Y ILS have indeed recently oscillated around 2.5%, amid a still elevated volatility. In the US, 5Y inflation expectations started 2021 at a higher level than in the EA and increased steadily during the year, possibly also reflecting the economic effects of the second round of pandemic related stimulus decided in March. In early 2022 they have also been affected by the Russian invasion of Ukraine (although less than those in the EA). After a few weeks of the military attack, US 5Y expectations stood at the same level as those in the EA, and followed a similar downward trend thereafter. On the other hand, 5Y5Y inflation expectations in the US have remained broadly stable around 2.5%.

Figure 1. Inflation expectations in the EA and the US



Note: 5-years (red solid line) and 5-years-in-5-years (blue solid line) inflation expectations in the EA (left panel) and the US (right panel) extracted from inflation-linked swaps.

3. Methodology

The analysis builds on the model from Brandt et al. (2021), a two-country BVAR that includes long-term yields and equity prices for both the EA and the US as well as the USD/EUR exchange rate. We enrich the set of asset prices of that model by introducing ILS. This allows us to separate neatly demand from supply shocks both in the EA and in the US. Our approach uses two symmetric BVARs

[6] Visco (2023) suggests that while inflation risk premia might have contributed to the increase in 5Y5Y ILS, there is usually a non-negligible uncertainty surrounding their estimates.

– one for each country – containing 6 variables. Structural identification is obtained through sign and magnitude restrictions.

3.1. VAR specification and variables

Both models include, for each economy, domestic and foreign 5-year risk-free rates (OIS for the EA and US Treasuries for the US) and stock prices, the USD/EUR exchange rate and the domestic 5-year ILS. They are estimated using daily changes (percentage changes in the case of stocks and the exchange rate) over the period July 2008 - March 2023 and include four lags.[7]

3.2. Identification of shocks in the EA model

We identify six different shocks based on sign and magnitude restrictions. Identification restrictions are placed only on the contemporaneous response of asset prices to the different disturbances.

Table 1 summarizes the identification scheme via sign restrictions imposed in the EA specification. A + (-) denotes a positive (negative) impact response of a given variable to an identified shock, while a missing entry means that the impact response remains unrestricted. Sign restrictions are imposed on the basis of theoretical insights concerning how a given innovation is expected to affect financial assets. In particular, following Brandt et al. (2021), the co-movement of bond yields, stock prices and the exchange rate allows us to identify monetary policy, macroeconomic (country-specific) and global risk shocks. Additionally, using ILS allows to further decompose macroeconomic (country-specific) innovations into supply and demand shocks.

Table 1. Identification scheme for the EA BVAR

Sign restrictions	Expansionary EA monetary policy	Favourable EA demand shock	Favourable EA supply shock	Favourable global risk	Favourable US macro shock	Expansionary US monetary policy
EA long-term yields	-	+	-	+	+	-
EA equity prices	+	+	+	+		+
EA inflation expectations	+	+	-			+
US long-term yields				+	+	-
US equity prices				+	+	+
USD/EUR	-	+		+	-	+

Note: Cell filled with + (-) mean that a given shock exerts a positive (negative) impact effect on a specific variable. Empty cells refer to situations where no assumption is imposed.

EA expansionary monetary policy shocks are identified by assuming (in line with economic theory) that it decreases domestic yields, it increases equity prices and inflation expectations and depreciates the exchange rate.[8] Favourable EA demand and supply shocks (second and third column) have a positive effect on equity prices. However, they have an opposite effect on long term yields and inflation expectations. A positive demand shock raises inflation expectations and long-term yields. A favourable supply shock, instead, lowers inflation expectations. This is the crucial difference that allows us to separate demand from supply shocks. A favourable supply shock also reduces yields if monetary policy – like in the EA – targets the inflation rate. Instead, when a central bank follows a

[7] The possibility that the transmission of shocks might be different in the current context of unprecedented, elevated inflation in the EA is assessed in Section 6 where we show how the main results of the paper change when the model is estimated only on the most recent data.

[8] The exchange rate is defined as US dollar per euro, which falls in case of a depreciation of the euro against the US dollar.

dual mandate – like in the US – the effect of supply shocks on yields is ambiguous. In addition, a EA demand shock is assumed to appreciate the euro as it improves the EA economic outlook and therefore the appetite for euro-denominated financial assets.[9] While it is safe to interpret the demand shock as to be truly EA-specific, it is not obvious that one can label the supply shock in a similar way. Because there are no additional supply shocks included in the model, and because of the identifying assumptions that are imposed, the supply shock may capture a variety of supply-side variations. The modelled supply shock therefore might contain foreign driven supply disruptions such as bottlenecks in the global supply chain or shocks to the supply of oil and gas.

An improvement in global risk sentiment ("risk on", fourth column) raises equity prices and risk-free rates in both countries reflecting an increased appetite of investors for holding risky assets. At the same time, it leads to a depreciation of the US dollar against the euro because in a "risk on" context the US "safe heaven" nature loses appeal and assets tend to re-allocate from US dollar denominated assets to foreign currency ones (including EA). A positive macro shock in the US (fifth column) puts upward pressure on US yields and equity prices and appreciates the US dollar. It also increases EA yields.[10]

Finally, the EA model allows for spillovers from US monetary policy to EA asset prices (Rey, 2016; Farhi and Werning, 2014; Bruno and Shin, 2015). For instance, empirical evidence has shown that an unexpected loosening of US monetary policy puts downward pressure on EA yields, while evidence on spillovers from the EA monetary policy to US asset prices is less clear. To identify this shock (sixth column) we impose a negative sign on the impact effect of US monetary policy on EA yields, while leaving the sign of the reaction of US variables to EA monetary policy shocks unrestricted. This latter fact however does not rule out spillovers from the EA to the US, but instead allows the model and therefore the data to choose the appropriate sign.

If one were to adopt only the aforementioned sign restrictions, three pairs of shocks would not be identified. We tackle this issue by imposing a set of magnitude restrictions (Arias et al., 2018) that constrain the relative size of the impact of a shock. We therefore assume that euro-area shocks have larger effects on EA yields than US or global shocks, while global shocks are assumed to have a stronger effect on US yields owing to the safe asset status of US Treasuries. In particular, a EA demand shock is separated from a global risk shock by imposing that the former has a larger effect on EA yields than on US ones, and that the latter has a larger effect on US yields than on EA ones. Second, EA supply shocks and US macro shocks are disentangled by assuming that the former has a larger effect on EA yields than on US yields, and vice versa for the latter. Third, EA supply shocks are identified from global risk shocks by imposing that they have a relatively larger effect on EA yields. Finally, and even though not strictly needed to achieve identification, we assume that a EA monetary policy shock leads to a larger decrease in EA yields than in US yields; vice versa for a US monetary policy shock.

3.3. Identification of shocks in the US model

As for the US model, sign restrictions are symmetric to those of the EA with two exceptions (Table 2). In particular, the response of US inflation expectations to a EA monetary policy shock and the

[9] An alternative interpretation is that a EA demand shock implies higher demand for domestic and foreign goods which coincides with more imports from the US than exports. This would imply a depreciation of the euro. For this reason, we checked the robustness of our results to the alternative specification that leaves the sign on the exchange rate unrestricted. The results are substantially unchanged.

[10] This assumption is consistent with Brandt et al. (2021). Since this US macro shock conflates demand and supply shocks, by imposing this sign one is implicitly assuming that the (positive) effect of foreign demand shocks on domestic long-term yields dominates the (negative) one stemming from favourable foreign supply shocks.

response of US yields to a US supply shock are set to be unrestricted. In this case, five shocks are not identified with sign restrictions only. First, a US demand shock is disentangled from a EA monetary policy shock by assuming that the first has a larger effect on US equity prices than on EA equities, and vice versa for the second shock. Second, the pairs "US supply shocks - EA macro shocks" and "US supply shocks - global risk shocks" are separated as in the EA model. Third, US supply shocks are identified from EA monetary policy shocks by assuming that the first have a larger effect on inflation expectations than the second. Fourth, EA macro shocks are disentangled from global risk shocks by imposing that the first have a larger effect on EA yields than on US yields, and vice versa for the second.

Table 2. Identification scheme for the US BVAR

Sign restrictions	Expansionary US monetary policy	Favourable US demand shock	Favourable US supply shock	Favourable global risk	Favourable EA macro shock	Expansionary EA monetary policy
US long-term yields	-	+		+	+	
US equity prices	+	+	+	+		
US inflation expectations	+	+	-			
EA long-term yields	-			+	+	-
EA equity prices	+			+	+	+
USD/EUR	+	-		+	+	-

Note: Cell filled with + (-) mean that a given shock exerts a positive (negative) impact effect on a specific variable. Empty cells refer to situations where no assumption is imposed.

4. The drivers of market-based inflation expectations in the EA and in the US

In this section, we use our model to study the drivers of the recent surge in inflation expectations in the US and the EA described in Section 2. We focus on two questions. First, what are the underlying sources of the increase in inflation expectations? Second, has monetary policy been effective in containing their surge since the start of the monetary policy tightening processes?

To answer these questions, this section shows the results that are obtained by decomposing EA and US medium-term (5Y) and medium- to long-term (5Y5Y) market-based inflation expectations into their main drivers since the beginning of 2021.[11] While the first measure is also influenced by temporary shocks to supply and demand, the second one reflects relatively more structural changes in inflation expectations and can thus be used to assess the anchoring of medium- to long-term inflation expectations and therefore central bank credibility.

4.1. Medium-term inflation expectations

Figure 2 shows the historical decompositions of medium-term inflation expectations. Since the beginning of 2021, the dynamics of 5Y ILS can be divided into four sub-periods (see also the bottom panels of the figure).

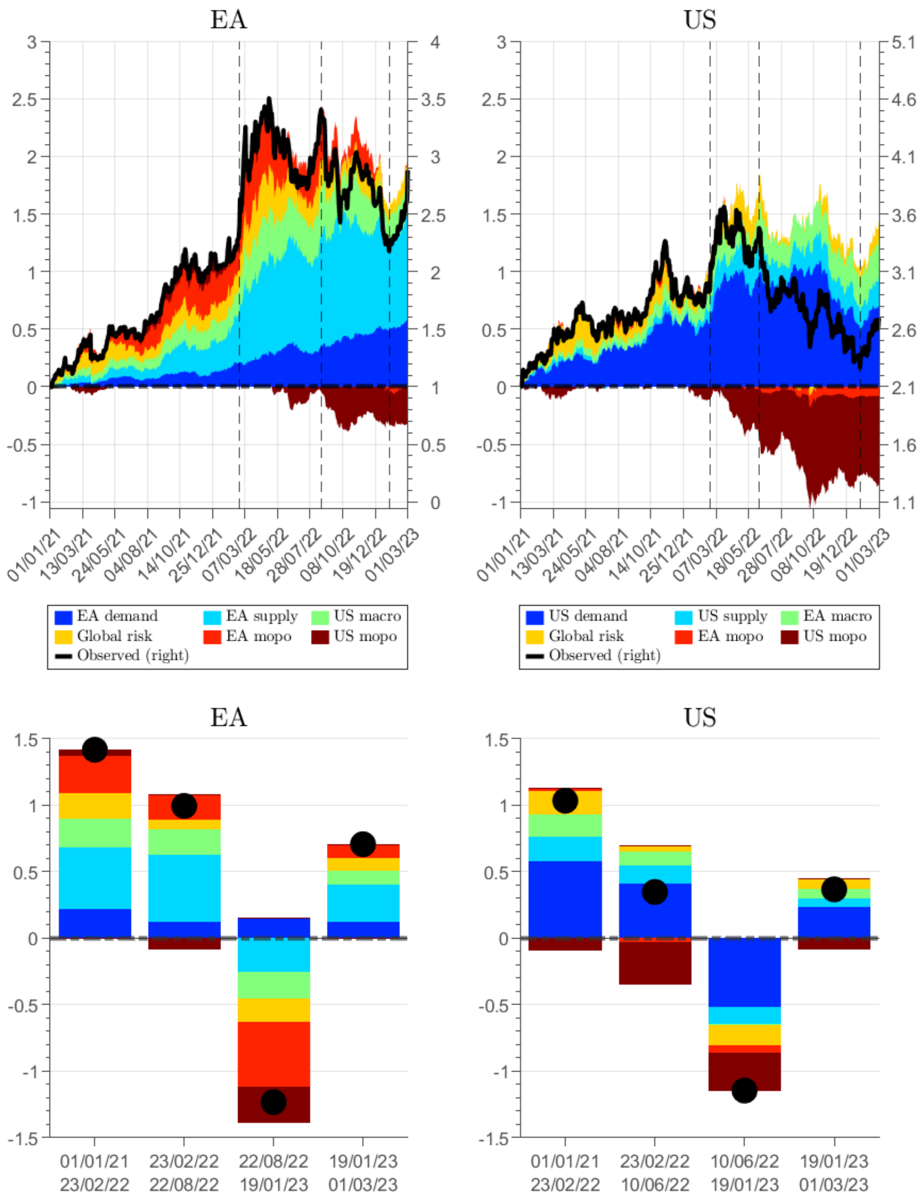
- In the first phase, from January 1 2021 to February 23 2022, the day before the invasion into Ukraine, 5Y inflation expectations in the EA increased by 140 b.p. mainly on the back of

[11] The results shown for the 10-year ILS are very similar to those obtained when estimating the model using 5-year ILS that, for ease of exposition, are not reported in this paper.

supply-side factors (50 b.p.), which were most likely related to bottlenecks, and a monetary policy that remained relatively accommodative (30 b.p.) with respect to historical regularities.

- During the second period, starting with the war in Ukraine (February 24 2022) and ending on August 28 2022, supply shocks have again been the strongest driver of EA medium-term inflation expectations.[12] The contribution of EA demand shocks has been relatively small but always positive, thus cumulating over the course of 2022 most likely reflecting the gradually improving business cycle conditions.

Figure 2. Decomposition of 5-year ILS since the beginning of 2021.



Note: The top left (right) panel shows the time series of cumulated historical decompositions as well as observed 5-year ILS for the EA (US) since January 1, 2021. The left axis reports cumulated changes since the starting period, whereas the right axis reports actual ILS values. The bottom left (right) panel plots overall cumulated historical decompositions for

[12] In order to better separate the effects from the post-pandemic period and the period following the invasion of Ukraine, in the Appendix, we show the decomposition of 5-year ILS starting in January 2022.

the EA (US) during four different sub-periods. Those subsamples are highlighted with black dashed lines in the top panels.

- The third period (August 22 2022 to January 1 2023) is characterized by a marked drop of inflation expectations, from a peak reached in August 2022. The model attributes it to a falling contribution from supply shocks (likely related to favourable energy price dynamics), and to the combined effects of negative EA and US monetary policy shocks. Of the total fall in inflation expectations by 120 b.p. since August 2022, 75 b.p. can be attributed to tighter monetary policies from the EA (50 b.p.) and from the US (25 b.p.), and 25 b.p. to easing supply-side pressures.

- The last phase, which starts on January 19 2023, displays an increase in inflation expectations most likely due to higher-than-expected core inflation releases, which might have caused financial market participants to reassess their opinions about the degree of inflation stickiness, and uncertainty about the end-point of the tightening cycle.

Although medium-term inflation expectations dynamics were qualitatively similar in the US, the underlying drivers were markedly different.

- In the period from the beginning of 2021 until the onset of the war in Ukraine, US inflation expectations increased mainly because of domestic demand (60 b.p.) likely related to unprecedented fiscal stimulus packages provided by the US government and the subsequent strong consumption rebound. Supply-side factors, related to bottlenecks in production chains or changes in energy prices, contributed only by a smaller amount (20 b.p.).

- Since the beginning of the war in Ukraine, overall inflation expectations have increased, despite two opposing forces that pushed inflation expectations in different directions: on the one hand, demand kept constantly feeding them; on the other hand, the ever more aggressive stance of the Fed in fighting accelerating prices put a solid and stronger brake on their run (-30 b.p.). In contrast to the ECB, the Fed started its tightening process sooner (March 2022) and more aggressively, which is reflected in the earlier and stronger effects US monetary policy shocks had on soothing domestic inflation expectations, and via spillovers also in the EA. In this sub-period, US supply-side factors again played a relatively smaller role than demand-side components.

- Inflation expectations receded since their last peak in June 2022 due to a combination of continued contractionary monetary policy shocks and to a decline in domestic demand pressures. Spillovers from EA monetary policy shocks did not significantly contribute to the developments of inflation expectations in the US in 2022, which appears to be in contrast to what can be observed for the role of US monetary policy shocks for EA inflation. Similarly to the EA, also an increase in global risk appetite added to the fall in inflation expectations in this time period.

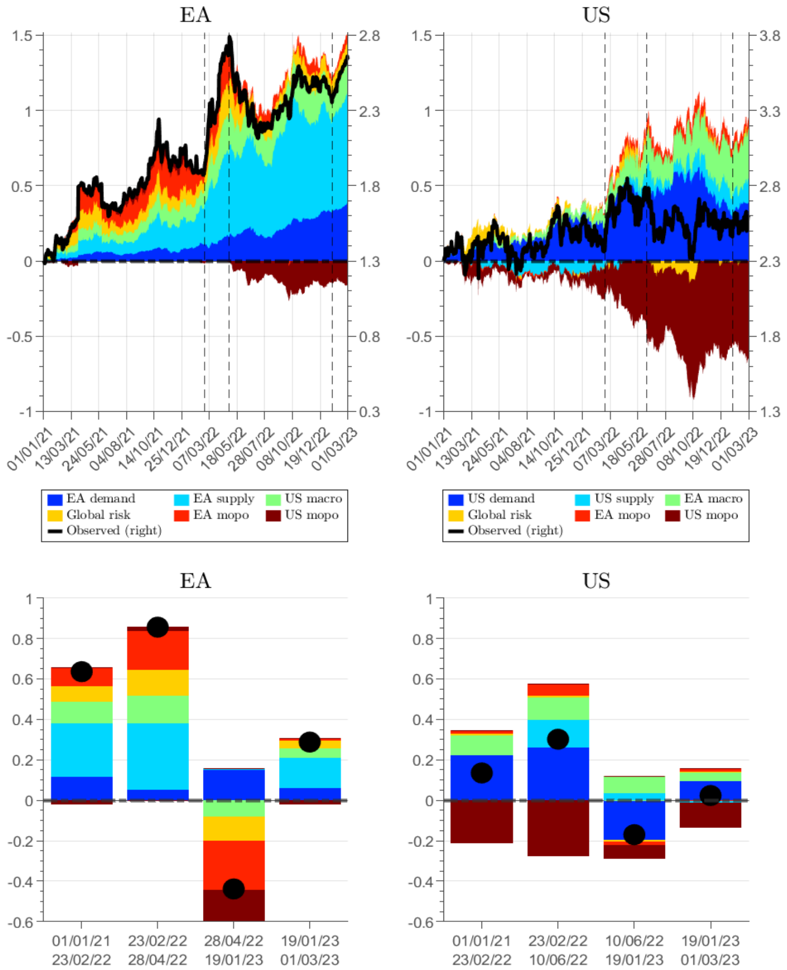
- Since January 19, 2023, surging medium-term inflation expectations in the US went hand in hand with the stream of stronger-than-expected consumer price, producer price, consumption, and labour market releases, but also – to a smaller extent – international (EA macro and global risk) demand factors.

4.2. Medium- to long-term inflation expectations

Medium- to long-term inflation expectations in the EA displayed very similar dynamics to that of medium-term inflation expectations. In the EA, 5Y5Y ILS increased since the beginning of 2021 and stood at 2.6% as of March 1 2023 (+130 b.p.).[13] In 2021, measures of medium- to long-term inflation expectations in the EA rose in response to the communication of a new monetary policy strategy that included the adoption of a symmetric inflation target of 2% over the medium term; this was reflected as positive monetary policy shocks. According to our model, the other drivers of the surge in 2022 and 2023 are very similar to those of medium-term expectations: while EA supply shocks played the lion's share, demand-side factors such as global risk or EA demand contributed only to a smaller extent. At the same time the relative impact of monetary policy shocks was slightly higher than that for medium-term expectations. The decomposition therefore reveals that both EA and US monetary policies have been effective in steering EA expectations at all horizons.

In the US, at the beginning of March 2023 medium- to long-term inflation expectations stood roughly at the same level than at the eve of the war in Ukraine. This mainly reflects the overall countervailing effects of supply, demand and monetary policy shocks. Unlike 5Y US ILS, medium- to long-term expectations have not fallen during 2022, due to persistent upward pressure from demand shocks.

Figure 3. Comparison of decomposition of EA 5-year in 5 years ILS and US 5-year in 5 years ILS in a BVAR with inflation-linked swaps.



[13] A caveat of this analysis is that the role of risk premia, something that we do not control for in this exercise, tends to increase with the maturity of inflation linked swaps.

5. Forecast Error Variance Decomposition

In this section we broaden the horizon of analysis looking at the Forecast Error Variance Decompositions (FEVDs), namely the average importance of each structural shock in the variation of each variable included in the model, over the full period along which ILS are available (July 2008 – March 2023).

Table 3 reports the one-day ahead FEVD of medium-term inflation expectations in the EA and the US.[14] First, domestic demand shocks are twice as relevant for inflation expectations in the US than the EA. Supply shocks, on the other hand, play a slightly larger role in the EA than the US; this could stem from the fact that – contrary to the EA – the US are a net exporter of energy and thereby their economy is less exposed to energy shocks. Finally, domestic monetary policy shocks are equally important in generating fluctuations in domestic inflation expectations. However, US monetary policy generates significantly stronger spillovers than EA monetary policy. Global risk has broadly comparable effects on inflation expectations in the two economies.

Table 3 Forecast Error Variance Decomposition for a forecast horizon of one day ahead for 5-year inflation expectations in the EA and the US
(percent)

	Domestic demand	Supply	Foreign macro	Global risk	EA monetary policy	US monetary policy
EA 5-year ILS	11.7	25.7	12.5	17.0	20.8	12.4
US 5-year ILS	24.9	21.8	10.0	20.8	4.4	18.1

6. Robustness

In this section, we test the robustness of the main results to changes in the identification scheme. In particular, we consider four alternative approaches summarized in Table 4. Figure 4 compares the decompositions from these alternatives with the baseline approach (presented in Sections 3 and 4) for the dynamics of inflation expectations in two sub-periods: i) from the start of the war in Ukraine until the peak of the respective inflation expectations process and ii) since that peak until mid-January 2023.

Table 4. Estimation and identification approaches of the robustness analysis

Case 1	Estimation period: January 2021 – March 2023
Case 2	Effect of domestic demand shock on exchange rate unidentified
Case 3	No over-identifying restrictions
Case 4	Effect of supply shock on domestic yields unidentified (only EA) and real yields instead of nominal yields.

In the first robustness exercise, we estimate the model only on the sub-period that we have studied in Section 4 instead of the whole sample, i.e. from January 2021 until March 2023 instead of starting from July 2008. The results are broadly in line with the baseline approach but feature smaller effects

[14] FEVDs for the remaining horizons are to all practical purposes indistinguishable from those we report here.

of US monetary policy, US demand, and EA supply shocks, whereas EA monetary policy innovations are estimated to have contributed more.

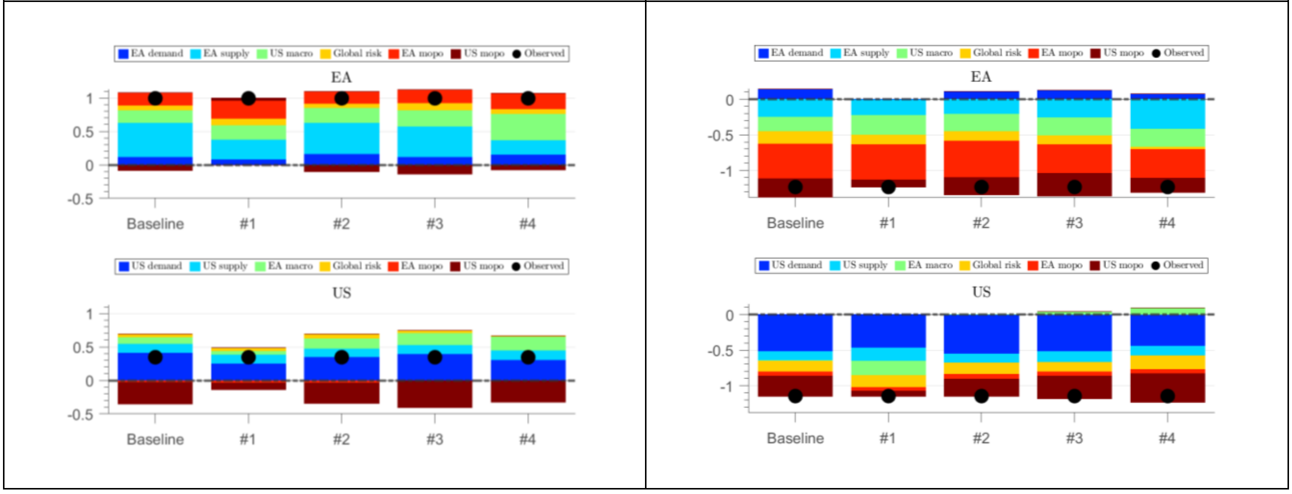
In the second exercise, we allow for the alternative interpretation that a domestic demand shock, through higher demand for foreign goods and services in addition to domestic ones, could lead to a net depreciation of the domestic currency. We thus leave the sign of the effect of domestic demand shocks on the exchange rate unrestricted. The results are practically unchanged with respect to the baseline approach.

We further study the role of the additional over-identifying restrictions we imposed, namely those related to the assumption that domestic shocks have larger effects on domestic variables than on foreign variables, for example concerning the effects of monetary policy shocks on yields. The results are again substantially unchanged.

As we explain in Section 3.2, for the EA we assume that an adverse supply shock causes long-term yields to increase. In our fourth robustness exercise we relax this assumption. Moreover, we also use real yields instead of nominal ones, where we compute the former by subtracting ILS of corresponding-maturity from nominal yields. The model continues to predict that demand shocks played a larger role than supply shocks in the US, while the opposite holds in the EA (Panel a). However, part of the effect stemming from EA supply shocks is substituted by a higher US macro effect. The reason for this result might be due to the fact that the model confounds EA and global supply-side factors because US macro shocks combine US demand and supply components. Thus, without the above-mentioned assumption the model might simply assign the increase in EA yields to global factors instead. As for the US and the second sub-period, results are very similar to the baseline.

Figure 4. Robustness checks of Historical Decompositions

a) February 23, 2022 to local peaks	*b) Local peaks to January 19, 2023*



Note: The bar charts show cumulated historical decompositions both for the EA and the US during two sub-periods. The figure shows the four robustness exercises described in the main text, and for ease of comparison also reports our baseline results.

7. Conclusions

In the post-Covid high inflation environment, monitoring inflation expectations plays a crucial role for central banks. In this paper, we propose a methodology to quantify the structural drivers of EA and US inflation expectations as measured in real time by inflation-linked swaps. We decompose their daily fluctuations into domestic, foreign and global shocks by means of a Bayesian VAR model.

The results show that since the beginning of 2021 until mid-2022, medium-term inflation expectations (5-year ILS) in the EA increased mostly in response to adverse supply shocks. The contribution of EA demand shocks rose progressively over the course of 2022, reflecting improved business cycle conditions. Our evidence also documents strong US monetary policy spillovers on EA inflation expectations since the second half of 2022 and a strong soothing effect stemming from EA monetary policy tightening. In the US instead, inflation expectations have been steadily sustained by domestic demand shocks until the end of October 2022, and reined-in by contractionary monetary policy shocks since March 2022, when the Fed started its tightening cycle. Medium-to-long-term inflation expectations (5-year in 5 years), a measure of the credibility of monetary policy, behaved in a qualitatively similar way to medium-term inflation expectations.

Bibliography

1. Arias, Jonas E., Juan F. Rubio-Ramirez, and Daniel F. Waggoner (2018), “Inference based on structural vector autoregressions identified with sign and zero restrictions: Theory and applications,” *Econometrica*, Vol. 86(2), pp. 685-720.

2. Brandt, Lennart, Arthur Saint Guilhem, Maximilian Schröder, and Ine Van Robays (2021), “What drives euro area financial market developments? The role of US spillovers and global risk”, *ECB Working paper series*, No. 2560, May.

3. Bruno, Valentina and Hyun Song Shin (2015), “Capital flows and the risk-taking channel of monetary policy”, *Journal of Monetary Economics*, 71, 119–132.

4. Cecchetti, Sara, Adriana Grasso and Marcello Pericoli (2022). “An analysis of objective inflation expectations and inflation risk premia”, *Temi di Discussione (Economic Italy Working Papers Series)*, 1380, Bank of Italy, Economic Research and International Relations Area.

5. Cieslak, Anna and Andreas Schrimpf (2019), “Non-monetary news in central bank communication”, *Journal of International Economics*, 118, 293–315.

6. Cieslak, Anna and Hao Pang (2020), “Common Shocks in Stocks and Bonds”, *SSRN Electronic Journal*, 2020.

7. Degasperi, Riccardo (2021), “Identification of Expectational Shocks in the Oil Market using OPEC Announcements”, *mimeo*.

8. Farhi, Emmanuel and Ivan Werning (2014), “Dilemma not trilemma? Capital controls and exchange rates with volatile capital flows”, *IMF Economic Review*, 2014, 62 (4), 569–605.

9. Jarocinski, Marek and Peter Karadi (2020), “Deconstructing monetary policy surprises -The role of information shocks”, *American Economic Journal: Macroeconomics*, 12 (2), 1–43.

10. Rey, Helene (2016), “International channels of transmission of monetary policy and the Mundellian trilemma”, *IMF Economic Review*, 64 (1), 6–35.

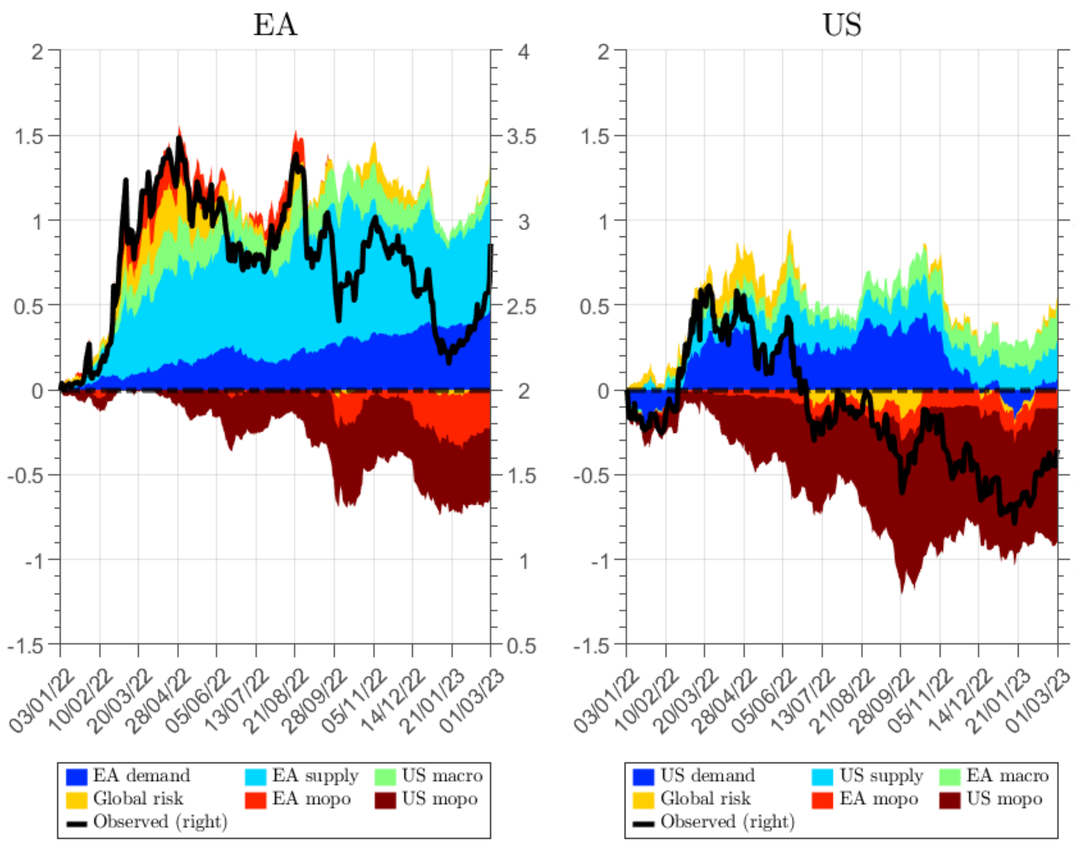
11. Venditti, Fabrizio and Giovanni Furio Veronese (2020), “Global Financial Markets and Oil Price Shocks in Real Time”, *SSRN Electronic Journal*, 2020.

12. Visco, Ignazio (2023), “Inflation expectations and monetary policy in the euro area”, *95th International Atlantic Economic Conference, Robert Mundell Distinguished Address*, March 23 2023.

Appendix

Figure A.1. shows the decomposition resulting from the same model estimates, but with a different reference point (namely, January 3rd 2022), which allows to better separate the different contributions of the analysed drivers in the period following the start of the war in Ukraine. The result of this exercise reiterates the central observations from the main text about the relative importance of supply and demand factors in the EA and in the US as well as the importance of spillovers from US monetary policy tightening.

Figure A.1. Decomposition of 5-year ILS since the beginning of 2022.



Note: The left (right) panel shows the time series of cumulated historical decompositions as well as observed 5-year ILS for the EA (US) since January 3, 2022. The left axis reports cumulated changes since the starting period, whereas the right axis reports actual ILS values.