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Repricing inflation risk in choppy energy markets

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Barclays' **Samy Ben Aoun** outlines a method for modelling the sensitivity of inflation swaps to energy shocks

Inflation swaps provide a market-based proxy for inflation expectations and offer a useful framework for analysing how energy price shocks are transmitted. In particular, the sensitivity of short-term inflation swaps to energy prices can be interpreted as a real-time measure of how markets assess the capacity of distribution chains to absorb cost pressures. When businesses absorb higher input costs, pass-through to consumers remains limited; as these buffers are gradually exhausted, pass-through becomes more likely and inflation expectations adjust accordingly.

Our research on inflation makes three key findings. First, the relationship between energy prices and short-term inflation expectations is non-linear, with pass-through increasing disproportionately at elevated energy price levels. Second, pass-through depends not only on the magnitude of a supply shock, but also on its duration, reflecting the gradual erosion of margins and absorption capacity over time. Third, the repetition of supply-side disruptions may alter the distribution of inflation outcomes by increasing persistence and upside asymmetry. Investors may therefore require greater compensation for inflation risk than was necessary in the pre-2021 environment.

Taken together, the findings provide a framework for understanding how repeated supply disruptions may influence the transmission of inflation and the pricing of inflation risk across maturities.

1. Pass-through mechanism

Structure of inflation curve

The euro area inflation swap curve can be decomposed into three distinct segments, each driven by a different set of forces.

The front end, from spot to three months, captures the near-term inflation footprint as directly observable in consumer prices such as fuel, food, airfares and car prices. This segment is heavily influenced by seasonal patterns, including holiday effects, travel cycles and heating demand, and therefore requires a degree of filtering to extract the underlying signal from calendar noise.

The intermediate segment, from three months to two years, is where energy futures exert their strongest influence. This is the horizon over which distribution chains transmit cost shocks to consumer prices, and where the market forms its most active view on the trajectory of pass-through. The article focuses on this segment.

Beyond two years, the curve becomes increasingly dominated by hedging demand and portfolio flows rather than by fundamental price dynamics. At this horizon, energy shocks are typically priced as transitory, with inflation expectations anchored close to the European Central Bank (ECB) target regardless of the prevailing energy environment.

First-round effects and non-linearity of pass-through

When an energy shock occurs, the immediate market reaction is to reprice short-term inflation expectations upward. This is a first-round effect, namely an increase in prices rather than a change in their underlying dynamics. Here, the key question is not the magnitude of the shock but whether the distribution chain can absorb it within existing margins.

For relatively small shocks that keep energy prices within their historical range, the answer is typically yes. Distributors compress margins, pass-through to consumers remains limited, and the sensitivity of inflation swaps to energy prices

stays low. The market implicitly recognises this absorption capacity as the baseline.

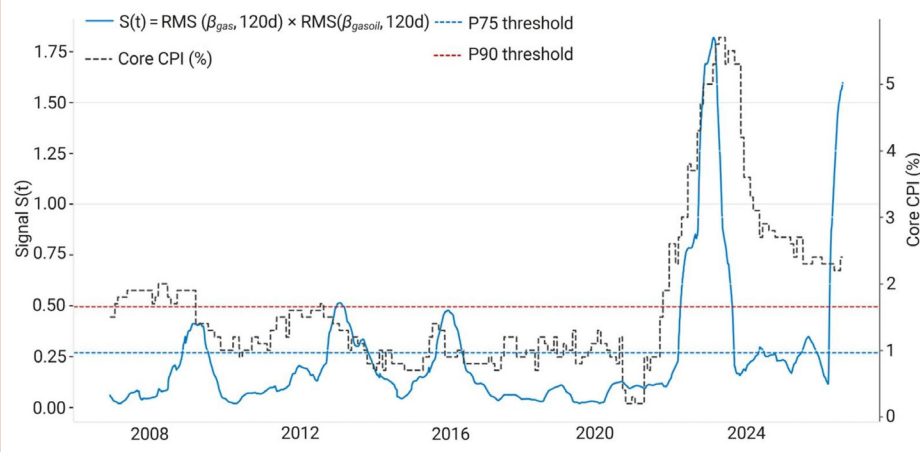
Non-linearity emerges as energy prices move into the upper part of their historical distribution. At these levels, the market prices a disproportionately larger pass-through. When energy prices reach the 75th to 90th percentile of their historical range, the sensitivity of the one-year inflation swap to further price increases is approximately three times higher than at the median. In this regime, short-term inflation swaps behave as a convex function of energy prices, where small shocks lead to limited revisions while larger shocks trigger disproportionately stronger responses. This convexity reflects the gradual exhaustion of margin buffers along the distribution chain, beyond which costs must ultimately be passed on to consumers.

To quantify these dynamics, we estimate a time-varying relationship between one-year euro area inflation swaps and key energy drivers using a Kalman filter with stochastic coefficients.

While crude oil remains an important driver of front-end inflation pricing, natural gas appears to be the dominant variable in inflation tail events. Empirical evidence suggests that gas contributes relatively little around median inflation outcomes but becomes one of the primary drivers of large inflation accelerations. This asymmetry implies that investors concerned with inflation surprises should monitor gas markets at least as closely as oil markets.

The crack spread, defined as the margin between crude oil and gasoil, provides an additional signal of stress within refining and distribution chains. Together, the resulting time-varying coefficients provide a daily measure of the market's implicit assessment of pass-through intensity across these channels.

1 Pass-through signal S(t) and euro area core inflation (2009–2026)



Source: Barclays

Transmission of cost shock

The transmission of energy and commodity shocks into consumer prices depends not only on the magnitude and persistence of the initial cost increase but also on the strength of aggregate demand. The ability of firms to pass higher input costs on to consumers ultimately depends on whether final demand remains sufficiently resilient to absorb higher prices.

When demand is weak, firms often respond to higher costs by compressing margins to protect market share. In this environment, pass-through remains limited and inflationary pressures tend to dissipate as they move through the distribution chain. By contrast, when household consumption, corporate spending and public expenditure remain robust, firms face less resistance to price increases and are more likely to transfer higher costs to final consumers.

The post-pandemic period provides a useful illustration of this mechanism. Unlike previous energy shocks, the inflation surge of 2021-2023 occurred in an environment characterised by strong household balance sheets, substantial fiscal support and resilient demand. As a result, cost pressures that might previously have been absorbed within margins were transmitted more broadly across goods and services prices.

Demand conditions therefore act as a transmission accelerator. Identical supply shocks can generate very different inflation outcomes depending on the capacity of firms to preserve volumes while raising price.

Second-round effects and duration channel

The distinction between first and second round effects is fundamentally a question of duration.

The existence of this duration channel is directly observable in euro area inflation data. Producer price inflation typically reaches food inflation after five to six months and core inflation after six to seven months. The transmission mechanism therefore operates as a delayed pipeline through which cost pressures progressively diffuse across the consumer basket.

A shock that is intense but short lived remains a first-round event: prices rise and then retrace as energy normalises without triggering the wage and service price dynamics associated with more persistent inflation.

By contrast, a shock that is both intense and sustained crosses a different threshold. Initially, distributors absorb higher costs within margins. But as weeks turn into months, these margins are gradually eroded. Eventually, the adjustment can no longer be contained, and costs are passed through more broadly, not as a one-off price change but as a repricing that impacts wages, services and contractual arrangements. This is a second-round dynamic, as core inflation begins to rise.

This mechanism is directly visible in the time varying estimates of pass-through. Controlling for the level of energy prices, inflation swap sensitivities to both natural gas and crude oil increase with the duration of the shock. The longer elevated prices persist, the more the

market revises upward its assessment of pass-through.

The analysis suggests that the empirical thresholds are broadly stable across different shock episodes. A shock at the 75th percentile of energy price intensity sustained for six months, or at the 90th percentile sustained for two months, is historically associated with a material increase in core inflation over the subsequent six months.

Measuring the signal: intensity, duration

To aggregate the pass-through information from natural gas and gasoil into a single measure, we compute the root mean square of each time-varying coefficient over a rolling 120-day window and take their product:

$$S(t) = \sqrt{\left(\frac{1}{120} \int_{t-120}^t \beta_{gas}^2(s) ds\right)} \sqrt{\left(\frac{1}{120} \int_{t-120}^t \beta_{gasoil}^2(s) ds\right)}$$

The signal increases with both the intensity and the persistence of the shock, and captures the joint effect across the two channels, generating a non-linear response. This construction is particularly informative for core inflation dynamics: when both the intensity and the duration of pass-through are elevated, the signal anticipates the emergence of second-round effects. It therefore provides a forward-looking indicator that goes beyond what can be inferred from energy price levels or instantaneous pass-through measures alone (see figure 1).

2. Three inflation regimes and breakdown of symmetry

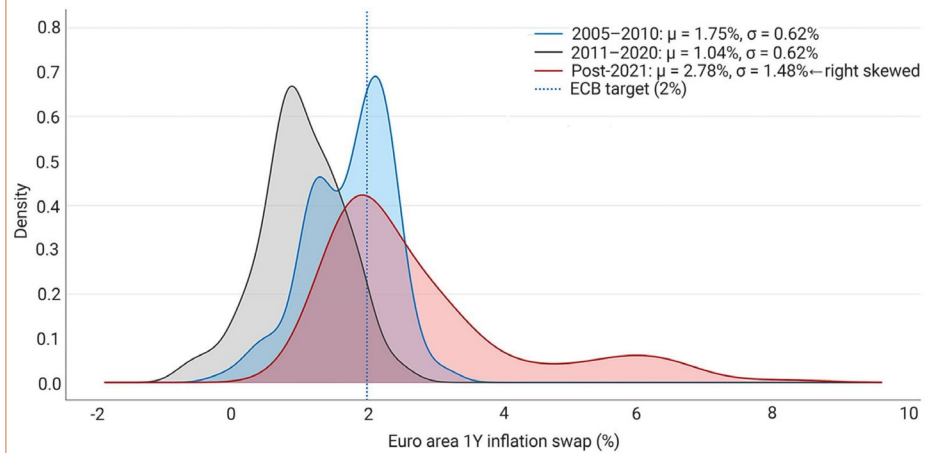
From 2005 to 2010, inflation was moderate and its distribution broadly Gaussian, centred close to the ECB target with symmetric upside and downside risks. Three structural forces acted as disinflationary anchors: a relatively large working-age population; deepening globalisation, which continuously optimised production costs; and technological progress. The market therefore priced inflation as a mean-reverting and symmetric process.

From 2011 to 2020, the distribution shifted lower and remained approximately Gaussian but was recentred around 1% with limited dispersion. The same structural forces persisted, with even greater intensity, and the market broadly priced this symmetry correctly.

Since 2021, following Covid and the first meaningful supply shock in decades both the



2 Three inflation regimes: distribution of euro area short-term inflation expectations



Source: Barclays

level and the shape of the distribution of inflation expectations have changed. Inflation has returned to, or exceeded, target, but the distribution is no longer symmetric. It is skewed to the upside, with realised inflation persistently exceeding the forward curve and tail risks clearly biased higher. This is consistent with the hypothesis of a regime shift rather than a purely cyclical deviation.

The structural forces that anchored inflation over the past two decades are now being challenged simultaneously. The demographic tailwind is reversing as the ratio of working-age population to dependants declines across major economies. Globalisation is fragmenting under geopolitical pressure, tariff escalation and rising labour costs in previously low-cost regions. Technology, long a source of disinflation, is undergoing structural change, as the energy intensity of digital infrastructure and the concentration of semiconductor supply chains introduce new cost pressures. These shifts are reinforced by rising defence spending across Europe, which competes with productive investment, and by increasing climate-related disruptions affecting food and energy supply chains.

Market pricing conventions were calibrated to the pre-2021 regime. Since 2021, pricing has been adjusting to a new set of inflation dynamics, creating transitional gaps between realised outcomes and market-implied expectations.

Prior to 2021, a Gaussian framework for short-term inflation expectations was broadly appropriate, with realised inflation tracking

forwards without systematic bias. Since 2021, this framework has coincided with a persistent underestimation of realised inflation. Between 2000 and 2020, euro area inflation exceeded 3% only once, briefly, in 2007. Since 2021, it has done so repeatedly, reaching levels not observed since the 1980s (see figure 2).

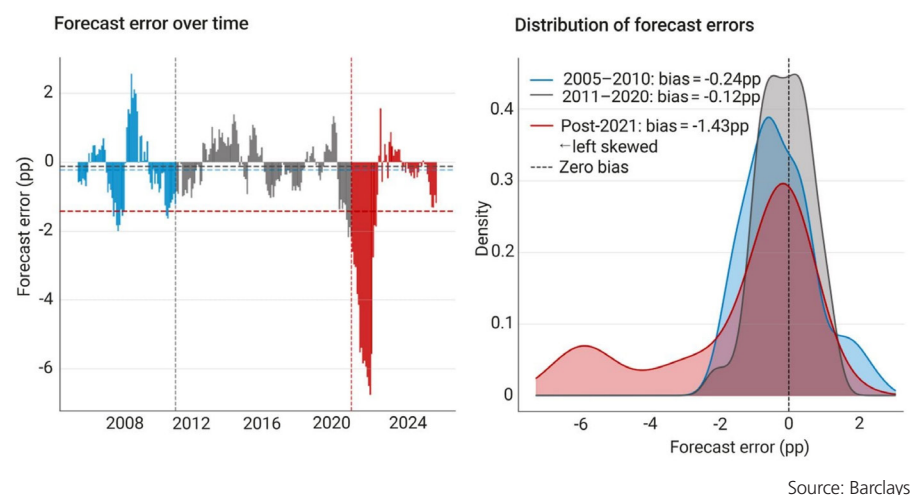
3. Pricing of repeated supply shock

From inflation-linked bonds and inflation swaps, the market constructs an implied inflation term structure extending out to 30 years. Beyond the one-year horizon, the forward curve is relatively flat. The spread between the one-year forward one-year rate and the five-year forward five-year rate typically remains limited, suggesting that medium-term inflation expectations remain well anchored even during periods of elevated short-term inflation volatility.

Historically, this configuration was consistent with an environment in which supply-side shocks were generally perceived as isolated and transitory. However, the post-2020 environment has been shaped by a succession of shocks affecting global supply chains, whose cumulative effect may increase the likelihood that inflation pressures propagate more broadly through the economy.

Viewed through this lens, inflation risk becomes increasingly linked to the persistence and recurrence of supply-side disruptions rather than to any single event. Repeated shocks may gradually alter the distribution of

3 Systematic forecast bias: inflation swap vs realised HICP +9 months



inflation outcomes by increasing both persistence and upside asymmetry. As a result, investors may over time require additional compensation for bearing inflation risk. The economic rationale for such compensation becomes stronger as supply shocks become more frequent and the intervals between them shorten.

The post-2021 inflation experience provides a useful benchmark for assessing the potential magnitude of this compensation. The gap between the mean and the median of realised inflation outcomes exceeds 50 basis points over the period, indicating that upside inflation surprises have been sufficiently frequent and large to shift the distribution to the right. This divergence should not be interpreted as a direct estimate of an inflation risk premium. Rather, it provides an empirical measure of the asymmetry investors have been exposed to in recent years. To the extent that repeated supply shocks continue to generate similar asymmetries, a medium-term inflation risk premium of a comparable size would not appear inconsistent with the realised distribution of outcomes.

In this framework, the relevant question is whether existing pricing fully reflects the possibility that repeated supply disruptions may become a persistent feature of the inflation regime. If such a regime were to emerge, the compensation required for bearing inflation risk could gradually increase even if long-term inflation expectations remain anchored around the central bank's target (see figure 3).

4. Asymmetry of inflation risk pricing

The behaviour of real interest rates reveals an important distinction between short-term macroeconomic dynamics and long-term risk pricing. Historically, short-dated real rates in the euro area have been predominantly negative across very different inflation regimes. From 2011-2020, inflation averaged around 1%, yet policy rates were pushed even lower, and into negative territory, to stimulate demand and support growth. As a result, short-term real rates remained persistently negative despite a low-inflation environment.

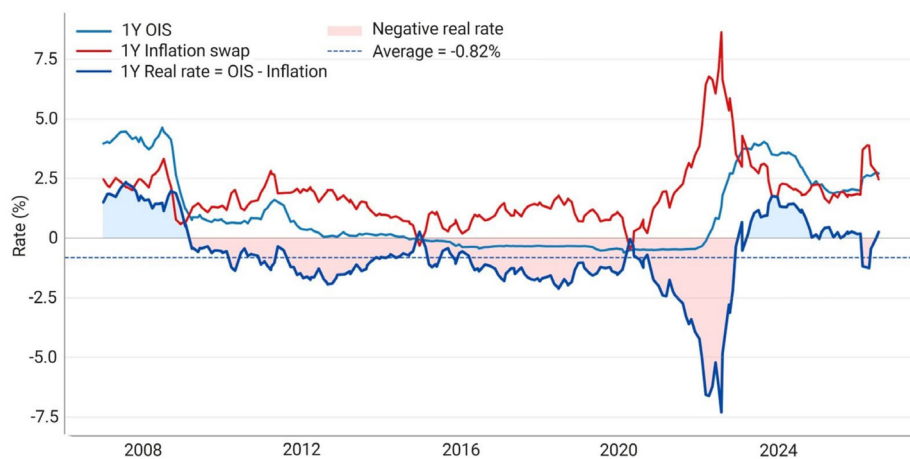
The same pattern re-emerged during the inflation surge that followed the post-pandemic energy shock. Inflation rose well above target while monetary policy adjusted only gradually. Although nominal rates increased substantially, realised inflation exceeded short-term rates leaving short-term real rates negative once again. In both low-inflation and high-inflation environments, realised inflation has tended to exceed short-term nominal rates.

Further along the curve, however, the picture changes. Medium- and long-term real rates are typically less negative than their short-dated counterparts and can become positive during periods of elevated uncertainty. This should not necessarily be interpreted as evidence that investors receive substantial compensation for inflation risk. Rather, it reflects the presence of a term premium embedded in nominal yields. Investors require compensation for bearing duration risk, particularly in environments characterised by fiscal uncertainty, rising





4 Structurally negative short-term real rate: OIS 1Y minus inflation swap 1Y (2007–2026)



Source: Barclays

sovereign issuance and greater volatility in future rate expectations. As a result, long-term real rates tend to be supported by nominal term premia even when short-term real rates remain negative.

This creates an important asymmetry between nominal interest rate and inflation markets. Duration risk benefits from a large structural hedging community and therefore generates an observable and persistent risk premium. Inflation markets, by contrast, are supported by a smaller and less systematic hedging base. As a result, duration risk is explicitly priced through nominal term premia, while inflation risk appears less visibly reflected in inflation forwards despite the repeated inflation surprises observed since 2021.

This compensation appears to originate primarily from nominal term premia rather than from a clearly identifiable inflation-risk premium. In other words, investors are visibly compensated for bearing duration uncertainty, while the compensation they receive for bearing inflation uncertainty remains far less apparent (see figure 4).

Inflation risk depends not only on the magnitude, frequency, and persistence of supply shocks, but also on the economy's capacity to absorb them. Energy and producer-price shocks do not immediately feed into core inflation. Instead, they pass through a transmission pipeline that operates with significant delays, particularly through food, industrial goods, and services. The evidence suggests that firms have recently absorbed an important share of higher

input costs through margins. As long as this absorption capacity remains available, pass-through into core inflation may remain limited. However, if repeated supply disruptions continue to erode margins, the probability of broader inflation transmission increases significantly.

Inflation-linked instruments remain exposed to a distinct set of macroeconomic scenarios. Their behaviour is influenced by the interaction between supply shocks, monetary policy expectations and rate volatility, while providing protection against purchasing-power erosion that is often only partially hedged elsewhere in traditional asset allocations. As a result, their role increasingly depends on how investors assess the persistence of supply-side risks and their potential transmission into medium-term inflation outcomes. ■

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