# The transmission of shocks to food and energy commodity prices to food inflation in the euro area*


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**Abstract**

We estimate how shocks to food and energy (fuel) commodity prices pass-through to food consumer prices in the euro area, where the current episode of substantial and persistent increase in food prices is unprecedented when looking at the past decades. We extend the workhorse food value chain model of Ferrucci et al. (2012) to account for fuel prices and asymmetries. We show that there is a persistent and significant effect of shocks to food and energy commodity prices on food inflation that reaches a maximum at around 12 months after the shock. We also show that both types of shocks impact food consumer prices in an asymmetric way, with increases in prices having a significant, positive effect, while price decreases have a milder effect in the case of food commodities, and a statistically non-significant effect in the case of energy commodities.



**JEL Classification**: E31, Q17, Q18.
**Keywords:** food prices; energy prices; asymmetries; euro area.



*We thank Pablo Burriel, Ángel Gavilán, Corinna Ghirelli, Philip Lane, Florens Odendahl, Carlos Thomas, Alberto Urtasun and seminar participants at Banco de España and the Eurosystem's Working Group on Forecasting for their comments. At the time of writing this paper Águeda Gras-Miralles was on an internship at Banco de España. The views expressed in this paper are those of the authors and do not necessarily represent the views of the Banco de España or the Eurosystem.


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# 1 Introduction

The global upsurge in the prices of food commodities since early 2021 has generated an increase in food consumer prices that is being sharper than in other episodes of stress witnessed in these markets at least over the past two and a half decades. The pandemic shock and the impact of the Russian invasion of Ukraine affected international food commodity markets directly, but also indirectly through their impact on energy markets. Indeed, the energy shock hit food commodity prices through its effects on general producer and inputs costs, impacting on the costs of fertilisers and motor fuels, among other channels.

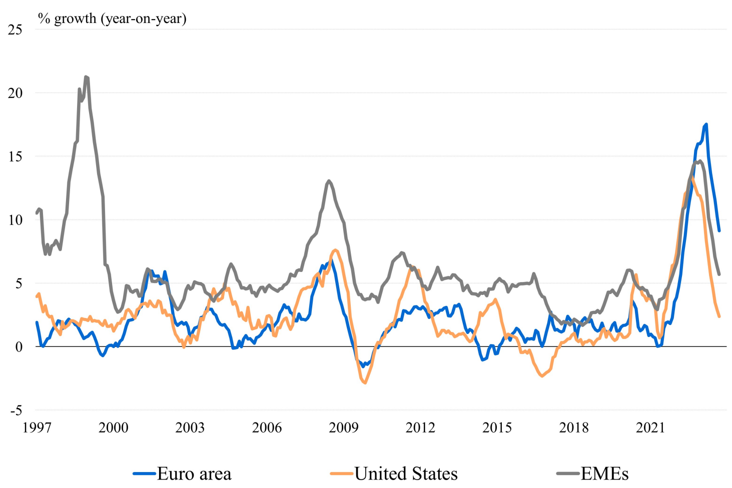
The current episode of substantial and persistent increases in food prices is unprecedented when compared to previous ones. In the case of the euro area, food consumer prices registered a peak of 17.5% in March 2023, above that of other economies worldwide (see Figure 1a). In addition, the upward push has been more widespread across food price categories than in past episodes, affecting to a larger extent the dynamics of prices for most food categories. At the global level, some 90% food sub-items recorded rates in the top 5% of their historical distribution at the peak of the current episode (March 2023), compared with the much lower registers of previous episodes over the past twenty years (in which between 30% and 60% of sub-items were affected). The increase in commodity prices has transmitted through the food value chain to producer prices and consumer prices, with intensity (see Figure 1b).

The empirical literature has analysed the pass-through from international food commodity prices to food inflation, and the transmission of food prices along the value chain, mostly abstracting from the role of energy prices or asymmetries: Rigobon (2010), Ferrucci et al. (2012), Ianchovichina et al. (2014), Porqueddu and Venditti (2014), Cachia (2017), Rezitis and Tsionas (2019), Jiménez-Rodríguez and Morales-Zumaquero (2022). A related literature has looked at the pass-through from energy price increases to food inflation: Rigobon (2010), Roeger and Leibtag (2011), de Winne and Peersman (2016), Peersman (2022). Another branch of the literature has analyzed the asymmetric response of general inflation to positive (above a threshold) versus negative (below a threshold) oil price shocks, see e.g. Kilian and Vigfusson (2011).

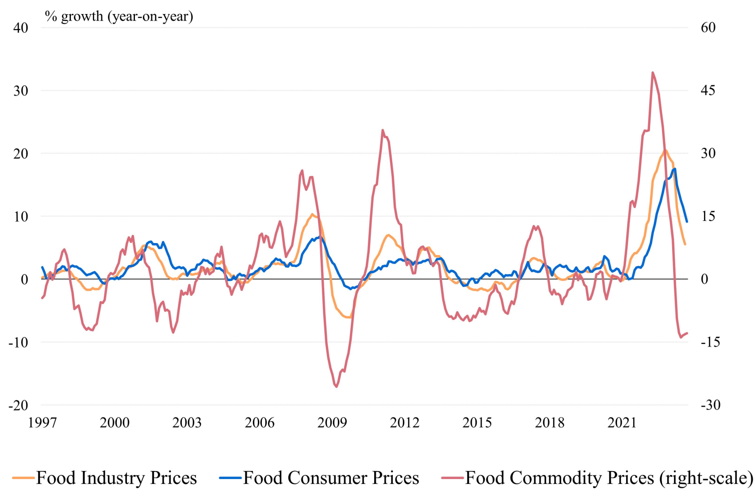
In this paper we take elements from these three branches of the literature to estimate how shocks to international food commodity and fuel prices pass-through to food consumer prices in the euro area. We extend Ferrucci et al. (2012) to account for fuel prices and for the potential presence of non-linearities (as in Kilian and Vigfusson, 2011). The rest of the paper is organized as follows: in Section 2 we describe the data and empirical

Figure 1: Euro area food price inflation

(a) **International comparison of consumer price inflation**




(b) **Elements of the food price value chain in the euro area**




Sources: Eurostat, European Commission Directorate-General for Agriculture and Rural Development (DG-Agri) and OECD. EMEs: Emerging Market Economies.

methodology, in Section 3 we discuss the main results of our analysis, and in Section 4 we provide concluding remarks.

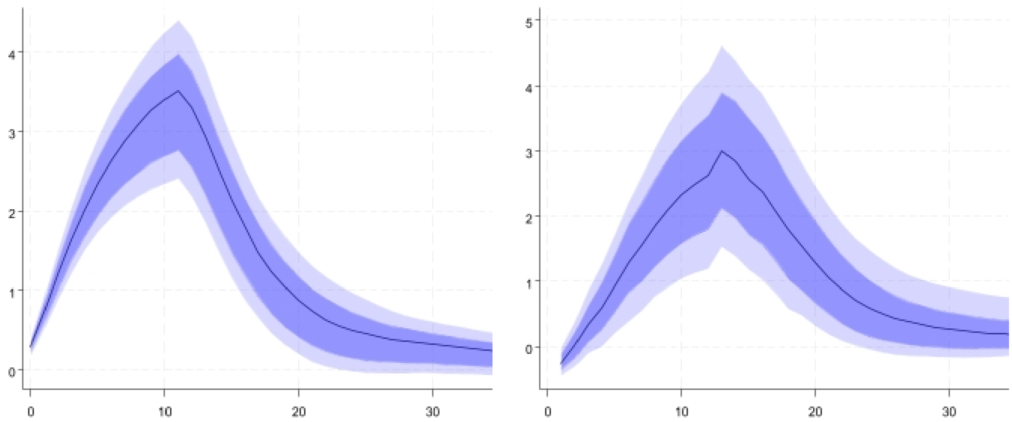
## 2 Data and Methodology

As food commodity prices we use European Union (EU) references to account for the role of EU's Common Agricultural Policy.[1] Euro area producer prices (producer price

[1]The reference food index is an aggregate of six food groups: cereals, dairy, meat, fats and oils, sugar and coffee. EU food commodity prices' main source is European Commission's DG-Agri. Each food group

Figure 2: Linear model: response of euro area consumer food inflation to food commodity and fuel prices' shocks.

(a) Food commodity (b) Fuel




Notes: Impulse responses of euro area food consumer price inflation to a 10% shock in food commodity prices (upper panel) and to a 40% shock to fuel prices (lower panel), as dictated by a simplified version of equation (1) in which the terms affecting $p^*$ and $x^*$ are not activated.

index) and consumer prices (harmonized index of consumer prices, HICP[2]) are taken from Eurostat. The reference sample is January 1997 to February 2023.

The model is an extension of the food pricing chain model of Ferrucci et al. (2012) in which we account for fuel prices[3] and non-linearities (as in Kilian and Vigfusson, 2011), as follows:

$$y_t = c + \sum_{i=0}^{I} A_i y_{t-i} + \sum_{i=0}^{J} \beta_i p_{t-i} + \sum_{i=0}^{K} B_i x^*_{t-i} + \sum_{i=0}^{L} C_i p^*_{t-i} + \epsilon_t \qquad (1)$$

where $y_t$ includes commodity, producer and consumer food prices. Each price depends on lags of the three variables ($\sum_{i=0}^{I} A_i y_{t-i}$), and contemporary and lagged fuel prices $p_t$ ($\sum_{i=0}^{J} \beta_i p_{t-i}$). $x^*_t$ is a non-linear transformation of the commodity price index (first element of $y_t$). $p^*_t$ is a nonlinear transformation of $p_t$. Both nonlinear variables are defined following Hamilton (1996). More specifically, let $yc_t$ be the first element of $y_t$, then

$$x^*_t = max(0, yc_t - max(yc_{t-1}, yc_{t-2}, ..., yc_{t-12})) \qquad (2)$$

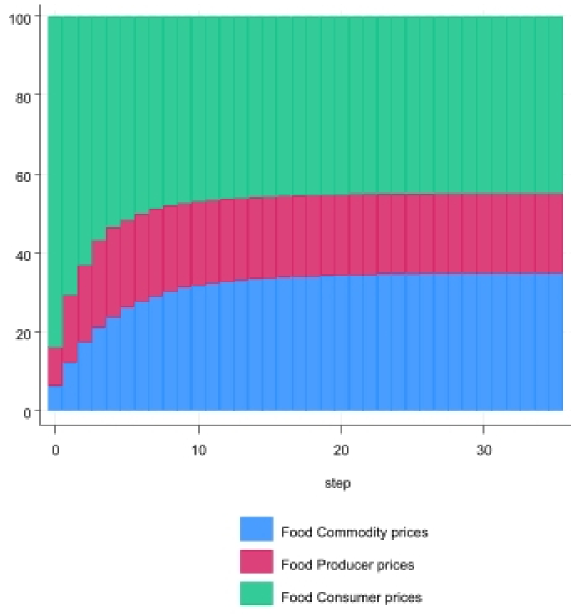
$$p^*_t = max(0, p_t - max(p_{t-1}, p_{t-2}, ..., p_{t-12})) \qquad (3)$$

is the simple average of its subcomponents.

[2]For the analysis we exclude the most volatile elements, namely fruit and vegetables, and also fish due to the lack of an EU reference commodity.

[3]Due to data shortages, the fuel price is a GDP weighted index of agricultural motor fuel prices in Germany, France, Italy and Spain.

Figure 3: Variance decomposition of euro area consumer food inflation error predictions




Note: Computed from the simplified version of equation (1) in which the terms affecting $p^*$ and $x^*$ are not activated.

Equations (2) and (3) compare the price of each commodity each month with the maximum value observed during the preceding 12 months. This is done to capture price increases that go beyond the compensation of previous decreases, in order to control for the stylized fact that most of the individual price increases observed historically are simply corrections of earlier decreases.

Following Ferrucci et al. (2012) we first run model (1) for each of the six main food categories (cereals; dairy; meat; fats and oils; sugar; coffee). Then, we build a reference food index weighting each models' impulse response functions by the weight of the food category on the HICP.[4]

## 3 Results

In Figure 2 we show the results for the linear version of model (1), i.e. one in which the terms affecting $x^*$ and $p^*$ are not activated. We assume a Cholesky identification scheme. For illustrative purposes, we calibrate the two commodities' price shocks to proxy the increase observed in February-March 2022 (Russian invasion of Ukraine), that amount to temporary increases of 10 percent in food commodity prices, and 40 percent in fuel commodity prices. The impulse response functions show a significant and persistent

[4] The results for each food category are available from the authors upon request.

impact of both shocks on euro area food inflation, with maximum impact 12 to 15 months after the shock. In addition, in Figure 3 we show the variance decomposition of euro area food consumer inflation: the longer the horizon, the higher the weight of shocks to food commodity prices in explaining the variance of the error of food consumer inflation.

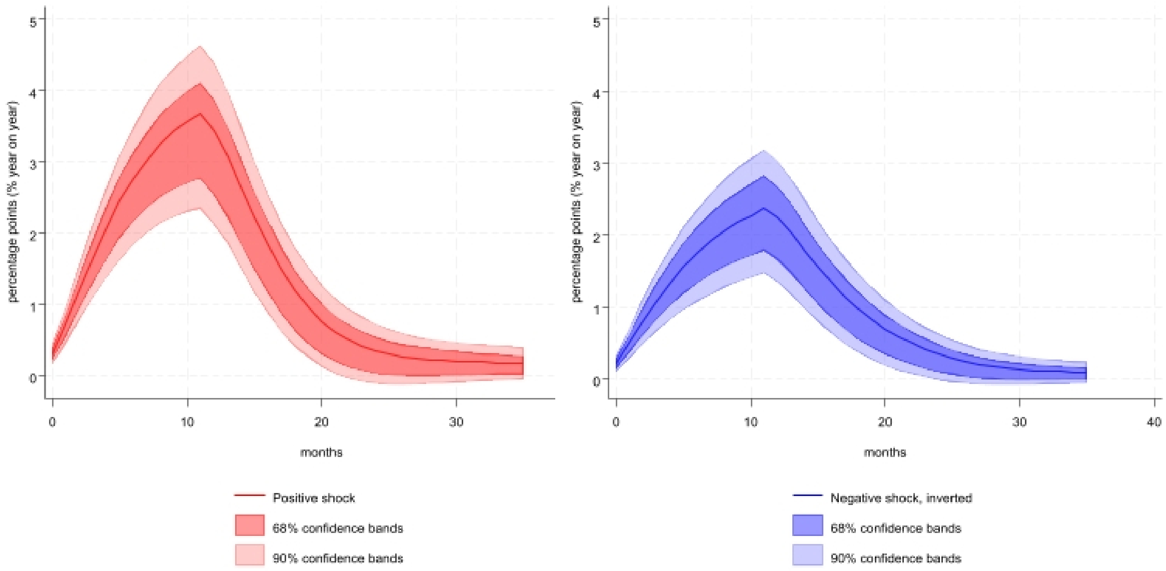
In Figure 4, in turn, we show the results obtained estimating the full version of model (1), that we identify and estimate following Kilian and Vigfusson (2011). A positive (see equation 2) food commodity price shock causes a similar, though somewhat larger, impact compared to the linear version: a temporary shock of 10 percent translates into an increase in food inflation of 3.8 percentage points over the next 12 months. The pass-through turns out to be smaller when, instead, there is a negative shock of the same magnitude. Notice that we have chosen a large shock as non-linearities are also contingent on the size of the shock. In the figure, the median response to the positive shock is larger in a statistically meaningful sense than the response to the negative shock, quite clearly within the 68% confidence interval. It is worth noting that in our sample positive food commodity shocks are more frequent and larger than negative ones. Turning to the impact of an energy shock, the key message that stands out is that the effect of a fuel price shock on food consumer inflation is statistically different from zero at the standard significance level only for positive shocks.

## 4 Conclusions

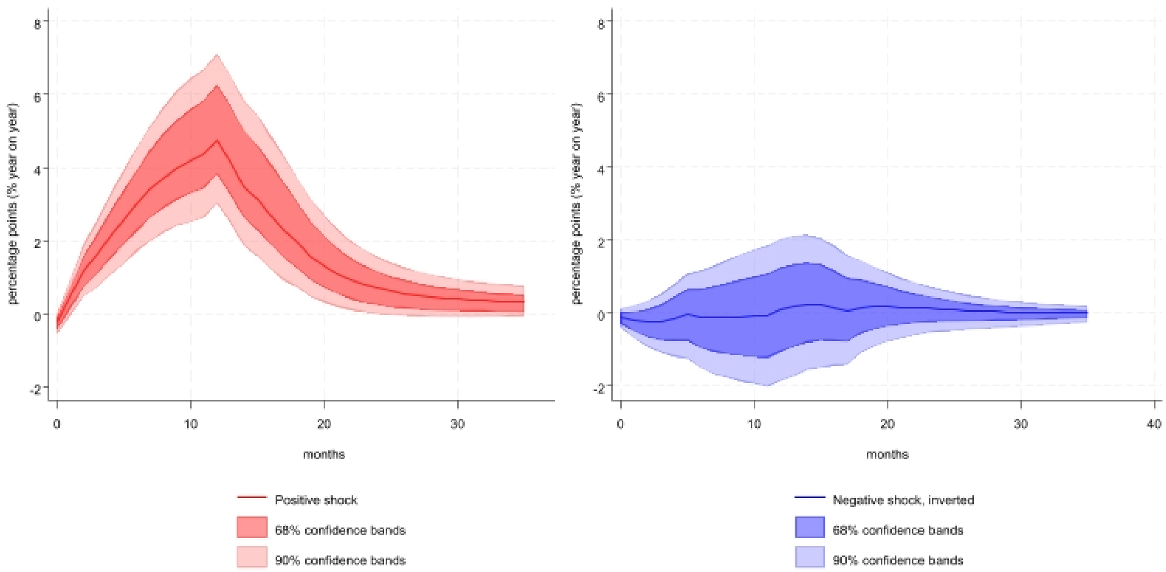
We show that there is a persistent and significant effect of shocks to food and energy commodity prices on food inflation. Moreover, both types of shocks impact food consumer prices in an asymmetric way, with increases having a significant, positive effect, in both cases, while decreases have a milder effect in the case of food commodities and a null effect for energy. To our view, the economic implications of these results are of significant interest for authorities in charge of the conduction of policies aimed at controlling inflation in the euro area, as the unveiled asymmetries generate a significant persistence of the upward shocks in food and energy commodities on euro area HICP. This is the case because the downward phase in commodity prices would not exert a commensurate downward pressure on food consumer prices. This gets reinforced by the fact that positive shocks tend to be more frequent and larger than negative shocks. A clear example of these mechanics is the most recent inflationary episode, in which positive and very large shocks in food and energy commodity prices pushed food inflation upwards, while the subsequent period of normalization of commodity prices did not push down inflation at

Figure 4: Fully non-linear model: response of euro area consumer food inflation to food commodity and fuel prices' shocks.

(a) Food commodity




(b) Fuel




Impulse responses of food consumer price inflation in the euro area to shocks in food commodity prices (10%, upper panels) and fuel prices (40%, lower panels), as indicated in equation 1.

the same pace, thus leading to a strong persistence of food inflation across the euro area, with a significant impact on overall inflation rates.

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