“EL NIÑO” AND “LA NIÑA”: REVISITING THE IMPACT ON FOOD COMMODITY PRICES AND EURO AREA CONSUMER PRICES

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Abstract

This paper challenges the prevailing assumption that the intensification of the weather phenomena known as El Niño and La Niña generally exert upward and downward pressures, respectively, on international food commodity prices that, in turn, affect consumer prices even in distant jurisdictions such as Europe. As regards the first point, we show that there are nuances that have to do with composition effects (the type of commodity) and sample periods (more recent decades present a different frequency of weather events, with producers having adopted mitigation strategies over time), in such a way that the impact is weaker nowadays and, in some cases, may even change sign (for some commodities, depending on the period of reference). With regard to the second point, and focusing on consumer price inflation in the euro area and its four largest constituent countries (Germany, France, Italy, and Spain), we show that it is crucial to account for the mitigating and sample-period-specific role of domestic agricultural policies (in the euro area, the European Union's Common Agricultural Policy, CAP). To carry out our analysis, we construct a detailed database for the 1970–2023 period and use a local projections empirical framework. Among other results, we show that when using a sample period that starts at the time of the creation of the euro area (in the late 1990s), an intensification of El Niño actually decreases euro area headline inflation by about 0.3 percentage points (pp) after 12 months, while La Niña increases it by 0.6 pp over the same horizon. We explain our results on the basis of the aforementioned factors: composition effects, sample periods, and the CAP.

Keywords: El Niño, La Niña, food prices, euro area inflation.

JEL classification: C32, F62, F64, O13, Q54.

Resumen

Este documento cuestiona la creencia generalizada de que la intensificación de los fenómenos climáticos conocidos como El Niño y La Niña ejercen presiones generales al alza y a la baja, respectivamente, sobre los precios internacionales de los productos alimenticios que, a su vez, afectan a los precios al consumidor, incluso en jurisdicciones lejanas como Europa. Respecto al primer punto, se muestra que hay matices que tienen que ver con los efectos de composición (tipo de producto) y los períodos muestrales (décadas más recientes presentan una frecuencia diferente de eventos climáticos; y los productores han adoptado estrategias de mitigación a lo largo del tiempo), de manera que el impacto es hoy más débil y, en algunos casos, incluso puede cambiar de signo (para algunos *commodities* dependiendo del período de referencia). En cuanto al segundo punto, y si se observa la inflación de los precios de consumo en el área del euro (EA) y sus cuatro países más grandes (Alemania, Francia, Italia y España), se ve que es crucial tener en cuenta los factores mitigantes y específicos del período muestral de las políticas agrícolas internas (en la EA, la Política Agrícola Común de la Unión Europea, PAC). Para llevar a cabo este análisis, se ha construido una base de datos detallada para el período 1970-2023 y se ha utilizado un marco empírico de proyecciones locales. Entre otros resultados se muestra que, cuando se toma un período de muestra que comienza en el momento de la creación de la EA (finales de la década de 1990), una intensificación de El Niño en realidad disminuye la inflación general de la EA en aproximadamente 0,3 puntos porcentuales (pp) al cabo de 12 meses, mientras que La Niña la incrementa en 0,6 pp en el mismo horizonte. Estos resultados se racionalizan sobre la base de los factores antes mencionados: los efectos de composición, los períodos muestrales y la PAC.

Palabras clave: El Niño, La Niña, precio de alimentos, inflación del área del euro.

Códigos JEL: C32, F62, F64, O13, Q54.

1 Introduction

The 2023–2024 El Niño has peaked as one of the strongest events on record, comparable to the extraordinary El Niño episode of 1997–1998, according to the World Meteorological Organization (WMO) and in line with predictions by the National Center for Atmospheric Research (Yeager et al., 2022).[1] El Niño is a cyclically occurring climate phenomenon associated with warming of the ocean surface in the central and eastern tropical Pacific Ocean.[2] It induces anomalous temperatures, precipitation, and speeds and strength of ocean currents, leading to extended episodes of drought and floods in tropical countries.[3]

The counterpart phenomenon to El Niño, La Niña, induces the opposite effect, i.e., cooler sea surface temperatures across the central and eastern equatorial Pacific. La Niña sometimes follows El Niño events, and according to the most recent available forecasts at the time of writing, it may develop in June–August (49% chance) or July–September (69% chance) of 2024.[4] Together, El Niño and La Niña represent the "warm" (El Niño) and "cold" (La Niña) phases of the El Niño-Southern Oscillation (ENSO). These climate alterations significantly impact agricultural yields in affected regions (e.g., Iizumi et al., 2014, Hsiang and Meng, 2015, Smith and Ubilava, 2017). In addition, indirect effects on the economy may stem from trade and relate to global value chain production and food commodity market competitiveness. Thus, ENSO has recently attracted significant attention from policy makers and central bankers because of its possible adverse (upward) effects on prices. In particular, in the last two years this phenomenon has been in the spotlight in the press as never before. Figure 1 shows newspaper-based indicators that capture the popularity of ENSO phenomena in the press in several developed countries.[5] As expected, the press draws attention to ENSO events when they occur. However, the tremendous peak corresponding to the last El Niño event (2023–2024) stands out. This confirms that the public is now extremely interested in this topic.

This paper investigates the effect of El Niño and La Niña events on euro area inflation. This issue is particularly of interest today since most economies are getting back on track after the 2022–2023 inflationary crisis. In this context, we find it extremely important to

[1]The National Center for Atmospheric Research (NCAR) is supported by the National Science Foundation. More information can be found here.

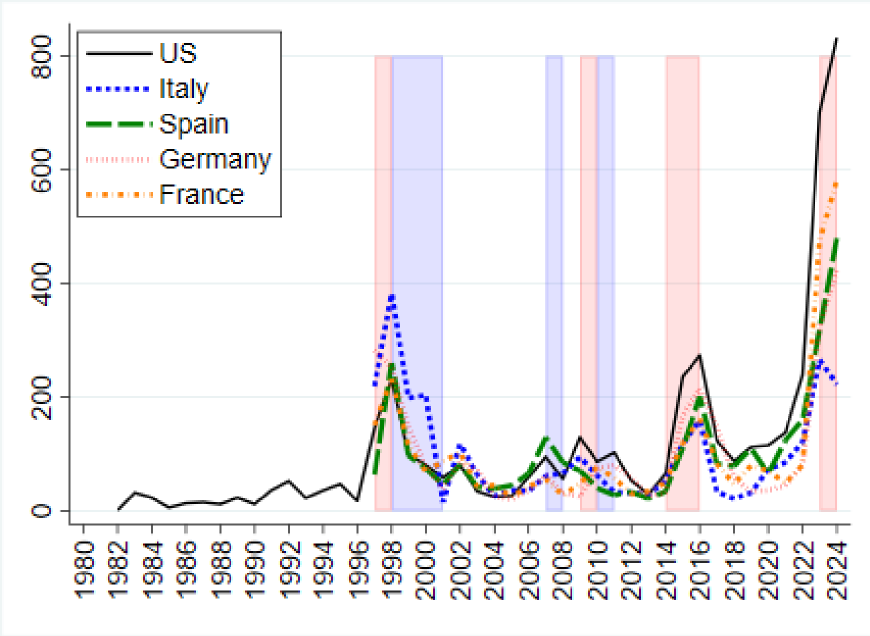
[2]It occurs every two to seven years on average and typically lasts nine to twelve months.

[3]See Zebiak et al. (2015) and the literature therein.

[4]See the Climate Prediction Center of the National Oceanic and Atmospheric Administration (NOAA).

[5]The United States, Spain, Italy, Germany, and France. Note that these European countries are not directly affected by ENSO events, yet they talk about them when they occur.

Figure 1: Newspaper-based ENSO popularity indexes



Note: Newspaper-based ENSO-popularity indicators for specific countries at a yearly frequency. These indicators are constructed following the procedure described in Section J of the Appendix. Red-shaded (blue-shaded) areas indicate strong El Niño (La Niña) episodes, which are declared when average sea surface temperatures in the equatorial Pacific are at least 1.5 degrees Celsius warmer (cooler) than normal. Strong El Niño episodes occurred in 1997–1998, 2009–2010, 2014–2016, and 2023. Strong La Niña episodes occurred in 1998–2001, 2007–2008, and 2010–2011. For more details, see Table 2 in Section 7.

properly present and discuss the implications of ENSO events for the euro area. For instance, the European Central Bank (ECB) has regularly mentioned El Niño as a risk factor in its inflation forecasts. To give an example, in July 2023 the ECB stated that *"It was observed that, while food inflation had started to come down somewhat, it remained elevated overall, and geopolitical risks and weather and climate-related factors, including El Niño, pointed to upside risks."*[6] Moreover, in its December 2023 Macroeconomic projections, the ECB warns about the *"[...] combination of climate change-related risks and the El Niño phenomenon which might amplify the frequency of extreme weather events resulting from climate change in general [...]"*. See Box 4 in ECB (2023).

This conjecture is supported by rich evidence on the impact of El Niño events, both from a global perspective (e.g., Brunner, 2002; Hsiang and Meng, 2015; Cashin et al., 2017; Adolfsen and Lappe, 2023) and also based on developing countries, which are directly affected by these phenomena (e.g., Martín, 2016; Abril-Salcedo et al., 2020). This evidence supports the broad consensus that El Niño raises food commodity prices, although country-specific consumer-price impacts may differ depending on a country's exposure to these climate patterns, its

[6] See "Account of the monetary policy meeting of the Governing Council of the ECB of 14-15 June 2023".

openness to global commodity trade, and its food commodity trade orientation (e.g., Cashin et al., 2017). These results are reported in detail in Table C.5 of Section C of the Appendix. Thus, there are differences in the impact of El Niño events among countries (e.g., Cashin et al., 2017; Andrian et al., 2024) and among food items (e.g., Iizumi et al., 2014; Ubilava, 2012; Ubilava and Holt, 2013; Smith and Ubilava, 2017; Ubilava, 2017) that should be taken into account. Yet, to our knowledge the literature has not yet studied the impact of ENSO events on euro area consumer prices. Only a few studies focus on prices in specific European countries or some form of European aggregate, but not the euro area. [7] This paper aims to fill this gap.

Our main finding is that from 1997 onwards, ENSO shocks have led to asymmetric effects on commodity prices and on euro area inflation. Specifically, El Niño shocks negatively affect both international and EU food commodity prices, and this effect passes through (partially) to euro area consumer prices. Hence, El Niño shocks have disinflationary effects when considering the most recent sample. In contrast, La Niña exerts an inflationary effect both on international and EU food commodity prices, which pass through to euro area inflation. These results are novel given that the literature on ENSO shocks tends to focus on earlier periods, when the aggregate effect of El Niño shocks is inflationary. Here, we put forward a number of possible explanations that may help rationalize the change in results compared to the previous period, such as the reform of the EU Common Agricultural Policy framework (see Section 7).

Our results are related to the recent study by Peersman (2022), who investigates the causal effects of international food commodity price shocks on euro area inflation by means of instrumental structural vector autoregressions. He uses a series of unanticipated harvest shocks as an instrument to identify exogenous international food commodity price shocks. This instrument is estimated as the residual from a harvest equation that controls for a number of possible determinants of food production, including global weather phenomena—represented by ENSO events.[8] He finds that exogenous food commodity price shocks (a 1% increase in international commodity prices) have a strong impact on international consumer

[7]Brunner (2002) focuses on the G-7 aggregate; Cashin et al. (2017) consider an ad-hoc definition of the European region that includes the following 13 countries: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, Turkey, and the United Kingdom; Laosuthi and Selover (2007) study a sample of developed countries that includes France, Italy, and Germany.

[8]In the harvest equation, a global food production index excluding European harvests is regressed on a set of variables reflecting a trend, ENSO shocks, and a vector of control variables that could affect global food production. The variables measuring ENSO shocks represent global weather phenomena that may simultaneously affect European and non-European harvests.

prices (1.18 percentage points (pp) after 8 quarters) and on European Union commodity prices (1.07 pp). This inflationary result is in line with our finding for La Niña, over a similar sample. However, we find a deflationary impact of El Niño on the same sample. In any case, our results are not directly comparable to those of Peersman (2022) for a number of reasons: (i) we consider the direct impact of ENSO shocks, distinguishing between El Niño and La Niña shocks, while Peersman (2022) uses shocks to global harvests of corn, wheat, rice, and soybeans outside of Europe and unrelated to global economic developments to identify exogenous international food commodity price shocks; (ii) he focuses on a narrower set of components for food prices in the EU (cereals, meat, and dairy); (iii) he applies a weighting scheme for EU food commodity prices based on production (Eurostat economic accounts for agriculture), whereas we consider a harmonized index of consumer price (HICP) weights.

We contribute to the existing literature along a number of dimensions. First, we study the impact of El Niño and La Niña on euro area inflation using both euro area consumer prices (which are the target of the ECB's monetary policy) and European Union (EU) food commodity prices, given the relevance of EU commodity prices for assessing the pass-through from international food commodity prices to the relevant prices within the euro area (for a detailed discussion, see Ferrucci et al., 2012 and Borrallo et al., 2024). This is key, since the international and EU food commodity baskets differ both in terms of their composition and weight. This implies that changes in global prices for specific commodities induced by El Niño should not translate one-to-one to the euro area commodity prices because that commodity may not be as relevant for the European region.

Second, we rely on local projections à la Jordà (2005), in line with the most recent literature on the economic effects of ENSO events (e.g., Cashin et al., 2017; Atems and Sardar, 2021; Adolfsen and Lappe, 2023). In this context, most of the existing evidence employs a top-down approach (estimating the impact of El Niño/La Niña on aggregate prices directly) or a disaggregated approach (the impact of El Niño/La Niña on specific components). Our methodological contribution is that we rely on a bottom-up approach, in which disaggregated effects on specific food components are correctly factored in to assess the overall effect of El Niño on aggregated prices. This is important because direct effects on prices of specific components may offset each other, and this may bias top-down results (Ferrucci et al., 2012).

Third, although our main results refer to the period from 1997 onwards, i.e., since the existence of the euro area, we complement them by constructing a new database of EU prices spanning from 1972 onwards, which allows us to test the effect of ENSO events on a larger sample that includes quite extreme ENSO episodes dating back to the 1970s.

Fourth, we show that our methodology allows for the replication of most of the existing evidence focusing on international food commodity prices.[9] This reassures us about the validity of our method and is an indirect test to show the robustness of our main results based on the euro area.

The rest of the paper is organized as follows. Section 2 provides a review of the relevant literature. In Section 3, we describe the data. We stress three important values added of our approach: First, we demonstrate the importance of focusing on EU food commodity prices when assessing the impact of ENSO events on prices in the European Union region. Second, we describe in detail which food components we consider and how we factor them in to obtain the impact of ENSO events on aggregate prices in a correct way. Third, we discuss in detail how we build backwards the EU price database. Section 4 outlines the empirical framework, and in Section 5 we present our results. Finally, Section 6 outlines a number of robustness exercises, while in Section 7 we discuss a number of possible channels that can explain our findings. Section 8 concludes with final observations and remarks.

2 Literature review

The literature on the impact of El Niño events suggests heterogeneous GDP growth and inflation responses to El Niño shocks depending on the country. As regards economic growth, tropical countries experience economic losses (mostly in the agriculture, infrastructure, and energy sectors) to the extent that they are directly affected by weather anomalies. By contrast, El Niño shocks benefit economic activity in countries in temperate regions, which are not directly exposed to these weather-related anomalies. The latter can be explained by, among other factors, trade and aggregate demand resulting from weather disruptions (Brunner, 2002; Laosuthi and Selover, 2007; Martín, 2016; Cashin et al., 2017; Smith and Ubilava, 2017; Beltran et al., 2023). Whenever asymmetries are considered, GDP growth responds negatively to El Niño shocks, while La Niña shocks do not affect economic activity (Smith and Ubilava, 2017). This literature is summarized in Table C.4 in Section C of the Appendix. The inflationary effects of El Niño shocks are also heterogeneous across countries (e.g., Brunner, 2002; Laosuthi and Selover, 2007; Ubilava and Holt, 2013; Martín, 2016; Cashin et al., 2017; Abril-Salcedo et al., 2020; Atems and Sardar, 2021; Adolfsen and Lappe,

[9] International food commodity prices are measured by the World Bank's Commodity Price Index, in the World Bank (WB) Pink Sheet Database.

2023; Romero and Saldarriaga, 2023) and are summarized in Table C.5 in Section C of the Appendix. Thus, a disaggregated perspective is crucial to correctly gauge the transmission of weather shocks to aggregate prices, as such heterogeneity can stem from the following several dimensions.

First, from a global perspective specific food commodity prices respond differently to the same shock: for instance, palm and coconut oil prices increase after El Niño shocks whereas soybeans and maize are not affected (Atems and Sardar, 2021).[10] Second, while weather anomalies are, in principle, a local phenomenon (they directly affect production and the prices of food commodities grown in specific regions/countries), in some cases their effects may spread globally to prices of highly substitutable commodities (as in the case of oils and cereals). Hence, the transmission depends on the degree of substitutability of the affected commodity goods (Ubilava and Holt, 2013; Ubilava, 2023). Third, responses differ according to the region (tropical regions are more affected, as opposed to temperate regions) and the country. For example, a shock may be transmitted to local food commodity prices, depending on the degree of diversification of the country and its size (Laosuthi and Selover, 2007), or the shock may be diluted in temperate countries since food commodities account for only a fraction of the cost of finished goods (Brunner, 2002). Fourth, the transmission to consumer prices depends, among other factors, on the share of the exposed food that is present in a country's consumer price index (CPI) basket (Cashin et al., 2017). In total, the existing evidence on the transmission of CPI inflation in Europe amounts to 0.07 percentage points (Cashin et al., 2017) or has been found to have only a marginally significant effect (for the G-7 countries) (Brunner, 2002).

3 Data

Our aim is to test the impact of extreme ENSO events on inflation in the euro area through the relevant food commodity prices for the euro area. Our variable of interest is the Oceanic El Niño Index (ONI), the main indicator for monitoring the seasonal El Niño-Southern Oscillation climate pattern, from the US National Centers for Environmental Information. It indicates the extent to which the three-month average sea surface temperature of a region of the Pacific Ocean (120°W–170°W) is significantly warmer (El Niño > 0.5 ° C) or colder (La Niña $<$ –0.5 ° C) than a historical average. Five consecutive index values above (below) the threshold of +0.5 ° C (–0.5 ° C) are considered to represent an El Niño (La Niña) episode.

[10] When accounting for asymmetry in the weather anomaly, La Niña shocks increase aggregate food commodity prices while El Niño shocks have ambiguous results, with some food commodities being positively impacted and others being negatively affected (Atems and Sardar, 2021).

As for food commodity prices for the euro area, we consider the food commodity prices of the European Union, as the euro area countries trade within the single market of the EU for products. This is an important contribution to the literature, which often studies the impact of El Niño events on international food commodity prices, based on the criterion that El Niño is a global phenomenon that affects prices worldwide. By contrast, to the extent that our object of analysis are euro area prices, we explicitly consider EU food commodities. This allows to enhance the existing literature in two directions. First, we can take into account the role of the EU's Common Agricultural Policy (CAP). The CAP smooths the transmission of shocks from international food commodity prices to European farm-gate prices. Due to this policy, European farm-gate prices have been less volatile than international food commodity

Table 1: International vs. EU food commodity price index

Group	**Item**	**WB Weight**	**EU Weight**
Food		100.0	100.0
Cereals		28.2	25.0
	Rice	8.5	
	Wheat / Durum	7.1	8.3
	Maize	11.5	
	Barley	1.2	8.3
	Rye		8.3
Vegetable oils		40.8	5.0
	Soybeans	10.1	
	Soybean oil	5.3	1.3
	Soybean meal	10.7	
	Palm oil	12.3	
	Coconut oil	1.3	
	Groundnut oil	1.1	
	Olive oil		1.3
	Rapeseed oil		1.3
	Sunflower oil		1.3
Dairy and eggs		0.0	21.0
	Raw milk		5.3
	Skimmed milk powder		5.3
	Edam cheese		5.3
	Eggs		5.3
Other food		31.0	49.0
	Sugar	9.8	9.0
	Bananas	4.9	
	Meat, beef (cows, steers)	6.8	18.0
	Meat, chicken	6.0	9.0
	Meat, pork		9.0
	Oranges	3.6	
	Coffee		4.0

Note: This table compares the composition and weights of the international food commodity price index, as available from the World Bank Pink Sheet Database, and the European Union food commodity price index (own calculations).

prices. Second, there is an important difference between aggregate EU and international food commodity prices, which stems from changes in terms of (i) composition—different food items entering into the computation of the aggregate index—as well as in terms of (ii) weights. As shown in Table 1, both the composition of the index and its weights can differ substantially, especially the "vegetable oils" component.

In this paper, we construct two datasets to test the impact of both El Niño and La Niña events on euro area inflation in different time periods. The baseline sample starts from 1997, which coincides with the establishment of the euro area.[11] This is our natural first choice, since we are interested in the impact of ENSO events on euro area inflation. In addition, we construct a larger sample that tracks euro area prices from 1970, covering a period in which the euro area did not yet exist. This larger sample gives us an additional tool to check the robustness of our results along three directions: first, comparing with the existing literature, which typically considers periods including at least the 1980s; second, including more ENSO events; third, discussing potential the implications of the CAP on euro area prices. In the rest of this section, we describe in detail which variables we consider and how we construct the relevant series of interest.

3.1 Baseline sample: European food prices since 1997

This database contains monthly food prices at different levels of the food production process (food consumer, food producer, and food commodity prices) from January 1997 to December 2023 for the euro area and for the four largest European countries (France, Germany, Italy, Spain). Food consumer prices and food producer prices are obtained from Eurostat, while for food commodity prices we rely on the European Commission's Directorate-General for Agriculture and Rural Development (DG Agri) database.

Specifically, we compile data on food prices for six food groups: cereals, dairy, fats and oils, meat, sugar, and coffee, representing close to 70% of the food consumption basket. We exclude fruit and vegetable prices as they are highly volatile, as well as fish prices as there is no reference for its commodity price at the European Union level.

Food consumer prices and food producer prices are obtained from Eurostat, using the corresponding category for each group (see Table A.1 in Section A of the Appendix). We then consider the European Union's corresponding food commodity prices available from the European Commission's DG Agri. This database provides highly detailed indexes, allowing us to construct an index for each food group commodity as the simple average of its components. For instance, the cereal food commodity price index is the mean price of feed barley, malting barley, feed maize, bread wheat, feed wheat, durum wheat, feed rye, and bread rye (refer to Table A.1 for the composition and correspondences among food price indexes).

[11] The eurozone was born with its first 11 member states on 1 January 1999. However, euro area data are gathered since 1997.

When data are not available for commodity prices, we use international commodity prices instead.[12]

As for the control variables, we include economic activity by means of the industrial production index (IPI) growth for the euro area, as available from Eurostat. We also control for oil price and fertilizer price indexes as provided by the World Bank's Pink Sheet, which we convert into euros using the spot exchange rate. Both variables are defined at the global level.

3.2 Larger sample: European food prices since 1972

We also construct a novel database from January 1971 onwards. Data on consumer prices are not available for any of the six groups, so we focus on the available aggregates: "headline" and "food and nonalcoholic beverages" consumer prices. In contrast, food commodity prices for the European region are available for this longer period of time. To extend these series backwards, we combine monthly information available from Eurostat (for the 1971–1995 period) and DG Agri (European Commission) from 1996 onwards.[13] Specifically, for data before 1996 we take the components that appear both in the DG Agri database and Eurostat and whose monthly growths have a correlation of 65% or more in the 1991–1994 period. Then, after 1996 we extend these indexes with those used in the previous section (see Table A.2 in Section A of the Appendix).

In addition, in this larger sample we also include the global food commodity price index, as available from the World Bank's Commodity Price "Pink Sheet" Database, which is available at a monthly frequency from 1960 onwards, as well as the price of its food commodity components: cereals, oils and meals, and other food and beverages, which are weighted according to the export value of each item relative to the total exports of low-income countries. All indexes are converted from US dollars to euros. Further information on the data composition and sources is available in Section B of the Appendix.

4 Methodology

We estimate the impact of an intensification of El Niño on prices by using the local projections (LPs) method of Jordà (2005), in line with the most recent literature (e.g., Atems and Sardar,

[12]This relates to only a few components: prices of rapeseed oil, sunflower oil, and soybean oils (which belong to the fats and oils category) are taken from the International Monetary Fund (IMF) database; the sugar price is provided by the WB Pink Sheet; the coffee price is from the International Coffee Organization (see Table A.1).

[13]We use monthly data from Eurostat from 1971 to December 1995, and we link these with monthly data from DG Agri from January 1996 onwards for all available components since 1971, except for egg prices, which are available from 1997 onwards.

2021 and Adolfsen and Lappe, 2023). The LPs estimator is attractive since it directly projects an outcome at the future horizon h on current covariates and does not require specification and estimation of the unknown true underlying multivariate system. For this reason, we believe that in our setting LPs is the most suitable methodology.

We consider the following specification:

$$\pi_{t+h} = \alpha + \sum_{i=1}^{j} \beta^h \cdot \pi_{t-i} + \gamma^h \cdot ni\tilde{n}o_t + \sum_{i=0}^{j} \nu^h \cdot fuel_{t-i} + \sum_{i=0}^{j} \delta^h \cdot fert_{t-i} + \sum_{i=0}^{j} \kappa^h \cdot IPI_{t-i} + \epsilon_t, \quad (1)$$

where $h = 0, ..., 18$. The variable of interest *niño* is the Oceanic El Niño Index (ONI). When we consider La Niña, we replace this variable with the absolute value of the La Niña indicator. Control variables include oil prices ($fuel_t$), fertilizer prices ($fert_t$), and the industrial production index (IPI_t) as a proxy for economic activity. All variables in the model refer to log month-on-month changes. The dependent variable is a measure of the euro area price inflation, which can be defined as consumer prices or commodity prices, and can be set at the aggregate level or disaggregated at a more granular level, depending on the specification. Additionally, we suppose that industrial production and fuel and fertilizer prices are exogenous to food commodity prices.

The shock considered in the analysis is the effect of an intensification of an El Niño event, i.e., an increase of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño event is already taking place. Since the *niño* variable takes the ONI value when an El Niño event is taking place and 0 otherwise, the intensification of an El Niño event implies a rise of γ percentage points in price growth. This interpretation applies also for La Niña shocks, since since intensifications of this event enter with the absolute value in the equation. Note, the *niño* variable enters into the equation contemporaneously, as the estimation structure of local projections allows us to calculate how it affects future values of the target variable through the impulse response function (IRF).

For each specification, we choose the optimal lag structure according to the following two-step strategy.[14] First, we estimate the model including the same number of lags—from 1 to 6 lags—for all control variables except for the El Niño variable, which enters only contemporaneously. For each specification, we compute the Hannan-Quinn information criterion, and then we choose the number of lags that corresponds to the model that performs best according to the Hannan-Quinn criterion. In a second step, for each model we exclude the

[14]For all cases, in order to find the optimum specification we apply this procedure to the first horizon regression of the LP exercise and then keep the resulting specification for all horizons.

non-significant lags from the regression (aside from the contemporaneous and the first lag, which always remain).[15] Finally, our linear projection estimations account for heteroscedasticity by using Huber-White corrected standard errors, as suggested in Montiel Olea and Plagborg-Moller (2021).

We run our estimations from different perspectives. First, we estimate the IRF of aggregate price indicators (a headline and food consumer price index, and an aggregate commodity price index) to an El Niño shock. Second, we run the analysis at the disaggregated level and provide the corresponding IRF of each of the 6 specific food groups. Third, to aggregate these results back at the more aggregated level, we proceed in two ways: using (i) a top-down approach and (ii) a bottom-up approach.

The top-down approach is what is commonly reported in the literature. Basically, it amounts to estimating the model on the aggregate price indexes, which are weighted averages of the group-specific food components. This method may lead to composition bias since direct effects on prices of specific components may be offsetting each other, as pointed out by Ferrucci et al. (2012).

This issue can be resolved by means of approach (ii). That is, in the bottom-up approach one first estimates the response of each specific component to an El Niño shock and then groups responses to an aggregate level (Ferrucci et al., 2012). In the aggregation, the median responses are aggregated by means of a weighted average. The construction of the confidence bands of the aggregate IRFs in the bottom-up approach is based on a block bootstrap procedure with fixed regressors. We jointly resample the estimated residuals of the twelve models (one model for each of the six food commodity price components plus one model for each of the food consumer price components) via a block bootstrap and combine the re-sampled residuals with the fixed regressors. This gives us a bootstrapped series of commodities and consumer food price values on which we re-estimate the models and the IRFs. We repeat the bootstrap procedure 1000 times and construct the respective confidence bands for the aggregated IRFs by aggregating the IRFs for each individual bootstrap run and then extracting the corresponding percentiles. This allows us to compute confidence bands that take into account the cross-sectional correlation of the error terms across distinct

[15] For all cases, the optimum number of lags is one lag, except for the models of dairy consumer prices (2 lags), coffee consumer prices (2 lags), and sugar consumer prices (3 lags). Hence, step two of the procedure applies only to these latter specifications. It turns out that for the model of dairy consumer prices, we keep the second lag of the dependent variable and the economic activity variable and drop the second lag of oil and fertilizer prices. For the model of coffee consumer prices, we keep only the second lag of the dependent variable and drop the second lag for all other controls; for the model of sugar consumer prices, we include up to the third lag of the dependent variable and the third lag of the activity indicator, while the rest of the controls enter with the first lag only.

food-commodity and consumer-price components. For a general description of bootstrapping methods, see Kreiss and Lahiri (2012).

5 Results

All figures and the discussion below should be read as referring to the effects of shocks defined as an increase of 1° C in the ocean surface temperature during an El Niño event (ONI) and a decrease of 1° C in the ocean surface temperature during a La Niña event (ONI)—thus, an intensification of either an El Niño or La Niña episode.

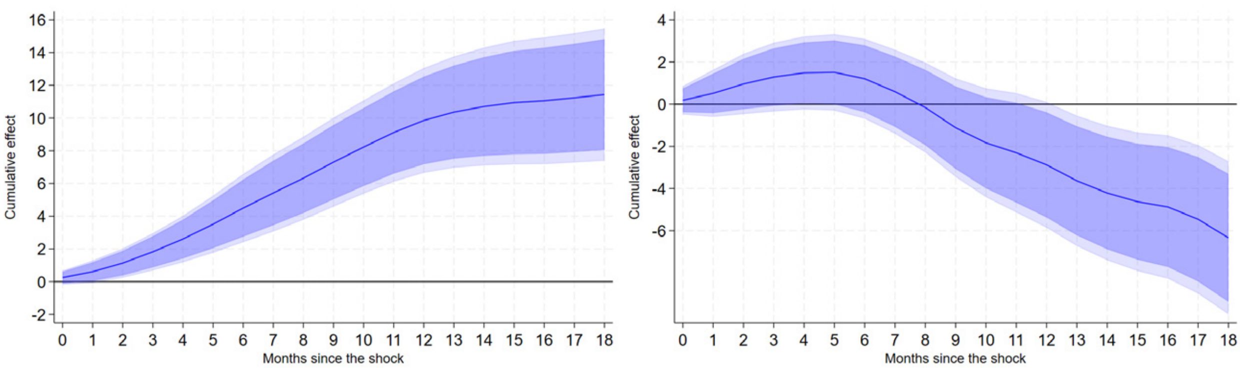
5.1 Impact on international food commodity prices

Results of both El Niño and La Niña shocks on international food commodity prices over the longer sample period (1972–2023) are in line with the existing evidence (e.g., Brunner, 2002; Cashin et al., 2017; Adolfsen and Lappe, 2023) that currently shapes discussions about the risks implied by these climate-related phenomena.

Our results show that the intensification of an El Niño event leads to a significant increase in global food commodity price growth of about 9 percentage points one year after the shock and that this cumulative effect remains significant for at least 18 months after the shock. In contrast, the impact of La Niña is barely significant in the fourth month after the shock, causing an increase in international food commodity prices somewhat below 2 percentage points (see Figure 2) and is otherwise not significant.

Section D in the Appendix reports food-group-specific effects of ENSO shocks. For the case of El Niño, most of the spike in the aggregate food commodity index is due to the

Figure 2: International commodity price responses to an intensification of El Niño/La Niña



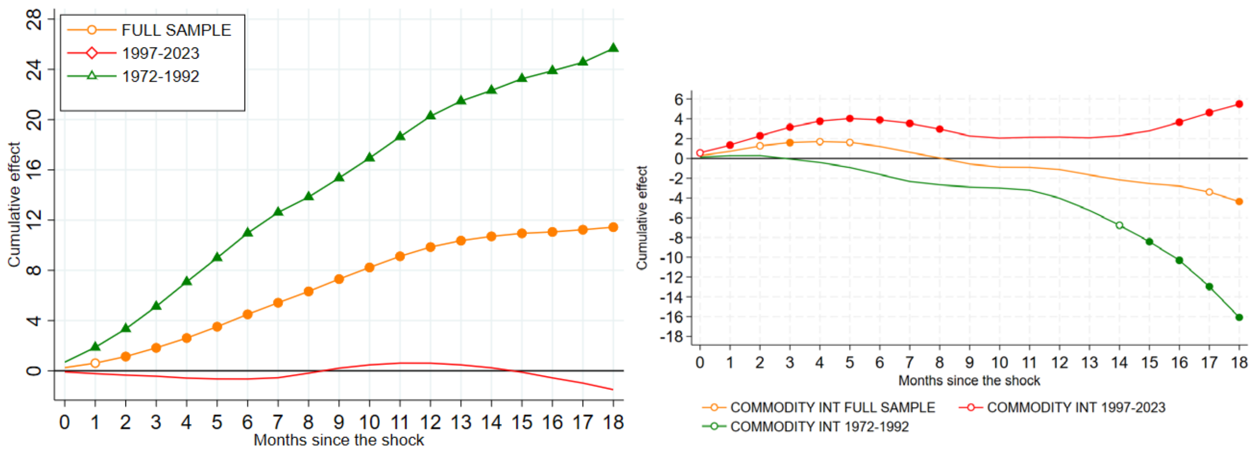
(a) El Niño **(b) La Niña**

Note: Monthly cumulative response of international commodity prices to an El Niño/La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Results are based on linear projection estimations. The shock considered in the left (right) panel is an intensification of an El Niño (La Niña), i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

response of vegetable oils, and to a lesser extent sugar and cereals. Results for El Niño are broadly consistent with the previous literature. For example, Smith and Ubilava (2017) document a decrease in global production, which then implies an increase in the price. Other studies find a positive impact on the price of cereals (Brunner, 2002; Laosuthi and Selover, 2007; Ubilava, 2017; Adolfsen and Lappe, 2023), on the global prices of vegetable oils (Ubilava and Holt, 2013), and on the price of sugar (Cashin et al., 2017). However, for a few specific items we find it hard to reconcile our results with previous ones, essentially because the existing evidence is not clear-cut, i.e., Brunner (2002), Cashin et al. (2017), and Martín (2016) show a positive impact of El Niño on coffee, while Ubilava (2012) demonstrate that the impact of El Niño depends on the type of coffee, finding a positive impact of El Niño on robusta coffee beans and a negative impact on arabica coffee beans.

Given our aim of studying the impact of the intensification of ENSO events on euro area inflation, we split the sample into two periods. The first spans from 1972 to the Common Agricultural Policy reform in 1992, known as MacSharry's reform, by which the EU moves from indirect support to farmers via guaranteed prices to direct support via income transfers. In the guaranteed prices system (before 1992), excessively high food commodity prices generate an excess of production (sustained also by excessive stocks and export subsidies) which, in turn, creates negative consequences such as the fall of farm income and soaring budget expenditure, while consumption increases at a slower pace than production (Garzon (2006)). The second period starts in 1997, shortly before the launch of the euro.

Figure 3: International commodity prices' responses to an intensification of El Niño / La Niña. Split sample.



(a) El Niño **(b) La Niña**

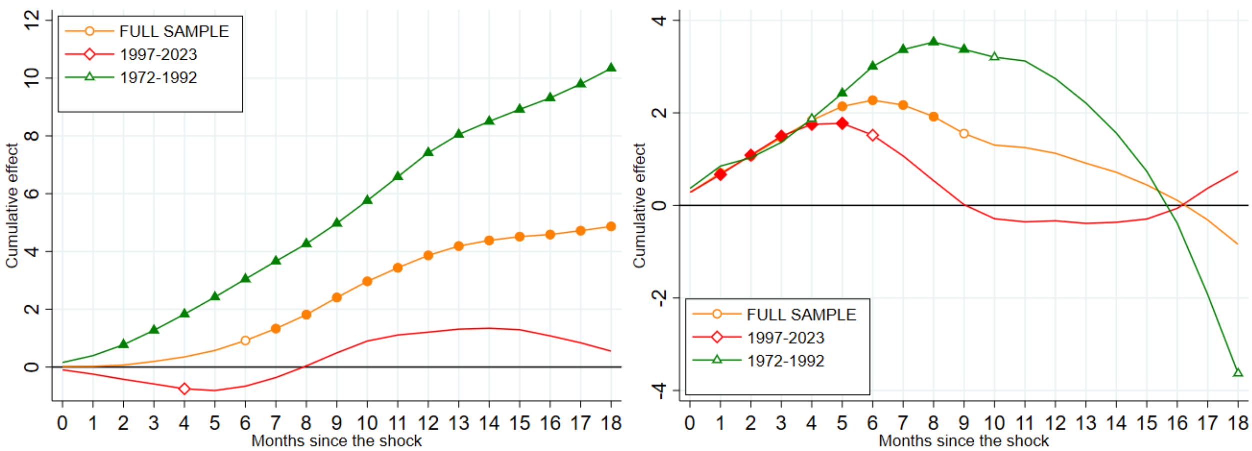
Note: Monthly cumulative response of international commodity prices to an El Niño / La Niña shocks. Full (empty) symbols indicate statistical significance at 5 (10)%; solid line, no statistical significance. Results are based on linear projection estimations with bottom-up approach. The shock considered in the left (right) column is an intensification of an El Niño (La Niña), i.e. an increase (decrease) of 1° Celsius in the ocean surface temperature in the East-Central tropical Pacific when an El Niño (La Niña) event is already taking place.

Splitting the sample reveals two striking results. First, the impact of El Niño on international commodity prices is very intense in the former period (1972–1992), i.e., an intensification of El Niño causes an increase of about 20 percentage points in international food commodity prices after 12 months. Second, and more importantly, this impact completely fades away when considering the more recent euro area sample (1997–2023). One possible explanation is that during the former period, which includes the 1980s, four strong El Niño events occurred consecutively in a closely spaced manner. In contrast, the most recent period features strong El Niño events that occurred with more time between each occurrence. Section 7 presents a discussion of further additional economic explanations.

In the case of La Niña, the sample split shows that the former period is consistent with existing findings along two dimensions: (i) La Niña tends to exert a softer effect on prices than El Niño, and (ii) if anything, La Niña slightly reduces international commodity prices. By contrast, when considering the euro area sample, La Niña yields price increases. In any case, the maximum impact takes place around the fifth month after the shock, with an increase in international food commodity prices of about 4 percentage points, which is still well below the estimated impacts of El Niño on food commodity prices. This confirms that La Niña has softer effects than El Niño. The positive effect found in the most recent period might be explained by the fact that the 2000–2012 period featured 4 strong La Niña events that happened consecutively in a closely spaced manner.

5.2 Impact on EU food commodity prices

Figure 4: EU commodity prices' responses to an intensification of El Niño / La Niña. Split sample.



(a) El Niño **(b) La Niña**

Note: Monthly cumulative response of international commodity prices to an El Niño / La Niña shocks. Full (empty) symbols indicate statistical significance at 5 (10)%; solid line, no statistical significance. Results are based on linear projection estimations with bottom-up approach. The shock considered in the left (right) column is an intensification of an El Niño (La Niña), i.e. an increase (decrease) of 1° Celsius in the ocean surface temperature in the East-Central tropical Pacific when an El Niño (La Niña) event is already taking place.

Turning to the impact on EU food commodity prices, and maintaining the sample divided into two periods, results show that in 1972–1992 El Niño significantly affected EU food commodity prices by about 7 percentage points 12 months after the shock. This effect vanishes when considering the most recent period (see Figure 4). Note that during the first period, food commodity prices were guaranteed in the European Union, such that agricultural producers had and incentive to overproduce. As long as El Niño adversely affected international production, European producers (supported by export subsidies) had an incentive to export their surpluses at international prices. The CAP reform in 1992 entailed direct support to farmers via income. Once incentives for EU farmers to overproduce and export were removed as of 1992, it is no surprise that El Niño no longer had any effect on EU commodity prices. By contrast, La Niña induces a moderated and short-lived (up to 5 months after the shock) inflationary effect on EU food commodity prices, an effect that is robust over time. This apparent inconsistency between the response of international (not significant in the short term and turning negative afterwards) and EU commodity prices (positive) in the case of a La Niña shock in the former period (until 1992) can be explained looking at the disaggregated effects (see Figure D.5 in Section D and Figure G.14 in Section G of the Appendix). In both price indicators, the positive impact comes from meat and sugar, while the negative one is due to vegetable oils. What drives the difference is the different weighting schemes used to aggregate food components: vegetable oils have a large weight in the international commodity index and a small weight the EU one. Conversely, meat counts much more in the EU commodity weighting scheme than in the international scheme (see Table 1).

5.3 Consumer price results

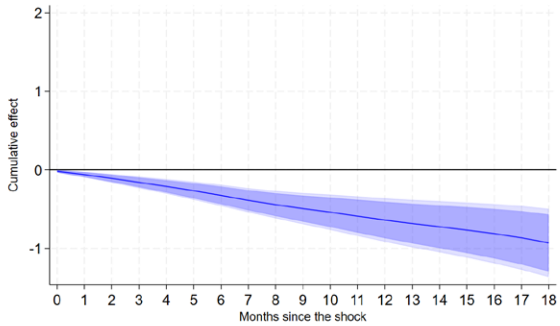
In this section, we focus on the target of our analysis, i.e., the impact of ENSO events on food inflation in the euro area, for which we consider the euro area sample since 1997. We consider a restricted definition of the HICP food price index consistent with our EU commodity price index, in which we retain 6 food groups that amount to 70% of the food consumer basket (see Figure A.1 in Section A of the Appendix).[16] In particular, we consider cereals, dairy, fats and oils, meat, sugar, and coffee and leave aside the other food groups (mineral water and juices, fruits and vegetables, and fish) due to their high volatility and the lack of consistent price data available. This approach results in a negative and significant impact of an intensification of El Niño of about 0.6–0.7 (top down–bottom up) percentage

[16]Results based on the aggregate HICP food price index are in line with our findings for our restrictive definition of the HICP food price index and are available to the reader upon request.

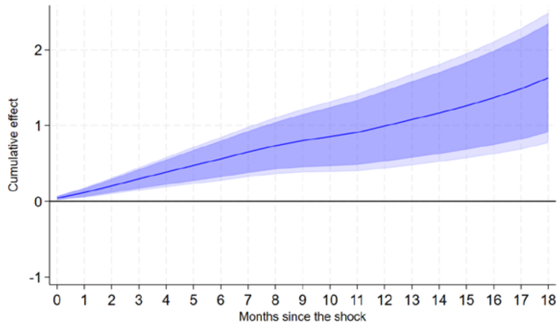
points on food inflation 12 months after the shock, as the impact on commodity prices passes through to food inflation and to headline inflation. The impact is positive and more pronounced in the case of the intensification of a La Niña event (1–1.1 percentage points) (see Figure 5).

The impact on food inflation passes through to headline inflation in a significant way.

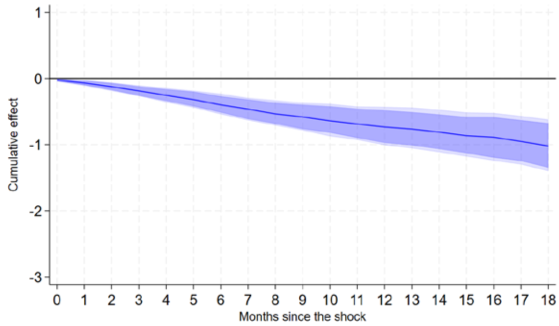
Figure 5: Response of euro area food consumer price inflation to an intensification of El Niño/La Niña



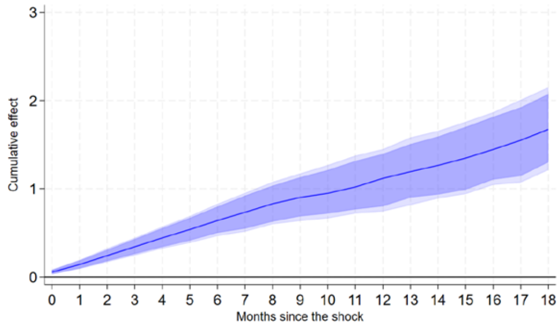
(a) El Niño. Top down



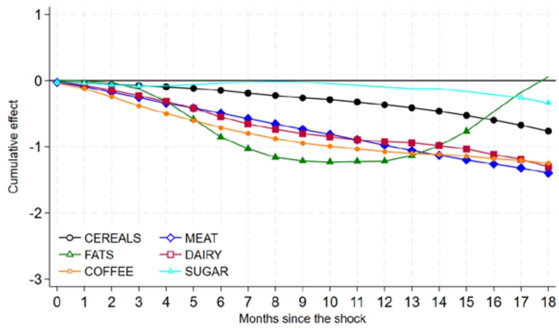
(b) La Niña. Top down



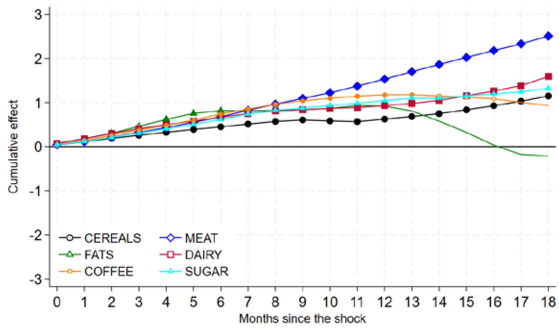
(c) El Niño. Bottom up



(d) La Niña. Bottom up



(e) El Niño. Disaggregated

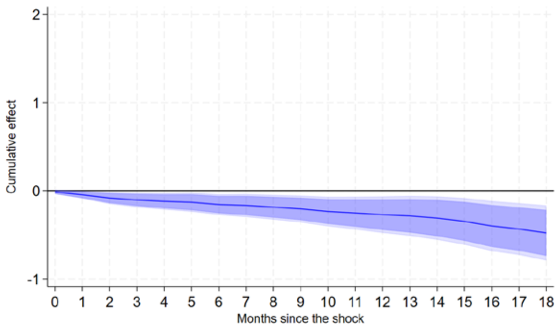


(f) La Niña. Disaggregated

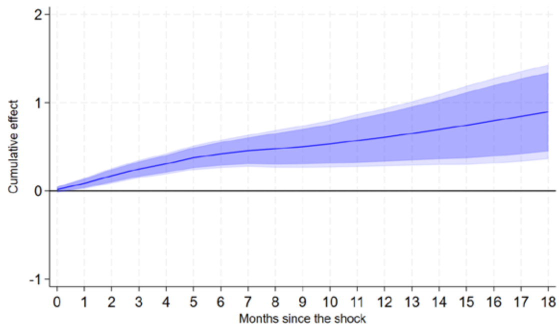
Note: Monthly cumulative response of the euro area food HICP based on our own six food group aggregate to an El Niño shock (left panels) and La Niña shock (right panels) along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. In the third row, full (empty) symbols indicate statistical significance at the 5(10)% level; a solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered in the left (right) panel is an intensification of an El Niño (La Niña), i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

Contrary to common belief, we find that El Niño weakly reduces euro area inflation by 0.3 percentage points after an intensification of an El Niño event. Besides, we find a stronger positive effect of an intensification of La Niña events of about 0.6 percentage points in cumulative terms 12 months after the shock (see Figure 6). These two results are crucial in

Figure 6: Response of euro area headline consumer price inflation to an intensification of El Niño/La Niña



(a) Headline inflation. El Niño



(b) Headline inflation. La Niña

Note: Monthly cumulative response of the euro area headline HICP to an El Niño/La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Results are based on linear projection estimations. The shock considered to the left (right) is an intensification of an El Niño (La Niña), i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

the current circumstances as (i) El Niño might not have been pushing inflation upwards as believed and, more importantly, (ii)one should take into account the risks to inflation due to an intensification of La Niña events.[17]

6 Robustness

We provide a number of robustness exercises. First, we check the robustness of the baseline results by expanding our model to follow the value chain perspective of Ferrucci et al. (2012). We do so by adding at least one lag of food producer prices and of food consumer prices in the food commodity equation, and at least the first lag of food producer prices and food commodity prices in the model for food consumer prices (Equation 1). Results are reported in Section E in the Appendix and are very similar to our main results.

As a second robustness exercise, we carry out the analysis at the country level for the most important euro area countries: Italy, France, Germany, Spain (see Section F in the Appendix). The responses of food inflation to intensifications of El Niño and La Niña for each of those countries are quite similar to the responses of the euro area as a whole.

[17]On a conjunctural note, at the time of writing, the El Niño Southern Oscillation is likely to turn into a La Niña phase this summer: there is a 65% chance that La Niña is declared between July to September 2024 and persists into the Northern Hemisphere winter of 2024–2025 (85% chance during November–January), according to NOAA's Climate Prediction Center. See the "ENSO: Recent Evolution, Current Status and Predictions" report of June 24th, 2024.

Moreover, we re-estimate the analysis for consumer prices using the larger sample (from the 1970s), for the euro area (see Section G in the Appendix). Unfortunately, data for each of the six consumer prices were not available from 1971, so we estimate the effects of El Niño and La Niña shocks on the food component of the HICP, the headline component, and commodity prices. The response of food inflation to both shocks was similar to the top-down and bottom-up results of the main exercise. However, headline inflation in the euro area does not react significantly to El Niño, although it still reacts significantly to La Niña, and commodity prices increase significantly after both phenomena.

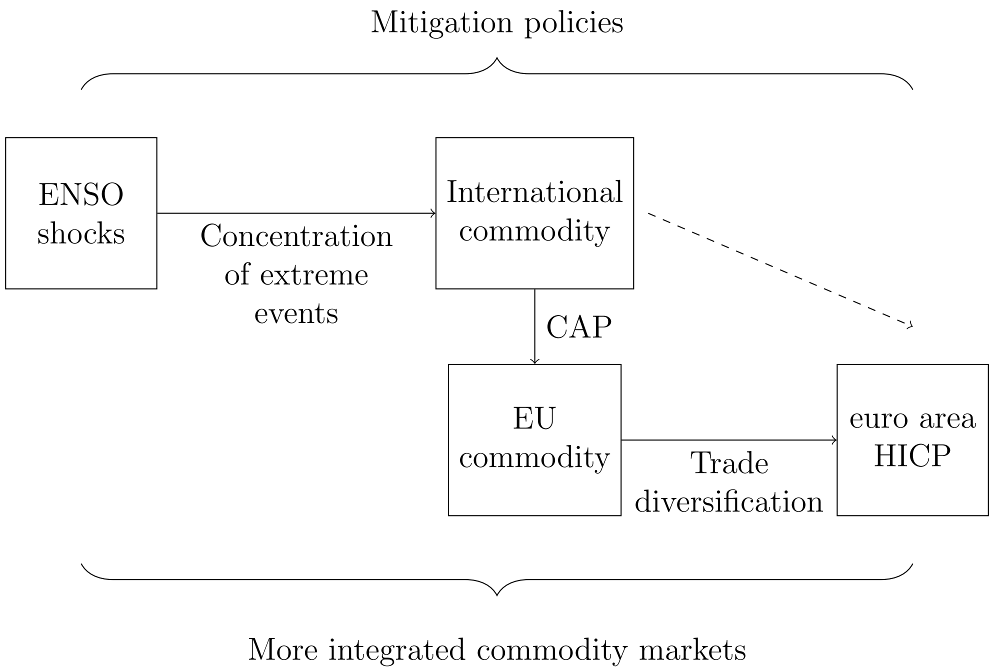
Finally, as an additional robustness analysis, we run the baseline model for the international food commodity prices adding, on one hand, the one-month change in the dollar-to-euro exchange rate, and on the other hand, changing the number of lags for food commodity, fertilizer, and oil prices and activity to 12. The resulting figures are shown in Appendix H. For El Niño shocks, adding the exchange rate to the baseline model does not change the results, but including more lags reduces their effects on food commodity price growth by around 20% relative to the baseline model. However, for La Niña, adding the exchange rate makes the short-run positive effect of the phenomenon on commodity price growth not statistically significant, while no meaningful change happens when adding 12 lags to the baseline model.

7 Discussion

With respect to food commodity prices, we show that there are nuances that have to do with composition effects (type of commodity) and sample periods (with more recent decades presenting smaller effects than the former period observed). With respect to consumer price inflation in the euro area, we show that it is crucial to account for the role of domestic agricultural policies (for the euro area, the CAP) and trade patterns. In particular, focusing on the euro area (EA) sample, an intensification of El Niño decreases EU food commodity prices by 1 pp, which in turn decreases EA headline inflation by about 0.3 pp after 12 months. As for La Niña shocks, these increase EU food commodity prices by 1.8 pp, which passes through to EA headline inflation (+0.6 pp after 12 months). While the impact of the intensification of La Niña on both international and EU food commodity prices is stable over time, the impact of El Niño shocks on international commodity prices changes over time. These are positive and large when including the 1970s and 1980s in the analysis, whereas they fade away (for international commodity prices) or even switch signs (for EU commodity prices) when restricting to the EA sample.

Our findings can be explained by a number of factors. For the convenience of the reader, we represent these arguments in the following diagram (see Figure 7) and explain them one by one.

Figure 7: Schema of channels



Note. For mitigation policies, see Section 7.2; for the concentration of extreme events, see Section 7.1; for the CAP see Section 7.4); for trade diversification, see Section 7.5; for more integrated commodity markets, see Section 7.3.

7.1 Concentration of extreme phenomena in the 1980s

A possible explanation for the smaller impact of El Niño shocks in the most recent sample might be a change in the distribution of ENSO events. In Table 2, we report descriptive statistics for all ENSO events included in this analysis. Strong ENSO events are shown in bold. For El Niño, we note that in the former period, and especially during the 1980s, there was an extreme concentration of strong El Niño phenomena (three strong El Niño events in a row within the decade from 1982 to 1992). Moreover, these events are associated with a striking variation in commodity prices. These episodes took place in a time when food inflation volatility was high and market integration was not as developed as it later became. As a consequence, the combination of a high concentration of strong El Niño events in the 1980s and the strong food price variation in that decade may have driven the results for the former sample, and hence in part explain our findings.

Table 2: Caracteristics of ENSO phenomena

EL NIÑO					LA NIÑA				
Start	End	Length†	EU comm.§	Int. comm.¶	Start	End	Length†	EU comm.§	Int. comm.¶
May-72	**Mar-73**	**12**	**13.9**	**37.8**	Jan-71	Jan-72	14	11.1	-6.1
Sep-76	Jan-77	6	4.9	3.2	**May-73**	**Jul-74**	**16**	**36.6**	**38.5**
Sep-77	Dec-77	5	2.7	9.4	**Oct-74**	**Apr-76**	**20**	**-16.2**	**-33.8**
Oct-79	Jan-80	5	3.8	1.1	Sep-83	Jan-84	6	-0.6	1.8
Apr-82	**Jun-83**	**16**	**9.4**	**11.9**	Oct-84	Aug-85	12	-7.1	-20.6
Sep-86	**Feb-88**	**19**	**-1.5**	**12.7**	**May-88**	**May-89**	**14**	**16.8**	**28.1**
May-91	**Jun-92**	**15**	**2.0**	**-4.8**	Aug-95	Mar-96	9	-4.5	8.8
Sep-94	Mar-95	8	-0.7	-2.0	**Jul-98**	**Feb-01**	33	3.5	0.1
May-97	**May-98**	**14**	**-9.9**	**-2.8**	Nov-05	Mar-06	6	9.7	4.6
Jun-02	Feb-03	10	5.0	-4.2	**Jun-07**	**Jun-08**	**14**	**13.6**	**38.7**
Jul-04	Feb-05	9	0.6	-6.4	Nov-08	Mar-09	6	-4.8	-0.1
Sep-06	Jun-07	6	1.7	8.4	**Jun-10**	**May-11**	**13**	**23.6**	**17.9**
Jul-09	**Mar-10**	**10**	**4.6**	**4.2**	Jul-11	Apr-12	11	-4.7	7.8
Oct-14	**Apr-16**	**20**	**-5.6**	**-0.7**	Aug-16	Dec-16	6	5.2	4.9
Sep-18	Jun-19	11	1.2	6.2	Oct-17	Apr-18	8	-7.2	3.9
May-23	**Dec-23**	**9**	**-5.4**	**-5.9**	Aug-20	May-21	11	19.0	36.3
					Aug-21	Jan-23	19	28.8	15.6
Avg. all events		10.9	1.7	4.3	Avg. all events		12.8	7.2	8.6
Avg. strong events (*)		14.4	1.0	6.6	Avg. strong events (*)		18.3	14.9	17.9

Note: The table shows the month and year in which events of El Niño (La Niña) start and end, the number of months for which these events took place, and the change in both the European and International food commodity prices during each event. Rows in bold refer to strong El Niño and La Niña events: A strong El Niño (La Niña) is defined as an event where the average sea surface temperature in the equatorial Pacific is at least 1.5 degrees Celsius warmer (colder) than normal.
†Length: Number of months since the start of the event.
§EU commodity price. We report the rate of change between the final month of the event and the initial month of the event.
¶International commodity price. We report the rate of change between the final month of the event and the initial month of the event.
(*) We compute the average considering only strong events, which are listed in bold in the table.

7.2 Mitigation policies and the *financialization* of food commodities

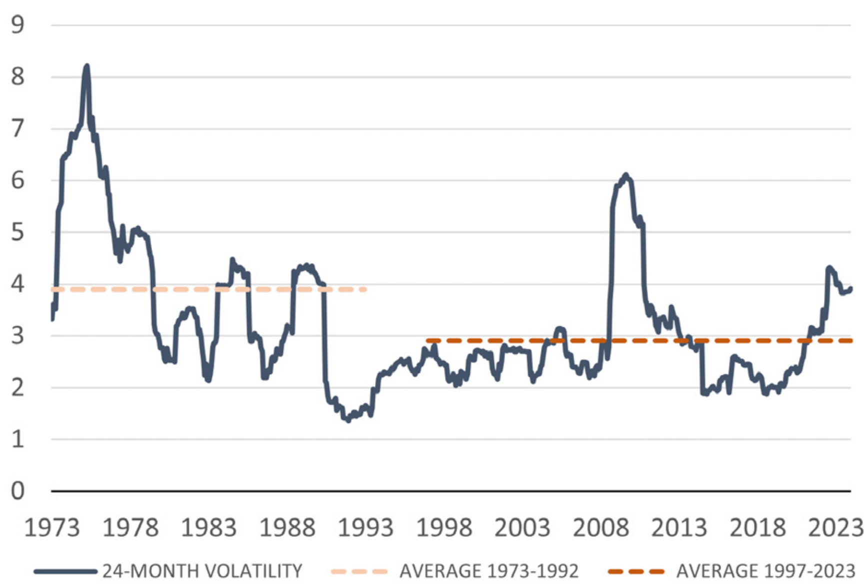
Early warning systems allow farmers to frontload or delay the planting and harvesting of crops when the formation of an El Niño event is detected, thereby mitigating potential losses (see, for instance, Adams et al., 2003; Paz et al., 2007; Raj et al., 2020). This channel could help explain our results. Indeed, fully fledged policies for anticipating, respondingto, and mitigating the effects of the ENSO phases have been called for by the Food and Agriculture Organization (FAO). For instance, FAO (2023) points to policies that helped fishers protect their boats ahead of storms or reinforced river embankments ahead of floods. The organization also calls for responding to harvest damage by distributing drought-tolerant seeds to rainfed farmers and protecting livestock health, among other strategies. The FAO also emphasizes capitalizing on the positive spillover effects of El Niño and offsetting its losses, for instance, by supplying seeds to flood-affected farmers so they can plant and regain a harvest as flood waters recede. A third step the FAO calls for is the fast delivery of the most-needed products for farmers in case of devastation, such as veterinary medicines, seeds, and water bladders, while providing cash to severely affected families to meet their most immediate needs.

Another factor that might have mitigated the impact of the El Niño-Southern Oscillation over the most recent decades is the hedging strategies on food commodity derivative markets that have developed markedly since early 2000 and which have proven to be effective in lowering risks (see, for instance, Jiang and Fortenbery, 2019; Ferreira et al., 2022; Pantoja-Robayo and Rodriguez-Guevara, 2023). This is probably related to the more intense participation of institutional investors providing further liquidity to the food commodity derivative markets since the late 1990s, known as the financialization of commodity markets, as these traders tend to adopt higher risk-return positions that generate broader hedging opportunities for commercial investors (ECB, 2011; Tang and Xiong, 2012; Cheng and Xiong, 2014).

7.3 The volatility of food commodity prices in the 1980s

Increased globalization and economic integration may also partly explain why the impact of ENSO phenomena has decreased over time. As is shown in Figure 8, food commodity price volatility has decreased since the middle of the 1980s. Gozgor (2019) shows that the level of economic integration is negatively related to both agricultural commodity price volatility and food price volatility.[18] This means that a higher degree of globalization and economic

Figure 8: 24-month volatility of international food commodity prices



Note: Own calculations. The figure shows the 24-month standard deviation of the international food commodity index. The horizontal lines show the average from 1973 to 1992 and from 1997 to 2023.

[18]The paper regresses an integration index on several variables such as agricultural and food price volatility in a panel-data setting based on 133 countries.

integration is associated with a reduction in food and agricultural price volatility. This argument suggests that food commodity prices have become less reactive to shocks, and hence the effects of ENSO climate phenomena may have become weaker.

7.4 EU's Common Agricultural Policy

The reform of the Common Agricultural Policy (CAP) in 1992, known as MacSharry's reform, may also help explain our findings, i.e., the differences in the inflationary effects of El Niño in different samples. Until 1992, the CAP guaranteed minimum food commodity prices for farm production, and farmers were offered subsidies to export. This combination encouraged excess production and trade out of Europe. Hence, in this setting, when international food commodity prices increased due to El Niño shocks, European farmers had an incentive to export to international markets. As a consequence, food commodity supply decreased in the European market and EU food commodity prices increased due to competition effects. After 1992 this policy changed, such that support to farmers became direct – through rents – and minimum prices and export subsidies were no longer guaranteed.

7.5 Trade diversification in the euro area

The working hypothesis here is that trade patterns may have helped mitigate the effect of ENSO events on EU food commodity prices over time. To shed light on this potential channel, we provide some facts on the evolution of EU trade by food group, in line with our main analysis.[19] For this descriptive exercise, we focus on three food groups, namely cereals, meat, and dairy, which together represent 50% of the EU consumer food basket.

For each food group and year, we compute the import share, defined as the sum of shares of EU imports coming from countries that are affected or not by ENSO phenomena (either El Niño or La Niña) out of the total EU imports, for the corresponding food category. We also compute the Herfindahl-Hirschman Index (HHI) in order to measure the degree of import concentration across trade partners, distinguishing between the import concentration from countries that are affected by ENSO phenomena and the import concentration from other countries that are not directly affected by ENSO phenomena.

The following dynamics stand out. For each food group, the share of imports from ENSO-affected countries has decreased since 2000 to the benefit of the import share from ENSO-neutral countries, which has increased (see Figure 9). This means that since the 2000s, the

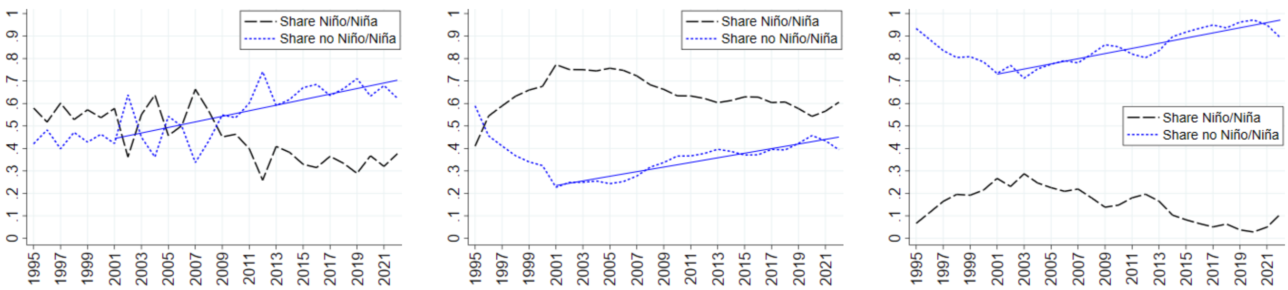
[19]For details on the data and methodology, see Section I in the Appendix.

EU has traded more intensively with ENSO-neutral countries, shifting imports away from ENSO-affected countries. In terms of concentration, for dairy and cereals we observe an increase in the overall concentration index since the 2000s, resulting from both the increased concentration within the market segment of imports from ENSO-neutral countries and the broader gap in import shares to the benefit of this group of countries (see Figure 10). [20]

Instead, for meat the overall concentration index has remained broadly stable since the 2000s, as a result of two offsetting trends: the increase in concentration within the segment of ENSO-neutral countries and the narrowing of the import share gap to the benefit of this group of countries, which lowers the concentration.

All in all, this descriptive evidence is consistent with the working hypothesis that EU countries may have implemented trade strategies that protect the EU market from the food price volatility implied by ENSO shocks along two dimensions: (i) by shifting the import share from countries affected by ENSO shocks towards countries not affected by these phenomena and (ii) by concentrating within the segment of the import market of countries not

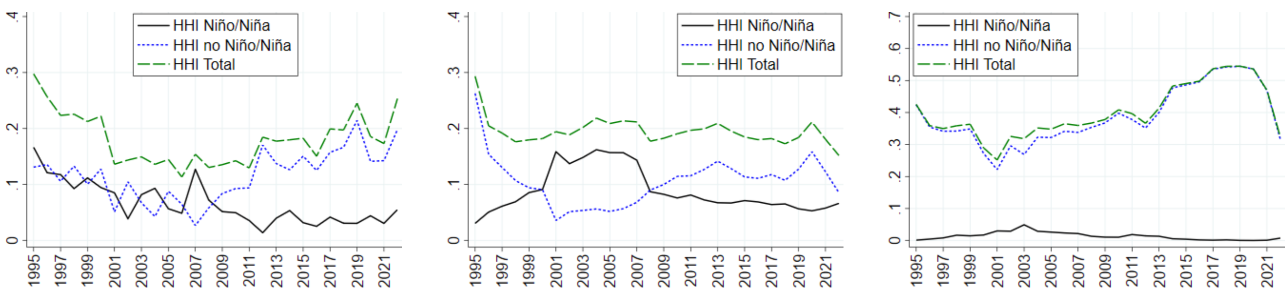
Figure 9: Import share by food group



(a) Cereals (b) Meat (c) Dairy

Note. Source: BACI International Trade Database at the Product-Level by CEPII (BACI-CEPII). These figures display import share indexes as described in Section I of the Appendix. The solid thin blue line depicts the linear trend of the import share from ENSO-affected countries since 2001, to facilitate the reading of the graph.

Figure 10: Import concentration by food group



(a) Cereals (b) Meat (c) Dairy

Note. Source: BACI-CEPII. These figures display import concentration indexes as described in Section I of the Appendix.

[20] This follows from the fact that the increase in the overall concentration index is coupled, firstly, with the increase in import shares from ENSO-neutral countries and, secondly, with the rise in concentration in this segment of countries in the period when concentration in the ENSO-affected group remains virtually stable.

affected by ENSO shocks, i.e., importing more from fewer ENSO-neutral countries. This may help explain our findings. However, this conclusion has to be taken with a grain of salt as trade data cover only the most recent period and, hence, we are extrapolating the trade dynamics backwards.

8 Conclusions

This paper investigates the effect of El Niño and La Niña events on euro area inflation. We focus on a comprehensive granular database covering both euro area consumer prices and European Union (EU) food commodity prices. We also construct a new database of EU prices from 1972 onwards, allowing us to test the effect of ENSO events on a larger sample. We assess the impact of these climatic events by means of local projections techniques, following the methodology of Jordà (2005).

Our findings based on data from 1997 onwards show that an intensification of an El Niño event actually results in a decrease in euro area headline inflation of approximately 0.3 percentage points 12 months post-shock. In stark contrast, a La Niña event leads to an increase in headline inflation of 0.6 percentage points 12 months after the shock. When we extend our analysis to include data dating back to the 1970s, we identify the 1980s as a pivotal decade demonstrating a significant positive impact of El Niño on both global and European Union food commodity prices. This finding aligns with the existing literature. Interestingly, this trend reversed post-1997.

All in all, our results suggest that El Niño may not have been a key driver of upward inflation pressures in the euro area during the most recent episode of high inflation. Nevertheless, policymakers should remain alert to the inflation risk associated with an intensification of the impending La Niña event.

This paper contributes to the existing literature by filling a gap in the study of the impact of ENSO events on euro area prices. Our bottom-up approach, which factors in disaggregated effects on specific food components to assess the overall effect of El Niño and La Niña on aggregated prices, provides a more nuanced understanding of these phenomena. Furthermore, our methodology allows us to replicate most of the existing evidence on international food commodity prices, thereby validating our approach and indirectly testing the robustness of our main results based on the euro area.

References

Abril-Salcedo, Davinson Stev, Luis Fernando Melo-Velandia and Daniel Parra-Amado. (2020). "Nonlinear relationship between the weather phenomenon El niño and Colombian food prices". *Australian Journal of Agricultural and Resource Economics*, 64(4), pp. 1059-1086. https://doi.org/https://doi.org/10.1111/1467-8489.12394

Adams, Richard M, Laurie L Houston, Bruce A McCarl, Mario Tiscareño, Jaime Matus and Rodney F Weiher. (2003). "The benefits to mexican agriculture of an el niño-southern oscillation (enso) early warning system". *Agricultural and Forest Meteorology*, 115(3-4), pp. 183-194. https://doi.org/10.1016/s0168-1923(02)00201-0

Adolfsen, Jakob Feveile, and Marie-Sophie Lappe. (2023). "Risks to global food commodity prices from El Niño". *Economic Bulletin Boxes*, 6. https://www.ecb.europa.eu/press/economic-bulletin/focus/2023/html/ecb.ebbox202306_01~36e78cc75e.en.html

Andrian, Leandro, Carlos Miguel Álvarez, Augusto Chávez, Emily Díaz, Cristhian Larrahondo, Luis Fernando Serrudo, Miguel Alzamora and Daniel Cárdenas. (2024). "Efectos del fenómeno "El Niño" en la Región Andina". Technical report, january 2024, Interamerican Development Bank. https://sinia.minam.gob.pe/sites/default/files/archivos/public/docs/Efectos-del-FEN-en-la-Region-Andina--una-aproximacion-empirica.pdf

Atems, Bebonchu, and Naafey Sardar. (2021). "Exploring asymmetries in the effects of El Niño-Southern Oscillation on U.S. food and agricultural stock prices". *The Quarterly Review of Economics and Finance*, 81, pp. 1-14. https://doi.org/https://doi.org/10.1016/j.qref.2021.04.013

Baker, Scott R., Nicholas Bloom and Steven J. Davis. (2016). "Measuring Economic Policy Uncertainty". *The Quarterly Journal of Economics*, 131(4), pp. 1593-1636. https://doi.org/10.1093/qje/qjw024

Beltran, Paula, Metodij Hadzi-Vaskov and Ilya Stepanov. (2023). "Online Annex 2. El Niño's Potential Impact on Latin America". Regional Economic Outlook Western Hemisphere Online Annex 2, IMF Washington, D.C. https://www.imf.org/-/media/Files/Publications/REO/WHD/2023/October/English/onlineannex-2-en.ashx

Borrallo, Fructuoso, Lucía Cuadro-Sáez, Águeda Gras-Miralles and Javier J. Pérez. (2024). "The transmission of shocks to food and energy commodity prices to food inflation in the euro area". *Applied Economics Letters*, pp. 1-6. https://doi.org/10.1080/13504851.2024.2369711

Brunner, Allan D. (2002). "El niño and world primary commodity prices: Warm water or hot air?" *The Review of Economics and Statistics*, 84(1), pp. 176-183. http://www.jstor.org/stable/3211747

Cashin, Paul, Kamiar Mohaddes and Mehdi Raissi. (2017). "Fair weather or foul? the macroeconomic effects of el niño". *Journal of International Economics*, 106, pp. 37-54. https://doi.org/https://doi.org/10.1016/j.jinteco.2017.01.010

Cheng, Ing-Haw, and Wei Xiong. (2014). "Financialization of commodity markets". *Annual Review of Financial Economics*, 6(1), p. 419-441. https://doi.org/10.1146/annurev-financial-110613-034432

ECB. (2011). "Financialisation of Commodities". *Financial Stability Review*, Tech. rep., ECB. 2, pp. 31-32. https://www.ecb.europa.eu/press/financial-stability-publications/fsr/focus/2011/pdf/ecb~6fdfdfce1c.fsrbox201112_04.pdf

ECB. (2023). “Eurosystem staff macroeconomic projections for the euro area.” Technical report, European Central Bank. https://www.ecb.europa.eu/press/projections/html/ecb.projections202312_eurosystemstaff~9a39ab5088.en.html

FAO. (2023). “El Niño: Anticipatory Action and Response Plan, October 2023–March 2024”. Tech. rep., FAO. https://doi.org/10.4060/cc8496en

Ferreira, George Lucas Máximo, Julyerme Matheus Tonin and Alexandre Florindo Alves. (2022). “Impacts of el niño southern oscillation on hedge strategies for brazilian corn and soybean futures contracts”. *Revista de Economia e Sociologia Rural*, 60(spe). https://doi.org/10.1590/1806-9479.2021.250643

Ferrucci, Gianluigi, Rebeca Jiménez-Rodríguez and Luca Onorante. (2012). “Food Price Pass-Through in the Euro Area: Non-Linearities and the Role of the Common Agricultural Policy”. *International Journal of Central Banking*, 8, pp. 179-218. https://www.ijcb.org/journal/ijcb12q1a9.htm

Garzon, Isabelle. (2006). *The MacSharry Reform* (1992). Palgrave Macmillan UK, pp. 61-75. https://doi.org/10.1057/9780230626577_6

Gozgor, Giray. (2019). “Effects of the agricultural commodity and the food price volatility on economic integration: an empirical assessment”. *Empirical Economics*, 56(1), p. 173-202. https://doi.org/10.1007/s00181-017-1359-6

Hsiang, Solomon M., and Kyle C. Meng. (2015). “Tropical Economics”. *American Economic Review*, 105(5), pp. 257-61. https://doi.org/10.1257/aer.p20151030

Iizumi, Toshichika, Jing-Jia Luo, Andrew J. Challinor, Gen Sakurai, Masayuki Yokozawa, Hirofumi Sakuma, Molly E. Brown and Toshio Yamagata. (2014). “Impacts of El Niño Southern Oscillation on the global yields of major crops.” *Nature Communications*, 5(3712). https://doi.org/10.1038/ncomms4712

Jiang, Jingze, and T. Randall Fortenbery. (2019). “El Niño and La Niña induced volatility spillover effects in the U.S. soybean and water equity markets”. *Applied Economics*, 51(11), pp. 1133-1150. https://doi.org/10.1080/00036846.2018.1524980

Jordà, Òscar. (2005). “Estimation and inference of impulse responses by local projections”. *American Economic Review*, 95(1), p. 161-182. https://doi.org/10.1257/0002828053828518

Kreiss, Jens-Peter, and Soumendra Nath Lahiri. (2012). “Bootstrap Methods for Time Series”. *Handbook of statistics*, 30, pp. 3-26. https://doi.org/https://doi.org/10.1016/B978-0-444-53858-1.00001-6

Laosuthi, Thanarak, and David D Selover. (2007). “Does el niño affect business cycles?” *Eastern Economic Journal*, 33(1), p. 21-42. https://doi.org/10.1057/eej.2007.2

Martín, Lucía. (2016). *¡Es Niño!: Impacto económico en la Región Andina*. https://doi.org/10.18235/0000234

Montiel Olea, José-Luis, and Mikkel Plagborg-Moller. (2021). “Local projection inference is simpler and more robust than you think”. *Econometrica*, 89(4), pp. 1789-1823. https://arxiv.org/pdf/2007.13888

Pantoja-Robayo, Javier, and David Rodriguez-Guevara. (2023). “The climate effect on colombian coffee prices and quantities based on risk analysis and the hedging strategy in discrete setting approach”. *Agris on-line Papers in Economics and Informatics*, 15(4), p. 97-107. https://doi.org/10.7160/aol.2023.150407

Paz, Joel O., Clyde W. Fraisse, Luther U. Hatch, Axel Y. Garcia y Garcia, Larry C. Guerra, Oxana Uryasev, John G. Bellow, James W. Jones and Gerrit Hoogenboom. (2007). "Development of an ENSO-based irrigation decision support tool for peanut production in the southeastern US". *Computers and Electronics in Agriculture*, 55(1), pp. 28-35. https://doi.org/https://doi.org/10.1016/j.compag.2006.11.003

Peersman, Gert. (2022). "International food commodity prices and missing (dis)inflation in the euro area". *The Review of Economics and Statistics*, 104(1), p. 85-100. https://doi.org/10.1162/rest_a_00939

Raj, Esack Edwin, Rajagopal Raj Kumar and K. V. Ramesh. (2020). "El niño–southern oscillation (enso) impact on tea production and rainfall in south india". *Journal of Applied Meteorology and Climatology*, 59(4), p. 651-664. https://doi.org/10.1175/jamc-d-19-0065.1

Romero, José Vicente, and Sara Naranjo-Saldarriaga. (2023). "Weather Shocks and Inflation Expectations in Semi-Structural Models". *Latin American Journal of Central Banking*, p. 100112. https://doi.org/https://doi.org/10.1016/j.latcb.2023.100112

Smith, Sarah C., and David Ubilava. (2017). "The El Niño Southern Oscillation and economic growth in the developing world". *Global Environmental Change*, 45, pp. 151–164. https://doi.org/https://doi.org/10.1016/j.gloenvcha.2017.05.007

Tang, Ke, and Wei Xiong. (2012). "Index investment and the financialization of commodities". *Financial Analysts Journal*, 68(6), p. 54-74. https://doi.org/10.2469/faj.v68.n6.5

Ubilava, David. (2011). "El niño, la niña, and world coffee price dynamics". *Agricultural Economics*, 43(1), p. 17-26. https://doi.org/10.1111/j.1574-0862.2011.00562.x

Ubilava, David. (2017). "The ENSO Effect and Asymmetries in Wheat Price Dynamics". *World Development*, 96(C), pp. 490-502. https://doi.org/10.1016/j.worlddev.2017.03.031

Ubilava, David. (2023). *What this year's El Niño means for wheat and global food supply*. The Conversation. https://theconversation.com/what-this-years-el-nino-means-for-wheat-and-global-food-supply-209386

Ubilava, David, and Matt Holt. (2013). "El Niño southern oscillation and its effects on world vegetable oil prices: assessing asymmetries using smooth transition models". *Australian Journal of Agricultural and Resource Economics*, 57(2), pp. 273-297. https://doi.org/https://doi.org/10.1111/j.1467-8489.2012.00616.x

Yeager Stephen G., Nan Rosenbloom, Anne A. Glanville, Xian Wu, Isla Simpson, Hui Li, Maria J. Molina, Kristen Krumhardt, Samuel Mogen, Keith Lindsay, Danica Lombardozzi, Will Wieder, Who M. Kim, Jadwiga H. Richter, Matthew Long, Gokhan Danabasoglu, David Bailey, Marika Holland, Nicole Lovenduski, Warren G. Strand, and Teagan King. (2022). "The Seasonal-to-Multiyear Large Ensemble (SMYLE) prediction system using the Community Earth System Model version 2". *Geoscientific Model Development*, 15(16), pp. 6451-6493. https://doi.org/10.5194/gmd-15-6451-2022

Zebiak, Stephen E., Ben Orlove, Ángel G. Muñoz, Catherine Vaughan, James Hansen, Tara Troy, Madeleine C. Thomson, Allyza Lustig, and Samantha Garvin. (2015). "Investigating El Niño-Southern Oscillation and society relationships". *WIREs Climate Change*, 6(1), pp. 17-34. https://doi.org/https://doi.org/10.1002/wcc.294

Appendix

A Food components across sources

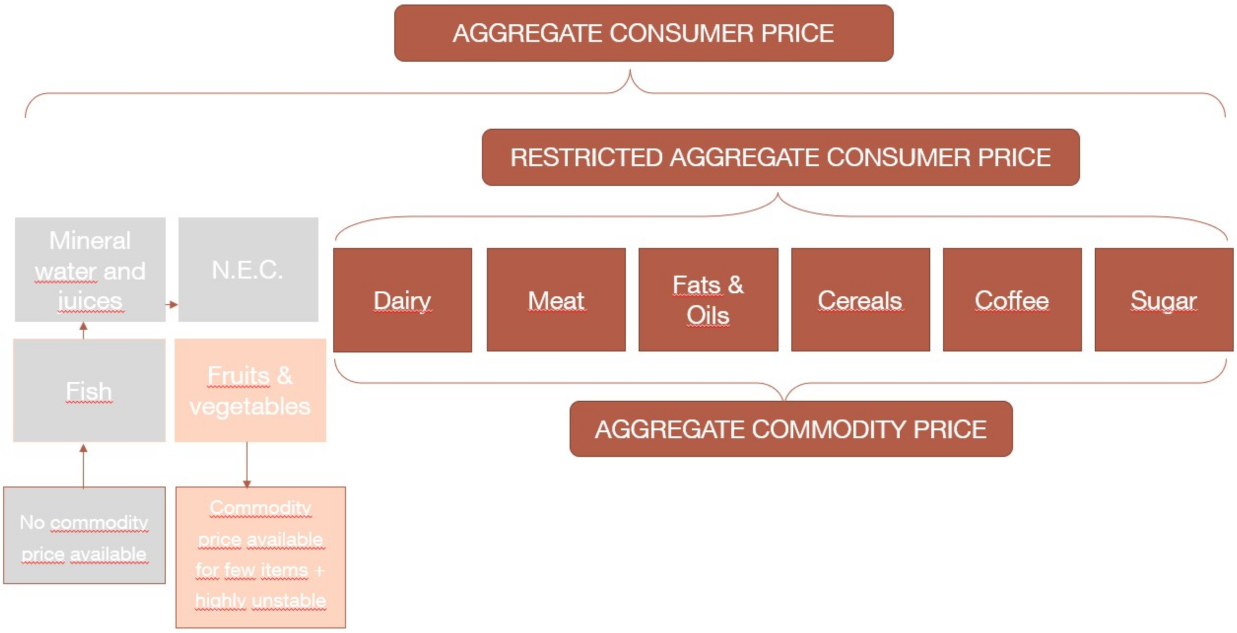
Table A.1: Food prices: definitions and subcomponents across food groups and production processes

	Commodity price	Producer price	Consumer price
Cereals	feed barley, malting barley, feed maize, bread wheat, feed wheat, durum wheat, feed rye, and bread rye	Cereals: manufacture of grain mill products, starches and starch products	Cereals: bread and cereals
Dairy	Skim milk powder, raw milk, butter, cheddar, edam, and eggs	Manufacture of dairy products	Dairy: milk, cheese, and eggs
Fats and Oils	Rapeseed oil, sunflower oil, soybean oil—the three of them from the IMF—and olive oil	Manufacture of oils and fats	Oils and fats
Meat	Cows, steers, pigs class E, and chicken	Production of meat and poultry meat products	
Sugar	White sugar (from WB Pink Sheet since May 2023)	Manufacture of sugar	Sugar: sugar, jam, honey, syrups, chocolate, and confections
Coffee	Coffee (from the International Coffee Organization)	Processing of tea and coffee	Coffee, tea, and cocoa

Table A.2: Food commodity price indexes before and after 1996

	Components of commodity prices before 1996	Components of commodity prices after 1996
Cereals	feed rye, durum wheat, feed barley, and feed maize (before 1991, feed maize comes from the Pink Sheet)	feed barley, malting barley, feed maize, bread wheat, feed wheat, durum wheat, feed rye, and bread rye
Dairy	Skim milk powder, raw milk, edam, and eggs	Skim milk powder, raw milk, butter, cheddar, edam, and eggs
Fats and Oils	Soybean oil until 1980, then also rapeseed oil and sunflower oil	Rapeseed oil, sunflower oil, soybean oil—all three from the IMF—and olive oil
Meat	Cows, pigs class E and chicken	Cows, steers, pigs class E, and chicken
Sugar	Sugar (from the International Financial Statistics up to 1979 and IMF commodity prices from 1980 onwards)	White sugar (from WB Pink Sheet since May 2023)
Coffee	Coffee (robusta, from the Pink Sheet)	Coffee (from the International Coffee Organization)

Figure A.1: Correspondence of EU commodity prices and euro area consumer prices



Note: Own elaboration. N.E.C. means not elsewhere classified.

B Detailed commodity food price data since 1972

This section describes in detail the sources and procedures used to construct the variables since 1972.

Global food commodity prices. Monthly data on global food commodity price indexes are obtained from the World Bank's Pink Sheet. We include in the database the food aggregate as well as each of the food groups and items. Food items are aggregated into groups and the total food aggregate according to the average export value weights in emerging economies in the 2002–2004 period. All indexes are converted from US dollars to euros.

European Union food commodity prices. To construct this aggregate price index, we proceed as follows:

- We consider monthly data for cereals, meat, and dairy from 1972 to 2023. We concentrate on these three food groups due to data availability restrictions for their components: cereals (rye, durum, feed barley), meat (heifers, chicken, cows, pigs), and dairy and eggs (raw milk, skimmed milk powder, edam cheese, and eggs). We use DG Agri monthly data on food commodity prices from 1991 onwards, and we complete the database with the equivalent Eurostat monthly prices, available on a monthly basis from 1971 to 1995/99 depending on the specific food item. All prices are expressed in euros.

- We include in our database the food items showing a correlation between growth rates from the two data sources higher than 0.65 during the overlapping period (1991–1994). For instance, edam cheese prices show the lowest correlation of 0.66 between the growth rates available in Eurostat and DG Agri. Cows' meat shows the highest (0.95).

- For each food item, we use the Eurostat price index from January 1971 to December 1995 normalized to 100 in January 1971.[21] Then, we continue the series applying to the last observation available from the Eurostat data the corresponding growth rate in DG Agri.

- Each food group price index is calculated as the simple average across its food items' prices. The aggregate food commodity price for the European Union is the weighted average of the food group price indexes, according to the weight of each category in the food consumption basket in 2021 (0.31 for cereals, 0.43 for meat, and 0.26 for dairy and egg products).

[21] For eggs, we use the Eurostat data until 1996

- To ensure that this procedure is correct, we compare the resulting food commodity aggregate price index growth rate to the equivalent price series in Eurostat (available at a yearly frequency from 2000 onwards). Figure B.2 shows that the two series are very similar over the last two decades, ensuring that our procedure is valid.

Euro area consumer prices.

The harmonized index of consumer prices (HICP) is obtained from Eurostat, whereas food consumer prices are obtained from the OECD, starting in 1971, and we link these with Eurostat data from 1996 onwards.

- First, we construct a long time series of the energy component of the consumer price index for the European region by aggregating the energy indexes of France, Germany, and Italy, which are available from the OECD database. This series is considered a proxy for the energy index of the euro area. In the aggregation, we implement the Eurostat methodology.

- Second, we construct a long time series of the HIPC energy component for the euro area by exploiting all available data. Data for the energy component of the consumer price index for the euro area is available from the OECD database from 1977 onwards and from Eurostat from 1990 onwards. To stretch the Eurostat series back to 1971, we proceed as follows. We extend the Eurostat energy index for the euro area backwards until 1977 by applying the growth rate of the OECD energy index for the euro area. Then, we extend the resulting series back to 1971 by applying the growth rate of the aggregate energy index based on OECD data for Italy, France, and Germany computed in the previous step.

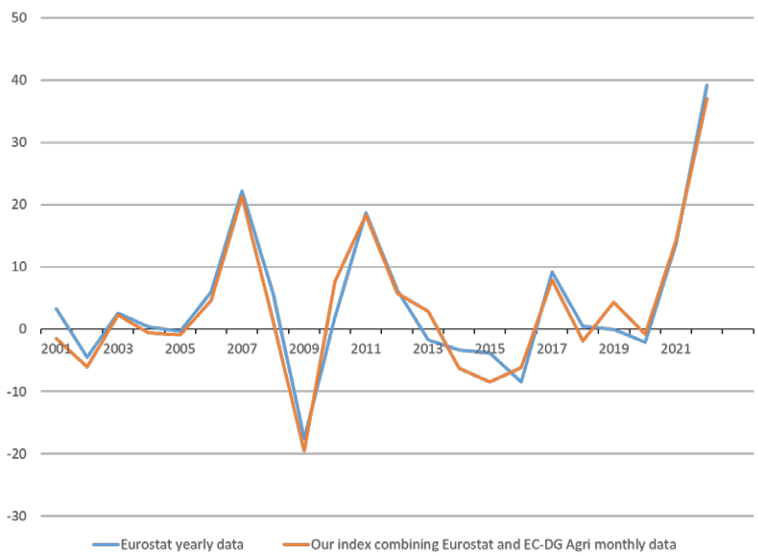
- Then, once we have long time series for the (i) headline HICP, (ii) food HICP, and (ii) energy HICP for the euro area since 1971, we construct the core HICP index for the euro area by first adding up (ii) and (iii) and then subtracting the resulting sum from the headline HICP. Note, for these operations we implement the Eurostat methodology.

Other control variables.

- **Crude oil prices and the fertilizer price index** are obtained from the World Bank's Pink Sheet and converted into euros.

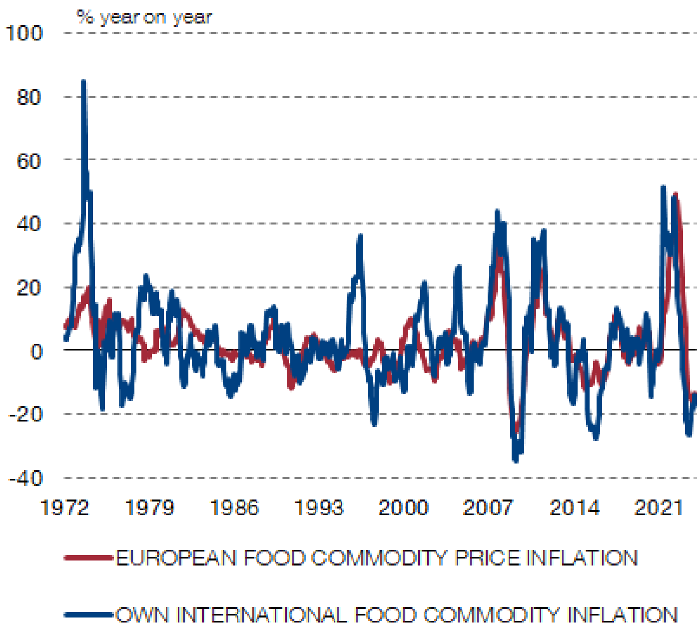
- **Economic activity for the euro area**. In the European region-based estimations, we also control for the economic activity in the European region by including as a regressor the monthly industrial production index (IPI) growth in the region. Since we need a large time series from the 1970s onwards, we construct our own variable by combining different data. Most of the data are provided by the OECD, except for the most recent data (December 2023), which are obtained from the Eurostat database. In all cases, we consider industrial production excluding construction. For January 1971 to July 1974, we use the IPI for Europe (OECD), and we link this with the IPI for the euro area for August 1975 to November 2023. For the last datapoint (December 2023), which at the time of writing has not yet been released in the OECD database, we use industrial production excluding construction, obtained from Eurostat.

Figure B.2: Comparison between our price index and Eurostat data



te: The comparison starts from 2000 onwards, since this is when Eurostat started reporting annual data. show that our price index, which combines monthly data from Eurostat and the European Commission - AGRI, when aggregated at a yearly frequency shows a very similar evolution to the original yearly price ›x of Eurostat.

Figure B.3: European and world food commodity price inflation



Note: Own calculations.

Table B.3: Components of the global food commodity price index (WB)

Commodity component	Time availability
Rice	1960M1-2023M12
Wheat	1960M1-2023M12
Maize	1960M1-2023M12
Barley	1960M1-2020M8
Soybeans	1960M1-2023M12
Soybean oil	1960M1-2023M12
Soybean meal	1960M1-2023M12
Palm oil	1960M1-2023M12
Coconut oil	1960M1-2023M12
Groundnut oil	1960M1-2023M12
Sugar	1960M1-2023M12
Bananas	1960M1-2023M12
Beef	1960M1-2023M12
Chicken	1960M1-2023M12
Oranges	1960M1-2023M12
Cocoa (*)	1960M1-2023M12
Coffee, robusta (*)	1960M1-2023M12
Tea, average 3 auctions (*)	1960M1-2023M12
Fish meal (**)	1979M1-2023M12
Palm kernel oil (**)	1996M1-2023M12
Rapeseed oil (**)	2002M2-2023M12
Sunflower oil (**)	2002M2-2023M12
Lamb (**)	1971M1-2023M10
Mexican shrimp (**)	1960M1-2023M10
Sorghum (***)	1960M1-2020M08
Groundnuts (***)	1980M1-2023M12

Note: These are the food commodity prices that compose the global food commodity price index as provided by the World Bank.
(*) denotes subcomponents that are part of the World Bank Beverage Commodity Price Index.
(**) denotes subcomponents that are not part of either the Food or the Beverage Commodity Indexes.
(***) indicates weights considered in the Food Commodity Price Index.

C Literature review

Table C.4: Literature review: Impact of El Niño on GDP growth

	Results	Coverage	El Niño	Method	Sample	Controls
Beltran et al. (2023)	Heterogeneous effect on GDP across countries: negative for CAPDR(∗), Colombia, Ecuador, Peru; positive for Argentina, Paraguay, Uruguay; ambiguous on Bolivia, Brazil, Chile, Mexico	Latin America	Oceanic Niño Index (ONI)	Local projections in cross-country panel	Not mentioned	account for other shocks (but do not mention which ones)
Cashin et al. (2017)	Heterogeneous responses across countries: negative but short-lived for Australia, Chile, Indonesia, India, Japan, New Zealand, South Africa; positive for the US, Europe, China	Global: 21 countries/regions in an interlinked model	Southern Oscillation Index (SOI)	GVAR model	1979–2013	inflation, real exchange rate, short-term and long-term interest rates, real equity prices, real energy and non-fuel commodity prices
Martín (2016)	GDP loss that ranges between 0.5–1.5 pp depending on the country, mostly concentrated in agriculture, infrastructure, and energy sector.	Bolivia, Peru, Ecuador, Colombia, Venezuela	Southern Oscillation Index (SOI)	country-level AR models	not defined, but includes 1982–1998	economic crisis dummies
Brunner (2002)	positive effect of 0.5 pp on GDP growth in the G-7 countries, significant at the 10% level. Possible explanations: increase in investment spending or in aggregate demand from other countries devastated by El Niño (e.g., food, housing materials, machinery, equipment).	Global: aggregate G-7 countries	SST or SOI anomaly measure	VAR models	1963 - 1998	average CPI inflation rate, average GDP growth rate, international real commodity price inflation

Continued on next page

Table C.4: Literature review: Impact of El Niño on GDP growth (Continued)

	Results	Coverage	El Niño	Method	Sample	Controls
Smith and Ubilava (2017)	El Niño yields 1–2% annual growth loss, while La Niña yields not significant effects. The effect of El Niño is twice as large in the tropics relative to temperate areas, especially in Africa and Asia Pacific.	69 developing countries in Africa, Asia, and the Pacific and in Central and South America	SST anomaly measure	Panel linear fixed effects models, pooled mean group estimator, country-specific AR models	annual data, 1961–2015	agriculture value added % of GDP and employment in agriculture % of total employment as proxies for country vulnerability to El Niño
Laosuthi and Selover (2007)	weak association with GDP growth. The main exceptions are South Africa, Australia, India, and Malaysia. Results are rationalized by portfolio theory, which suggests that larger countries and more diversified countries should be relatively less affected by El Niño than smaller, less diversified countries.	22 (emerging and developed) countries(∗∗)	Southern Oscillation Index (SOI)	Granger causality between El Niño Southern Oscillation Index (SOI) and GDP growth	annual/quarterly data, 1951–2001	no

Note: (∗) CAPDR stands for Central America, Panama, and the Dominican Republic.

(∗∗) Emerging countries: Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, India, Indonesia, Malaysia, Mexico, Peru, Philippines, South Africa, and Thailand; developed countries: Australia, Canada, France, Germany, Italy, Japan, UK, and the US

Table C.5: Literature review: Impact of El Niño on inflation

	Results	Coverage	El Niño	Method	Sample	Controls	
Ubilava and Holt (2013)	Palm oil is directly affected by El Niño/La Niña (since it is produced in Oceania and Southeast Asia). Other vegetable oils (soybean oil, sunflower seed oil, rapeseed oil produced in not directly affected regions) are indirectly affected due to strong substitutability in consumption between vegetable oils. El Niño (La Niña) yields a vegetable oil price increase (decrease). A 3 st. dev. ENSO shock (0.7 C sea surface temperature (SST) anomaly), yields a 6–10% change in vegetable oil prices.	Global	Global vegetable oils prices: palm, soybean, rapeseed, and sunflower seed	SST anomalies	STAR	monthly data, 1972–2010	month dummies to control for seasonal effects
Cashin et al. (2017)	Non-fuel commodity prices increase after El Niño. Energy prices increase due to higher demand from Asia, to compensate for (i) lower electricity output and (ii) an increase in water demand for irrigation. This translates into a global oil demand shock (both oil prices and global output increase). CPI inflation increases in most countries (in the US and Europe this increases by 0.12 and 0.07 pp, respectively). Responses are larger in economies that have a higher share of food in their CPI baskets.	21 countries / regions(∗)	national CPI inflation; global energy and non-fuel commodity prices	Southern Oscillation Index (SOI)	Country-specific local projections and GVAR	1979–2013	GDP growth, CPI inflation, exchange rate, short-term and long-term interest rates, equity prices, energy and non-fuel commodity prices.

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Table C.5: Literature review: Impact of El Niño on inflation (Continued)

	Results	**Coverage**	**El Niño**	**Method**	**Sample**	**Controls**	
Martín (2016)	El Niño increases CPI inflation from 1 pp (Colombia) to 5 pp (Ecuador) pp depending on the country.	Bolivia, Peru, Ecuador, Colombia, and Venezuela	national CPI inflation	Southern Oscillation Index (SOI)	country-level AR models	Includes the 1982–1998 period; sample period not mentioned	Change in monetary aggregate as proxy for monetary policy
Romero and Saldarriaga (2023)	El Niño directly affects food inflation, which in turn increases inflation expectations (second round of effects).	Colombia	Inflation expectations, local food prices	Oceanic Niño Index (ONI)	BVARx	monthly data, 2003–2020	International food price index, real exchange rate, local food prices, industrial production, inflation expectations
Brunner (2002)	A one st.-dev. positive surprise in ENSO raises real commodity price inflation by 3.5–4 pp. Qualitatively similar effects are observed on G-7 overall prices, although much weaker and only marginally significant. This is because primary commodities account for only a fraction of overall finished good costs.	Global: aggregate G-7 countries	global real non-oil primary commodity prices and G-7 consumer price inflation	SST or SOI anomaly measure	VAR	quarterly data, 1963–1998	Average CPI inflation rate, average GDP growth rate, international real commodity price inflation
Abril-Salcedo et al. (2020)	Cumulated effect of El Niño is a 600 bp increase in food inflation 9 months after the shock. Over 1962–2018, no evidence emerges of changes in the size of food inflation responses over time. A La Niña shock yields ambiguous effects.	Colombia	National food price inflation	SST anomaly measure	Nonlinear smooth transition regression model (STR)	monthly data, 1962–2018	no

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Table C.5: Literature review: Impact of El Niño on inflation (Continued)

	Results	**Coverage**	**El Niño**	**Method**	**Sample**	**Controls**	
Atems and Sardar (2021)	Heterogeneous effects between La Niña and El Niño.(∗∗) La Niña shocks lead to positive responses to overall agriculture commodity prices. This is because agricultural output decreases after La Niña events, which increases prices in the following period. El Niño shocks do not affect overall agriculture commodity prices. Results for stocks are similar: La Niña shocks are beneficial to stock prices of agricultural companies, while El Niño shocks are detrimental or insignificant.	US	Stock prices of 12 US food and agricultural companies and global food commodity prices	SST anomaly measure	State-dependent local projections	weekly/monthly data, 1990–2019.	CPI price index, industrial production index
Laosuthi and Selover (2007)	Weak association between El Niño and CPI inflation. Main exceptions are South Africa, Australia, UK, and the Philippines. El Niño affects the price of maize, sorghum, rice, coconuts, and palm oil but has no effect on other commodity prices. Results can be explained by portfolio theory, which suggests that larger countries and more diversified countries should be relatively less affected by ENSO fluctuations than smaller, less diversified countries.	22 countries (∗∗∗)	national CPI inflation and commodity price inflation	Southern Oscillation Index (SOI)	Granger causality between El Niño Southern Oscillation Index (SOI) and CPI inflation, and commodity price inflation	annual(or quarterly) data, from 1951–2001	no

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Table C.5: Literature review: Impact of El Niño on inflation (Continued)

	Results	**Coverage**	**El Niño**	**Method**	**Sample**	**Controls**	
Adolfsen and Lappe (2023)	El Niño raises global food commodity prices for up to 2 years, with a 9% peak in price increases occurring 16 months after the start of the shock. Effects are significant for soybeans, corn, and rice but insignificant for wheat and null for coffee and cocoa.	Global	global food commodities	Oceanic Niño Index (ONI)	Local projections	not mentioned	global fertilizer and oil prices and global industrial activity

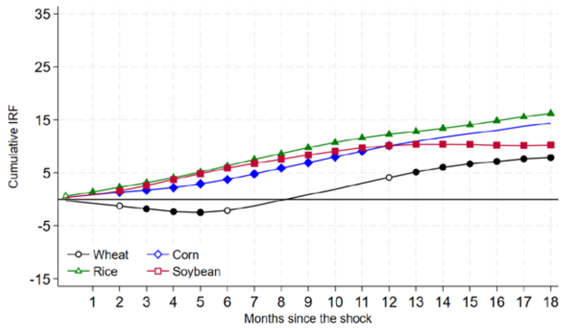
Note: (∗) Europe is included as one region and includes the following 13 countries: Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

(∗∗) La Niña shocks lead to positive responses for cocoa, coffee, coconut oil, palm oil, wheat, and sugar, and insignificant responses for soybeans, barley, maize, sorghum. El Niño shocks lead to negative responses for cocoa, coffee, barley, sorghum, wheat, potassium, chloride, and urea; the response is not significant for soybeans, and maize and positive for coconut oil, palm oil, and sugar.

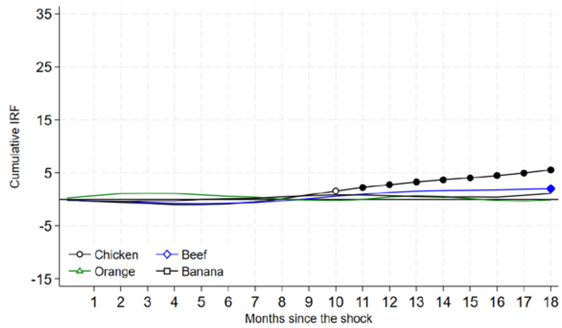
(∗ ∗ ∗) Emerging countries: Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, India, Indonesia, Malaysia, Mexico, Peru, Philippines, South Africa, and Thailand; developed countries: Australia, Canada, France, Germany, Italy, Japan, UK, and the US

D Additional results: group-specific international food commodity responses

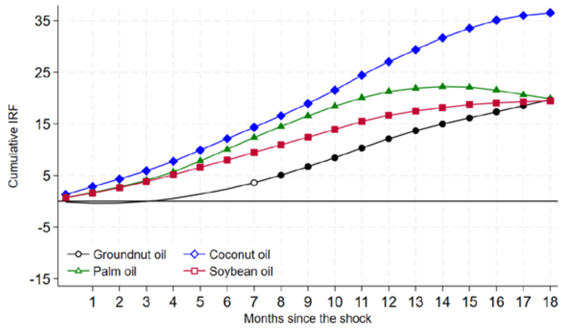
Figure D.4: Response of international commodity prices to an intensification of El Niño



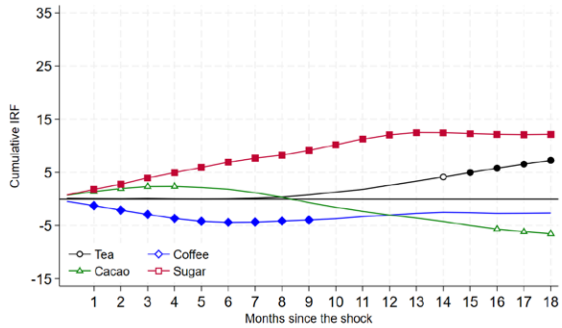
(a) Cereals



(b) Meat



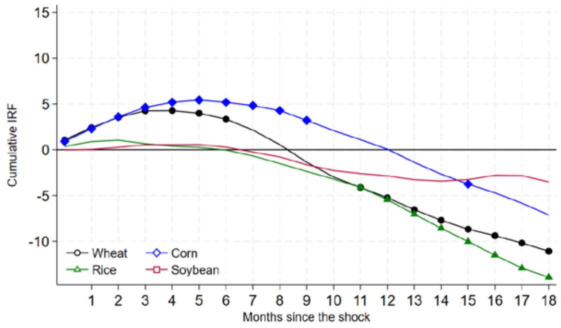
(c) Vegetable oils



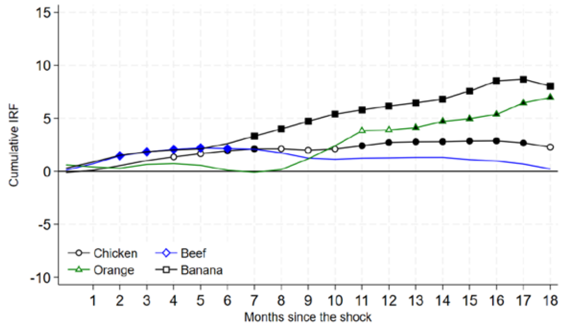
(d) Beverages and sugar

Note: Monthly cumulative response of international food commodity prices to an El Niño shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. In the third row, full (empty) symbols indicate statistical significance at the 5(10)% level; a solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered in the left (right) panel is an intensification of an El Niño, i.e., an increase of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño event is already taking place.

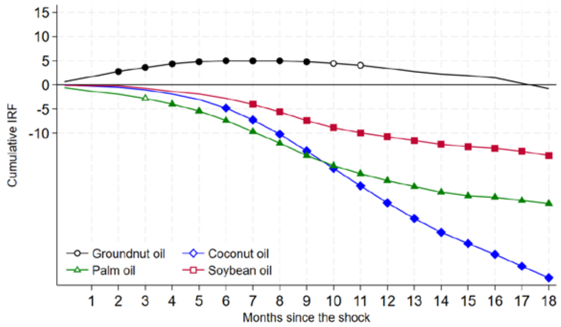
Figure D.5: Response of international commodity prices to an intensification of La Niña



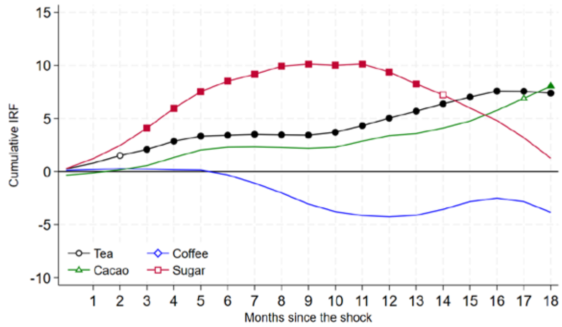
(a) Cereals



(b) Meat



(c) Vegetable oils

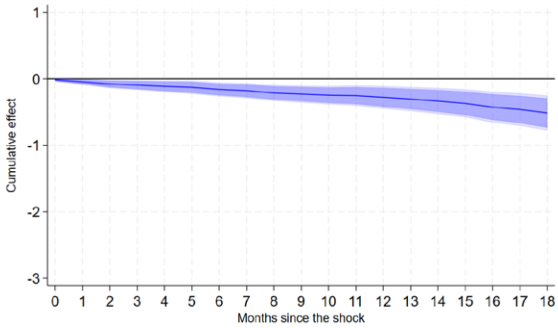


(d) Beverages and sugar

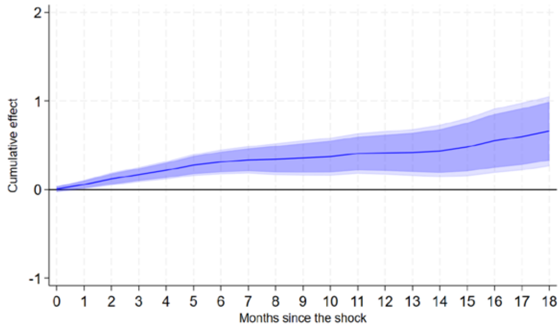
Note: Monthly cumulative response of international food commodity prices to a La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. In the third row, full (empty) symbols indicate statistical significance at the 5(10)% level; the solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered is an intensification of a La Niña, i.e., a decrease of 1° C in the ocean surface temperature in the east-central tropical Pacific when a La Niña event is already taking place.

E Robustness: value chain perspective

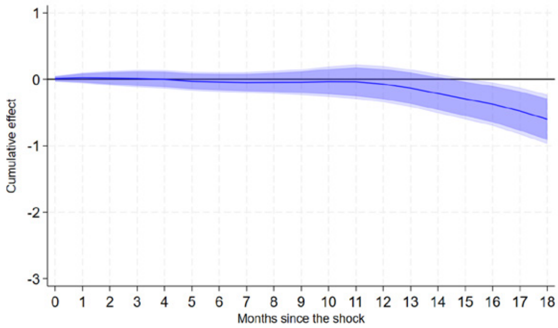
Figure E.6: Robustness 1: Response of euro area inflation. Value chain (Eurostat aggregates)



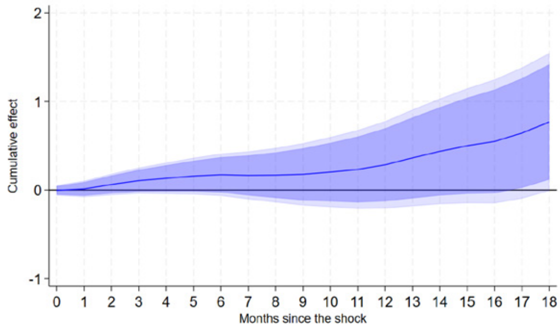
(a) Headline inflation. El Niño



(b) Headline inflation. La Niña



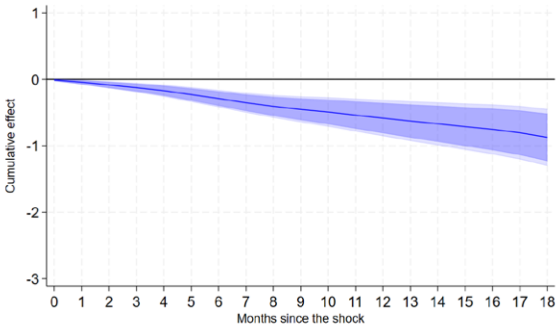
(c) Food inflation. El Niño



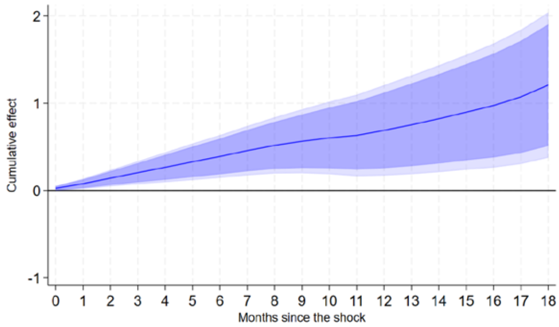
(d) Food inflation. La Niña

Note: Monthly cumulative response of euro area headline inflation and food inflation—Eurostat aggregate—to an El Niño shock (left panel) and La Niña shock (right panel) along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. The shock considered in the left (right) panel is an intensification of an El Niño (La Niña), i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

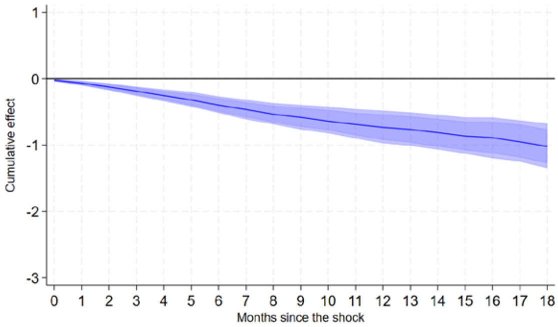
Figure E.7: Robustness 1: Response of euro area food inflation. Value chain (own aggregate)



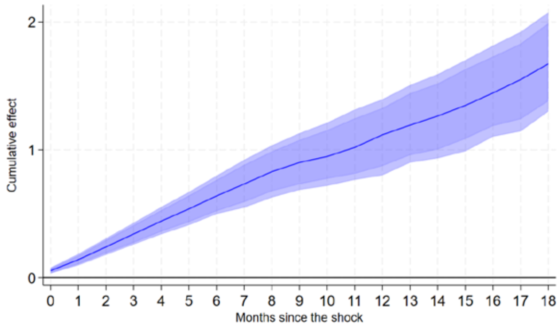
(a) El Niño. Top down



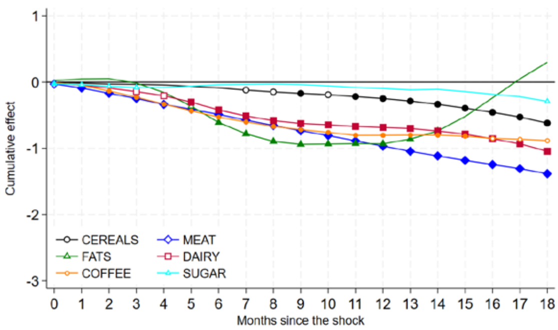
(b) La Niña. Top down



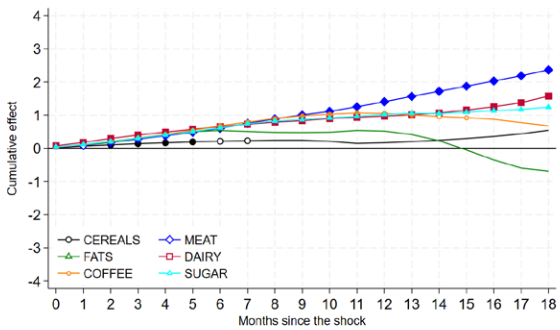
(c) El Niño. Bottom up



(d) La Niña. Bottom up



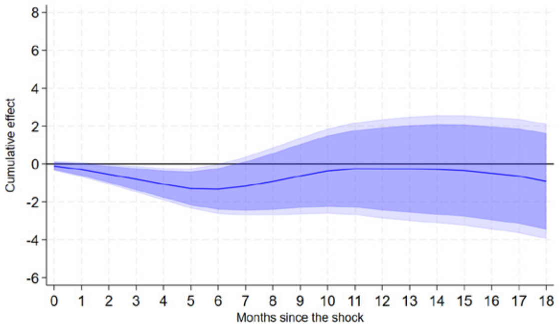
(e) El Niño. Disaggregated



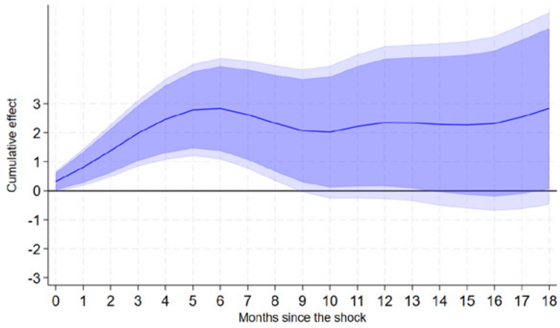
(f) La Niña. Disaggregated

Note: Monthly cumulative response of euro area food HICP according to our own six food group aggregate to an El Niño shock (left panel) and a La Niña shock (right panel) along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. In the third row, full (empty) symbols indicate statistical significance at the 5(10)% level; a solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered in the left (right) panel is an intensification of an El Niño (La Niña), i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

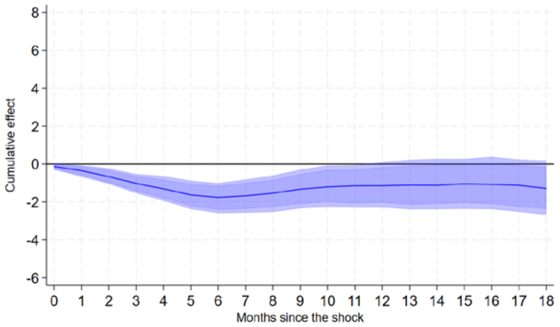
Figure E.8: Response of European Union food commodity prices. Value chain



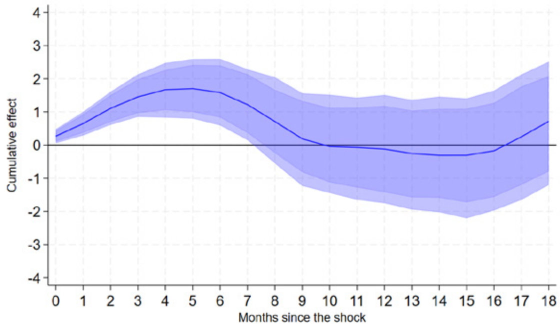
(a) El Niño. Top down



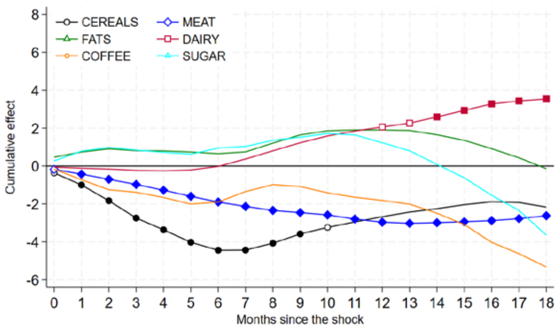
(b) La Niña. Top down



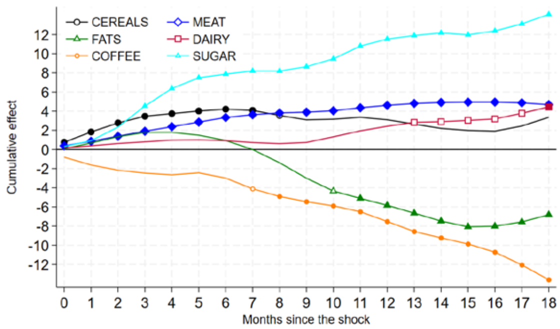
(c) El Niño. Bottom up



(d) La Niña. Bottom up



(e) El Niño. Disaggregated

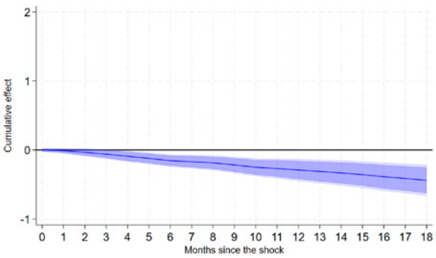


(f) La Niña. Disaggregated

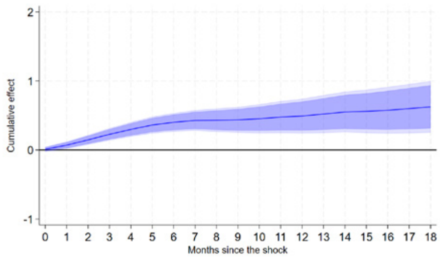
Note: Monthly cumulative response of euro area food commodity prices to an El Niño shock (left panel) and La Niña shock (right panel), along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. In the third row, full (empty) symbols indicate statistical significance at the 5(10)% level; a solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered in the left (right) panel is an intensification of an El Niño (La Niña) event, i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

F Robustness: results for France, Italy, Germany and Spain

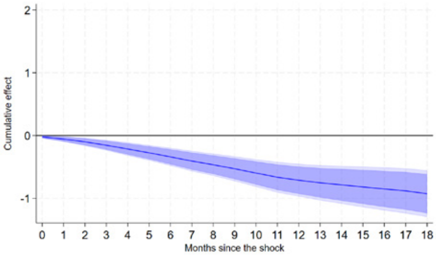
Figure F.9: France. Inflation responses



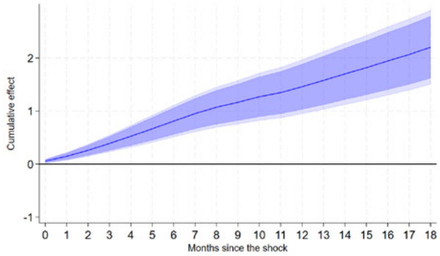
(a) El Niño. Headline inflation



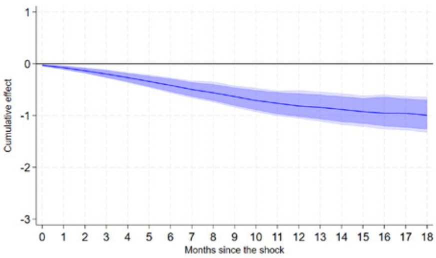
(b) La Niña. Headline inflation



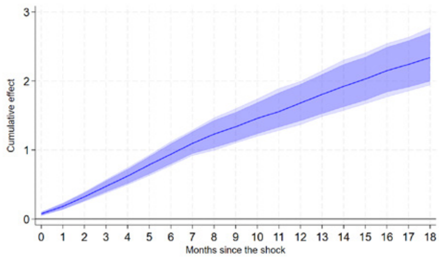
(c) El Niño. Food inflation (TD)



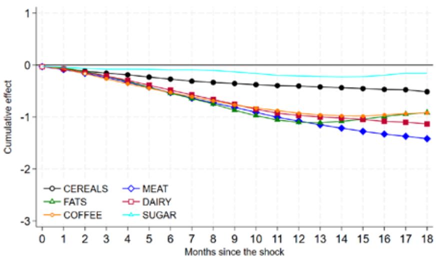
(d) La Niña. Food inflation (TD)



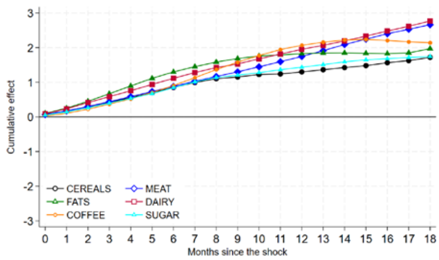
(e) El Niño. Food inflation (BU)



(f) La Niña. Food inflation (BU)



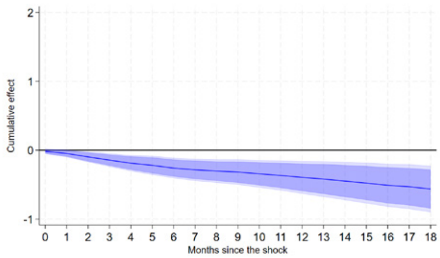
(g) El Niño. Disaggregated



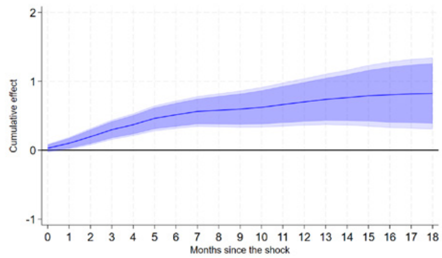
(h) La Niña. Disaggregated

Note: Monthly cumulative response of France's headline HICP to an El Niño/La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Results are based on linear projection estimations. The shock considered is an intensification of an El Niño (La Niña) event, i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

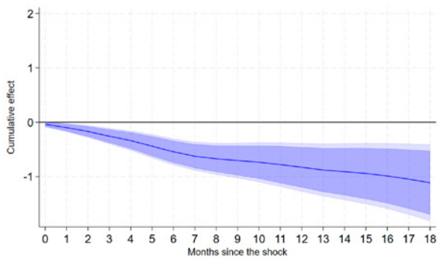
Figure F.10: Germany. Inflation responses



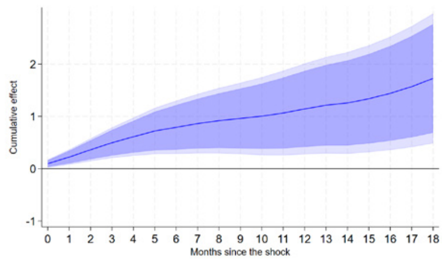
(a) El Niño. Headline inflation



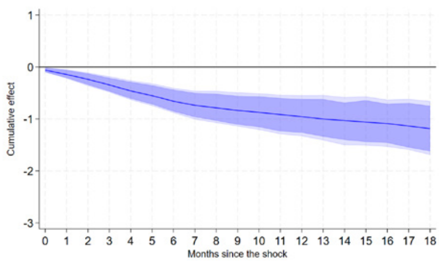
(b) La Niña. Headline inflation



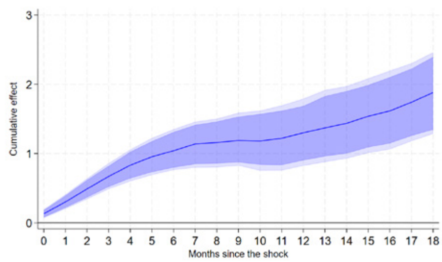
(c) El Niño. Food inflation (TD)



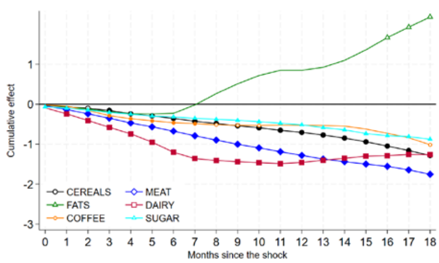
(d) La Niña. Food inflation (TD)



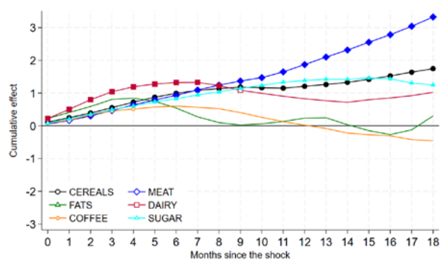
(e) El Niño. Food inflation (BU)



(f) La Niña. Food inflation (BU)



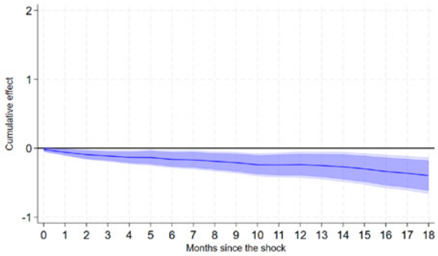
(g) El Niño. Disaggregated



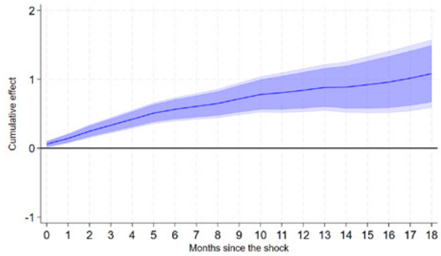
(h) La Niña. Disaggregated

Note: Monthly cumulative response of Germany's headline HICP to an El Niño/La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Results are based on linear projection estimations. The shock considered is an intensification of an El Niño (La Niña) event, i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

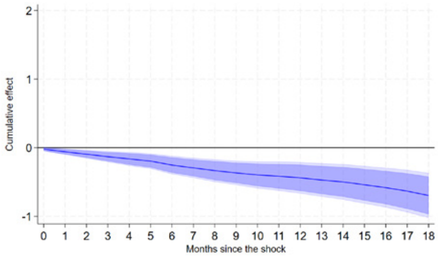
Figure F.11: Italy. Inflation responses



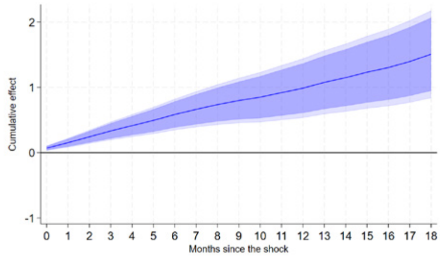
(a) El Niño. Headline inflation



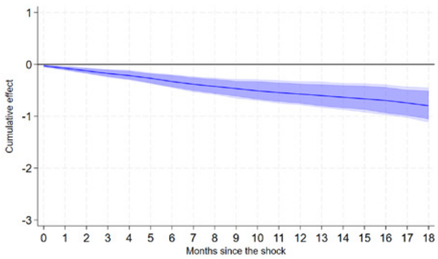
(b) La Niña. Headline inflation



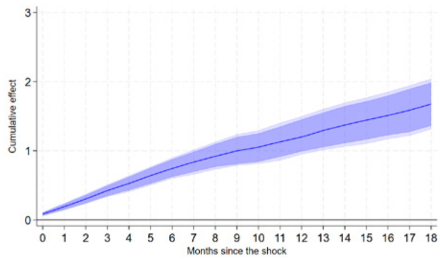
(c) El Niño. Food inflation (TD)



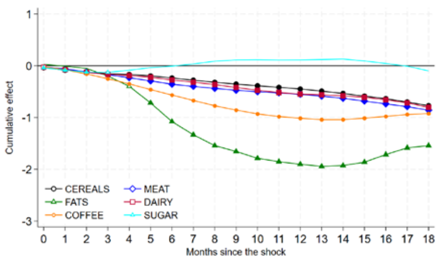
(d) La Niña. Food inflation (TD)



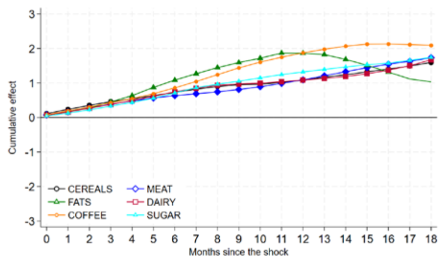
(e) El Niño. Food inflation (BU)



(f) La Niña. Food inflation (BU)



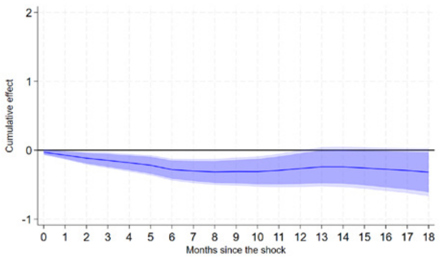
(g) El Niño. Disaggregated



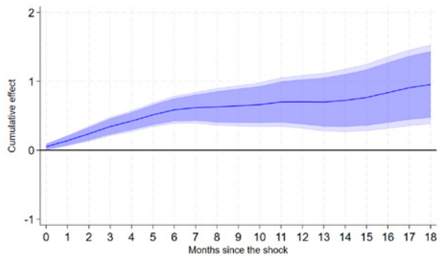
(h) La Niña. Disaggregated

Note: Monthly cumulative response of Italy's headline HICP to an El Niño/La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Results are based on linear projection estimations. The shock considered is an intensification of an El Niño (La Niña) event, i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

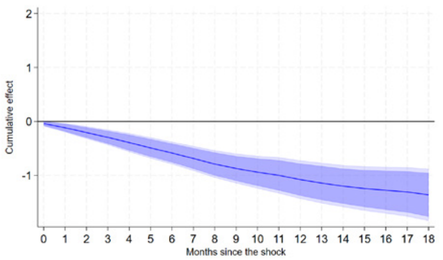
Figure F.12: Spain. Inflation responses



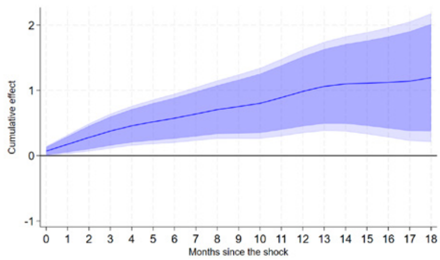
(a) El Niño. Headline inflation



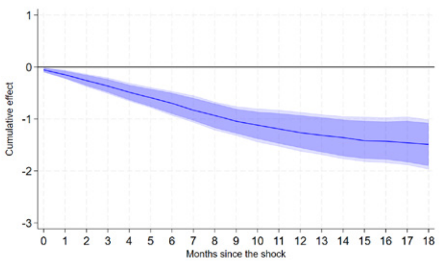
(b) La Niña. Headline inflation



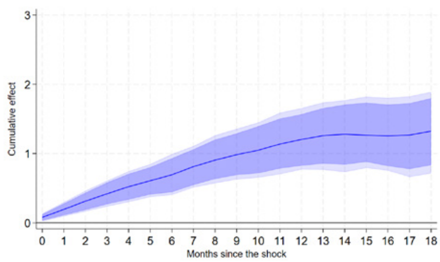
(c) El Niño. Food inflation (TD)



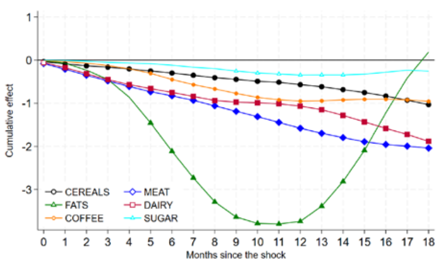
(d) La Niña. Food inflation (TD)



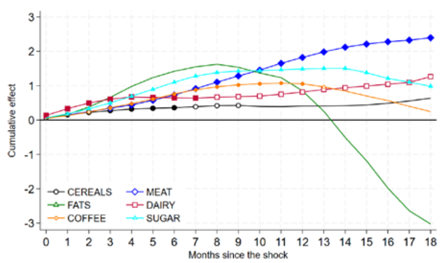
(e) El Niño. Food inflation (BU)



(f) La Niña. Food inflation (BU)



(g) El Niño. Disaggregated

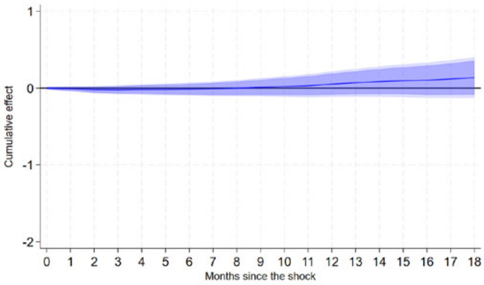


(h) La Niña. Disaggregated

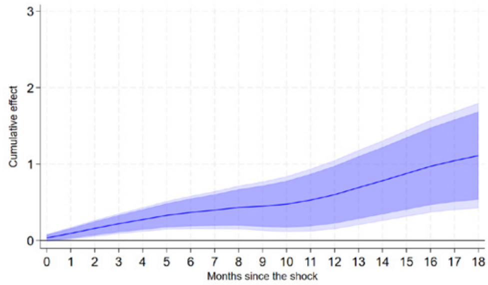
Note: Monthly cumulative response of Spain's headline HICP to an El Niño/La Niña shock along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Results are based on linear projection estimations. The shock considered is an intensification of an El Niño (La Niña) event, i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

G Robustness: historical evidence

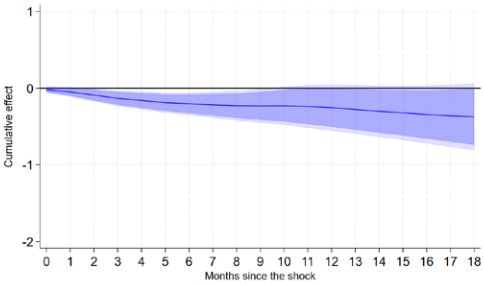
Figure G.13: Response of euro area headline and food and food commodity inflation. Data since 1970



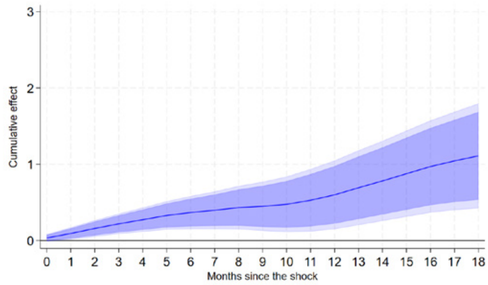
(a) El Niño. Headline inflation



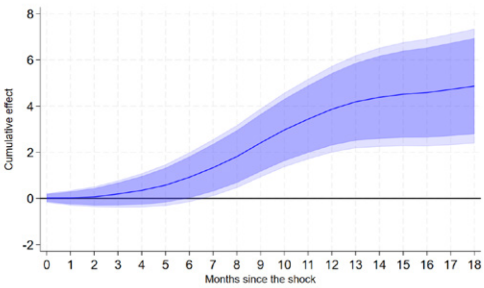
(b) La Niña. Headline inflation



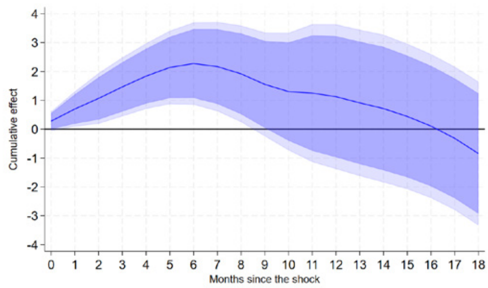
(c) El Niño. Food inflation



(d) La Niña. Food inflation



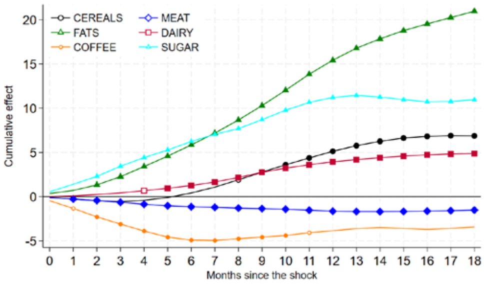
(e) El Niño. Food comm. inflation (TD)



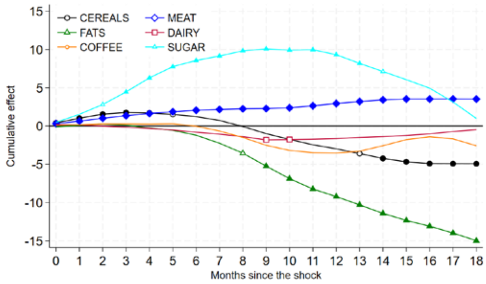
(f) La Niña. Food comm. inflation (TD)

Note: Monthly cumulative response of euro area headline and food HICP, as well as food commodity prices, to an El Niño shock (left panel) and a La Niña shock (right panel) along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. In the third row, full (empty) symbols indicate statistical significance at the 5(10)% level; a solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered in the left (right) panel is an intensification of an El Niño (La Niña), i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

Figure G.14: Response of disaggregated euro area food commodity prices. Data since 1970



(a) El Niño. Food commodity prices

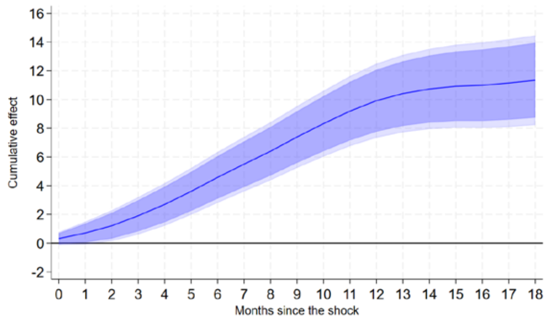


(b) La Niña. Food commodity prices

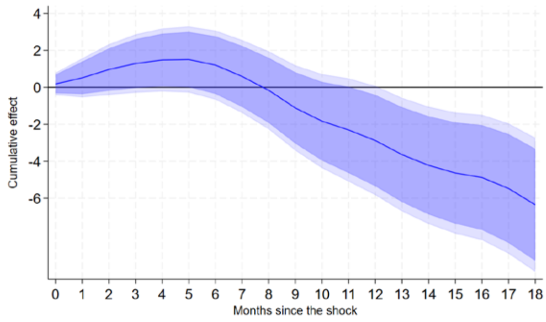
Note: Monthly cumulative response of euro area food commodity prices to an El Niño shock (left panel) and a La Niña shock (right panel) along with 5% (lighter blue area) and 10% (darker blue area) confidence bands. Full (empty) symbols indicate statistical significance at the 5(10)% level; a solid line indicates no statistical significance. Results are based on linear projection estimations. The shock considered in the left (right) column is an intensification of an El Niño (La Niña) event, i.e., an increase (decrease) of 1° C in the ocean surface temperature in the east-central tropical Pacific when an El Niño (La Niña) event is already taking place.

H Robustness: adding controls and lags

Figure H.15: Response of international food commodity prices to adding the exchange rate as a control variable.

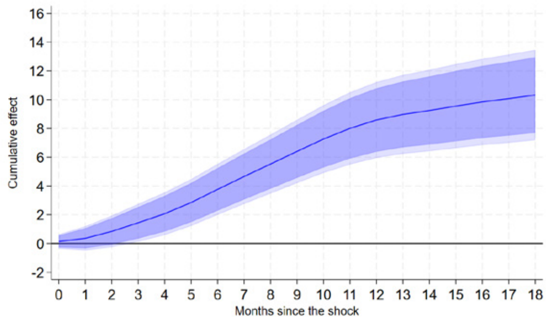


(a) El Niño

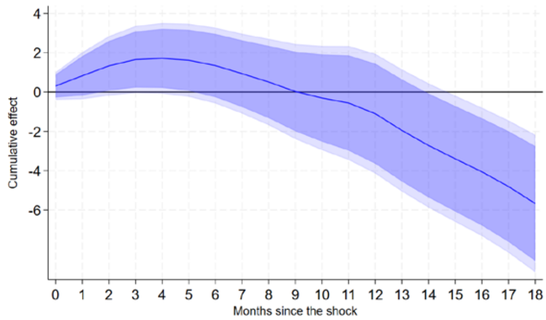


(b) La Niña

Figure H.16: Response of international food commodity prices to adding 12 lags of food commodity, fertilizer and oil prices and activity.



(a) El Niño



(b) La Niña

I EU trade patterns over time

For the purpose of this exercise, we rely on annual data from the "Base pour l'Analyse du Commerce International of the Centre d'études prospectives et d'informations internationals" (BACI-CEPII), at the HS-6 product level. The dataset includes bilateral trade flow information about the import value of each trade partner over a 28-year period from 1995 to 2022.

We aggregate import data into the 6 food categories that we used in the rest of the study: cereals, coffee, meat, dairy products and eggs, oils and fats, and sugar. In addition, the Economic and Monetary Union (EMU) is considered as a single importer, so the import value of each product coming from each trading partner is aggregated among the member states. Only imports from extra-EU economies are considered. We compute two measures.

First, we use the Herfindahl-Hirschman Index (HHI) to represent the degree of import concentration across trade partners. It ranges between 0 and 1, with highly concentrated imports resulting in a higher value of the indicator.[22] For each food category c, the HHI index is constructed by adding up the squared shares of EMU imports coming from country j in the total EMU imports of food category c:

$$HHI^{c}_{EMU} = \sum_{j=1}^{N} (Share^{c}_{EMU,j}) \tag{I.1}$$

This general measure of concentration, HHI_Total, can be disaggregated to focus only on specific trading partners. In particular, the concentration of imports coming from economies affected by El Niño or La Niña, HHI_Niñx, can be calculated by adding up the squared shares of EU imports coming only from countries affected by any of these climate phenomena. Similarly, the concentration of imports coming from the rest of the countries, HHI_no_Niñx, can be calculated by adding up the squared import shares coming only from economies not affected by El Niño or La Niña.[23]

The second measure we consider is the import share, which is computed for each food category by adding up the shares of EMU imports coming from a specific group of countries in the total EU imports of the corresponding food category. Thus, the index Share_Niñx can be calculated as the share of EMU imports coming from countries affected by El Niño or La Niña and the index Share_no_Niñx as the share of EMU imports coming from the rest of the

[22] An index equal to 1 represents a case of extreme concentration: a product that is imported from one trade partner only. An index close to 0 represents a case of high diversification: a product that is imported from many trade partners.

[23] The sum of HHI_Niñx and HHI_no_Niñx equals HHI_Total.

economies.[24] Results for import concentration and import shares are shown in Figures 10 and 9 of Section 7 in the main text, respectively.

[24]The sum of HHI_Niñx and HHI_no_Niñx is 1.

J Construction of newspaper-based index of ENSO popularity

This section explains the construction of the newspaper-based indexes discussed in Section 1 of the main text. These indexes capture the importance ENSO phenomena have gained in the press over time in the following countries: US, Germany, France, Italy, and Spain.

To construct these indexes, we build upon the methodology of Baker et al. (2016), who constructed the well-known economic policy uncertainty (EPU) indicator for a number of countries.

To access newspaper articles, we rely on the Factiva repository provided by Dow Jones. We focus on the printed editions of newspapers and ignore their online versions. For each country, we consider as many newspapers as possible to ensure that selected newspapers cover almost the entire ideological spectrum and hence minimize any ideological bias that may stem from analyzing the media. We consider the following newspapers, by country:

- US: The Boston Globe, The Telegraph, The Economist, The Globe and Mail, The Guardian, The Wall Street Journal, Los Angeles Times, The New York Times, The Times, Chicago Tribune, and Washington Post.
- Germany: Berliner Zeitung, Berliner Morgenpost, Die Welt, Frankfurter Allgemeine Zeitung, Handelsblatt, Süddeutsche Zeitung, Der Tagesspiegel, and Die Tageszeitung.
- France: La Tribune, L'Opinion, Le Monde, Libération, La Croix, Le Figaro, and Les Echos.
- Italy: Corriere della Sella, La Stampa, Il Sore 24 Ore, ItaliaOggi, La Repubblica, Il Giornale, and Il Fatto Quotidiano.
- Spain: ABC, Cinco Días, El Economista, El Mundo, El País, Expansión, and La Vanguardia.

For the US, the time coverage is longer such that we can construct the indicator from 1980. For the considered European countries (*the big 4*), our indicator starts from January 1997 due to data availability. We construct our measure of ENSO popularity at a monthly frequency and aggregate it at the yearly level for graphical purposes.

In a nutshell, the ENSO popularity index is constructed as the proportion of newspaper articles that are about ENSO climate phenomena. To do this, we count the number of articles in each month and newspaper that contain either *El Niño* or *La Niña* and which are also on the topic of the *climate*. For each country, we adapt the language accordingly. In practice, we consider the following keywords for each country:

- US: *(El Nin* or La Nin*) and climat**
- Germany: *(El Nin* or La Nin*) and klima**
- France: *(El Nin* or La Nin*) and clima**
- Italy: *(El Nin* or La Nin*) and clima**
- Spain: *(El Nin* or La Nin*) and climático* not (Jesus or Navidad or Greta).* Note, since in Spanish *El Niño* means boy and *La Niña* means girl, we need to add additional requirements to minimize false positives (i.e., counting articles that are not related to the ENSO phenomena). In particular, we need to exclude articles about the climate and Christmas, which can contain *El Niño Jesus* (which means *baby Jesus*) and articles about climate and the young climate activist Greta Thunberg, which may contain *La Niña Greta*.

The construction of the indexes closely follows the procedure used by Baker et al. (2016). First, for each newspaper we count the number of articles published in a given month that contain the aforementioned keywords. Second, we divide this count by the total number of published articles that month, in order to express this count as a proportion of articles published by the newspaper in that month. Third, we standardize each monthly series of scaled counts by dividing by the standard deviation. This makes the volatility of the series comparable across newspapers. Fourth, for each country we average the newspaper-based standardized series across newspapers to compute an aggregated index. Fifth, we rescale the resulting index to mean 100 to obtain a set of homogeneous country-based ENSO popularity indexes. Finally, these indicators are aggregated at a yearly frequency and plotted in Figure 1.

Note, the huge peak corresponding to the last El Niño event (2023–2024) is striking, especially for the US. We double-checked the articles selected to construct the indicators for this period, and the peak is indeed genuine, i.e., all articles selected refer to El Niño or La Niña climate events when discussing topics related to climate. This confirms that the public is now extremely interested in this topic.

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