Actinver Institutional Research

Economic Research

The El Niño Phenomenon in Mexico

MX Economy: Macro

September 11, 2026

- **El Niño conditions have been present since June 2026, and the episode could become one of the strongest on record since 1950, with its peak intensity expected toward the end of this year.**
- **In Mexico, its effects are not uniform: rainfall varies significantly across regions and throughout the year, so the impact on agriculture depends on where production is located, the crop calendar, and the production method.**
- **The evidence does not point to a generalized upward pressure from El Niño on agricultural prices, although the breakdown by product shows heterogeneous responses.**

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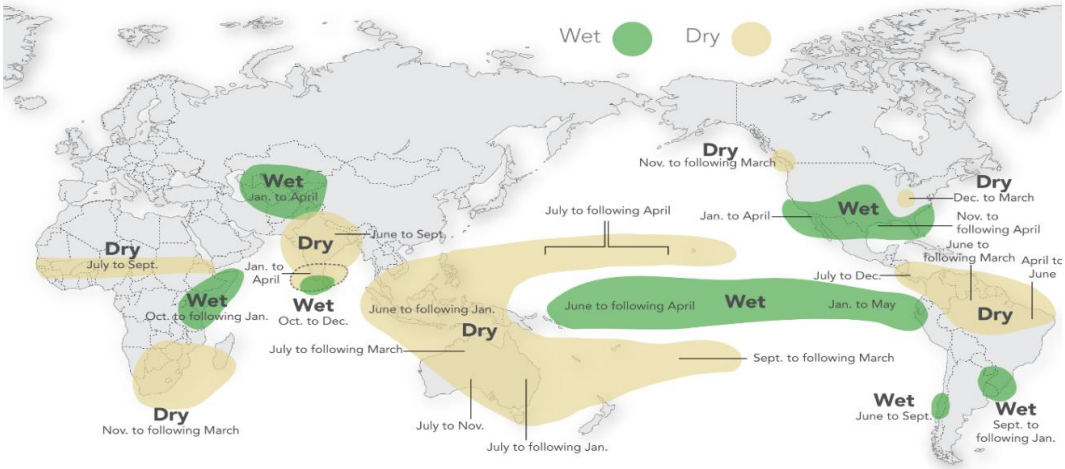
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1.- El Niño Context

El Niño (El Niño–Southern Oscillation, ENSO) is a climate disruption associated with changes in the sea surface temperature of the tropical Pacific Ocean and in atmospheric circulation. It has three phases: i) El Niño, associated with anomalous warming of the equatorial Pacific waters; ii) La Niña, with anomalous cooling; and iii) a neutral phase. These variations can alter rainfall and temperature patterns in different regions of the world.

Historical Rainfall Patterns Associated with El Niño
(Periods with wetter or drier conditions than usual)



Source: International Research Institute for Climate and Society (IRI), Columbia University (2020). Analysis based on data from 1951 to 2016.

The effects of El Niño on rainfall have been documented by the International Research Institute for Climate and Society (IRI) at Columbia University, whose maps have become a widely used reference for analyzing the regional effects of the phenomenon. Its analysis, incorporating data from 1951 to 2016, identifies the regions and times of year in which, under El Niño conditions, patterns of excess rainfall or drought occur relative to neutral conditions.

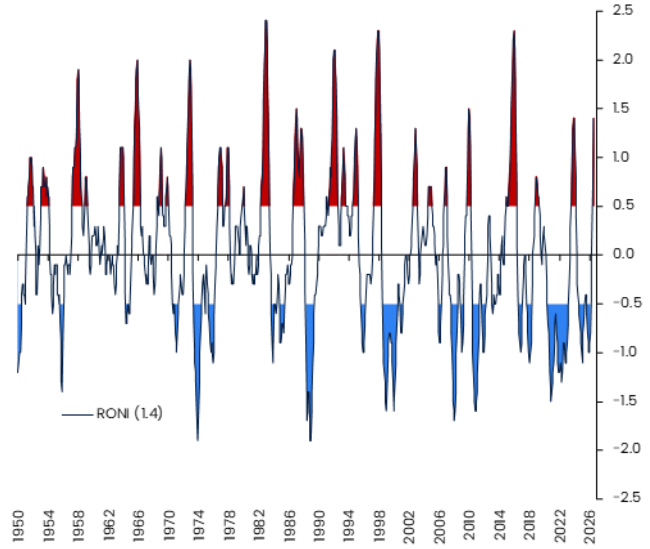
2.- El Niño in 2026

Monitoring of the phenomenon is carried out by the National Oceanic and Atmospheric Administration (NOAA), through its Climate Prediction Center (CPC). To identify and track the El Niño, La Niña, and neutral phases, the CPC uses the Relative Oceanic Niño Index (RONI), an indicator based on temperature anomalies in the tropical Pacific. Based on the index's historical series, 25 El Niño episodes have been identified since 1950, with an average duration of nearly ten months and an average of around six months to reach peak intensity.

In June of this year, NOAA declared that El Niño conditions are present and forecasts that they will persist at least until early spring 2027, reaching their peak intensity toward the end of 2026, potentially becoming one of the strongest episodes on record since 1950.

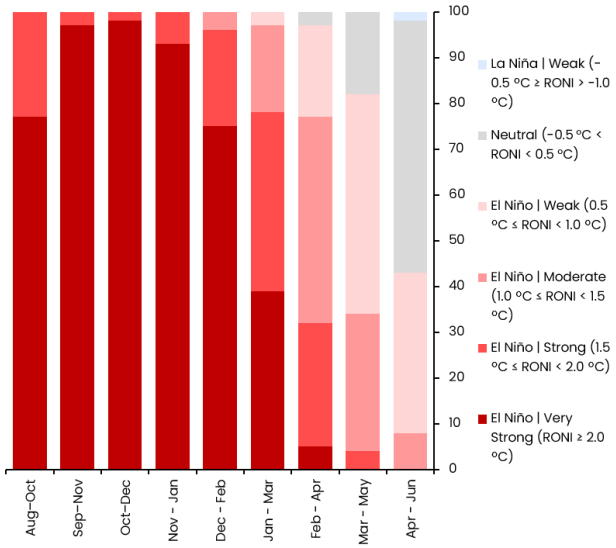
Relative Oceanic Niño Index (RONI)

(°C); Aug – 26



El Niño Phenomenon Probabilities

(%; 3-month moving window); Sep – 26



Source: Actinver with data from NOAA.

3.- El Niño and Rainfall Patterns in Mexico

In Mexico, the effects of El Niño on precipitation are heterogeneous. In addition to varying by region, they change significantly throughout the year. The same intensification of the phenomenon can be associated with higher rainfall during some months and lower precipitation during others, so looking only at the annual average can obscure relevant differences in the country's climate exposure.

To identify these patterns, we use monthly precipitation data from the Global Precipitation Climatology Centre (GPCC), an international database that integrates rainfall observations and organizes them on a homogeneous geographic grid. For Mexico, the data used covers the 1950–2019 period and divides the territory into 868 cells of 0.5 degrees latitude by 0.5 degrees longitude, roughly equivalent to areas of about 50 kilometers per side. This structure allows precipitation to be analyzed at a much finer level of detail than a national or state-level series.

This information is combined with NOAA's Relative Oceanic Niño Index (RONI), which measures the intensity of the thermal anomalies associated with ENSO in the tropical Pacific. Unlike a binary classification between El Niño episodes and neutral conditions, using RONI makes it possible to estimate how precipitation changes across different intensity levels of the phenomenon.

For each of the 868 cells and for each month of the year, we independently estimate the following relationship:

$$P_{i,m,y} = \alpha_{i,m} + \delta_{i,m}(y - 1984.5) + \beta_{i,m} RONI_{m,y} + \varepsilon_{i,m,y}$$

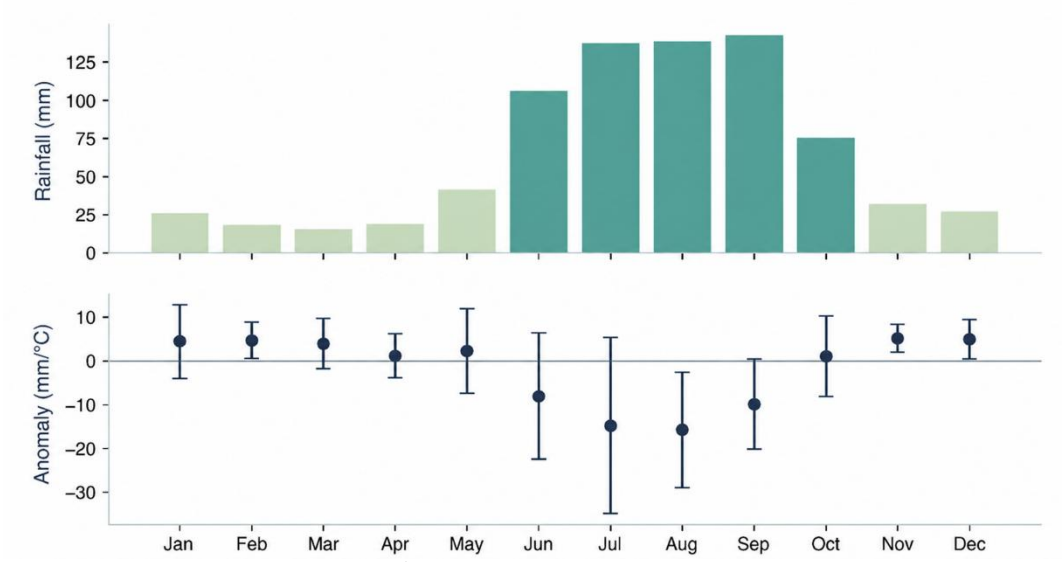
where $P_{i,m,y}$ represents monthly precipitation, measured in millimeters, in cell i, during month m and year y. The term $\alpha_{i,m}$ captures permanent differences in rainfall levels between regions and months, while $\delta_{i,m}$ incorporates a time trend specific to each location-month combination.

The term $(y - 1984.5)$ incorporates a time trend centered on the midpoint of the sample, 1950–2019. This facilitates interpretation of the constant without altering the estimated relationship between RONI and precipitation. The coefficient $\beta_{i,m}$, in turn, measures how many millimeters monthly precipitation changes, on average, for a 1 °C increase in RONI.

This strategy makes it possible to separately identify two fundamental dimensions of El Niño's impact in Mexico: the seasonal dimension, i.e., how the relationship between ENSO and rainfall changes throughout the year; and the geographic dimension, which allows us to observe how that same relationship varies across different areas of the territory.

Territorial climatology and precipitation sensitivity to RONI

(Monthly precipitation and change in millimeters per +1 °C of RONI); 1950–2019



Source: Actinver with data from GPCC and NOAA/CPC.

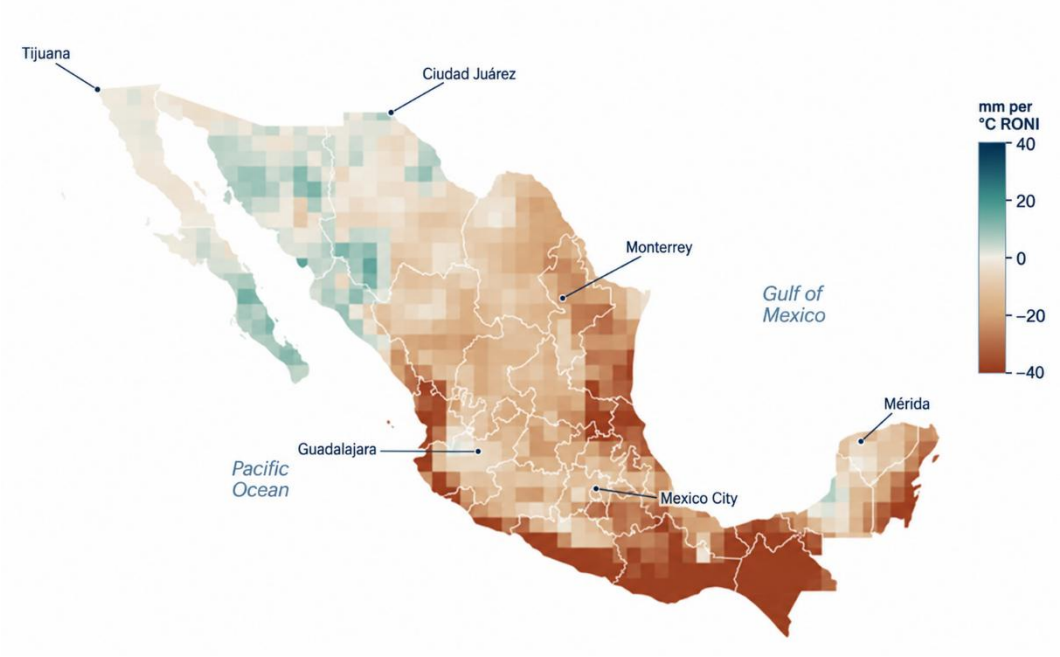
The results show marked seasonality. Focusing on the lower part of the chart above, only February, August, November, and December show statistically significant results (the 95% joint bands exclude zero). Thus, a 1 °C increase in RONI is associated with approximately +4.7 mm of precipitation in February, while in August the relationship is -15.7 mm, reinforcing the evidence that the relationship between ENSO and precipitation changes significantly throughout the year.

This seasonality is especially relevant for Mexico because, historically, most annual precipitation occurs during the summer. Between June and October, around 601 mm accumulate out of the roughly 780 mm of annual precipitation, equivalent to about 77% of the total. As a result, a reduction in rainfall during these months can be considerably more relevant than an increase of similar magnitude during the winter, when typical precipitation is much lower.

This result implies that higher precipitation during some winter months does not necessarily offset lower rainfall during the summer. For activities such as agriculture, water availability matters precisely when it coincides with the stages when crops need it, so the year-round distribution of precipitation is as important as the total rainfall for the year.

The second relevant dimension is geographic. The coefficients estimated for the same date show significant differences within the territory. In August, for example, the negative association observed at the national level reflects a set of very different local responses. Some regions show considerable reductions in precipitation, others show more moderate effects, and there are even regions with higher rainfall. As a result, the national coefficient should be interpreted as a territorial aggregation rather than a uniform effect on each state, municipality, or productive unit.

Local Sensitivity of Precipitation to RONI in August at the Cell Level
(mm for every +1 °C of RONI; 0.5-degree cells); 1950 – 2019



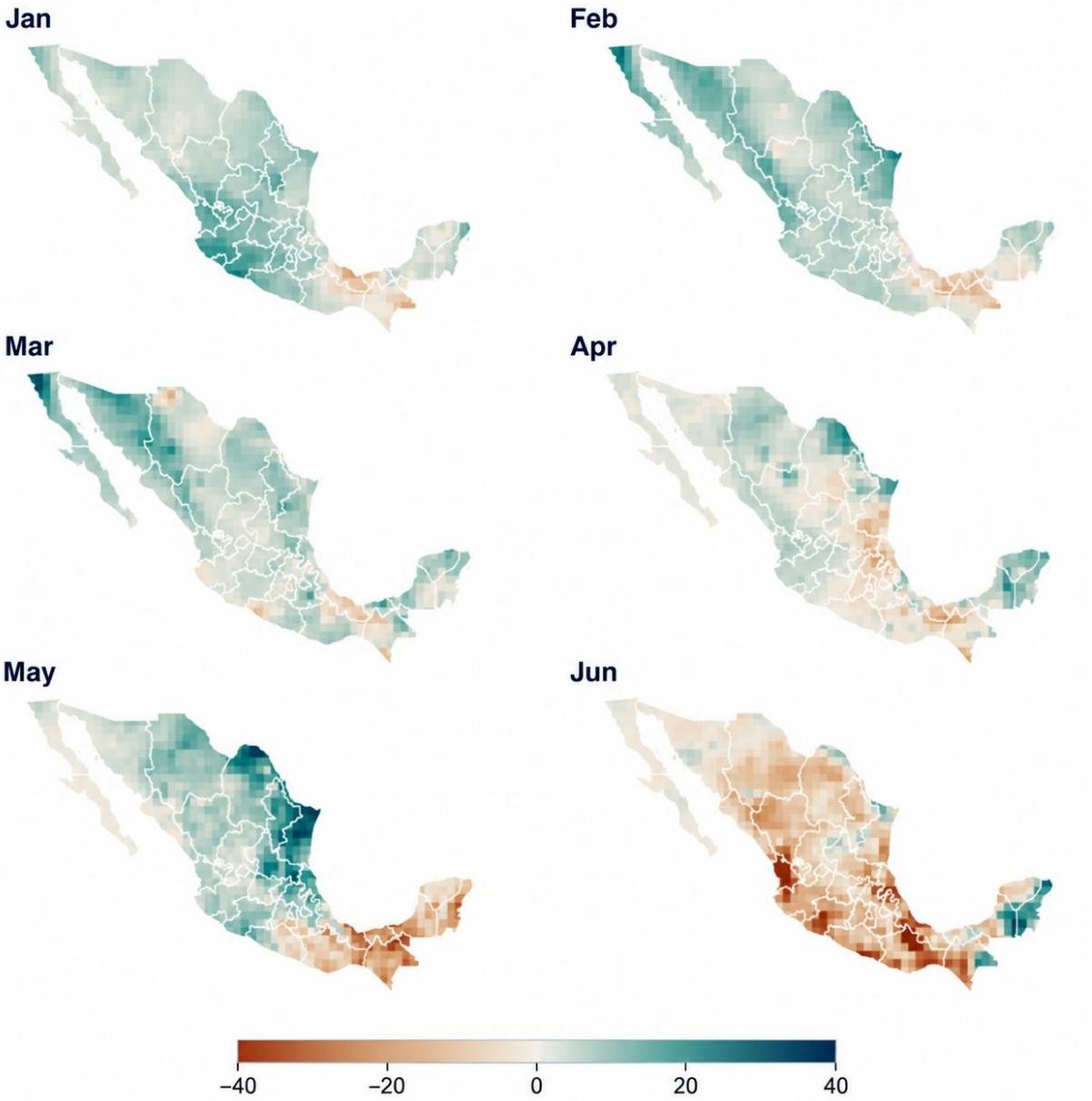
Source: Actinver with data from GPCC and NOAA/CPC.

Spatial heterogeneity also changes throughout the year. Extending the analysis to all twelve months reveals a clear transition between a winter phase with positive associations in various regions and a summer season in which more widespread negative relationships emerge, although with significant differences between areas of the country.

Taken together, the following maps show that there is no single effect of El Niño on rainfall in Mexico. The response depends simultaneously on the intensity of the phenomenon, the time of year, and the region analyzed. This heterogeneity is fundamental to understanding its economic consequences, since the potential impact on agricultural activity will depend on the coincidence between these precipitation anomalies, the location of production, the crop calendar, and access to other water sources.

Sensitivity of Precipitation to RONI, January–June at the Cell Level

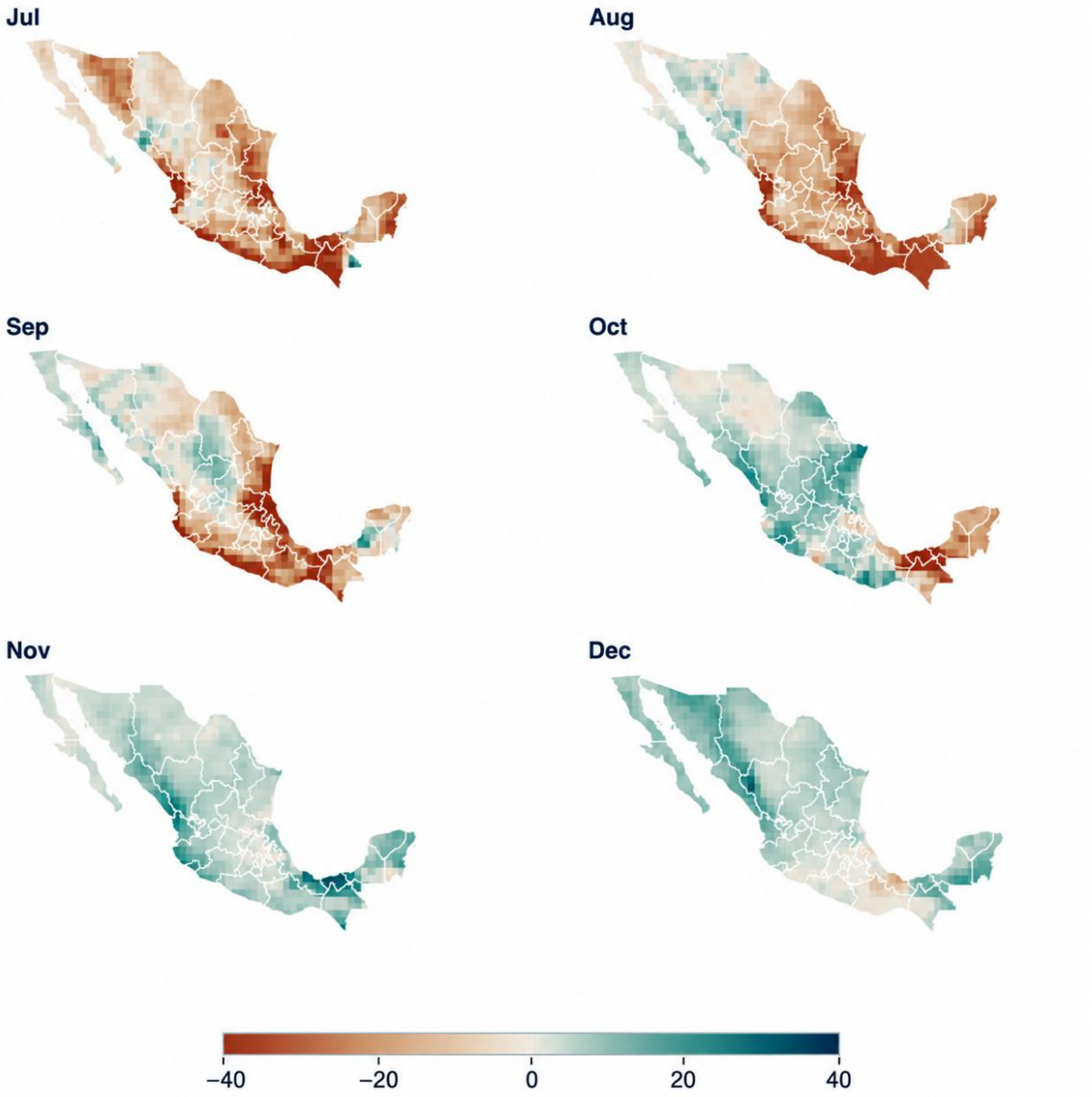
(mm of precipitation for every +1 °C of RONI); 1950–2019



Source: Actinver with data from GPCC and NOAA/CPC.

Sensitivity of Precipitation to RONI, July–December at the Cell Level

(mm of precipitation for every +1 °C of RONI); 1950–2019



Source: Actinver with data from GPCC and NOAA/CPC.

4.- Calendars and Exposure of Agricultural Production

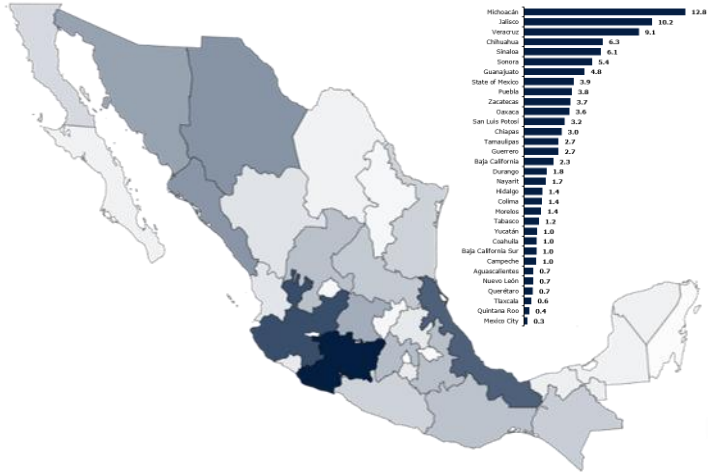
The rainfall heterogeneity associated with El Niño does not automatically translate into changes in agricultural production. Its potential impact depends on where crops are located, at what point in the year they are in production, and what water source they depend on. A reduction in precipitation can have very different consequences if it occurs during the planting of a rain-fed crop than if it coincides with the harvest of predominantly irrigated production.

Mexican agriculture shows a high degree of territorial concentration. In 2025, Michoacán, Jalisco, and Veracruz together accounted for roughly a third of the value of national agricultural production. However, their exposure to precipitation differs: while Veracruz shows a high dependence on rain-fed agriculture, in Michoacán and Jalisco the mix between irrigation and rain-fed farming is more balanced.

This difference is relevant because rain-fed agriculture depends directly on the distribution of rainfall during the production cycle. In irrigated agriculture, by contrast, precipitation remains important, but its effect can be transmitted indirectly through water availability in dams and aquifers, recharge, and extraction costs. This matters because a high share of irrigation does not imply an absence of climate exposure.

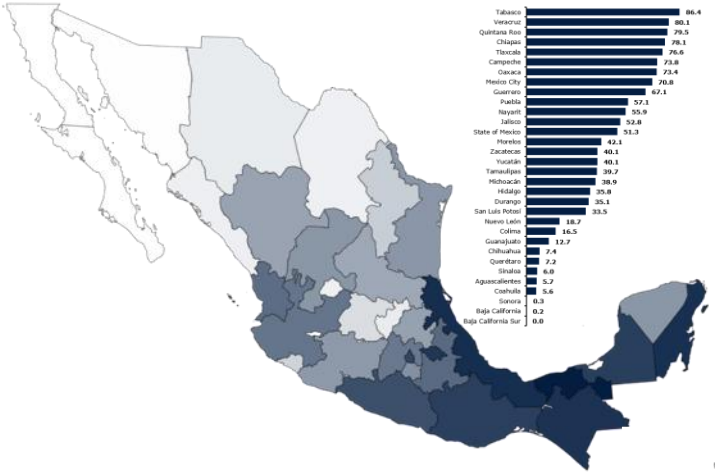
State Share in the Value of National Agricultural Production

(% of national production value; Total = MXN 812 billion); 2025



Rain-Fed Agricultural Production

(% of state production; Total = MXN 325 billion); 2025

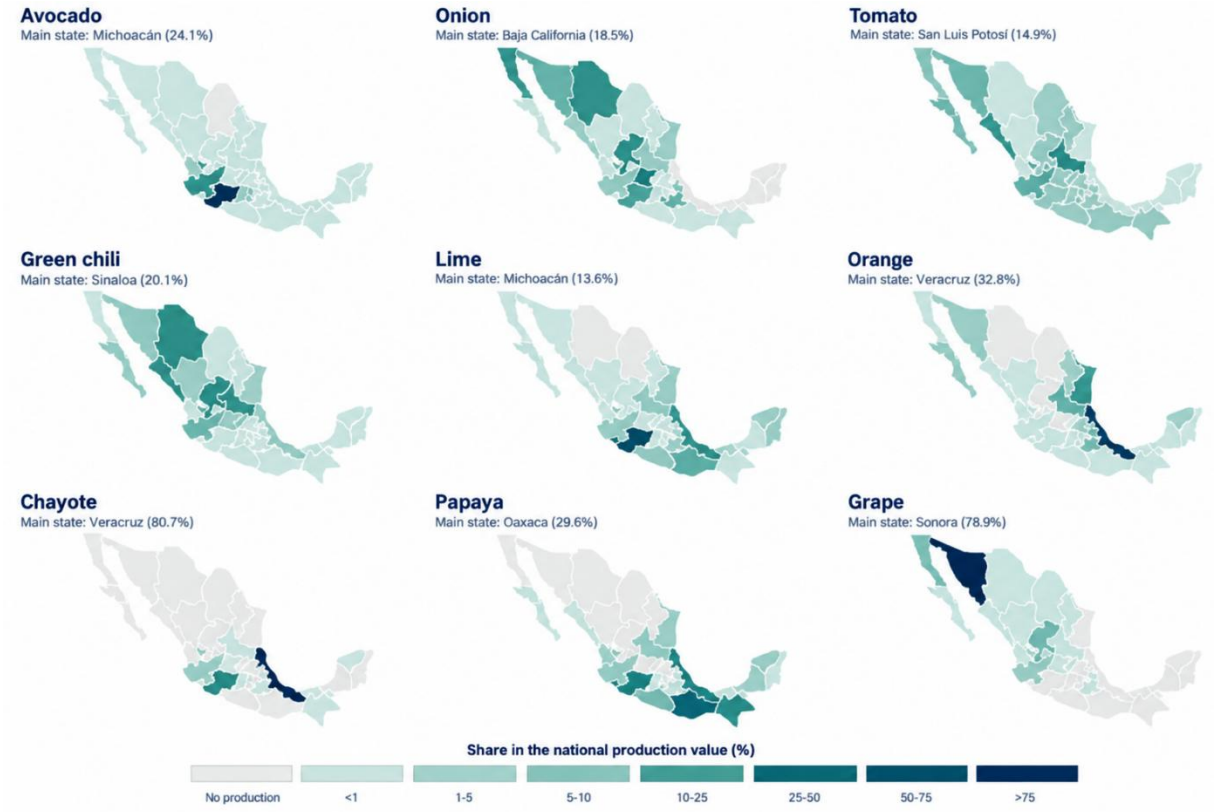


Source: Actinver with data from the Ministry of Agriculture and Rural Development.

The composition of production also varies considerably by region. Some crops show a high degree of territorial concentration, while others are produced in a more distributed way across different states. For example, avocado is concentrated mainly in Michoacán, orange and chayote in Veracruz, and grapes in Sonora; in contrast, products such as onion and tomato show a more diversified regional distribution. These differences mean that the same precipitation anomaly can affect a very different share of national supply depending on the crop and the region in which it occurs.

State Distribution of Production Value for Selected Crops

(Each state's share of each crop's national value; %); 2025



Source: Actinver with data from the Ministry of Agriculture and Rural Development.

The location of production is only part of climate exposure. The timing of a precipitation anomaly also matters. In Mexico, agricultural production includes cyclical crops—that is, those planted and harvested within a specific agricultural cycle—as well as perennial crops, which remain established for several years and can produce without requiring new planting each cycle.

Cyclical crops are organized mainly around the spring–summer and fall–winter cycles, which do not necessarily coincide with the calendar year and can overlap: within the same month, planting for one cycle may be starting while harvesting for another cycle is underway.

Data from the Agri-Food and Fisheries Information Service (SIAP) make it possible to distinguish planted and harvested area by crop, cycle, and production method. Monthly progress figures accumulate within the agricultural year, so interpreting them requires identifying the increases between comparable reporting periods rather than assuming that all the area reported in a given month was planted during that period.

Monthly Planting Calendar for Cyclical Crops

(Median share of annual planting by month; %); 2018–2024



Source: Actinver with data from the Ministry of Agriculture and Rural Development.

Production calendars are essential for interpreting the effect of El Niño. A reduction in rainfall can coincide with the planting of one crop, the development of another, and the harvest of a third. Consequently, it is not enough to know how much precipitation changes in a given state; it is also necessary to identify whether that anomaly occurs during a relevant stage of the production cycle.

For perennial crops, such as avocado, lime, or orange, relevant exposure cannot be defined based on an annual planting date, since the crop remains established for several years. In these cases, stages such as flowering and fruit formation and growth matter, so we use annual precipitation windows and production calendars as a reference to approximate the exposure period.

5.- From Precipitation to Production

To evaluate whether differences in precipitation translate into changes in agricultural activity, we build a municipal panel that combines SIAP production data with GPCC precipitation data. The unit of analysis corresponds to a combination of municipality, crop, agricultural cycle, production method, and year. The sample used in this extension comprises 142,363 observations, 18,652 productive units, and 2,351 municipalities.

The data structure is a panel of productive units observed over time. Each unit, denoted by u, corresponds to a specific combination of municipality, crop, agricultural cycle, and production method, whether irrigated or rain-fed. For example, irrigated onion production during the spring–summer cycle in a given municipality constitutes a different unit from rain-fed onion production in that same municipality. Each of these units can be observed over several years, identified by y.

This structure makes it possible to compare similar productive units that faced different climate conditions. In simple terms, the estimation compares municipalities that produced the same crop, during the same agricultural cycle, under the same production method, and in the same year, but that received different amounts of rainfall. This is intended to separate local precipitation variation from other factors that may have simultaneously affected all producers of the same crop in a given year.

For each productive unit, we build a precipitation measure corresponding to the agricultural-cycle window during which the crop is exposed. Observed precipitation is compared with its usual level to identify whether a rainfall deficit or excess occurred during that period. We denote this precipitation anomaly as $A_{u,y}$.

From it we construct two variables:

$$D_{u,y} = \frac{\max(-A_{u,y}, 0)}{100}$$

$$E_{u,y} = \frac{\max(A_{u,y}, 0)}{100}$$

where $D_{u,y}$ measures the precipitation deficit and $E_{u,y}$ is the precipitation excess of productive unit u during year y. Both variables are expressed in units of 100 millimeters. For example, if 150 millimeters less rain than usual is recorded during the relevant window for a crop, $D_{u,y}$ takes a value of 1.5 and $E_{u,y}$ equals zero. If, conversely, 150 additional millimeters are recorded, the opposite occurs.

Separating deficits from excesses allows the agricultural response to differ between the two types of anomaly. This matters because a reduction in precipitation does not necessarily have the opposite effect of an increase of the same magnitude: both water scarcity and excess water can affect planted area, yield, or production through different mechanisms.

The main specification is:

$$z_{u,y} = \alpha_u + \lambda_{c,s,r,y} + \theta^D_{z,r} D_{u,y} + \theta^E_{z,r} E_{u,y} + \varepsilon_{u,y}$$

where $z_{u,y}$ represents the agricultural outcome observed for productive unit u in year y. Four outcomes are analyzed: planted area, the share of planted area that reaches harvest, yield per hectare harvested, and total production.

The term α_u represents a fixed effect for each productive unit. In practice, it controls for relatively permanent characteristics of a specific combination of municipality, crop, cycle, and production method, such as soil conditions, altitude, agricultural infrastructure, or structural productivity differences. In this way, the estimation does not directly compare, for example, a highly productive municipality in Sinaloa with another with completely different conditions in Oaxaca; instead, it mainly exploits changes observed within comparable units over time.

The term $\lambda_{c,s,r,y}$, in turn, represents a fixed effect specific to each combination of crop, agricultural cycle, production method, and year, respectively. This term absorbs factors that simultaneously affect all producers of the same crop under similar production conditions in a given year. For example, a nationwide change in fertilizer prices, a widespread pest outbreak, or a technological change affecting rain-fed beans during the same cycle would be captured by this effect.

As a result, identification of the coefficients θ^D and θ^E comes from comparing units that produce the same crop, in the same cycle, under the same production method, and during the same year, but that faced different precipitation anomalies. The coefficient θ^D measures the association between a larger rainfall deficit and the agricultural outcome, while θ^E captures the corresponding relationship for a precipitation excess.

The estimation further distinguishes between rain-fed and irrigated agriculture, since the transmission of precipitation differs in each case. In rain-fed crops, rainfall is directly one of the main water sources during the production cycle. In irrigated agriculture, by contrast, the relationship can operate more indirectly, through the availability of surface or groundwater, storage levels, irrigation restrictions, or extraction costs. As a result, a high share of irrigation does not imply that production is immune to climate conditions.

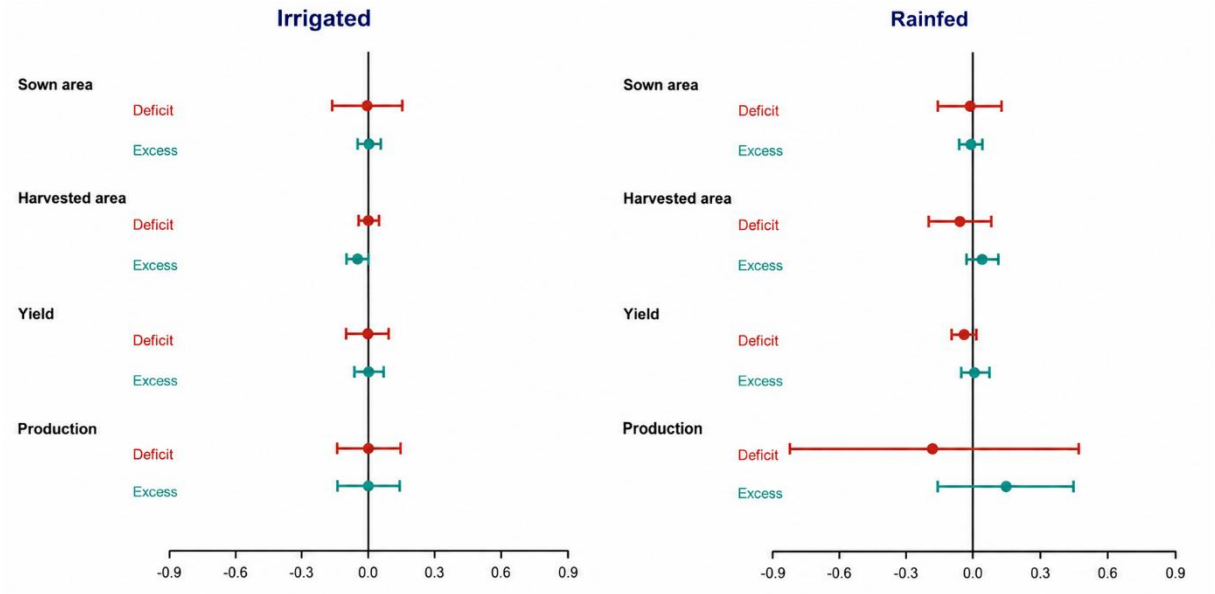
For planted area, yield, and production we use the inverse hyperbolic sine transformation, $asinh(x)$. This transformation is useful because it allows zero-value observations to be retained, unlike the logarithm, which can only be applied to positive values. For sufficiently large values, its behavior is similar to that of a logarithmic transformation; however, its coefficients should not be interpreted directly as percentage changes.

The methodology was adapted to 25 representative production groups covering 28 agricultural products of interest. For annual or short-cycle crops, climate exposure is built using the corresponding production windows.

For perennial crops, such as avocado, lime, or orange, an "annual planting date" does not correctly represent the exposure period, so the main specification uses precipitation throughout the year, and, when sufficient data are available, the monthly production calendar is used as a sensitivity exercise.

Agricultural Response to Precipitation Anomalies

(Coefficients per 100 mm of anomaly and 95% confidence intervals)



Source: Actinver with data from the Ministry of Agriculture and Rural Development.

The results do not show a uniform response of agricultural activity to precipitation anomalies. In rain-fed agriculture, the coefficients associated with rainfall deficits generally show the expected direction: lower precipitation is associated with lower yields and lower production. By contrast, the estimated associations for irrigated agriculture are considerably smaller. However, the confidence intervals are wide and all of them include zero, so the estimates do not allow us to identify a common effect with sufficient statistical precision.

This lack of precision does not mean that precipitation is irrelevant to agricultural production. Rather, it indicates that its effect depends on the crop, the region, the production method, and the point in the agricultural cycle at which the anomaly occurs. As a result, aggregate results can mask relevant responses for specific products, especially when their production is territorially concentrated or coincides with sensitive stages of the production cycle.

The production response, therefore, is not a mechanical or homogeneous channel between El Niño and prices. To assess its possible pass-through to consumers, it is also necessary to consider the territorial concentration of supply, storage capacity, trade, and the speed with which changes in availability are passed on to prices.

6.- From Precipitation to Prices

Changes in agricultural production do not translate automatically or proportionally into the prices faced by consumers. The magnitude and speed of this pass-through depend on factors such as supply availability in other regions, inventories, imports, storage, and marketing. The next step, therefore, is to directly assess whether conditions associated with El Niño are reflected in the prices of agricultural products included in the National Consumer Price Index (INPC).

To evaluate this relationship, we use monthly data on INPC price indices and analyze how their trajectory changes over the following twelve months in response to variations in ENSO intensity. This horizon captures effects that may appear gradually, in line with production, marketing, and price-adjustment timelines for agricultural goods.

For each price index we define the cumulative 12-month change as:

$$G_{t,12} = 100[\log(P_{t+12}) - \log(P_{t-1})],$$

where P_t represents the level of the price index in month t. Thus, $G_{t,12}$ approximately measures how much the price changes, in percentage terms, over the twelve months following each starting point.

To allow the warm (El Niño) and cold (La Niña) phases of ENSO to have distinct relationships with prices, we split RONI into two components:

$$R_t^+ = \max(RONI_t, 0), \quad R_t^- = \min(RONI_t, 0).$$

The component R_t^+ captures the intensity of the warm conditions associated with El Niño, while R_t^- captures the cold conditions associated with La Niña. In this way, the estimation does not impose that both phenomena have effects of equal magnitude and opposite sign.

The specification used is:

$$G_{t,12} = \mu_{m(t)} + \beta^t R_t^+ + \beta^- R_t^- + \delta' Z_t + \varepsilon_{t+12},$$

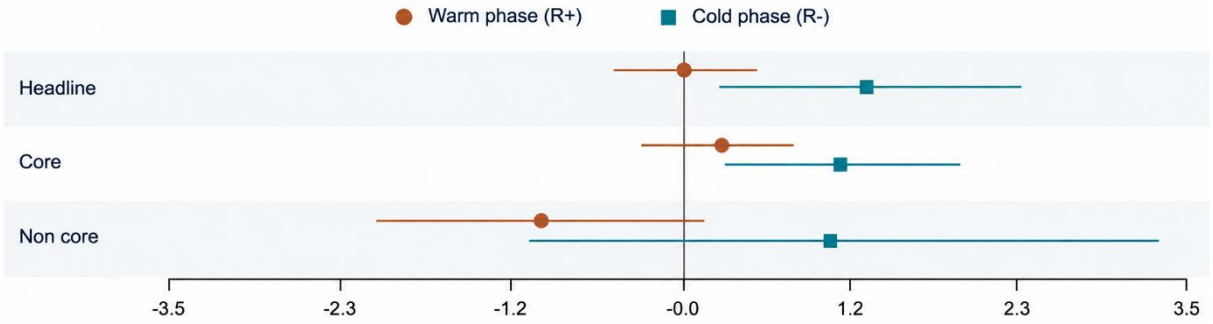
where $\mu_{m(t)}$ incorporates calendar-month effects to control for the usual seasonality of prices, while Z_t gathers variables that capture other macroeconomic factors that can simultaneously influence inflation, including the prior dynamics of prices, the exchange rate, and energy and utility prices.

The coefficient β^t measures how many percentage points the cumulative price change over the following twelve months shifts for a 1 °C increase in the warm component of RONI, holding constant the other factors considered in the estimation. Similarly, β^- captures the corresponding association with the cold phase of ENSO.

The estimation is carried out initially for headline, core, and non-core inflation, and is then extended to agricultural products within the INPC. This breakdown makes it possible to assess whether a barely visible response in the aggregate indices may mask different behaviors across products, particularly those whose production shows a high degree of territorial concentration or greater exposure to climate conditions.

Inflation Response to the Warm and Cold Phases of ENSO

(Cumulative 12-month change per +1 °C of RONI; percentage points)



Source: Actinver with data from INEGI, NOAA/CPC, and own estimates.

Note: The lines represent 95% confidence intervals.

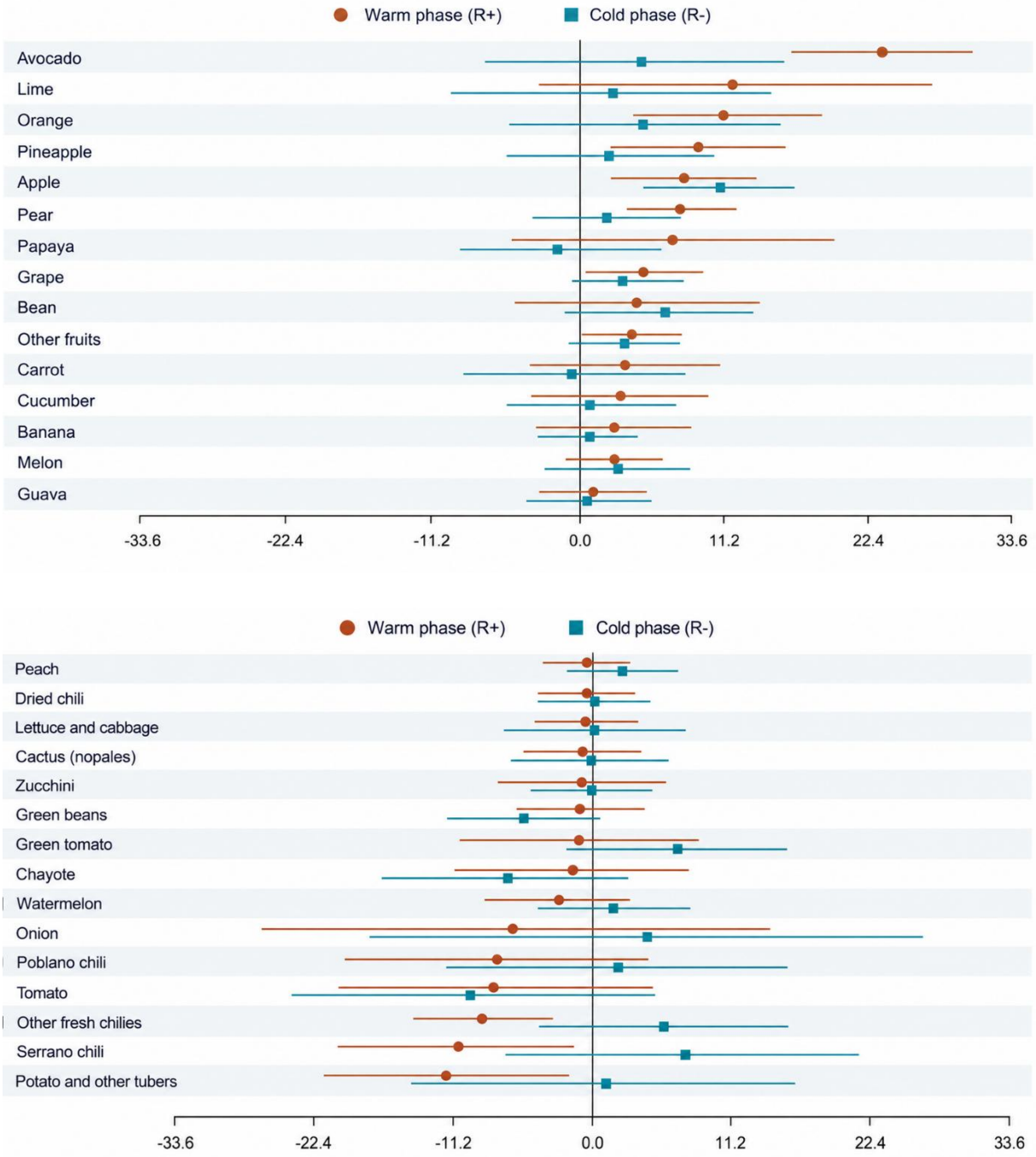
At the aggregate level, the results do not show uniform inflationary pressure associated with the warm phase of ENSO (where we currently stand in 2026). The coefficients for headline, core, and non-core inflation show considerable uncertainty and, in line with the historical evidence from the original exercise, do not allow us to identify a generalized inflationary premium associated with El Niño. This suggests that any effect on prices may be concentrated in specific products and diluted when aggregated into broader indices.

The breakdown by product reveals considerable heterogeneity that is not observed in the aggregate indices. For the warm phase of RONI, some products show positive associations of meaningful magnitude, including avocado, orange, pineapple, apple, and pear, while others, such as some chili peppers and potatoes and other tubers, show negative coefficients.

This pattern reinforces the idea that El Niño does not constitute a uniform shock to agricultural prices. The response depends on the location of production, each crop's calendar, supply conditions, and the capacity to adjust through other regions, storage, or trade. As a result, offsetting movements between products can partially cancel out within aggregate indices.

Inflation Response to the Warm and Cold Phases of ENSO

(Cumulative 12-month change per +1 °C of RONI; percentage points)



Source: Actinver with data from INEGI, NOAA/CPC, and own estimates.

Note: The lines represent 95% confidence intervals.

6.- Conclusion

The evidence analyzed throughout this document does not support the idea of a climate shock that mechanically translates into generalized inflationary pressures.

In Mexico, the relationship between ENSO and precipitation is markedly seasonal and geographically heterogeneous: only some months show statistically significant associations, and a single national coefficient groups together local responses of opposite sign. This heterogeneity is amplified when moving to production, where the impact depends on crop location, the production calendar, and the method used—rain-fed or irrigated; while rainfall deficits are associated with lower yields and production in rain-fed agriculture, the imprecision of the estimates prevents identifying a common effect across the entire sector.

Consistently, on the price side there is no inflationary premium attributable to the warm phase of ENSO in the headline, core, and non-core indices, although the breakdown by product reveals meaningful and opposite-sign responses—positive for products such as avocado, orange, pineapple, apple, and pear, and negative for some chili peppers, potatoes, and other tubers—that tend to cancel out when aggregated.

The takeaway for tracking inflation, therefore, is one of idiosyncratic risks (at the level of crop, agricultural cycle, water-use method, and month combinations), rather than an upward adjustment to the overall inflation outlook.

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June 30, 2026 | Update

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Our recommendations are set based on an expected projected return which, as any estimate, cannot be guaranteed. Readers should be aware that a number of subjective elements have also been taken into consideration in order to determine each analyst's final decision on the recommendation. These include the specific risk profile, financial stance, pending corporate actions, and the degree of certainty of the financial projections, among others.

OUTPERFORM: Total return [TR] (including dividends) for year-end 2027 higher than the TR of IPC Index.
MARKET PERFORM: Total Return [TR] (including dividends) equal to (+/- 3.5%) the TR of IPC Index.
UNDERPERFORM: Total Return [TR] (including dividends) lower than the TR of IPC Index.

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