

## El Niño and Firms: Impact on Food and Beverages Manufacturing Firms in Ethiopia

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*This paper examines the effect of the extreme drought, which is caused by El Niño on firms' performance in food and beverage manufacturing sector in Ethiopia. Combining panel data of Ethiopia Manufacturing Firms, remote sensed data on rainfall from Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data, and survey, we build a district - level measure of El Niño exposure and use within district variation over time to employ difference-in-difference estimation. We find that El Niño exposure decreases firms' performance in terms of sales, employment, total factor, and labor productivity. The finding was robust to different model specifications. We identify shortage of domestic-sourced raw materials as a main channel: El Niño drought shock reduces the availability of domestic raw material.*

### Introduction

Droughts have intensified and become more frequent in recent years due to climate change (Tollefson, 2021, 2022), with developing countries having lower adaptive capacities, hence, experiencing a heightened impact. While such changes could affect the performance of firms, evidence on the impact of droughts on firms and manufacturing sector in general is scarce (see e.g., Lin & Sheng, 2022). Furthermore, there is no empirical study on how the El Niño induced drought affects manufacturing firms, particularly food and beverage manufacturing firms. Given the projected doubling of the frequency of extreme El Niño events in the future (Cai et al., 2014), there is a need for evidence on the effect of these events on manufacturing firms to support effort for enhancing the adaptive capacity and resilience of firms.

The current study examines the impacts of the El Niño induced drought on manufacturing firms' performance (sales, employment, total factor and labour productivity) in Ethiopia – one of the most climate change vulnerable countries in the world. El Niño is an extreme atmospheric condition that periodically warms the water across the central and east-central Equatorial Pacific. In this study, we specifically focus on the 2015-16 El Niño event, which triggered one of the worst droughts in the central and northern parts of Ethiopia in decades. Specifically, we aim to answer three research questions: First, do El Niño induced droughts affect food and beverage manufacturing firms' performance, as measured in terms of firms' sale, employment, and total factor and labour productivity? Second, what are the mechanisms through which extreme drought affects firms' performance? Third, what strategies do surviving firms adopt to cope and adapt to droughts? By doing so, our work: (i) contributes to advancing our understanding of the impact of extreme weather events on the

firm dynamics in terms of employment creation, firm entry, survival, and growth and (ii) helps policy makers to make an informed decision to mitigate the impact of droughts on firms.

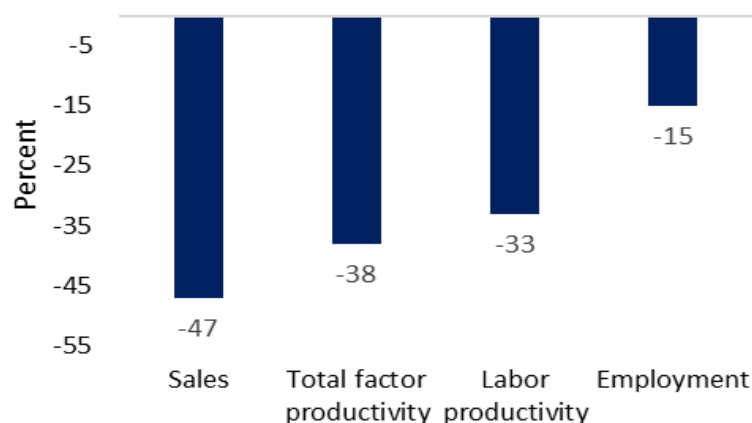
## Methodology

To identify the causal impact of El Niño drought on food and beverage manufacturing firms, we adopt a quasi-experiment approach, i.e., difference-in-differences estimation. The estimation compares outcomes of the treatment group (firms located in El Niño induced drought-affected districts) with outcomes of the control group (firms operating in non-affected districts) before and after the 2015-16 El Niño induced drought. Specifically, we assign the 2015 to 2016 period as a treatment period and the 2012-2014 period as a pre-treatment period. Our analysis draws upon data from three sources. First, we use the annual Ethiopia Large and Medium Manufacturing Firms census collected by the Central Statistical Agency (CSA) of Ethiopia, Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data, and primary (survey) data. The census provides the establishment's location at district level, the second lowest administrative unit of Ethiopia, which help us to exploit the geographic variations and create a treatment variable for identification at a district level. Based on the CHIRPS data, a gridded spatial dataset of about 0.05-degree resolution (approx. 5550 meters), we calculate the Standardized Precipitation Index (SPI), which measures precipitation deviation of precipitation from its long-term trend (30 years). Districts with an average SPI less than -2 are considered as drought affected and all other districts are considered as non-drought affected. The primary (survey) data was administered with a random sample of managers of surviving firms in the drought affected areas to identify the coping and adaptation strategies that firms adopt in the face or anticipation of El Niño induced droughts.

## Results

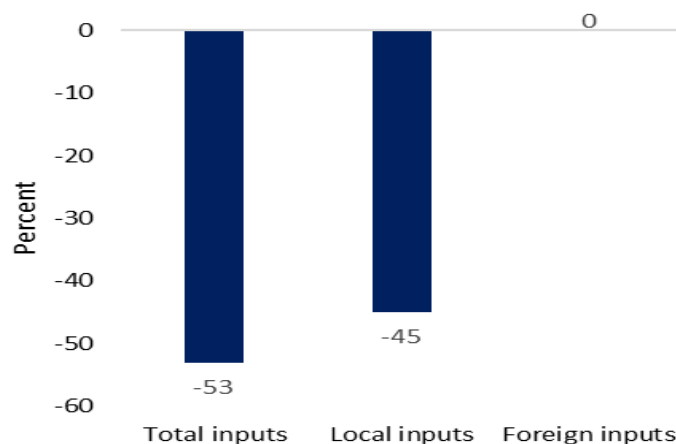
We have three key results, firstly - El Niño induced droughts inhibit firms' performance. Figure 1 presents the estimation results of the impact of El Niño induced droughts on firm performance outcomes: sales, employment, labour, and total factor productivity (TFP). The results show that El Niño induced droughts have decreased firms' sales, employment, labour, and total factor productivity. Specifically, firms exposed to El Niño induced droughts, compared to firms that were not, have experienced approximately 47, 38, 33, and 15% reduction in sales, TFP, labour productivity, and employment, respectively. This is in line with our expectation that firms exposed to the El Niño drought shock tend to experience a decrease in performance outcomes.

Figure 1: the effect of El Niño on firm performance outcomes



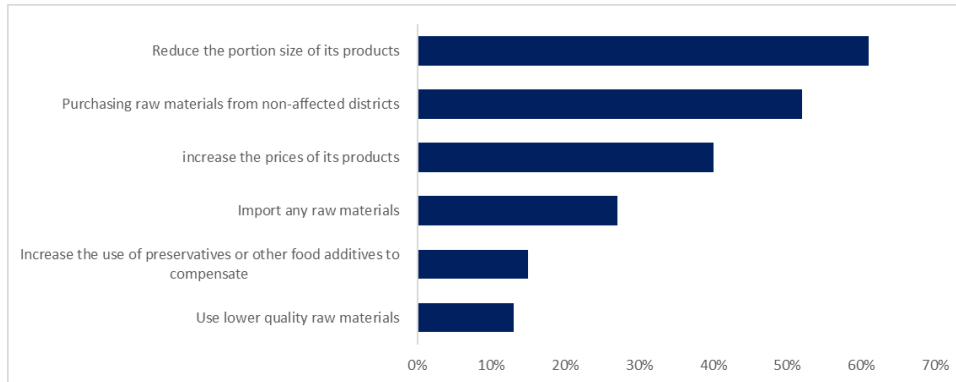
We also find that the El Niño induced drought affected firms' performance through reducing the supply and use of raw materials, particularly from domestic sources. Figure 2 presents the impact of El Niño induced droughts on firm performance through use of raw material inputs. The results show that the El Niño induced drought has decreased firms' use of raw materials input use by about 53%, which confirms the findings from our survey with the managers of surviving firms who reported shortage of raw materials as a major challenge during the El Niño induced drought. The results also show that the drought reduced the use of domestic raw materials (by 45%), but not of imported raw materials. This suggests that the drought adversely affected firm performance through reduced use of local materials, and firms could not counterbalance this reduction by increasing their use of imported raw materials to sustain their performance. The other mechanisms that were interpreted from the survey are shortage of electric power and increase the price of raw materials if available.

Figure 2: the impact of El Niño on the firms' use of raw materials



Our third result is that firms exposed to the El Niño induced droughts adopt several strategies to cope with and adapt to the adverse effect of the drought on their performance, but reducing production capacity is the most common. Figure 3 presents the strategies that firms adopt to adapt and cope with the El Niño induced drought. Most firms (60%) reported that they reduce their production capacity as a major adaptation and coping strategy. Firms also buy raw materials from neighbouring areas that were not affected by the drought and increase the price of their products to compensate for the loss that could arise from the high cost of raw material.

Figure 3: strategies adopted by firms to cope with and adapt to El Niño induced drought.



### Policy Recommendations

The empirical findings of the study have two direct implications for policy development. Firstly, firms need to be supported with accessing raw materials (through improving supply chain resilience and exploring alternative raw material sourcing strategies) in time of drought to minimize the negative effects of their performance. Secondly, interventions are needed to enhance the resilience and adaptive capacity of food and beverage firms, so that the firms are not significantly affected by droughts. Such interventions include facilitating access to contingent line of credit, investing on distribution infrastructure (e.g., roads) and agricultural production infrastructure (e.g. irrigation), offering training programs for drought management planning, and providing tax relief to encourage investments in drought management.

## References

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