When the rains fail: How drought undermines manufacturing productivity in Ethiopia

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- Drought reduces manufacturing firm productivity by 2-3.5%, and the damage deepens over two years before stabilising. Standard disaster assessments that focus only on the year of the shock substantially undercount the cost.
- The primary channels are labour-productivity loss, raw-material supply-chain breakdown, and collapsing rural demand. Capital investment is entirely absent throughout—not because returns are low, but because firms cannot access credit.
- Firms hit by two droughts lose more than the sum of both shocks combined. As climate change increases drought frequency, these compounding losses will grow.
- Agriculture-dependent firms feel the worst productivity effects in the second year after drought, not the first. Reactive policy triggered by production data will always arrive too late for this group.
- 67% of firms cite a lack of access to credit as the primary barrier to resilience investment, identifying a market failure rather than a lack of willingness to adapt.
- Four targeted interventions can reduce the damage: drought-linked credit facilities, early-warning systems for manufacturers, road infrastructure investment, and integration of climate risk into industrial development plans.

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The policy problem

Ethiopia has staked its development future on manufacturing. Successive Growth and Transformation Plans and the current Ten-Year Development Plan (2021-2030) target manufacturing as the engine of job creation, productivity upgrading, and export diversification. Industrial parks have attracted foreign investment, and manufacturing value added has grown steadily.

Yet this strategy faces a threat that industrial policy frameworks have largely ignored: drought.

Ethiopia is among the world's most drought-prone countries. The 2011 La Niña drought affected 4.8 million people. The 2016 El Niño event—one of the three strongest on record—affected 10.2 million people and caused economic losses of 2.1% of GDP (EM-DAT, 2023). With climate change intensifying the frequency and severity of drought, this threat will only grow.

Why manufacturing?

Over 87% of Ethiopia's electricity is generated by hydropower (Abdisa, 2018). When reservoirs fall, factories lose power. Most manufacturing firms also depend directly on agricultural inputs or on rural households as their main customers. Drought, therefore, hits factories through three simultaneous channels: energy, inputs, and demand.

Despite these structural vulnerabilities, no firm-level causal evidence existed on whether drought actually reduces manufacturing productivity in any sub-Saharan African country. Without this evidence, industrial policy has been designed without accounting for climate risk, and climate finance has concentrated on agriculture and social protection while ignoring manufacturing.

What the research does

This study provides the first firm-level causal estimates of the impact of drought on manufacturing Total Factor Productivity (TFP), a measure of how efficiently firms convert labour, materials, and capital into output, in sub-Saharan Africa.

Data

- We use eleven years of data (2008-2018) from Ethiopia's Large and Medium Manufacturing Industry Survey, covering over 1,000 firms annually with information on output, inputs, employment, capital, and precise firm location.
- Drought severity is measured at each firm’s location using the Standardised Precipitation Evapotranspiration Index (SPEI), which

captures both reduced rainfall and increased evaporation due to higher temperatures.

- We study two distinct drought events: the 2011 La Niña drought (4.8 million people affected) and the 2016 El Niño event (10.2 million affected; losses of 2.1% of GDP).

Method

To isolate the causal effect of drought from other factors, we use the Callaway and Sant'Anna (2021) staggered difference-in-differences estimator, which compares drought-affected firms only to genuinely unaffected firms, avoiding the misleading results that conventional methods produce when some firms are affected earlier than others.

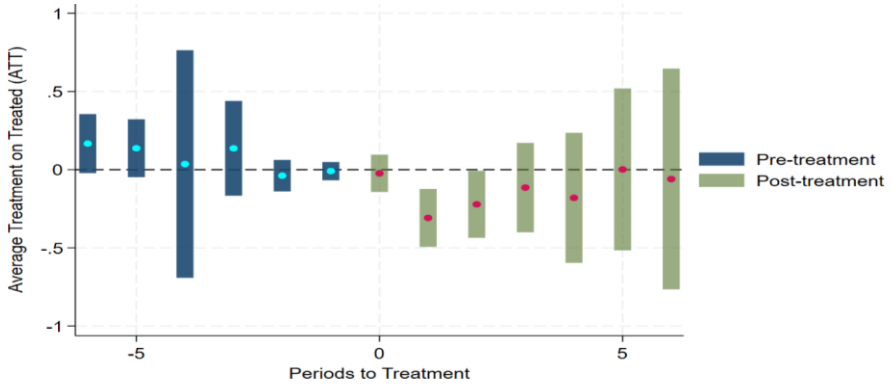
We also conducted a primary survey of 1,659 manufacturing firms (January to April 2025) to understand firms' direct experience of drought disruption, their coping strategies, and the barriers preventing them from investing in resilience.

Key findings

Drought causes large, delayed, and persistent productivity losses

Drought reduces manufacturing TFP by 2-3.5% relative to unaffected firms. Critically, this damage does not appear in the year of the drought. It emerges in years two and three, as firms exhaust the buffers—inventories, supplier credit, deferred purchases—that absorbed the initial shock. Four years after the drought, productivity has still not recovered.

Figure 1: Effect of drought on firm TFP event study, noting drought's effect on firm productivity peaks in years two and three and does not reverse



Source: Authors' calculations from LMMIS 2008-2018 using Callaway and Sant'Anna (2021) estimator.

This matters for policy: disaster impact assessments that measure costs only in the year of the event will systematically underestimate the true productivity damage from drought.

Three channels drive the losses

- **Labour productivity falls sharply, but no workers are dismissed**. Firms retain staff but operate less efficiently as food insecurity impairs workers' physical capacity, power cuts stop machinery, and hours are reduced.
- **Raw material supply chains break down in a two-stage process**. Initial shortages ease as firms source alternatives, but then deepen again as soil damage, livestock losses, and broken supplier relationships permanently reduce the agricultural input base.
- **Rural consumer demand collapses immediately**. With farming households forming most of the consumer base, drought-induced income losses translate directly into lower demand for manufactured goods within the same season.

Agri-dependent firms face a two-year lag—and need earlier support

Food processors, textile mills, and leather producers show no significant productivity loss in the year of the drought or the year after. Their worst effects emerge in year two, once inventories are depleted, and supply-chain damage becomes impossible to work around. By contrast, firms not linked to agriculture show losses from year one.

This timing gap means that support triggered by observable production declines will arrive two years too late for the firms most structurally vulnerable to drought.

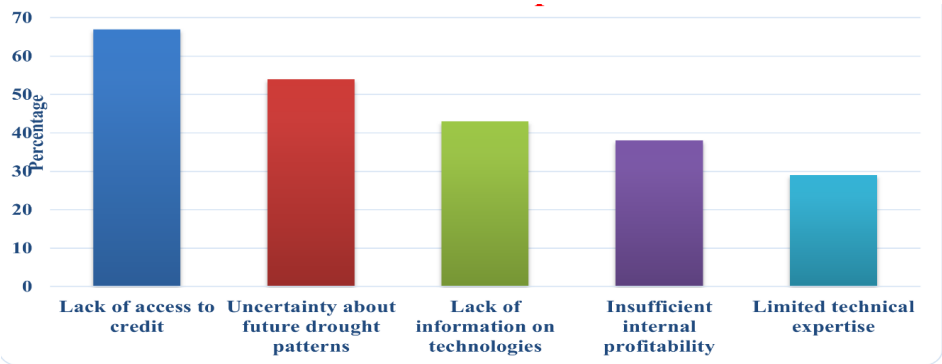
Firms hit twice lose more than the sum of both shocks

About 90% of firms affected by the 2016 drought had also been hit in 2011. The total productivity loss for these firms exceeds the sum of the two individual shocks by 31%. When the second drought strikes, firms enter it with depleted reserves, weakened supplier networks, and no remaining financial buffers. As droughts become more frequent with climate change, this compounding effect will intensify.

Firms want to invest in resilience but cannot finance it

The survey reveals that firms are not failing to adapt because they judge resilience investment to be unprofitable. The dominant barrier is credit access.

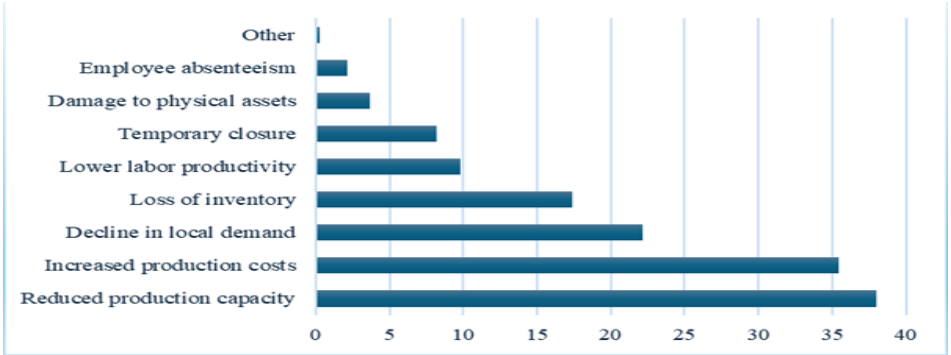
Figure 2: Barriers to adaptation



Source: Authors' primary survey of 1,659 Ethiopian manufacturing firms, January to April 2025.

Firms most commonly report reduced production capacity (38%) and increased production costs (35%) as the primary operational effects, with demand decline (22%) and inventory loss (18%) following. Capital investment to address these problems is minimal: only 4% of firms invested in new equipment.

Figure 3: What effects did your firm experience due to drought?



Source: Authors' primary survey of 1,659 Ethiopian manufacturing firms, January to April 2025

Policy recommendations

Introduce drought-linked credit and insurance products for manufacturers

The most important single intervention is relaxing the credit constraint that prevents firms from investing in resilience. The Ethiopian Development Bank and development partners should design subsidised loan facilities and drought index insurance products specifically for manufacturing firms, linked to early SPEI-based drought triggers. Eligibility should prioritise small firms and agri-dependent sectors, where the financing gap is greatest.

Extend drought early-warning systems to cover the manufacturing sector

Current early-warning infrastructure focuses on agriculture and food security. The Ethiopian Meteorological Institute and the Disaster Risk Management Commission should issue manufacturing-specific drought alerts at the onset of a drought event—not when production data signal a problem. Agri-dependent firms need supply-chain support activated at least two years before observable output begins to fall.

Integrate climate vulnerability into Ethiopia's industrial location and investment strategy

The Ethiopian Investment Commission and the Ministry of Industry should incorporate drought-exposure maps into decisions about industrial park locations, sector promotion priorities, and FDI targeting. Manufacturing concentrated in agri-linked sectors in drought-prone regions faces systemic and growing risks that standard productivity projections do not capture.

Expand international climate finance to cover manufacturing-sector resilience

International climate finance for Ethiopia—through the Green Climate Fund, the African Development Bank, and bilateral donors—has concentrated on agriculture and social protection. Given that droughts impose large and persistent costs on manufacturing, climate finance should expand to include manufacturing resilience programmes: backup energy infrastructure, input diversification support, and working-capital facilities for drought-affected firms.

Implementation challenges

Financial constraints and fiscal space

Subsidised credit and drought insurance require fiscal resources or donor support. Ethiopia's public finances are under strain following the post-2020 conflict period. Blended finance structures —combining government guarantees with private lending and development finance institution capital—would allow programmes to scale without requiring full public financing.

Targeting and identification

Directing support to drought-affected manufacturers requires reliable firm-level location data and timely SPEI monitoring. The Ethiopian Statistical Service LMMIS already provides geolocated firm data; linking it to real-time SPEI feeds from the Climatic Research Unit would enable objective, transparent targeting that limits political discretion in allocating support.

Institutional coordination

Effective drought response in manufacturing requires coordination among the Ministry of Industry, the Ministry of Finance, the Ethiopian Development Bank, the Meteorological Institute, and the Disaster Risk Management Commission. These agencies currently operate largely independently of climate and industrial policy. Establishing a formal Manufacturing Climate Resilience Working Group under the Ministry of Industry would provide the necessary coordination mechanism.

Political economy of sector prioritisation

Expanding support for large and medium manufacturers may face political resistance if it is perceived as favouring formal-sector firms over smallholder farmers or informal workers, who face greater absolute poverty and are more numerous. Communicating the employment and income multipliers generated by manufacturing—and the rural demand and input-supply links that connect farm and factory welfare—will be important for building political support.

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