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Wondatir A. Gebre

w.a.gebre@lancaster.ac.uk

Lancaster University Management School

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The Long Shadow of Famine: Historical Drought and the Geography of Foreign Investment in Ethiopia

Wondatir A. Gebre[1]

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Abstract

Do climate disasters shape where foreign firms locate decades after the event? This paper links the 1983–84 Ethiopian drought, one of the most severe climate disasters of the twentieth century, to the location of foreign manufacturing firms three decades later. I combine geocoded firm records from the Ethiopian Statistical Service, gridded Standardised Precipitation–Evapotranspiration Index (SPEI) data, and the three waves of the Ethiopian LSMS–ISA panel (2011, 2013 and 2015), and estimate fixed-effects logit models that compare drought-exposed and unexposed communities within the same region. Exposed communities are 11 to 14 percentage points less likely to host a foreign firm in the 2010s, and about 16 points less likely under a stricter drought threshold. The evidence points to human capital as the main channel: the cohort exposed in early life completed 1.6 to 2.8 fewer years of schooling, and community schooling is strongly associated with foreign firm presence. The penalty is smaller for joint ventures than for wholly foreign-owned firms, and it disappears by 2015, after the 2012 Investment Proclamation expanded investment incentives. The results suggest that the human-capital scars of climate shocks can last long enough to shape the spatial distribution of capital, and that climate resilience and education belong in the same investment-promotion strategy.

JEL codes: F21, O13, O15, Q54, R30.

Keywords: Climate shocks; drought; foreign direct investment; human capital; early-life exposure; Ethiopia.

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[1] Department of Economics, Lancaster University Management School, Lancaster LA1 4YX, United Kingdom. Email: w.a.gebre@lancaster.ac.uk.

1 Introduction

Foreign direct investment (FDI) is widely promoted as a route out of low-productivity equilibria in Sub-Saharan Africa. Governments have tried investment proclamations, special economic zones, investment promotion agencies and bilateral treaties, in the expectation that foreign capital, technology and management will spill over into local economies (Diao, McMillan and Rodrik 2019; Diao et al. 2021). Yet those spillovers are local. Who benefits from FDI depends on where foreign firms choose to locate within a country, and the sub-national geography of foreign investment remains only partly understood.

At the same time, a large literature shows that climate shocks impose lasting costs on agricultural economies. Droughts lower incomes and nutrition and, through in-utero and early-childhood channels, reduce health and schooling decades later (Almond and Currie 2011; Maccini and Yang 2009; Dinkelman 2017). These two literatures rarely meet. Climate-economy research has focused on the contemporaneous effects of weather on output, agriculture, conflict and migration (Dell, Jones and Olken 2014; Carleton and Hsiang 2016; Burke, Hsiang and Miguel 2015). The FDI-location literature, in turn, explains where firms invest with present-day institutions, factor endowments, market access and agglomeration (Noorbakhsh, Paloni and Youssef 2001; Head and Mayer 2004; Blonigen 2005). Neither asks whether a historical climate shock can redraw the sub-national map of foreign investment long after the shock has passed.

This paper asks that question. It studies whether exposure to the 1983–84 Ethiopian drought reduces a community's likelihood of hosting a foreign firm in the 2010s, and which channel best accounts for the relationship. The drought affected 12 of the country's then 14 administrative regions and is associated with more than 300,000 deaths (CRED 2023). Its spatial footprint, driven by the failure of both the *Belg* and *Kiremt* rains, provides variation in early-life conditions across communities that is plausibly unrelated to later investment decisions once regional differences are held fixed.

Ethiopia is a useful setting for three reasons. First, the country opened to foreign capital only in the 1990s, and foreign manufacturing expanded mainly after 2000. The cohort exposed to the drought in early life had therefore reached working age by the time foreign firms were choosing where to locate. Second, successive development plans between 2002 and 2015 produced uneven

diffusion of foreign manufacturing across districts, creating meaningful within-country variation in foreign firm presence. Third, geocoded firm records from the Ethiopian Statistical Service can be linked to LSMS–ISA communities, which allows firm location to be matched to historical climate exposure and to community schooling.

The empirical analysis proceeds in three steps. I first estimate fixed-effects logit models relating foreign firm presence to 1983–84 drought exposure, conditioning on contemporaneous community characteristics and on region and wave fixed effects. I then examine the human-capital channel by relating drought to the schooling of the cohort born in 1978–85, and schooling to foreign firm presence. This second step is presented as evidence consistent with a channel, not as a formal mediation analysis. Finally, I study heterogeneity by ownership, persistence across survey waves, and sensitivity to the drought threshold.

Four findings emerge. First, communities exposed to the drought are 10.6 to 13.9 percentage points less likely to host a foreign firm in the 2010s. Under a stricter threshold (SPEI ≤ -1.5) the gap rises to 15.7 points, so the penalty grows with the intensity of exposure. Second, the evidence is consistent with human capital as the leading channel: the exposed cohort completed 1.6 to 2.8 fewer years of schooling, and each additional year of community schooling is associated with a 4 to 6 percentage-point higher probability of foreign firm presence. Third, joint ventures are less deterred than the full sample of foreign firms, consistent with local partners reducing information and operating frictions. Fourth, the penalty is large in 2011 and 2013 but statistically indistinguishable from zero by 2015, a pattern consistent with the incentive expansion under Investment Proclamation No. 769/2012 and with the expansion of road networks into previously remote districts.

The paper makes three contributions. First, it extends the early-life shocks literature from individual outcomes, such as health, schooling and wages (Maccini and Yang 2009; Akresh et al. 2012; Dinkelman 2017; Hyland and Russ 2019), to a firm-location outcome that matters for aggregate development. It shows that the human-capital scars of a climate shock can aggregate up to influence where capital goes. Second, it adds a historical climate dimension to the FDI-determinants literature, which has emphasised contemporaneous factors (Noorbakhsh, Paloni and Youssef 2001; Brooks et al. 2010; Amighini, Rabellotti and Sanfilippo 2013). Third, it provides within-country evidence, holding national institutions, macroeconomic policy and the exchange

rate fixed, on how climate history interacts with structural transformation (Albert, Bustos and Ponticelli 2021; Efobi 2022). The results bear directly on how climate-resilience and education investments should be sequenced alongside FDI promotion.

The rest of the paper is organised as follows. Section 2 describes the 1983–84 drought, sets out the conceptual framework and states the hypotheses. Section 3 describes the data and the construction of variables. Section 4 presents the empirical strategy. Section 5 reports the results. Section 6 discusses mechanisms, policy and limitations, and Section 7 concludes.

2 Background, Conceptual Framework and Hypotheses

2.1 Ethiopia and the 1983–84 drought

Ethiopia covers about 1.1 million km² and is home to more than 120 million people. Its topography, from highlands above 4,000 metres to lowlands below sea level, produces agro-ecological zones ranging from humid temperate plateaus to arid lowlands. About two-thirds of the labour force works in agriculture, mostly rain-fed smallholder farming of teff, maize, wheat and sorghum, or pastoralism. Rain arrives in two seasons, the short *Belg* (February–May) and the main *Kiremt* (June–September). The failure of either season causes localised drought; the failure of both, as in 1983–84, produces a national crisis.

In mid-1983 Ethiopia entered one of the worst humanitarian crises of the twentieth century. Successive poor rainy seasons, compounded by civil conflict and weak agricultural infrastructure, led to a near-collapse of food production in the central and northern highlands (de Waal 1997; Devereux 2009). Between six and ten million people faced acute food insecurity. By late 1984 Tigray, Wollo and Eritrea were severely affected; by mid-1985 the crisis had spread to northern Shoa, Sidamo, Hararghe and eastern Gondar, and even surplus-producing areas suffered sharp harvest losses. According to EM–DAT, about 7.75 million people out of a population of 42.5 million were at acute risk by January 1985, and recorded mortality exceeded 300,000 (CRED 2023). A 1985 USAID assessment estimated that 1.5 to 2 million people abandoned their farms for relief camps or for Sudan, and others were moved through government resettlement programmes.

The drought was therefore not a temporary fall in income. It was a sustained disruption to nutrition, health and schooling for children in the womb or in early childhood at the time. This human-capital scar is the starting point of the analysis.

Two decades later, Ethiopia began positioning itself as a manufacturing hub through industrial parks, tax incentives and a national Investment Commission. These reforms attracted measurable FDI, but its spatial distribution remains highly uneven: a few districts host most foreign establishments, while large parts of the country, including many districts hit in 1983–84, host none.

2.2 Conceptual framework

The framework links a historical climate shock to the present-day location of foreign firms through the persistence of human capital. It rests on two links, each grounded in an established literature (Figure 1).

Link 1: climate shocks reduce early-life human capital. Adverse conditions in utero and in early childhood leave lasting marks on cognitive and physical development (Almond and Currie 2011; Cunha and Heckman 2007). Weather shocks are transmitted through household incomes (Wolpin 1982; Paxson 1992). Early-childhood malnutrition lowers later schooling and earnings in Zimbabwe (Alderman, Hoddinott and Kinsey 2006), birth-year rainfall predicts adult height, schooling and wages in Indonesia (Maccini and Yang 2009), and early-life shocks affect child ability and schooling in Burkina Faso (Akresh et al. 2012) and cognitive skills in China (Leight, Glewwe and Park 2015). In Sub-Saharan Africa, drought exposure in early life translates into long-run disadvantage in health and the labour market (Dinkelman 2017; Hyland and Russ 2019).

Link 2: local human capital shapes where foreign firms locate. The skill of the local labour pool is a robust determinant of FDI location. Noorbakhsh, Paloni and Youssef (2001) show that the responsiveness of FDI to human capital has risen over time; Brooks et al. (2010) identify human capital as the binding constraint in skill-intensive sectors; Amighini, Rabellotti and Sanfilippo (2013) show that schooling attracts Chinese outward FDI; and Miningou and Tapsoba (2020) find that the efficiency of education systems, not only their size, conditions FDI inflows. The logic is simple: foreign firms bear fixed costs of hiring, training and managing local workers, and these costs fall as the average skill of the local workforce rises.

Combining the two links gives the central proposition. Because the 1983–84 drought reduced human-capital accumulation in exposed communities, and because local human capital shapes firm location, exposed communities should be less likely to host foreign firms decades later, even after contemporaneous fundamentals are held fixed. In this framework the early-life shocks literature supplies the mechanism, schooling, while the FDI-location literature supplies the model of firm behaviour. Three other channels could also link historical drought to FDI: decay of infrastructure, disruption of local institutions, and investor perceptions of risk (Blonigen 2005; Wegenast et al. 2019). The empirical analysis conditions on observable proxies for each.

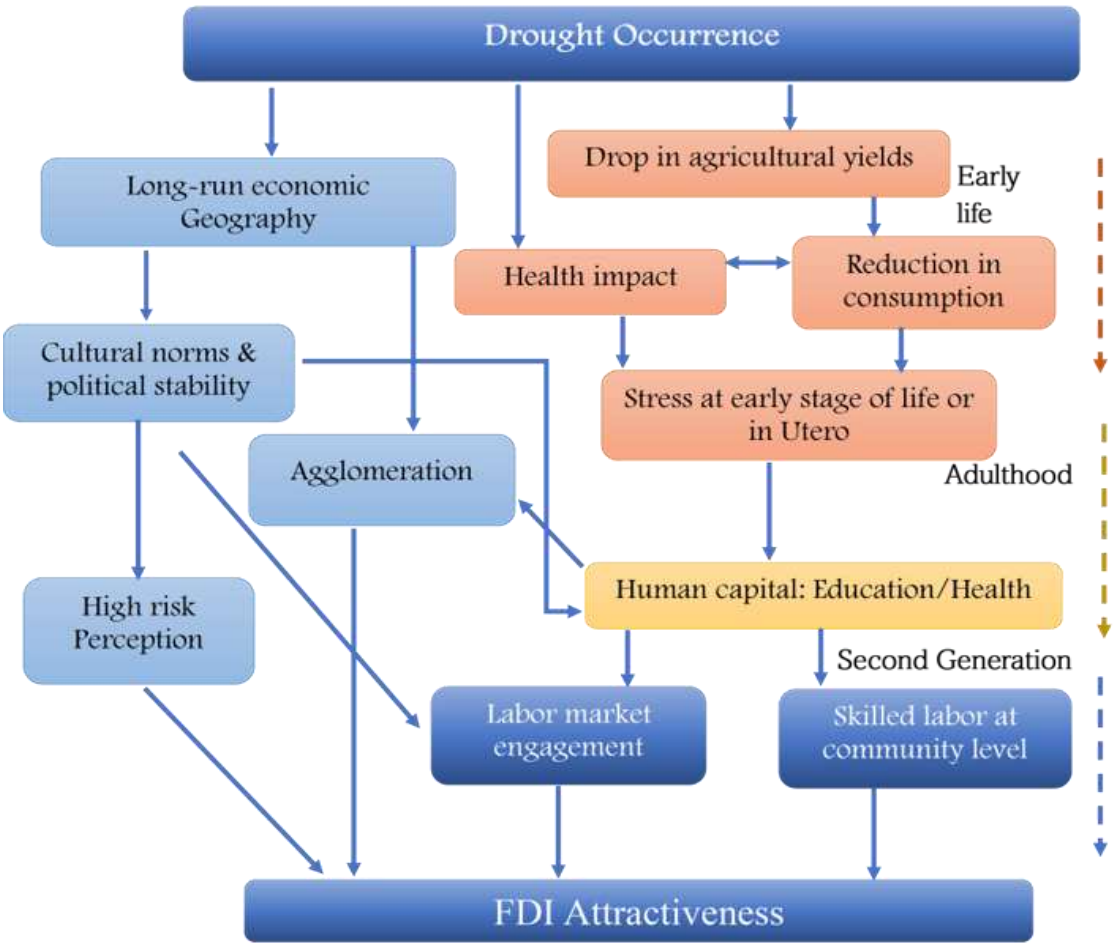


Figure 1: Conceptual framework: from the 1983–84 drought to present-day foreign firm location. The drought reduces early-life nutrition, health and schooling; the resulting community-level human-capital deficit raises the costs foreign firms face in exposed districts and lowers the probability that they locate there decades later. Auxiliary channels (infrastructure, institutions and investor risk perception) are conditioned on in the analysis. Adapted from Hyland and Russ (2019) and Efobi (2022).

2.3 Hypotheses

The framework yields three testable hypotheses.

H1 (Drought and FDI). Communities exposed to the 1983–84 drought are less likely than unexposed communities in the same region to host a foreign firm in the 2010s, conditional on contemporaneous characteristics.

H2 (Human-capital channel). Drought exposure lowers the schooling of the cohort born in 1978–85, and community schooling is positively associated with foreign firm presence.

H3 (Ownership structure). The drought penalty is weaker for joint ventures than for wholly foreign-owned firms, because local partners reduce information frictions and operating risk.

3 Data and Variables

The analysis combines four sources: firm records, disaster records, household and community surveys, and gridded drought data. This section describes each source, explains how drought exposure is measured, and defines the variables used in estimation.

3.1 Firm data

Firm data come from the Large and Medium Manufacturing Industry Survey (LMMIS, 1996–2020), conducted annually by the Ethiopian Statistical Service (ESS). The survey covers all manufacturing establishments with ten or more workers that use power-driven machinery, both domestic and foreign and both public and private. Because coverage of formal manufacturing is universal, it functions as an annual census. Each record reports ownership, ISIC sector, geocoded location, output, inputs, sales, employment and year of establishment. The LMMIS has been widely used to study Ethiopian industrial performance (Bigsten and Gebreeyesus 2007; Siba et al. 2012; Abebe, McMillan and Serafinelli 2022). The data are not publicly distributed; ESS granted access for this study. The analysis uses the more than 300 foreign-owned and joint-venture establishments recorded in the survey during the study period, which are matched by geographic coordinates to LSMS–ISA communities.

3.2 Disaster data

Disaster records come from EM–DAT, maintained by the Centre for Research on the Epidemiology of Disasters (CRED 2023) and widely used in climate-economy research (Cavallo et al. 2013; Felbermayr and Gröschl 2014; Carleton and Hsiang 2016). EM–DAT reports events at the level of affected administrative units and does not provide community-level coordinates. It is therefore used only to fix the onset, duration and humanitarian scale of the 1983–84 event. The spatial pattern of exposure is measured with gridded SPEI data, for two reasons: EM–DAT's administrative units are too coarse, and sub-national disaster reporting in Ethiopia, which is often tied to requests for federal aid, may be subject to political reporting bias.

3.3 Household and community data

Household and community data come from the World Bank's Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS–ISA), implemented with ESS (Carletto, Jolliffe and Banerjee 2015). I use all three Ethiopian waves (2011, 2013 and 2015). To measure the human capital of the exposed generation, I restrict attention to individuals born between 1978 and 1985, who were in utero or in early childhood during the drought. Appendix Table A1 reports the age structure of this cohort in each wave. From these data I construct the mean years of schooling of the cohort in each community, which serves as the channel variable, together with the community controls defined in Section 3.5.

3.4 Measuring drought exposure

I measure drought with the Standardised Precipitation–Evapotranspiration Index (SPEI) of Beguería, Vicente-Serrano and Angulo-Martínez (2010), following Albert, Bustos and Ponticelli (2021). Unlike the Standardised Precipitation Index, which uses precipitation alone, the SPEI also accounts for potential evapotranspiration and so captures the role of temperature in moisture availability (Stagge et al. 2014). This makes it better suited to the warming Ethiopian highlands.

Exposure is constructed in three steps. First, EM–DAT fixes the timing and scale of the event. Second, the geocoordinates of LSMS communities and LMMIS firms locate each community and firm. Third, the gridded SPEI is spatially joined to woreda boundaries, so that each woreda takes the SPEI value of the grid cell in which it falls, and each community inherits the value of its

woreda. The 1983–84 SPEI is the average over the two drought years. Following the standard classification, a community is coded as exposed if its 1983–84 SPEI is −1 or lower, which corresponds to severe-to-extreme drought. This is the main treatment definition throughout. The stricter thresholds (SPEI ≤ −1.5 and SPEI ≤ −2) and a continuous SPEI measure are used only as intensity and robustness checks. Figure 2 maps drought severity.

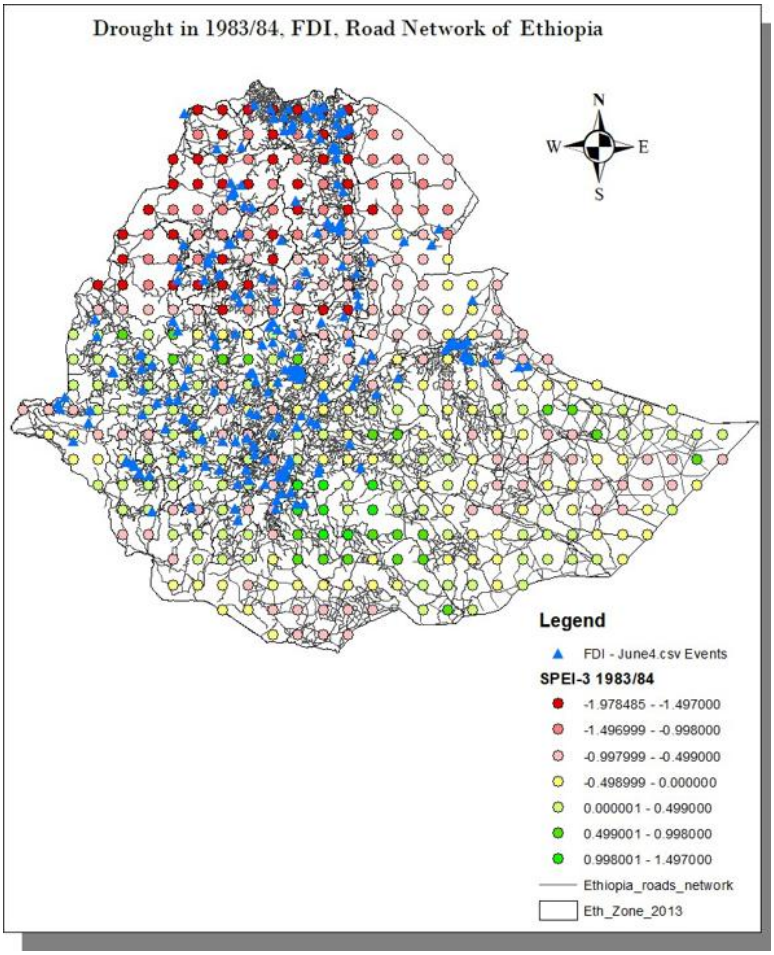


Figure 2: Spatial distribution of 1983–84 drought severity, Ethiopia. Points are woreda centroids shaded by 1983–84 SPEI: red indicates severe-to-extreme drought (SPEI < −1), with darker shades indicating greater intensity, and green indicates unaffected areas. Blue triangles mark communities with foreign firm presence; grey lines show the road network.

3.5 Variable definitions

Treatment. Drought_c equals one if the 1983–84 SPEI of community c is −1 or lower, and zero otherwise. Because it refers to a single historical event, it does not vary over time.

Outcome. FDI_{ct} equals one if at least one foreign-owned or joint-venture firm is present in community *c* at wave *t*, and zero otherwise. It measures the presence (stock) of foreign investment, not new entry. A mean of 0.293 therefore means that about 29 percent of community–wave observations host at least one foreign firm.

Channel variable. HC_c is the mean years of schooling of the 1978–85 cohort in community *c*. A robustness version uses the share of the cohort with at least secondary education.

Controls. Community controls are distance to the nearest main road and to the nearest market (km), an indicator for conflict in the past two years, an indicator for drought in the past five years, an urban indicator, community population, the number of pre-existing domestic firms, mean annual temperature and an indicator for belonging to a politically represented ethnic group ("ethnic power"). Distances to roads and markets vary across waves because both networks expanded between 2011 and 2015; each community is re-matched to the nearest road and market in each wave.

Sample. The unit of analysis is the community–wave. The estimation sample is a balanced panel of about 400 communities observed in 2011, 2013 and 2015, for which LMMIS foreign firm locations are matched to LSMS–ISA communities by geographic coordinates. Where woreda boundaries changed between waves, communities are held to their original definitions using official crosswalks. Missing values affect fewer than 5 percent of observations for every variable and are concentrated in a few controls. They are handled by multiple imputation by chained equations (five imputed datasets, combined by Rubin's rules); all main results are unchanged under listwise deletion. Continuous variables are winsorised at the 1st and 99th percentiles.

3.6 Descriptive statistics

Table 1 reports summary statistics. About 29 percent of community–wave observations host a foreign firm, and about 12 percent host a joint venture. About 29 percent of communities were exposed to the 1983–84 drought under the main threshold. Members of the 1978–85 cohort completed on average 6.0 years of schooling (standard deviation 3.7). Communities are on average 14 km from a main road and 59 km from a market, illustrating the infrastructural disadvantage that often accompanies climatic disadvantage.

Table 1: Summary statistics, community–wave panel (LSMS–ISA 2011–2015)

Variable	Obs.	Mean	Std. dev.	Min	Max
Outcomes, treatment and channel					
Foreign firm present (FDI)	1,199	0.293	0.455	0	1
Joint venture present	1,198	0.118	0.323	0	1
Drought exposure, 1983–84 (SPEI ≤ −1)	1,199	0.294	0.455	0	1
Mean years of schooling, 1978–85 cohort	1,197	5.997	3.704	0.20	20.67
Community controls					
Distance to nearest road (km)	1,199	14.406	21.010	0.06	240.85
Distance to international border (km)	1,199	260.154	116.880	13.16	500.22
Distance to nearest market (km)	1,199	59.220	51.269	0.35	282.81
Mean annual temperature (°C × 10)	1,184	193.661	34.875	110	293.17
Community population	1,197	8,176.1	11,683	57	170,000
Number of pre-existing domestic firms	1,199	0.518	0.816	0	6
Drought in past five years	1,199	0.111	0.314	0	1
Conflict in past two years	1,199	0.167	0.373	0	1
Conflict events in past two years	1,199	0.451	0.497	0	1
Urban status	1,199	0.975	0.463	0	2
Community mobility index	1,198	2.082	1.094	0	5
Ethnic power	1,199	0.111	0.313	0	1
Interaction terms					
Drought × distance to road	1,184	5.599	0.313	0	70.65
Drought × distance to market	1,184	19.419	41.315	0	265.71
Drought × distance to border	1,184	65.739	113.60	0	379.89
Time and location					
Region identifier	1,199	5.472	3.690	1	15
Survey year	1,199	2013.165	1.589	2011	2015

Notes: The unit of observation is a community–wave. Ethnic power indicates that the community belongs to a politically represented ethnic group. Continuous variables are winsorised at the 1st and 99th percentiles.

4 Empirical Strategy

4.1 Identification

The identification strategy treats the spatial pattern of the 1983–84 drought as plausibly exogenous within regions. Ethiopia is drought-prone in general, but the precise geography of the joint failure of the *Belg* and *Kiremt* rains in 1983–84 is unlikely to be correlated with the characteristics that drive foreign investment three decades later, once regional differences and agro-ecological conditions are controlled for. Because exposure is time-invariant, it is identified from differences between exposed and unexposed communities within the same region, not from changes within a community over time.

Three threats to this interpretation deserve attention. First, exposure may be correlated with persistent features of geography, such as remoteness, agricultural potential, market access or state presence, that independently affect investment. I address this with region fixed effects, mean annual temperature, and contemporaneous controls for road and market access and for past conflict, while acknowledging that unobserved persistent geography cannot be fully ruled out (Section 6). Second, drought-induced migration could have changed the composition of communities. Because the outcome is the location of firms, which is fixed in space, and because the channel variable is measured for a specific birth cohort, compositional change is less of a concern for the main estimates than for individual-level outcomes. Third, the policy response after 1985, including resettlement and food aid, may have been correlated with drought severity. The models include contemporaneous controls, and a robustness check drops the regions most affected by resettlement. Because the design compares communities within regions rather than testing for pre-shock equivalence, the estimates are best read as conditional associations with a plausibly exogenous historical shock.

4.2 Baseline specification

Because the outcome is binary, the baseline model is a fixed-effects logit:

$$\Pr(\text{FDI}_{ct} = 1 \mid X_{ct}) = \Lambda\big(\beta\,\text{Drought}_c + \gamma' X_{ct} + \mu_r + \lambda_t\big),$$

where $\Lambda(\cdot)$ is the logistic distribution function, Drought_c is the 1983–84 exposure indicator, X_{ct} is a vector of time-varying community controls, μ_r are region fixed effects and λ_t are wave fixed effects. Standard errors are clustered at the community level. The coefficient β tests H1.

A logit model respects the binary nature of the outcome. To check that the results do not depend on the estimator, I also report a linear probability model with the same fixed effects. I report the Wald χ^2 test of joint significance for each logit specification. Marginal effects are average marginal effects (AMEs), computed for every observation and then averaged, rather than effects at the sample mean, which can mislead when covariates are dispersed.

4.3 Evidence on the human-capital channel

To examine whether human capital links historical drought to FDI, I estimate the two relationships that make up the proposed channel. This is evidence on whether the data are consistent with the channel, not a formal causal mediation analysis: identifying an indirect effect would require sequential-ignorability assumptions (Imai, Keele and Tingley 2010) that the present data cannot support.

The first equation relates drought to the schooling of the exposed cohort:

$$\text{HC}_c = \pi\,\text{Drought}_c + \phi' Z_c + \mu_r + \eta_c,$$

where Z_c is a vector of community controls. The second adds schooling to the FDI model:

$$\Pr(\text{FDI}_{ct} = 1) = \Lambda\big(\beta\,\text{Drought}_c + \theta\,\text{HC}_c + \gamma' X_{ct} + \mu_r + \lambda_t\big).$$

A negative π together with a positive θ is consistent with H2. The product of the two, reported below, is an illustrative calculation of how much of the drought gap the schooling channel could account for, not an identified causal quantity.

4.4 Heterogeneity, persistence and sensitivity

Three further exercises complete the analysis. First, the baseline model is re-estimated with joint-venture presence as the outcome, to test H3. Second, the sample is split by survey wave to examine whether the penalty persists or fades over time. Third, the drought threshold is tightened to SPEI ≤ -1.5 to test whether the penalty grows with the intensity of exposure.

5 Results

5.1 Historical drought and foreign firm presence

Table 2 reports the baseline estimates. The drought coefficient is negative, statistically significant and economically large in every specification. Without controls (column 1), the logit coefficient of −0.753 corresponds to an odds ratio of 0.47: exposed communities have 53 percent lower odds of hosting a foreign firm, an average marginal effect of −10.6 percentage points. Adding controls and fixed effects (column 2) increases the marginal effect to −11.9 points, and adding interactions between drought and infrastructure (column 3) increases it to −13.9 points. The linear probability model (column 4) gives a similar estimate of −16.5 points. The Wald test rejects joint insignificance in every logit specification.

The controls behave as expected. Distance to roads and markets lowers the probability of foreign firm presence, consistent with transport costs. The number of domestic firms enters positively, consistent with agglomeration, and recent conflict strongly deters foreign investment. That the drought coefficient remains large once these contemporaneous fundamentals are controlled for suggests that it captures a long-run legacy rather than a correlation with present-day conditions.

Table 2: Historical drought and foreign firm presence

	(1)	(2)	(3)	(4)
	Baseline	Controls	Interactions	LPM
Drought (1983–84)	−0.753***	−1.168**	−1.386**	−0.165**
	(0.260)	(0.578)	(0.636)	(0.068)
Average marginal effect	−0.106***	−0.119**	−0.139**	
Odds ratio	0.471	0.311	0.250	
Distance to road		−0.027***	−0.031***	−0.001
		(0.008)	(0.011)	(0.0006)
Distance to market		−0.005**	−0.004	−0.005*
		(0.002)	(0.003)	(0.002)
Conflict (past two years)		−1.130***	−1.055***	−0.104***
		(0.291)	(0.310)	(0.027)
Ethnic power		21.86***	21.17***	0.204
		(0.623)	(0.626)	(0.132)
Drought (past five years)		−0.448	−0.505	−0.041
		(0.371)	(0.378)	(0.036)
Urban		−1.170***	−0.965***	−0.151***
		(0.262)	(0.267)	(0.032)
Number of domestic firms		2.020***	2.020***	0.281***
		(0.145)	(0.147)	(0.013)
Region fixed effects	No	Yes	Yes	Yes
Wave fixed effects	No	Yes	Yes	Yes
Observations	1,198	1,178	1,178	1,178
Wald χ^2 (p-value)	7.91 (0.004)	729 (0.000)	623 (0.000)	

Notes: The dependent variable equals one if a foreign firm is present in the community in that wave. Columns (1)–(3) are logit models; column (4) is a linear probability model. Odds ratios are exp(β). Standard errors clustered at the community level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5.2 The human-capital channel

Tables 3 and 4 report the two relationships that make up the proposed channel. Communities exposed to the 1983–84 drought have 1.61 fewer years of cohort schooling on average (Table 3, column 1), and 2.76 fewer once interactions are included (column 3). In turn, schooling is strongly associated with foreign firm presence (Table 4). The coefficient of 0.665 in column 1 corresponds to an odds ratio of 1.94, and the average marginal effect implies that each additional year of cohort schooling is associated with a 6.1 percentage-point higher probability of hosting a foreign firm; with controls the effect is 4.2 points.

Multiplying the schooling gap (−1.61 years) by the per-year association (0.061) gives an illustrative figure of about −9.8 percentage points, close to the baseline drought gap of −10.6 points. This calculation is descriptive rather than causal, but together the two relationships are consistent with human capital being the main channel through which the historical drought is related to present-day foreign investment.

Table 3: Historical drought and schooling of the 1978–85 cohort

	(1)	**(2)**	**(3)**	**(4)**
	Baseline	Controls	Interactions	OLS
Drought (1983–84)	−1.610***	−1.341**	−2.762**	−1.124***
	(0.347)	(0.308)	(0.718)	(0.233)
Distance to road	−0.020***	−0.011	−0.016***	−0.076
	(0.006)	(0.007)	(0.004)	(0.050)
Distance to market	−0.011***	−0.014***	−0.009***	−0.010***
	(0.002)	(0.003)	(0.001)	(0.0023)
Conflict (past two years)	−0.381**	−0.336*	−0.488**	−0.375*
	(0.183)	(0.185)	(0.220)	(0.223)
Ethnic power	4.550***	4.901***	4.200***	4.460***
	(1.080)	(1.100)	(1.060)	(1.060)
Urban	−2.674***	−2.670***	−2.620***	−2.630***
	(0.341)	(0.344)	(0.255)	(0.256)
Community population	0.0044***	0.004***	0.006***	0.006***

	(0.0002)	(0.0001)	(0.0007)	(0.0004)
Region fixed effects	Yes	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes	Yes
Observations	1,196	1,196	1,196	1,196
R^2 (%)	1.92	46.90	47.59	48.89

Notes: The dependent variable is the mean years of schooling of individuals born in 1978–85 in the community. Standard errors clustered at the community level in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 4: Cohort schooling and foreign firm presence

	(1)	**(2)**	**(3)**	**(4)**
	Baseline	Controls	Interactions	LPM
Years of schooling (cohort)	0.665***	0.561***	0.563***	0.064***
	(0.038)	(0.051)	(0.052)	(0.003)
Average marginal effect	0.061***	0.042***	0.042***	
Odds ratio	1.944	1.752	1.756	
Distance to road		−0.017**	−0.023**	−0.007
		(0.008)	(0.011)	(0.005)
Conflict (past two years)		−0.990***	−1.014***	−0.080***
		(0.332)	(0.333)	(0.024)
Ethnic power		17.61***	17.81***	−0.054
		(0.737)	(0.749)	(0.116)
Number of domestic firms		1.291***	1.296***	0.153***
		(0.165)	(0.165)	(0.013)
Region fixed effects	Yes	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes	Yes
Observations	1,196	1,196	1,174	1,174

Notes: The dependent variable equals one if a foreign firm is present in the community in that wave. Columns (1)–(3) are logit models; column (4) is a linear probability model. Together with Table 3, this

table provides evidence consistent with the human-capital channel; it is not a formal mediation analysis. Standard errors clustered at the community level in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

5.3 Heterogeneity by ownership

Table 5 re-estimates the baseline model with joint-venture presence as the outcome. The drought coefficient remains negative and significant, with odds ratios of 0.30 to 0.58. The average marginal effects, between −8.7 and −10.9 percentage points, are smaller than those for all foreign firms (−10.6 to −13.9 points). This is consistent with H3: domestic partners appear to soften the penalty by lowering search costs and contributing local information and political connections.

Table 5: Historical drought and joint-venture presence

	(1)	**(2)**	**(3)**	**(4)**
	Baseline	Controls	Interactions	LPM
Drought (1983–84)	−0.541***	−1.024**	−1.221**	−0.132**
	(0.170)	(0.499)	(0.554)	(0.065)
Average marginal effect	−0.087***	−0.095**	−0.109**	
Odds ratio	0.582	0.359	0.295	
Controls	No	Yes	Yes	Yes
Interactions	No	No	Yes	Yes
Region fixed effects	No	Yes	Yes	Yes
Wave fixed effects	No	Yes	Yes	Yes
Exposed communities (N)	142	139	139	139
Observations	1,196	1,175	1,175	1,175

Notes: The dependent variable equals one if a joint-venture firm is present in the community in that wave. Odds ratios are exp(β). Standard errors clustered at the community level in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

5.4 Persistence over time

Table 6 estimates the model separately for each wave, using the stricter SPEI ≤ −1.5 threshold. The penalty is large in 2011 (−22.0 percentage points) and 2013 (−23.8 points), and statistically indistinguishable from zero in 2015 (−0.3 points). Two developments plausibly explain the

decline. Investment Proclamation No. 769/2012 broadened the sectors eligible for incentives and strengthened investor protection, and road construction between 2010 and 2015 reduced the relative isolation of historically remote districts.

Table 6: Historical drought and foreign firm presence by survey wave (SPEI ≤ −1.5)

	2011	**2013**	**2015**
Drought (logit coefficient)	−2.78**	−2.29*	−0.033
	(1.42)	(1.24)	(1.04)
Average marginal effect	−0.220**	−0.238*	−0.003
	(0.112)	(0.128)	(0.110)
LPM coefficient	−0.195**	−0.215*	−0.039
	(0.096)	(0.121)	(0.114)
Controls	Yes	Yes	Yes
Interactions	Yes	Yes	Yes
Exposed communities (N)	107	121	105
Observations	327	427	422

Notes: Drought is defined by the stricter SPEI ≤ −1.5 threshold. The dependent variable equals one if a foreign firm is present in the community in that wave. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5.5 Sensitivity to the drought definition

Table 7 tightens the threshold to SPEI ≤ −1.5, so that only communities that experienced extreme drought are coded as exposed. The coefficient remains negative and highly significant in every column, and the average marginal effect rises to −15.7 percentage points in the most demanding specification, compared with −13.9 points under the main threshold. The penalty therefore grows with the intensity of exposure. Specifications using the continuous SPEI and a −2 threshold lead to the same conclusions. Figure 3 maps the extreme-drought communities together with the road network and foreign firm locations: the two remain visibly separate in space.

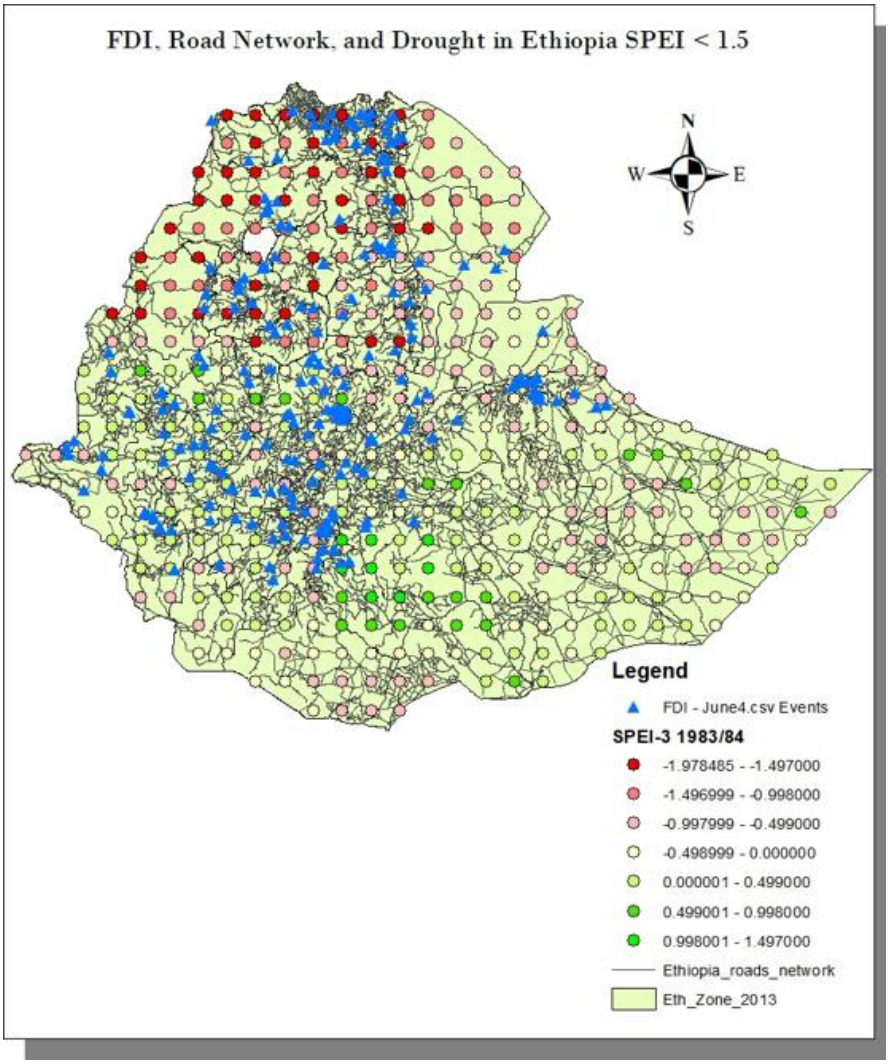


Figure 3: Foreign firm locations, the road network and extreme-drought communities (SPEI ≤ −1.5), Ethiopia. Points are woreda centroids shaded by 1983–84 SPEI (red = severe-to-extreme drought; green = unaffected). Blue triangles mark communities with foreign firm presence; grey lines show the road network.

Table 7: Foreign firm presence under a stricter drought threshold (SPEI ≤ −1.5)

	(1)	(2)	(3)	(4)
	Baseline	Controls	Interactions	LPM
Drought (1983–84)	−0.689***	−1.421***	−1.844**	−0.174***
	(0.330)	(0.457)	(0.725)	(0.025)
Average marginal effect	−0.136***	−0.148***	−0.157***	
Odds ratio	0.502	0.241	0.158	
Controls	No	Yes	Yes	Yes
Interactions	No	No	Yes	Yes
Region fixed effects	No	Yes	Yes	Yes
Wave fixed effects	No	Yes	Yes	Yes
Exposed communities (N)	211	205	205	207
Observations	1,198	1,178	1,178	1,178

Notes: Drought is defined by SPEI ≤ −1.5. The dependent variable equals one if a foreign firm is present in the community in that wave. Odds ratios are exp(β). Standard errors clustered at the community level in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

6 Discussion

The results show that the 1983–84 drought is associated with the location of foreign investment more than three decades later. Exposed communities are 10 to 14 percentage points less likely to host a foreign firm in the 2010s, and nearly 16 points less likely under the stricter threshold. The estimates are stable across estimators and thresholds and survive controls for contemporaneous conflict, infrastructure and agglomeration. This section discusses what drives the relationship, what it implies, and where the evidence stops.

Human capital as the main channel. The exposed cohort has 1.6 to 2.8 fewer years of schooling, and schooling is strongly associated with foreign firm presence. The illustrative product of the two relationships is close in size to the baseline drought gap. This is consistent with the fetal-origins and early-childhood mechanisms documented in individual-level studies (Almond and Currie

2011; Maccini and Yang 2009; Akresh et al. 2012; Dinkelman 2017), operating here at the level of the community.

Why the 1978–85 cohort matters. Members of this cohort were aged roughly 26 to 37 during the survey waves, while foreign manufacturers in Ethiopia often hire younger production workers. The framework does not require that this cohort staff the factories. Its schooling serves as a marker of the community's durable stock of human capital, for three reasons. First, this cohort includes the parents, teachers, local officials, supervisors and small-business owners whose own schooling shapes the human capital of the younger workers foreign firms hire, so a deficit in this cohort is transmitted to the next generation (Cunha and Heckman 2007; Alderman, Hoddinott and Kinsey 2006). Second, the drought damaged not only individuals but also local educational capacity, including schools, teachers and households' ability to keep children in school, which depresses the attainment of later cohorts in the same community. Third, the community-level design is what makes the cohort's schooling informative: it proxies for the local skill base that a prospective investor evaluates, which is the object the theory concerns.

Auxiliary channels. The negative effects of distance to roads and markets indicate that exposed districts combine their skill disadvantage with weaker connectivity. The positive coefficient on ethnic power and the negative coefficient on recent conflict show that local political conditions also matter (Wegenast et al. 2019). Because the 1983–84 famine remains internationally salient, exposed regions may also face a reputational stigma among investors. The models condition on these channels but cannot fully separate them from the human-capital channel.

Local partners soften the penalty. Joint ventures are less deterred by historical exposure than foreign firms as a whole. This is consistent with an internalisation logic in which a domestic partner supplies the social, political and informational capital that substitutes for a thin local skill base (Amighini, Rabellotti and Sanfilippo 2013).

The legacy fades with policy. The penalty is large in 2011 and 2013 but disappears by 2015, after the 2012 Investment Proclamation and a period of rapid road construction. Climate legacies are therefore not destiny, but recovery appears slow and dependent on policy.

Limitations. Four limitations deserve emphasis. First, years of schooling is an imperfect measure of skill: it omits school quality, vocational training and task-specific skills. Second, region and

wave fixed effects absorb much unobserved heterogeneity, but persistent features of geography, such as soil quality, historical settlement patterns and baseline remoteness, cannot be fully ruled out. The estimates are therefore best read as conditional associations with a plausibly exogenous historical shock. Third, the channel analysis is consistent with human capital but is not a formal mediation decomposition (Imai, Keele and Tingley 2010). Fourth, the analysis covers a single country, so its external validity is an open question. Richer skill measures, additional historical shocks and cross-country comparisons, and complementary channels such as migration and institutional adaptation are natural directions for further work.

7 Conclusion and Policy Implications

This paper shows that communities exposed to the 1983–84 Ethiopian drought are 10 to 16 percentage points less likely to host a foreign firm three decades later, depending on the specification and threshold. The evidence points to early-life human capital as the main channel. Joint ventures are less deterred by historical exposure, and the penalty fades after the investment reforms of 2012. Severe climate shocks are therefore not only short-run humanitarian crises: they can cast a long shadow on the geography of productive investment.

Three policy implications follow. First, climate adaptation and human-capital investment are complements. Cash transfers, school feeding, maternal and child health programmes, and catch-up education after shocks carry returns for investment attraction in addition to their direct welfare value. Second, infrastructure investment in climate-vulnerable districts can directly offset part of the long-run penalty by lowering costs for prospective investors. Third, joint-venture promotion, through matchmaking platforms, equity-participation incentives and partnership provisions, can help capital reach districts whose skill base would otherwise deter it. As climate change makes droughts more frequent across the tropics, these results imply that their costs will not be captured fully by contemporaneous output losses. Part of the bill will be paid decades later, in forgone investment in the regions least able to afford it.

Competing Interests

The author declares no competing interests.

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Data Availability

LSMS–ISA data are publicly available from the World Bank. EM–DAT data are available from CRED. SPEI data are publicly available from the SPEIbase (Beguería, Vicente-Serrano and Angulo-Martínez 2010). Firm-level data from the Ethiopian Statistical Service are restricted; researchers may apply to ESS for access.

Appendix

Table A1: Age structure of the 1978–85 cohort used to compute community schooling averages

Age (years)	2011	2013	2015	Total
26	645	0	0	645
27	910	0	0	910
28	1,343	1,477	0	2,820
29	584	647	0	1,231
30	1,014	1,107	1,164	3,285
31	572	567	654	1,793
32	1,077	1,244	1,370	3,691
33	0	394	429	823
34	0	434	482	916
35	0	0	1,140	1,140
36	0	0	271	271
Total	6,145	5,870	5,510	17,525

Notes: Number of individuals born 1978–85 observed in each LSMS–ISA wave, by age at interview.

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