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Keywords: industrial parks, economic growth, living standards, female empowerment, Ethiopia

JEL Codes: O14, O18, J16, J21, D13

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†Institute of New Structural Economics, Peking University

‡China Center for Economic Research, National School of Development, Peking University; Institute of South-South Cooperation and Development, Peking University

§Corresponding author. Email: hyxu@nsd.pku.edu.cn

1 Introduction

Industrialization is widely recognized as a crucial pathway for less developed countries to reduce poverty and achieve sustainable prosperity (Rodrik, 2013, 2014; UNIDO, 2017). However, building industrial sectors typically requires sound infrastructure, reliable utilities, and supportive institutions—conditions that many developing countries struggle to provide nationwide given their constrained resources and limited implementation capacity. As a result, governments often turn to industrial parks as a targeted strategy for fostering industrial activity (Farole, 2011; UNIDO, 2023). These parks, which are geographically delimited zones equipped with essential infrastructure, regulatory incentives, and streamlined administrative services, are designed to create localized advantages that attract industrial investment, particularly from international firms.[1] Beyond job creation and export promotion, many governments view industrial parks as instruments for raising regional productivity through economic linkages and knowledge spillovers, thereby catalyzing broader structural transformation (Alder et al., 2016; Neumark and Simpson, 2015; UNDP, 2024).

An extensive body of research has examined the impacts of industrial parks and other place-based industrial policies (Alder et al., 2016; Gobillon et al., 2012; Grant, 2020; Ham et al., 2011; Juhász et al., 2023; Lu et al., 2019; Wang, 2013). This literature, however, focuses primarily on advanced and emerging economies such as the United States, China, and India. Less developed African countries, where industrial parks have proliferated in recent decades, have received comparatively little attention.[2] A separate qualitative literature, much of it supported by the World Bank, has examined industrial parks in the African context (Akinci and Crittle, 2008; Akinci and Farole, 2011; Fanuel et al., 2022; Farole, 2011). Drawing on investor surveys and aggregate data on investment, exports, and employment, these reports offer valuable insights into the practices and performance of African industrial parks. They do not, however, identify causal effects or capture spillovers beyond park boundaries. Moreover, although this literature points to factors that may contribute to park success, quantitative evidence on their importance remains scarce.

This paper examines the social and economic impacts of industrial parks in Ethiopia, Africa's second-most populous country, where the government has actively used them as a policy instrument to promote growth. Leveraging the staggered opening of parks across districts and combining

[1] This paper adopts the broad definition of industrial parks used by the United Nations Industrial Development Organization (UNIDO, 2019, 2023), which encompasses special economic zones, free-trade zones, export processing zones, and other related forms.

[2] Over the past three decades, Africa has emerged as a major site for industrial parks. The number of special economic zones (SEZs), one prominent form, grew from roughly 20 in 1990 to 237 by 2020 (UNCTAD, 2021).

satellite imagery with household survey data, we address several key questions. At the macro level, does the establishment of an industrial park generate sizable gains in local economic activity and urbanization? If so, to what extent do these gains spill over to nearby regions, and how do the effects vary with location fundamentals and other characteristics? At the micro level, how does the arrival of a park affect local living standards and employment outcomes? Given the well-documented gender imbalance in industrial park employment, how do these parks shape gender-related outcomes?

To examine these questions, we employ a difference-in-differences design that compares outcomes in districts that receive an industrial park with those in districts that never do, before and after park operation.[3] To improve comparability and address concerns about differential pre-trends, we construct the control (never-treated) group using propensity score matching on a rich set of baseline geographic and economic characteristics. Our first set of findings shows that industrial parks significantly boost local economic growth and urbanization. In particular, districts hosting industrial parks experience roughly a 21 percent increase in nighttime light intensity and a 3-percentage-point increase in the share of impervious surface area relative to control districts. These magnitudes are substantial yet plausible, given low initial levels and the sizable economic opportunities these parks introduce.

These gains, however, are highly localized: the positive economic impacts of industrial parks are largely confined to the districts where they are located. Nearby districts exhibit only modest changes in nighttime light intensity and impervious surface area, none of which are statistically significant at conventional levels. These limited spillover effects are consistent with prior research from the same country context showing that labor market frictions spatially constrain the diffusion of employment opportunities (Abebe et al., 2021; Witte et al., 2025). They also align with qualitative evidence from selected African case studies, which suggest that industrial parks in those settings are relatively isolated, with weak forward and backward linkages and limited integration into domestic markets (Akinci and Crittle, 2008; Fanuel et al., 2022; Farole, 2011).

We further find that the effectiveness of industrial parks hinges on several factors. Because the Ethiopian government deliberately dispersed industrial parks across the country in response to ethnic-equity considerations, some parks were located in relatively remote or less-developed areas (Kebede and Heshmati, 2023). Leveraging this variation, we show that parks with better market

[3] A "district" refers to a third-level administrative unit in Ethiopia, locally known as a *woreda*. This administrative division is broadly comparable to a county in the United States or China.

access, stronger transport connectivity, and deeper local labor markets generate more substantial impacts on local economic activity and urbanization. This pattern highlights the critical role of location fundamentals in determining the success of industrial parks. We also find suggestive evidence that parks specializing in labor-intensive industries achieve stronger effects, indicating that the policy is more effective when aligned with existing comparative advantages. Contrary to the common expectation that privately operated parks outperform public ones due to stronger profit incentives and managerial autonomy, we find no conclusive evidence that private parks deliver superior outcomes, possibly because public parks benefit from stronger government support and administrative coordination.

Drawing on data from the Ethiopia Demographic and Health Survey (DHS), we then extend our analysis beyond district-level outcomes and examine how industrial parks affect the living standards and well-being of local residents. We find that the establishment of industrial parks significantly enhances local living standards. Specifically, districts hosting industrial parks experience notable improvements in per capita ownership of durable goods and in housing quality. Households in these areas also exhibit a 0.4-standard-deviation increase in a composite wealth index, indicating substantial gains in wealth relative to the national average. Overall, the evidence suggests that industrial parks meaningfully improve household welfare and living conditions in targeted areas.

Finally, our micro-level results reveal substantial gender-differentiated impacts. In settings at early stages of industrialization, industrial parks tend to concentrate in labor-intensive industries, such as textiles and garments, that predominantly employ women (Staritz, 2010). Consistent with this pattern, we find a 13-percentage-point increase in non-agricultural employment among women, a 46.3 percent rise relative to the sample mean, while male employment rates increase only modestly.[4] Building on prior research showing that improved job opportunities can enhance women's social and household status (Aizer, 2010; Heath and Mobarak, 2015; Jensen, 2012), we further examine how industrial parks influence gender dynamics. Our analysis shows that these disproportionate employment gains not only improve women's decision-making authority and financial autonomy but also reduce their acceptance of domestic violence, suggesting that the policy has induced meaningful progress toward gender equality and women's empowerment.

Our work contributes to the expanding literature on place-based industrial policies (Juhász et al., 2023; Juhász and Steinwender, 2023). The impacts of industrial parks and related initiatives

[4]This gender disparity aligns with the parks' emphasis on female-labor-intensive industries in Ethiopia, where over 80 percent of the workforce in these zones is female (Fanuel et al., 2022; UNDP, 2024).

have been extensively studied in developed and emerging economies (Alder et al., 2016; Austin et al., 2018; Gobillon et al., 2012; Grant, 2020; Ham et al., 2011; Lu et al., 2023, 2019; Wang, 2013; Zhao and Qu, 2024). However, their effectiveness in less developed countries remains an open question. A complementary qualitative literature provides descriptive evidence on industrial parks in African settings (Akinci and Crittle, 2008; Akinci and Farole, 2011; Fanuel et al., 2022; Farole, 2011). These studies document substantial heterogeneity in park performance and highlight several key factors that may drive this variation. We contribute to this literature by providing rigorous quantitative evidence on the impacts of industrial parks in Ethiopia and by empirically examining the conditions under which such policies are more likely to succeed. Our findings—which reveal substantial local gains but limited spillovers, and emphasize the importance of location fundamentals and comparative advantage—offer insights with considerable policy relevance. In addition, our investigation of gender dynamics broadens the set of outcomes typically considered in evaluations of these place-based policies.

This paper also relates to a body of work on industrial employment and labor market dynamics in Ethiopia, particularly studies that provide experimental evidence on the effects of factory employment and labor market frictions in the country's industrial park context. Blattman and Dercon (2018), Blattman et al. (2022), and Abebe et al. (2024) show that factory jobs can raise women's income and well-being in the short run, though they often involve high turnover and health risks. Abebe et al. (2021) documents how spatial job-search frictions limit the diffusion of employment opportunities, consistent with our finding that the economic effects of industrial parks are largely localized. More recent work examines ways to reduce information frictions through public employment services (Witte et al., 2025). Relatedly, Hardy et al. (2024) and Meyer et al. (2021a) document how sectoral shocks affect Ethiopian workers. Our study complements this literature by evaluating a large-scale development policy and providing quasi-experimental evidence on its impacts on labor market outcomes and household welfare.

Finally, our study contributes to research on the determinants of female empowerment. A large body of evidence shows that improvements in women's labor market opportunities can enhance their mobility, bargaining power, and influence over household resource allocation (Field et al., 2021; Heath and Mobarak, 2015; Jensen, 2012; Majlesi, 2016; Molina and Tanaka, 2023; Qian, 2008). Related work demonstrates that education, information dissemination, and social movements can reshape gender attitudes and norms (Dhar et al., 2022; Jensen and Oster, 2009; Levy and Mattsson, 2023; Luo and Zhang, 2022). We complement these efforts by providing novel evidence

on the gender-differentiated impacts of industrial parks, many of which specialize in female-labor-intensive industries. We find that these initiatives disproportionately increase women's employment opportunities, which in turn enhance women's decision-making authority and financial autonomy and reduce their acceptance of domestic violence. Together, these findings illustrate that place-based economic policies, even those not explicitly designed to target social norms, can play a meaningful role in advancing gender equality.

The remainder of the paper is organized as follows. Section 2 provides background on Ethiopia's industrial parks, focusing on institutional features relevant to our research design. Section 3 describes the data, key variables, and empirical strategy. Section 4 presents the main results and robustness analyses. Section 5 concludes.

2 Context

2.1 The Global Practice and Rationale of Industrial Parks

Industrial parks take a variety of forms. According to the United Nations Industrial Development Organization (UNIDO), they include—and are sometimes used interchangeably with—special economic zones, free-trade zones, high-tech zones, and enterprise zones (UNIDO, 2019, 2023). Although these facilities may differ in their specific mandates and institutional arrangements, they share common overarching goals. They are strategically designed to overcome barriers that frequently impede industrial development, such as inadequate infrastructure, limited access to finance, and weak external institutions (Akinci and Crittle, 2008). By providing serviced land, factory shells, reliable utilities, security, and streamlined administrative services, industrial parks reduce both entry and operating costs for firms and create localized environments conducive to business operations, particularly for foreign investors (Akinci and Farole, 2011; Farole, 2011). In addition, these zones often offer incentive packages, such as exemptions from duties on imported inputs, VAT reductions, corporate tax holidays, and trade preferences, which further enhance the attractiveness of these locations (Fanuel et al., 2022; UNDP, 2024).

In theory, the agglomeration of industrial activities within a zone can foster job creation and generate spillover effects both within and beyond park boundaries. These effects may include knowledge and technology transfer, information sharing, supply-chain linkages, increased specialization among firms, and the development of a skilled workforce. Through these channels, industrial parks are expected to promote broader economic development. As a result, they are frequently designed

with the stated objective of serving as regional growth hubs capable of catalyzing wider structural transformation (Neumark and Simpson, 2015). Industrial parks are also expected to stimulate urbanization: as firms and workers locate near these zones, surrounding areas often experience the growth in commercial services, housing, and infrastructure, gradually taking on urban economic and social characteristics (UNIDO, 2023).

Empirical studies show that such zones have substantially contributed to gains in productivity, exports, GDP, and human capital in China, India, and other emerging economies (Aggarwal, 2007; Garg, 2025; Lu et al., 2023, 2019; Wang, 2013). Drawing in part on these experiences, the adoption of industrial parks as a policy instrument to attract investment and promote growth has expanded rapidly worldwide. Special economic zones, for instance, have proliferated: by 2018, approximately 5,400 zones existed across 147 economies, with numbers continuing to rise (UNCTAD, 2019). Africa has become an important locus of this expansion, experiencing a twelvefold increase in the number of industrial parks from 1990 to 2020 (UNCTAD, 2021). Ethiopia stands out within this trend and has aggressively promoted industrial park development as a central pillar of its industrialization and economic growth strategy.

2.2 Industrial Parks in Ethiopia

Adoption of Industrial Park Policy. Ethiopia's turn toward industrial parks is closely connected to its broader development trajectory. Since the early 1990s, the government has undertaken a series of reforms aimed at shifting the predominantly agrarian economy toward industrialization. The first major effort, the Agricultural Development–Led Industrialization (ADLI) strategy, placed agriculture at the center of the growth agenda, with the expectation that productivity gains in agriculture would stimulate demand for industrial goods and ultimately induce structural transformation (Abrar, 2000). Despite substantial public investment, ADLI did not generate the expected acceleration in growth, and by the mid-2000s Ethiopia remained among the world's poorest countries, with only modest changes in its economic structure.

In response to these limitations—and drawing on the experiences of rapidly industrializing Asian economies—the government shifted in the mid-2000s toward a more manufacturing- and export-oriented development strategy (UNDP, 2017). This approach emphasized light manufacturing sectors such as textiles, garments, and leather products, which were viewed as labor-intensive industries capable of absorbing a large, young workforce while remaining competitive in global markets (Jote, 2020; Kebede and Heshmati, 2023).

Foreign direct investment (FDI) was expected to play an important role in this strategy. Although Ethiopia possessed several potential advantages, including low-wage labor, access to water resources, and preferential access to U.S. markets through the African Growth and Opportunity Act (AGOA), private investment, particularly from foreign firms, remained limited. High transport costs, bureaucratic hurdles, and security concerns posed persistent barriers. To mitigate these constraints, the government increasingly turned to industrial parks, drawing on examples from China and other emerging economies where zone-based industrial policies had been used to relax localized constraints on firms and attract export-oriented manufacturing.

Expansion of Industrial Parks. Ethiopia's industrial park program began in 2008 with the establishment of the Eastern Industrial Park (EIP), a privately developed zone operated by a Chinese investor. Designed to host 80 firms and employ 20,000 workers, EIP initially struggled to attract tenants, in part because it was an untested policy instrument and faced considerable uncertainty. Over time, as information about the zone diffused and operational practices improved, investment gradually increased. The park also benefited from broader global dynamics, including China's launch of the Belt and Road Initiative (BRI) in 2013, which encouraged some Chinese firms facing rising domestic production costs to relocate labor-intensive activities abroad.

The gradual improvement of EIP, together with global trends in manufacturing relocation, influenced the Ethiopian government's decision to scale up industrial park development. In 2014, the government opened its first publicly owned industrial park, marking a shift toward state-led zone development. Industrial parks were also incorporated into the country's Growth and Transformation Plan as a central component of its industrial policy framework (Ethiopia National Planning Commission, 2016). That same year, the government established the Industrial Parks Development Corporation (IPDC), a federal agency responsible for developing, operating, and managing publicly owned industrial parks.

The construction of industrial parks expanded rapidly thereafter. As shown in Appendix Figure A1, the number of operational parks increased sharply beginning in 2014 and continued to rise in subsequent years. By the end of 2021, Ethiopia had established 22 industrial parks across 18 districts, with an average developed area of approximately 220 hectares per park.

Geography of Industrial Parks. Appendix Figure A2 illustrates the spatial distribution of Ethiopia's industrial parks. Unlike China's early strategy of concentrating industrial zones in more

developed coastal areas (Lu et al., 2023), Ethiopia has adopted a more dispersed model. These location choices reflect a mix of economic and political considerations, as is common in industrial policy design (Juhász and Lane, 2024). On the economic side, factors such as land availability, construction feasibility, and access to markets and transport infrastructure are clearly relevant. At the same time, under Ethiopia's ethnic federal system—where administrative regions correspond closely to distinct ethnic groups—political balance and regional equity also play an important role in shaping sitting decisions (Kebede and Heshmati, 2023; UNDP, 2024). The government's stated objective of eventually establishing at least one park in each region exemplifies this political logic.

As a result, some industrial parks are located near major urban centers such as Addis Ababa, while others are situated in more remote southern and western regions. This dispersion is also consistent with a longstanding view that placing industrial zones in lagging areas can create growth poles capable of stimulating local economic development (Akinci and Crittle, 2008). Within regions, siting patterns vary as well: some parks are positioned close to regional capitals, whereas others are located farther away due to construction constraints or local political dynamics (Fanuel et al., 2022; Kebede and Heshmati, 2023). This blend of economic and political siting considerations generates meaningful variation across parks in market access, labor market depth, and infrastructure quality. This variation provides a useful setting for examining how the effects of industrial parks depend on underlying location fundamentals.

Specialization and Incentive Structure. Appendix Table A1 provides an overview of Ethiopia's industrial parks, including their sectoral specialization and ownership structure. More than half of the parks specialize in textiles, apparel, and leather—labor-intensive sectors that align closely with the country's comparative advantage. Others focus on more advanced industries, including ICT and pharmaceuticals, or on capital-intensive sectors such as construction materials. Several parks operate without a designated specialization and admit firms from a diverse set of industries.

In terms of ownership, 16 of the 22 parks are publicly owned and operated, reflecting the government's active role in advancing the industrial park program. Public parks are developed and managed by the Industrial Parks Development Corporation (IPDC), the federal agency responsible for coordinating and overseeing state-led industrial zone development. The co-existence of public and private parks is broadly consistent with international practice (Farole, 2011).

The regulatory framework and incentive structure governing Ethiopia's industrial parks share important similarities with those in other African countries (Akinci and Crittle, 2008; Farole, 2011;

Zeng, 2015). Appendix Table A2 summarizes the key fiscal and non-fiscal incentives. Firms operating in Ethiopian parks receive fiscal incentives such as corporate income tax holidays (up to 15 years) and customs duty exemptions on capital goods and raw materials. Non-fiscal incentives include long-term leases of serviced land and one-stop-shop administrative services. Public parks offer additional benefits, including export tax exemptions, salary tax waivers for expatriate staff, and export credit guarantees. They also provide subsidized factory-shed leases: firms pay roughly \$2 per m^2 per month for the first four years, with the rate eventually rising to \$3 after eleven years. Private parks, in contrast, typically charge higher commercial rates that vary with facility quality and the range of services provided (Tegegn, 2020). Public parks, by virtue of their ownership structure, also tend to benefit from stronger policy support and closer administrative coordination with federal and regional authorities.

Performance, Linkages, and Labor Composition. Aggregate statistics indicate that Ethiopia's industrial parks have generated notable direct effects on employment and exports. In 2019/20, an average park exported USD 11.6 million, and collectively the parks accounted for roughly 70 percent of Ethiopia's textile and apparel exports and nearly 40 percent of all manufacturing exports (Fanuel et al., 2022). In 2021, an average park employed about 6,400 workers; taken together, the parks contributed approximately one in every seven new formal private-sector jobs in recent years (Fanuel et al., 2022; UNDP, 2024). Wages in industrial parks are generally higher than those in other local sectors: survey data from 107 park firms show a median monthly compensation of around ETB 4,063, compared with median earnings of 812 ETB in agriculture, 2,876 ETB in services, and 2,135 ETB in non-park industry (Meyer et al., 2021b). Beyond these direct gains, the concentration of firms and workers also stimulates demand for nearby services and commerce.

Despite these achievements, the performance of industrial parks in Ethiopia lags behind that of more established zones in the Asia-Pacific region. Previous research points to several structural constraints, including intermittent political instability, regulatory bottlenecks (particularly in foreign exchange markets), and shortages of skilled labor (Fanuel et al., 2022; UNDP, 2024). Moreover, many parks function as relatively isolated enclaves with limited linkages to the domestic economy. This is reflected in both investor composition—about 95 percent of firms originate from Asia, Europe, or the United States—and input sourcing patterns, with local purchases accounting for less than 5 percent of intermediate inputs in key sectors such as garments. During our fieldwork in Ethiopia, managers of international firms consistently emphasized the shortage of reliable local

suppliers capable of meeting required production standards.

Finally, labor force composition in the parks exhibits a pronounced gender imbalance. Firm-level surveys indicate that women constitute between 86 and 96 percent of the workforce in major industrial parks (UNDP, 2024). This pattern mirrors experiences in other early-industrializing economies such as Bangladesh, Cambodia, and Vietnam, where light manufacturing sectors disproportionately employ young women. Although this phenomenon is widely documented in qualitative accounts (Akinci and Crittle, 2008; Farole, 2011; UNDP, 2024), its implications for women's economic and social outcomes remain underexplored in quantitative research. This study helps fill this gap by examining how the industrial park policy affects women's employment and empowerment.

3 Data and Empirical Strategy

3.1 Data Sources and Variable Construction

To assess the impact of industrial parks on local economic activity and residents' well-being, we assemble a dataset that links the staggered rollout of parks to spatial indicators of development and nationally representative household surveys. Specifically, the data combine administrative records on park locations and opening years, district-level measures of nighttime light intensity and impervious surface coverage, and household- and individual-level outcomes from multiple rounds of the Ethiopia Demographic and Health Surveys.[5]

3.1.1 Industrial Parks Data

Data on industrial parks are obtained from the Ethiopia Investment Commission (EIC), which provides the list of all parks established by 2023, together with information on their location, ownership, opening year, land area, and sectoral specialization.[6] These records are cross-verified with documentation from the Industrial Parks Development Corporation (IPDC) and official park reports. Appendix Table A1 summarizes key characteristics. Of the 22 operational parks, 16 are publicly owned and 6 are privately operated. Over half specialize in labor-intensive manufacturing sectors, while others focus on pharmaceuticals, ICT, or operate as multi-sector platforms. The staggered rollout of parks between 2008 and 2021 generates the temporal variation in treatment exposure central to our empirical strategy.

[5] See the replication files from Huang et al. (2026) for more details.

[6] All parks remained operational in 2023.

To construct treatment status, we identify the administrative district (*woreda*) in which each park is located.[7] A district is coded as treated from the opening year of its first industrial park onward and as untreated in all preceding years. To improve comparability and estimation precision, we identify a set of districts that never host a park but are similar to treated districts in their baseline characteristics. Specifically, using propensity score matching, we select never-treated districts located within 100 kilometers of any industrial park and comparable in their pre-treatment geographic and socioeconomic profiles. These matched districts constitute the control group in the empirical analysis.[8]

3.1.2 District-Level Measures

Nighttime Light Intensity. Nighttime light (NTL) data are widely used as a proxy for local economic activity, particularly in settings where conventional statistics are limited. Henderson et al. (2012) show that NTL correlates strongly with GDP in Africa, and subsequent work confirms its value in capturing spatial variation in development (Michalopoulos and Papaioannou, 2014). At the same time, recent research highlights several measurement challenges. As Gibson et al. (2021) and Asher et al. (2021) note, commonly used DMSP–OLS data are affected by sensor saturation in dense urban areas, low sensitivity in dimly lit regions, blooming effects that blur spatial boundaries, and inter-satellite inconsistencies that complicate comparisons over time. Additional discontinuities may also arise from atmospheric variation, orbital differences, and sensor upgrades if data are not properly harmonized.

To address these concerns, we employ the harmonized global NTL dataset developed by Chen et al. (2020), which calibrates DMSP–OLS and VIIRS observations into a consistent VIIRS-like series. This harmonization improves spatial resolution and dynamic range and mitigates the cross-year comparability issues documented in earlier datasets. Using this product, we construct an annual district-level panel spanning 2005–2020.[9] The underlying raw sources, DMSP–OLS (2005–2012) and VIIRS (2013 onward), are rendered comparable through cross-sensor calibration, ensuring consistent spatial and temporal coverage across the study period.

[7] Ethiopia consists of 684 districts, with an average land area of approximately 1,600 square kilometers and an average population of about 150,000.

[8] Details about the matching procedure are provided in Section 3.2.

[9] We end the sample in 2020 to avoid confounding from the onset of the Tigray conflict in late 2020, which continued into 2022 and resulted in significant displacement and economic disruption.

Impervious Surface Area. Impervious surfaces, which are areas that prevent water infiltration, are closely associated with built structures such as roads and rooftops. These surfaces are strongly correlated with urban expansion and population growth (Stankowski, 1972). Accordingly, the percentage of impervious surface area (%ISA) is widely used as an indicator of urban development (Yuan and Bauer, 2007). We draw on the Global 30-meter Impervious Surface Dynamic Dataset (GISD30) developed by Zhang et al. (2021), which derives impervious land cover from time-series Landsat imagery processed on the Google Earth Engine platform. ISA data are available at five-year intervals; in this study, we use observations for the years 2005, 2010, 2015, and 2020. We calculate the impervious surface ratio at the district level as total impervious area divided by the district's total land area. This measure provides a spatially consistent indicator of built-up expansion and serves as our primary outcome for assessing how industrial parks affect urbanization. The high spatial resolution and temporal consistency of the GISD30 product allow us to capture both the level and evolution of urban land cover with precision.

Geographic and Socioeconomic Controls. To account for geographic heterogeneity across districts, we construct measures of average elevation and terrain slope using the 90-meter resolution Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM), provided by the International Center for Tropical Agriculture (Reuter et al., 2007). District boundary shapefiles are obtained from the Ethiopia GeoPortal to ensure precise spatial delineation. We complement these geographic controls with baseline socioeconomic characteristics derived from the 2007 Ethiopian Population and Housing Census, drawing on both official tabulations and IPUMS microdata from the same census (Ruggles et al., 2025). The microdata provide detailed information on demographic attributes, residence type, and employment status, which we aggregate to the district level to construct pre-treatment controls. These measures help account for underlying differences that may be correlated with both the siting of industrial parks and the subsequent trajectories of local economic activity and household well-being.

3.1.3 Household and Individual Outcomes

Microdata on household and individual outcomes are drawn from the Ethiopia Demographic and Health Surveys (DHS), a nationally representative survey program collecting detailed information on living standards, demographic characteristics, health, employment, and women's empowerment. Each survey geocodes cluster locations (typically groups of adjacent villages or urban neighbor-

hoods), which enables spatial linkage between clusters, administrative districts, and industrial park locations (Ethiopian Public Health Institute, 2021).[10] Our analysis uses five survey rounds: 2000, 2005, 2011, 2016, and 2019. We exclude observations with missing demographic information, such as age or ethnicity, as well as individuals classified as visitors rather than usual household members.

To assess the impact of industrial parks on household living standards, we focus on three key outcomes: (1) per capita ownership of durable goods, defined as the total number of durable items (e.g., televisions, radios, mobile phones, refrigerators, vehicles) divided by the total number of household members; (2) housing quality, measured by an indicator equal to one if the household has access to all four basic amenities—electricity, piped water, a toilet facility, and a finished floor—and zero otherwise; and (3) the DHS wealth index, a composite measure of economic well-being constructed through principal component analysis of household assets, housing materials, and access to basic services, and standardized for each survey round to facilitate comparisons over time (Abagna et al., 2025).

At the individual level, we examine (1) non-agricultural employment, indicating whether the respondent was employed outside agriculture at the time of the survey; (2) savings account ownership, capturing access to formal financial services; (3) household decision-making power, defined as an indicator equal to one if the respondent reported sole or joint authority over decisions regarding personal health care, major household purchases, daily purchases, visits to relatives, and food preparation; and (4) attitudes toward domestic violence, defined as an indicator equal to one if the respondent reported that domestic violence is justified under at least one specified circumstance.

3.2 Empirical Strategy

Our empirical strategy compares districts that host industrial parks with those that never do, before and after the parks become operational. We estimate the effects using a difference-in-differences specification, summarized as:

$$Y_{dt} = \beta \times \text{Treatment}_{dt} + \gamma \text{X}_{dt} + \lambda_d + \mu_{rt} + \epsilon_{dt}, \tag{1}$$

where Y_{dt} denotes the satellite-derived outcome for district d in year t, and Treatment_{dt} is an indicator equal to one if at least one industrial park is operational in district d in year t and

[10] Cluster coordinates are randomly displaced by up to 2 km in urban areas and 5–10 km in rural areas for confidentiality, but remain valid for linkage at the district level.

zero otherwise. Since no parks close during the study period, once a district becomes treated, the treatment indicator remains one in all subsequent years. In all regression models, we include district fixed effects, λ_d, to absorb time-invariant determinants of economic outcomes specific to each district. Region-by-year fixed effects, μ_{rt}, are also incorporated to account for macroeconomic shocks common to all districts within the same region in a given year.

Given that the placement of industrial parks reflects both political and economic considerations, treated districts can differ systematically from those that never host a park.[11] If such differences are associated with distinct economic or demographic trajectories, the parallel trends assumption may be violated. To address this concern, we employ propensity score matching to identify never-treated districts that are observably similar to treated ones. We restrict the donor pool to districts located within 100 kilometers of any industrial park, and estimate propensity scores using a logit model that includes population density, urbanization rate, employment rate, distance to Addis Ababa, distance to the nearest city, and geographic characteristics such as average slope and elevation. The matched sample comprises 17 treated and 122 control districts. Summary statistics in Panel C of Appendix Table A3 show that the matched control districts closely resemble treated districts across key pre-treatment characteristics.[12]

To further address potential differential trends, we include linear time trends interacted with a rich set of baseline district characteristics, including latitude, longitude, elevation, slope, distance to Addis Ababa, urbanization rate, population, and ethnic and linguistic composition, to capture systematic variation in outcome trajectories associated with these features. In addition, we estimate event-study models to assess pre-treatment trends and to examine dynamic effects over time. Standard errors are clustered at the district level to account for within-district correlation, and we implement the spatial adjustment proposed by Conley (1999) as a robustness check to accommodate potential spatial dependence in the error structure. Finally, because industrial parks may generate spillovers to nearby districts, potentially violating the stable unit treatment value assumption (SUTVA), Section 4.2 tests for and isolates geographic spillover effects.

We employ a similar strategy to evaluate the impact of industrial parks on household and individual outcomes. Using the geographic coordinates recorded in the DHS, we identify the administrative district of each respondent and restrict the analysis to districts in which survey respondents

[11] Because only eighteen districts ever receive a park, restricting the analysis to treated districts would substantially limit statistical power. We therefore include a set of never-treated districts as the comparison group.

[12] Standardized mean differences for these district-level variables fall below 0.1 and are not statistically significant at the 10 percent level.

are observed. We apply the same matching procedure as in the district-level analysis, limiting the sample to districts within a 100-kilometer radius of any industrial park to construct comparable treated and control groups. We then estimate the following equation:

$$Y_{idt} = \beta \times \text{Treatment}_{dt} + \gamma \text{X}_i + \lambda_d + \mu_{rt} + \epsilon_{idt}, \tag{2}$$

where Y_{idt} denotes outcomes for household or individual i in district d in year t. X_i includes individual-level controls such as household size, age of the household head, respondent's age, and respondent's age squared. All other variables are defined consistently with those in Equation 1. For each outcome, we also estimate event-study specifications to assess the validity of pre-treatment trends. Given potential biases in staggered difference-in-differences settings arising from treatment effect heterogeneity across cohorts or over time, we implement the estimators proposed by Sun and Abraham (2021) and Borusyak et al. (2024) as robustness checks. Finally, to further assess sensitivity, we re-estimate the specification using alternative sets of control districts and examine robustness to controlling for concurrent investments and programs.

4 Results

This section presents the main results. We begin by examining the effects on nighttime light intensity and impervious surface ratios in host districts and assessing potential spillover effects and sources of heterogeneity in park effectiveness. We then analyze changes in residents' living standards and employment outcomes. Finally, given the prominence of female-labor-intensive sectors within the industrial parks, we evaluate impacts on gender equality and women's empowerment.

4.1 Impacts on Light Intensity and Impervious Surface Ratio

Table 1 reports estimates from Equation 1, focusing on the effects of industrial parks on nighttime light intensity and impervious surface coverage. Columns 1–4 present results for nighttime lights. In Columns 1–2, we employ the inverse hyperbolic sine (IHS) transformation to accommodate zero luminosity values and reduce the influence of extreme observations. The estimates indicate a 26.5 percent increase in nighttime light intensity following the onset of park operations, statistically significant at the 5 percent level. The magnitude and significance of this effect remain stable when we additionally adjust for linear trends interacted with baseline district characteristics. Given Ethiopia's low initial income level, a 26.5 percent increase in luminosity is both plausible and

economically meaningful.[13] The pattern aligns with recent reports documenting the sizable contribution of industrial parks to formal employment and manufacturing exports in Ethiopia, including their role in accounting for roughly one in seven new formal private-sector jobs and nearly 40 percent of total manufacturing exports (Fanuel et al., 2022; UNDP, 2024). The findings also echo emerging evidence from other settings, including India's industrial zone program, which reports substantial gains in formal employment and local production (Garg, 2025).

Table 1: Impacts on Nighttime Light Intensity and Impervious Surface Ratio

	IHS(Intensity)		Light Intensity		Impervious Surface Ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.265**	.214**	1.723*	1.276**	.032**	.028**
	(.105)	(.090)	(.932)	(.622)	(.014)	(.012)
District FE	Y	Y	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	N	Y	N	Y	N	Y
Mean of dep.	.209	.209	.879	.879	.038	.038
Observations	2,224	2,224	2,224	2,224	556	556

Notes: The dependent variables are as follows: the IHS transformation of nighttime light in Columns 1–2, the nighttime light in Columns 3–4, and the impervious surface ratio in Columns 5–6, respectively. All models include district fixed effects and region by year fixed effects. Even-numbered columns additionally control for linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Columns 3–4 present estimates using the raw luminosity measure. The results show similarly robust effects, with treated districts experiencing an average increase of approximately 1.3 units in nighttime light intensity. Appendix Table A4 decomposes these changes into extensive and intensive margins. The results indicate that the increase in luminosity is concentrated on the intensive margin, whereas effects on the extensive margin are small in magnitude and statistically indistinguishable from zero. The absence of an extensive-margin response also supports the use of the IHS transformation in the previous analysis: because treatment does not materially increase the probability of positive luminosity, the transformation is unlikely to introduce bias.[14]

[13] Ethiopia's GDP per capita was approximately $558 in 2014.

[14] Chen and Roth (2024) show that log-like transformations can bias average treatment effects when treatment substantively affects the extensive margin. When extensive-margin effects are negligible, such concerns are minimal.

Columns 5–6 evaluate the impact of industrial parks on the impervious surface ratio in host districts and show an increase of roughly 3 percentage points attributable to park operations. The magnitude and statistical significance of the estimates remain stable across specifications, highlighting the contribution of industrial parks to local urbanization. Relative to the sample mean, the 3-percentage-point increase represents a substantial expansion of developed land and aligns with the role of industrial parks as hubs for labor settlement, business formation, and service clustering. By attracting firms and workers and stimulating complementary commercial activity, park operations reshape the physical and economic landscape of host districts. Importantly, the observed increase in impervious surface ratio is unlikely to reflect only the mechanical effect of the parks' own construction footprint, as an average park occupies only about 0.14% of district land area. This pattern suggests that the estimated effect reflects broader local development beyond the park site itself, rather than direct land conversion within park boundaries.

Addressing Spatial Correlation. To account for potential spatial correlation in the satellite-based measures, we estimate standard errors using the spatial adjustment procedure developed by Conley (1999). Following common practice, we assume that spatial correlation across districts declines linearly up to 100 kilometers and is zero beyond this distance. As reported in Appendix Table A5, applying the Conley correction does not materially affect inference. Results are similar when using a 50-kilometer cutoff, indicating that the findings are robust to alternative assumptions regarding spatial decay.

Addressing Treatment Effect Heterogeneity. Because industrial parks are introduced at different times across districts, conventional difference-in-differences estimators may be biased when treatment effects vary across cohorts or over time. Recent econometric work shows that staggered adoption can lead to weighting distortions and potentially misleading average effects if such heterogeneity is not accounted for. To address this concern, we implement the estimators proposed by Sun and Abraham (2021) and Borusyak et al. (2024), which recover unbiased treatment effects in staggered settings. As reported in Appendix Table A6, results based on these alternative estimators are similar to the baseline in both magnitude and statistical significance, indicating that our main findings are not driven by weighting artifacts or treatment effect heterogeneity.

Testing Pre-Trends. To assess the validity of the identifying assumptions and to examine dynamic treatment effects, we estimate an event-study specification derived from Equation 1. In this

specification, the treatment indicator is replaced with a set of dummy variables representing periods relative to the year in which industrial parks become operational:

$$Y_{dt} = \sum_{k=-5}^{5} \beta_k \times D_{k(dt)} + \gamma \mathrm{X}_{dt} + \lambda_d + \mu_{rt} + \epsilon_{dt}, \tag{3}$$

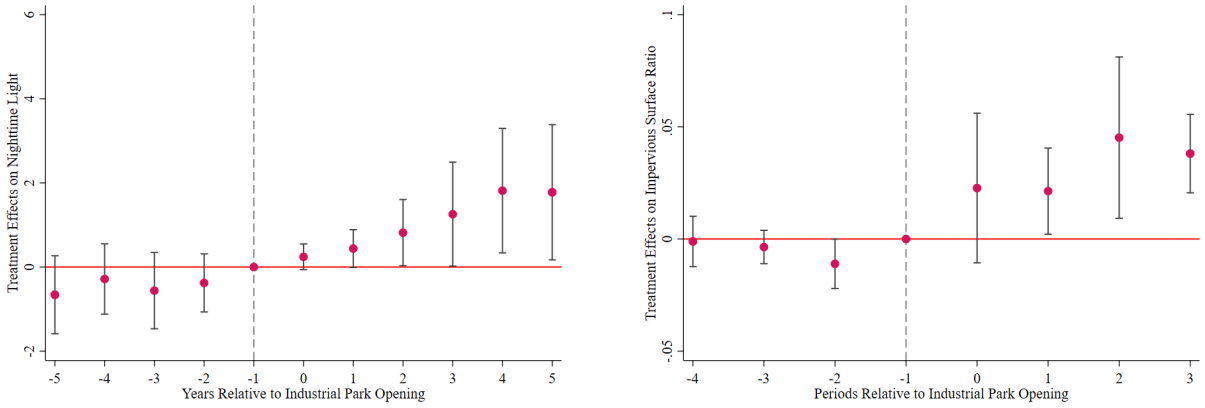
where $D_{k(dt)}$ is an indicator equal to one if district d is k periods away from the opening year in period t. For example, $k = 2$ indicates two periods after opening, while $k = -2$ indicates two periods prior. We set $k = -1$ (the period immediately before opening) as the omitted category, making all effects relative to this baseline. Other variables are defined as in Equation 1, and the specification corresponds to that used in the even-numbered columns of Table 1. Results are presented in Figure 1.

The event-study results yield two primary insights. First, coefficients in the periods preceding industrial park operations are generally small in magnitude and statistically indistinguishable from zero, providing no evidence of differential pre-trends between treated and control districts. This finding supports the validity of the difference-in-differences identification strategy. Second, treatment effects emerge in the opening year and grow steadily thereafter, consistent with a gradual build-up of activity as firms enter parks, production scales up, and agglomeration forces intensify. The discrete shift in post-opening coefficients reinforces the interpretation that observed increases in local economic activity and urban development are driven by the operationalization of industrial parks.[15]

In Appendix Figure A3, we present an event-study analysis using monthly data on nighttime light intensity. The finer temporal resolution allows for a more precise assessment of short-run dynamics around park openings.[16] Nighttime light levels remain essentially flat in the months prior to park operation. Luminosity then begins to rise shortly after parks become operational, with the magnitude of the effect strengthening in the following months. This pattern closely mirrors the annual event-study results and reinforces the interpretation that post-opening increases in nighttime lights reflect genuine economic activity rather than temporary construction-related illumination.

[15] Impervious surface data are observed at five-year intervals. Accordingly, in Figure 1b, each event period corresponds to a five-year interval rather than a single calendar year. Thus, "event time = +1" captures outcomes 1–4 years after opening, while "event time = +2" captures outcomes 5–9 years after opening. This temporal aggregation does not affect identification, as identification relies on comparisons between pre- and post-treatment observations measured at a consistent frequency across districts.

[16] The monthly panel combines DMSP–OLS data for 2005–2012 with VIIRS data for 2013 onward (Elvidge et al., 2021, 1997).



(a) Nighttime Light Intensity

(b) Impervious Surface Ratio

Figure 1: Event-Study Estimates for Nighttime Light Intensity and Impervious Surface Ratio

Notes: This figure plots coefficient estimates and 95% confidence intervals from Equation 3. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Markers at the left and right ends of the timeline represent average effects observed five years before and five years after the opening of industrial parks for nighttime lights (four periods before and three periods after for the impervious surface ratio), respectively. All effects are normalized relative to the period immediately preceding park opening. Robust standard errors are clustered at the district level.

Controlling for Concurrent Interventions. To ensure that the estimated impacts of industrial parks are not confounded by other development initiatives implemented during the same period, we account for two major types of concurrent interventions. First, we control for the potential influence of Chinese development assistance (An et al., 2025; Dreher et al., 2021) by constructing a binary indicator equal to one for districts that receive infrastructure-related Chinese assistance, from the year of first receipt onward.[17] Second, we account for large transport infrastructure projects completed during our study period, including the Addis–Adama Expressway (2014), the Addis–Djibouti Railway (2016), and the Addis Ababa Light Rail (2015). For each project, we define a binary indicator equal to one for districts traversed by the infrastructure from the year of completion onward. Appendix Table A7 shows that the estimated effects remain stable after including these additional controls, indicating that the impacts of industrial parks are not driven by contemporaneous transport investments or Chinese development assistance.

[17] Our measure is based exclusively on official development assistance (ODA) data, restricting the sample to projects that qualify as "aid" in the strict sense. It therefore excludes foreign direct investment (FDI) flows and other non-ODA forms of Chinese financing.

Robustness to Alternative Samples and Control Groups. We further assess the robustness of our findings to alternative sample definitions and control group constructions. Appendix Table A8 reports results when the control group is restricted to matched districts located within 50 kilometers of any industrial park. Appendix Table A9 presents estimates after excluding the first experimental zone, the Eastern Industrial Park, and its host district from the sample. In Appendix Table A10, we exclude all districts within the Addis Ababa metropolitan area, the most economically developed region of the country. Because policy environments may differ across regional boundaries, Appendix Table A11 restricts the control group to matched districts located within the same province as each treated district. Across all these alternative specifications, the estimated effects remain closely aligned with our baseline results, reinforcing the credibility of our findings.

4.2 Geographic Spillover Effects

So far, our analysis shows that industrial parks substantially increase economic activity and urbanization within host districts. A natural question, however, is whether these gains reflect net regional growth or instead displacement from nearby areas. Growth in treated districts could, in principle, come at the expense of nearby localities if labor, capital, or firms are diverted from those areas, thereby dampening economic activity and urban development (Juhász and Steinwender, 2023; Ziff, 2025). At the same time, policymakers explicitly anticipate positive spatial externalities. By fostering input–output linkages, supplier development, and technology diffusion, industrial parks may stimulate production networks and raise productivity in nearby areas (Bloom et al., 2019; Greenstone et al., 2010).[18] These potential spillovers constitute a central rationale for the government's investment in industrial park development.

This subsection assesses the geographic spillover effects of industrial parks by comparing districts near park locations with those located farther away, before and after operations begin. If industrial parks generate meaningful spatial spillovers, effects should be most pronounced in proximate districts, due to easier access to jobs, supplier contracts, market information, and technology transfers. To test for potential spillovers, we introduce a binary indicator, "Nearby," which equals one for districts located within ten kilometers of an operational industrial park in a given year and zero otherwise. This variable is included alongside the main treatment indicator in the regression model specified in Equation 1.

[18] For example, firms within parks may contract with domestic suppliers for intermediate inputs or disseminate production know-how and managerial practices to other enterprises, generating broader regional gains.

Table 2: Testing for Geographic Spillover Effects

	IHS(Intensity)		Light Intensity		Impervious Surface Ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.271**	.221**	1.566*	1.185**	.029**	.025**
	(.107)	(.091)	(.819)	(.553)	(.011)	(.010)
Nearby	.015	.017	-.408	-.221	-.006	-.005
	(.029)	(.026)	(.310)	(.279)	(.005)	(.005)
District FE	Y	Y	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	N	Y	N	Y	N	Y
Mean of dep.	.209	.209	.879	.879	.038	.038
Observations	2,224	2,224	2,224	2,224	556	556

Notes: The dependent variables are as follows: the IHS transformation of nighttime light in Columns 1–2, the nighttime light in Columns 3–4, and the impervious surface ratio in Columns 5–6, respectively. All models include district fixed effects and region by year fixed effects. Even-numbered columns additionally control for linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

The results, reported in Table 2, provide no evidence that industrial parks have generated meaningful economic effects on nearby districts. While the coefficients for the treatment indicator remain consistently positive and statistically significant, the coefficients on the "Nearby" indicator are small and statistically indistinguishable from zero across all key outcomes. This absence of spatial spillovers may reflect frictions in labor mobility and information flows that limit the diffusion of employment opportunities across administrative boundaries, as documented in recent work on Ethiopia's labor market (Abebe et al., 2021; Witte et al., 2025). This pattern is also consistent with the limited integration of industrial parks into the domestic production network, a characteristic widely documented in African zone programs (Akinci and Crittle, 2008; Farole, 2011).

Given the country's shallow industrial base prior to park development, where manufacturing accounted for only about 5 percent of GDP, firms rely heavily on imported raw materials, intermediate goods, and capital equipment. The absence of a local supplier ecosystem significantly constrains backward linkages, knowledge diffusion, and technology transfer beyond park boundaries. As a result, the economic contributions of industrial parks appear concentrated within host

districts, primarily through production, export revenues, employment creation, and spillovers to local services and commerce (Fanuel et al., 2022; UNDP, 2024). At this stage of development, industrial parks function more as self-contained production enclaves than as catalysts for broad regional industrial upgrading, falling short of the development objectives originally envisioned.

Finally, from an identification standpoint, the lack of measurable geographic spillovers suggests that gains in treated districts are unlikely to reflect displacement from neighboring areas. This reduces concerns about SUTVA violations and reinforces the validity of the baseline estimates.

4.3 Heterogeneity in Park Effectiveness

While industrial parks are a widely used place-based development tool, their performance varies substantially across settings. Prior qualitative studies document considerable heterogeneity in park outcomes and highlight locational fundamentals as key determinants of effectiveness (Akinci and Crittle, 2008; Akinci and Farole, 2011; Fanuel et al., 2022). In particular, site characteristics shape access to markets, transport infrastructure, labor pools, and supplier networks, and thus condition the extent to which parks can generate economic gains.

In Ethiopia, park placement has been shaped not only by economic considerations but also by political objectives aimed at maintaining regional and ethnic balance under the federal system (Kebede and Heshmati, 2023). As a result, parks are distributed across highly diverse environments—ranging from districts embedded in major urban and transport corridors to remote regions with limited infrastructure and relatively small labor pools. This spatial dispersion provides a valuable setting for examining how underlying geographic fundamentals mediate the impacts of industrial parks.

We begin by examining heterogeneity along two core geographic dimensions: proximity to urban markets and road network density. Urban centers function both as primary consumer markets for park-produced goods and as hubs for supporting services such as logistics, finance, and skills development. Closer proximity to cities is therefore expected to enhance park performance. To capture this dimension, we measure the distance from each district to the nearest major city, including Addis Ababa—the national economic hub—and regional capitals, and interact this measure with the treatment indicator in our difference-in-differences framework. Second, given Ethiopia's reliance on road-based transport, district-level road infrastructure is likely to be central to park functioning. Using the 2008 Global Roads Open Access Data Set, we construct baseline measures of primary and paved road density at the district level, and interact these measures with the treatment indicator to assess how transport connectivity shapes the economic impacts of industrial parks.

Table 3: Heterogeneous Effects by Market Accessibility

	Light Intensity			Impervious Surface Ratio		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	2.514**	2.192**	2.643**	.057**	.046**	.055**
	(1.136)	(.979)	(1.153)	(.024)	(.019)	(.023)
× Distance to Addis Ababa	-.008**			-.0002*		
	(.004)			(.0001)		
× Distance to State Capital		-.009**			-.0002**	
		(.004)			(.0001)	
× Distance to Nearest City			-.032**			-.0006**
			(.015)			(.0003)
District FE	Y	Y	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y	Y
Mean of dep.	.879	.879	.879	.038	.038	.038
Observations	2,224	2,224	2,224	556	556	556

Notes: The dependent variables are as follows: the nighttime light in Columns 1–3, and the impervious surface ratio in Columns 4–6, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table 3 presents heterogeneity estimates based on proximity to urban markets. Columns 1 and 2 use distances to Addis Ababa and to regional capitals, respectively. In both cases, the coefficients are negative, indicating that parks located farther from major cities generate substantially smaller increases in local economic activity. Column 3 adopts a broader definition of cities, identifying the fifty largest districts by population in the 2007 census. We compute each district's distance to the nearest such city and interact it with the treatment indicator. The results closely mirror those in Columns 1 and 2: greater distance from large population centers is associated with reduced park effectiveness. Columns 4–6 report analogous specifications using the impervious surface ratio as the outcome. The estimates exhibit a consistent pattern, reinforcing that proximity to major urban centers is a key determinant of industrial park effectiveness.

Table 4 turns to heterogeneity by road network density. For each outcome, we examine inter-

Table 4: Heterogeneous Effects by Transport Connectivity

	Light Intensity		Impervious Surface Ratio	
	(1)	(2)	(3)	(4)
Treatment	.035	-.058	.008*	.004
	(.241)	(.268)	(.004)	(.003)
× Primary Roads Density	.379**		.008*	
	(.181)		(.004)	
× Paved Roads Density		.630**		.014***
		(.273)		(.005)
District FE	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y
Mean of dep.	.879	.879	.038	.038
Observations	2,224	2,224	556	556

Notes: The dependent variables are as follows: the nighttime light in Columns 1–2, and the impervious surface ratio in Columns 3–4, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<.01, **p<.05, *p<.1).

actions with both primary road density and paved road density. Across all models, the interaction terms are positive and statistically significant at the 10 percent level, suggesting that industrial parks located in districts with denser road networks generate larger gains in local economic activity and urban development. This aligns with the central role of transportation connectivity in enabling firms to source inputs and distribute outputs efficiently. Because primary and paved road densities are continuous variables, the coefficient on the baseline treatment indicator captures the effect of industrial parks in districts with zero road density. These coefficients are generally small and not statistically significant, indicating that parks have limited impact in districts lacking substantial transport infrastructure.

In Appendix Table A12, we extend the heterogeneity analysis to three additional dimensions: (i) the size of the local labor force, (ii) the degree of specialization in labor-intensive activities, and (iii) park ownership structure. Columns 1 and 4 show that parks located in districts with larger labor pools generate stronger economic effects, consistent with the notion that deeper labor

markets facilitate recruitment and support production expansion. Columns 2 and 5 assess sectoral specialization. Parks focused on labor-intensive industries exhibit larger impacts, particularly on impervious surface expansion, in line with the view that industrial zones perform better when aligned with a country's comparative advantage (Akinci and Farole, 2011).

Columns 3 and 6 examine ownership structure. The interaction terms for public ownership are small and imprecisely estimated across outcomes, providing no evidence of systematic performance differences between publicly and privately operated parks. Although conventional wisdom suggests that privately managed parks may outperform public ones due to stronger profit incentives and managerial autonomy (Akinci and Crittle, 2008; Farole, 2011), Ethiopia's institutional environment complicates this prediction: public parks benefit from coordinated government support, while private developers often face greater administrative and land-related hurdles.[19] This pattern suggests that creating a level playing field and strengthening coordination mechanisms are crucial for enabling private parks to leverage their operational flexibility and contribute more effectively to local development.

Taken together, these findings highlight the central importance of site selection and park design for maximizing the effectiveness of industrial zone development. Many developing countries operate under tight fiscal and administrative constraints yet rely on industrial parks as a core instrument for attracting global manufacturing investment. Constructing such parks, however, is financially demanding. Ethiopia, for example, financed a substantial share of its state-owned industrial parks through a US$1 billion sovereign Eurobond issued at an annual interest rate of 6.625% (Fanuel et al., 2022). In contexts where government revenues are limited and borrowing costs are high, careful prioritization becomes essential. Targeting locations with strong economic fundamentals and focusing on sectoral activities aligned with comparative advantage are critical for ensuring that scarce public resources are used effectively and that industrial parks generate meaningful and sustained development impacts.

4.4 Impacts on Household Outcomes

Our preceding analysis demonstrated that industrial parks generate substantial increases in local economic activity and urban expansion, as reflected in higher nighttime light intensity and growth in impervious surface areas. We now turn to micro-level evidence from the Ethiopia Demographic

[19] For instance, the Eastern Industrial Park, Ethiopia's first privately developed zone, experienced prolonged delays in expansion due to disputes over land acquisition.

and Health Surveys to examine how these aggregate developments translate into household welfare. In particular, we assess the effects of industrial parks on living standards and the DHS wealth index among local households.

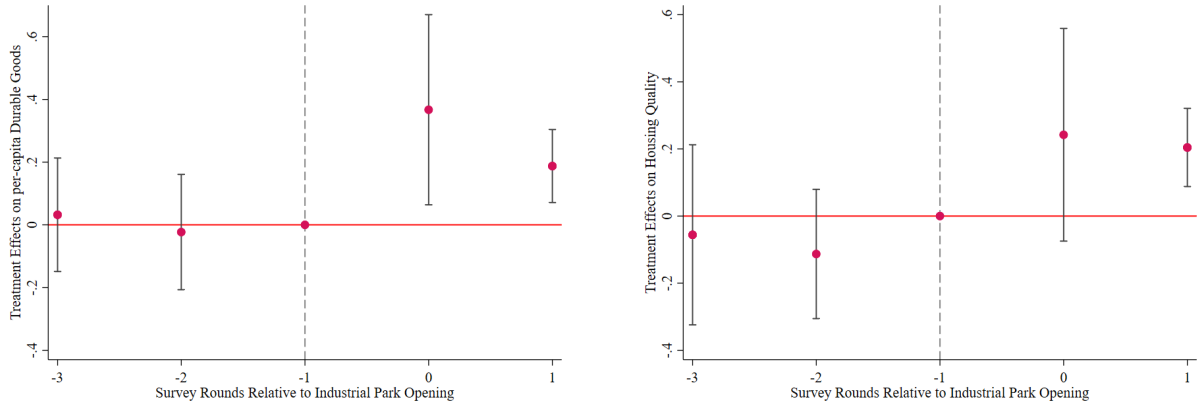
Table 5: Impacts of Industrial Parks on Living Conditions and Wealth

	Durable Goods		Housing Quality		Wealth Index	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.251***	.226***	.257***	.252***	.413*	.409*
	(.071)	(.066)	(.055)	(.055)	(.214)	(.206)
District FE	Y	Y	Y	Y	Y	Y
Region by Round FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of dep.	.297	.297	.305	.305	.001	.001
Observations	12,207	12,207	12,206	12,206	9,688	9,688

Notes: The dependent variables are as follows: the per-capita number of durable goods in Columns 1–2, an indicator for housing quality in Columns 3–4, and the standardized DHS wealth index in Columns 5–6, respectively. All models include district fixed effects and region by survey round fixed effects. Even-numbered columns additionally control for household size and the age of the household head. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table 5 summarizes the main results. Columns 1–2 estimate the impact on per capita ownership of household durable goods. Following the opening of industrial parks, households in host districts acquired an additional 0.226 durable items per capita. Given a sample mean of only 0.297 items per capita, this represents a substantial improvement in material living standards. Columns 3–4 examine changes in housing quality, measured by an indicator equal to one if a household has access to electricity, piped water, a toilet, and a paved floor. The probability of meeting this threshold increases by 25.2 percentage points after park operations, relative to a baseline mean of 30.5 percent. This marked improvement highlights the role of industrial parks in facilitating access to basic amenities and higher-quality housing.

Columns 5–6 assess impacts on the DHS wealth index, a composite measure of household economic well-being constructed from household assets, housing materials, and access to basic facilities. To ensure comparability across survey rounds, the index is standardized within each round, so the coefficients represent changes relative to the national average. The estimates show that household wealth in host districts increases by roughly 0.4 standard deviations following the



(a) Per Capita Durable Goods

(b) Housing Quality

Figure 2: Event-Study Estimates for Household Outcomes

Notes: This figure plots coefficient estimates and 95% confidence intervals from an event-study specification using household-level survey data. All models include district fixed effects, region by survey round fixed effects, household size, and the age of the household head. Markers at the left and right ends of the timeline represent the average effects observed three phases before and one phase after the opening of industrial parks, respectively. All effects are normalized relative to the phase immediately preceding park opening. Estimates are weighted using survey weights. Robust standard errors are clustered at the district level.

establishment of industrial parks. This improvement aligns with recent evidence from special economic zones in Africa Abagna et al. (2025), and indicates that the arrival of industrial parks meaningfully enhances the economic well-being of households in surrounding communities.

Taken together, these findings document substantial improvements in local living conditions associated with the establishment of industrial parks. These effects are plausible given that firms in the parks predominantly hire locally and offer wages above those available in surrounding labor markets. As discussed in Section 2, this wage premium is especially consequential in Ethiopia's predominantly agricultural economy. In addition, industrial parks stimulate ancillary growth in service and commercial activities, creating additional jobs and expanding income-earning opportunities. Overall, the household-level evidence aligns closely with the district-level gains documented earlier and highlights the transformative impact of industrial parks on local livelihood.

We conduct several robustness checks to assess the validity of these results. First, event-study estimates (Figure 2 and Appendix Figure A4) show no evidence of differential pre-trends: coefficients prior to park opening are close to zero and not statistically significant at conventional levels, while effects turn positive and grow over time once parks become operational.[20] Second, to address potential concerns about heterogeneous treatment effects in staggered adoption settings, we

[20]For brevity, event-study results for the DHS wealth index are shown in Appendix Figure A4.

re-estimate models using the estimators of Sun and Abraham (2021) and Borusyak et al. (2024). As reported in Appendix Table A13, these estimates closely track our baseline results. Finally, restricting the control group to matched districts within 50 kilometers of treated districts (Appendix Table A14) yields similarly stable coefficients. Collectively, these checks reinforce the robustness and credibility of our conclusions.

4.5 Impacts on Employment and Gender Equality

This section examines the broader social impacts of industrial parks in Ethiopia, focusing on changes in employment patterns and gender equality. As in many early industrializing economies, Ethiopia's industrial parks are concentrated in labor-intensive sectors—such as textiles, apparel, and leather—that traditionally employ a high share of female workers (Fanuel et al., 2022; Staritz, 2010). The expansion of these industries may disproportionately increase the demand for female labor in nearby communities, potentially raising women's participation in non-agricultural work and reshaping mobility, bargaining power within households, and broader gender norms (Heath and Mobarak, 2015; Jensen, 2012; Qian, 2008).

Table 6: Impacts of Industrial Parks on Non-Agricultural Employment

	Full Sample		Female Sample		Male Sample	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.118	.110	.140***	.133***	.017	.015
	(.104)	(.089)	(.052)	(.047)	(.216)	(.183)
District FE	Y	Y	Y	Y	Y	Y
Region by Round FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of dep.	.312	.312	.287	.287	.357	.357
Observations	17,219	17,219	11,055	11,055	6,164	6,164

Notes: The dependent variable for all columns is an indicator of employment. Regression analyses are organized as follows: Columns 1 and 2 analyze the full sample; Columns 3 and 4 focus on the female sample; and Columns 5 and 6 examine the male sample. All models incorporate district fixed effects and region by survey round fixed effects. Even-numbered columns additionally control for household size, the age of the household head, the respondent's age, and the respondent's age squared. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table 6 presents the estimated impacts of industrial parks on non-agricultural employment.

Columns 1–2 show that the introduction of a park is associated with an increase of approximately 11 percentage points in overall non-agricultural employment rate in host districts, although this estimate is imprecisely measured and not statistically significant at conventional levels. The remaining columns reveal that these effects are driven predominantly by women. Columns 3–4 show a statistically significant 13.3 percentage point rise in female non-agricultural employment–a 46 percent increase relative to the sample mean–following the onset of park operations. In contrast, impacts on male employment (Columns 5–6) are small in magnitude and statistically indistinguishable from zero. Overall, these results indicate that industrial parks substantially expand non-agricultural employment opportunities for women, effectively eliminating the pre-existing gender gap in non-agricultural employment within local districts.

Next, we examine whether improved labor market opportunities for women translate into greater female empowerment. We focus on three dimensions measured in the DHS: decision-making authority, financial autonomy, and attitudes toward domestic violence. Results are detailed in Table 7. Columns 1–2 report estimates for women's decision-making power, where the outcome is a binary indicator equal to one if a woman reports having the final say on key household decisions (including her own health care, major household purchases, daily household purchases, visits to family or relatives, and food preparation). Consistent with evidence linking women's earnings to enhanced intra-household bargaining power (Majlesi, 2016; Qian, 2008), the estimates indicate that the arrival of an industrial park significantly increases women's decision-making authority within the household.

Furthermore, the results in Columns 3–4 show sizable improvements in women's financial autonomy. The likelihood that a woman owns a savings account increases by 31.8 percentage points–a striking rise relative to the baseline rate of 6.3 percent. Savings account ownership is particularly consequential in many developing contexts: it enables women to safeguard earnings from potential family claim, thereby strengthening their control over income (Dupas and Robinson, 2013; Prina, 2015). Greater control over financial resources may also enhance women's incentives to participate in the labor force, as it increases the private returns to their work effort (Field et al., 2021). These mechanisms are likely mutually reinforcing, contributing to meaningful shifts in women's roles within both households and their broader communities.

In light of these developments, we also examine shifts in gender norms, focusing on attitudes toward domestic violence, a critical aspect of women's well-being. Domestic violence remains pervasive globally, and in many societies certain behaviors are still viewed as legitimate grounds for

Table 7: Impacts of Industrial Parks on Women's Empowerment

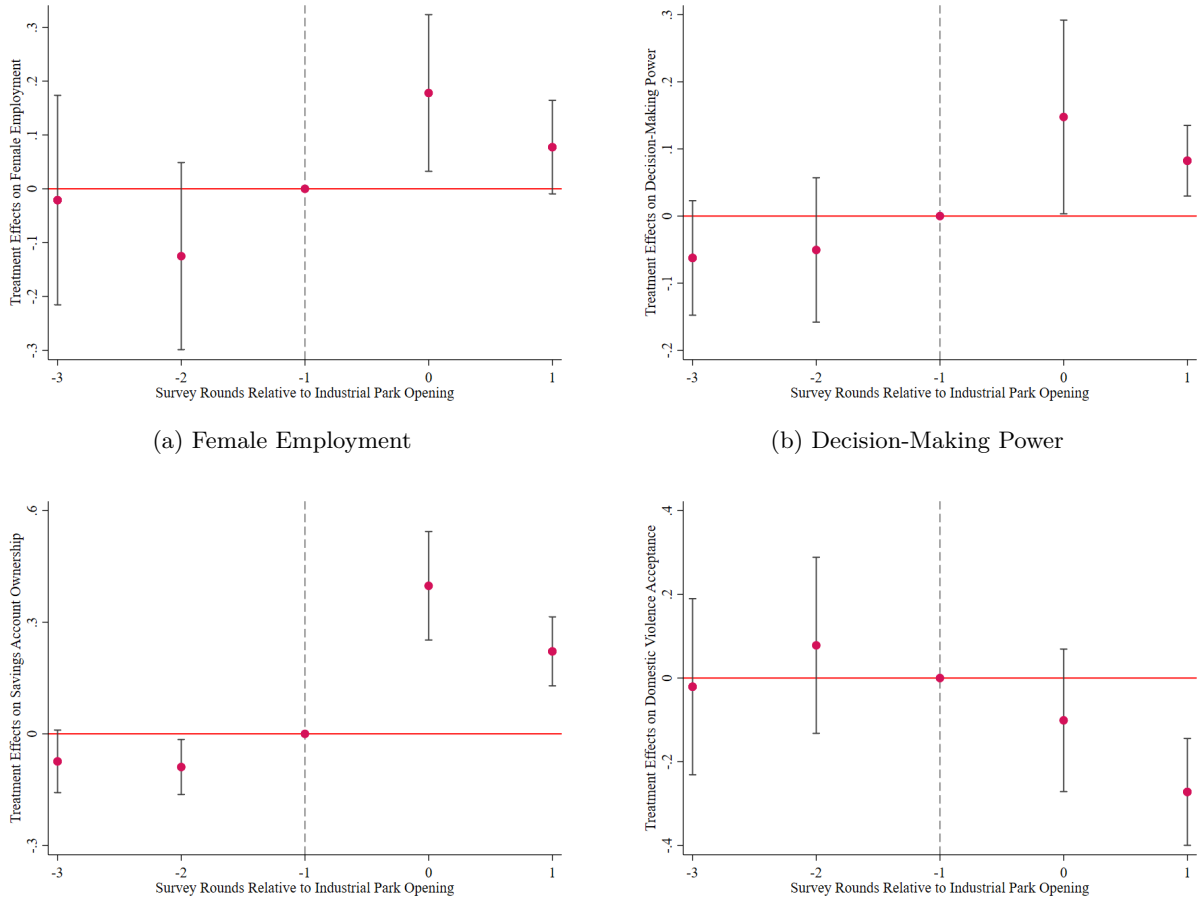
	Decision-Making Power		Savings Account Ownership		Domestic Violence Acceptance	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.109***	.103***	.318***	.318***	-.212***	-.212***
	(.035)	(.033)	(.060)	(.060)	(.063)	(.065)
District FE	Y	Y	Y	Y	Y	Y
Region by Round FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of dep.	.899	.899	.063	.063	.636	.636
Observations	4,737	4,737	11,155	11,155	11,109	11,109

Notes: The dependent variables are differentiated across columns as follows: Columns 1 and 2 analyze decision-making power, Columns 3 and 4 examine saving account ownership, and Columns 5 and 6 focus on acceptance of domestic violence. All models incorporate district fixed effects and region by survey round fixed effects. Even-numbered columns additionally control household size, the age of the household head, the woman's age, and the woman's age squared. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

spousal abuse (Aizer, 2010; Heath, 2014). As industrial parks expand women's access to employment and strengthen their financial independence, women's economic reliance on partners likely declines. This form of empowerment may foster more progressive gender attitudes and reduce the acceptance of domestic violence (Benshaul-Tolonen, 2024; Molina and Tanaka, 2023).

To test this hypothesis, we construct an indicator for acceptance of domestic violence, coded as one if a woman believes a husband is justified in beating his wife under any of five conditions: going out without permission, neglecting children, arguing with the husband, refusing sex, or burning food. As shown in Columns 5–6 of Table 7, the establishment of industrial parks leads to a statistically significant 21.2 percentage point decline in acceptance of domestic violence—an economically meaningful reduction from a baseline of 63.6 percent. Appendix Table A15 reports estimates for each justification separately. Across all conditions, coefficients are negative, indicating broad-based improvements in gender attitudes. The reductions are especially pronounced for unauthorized going out, neglecting kids, and arguing with the husband, consistent with the idea that formal employment—often requiring more frequent mobility outside the home and altering traditional domestic responsibilities—may directly contribute to these shifts in beliefs.

In a similar fashion, we conduct several robustness checks to assess the stability of our individual-



(a) Female Employment

(b) Decision-Making Power

(c) Savings Account Ownership

(d) Domestic Violence Acceptance

Figure 3: Event-Study Estimates for Female Employment and Women's Empowerment

Notes: This figure plots coefficient estimates and 95% confidence intervals from an event-study specification using women's survey data. All models include district fixed effects, region by survey round fixed effects, household size, the age of the household head, the woman's age, and the woman's age squared. Markers at the left and right ends of the timeline represent the average effects observed three phases before and one phase after the opening of industrial parks, respectively. All effects are normalized relative to the phase immediately preceding park opening. Estimates are weighted using survey weights. Robust standard errors are clustered at the district level.

level results. We show that the estimated effects on women's employment and empowerment remain similar in magnitude and statistical significance when alternative control groups are used and when we apply heterogeneity-robust estimators for staggered adoption, as reported in Appendix Tables A13 and A16. In addition, the event-study estimates in Figure 3 show no evidence of differential pre-trends and generally reveal clear increases in female employment and empowerment following the opening of industrial parks. These robustness checks demonstrate that the estimated effects on women's outcomes are not sensitive to alternative specifications, estimation strategies, or sample

definitions.

5 Conclusion

As global manufacturing continues to shift away from traditional hubs toward lower-cost economies, many African countries have increasingly turned to industrial parks as a key element of their industrial development strategies. These parks aim to overcome national constraints such as limited infrastructure, weak institutions, and pervasive insecurity by creating localized environments capable of attracting industrial activity. The policy ambition is substantial: industrial parks are expected to generate employment, stimulate exports, foster technology transfer, and ultimately accelerate structural transformation. Yet despite their growing prevalence, rigorous empirical evidence on their effectiveness in low-income settings remains scarce. Moreover, although prior work documents considerable variation in park performance across contexts, much less is known about the conditions that determine whether and when such programs succeed.

This paper provides a comprehensive evaluation of industrial parks in Ethiopia. Leveraging the staggered rollout of parks across districts, together with satellite-based measures of economic activity and nationally representative household survey data, we find that industrial parks generate meaningful but uneven impacts.

On the positive side, parks substantially increase local economic activity and urbanization, as reflected in gains in nighttime lights and impervious surface coverage. These gains, however, remain highly localized. We detect no evidence of spillovers to surrounding districts, likely due to labor-market frictions, a shallow domestic supplier base, and weak linkages between foreign firms and local producers. Park effectiveness also varies sharply by location. Parks situated closer to major cities and transport corridors, and in districts with deeper labor markets, exhibit much larger economic effects. This pattern underscores the importance of locational fundamentals and cautions against politically motivated or spatially dispersed placement strategies.

At the micro level, the district-level gains translate into substantial improvements in household welfare, including greater ownership of durable goods, better housing quality, and notable increases in wealth. Industrial parks also create significant non-agricultural employment opportunities for women, leading to gains in decision-making authority and financial autonomy, and to reductions in their acceptance of domestic violence. These findings suggest that industrial parks can not only raise female labor force participation but also reshape gender dynamics and advance women's

economic and social empowerment.

The results carry several policy implications. First, site selection is paramount: governments should prioritize locations with strong market access, adequate transport infrastructure, and large labor pools. Second, complementary policies that strengthen local supplier capabilities and reduce labor-market frictions are crucial for translating localized enclave effects into broader regional development. Third, given the substantial fiscal costs of industrial parks, careful sectoral targeting, particularly toward activities aligned with countries' comparative advantages, is essential to ensure that scarce public resources generate high returns.

Looking ahead, future work could examine business formation and firm-level responses within and outside industrial parks, including productivity dynamics, technology adoption, and the evolution of input–output linkages. A deeper understanding of how industrial parks reshape local business ecosystems will be essential for designing more effective industrial policies in low-income economies.

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Appendix: For Online Publication Only

Table A1: Industrial Parks in Ethiopia

Parks	Ownership	Year	Area	Specialization	Region
Adama IP	Public	2018	120	Textile and apparel	Oromia
Bahir-Dar IP	Public	2020	75	Textile and apparel	Amhara
Bole Lemi I IP	Public	2014	172	Textile, apparel and leather	Addis Ababa
Bole Lemi II IP	Public	2020	181	Textile, apparel and leather	Addis Ababa
Debre Birhan IP	Public	2019	100	Textile, apparel and agro-processing	Amhara
Dire Dawa IP	Public	2019	150	Multi-sectoral	Dire Dawa
Hawassa IP	Public	2016	140	Textile, apparel and leather	Sidama
ICT IP	Public	2015	200	Information and communication technology	Addis Ababa
Jimma IP	Public	2019	75	Textile, apparel and agro-processing	Oromia
Kilinto IP	Public	2019	279	Pharmaceutical	Addis Ababa
Kombolcha IP	Public	2017	75	Textile, apparel and leather	Amhara
Mekelle IP	Public	2017	75	Textile, apparel and leather	Tigray
Semera IP	Public	2021	50	Multi-sectoral	Afar
Bure IAIP	Public	2020	155	Multi-sectoral	Amhara
Yirgalem IAIP	Public	2021	109	Multi-sectoral	Sidama
Bulbula IAIP	Public	2021	263	Multi-sectoral	Oromia
CCCC Arerti IP	Private	2018	1,000	Construction materials and homeappliances	Amhara
DBL IP	Private	2016	78	Textile and apparel	Tigray
Eastern IP	Private	2008	1,167	Multi-sectoral	Oromia
George Shoe IP	Private	2015	76	Leather and leather products	Addis Ababa
HuaJian IP	Private	2015	138	Textile,apparel and leather	Addis Ababa
Vogue IP	Private	2015	177	Textile and apparel	Tigray

Notes: The unit of area is measured in hectares. Missing values are represented by "−". Data source: Industrial Parks Development Corporation and Ethiopian Investment Commission.

Table A2: Incentives for Investors in Ethiopian Industrial Parks

Incentive Category	Incentive Description
Fiscal Incentives	Income tax exemption of up to 15 years for industrial park developers and enterprises
	Exemption from customs duties and other taxes on imports of capital goods, construction materials, raw materials, spare parts, and vehicles
	Losses during the income tax holiday may be carried forward for up to half its duration, up to a maximum of five years
	Duty-free export privileges, except for hides and skins
	$*$ Salary tax exemption of up to 5 years for foreign employees of export-oriented firms
Non-fiscal Incentives	Customs facilitation through bonded export factory schemes and streamlined procedures for licensing, registration, tax identification, and customs clearance
	Protection against expropriation of assets by the state
	Guarantee for repatriation of capital and profits
	Access to industrial park land through charge-free leases of 60-80 years
Other Incentives	Expedited procedures for obtaining entry visas, work permits, and certificates of residency
	Multiple-entry visas granted to shareholders and general managers
	Facilitation of market linkages for investors and enterprises
	One-stop-shop service including licensing, registration, and aftercare
	$*$ Franco valuta privilege allowing approved enterprises to import raw materials using their own foreign currency, bypassing local exchange regulations
	$*$ Export credit guarantee scheme to mitigate financial risks by ensuring payment and encouraging trade in new or volatile markets

Notes: This table summarizes the fiscal and non-fiscal incentives provided to investors operating in industrial parks in Ethiopia. Incentives marked with a $*$ apply only to public industrial parks. Sources: Ethiopian Investment Commission (EIC) and Industrial Parks Development Corporation (IPDC).

Table A3: Summary Statistics

	Treated Group			Control Group		
	Mean	SD	N	Mean	SD	N
Panel A: Satellite-Based Outcomes						
Light Intensity	.942	2.374	272	.870	4.503	1,952
$\mathbb{I}$(Light Intensity > 0)	.897	.304	272	.527	.499	1,952
IHS(Light)	.405	.844	272	.182	.737	1,952
Impervious Surface Ratio	.062	.142	68	.035	.143	488
Panel B: Household- and Individual-Level Outcomes						
Durable Goods	.302	.472	2,103	.297	.490	10,104
Housing Quality	.247	.431	2,101	.317	.465	10,105
Wealth Index	.067	.953	1,550	-.011	1.004	8,138
Female Employment Status	.273	.446	1,887	.290	.454	9,168
Decision-Making Power	.903	.296	754	.899	.302	3,983
Ownership of Saving Account	.069	.254	1,907	.061	.240	9,248
Acceptance of Domestic Violence	.665	.472	1,900	.629	.483	9,209
Panel C: District-Level Characteristics						
Longitude	38.96	1.242	17	38.61	1.341	122
Latitude	9.419	1.798	17	8.832	1.783	122
Elevation	1,849	560.3	17	1,886	619.5	122
Slope	5.251	3.450	17	6.054	3.318	122
Distance to Addis Ababa	195.0	143.2	17	210.2	129.1	122
Distance to State Capital	112.9	121.1	17	135.5	89.90	122
Distance to Nearest City	52.00	49.81	17	60.06	45.23	122
Urbanization Rate	.282	.325	17	.181	.251	122
Employment Rate	.655	.109	17	.680	.111	122
Log Population Density	5.245	1.579	17	5.082	1.561	122

Notes: This table reports summary statistics for key outcome and control variables separately for treated districts and matched control districts.

Table A4: Extensive Margin: The Impact on Nighttime Light Intensity

	$\mathbb{I}$(Intensity > 0)	Light Intensity
	(1)	(2)
Treatment	.009	1.178**
	(.050)	(.515)
District FE	Y	Y
Region by Year FE	Y	Y
Linear Trends	Y	Y
Mean of dep.	.572	1.553
Observations	2,224	1,258

Notes: The dependent variables are as follows: the dummy of nighttime light in Column 1, the nighttime light for those light$>$ 0 in Column 2, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A5: Robustness Check: Addressing Spatial Correlation

	IHS(Intensity)		Light Intensity		Impervious Surface Ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.265***	.214***	1.723***	1.276***	.032***	.028***
	(.053)	(.048)	(.485)	(.310)	(.010)	(.008)
District FE	Y	Y	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	N	Y	N	Y	N	Y
Mean of dep.	.209	.209	.879	.879	.038	.038
Observations	2,224	2,224	2,224	2,224	556	556

Notes: This table presents the results from estimating Equation 1, using Conley (1999)'s method to adjust for spatial correlation across districts. The dependent variables are as follows: the IHS transformation of nighttime light in Columns 1–2, the nighttime light in Columns 3–4, and the impervious surface ratio in Columns 5–6, respectively. All models include district fixed effects and region by year fixed effects. Even-numbered columns additionally control for the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A6: Robustness Check: Addressing Treatment Effect Heterogeneity

	IHS(Intensity)		Light Intensity		Impervious Surface Ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Sun and Abraham (2021)						
Treatment	.259***	.211***	1.767**	1.344**	.035**	.031**
	(.056)	(.049)	(.786)	(.556)	(.015)	(.014)
Panel B: Borusyak et al. (2024)						
Treatment	.260***	.216***	1.814**	1.429**	.036**	.033**
	(.043)	(.037)	(.758)	(.595)	(.015)	(.014)
District FE	Y	Y	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	N	Y	N	Y	N	Y
Mean of dep.	.209	.209	.879	.879	.038	.038
Observations	2,224	2,224	2,224	2,224	556	556

Notes: This table presents the results using Sun and Abraham (2021)'s and Borusyak et al. (2024)'s methods to adjust for treatment effect heterogeneity across time and units. The dependent variables are as follows: the IHS transformation of nighttime light in Columns 1–2, the nighttime light in Columns 3–4, and the impervious surface ratio in Columns 5–6, respectively. All models include district fixed effects and region by year fixed effects. Even-numbered columns additionally control for the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A7: Robustness: Controlling for Concurrent Development Projects

	Chinese Assistance			Transport Infrastructure		
	(1) IHS(Light)	(2) Light Intensity	(3) Impervious Ratio	(4) IHS(Light)	(5) Light Intensity	(6) Impervious Ratio
Treatment	.200**	.994**	.021**	.208*	1.045**	.025**
	(.094)	(.448)	(.008)	(.107)	(.499)	(.010)
District FE	Y	Y	Y	Y	Y	Y
Region-Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y	Y
Mean of dep.	.209	.879	.038	.209	.879	.038
Observations	2,224	2,224	556	2,224	2,224	556

Notes: The dependent variables are as follows: the IHS transformation of nighttime light in Columns 1 and 4, the nighttime light in Columns 2 and 5, and the impervious surface ratio in Columns 3 and 6, respectively. Regression analyses are organized as follows: Columns 1–3 control for Chinese development assistance, and Columns 4–6 control for large transport infrastructure projects. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A8: Robustness Check: Alternative Control Group

	IHS(Intensity)	Light Intensity	Impervious Surface Ratio
	(1)	(2)	(3)
Treatment	.186**	1.031**	.029**
	(.079)	(.452)	(.012)
District FE	Y	Y	Y
Region by Year FE	Y	Y	Y
Linear Trends	Y	Y	Y
Mean of dep.	.368	1.561	.067
Observations	1,248	1,248	312

Notes: This table presents the results from estimating Equation 1, using matched districts within 50 kilometers of treatment areas as the control group. The dependent variables are as follows: the IHS transformation of nighttime light in Column 1, the nighttime light in Column 2, and the impervious surface ratio in Column 3, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A9: Robustness Check: Excluding the Eastern Industrial Park

	IHS(Intensity)	Light Intensity	Impervious Surface Ratio
	(1)	(2)	(3)
Treatment	.221**	1.358**	.029**
	(.096)	(.676)	(.013)
District FE	Y	Y	Y
Region by Year FE	Y	Y	Y
Linear Trends	Y	Y	Y
Mean of dep.	.210	.884	.038
Observations	2,208	2,208	552

Notes: This table presents the results from estimating Equation 1, excluding the Eastern Industrial Park and its host district from the sample. The dependent variables are as follows: the IHS transformation of nighttime light in Column 1, the nighttime light in Column 2, and the impervious surface ratio in Column 3, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A10: Robustness Check: Excluding Addis Ababa

	IHS(Intensity)	Light Intensity	Impervious Surface Ratio
	(1)	(2)	(3)
Treatment	.195**	.273*	.007***
	(.097)	(.161)	(.002)
District FE	Y	Y	Y
Region by Year FE	Y	Y	Y
Linear Trends	Y	Y	Y
Mean of dep.	.022	.024	.004
Observations	2,080	2,080	520

Notes: The dependent variables are as follows: the IHS transformation of nighttime light in Column 1, the nighttime light in Column 2, and the impervious surface ratio in Column 3, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A11: Robustness Check: Restricting to Districts within the Same Province

	IHS(Intensity)	Light Intensity	Impervious Surface Ratio
	(1)	(2)	(3)
Treatment	.215**	1.304**	.029**
	(.089)	(.612)	(.012)
District FE	Y	Y	Y
Region by Year FE	Y	Y	Y
Linear Trends	Y	Y	Y
Mean of dep.	.217	.911	.040
Observations	2,144	2,144	536

Notes: The dependent variables are as follows: the IHS transformation of nighttime light in Column 1, the nighttime light in Column 2, and the impervious surface ratio in Column 3, respectively. All models include district fixed effects, region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A12: Additional Heterogeneity Analyses

	Light Intensity			Impervious Surface Ratio		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-2.141*	.292	1.537	-.037*	.008*	.054
	(1.285)	(.275)	(1.016)	(.019)	(.004)	(.034)
× Local Labor Force	.215**			.004**		
	(.108)			(.002)		
× Labor-intensive Sector		1.242			.026*	
		(.918)			(.015)	
× Public Ownership			-.399			-.037
			(1.245)			(.035)
District FE	Y	Y	Y	Y	Y	Y
Region by Year FE	Y	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y	Y
Mean of dep.	.879	.879	.879	.030	.030	.030
Observations	2,224	2,224	2,224	556	556	556

Notes: The dependent variables are as follows: the nighttime light in Columns 1–3, and the impervious surface ratio in Columns 4–6, respectively. All models include district fixed effects and region by year fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). Robust standard errors, clustered at the district level, are reported in parentheses (***p<.01, **p<.05, *p<.1).

Table A13: Addressing Treatment Effect Heterogeneity—Household and Individual Outcomes

	Durable Goods	Housing Quality	Wealth Index	Employ -ment	Decision Making	Savings Account	Acceptance of D.V.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Sun and Abraham (2021)							
Treatment	.227***	.252***	.397*	.133***	.103***	.318***	-.212***
	(.063)	(.051)	(.225)	(.047)	(.033)	(.060)	(.065)
Mean of dep.	.297	.305	.001	.287	.899	.063	.636
Observations	12,207	12,206	9,688	11,055	4,737	11,155	11,109
Panel B: Borusyak et al. (2024)							
Treatment	.149***	.172***	.115	.112***	.099***	.236***	-.188***
	(.034)	(.048)	(.116)	(.031)	(.019)	(.066)	(.045)
Mean of dep.	.298	.305	-.002	.287	.899	.063	.636
Observations	12,153	12,152	9,634	11,055	4,737	11,155	11,109
District FE	Y	Y	Y	Y	Y	Y	Y
Region-Round FE	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y

Notes: This table presents the results using Sun and Abraham (2021)'s and Borusyak et al. (2024)'s methods to adjust for treatment effect heterogeneity across time and units. The dependent variables are as follows: the per-capita number of durable goods in Column 1, an indicator for housing quality in Column 2, the standardized DHS wealth index in Column 3, an indicator of female employment in Column 4, decision-making power in Column 5, saving account ownership in Column 6, and acceptance of domestic violence in Column 7, respectively. All models include district fixed effects, region by survey round fixed effects, and household size and the age of the household head, and Columns 4–7 additionally control the woman's age and the woman's age squared. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A14: Alternative Control Group—Household Outcomes

	Durable Goods		Housing Quality		Wealth Index	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	.275***	.247***	.298***	.294***	.463**	.464**
	(.075)	(.074)	(.053)	(.052)	(.221)	(.215)
District FE	Y	Y	Y	Y	Y	Y
Region by Round FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y
Mean of dep.	.338	.338	.359	.359	.144	.144
Observations	9,704	9,704	9,704	9,704	7,675	7,675

Notes: This table presents the results from estimating Equation 2, using districts within 50 kilometers of treatment areas as the control group. The dependent variables are as follows: the per-capita number of durable goods in Columns 1–2, an indicator for housing quality in Columns 3–4, and the standardized DHS wealth index in Columns 5–6, respectively. All models include district fixed effects and region by survey round fixed effects. Even-numbered columns additionally control household size and age of the household head. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A15: Impacts on Acceptance of Domestic Violence: By Category

	Domestic Violence Is Justified by				
	Unauthorized Going Out	Neglecting the Kids	Arguing	Refusing Sex	Burning the Food
	(1)	(2)	(3)	(4)	(5)
Treatment	-.134*	-.153***	-.173**	-.096	-.099
	(.072)	(.047)	(.077)	(.078)	(.098)
District FE	Y	Y	Y	Y	Y
Region by Round FE	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y
Mean of dep.	.437	.491	.425	.363	.411
Observations	11,064	11,069	11,043	10,818	11,068

Notes: The dependent variables are several different reasons of domestic violence: going out without telling husbands in Column 1, neglecting the children in Column 2, arguing with husband in Column 3, refusing to have sex with husband in Column 4, burning the food in Column 5, respectively. All models include district fixed effects, region by survey round fixed effects, and household size, the age of the household head, the woman's age, and the woman's age squared. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

Table A16: Alternative Control Group—Women's Outcomes

	Employment	Decision Making	Savings Account	Acceptance of D.V.
	(1)	(2)	(3)	(4)
Treatment	.099**	.116**	.321***	-.234***
	(.041)	(.053)	(.063)	(.059)
District FE	Y	Y	Y	Y
Region by Round FE	Y	Y	Y	Y
Controls	Y	Y	Y	Y
Mean of dep.	.300	.916	.072	.603
Observations	8,850	3,615	8,941	8,913

Notes: This table presents the results from estimating Equation 2, using districts within 50 kilometers of treatment areas as the control group. The dependent variables are as follows: an indicator of employment in Column 1, the decision-making power in Column 2, saving account ownership in Column 3, and acceptance of domestic violence in Column 4, respectively. All models include district fixed effects, region by survey round fixed effects, and household size, the age of the household head, the woman's age, and the woman's age squared. Estimates are weighted using survey weights. Robust standard errors, clustered at the district level, are reported in parentheses (***p<0.01, **p<0.05, *p<0.1).

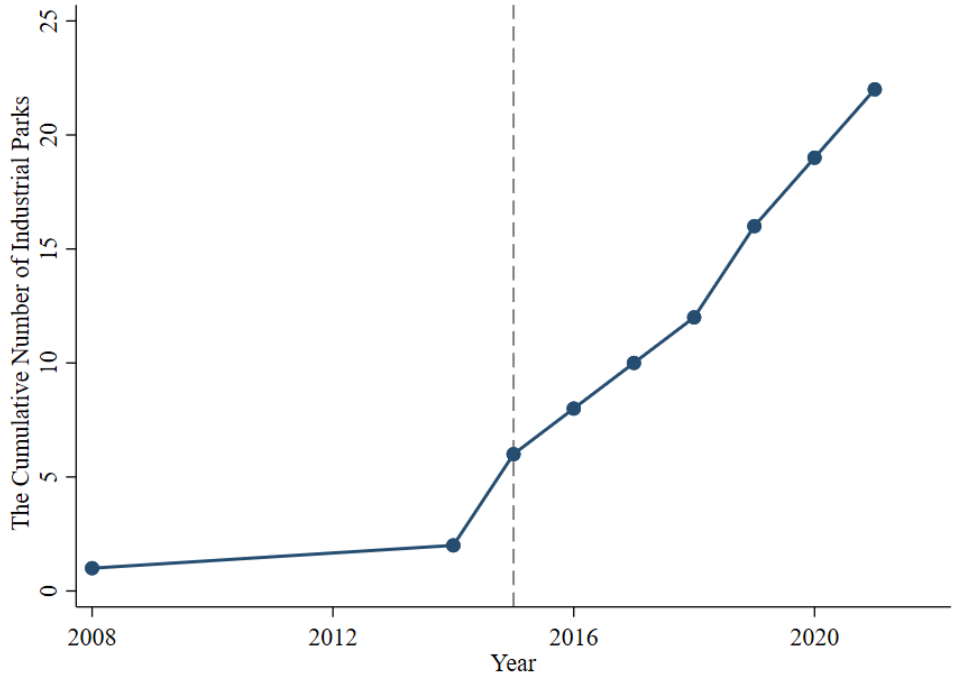

Figure A1: Cumulative Number of Industrial Parks in Ethiopia

Notes: This figure plots the cumulative number of industrial parks in Ethiopia over time. The vertical dashed line marks 2015, the year immediately following the establishment of the Industrial Parks Development Corporation (IPDC).

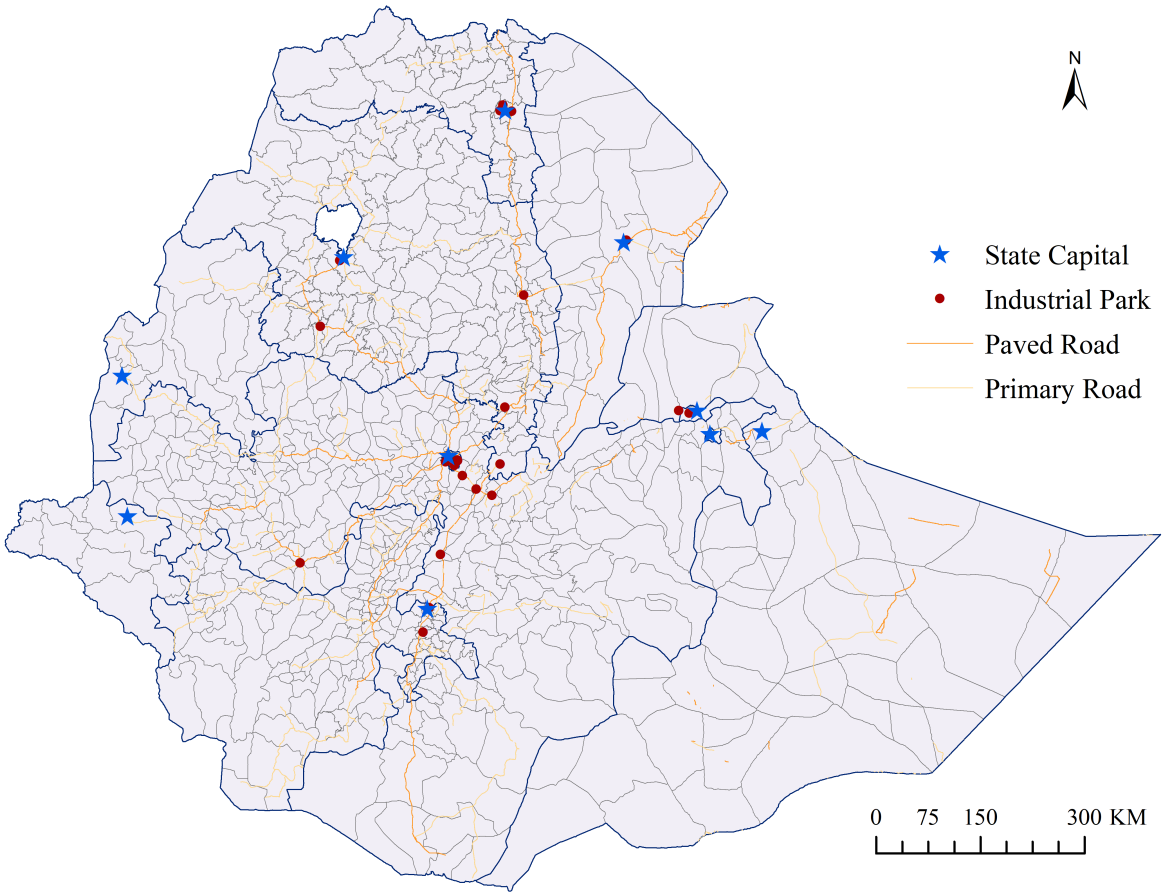

Figure A2: Geographic Distribution of Industrial Parks in Ethiopia

Notes: This map illustrates the locations of industrial parks and state capitals within Ethiopia, along with the layout of paved and primary roads. Industrial parks are marked by red dots, while state (regional) capitals are denoted by blue stars. Data sources: Industrial Parks Development Corporation and Ethiopian Investment Commission.

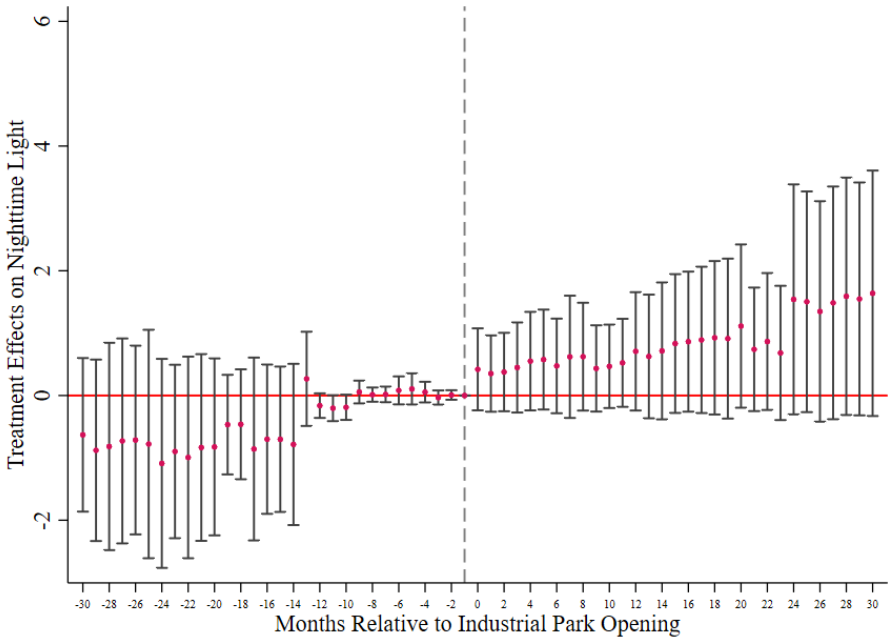

Figure A3: Event-Study Estimates for Monthly Nighttime Light Intensity

Notes: This figure plots coefficient estimates and 95% confidence intervals from the event-study specification using monthly nighttime light data. All models include district fixed effects, region by year-month fixed effects, and the linear time trends interacted with baseline district characteristics, including longitude, latitude, elevation, slope, distance to Addis Ababa, urbanization rate, population size, population density, the share of Christians, and the share of Amharic speakers (all measured in 2007). The sample spans 30 months before and 30 months after park opening. All effects are normalized relative to the month immediately preceding park opening. Robust standard errors are clustered at the district level.

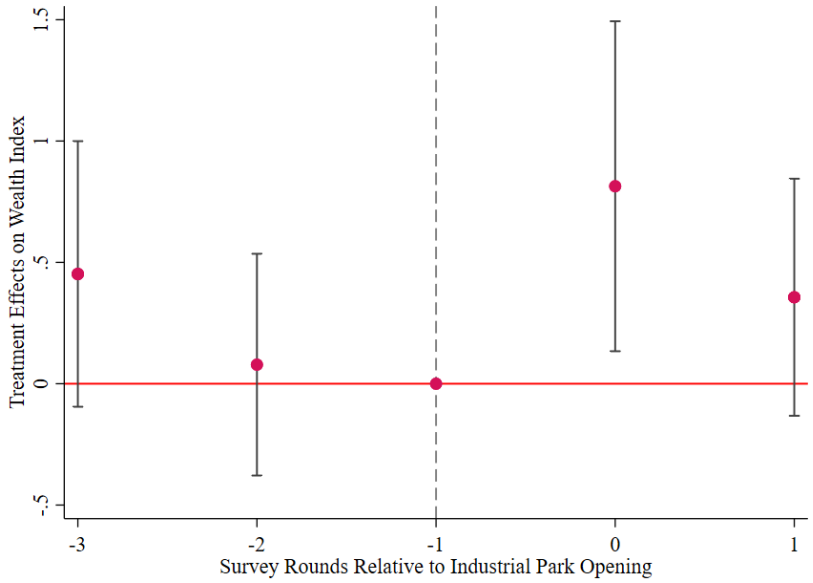

Figure A4: Event-Study Estimates for Wealth Index

Notes: This figure plots coefficient estimates and 95% confidence intervals from an event-study specification using household-level survey data. All models include district fixed effects, region by survey round fixed effects, household size, and the age of the household head. Markers at the left and right ends of the timeline represent the average effects observed three phases before and one phase after the opening of industrial parks, respectively. All effects are normalized relative to the phase immediately preceding park opening. Estimates are weighted using survey weights. Robust standard errors are clustered at the district level.