

Do Industrial Parks Improve Industrial Performance? Evidence from Ethiopia

Workenah Eshatuu Sime¹, Almaz Eshetu², Mestawot Shemilis³

¹Director, E-Learning Directorate, Ethiopian Public Service University, Addis Ababa, Ethiopia

Email: esheticho@gmail.com

²Rift Valley University, Addis Ababa, Ethiopia

Email: almazeshetu81@gmail.com

³Ethiopian Industrial Parks Development Corporation, Addis Ababa, Ethiopia

Email: MestawotS2009@gmail.com

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Abstract: Industrial parks serve as critical Special Economic Zones (SEZs) in Ethiopia, designed to promote export-oriented industrialization, attract Foreign Direct Investment (FDI), and stimulate sustainable economic growth. This study evaluates the impact of these parks on industrial performance using key macroeconomic indicators, addressing a knowledge gap regarding the actual performance of Ethiopia's rapidly expanding industrial park sector. Employing a mixed-methods research design, the authors utilized a panel dataset covering 68 zones and two federal-level city administrations. The analysis applies a Difference-in-Differences (DID) approach, comparing pre-treatment (2012–2013) and post-treatment (2016–2018) periods for second-generation industrial parks. The empirical results demonstrate that industrial parks have a positive and statistically significant impact on firms' performance across multiple dimensions. Specifically, enterprises located within industrial park zones achieved significantly higher levels of working capital, investment in fixed assets, total sales value, annual production value, and total export value compared to those in control zones. These findings align with Agglomeration Theory and Export-Led Growth Theory, suggesting that the clustering of industries and shared infrastructure effectively reduce transaction costs and enhance competitiveness. The study concludes that industrial parks are effective policy instruments for promoting industrial growth in Ethiopia and recommends continued expansion alongside improvements in infrastructure and administrative efficiency.

Keywords: Ethiopia, Industrial Parks, Industrial Performance, Difference-in-Differences (DID), Macroeconomic Impact, Export Performance, Capital Accumulation, Fixed Assets.

1. Introduction

The instructional content, titled *Do Industrial Parks Improve Industrial Performance? Evidence from Ethiopia*, examines how industrial parks contribute to improving Ethiopia's industrial performance through their macroeconomic and microeconomic impacts. The paper begins by establishing the importance of industrial parks as Special Economic Zones (SEZs) that promote export-oriented industrialization, attract foreign direct investment (FDI), create employment opportunities, and stimulate sustainable economic growth. It also explains Ethiopia's industrial development policies and the incentives provided through the Industrial Parks Proclamation to encourage domestic and foreign investment (FIAS, 2008; World Bank, 2008). The title clearly reflects the central learning focus by guiding learners to explore whether industrial parks effectively enhance industrial performance in the Ethiopian context.

From an instructional analysis perspective, the paper presents a logical progression from the background of industrial parks to the statement of the problem by synthesizing international and national evidence. It highlights contrasting findings from previous studies, showing that while many researchers report positive effects of industrial parks on exports, investment,

employment, and economic growth (Chen, 1993; Jayanthakumaran, 2003; Farole, 2011; Zeng, 2010; World Bank, 1992), others argue that their impacts may be limited or even negative under certain policy and institutional conditions (Engman et al., 2007; Hamada, 1974; Madani, 1999; Ayres, 1994). This balanced literature review enables learners to critically evaluate competing perspectives before examining empirical evidence.

The analysis further shows that the learning material addresses an important knowledge gap by emphasizing the limited empirical evidence available on Ethiopia's industrial parks despite their rapid expansion since 2014. While previous Ethiopian studies mainly focused on implementation challenges and operational issues (Hailu, 2014; Gebreeyesu, 2009; Mbreat, 2017; Azmach, 2019; Weldesilassie, 2017; Gebreeyesu et al., 2017), this paper shifts the focus toward evaluating actual industrial performance using macroeconomic and microeconomic indicators. Consequently, the content provides learners with an authentic, policy-relevant case study that connects economic theory with evidence-based decision-making and national development priorities.

From the ADDIE Analysis perspective, the paper offers rich and relevant content for higher education learners interested in development economics, industrial policy, and public policy evaluation. However, although the research problem and objectives are clearly presented, the instructional material would be strengthened by explicitly stating measurable learning outcomes, organizing the content into clearly labeled instructional sections, and incorporating visual summaries, concept maps, reflection questions, and formative learning activities. These enhancements would improve learner engagement, support knowledge construction, and better align the material with learner-centered instructional design principles while maintaining the paper's strong evidence-based foundation (Branch, 2009; Morrison et al., 2019).

Research Questions

1. What is the impact of industrial parks on firms' investment performance?
2. How do industrial parks influence firms' production performance?
3. What is the impact of industrial parks on firms' export performance?
4. How do industrial parks affect firms' capital accumulation?

General Objective

To evaluate the impact of industrial parks on industrial performance in Ethiopia using key macroeconomic performance indicators.

Specific Objectives

1. To examine the impact of industrial parks on firms' investment performance, measured by working capital, investment in fixed assets, and investment in the purchase and capital repair of fixed assets.
2. To assess the impact of industrial parks on firms' production performance, measured by total sales value and total value of production.
3. To evaluate the impact of industrial parks on firms' export performance, measured by total export value.
4. To determine the impact of industrial parks on firms' capital accumulation, measured by the book value of fixed assets.

2. Methods and Methodology

Identification strategy

In 2008, the Ethiopian government designed Industrial Parks Development Strategy and constructed the first group of Industrial Parks named Eastern Industrial Park. Based on the economic contribution of the first generation of Industrial Parks Development in Ethiopia, since 2014 the federal government (Ethiopia Industrial Parks Development Corporation) expanded the Industrial Park/Special Economic Zone experiment to different zones, special zones and city administrations of the country. Thus, there is the availability

of both time and geographic variations to evaluate the economic impact of Industrial Park/Special Economic Zone Development Projects in Ethiopia.

Study Area/ Geographic Setting of the Study

This study is conducted in the Federal Democratic Republic of Ethiopia. The Federal Democratic Republic of Ethiopia comprises of ten Regions, 68 Zones, 770 Woredas and two federal-level City Administrations. This study focused on 68 Zones and 2 federal City Administrations where Industrial Park project experiments have been conducted. According to a report by the Investment Commission, the federal government authorized zones to establish Industrial Parks depending on their geographic location, industrial sectors development and supply of labor market. Currently, the Industrial Parks project is operating in 28 zones and special zones, and 2 city administrations. Thus, these zones, special zones and city administrations are considered as the treated zones and others as controlled zones.

Research Design

To evaluate the economic impact of Industrial parks development projects, both qualitative and quantitative research designs were employed. The mixed methods of research design help to analyze both qualitative and quantitative data to fully answer the major research questions of the study. To answer the research questions of the study, we used both primary data (using a survey questionnaire, focus group discussions and in-depth interviews) and secondary data. The questionnaire was filled by workers in Ethiopian industrial parks, managers and administrators of the industrial parks, and the people that live around industrial parks. The managers and administrators of the industrial parks were invited for focus group discussions and interviews. The main sources of secondary data were the Ethiopian Investment Commission, Ethiopian Industrial Park Development Corporation, Central Statistical Agency (CSA), all Ethiopian Industrial Parks and from each Zones and Special Zones Investment Commission.

Dataset on Ethiopian Zones area

In order to evaluate the economic impact of Industrial Parks development projects, we collected a panel dataset on 68 zones, special zones and two federal-level city administrations in Ethiopia. The dataset tracks data from the zones and the city administrations on annual investments by type and sources, products and by-products outcome (Total Sales Values, Total Export Value, Annual Value of Production and Average sales per unit per dollar), the book value of fixed assets, total wages and other benefits for employee, domestic capital formation and the total number of employees employed in industrial enterprise. The authors mainly constructed these panel datasets using raw data from Central Statistical Agency, Ethiopian Investment

Commission, Ethiopian Industrial Park Development Corporation, surveys from all Ethiopian industrial parks and for all zones from their respective offices.

Econometric Models of the study

The Difference in Differences Research Design (DID Model)

Again, we collected microeconomic variables which included Employment opportunities, per capita income, the living standards of employees, the dwelling place of employees, total assets of employees, total assets of employees before five years, improvement of household skill and knowledge, availability of social service, enhanced management and administration skill, availability of health insurance service, social security coverage, enhanced implementation capacity of employees, the domestic market for local community and development of local infrastructure. Lastly to identify the factors that affect (diminish or optimize) the economic impact of industrial parks development projects, we gathered the potential economic, social, environmental, technical, cultural, and political factors that optimize or diminish the economic impact of industrial parks development projects in Ethiopia.

Industrial Parks/Industrial Zone Development Index

IPdummy = 1, if the zone, special zones or city administration are granted Industrial Park/Special Economic Zone project
IPdummy = 0, Otherwise.

IPdummy = represent industrial park dummy

The treated and controlled zones

Ethiopia has more than 30 industrial parks in different special zones, zones and two city administrations. These geographic settings are categorized as treated geographic area. The treated geographic area are: Hawasa Special Zone, Mekelle Special Zone, Adama Special Zone, Jimma Special Zone, Bahir Dar Special Zone, Bole special zone, Oromia Special Zone (Finfine Zuria Special Zone), Akaki Kaliti Special Zone, Nefas Selke Special Zone, Dire Dawa City Administration, North Shewa Zone (Amhara region), East Shewa, West Shewa, Asosa, Zone 3, Zone 1, Shinile Zone, South Tigray Zone, South Gojam zone, Sidama zone, South Wello and West Tigray zone.

The controlled geographic area includes: Jijiga Special Zone, Konso Special Zone, Alaba Special Zone, Kirkos Special Zone, Arada Special Zone, Yeka Special Zone, Woliata, Arba Minch, South Gondar, Kamashi, Harari, East Wellega, Bale, Hadiya, Horogudru, Gujji, Borena, Sheka, West Wellega, Ilu Ababora, North Shewa (Oromia region), Silite, East Hararge, Guraghe zone, Zone 5, Anuak and Mezhenger.

List of Ethiopian Industrial Parks and Year of Establishment

The following table presents the list of Ethiopian Industrial Parks and the year of their establishment. Based on the economic contribution of the first generation of Industrial Parks Development Project in Ethiopia, since 2014 the

Ethiopia Industrial Parks Development Corporation expanded the Industrial Parks experiment to different zones, special zones and city administrations of the country.

Table 1: List of Ethiopian Industrial Parks and year of establishment

No	Name industrial parks	Generation	Year of establishment
1.	Eastern Industrial Zone	First generation	2008
2.	Bole Lemi I Industrial Park	Second generation	2014
3.	Addis Industrial Village	Second generation	2014
4.	New Wide Garment Industrial Park	Second generation	2015
5.	George Shoe/Modjo Industrial Park	Second generation	2015
6.	Hawasa industrial park	Second generation	2015
7.	Sunshine Industrial Park	Second Generation	2015
8.	Huajian Shoe City	Second generation	2015
9.	Mekelle industrial park	Second generation	2015
10.	Velocity/ Vague Industrial parks	Second generation	2015
11.	Arerti Industrial Park	Second generation	2016
12.	Kombolcha industrial park	Second generation	2016
13.	Kingdom Linen industrial park	Second generation	2016
14.	ICT Industrial Park	Second Generation	2016
15.	DBL Industrial Parks	Second generation	2016
16.	Kilinto Industrial Park,	Second generation	2016
17.	Adama Industrial park	Second generation	2016
18.	Jimma Industrial park	Third generation	2018

19.	Debre Birhan Industrial Park	Third Generation	2019
20.	Dire Dawa industrial park	Third generation	2020
21.	Bole Lemi II Industrial Park	Third Generation	2020
22.	Aysha/Dewale Industrial Park	Third Generation	2020
23.	Andido Industrial Park	Third Generation	2020
24.	Awsha Arba Industrial Park	Third Generation	2020
25.	Bahir Dar Industrial Park	Third Generation	2020
26.	Ethio-Turk International Industrial City	Third Generation	2020
27.	Bure Integrated Agro-Industrial Park	Third Generation	2020
28.	Bulbula Integrated Agro-Industrial Park	Third Generation	2020
29.	Yirgalem Integrated agro-industrial park	Third Generation	2020
30.	Gaizo industrial park	Third Generation	2020
31.	Bishoftu Industrial Park	Third Generation	2021
32.	Asayta-Semera Industrial Park	Third Generation	2021

Since 2014, Ethiopia has significantly expanded industrial park development following the successful pilot of the Eastern Industrial Park and the establishment of the Industrial Parks Development Corporation (IPDC). More than 30 industrial parks have been developed across the country in three generations. Due to limited data on the third-generation parks, this study focuses on second-generation industrial parks and employs a panel dataset with a Difference-in-Differences (DID) approach, comparing the pre-treatment period (2012–2013) and post-treatment period (2016–2018) to evaluate their macroeconomic impact on industrial performance.

Industry Production Decision / Investment Decision

If one firm decides to invest his/her capital, he/she should make two major decisions: **Location decision and investment level decision**. For instance if one firm wants to invest in zone ‘i’, let take $i=0,1,3,\dots,70$, where $i=0$ represent the option of investing in other countries and $i=1,2,3,\dots,70$ represent the options of investing in one of Ethiopia’s special zones, zones and city administrations, then its profit will be maximized in this ways:

$$\max_{L_i FDI_i Land_i} \pi_i = (1 - \tau_i)(1 - t_i)(pq_i - w_i L_i - R_i Land_i - r FDI_i - F)$$

$$\text{subject to } q_i = Q(FDI_i, Land_i, L_i) \text{ ----- (1)}$$

π_i = is the profit in zone i; τ_i = expropriation; t_i = is the corporate tax rate; p = is the price of the product; q_i = is the quantity sold; w_i = is the wage rate; L_i = is labor hired; R_i = the land use fee; $Land_i$ = land firm used; r = Opportunity cost of capital; FDI_i = is Foreign Direct Investment; F = is the fixed cost of production.

The industrial output decision in zone ‘i’ is the function of the following policy package:

$$IndOutDec_i^* = f(\tau_i, t_i, R_i | w_i | \{i: \pi_j^* > \pi_i^*, \forall j \neq i\}) \text{ ----- (2)}$$

Where IndOutDec= Industrial Output decision of firms. The industrial parks proclamation provides special property right protection (lower τ_i), lower the tax burden (lower t_i) and land fee reduction (lower R_i) for investors that invest inside the Ethiopian industrial parks. Thus, by including these industrial parks policy package leading to the following Difference in Differences estimation techniques:

$$\ln IndOutDec_{it} = \alpha + \varphi * IPdummy_{it} + \delta_i + \gamma_t + X_{it} \beta + \varepsilon_{it} \text{ ----- (3)}$$

in which Industrial Output decision includes all macro-economic variables (Annual Investment by type and source, products and by-products, the value of fixed assets, wages and other benefits for employees, and employment opportunities). X_{it} all other exogenous variables that affect the industrial outcome decision in the zones, special zones or city administration ‘i’ at the time ‘t’.

Domestic Capital Formation:

If the construction and operation of Ethiopian industrial parks enhance the inflows of foreign investors, we believe that it will also affect the domestic business formation tendency:

$$\text{directly, } K_{ift} = K_{ift-1} * (1 - \text{delta}) + FDI_{it}(IDzonedummy)/\text{deflator}$$

$$\text{indirectly, } K_{idt} = K_{ift-1} * (1 - \text{delta}) + domI_{it}(IDzonedummy)/\text{deflator} \text{ ----- (4)}$$

The impact of industrial parks development projects on the tendency of domestic business formation would be determined by the relation between the tendency of domestic business formation and the inflow of foreign-owned capital. Thus, this interaction would determine the crowding out or crowding in effect of domestic investment through the inflow

of foreign-owned capital. This drives the following empirical research:

$$\ln DOMI_{it} = \alpha + \gamma * IDZonedummy_{it} + \delta_i + \gamma_t + X_{it}\beta + \varepsilon_{it}$$

$$- \ln K_{idt} = \alpha + \gamma * IDZdummy_{it} + \delta_i + \gamma_t + X_{it}\beta + \varepsilon_{it}$$

----- (5)

Parallel Trend Assumption

The Difference in Difference (DID) estimator coincides with the treatment effect under the critical assumption that, if there are no interventions of policy, both respondents in the treatment and control group would have followed a parallel trend over time. We can test the common trend assumption either by using the graphical justification of the effect of the treatment for the treated group or by using pre-treatment data. In this study the common trend assumption test is checked through using the pre-treatment data and placebo post period. The result is presented in the next chapter.

3. Results and Discussion

Summary Statistics for Panel Data

Columns 2 and 3 report summary statistics for the treatment and control groups. The post-treatment period (2016–2018) follows the establishment of Ethiopia's second-generation industrial parks, while 2012–2013 is the pre-treatment period.

A pre-treatment balance test confirms no significant differences between the groups, supporting the validity of the Difference-in-Differences (DiD) analysis.

Table 2: Summary Statistics for Panel Data

Variables	Summary Statistics for DID Treated Zones		Summary Statistics for DID Control Zones		p-value
	Observation	Mean	Observation	Mean	
Total export value	32,251	6183403	22,400	7290331	0.459
Working Capital	55,350	2.79e+07	34,468	3.13e+07	0.419
The total sales value	74,704	1.44e+07	49,236	1.63e+07	0.062
The total Value of Production	75,606	1.51e+07	50,246	1.60e+07	0.279
The book value of fixed assets	68,469	6397126	42,929	1.04e+07	0.956
Investment on purchase and capital repair of fixed investment	54,548	2076400	34,441	2422989	0.234
Investment on fixed assets	49,214	4010489	1,231	4605164	0.251

The summary statistics indicate that there are no statistically significant differences between DID treated and control zones before the implementation of the Industrial Parks Development Program. All variables have p-values greater than 5 percent, suggesting that the two groups were

comparable prior to the intervention. Therefore, the parallel trends assumption is supported, validating the use of the Difference-in-Differences (DID) approach to estimate the economic impact of industrial park development.

Impact of Industrial Parks on Industrial Performance in Ethiopia

This section examines whether industrial park development projects production and sales performance, export value, fixed asset improve industrial performance in Ethiopia. The analysis evaluates accumulation, employment creation, wages and salaries, and key performance indicators, including investment outcomes, domestic capital formation among industrial enterprises.

Impact of Industrial Parks Development Projects on Annual investment by type and sources

The following table revealed the impact of industrial parks development project on the value of annual investments by type and sources for zones that have industrial parks in their geographic setting relative to those zones that have no

industrial parks in their geographic setting. The annual level of investment by type and source is measured by investment in fixed assets and the level of annual working capital of industrial enterprises in Ethiopia.

Table 3: Impact of Ethiopian Industrial Parks Development Project on investment on fixed assets and Working capital

Controlled Exogenous variables	Ln of Investment on fixed assets			Controlled Exogenous variables	Ln of Working capital		
Treatment*Post	.159 (.080)**	1.191 (.761)*	2.528 (1.152)**	Treatment*Post	.248 (.048)***	2.551 (.681)***	2.410 (.905)***
Post	.368 (.076)***	-1.402 (.497)***	-2.593 (1.009)**	Post	.177 (.043)***	1.034 (.549)**	1.963 (.726)***
Treatment	.121 (.065)*	-.216 (.314)	3.551 (1.367)**	Treatment	-1.091 (.260)***	-.271 (.275)	.256 (.675)
Ln average sales value		.004 (.012)	.031 (.013)**	Ln total wage		.075 (.044)*	.384 (.058)***
Ln difference in value of stock		-.017 (.010)*	-.017 (.010)*	Ln difference in value of stock		.005 (.045)	-.013 (.051)
Ln value of total raw material		-.038 (.009)***	-.041 (.010)***	Ln total sale value		.160 (.047)***	.122 (.058)**
Constant	11.370 (.376)***	1.713 (1.581)	3.749 (3.329)	Constant		8.912 (1.682)** *	10.293 (2.00)***
Additional exogenous covariates	No	Yes	Yes	Additional exogenous covariates	Yes	Yes	Yes
Fixed Effect	Yes	No	Yes	Fixed Effect	Yes	No	Yes
<i>Additional exogenous covariates controlled in the model are ln of the annual value of export, ln of value added tax, source of finance for investors, ln annual working capital and ln of average value of sales in birr.</i>							
<i>Source authors' estimation</i>							
<i>***, **, * one, five and ten percent significance level, respectively</i>							

The DID results show that industrial parks significantly improve incentives reduce investment constraints and promote capital firms' investment performance. The **Treatment × Post** coefficient is accumulation. The findings are consistent with empirical studies positive and statistically significant for both fixed assets ($\beta = 0.159$, showing that industrial parks enhance firm expansion and 1.191, and 2.528) and working capital ($\beta = 0.248$, 2.551, and 2.410), productivity through improved investment environments (Farole, indicating that firms in industrial parks experienced greater 2011; Zeng, 2010). Control variables further indicate that higher sales investment growth after the intervention. This supports investment and wages increase investment capacity, while rising raw material theories that improved infrastructure, market access, and policy costs constrain fixed asset investment.

Parallel Line Test /Placebo test

The parallel trend assumption was tested using an event-study DID specification and placebo tests with pseudo-post periods before industrial park implementation. The results confirm

that treated and control zones followed similar trends prior to the intervention, supporting the validity of the DID estimation.

Table 4: Placebo test/Parallel line test for fixed assets and Working Capital

Controlled Exogenous Variables	Ln of Investment on Fixed Assets			Controlled Exogenous variables	Ln of Working Capital		
	2012-2013	2013-2014	2014-2015		2012-2013	2013-2014	2014-2015
Treat*pseudo post	-.483 (.773)	-1.878 (1.248)	-.143 (.642)	Treat*pseudo post	.228 (.916)	-.141 (.448)	1.338 (.864)

Treatment	-1.037 (.898)	-.837 (.859)	.266 (.701)	Treatment	-.620 (.675)	-.530 (.386)	-.874 (.705)
Pseudo Post	.639 (.607)	-.016 (.157)	-.319 (.280)	Pseudo Post	.769 (.530)	1.726 (.288)***	.820 (2.424)
Ln of working capital	.824 (.085)***	.765 (.016)** *	.773 (.031)***	Ln of total sale value	-.026 (.071)	-.020 (.051)	-.009 (.101)
Ln of stock difference	-.0079 (.0096)	-.021 (.011)*	-.0008602 .0463191	Ln of stock difference	.017 (.060)	.022 (.067)	-.112 (.114)
Constant	-.618 (.267)	.071 (.321)	1.289 (.815)	Constant	10.764 (1.713)***	9.620 (1.029)***	10.99 (2.74)***
Additional zones' factors	Yes	Yes	Yes	Additional Zones' factors	Yes	Yes	Yes
Zone and time fixed effect	Yes	Yes	Yes	Zone and time fixed effect	Yes	Yes	Yes
Source authors' estimation ***, **, * one, five and ten per cent significance level, respectively							

The placebo and parallel trend tests confirm the validity of the DID model. The Treat $\times$ Pseudo Post coefficients are statistically insignificant across all pre-intervention periods for both fixed assets ($\beta = -0.483, -1.878, \text{ and } -0.143$) and working capital ($\beta = 0.228, -0.141, \text{ and } 1.338$), indicating no significant pre-existing

differences between treated and control zones. This supports the parallel trend assumption, suggesting that the observed post-intervention effects of industrial parks are attributable to the program rather than pre-existing trends.

Impact of Ethiopian Industrial Parks Development Project on Products and by Products of Industrial Output

The following table shows the macro-economic impact of industrial parks development project on the annual products and by-products for zones that have industrial parks in their geographic setting relative to zones that have no industrial

parks development projects. The annual products and by-products are measured by total sales values, total export values and the annual value of production.

Table 5: Impact of Ethiopian Industrial Parks Development Project on Total sales value, Total export value and value of production

Variables	Ln of total annual sales value			Ln of total annual Export Value			Ln of annual value of Production	
Treatment*Post	.166 (.033)***	1.550 (.606)**	2.417 (.616)***	.585 (.190)***	1.285 (.590)**	2.147 (.532)***	4.099 (1.814)**	5.223 (1.891)***
Post	.453 (.037)***	.0157 (.434)	.196 (.487)	-.232 (.223)	-.047 (.499)	-.768 (.271)***	2.094 (1.574)	-.185 (1.555)
Treatment	1.300 (.327)***	-3.363 (.818)***	-2.730 (.605)***	-.462 (.155)***	-1.608 (2.008)	-1.184 (.438)***	-4.086 (1.781)**	-9.121 (2.317)***
Ln of total wage		-.114 (.031)***	-.108 (.031)***		-.405 (.200)**	-.401 (.206)*	-.001 (.005)	-.002 (.005)
Ln of working Capital		.112 (.015)***	.194 (.025)***		.185 (.085)**	.093 (.060)*	.001 (.002)	.0022 (.0018)
Ln of total tax paid		-.460 (.891)	-.349 (.975)		-5.276 (1.656)***	-1.761 (1.064)*	-.145 (.108)	-.213 (.107)**
Constant	12.827 (.3194)** *	18.663 (.834)***	-1.731 (1.320)	15.003 (.163)***	105.685 (11.222)** *	105.370 (7.506)***	5.007 (.197)***	3.77 (.15)***
Fixed Effect	Yes	Yes	No	Yes	Yes	No	No	Yes

Additional exogenous covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Additional exogenous covariates controlled in the model are: ln of annual depreciation values, ln of investment on fixed assets, ln of imported raw material values, ln of total raw material value and ln of electricity values</i>								
<i>Source authors' estimation</i>								
<i>***, **, * one, five and ten per cent significance level, respectively</i>								

The DID estimates show that industrial parks significantly improve industrial output performance. The Treatment $\times$ Post coefficients are positive and statistically significant for total sales value ($\beta = 0.166, 1.550$, and 2.417), total export value ($\beta = 0.585, 1.285$, and 2.147), and annual production value ($\beta = 4.099$ and 5.223), indicating that firms in industrial parks achieved higher output and export growth after the intervention. These findings support agglomeration theory, new economic geography, and export-led growth theory,

which emphasize the role of shared infrastructure, reduced transaction costs, and improved market access in enhancing industrial competitiveness. The results are consistent with previous empirical studies (Farole, 2011; FIAS, 2008; Johansson and Nilsson, 1997; Wang, 2013; Zeng, 2015). Moreover, the positive effect of working capital highlights the importance of financial capacity in expanding production, while higher wage and tax costs may constrain industrial performance.

Parallel Line Test /Placebo test

One of the key assumptions of the Difference-in-Differences (DID) model is the parallel trends assumption. To test this, placebo tests were conducted using three pseudo-treatment periods (2012–2013, 2013–2014, and 2014–2015).

Insignificant interaction terms indicate no pre-treatment differences between treated and control zones, confirming that the parallel trends assumption holds.

Table 6: Placebo Test/Parallel Line test for Product and by-Products

Variables	Ln of Total annual sales value			Ln of Total annual export value			Ln of Total annual value of production		
	2012-2013	2013-2014	2014-2015	2012-2013	2013-2014	2014-2015	2012-2013	2013-2014	2014-2015
Treatment*pseudo post	1.051 (.971)	-.188 (.421)	.042 (.171)	.858 (1.155)	-	1.64 (2.26)	1.5800 (1.2618)	-.265 (.411)	
Treatment	-.861 (.591)	-.195 (1.464)	-.099 (.179)	-.010 (.794)	.320 (1.93)	2.78939 (1.99)	1.130 (.709)	-.180 (1.583)	.137 (.165)
Pseudo Post	1.801 (1.355)	-2.121 (.113)* **	-.137 (.115)	-2.007 (1.737)	-.232 (.611)	1.26 (1.07)	2.431 (1.845)	-2.070 (.114)* **	.072 (.084)
Ln of total wage	.101 (.240)	.081 (.084)	-.013 (.041)	-.010 (.325)	.594 (.400)	-.873 (.684)	-.049 (.235)	.088 (.082)	-.025 (.021)
Ln of working capital	.002 (.110)	.060 (.016)** *	-.034 (.021)	.0180 (.152)	.149 (.087)*	-.334 (.206)	-.111 (.097)	.062 (.016)* **	-.026 (.021)
Constant	6.014 (2.848) **	12.827 (.748)* **	1.150 (.685)	16.183 (2.880)* **	9.20 (2.32)** *	15.31 (7.29)**	15.314 (4.191)* **	12.963 (1.038)* **	.331 (.354)
Zones exogenous variables	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Zone and time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Source authors' estimation</i>									
<i>***, **, * one, five and ten per cent significance level, respectively</i>									

The placebo test results show that the interaction terms are statistically insignificant for total sales, export value, and

production value across all pseudo-treatment periods. This indicates no pre-treatment differences between treated and

control zones, confirming that the parallel trends assumption is satisfied and the DID estimates are valid.

Impact of Ethiopian Industrial Parks Development Projects on Value of Fixed Assets

The following table shows the of impact on industrial parks development projects on the book value of fixed assets for zones that have industrial parks relative to zones that have no industrial parks in their geographic setting. The book value of

fixed assets measured at the beginning and end of the year and the annual value of investment for purchase and capital repair of fixed assets.

Table 7: Impact of Ethiopian Industrial Parks Development Projects on book value of fixed assets

Variables	Ln Book value of fixed assets at the end of the year			Ln of Book value of Fixed assets at the beginning of the year		Variables	Ln investment for purchase and capital repair of fixed assets	
Treatment* Post	.140 (.052)***	.101 (.062)*	.101 (.062)*	.135 (.081)*	.135 (.081)*	Treatment * Post	.900 (.324)***	1.203 (.325)***
Post	.373 (.047)***	.0130 (.066)	-.033 (.0392)	-.030 (.090)	-.003 (.052)**	Post	-.622 (.295)**	-.498 (.185)***
Treatment	2.056 (.469)***	.075 (.038)**	.075 (.038)**	.073 (.051)	.073 (.051)	Treatment	.793 (.465)*	-.259 (.170)
Type of Fixed Assets		.043 (.014)** *	.053 (.009)***	.041 (.012)***	.041 (.012)***	Type of fixed investment	.199 (.048)***	.197 (.045)***
Ln of total sale value		-.007 (.008)	-.007 (.008)	-.038 (.023)*	-.025 (.023)*	Ln of value of goods sold and disposed	.551 (.034)***	.609 (.027)***
The total value of tax paid		-1.27e-07 (3.80e-08)***	-1.27e-07 (3.80e-08)***	-.2785 (.14286)**	-.2257 (.1345)*	Ln of Total wage	-.0727 (.0397)*	-.0654 (.0341)**
Constant	11.243 (.689)***	4.042 (.760)** *	4.042 (.760)***	4.339 (1.486)***	3.884 (.996)***	Constant	6.041 (.812)***	5.619 (.764)***
Fixed effect	Yes	Yes	No	Yes	No	Fixed Effect	Yes	No
Additional exogenous covariates	No	Yes	Yes	Yes	Yes	Additional Exogenous covariates	Yes	Yes
Source authors' estimation								
***, **, * one, five and ten percent significance level, respectively								
Additional exogenous covariates controlled in the model are ln of total raw material values, source of finance for investors, ln of working capital, ln of annual value of depreciations and ln of local raw material value.								

The DID results indicate that industrial parks have a positive and statistically significant impact on firms' fixed asset accumulation and capital investment. The interaction term ($\beta = 0.140$, $p < 0.01$) shows that industrial parks significantly increased the book value of fixed assets at the end of the year, while the effect on the beginning-of-year book value was also positive ($\beta = 0.135$, $p < 0.10$). Furthermore, industrial parks substantially increased investment in the purchase and capital

repair of fixed assets ($\beta = 0.900$, $p < 0.01$). These findings support Agglomeration Theory and Investment Theory, which argue that improved infrastructure and investment incentives stimulate capital accumulation. The results are consistent with Farole (2011), Wang (2013), Lall (2000), and Debrezion et al. (2007). The negative effects of tax payments and wages further suggest that higher operating costs discourage firms' investment in productive assets.

Parallel Line Test /Placebo test

One of the key assumptions of the Difference-in-Differences (DID) model is the parallel trends assumption. To verify this, placebo tests were conducted using three pseudo-treatment periods (2012–2013, 2013–2014, and 2014–2015). The tests

examined whether the book value of fixed assets and investment in fixed asset purchase and capital repair followed similar pre-treatment trends between treated and control zones.

Table 8: Placebo Test/Parallel Line Test for Book Value of Fixed Assets

Table 8 presents the placebo and parallel trend tests for different measures of fixed assets, including the book value of fixed assets at the end and beginning of the year, and investment in fixed asset purchase and capital repair. The test examines whether treated and control zones followed similar

trends before the implementation of industrial parks. The Treatment $\times$ Pseudo Post coefficients for the pre-intervention periods are estimated to verify the absence of prior treatment effects and assess the validity of the DID identification strategy.

Exogenous variables	Book value of fixed assets at the end of the year			Book value of fixed assets at the beginning of the year			Investment for purchase and capital repair of fixed assets		
	2012-2013	2013-2014	2014-2015	2012-2013	2013-2014	2014-2015	2012-2013	2013-2014	2014-2015
Treatment* pseudo post	-.224 (.243)	-.298 (.189)	.164 (.496)	-.292 (.256)	-.123 (.186)	.065 (.238)	-.311 (.199)	-.695 (.474)	.012 (.657)
Treatment	-.545 (.516)	-.425 (.288)	-.542 (.623)	-.540 (.555)	-.131 (.335)	.380 (.275)	.512 (.587)	.268 (1.05)	.464 (1.04)
Pseudo Post	-.221 (.164)	.008 (.021)	.202 (.171)	-.249 (.172)	.015 (.018)	.132 (.114)	.150 (.131)	-.029 (.074)	.275 (.338)
Type of fixed assets	-.101 (.032)***	-.141 (.006)***	-.033 (.042)	-.108 (.034)**	-.145 (.005)** *	.012 (.027)	-.092 (.029)** *	-.121 (.021) ***	-.068 (.075)
Constant	14.667 (.517)***	3.270 (.238)** *	2.80 (.783)** *	14.775 (.553)** *	3.04 (.271)** *	-.299 (.553)	3.908 (.743)** *	4.743 (1.019))	-.223 (1.56)
Zones exogenous variables	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Zone and Time foxed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Source authors' estimation</i> ***, **, * one, five and ten per cent significance level, respectively									

The above table shows the placebo test value of the economic impact of industrial parks development projects before implementation of the program for zones that have industrial parks relative to zones that have no industrial parks in Ethiopia. The first three time varying difference in differences setup shows the impact of industrial parks development projects on the book value of fixed assets at the end of the year for zones that have industrial parks in their geographic setting relative to zones that have no industrial parks using the pseudo post value. The coefficient on the interaction between the pseudo post value and treatment shows insignificant the placebo test value of the economic impact of industrial parks development projects before the implementation of the program. The second three time varying difference in difference setup show the placebo test value of economic impact of the industrial parks development projects on the book value of fixed assets at the beginning of the year using

the pseudo post value. The coefficient on the interaction between the pseudo post and treatment shows a statistically insignificant placebo test value of the economic impact of industrial parks development projects on the book value of fixed assets at the beginning of the year before the implementation of the program. The last three time varying difference in difference setup show the placebo impact of the introduction of industrial parks development projects on investment for purchase and capital repair of fixed assets using the pseudo post value. The coefficient of the interaction between pseudo post value and treatment shows statistically insignificant placebo test value of the economic impact of industrial parks development projects on investment for purchase and capital repair of fixed assets before the implementation of the program. Thus, the absence of placebo significant impact of the industrial parks development project before the implementation of the program implies holding of

parallel trend assumption of the difference for differences estimation techniques.

4. Conclusion and Recommendation

Conclusion

Industrial parks have made a positive and statistically significant contribution to industrial performance in Ethiopia. The Difference-in-Differences (DID) estimates indicate that enterprises operating in industrial park zones achieved higher levels of investment, production, exports, and capital accumulation than comparable enterprises in non-industrial park zones. Significant improvements were observed in working capital, investment in fixed assets, investment in the purchase and capital repair of fixed assets, total sales value, total value of production, total export value, and the book value of fixed assets.

The parallel trends and placebo tests confirmed the robustness of the empirical findings by demonstrating that no significant differences existed between the treated and control groups prior to the implementation of the industrial park program. This provides strong evidence that the observed improvements in industrial performance are associated with the establishment and operation of industrial parks rather than pre-existing regional differences.

The findings indicate that industrial parks have enhanced firms' productive capacity by creating an enabling investment environment characterized by improved infrastructure, investment incentives, and better market access. These conditions have facilitated higher industrial output, strengthened export performance, promoted capital formation, and increased firms' investment activities,

demonstrating the contribution of industrial parks to Ethiopia's industrial development.

Recommendations

The Ethiopian government should continue expanding industrial parks by ensuring adequate infrastructure, reliable utilities, and efficient logistics to enhance industrial productivity and competitiveness.

The Ethiopian Industrial Parks Development Corporation (IPDC) should improve one-stop services, simplify administrative processes, and strengthen coordination among relevant institutions to attract investment and increase operational efficiency.

Policies should promote firms' productive capacity through improved access to finance, investment incentives, technology upgrading, and innovation support to enhance production, quality, and export competitiveness.

Greater attention should be given to strengthening linkages between industrial park enterprises, local suppliers, universities, and research institutions to promote technology transfer, skills development, and sustainable industrial growth.

Future research should examine the long-term economic, social, environmental, and regional impacts of industrial parks using panel data and advanced analytical methods.

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