

The Impact of Industrial Park Development on Labor Market and Domestic Investment Outcomes in Ethiopia: Evidence from a Difference-in-Differences Analysis

Workenh 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

This research was fully funded by the KDI School of Public Policy and Management.

Abstract: Industrial park development has become a key policy instrument for promoting industrialization and economic transformation in developing countries. However, empirical evidence on its effects on labor market and domestic investment outcomes remains limited in Ethiopia. This study examines the impact of industrial park development on labor market and domestic investment outcomes in Ethiopia using panel data from treated and control zones. A Difference-in-Differences (DID) estimation approach is employed to identify the causal effects of industrial park development while controlling for time-invariant unobserved heterogeneity and common time trends. The analysis focuses on labor market outcomes, measured by employee wages, commissions and professional allowances, and employment generation, as well as domestic investment outcomes, measured by the number of domestic investors, paid-up capital, and working capital. The findings reveal that industrial park development has significantly improved labor market outcomes by increasing employee wages, compensation, and employment opportunities, including female employment. In contrast, the analysis finds no statistically significant effect on domestic investment outcomes, suggesting that the expected spillover effects on domestic private investment have not yet materialized. The study concludes that industrial parks have been effective in promoting employment and improving labor market performance but have had limited success in stimulating domestic investment. The findings highlight the need for complementary policies that improve access to finance, strengthen domestic supplier linkages, facilitate technology transfer, and enhance the participation of local investors to maximize the broader economic benefits of industrial park development in Ethiopia.

Keywords: Industrial park development; Labor market outcomes; Domestic investment; Employment; Wages; Difference-in-Differences; Ethiopia.

1. Introduction

1.1. Background of the Study

Industrial parks, also known as Special Economic Zones (SEZs), have become one of the most widely adopted industrial policy instruments for promoting export-oriented industrialization, attracting foreign direct investment (FDI), generating employment, and accelerating structural transformation. By providing dedicated infrastructure, investment incentives, and a favorable regulatory environment, industrial parks aim to improve industrial competitiveness and facilitate integration into global value chains (FIAS, 2008; World Bank, 2008). Globally, more than 3,000 industrial parks operate across over 135 countries, creating millions of jobs and contributing significantly to international trade and economic development (World Bank, 2008).

The empirical literature, however, provides mixed evidence regarding the economic impact of industrial parks. A substantial body of research reports that industrial parks

enhance foreign direct investment, export performance, employment generation, productivity, and overall economic growth (Chen, 1993; Jayanthakumaran, 2003; Farole, 2011; Zeng, 2010; Wang, 2013). Conversely, other studies argue that their benefits depend on country-specific institutional and economic conditions, with some reporting limited spillover effects, inefficient resource allocation, weak integration with domestic firms, and constrained contributions to long-term economic development (Hamada, 1974; Madani, 1999; Engman et al., 2007; Hamilton & Svensson, 1982). These contrasting findings highlight the need for country-specific empirical evaluation.

In Ethiopia, industrial park development has become a key strategy for achieving industrialization and sustainable economic transformation. Since the establishment of the Ethiopian Industrial Parks Development Corporation in 2014, the government has invested substantially in developing industrial parks by offering tax incentives, infrastructure, and investment support to both domestic and foreign investors. The policy aims to enhance manufacturing competitiveness, create employment opportunities, increase exports, and strengthen private-sector participation. Despite these policy

efforts, empirical evidence on whether industrial parks have achieved these intended labor market and investment outcomes remains limited.

Most previous studies conducted in Ethiopia have primarily examined the implementation status, challenges, and prospects of industrial parks rather than rigorously evaluating their economic impacts (Gebreeyesus, 2009; Hailu, 2014; Weldesilassie et al., 2017; Azmach, 2019). Moreover, few studies have employed causal evaluation techniques capable of estimating the effects of industrial park development on labor market performance and domestic investment. To address this gap, this study employs a Difference-in-Differences (DID) approach to examine the impact of industrial park development on employee wages and compensation, employment outcomes, and domestic investment in Ethiopia, thereby providing empirical evidence to inform industrial policy and future investment strategies.

Research Questions

1. What is the impact of industrial park development on employee wages and compensation in Ethiopia?
2. What is the impact of industrial park development on employment outcomes in Ethiopia?
3. What is the impact of industrial park development on domestic investment outcomes in Ethiopia?

General Objective

To evaluate the impact of industrial park development on labor market and domestic investment outcomes in Ethiopia using a Difference-in-Differences analysis.

Specific Objectives

1. To examine the impact of industrial park development on employee wages and compensation in Ethiopia.
2. To assess the impact of industrial park development on employment outcomes in Ethiopia.
3. To evaluate the impact of industrial park development on domestic investment outcomes in Ethiopia.

2. Methods and Methodology

2.1. 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.

2.2. 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.

2.3. 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.

2.4. 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.

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

2.5. Econometric Models of the study

2.5.1. The Difference in Differences Research Design (DID Model)

2.5.1.1. 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, Guji, 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

As shown in the above table, since 2014 the Federal Democratic Republic of Ethiopia government has expanded industrial parks development throughout the country. Currently, more than 30 industrial parks are established in different zones, special zones and city administrations. The Ethiopian government used Eastern Industrial Parks for pilot test to examine the effectiveness of industrial parks operation. After confirming the positive role of Eastern Industrial Zone on Ethiopia's economy, in 2014 the Federal government established the Federal Industrial Parks Development Corporation (IPDC) to build and administer the Industrial Parks in different Zones, Special Zones and City administrations of the country to optimize economic impact of industrial parks development projects. Since 2014 more than 30 industrial parks have been established in different zones, special zones and city administrations. These industrial parks have three generations. The first generation is eastern industrial park which was established for pilot tests to examine the effectiveness of Industrial Parks Development Project in Ethiopia. The second generation of industrial parks were built after the establishment of Federal Industrial Parks Development Corporation (IPDC) whereas the third generation of industrial parks are the latest industrial parks established after the political reform took place in Ethiopia. Out of the three research questions of this study, authors addressed the macroeconomic impact of Industrial Parks Development Projects using this data setup. Because of the lack of enough compiled data for the third generation of Industrial Parks, the analysis of this study uses the second generation of Industrial Parks in Ethiopia. To strengthen the significance level of the coefficient, authors used the intersection year of establishment of the second generation of industrial parks for post treatment period.

2.5.1.2. 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'.

2.5.1.3. 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:

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

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

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:

$$\ln DOMI_{it} = \alpha + \gamma * \text{IDZonedummy}_{it} + \delta_i + \gamma_t + X_{it}\beta + \varepsilon_i$$

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

----- (5)

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 wage for Male employees	45,350	956338	28,818	1115104	0.219
The total wage for employees	45,708	1469920	29,070	1653341	0.219
Commission, bonus and professional allowances	27,003	149708.2	10,663	163841.2	0.468
Total wage for Male employees	45,350	956338	28,818	1115104	0.2187
Total number of domestic investors	8,931	5.16202	5,756	4.342425	0.113
Total current paid up capital	9,227	5.54e+07	5,892	7.53e+07	0.060
Total Female hired	37,275	68.40504	23,322	68.01638	0.933
Total Engaged per months	2,856	268.0742	2,677	436.0549	0.744

As shown in Table 5, there are no statistically significant differences between the treated and control zones before

the implementation of the Ethiopian Industrial Park Development Projects, as all p-values exceed the 5% significance level. This suggests that the two groups were comparable in terms of the selected outcome variables at baseline. Therefore, the null hypothesis of no significant difference cannot be rejected. The baseline comparability between the treated and control groups supports the validity of applying the Difference-in-Differences (DID) estimation technique to assess the economic impact of the industrial park development program.

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

3.1. 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.

3.2. The Macro Economic Impact of Industrial Parks Development Projects in Ethiopia

One of the objectives of this project is to evaluate the macro economic impact of industrial parks development projects in Ethiopia. The major macro-economic variables identified to measure the macro economic impacts are annual investments by type and sources, Products and by-products outcome (Total Sales Values, Total Export Value and Annual Value of Production), value of fixed assets, total Wages and Salaries of employees, Domestic capital formation and the total number of employees employed in industrial enterprise.

4.4.4. Impact of Ethiopian Industrial Parks Development Projects on Wages and other benefits for employees

The following table presents the Difference-in-Differences (DID) estimation results for the impact of Ethiopian Industrial Park Development Projects on employee wages and other

benefits in treated zones relative to control zones. Employee compensation is measured by total annual wages, total annual wages paid to male employees, and commissions, bonuses, and professional allowances.

Table 3: Impact of Ethiopian Industrial Parks Development Project on total wage and other benefits for employees

Variables	Ln of Total wage value for employees			Ln of wage for Male employees		Ln of commission, bonus and professional allowances		
Treatment* Post	.077 (.036)***	.426 (.176)**	.422 (.176)**	.449 (.264)*	.458 (.266)*	.111 (.120)	1.036 (.486)**	.948 (.467)**
Post	.634 (.040)***	.365 (.112)***	.265 (.120)**	.479 (.165)***	.365 (.160)**	.368 (.131)***	.408 (.396)	.558 (.387)
Treatment	-1.257 (.798)	.047 (.068)	.048 (.067)	.072 (.100)	.0750 (.101)	1.582 (.302)***	.004 (.112)	-.114 (.113)
Ln of working capital		.109 (.013)***	.109 (.013)***	.093 (.013)***	.093 (.013)***		.064 (.023)***	.098 (.024)***
Ln of total raw material values		.027 (.010)***	.019 (.010)**	.025 (.010)**	.015 (.010)		.065 (.065)	.086 (.068)
Source of Finance		.044 (.017)**	.034 (.014)**	.027 (.014)**	.026 (.014)*		.024 (.024)	.036 (.025)
Constant	12.410 (.797)***	8.825 (.389)***	9.258 (.370)***	8.813 (.380)***	9.335 (.361)***	9.336 (.321)***	7.869 (.595)***	8.368 (.541)***
Fixed effect	Yes	Yes	No	Yes	No	Yes	Yes	No
Additional exogenous covariates	No	Yes	Yes	Yes	Yes	No	Yes	Yes
<i>Source authors' estimation</i>								
***, **, * one, five and ten percent significance level, respectively								
<i>Additional exogenous covariates controlled in the model are Ln of average annual sales, Ln of value of the product at full capacity, Ln of average value of the product, Ln of difference in the annual value of stocks and Ln of total value of domestic capital</i>								

The DID results indicate that Ethiopian Industrial Park Development Projects had a positive and statistically significant impact on employee compensation. The interaction term (Treatment $\times$ Post) shows that the projects increased total annual wages by approximately 8 percent, total wages paid to male employees by about 53 percent, and commissions, bonuses, and professional allowances by more than 100 percent in treated zones compared with control zones. These findings support agglomeration theory, which suggests that the concentration of firms enhances productivity and improves labor market outcomes through higher wages and better employee benefits (Marshall, 1890; Porter, 1998). The results are also consistent with the study's conceptual framework, which argues that industrial park development promotes investment and firm productivity, leading to improved employee compensation. Moreover, the findings are in line with previous empirical studies that reported industrial parks contribute to higher wages and better employment conditions by attracting investment and increasing firm productivity (Farole,

2011; Newman et al., 2016; UNIDO, 2019). The positive effects of working capital and access to finance further suggest that firms with greater productive capacity are more likely to provide better compensation packages to their employees.

Parallel Line Test /Placebo test

A key assumption of the Difference-in-Differences (DID) estimation approach is that treated and control groups should follow similar trends before the implementation of the intervention. To test this assumption, a placebo test using a time-varying DID specification is conducted by assigning pseudo-post periods before the actual implementation of Ethiopian Industrial Park Development Projects. The test examines whether there were any significant differences in the trends of employee wages and benefits between treated and control zones prior to the intervention.

Table 4: Placebo test/ Parallel Line Test for Wages and other benefits for Employees

Variables	Ln of total wage value for employees			Ln of total wage for male employees			Ln of commission, bonus and professional allowance		
	2012-2013	2013-2014	2014-2015	2012-2013	2013-2014	2014-2015	2012-2013	2013-2014	2014-2015
Treatment* pseudo post	.417 (.345)	.508 (.551)	-.366 (.821)	.429 (.336)	.070 (.935)	-.207 (.754)	-.045 (1.44)	-.761 (1.462)	.608 (.994)
Treatment	-1.063 (.755)	-.041 (.553)	.644 (.648)	-.601 (.825)	-.532 (.537)	.204 (.729)	-3.110 (2.298)	-.399 (.505)	-.085 (1.139)
Pseudo Post	-.210 (.260)	.078 (.171)	-.776 (.401)*	-.235 (.250)	.040 (.168)	-.709 (.411)*	.564 (1.127)	(.144) (.320)	-.574 (.482)
Ln of working capital	.135 (.039)** *	-.066 (.030) **	.184 (.044)** *	.121 (.037)***	-.065 (.029)* *	.150 (.043)	.248 (.121)**	-.071 (.053)	.157 (.088)*
Constant	11.082 (1.136)	9.183 (.743) ***	8.451 (.854)** *	10.566 (1.133)** *	9.170 (.733)* **	8.818 (.836)** *	2.113 (3.534)	13.440 (1.286) ***	4.42 (1.87)
Zones exogenous variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zone and Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Source authors' estimation ***, **, * one, five and ten per cent significance level, respectively									

The results presented in the following table show that the interaction terms between treatment status and pseudo-post periods are statistically insignificant across all three outcome measures: total wages of employees, wages of male employees, and commissions, bonuses, and professional allowances. This indicates that there were no significant pre-treatment effects of industrial park development projects and that treated and control zones followed similar trends before the implementation of the program. Therefore, the parallel trend assumption required for the validity of the DID estimation is satisfied, confirming that the estimated post-intervention effects can reasonably be attributed to the development of industrial parks rather than pre-existing differences between the groups.

4.4.5. Impact of Ethiopian Industrial Parks Development Projects on the Domestic Capital formation

The following table presents the Difference-in-Differences (DID) estimation results on the impact of Ethiopian Industrial Park Development Projects on domestic capital formation in treated zones relative to control zones. Domestic capital formation is measured using three indicators: the total number of domestic investors, total initial paid-up capital by domestic investors, and total working capital of domestic investors. The models control for relevant firm-level characteristics and other covariates to estimate the effect of industrial park development on domestic investment outcomes.

Table 5: Impact of Industrial Parks Development on Domestic Capital Formation

Variables	Total number of domestic investors (Both sex)		Variables	Ln of total initial paid up capital by domestic investors		Variables	Ln of total working capital by domestic investors	
Treatment* Post	.127 (1.171)	1.099 (1.169)	Treatment* Post	.374 (1.447)	.920 (.800)	Treatment* Post	7.747 (9.466)	-4.045 (3.063)
Post	-2.070 (2.959)	-1.224 (1.010)	Post	-1.936 (.955)**	-1.826 (.482)***	Post	-5.800 (9.900)	1.914 (2.294)
Treatment	-.525 (1.149)	-1.014 (1.136)	Treatment	1.661 (2.081)	-.771 (.723)	Treatment	-8.508 (10.738)	4.583 (3.040)

Source of finance	.090 (.170)	.041 (.185)	Ln of Working Capital	-.288 (.100)***	-.133 (.074)*	Source of finance	.270 (.365)	-.157 (.250)
Ln of working Capital	-.145 (.236)	-.112 (.195)	Ln of License fee Paid	-.141 (.144)	-.061 (.102)	Ln of working capital	.581 (1.038)	-.632 (.493)
Ln of Banking charge	-.022 (.190)	-.004 (.124)	Ln of total wage value	-.004 (.098)	-.001 (.075)	Ln of total tax paid	-16.185 (24.818)	-12.784 (10.662)
Ln of income tax paid	-.076 (.249)	-.050 (.215)	Ln of Income tax paid	-.019 (.130)	-.006 (.097)	Ln of book value of fixed asset	.0193 (.077)	.556 (.633)
Ln of total wage value	-.304 (.154)* *	-.180 (.113)*	Ln of Banking charge paid	-.075 (.114)	-.032 (.082)	Ln of annual export value	.572 (.811)	-.365 (.401)
Constant	14.288 (6.787) **	10.609 (3.741)* **	Constant	20.162 (3.308)***	16.376 (2.187)** *	Constant	2.7505 (23.4350)	-7.829 (9.691)
Fixed Effect	Yes	No	Fixed Effect	Yes	No	Fixed Effect	Yes	No
Additional exogenous covariates	Yes	Yes	Additional exogenous covariates	Yes	Yes	Additional exogenous covariates	Yes	Yes
<i>Source authors' estimation</i>								
***, **, * one, five and ten percent significance level, respectively								
Additional exogenous covariates controlled in the model are Ln of value of total raw material, Ln of total sale value, Ln of the value of bank service charges, Ln of value of total tax paid and Ln of the value of products at full capacity								

The results show that Ethiopian Industrial Park Development Projects did not have a statistically significant impact on domestic capital formation. The DID coefficient (Treatment $\times$ Post) for the total number of domestic investors is 0.127 and 1.099 across the two specifications, indicating a positive but insignificant effect on domestic investor participation in treated zones compared with control zones. Similarly, the estimated coefficients for total initial paid-up capital are 0.374 and 0.920, while the coefficients for total working capital of domestic investors are 7.747 and -4.045, respectively. Although some coefficients show positive effects, their lack of statistical significance indicates that industrial park development has not generated a measurable increase in domestic capital accumulation during the study period. This finding suggests that the investment spillover effects expected from industrial parks have not yet been fully realized among domestic investors. The result is consistent with industrial development theories, which emphasize that improved infrastructure, investment incentives, and industrial linkages can promote local investment, but their effectiveness depends on complementary factors such as access to finance,

technological capability, and institutional support (Marshall, 1890; Porter, 1998). It also aligns with empirical evidence showing that domestic firms in developing countries often face constraints in benefiting from industrial park opportunities due to limited financial capacity and weak integration into industrial value chains (Farole, 2011; Newman et al., 2016). Therefore, additional policy interventions aimed at improving access to finance, technology transfer, and local supplier linkages are necessary to strengthen the role of industrial parks in promoting domestic capital formation.

Parallel Line Test /Placebo test

One of the key assumptions of the Difference-in-Differences (DID) estimation approach is the existence of a parallel trend between treated and control groups before the intervention. To test this assumption, a placebo test is conducted using pre-intervention data from 2012 and 2013 by assigning a pseudo-post period to examine whether domestic capital formation indicators followed similar trends before the implementation of Ethiopian Industrial Park Development Projects.

Table 6: Placebo Test/ Parallel Line Test for Domestic Capital Formation

Variables	Total number of domestic investors		Ln of total initial paid up capital by domestic investors		Ln of total working capital by domestic investors	
Treatment* pseudo post	-1.124 (1.923)	-1.197 (2.021)	-.017 (.115)	.363 (.330)	-.019 (.120)	-.098 (.280)
Treatment	-1.625 (1.349)	-1.462 (1.406)	.072 (.097)	-.924 (1.049)	.034 (.094)	.0480 (.183)
Pseudo Post	.191 (.968)	.149 (1.049)	.111 (.071)	.138 (.213)	.064 (.075)	-1.395 (.877)
Ln of working capital		-.004 (.135)		.070 (.035)		.100 (.029)***
Source of finance		-.070 (.186)		.001 (.035)		-.002 (.031)
Constant	2.908 (.885)***	3.038 (3.096)	15.767 (.3185)***	14.320 (1.168)***	16.831 (.411)	14.865 (1.005)***
Zones exogenous variables	No	Yes	No	Yes	No	Yes
Zone and Time fixed effect	yes	Yes	Yes	Yes	Yes	Yes
<i>Source authors' estimation</i>						
***, **, * one, five and ten per cent significance level, respectively						

The results presented in the following table show that the interaction terms between treatment status and pseudo-post periods are statistically insignificant for all three measures of domestic capital formation: the total number of domestic investors, total initial paid-up capital, and total working capital of domestic investors. This indicates that there was no significant difference in the trends between treated and control zones before the implementation of industrial park development projects. Therefore, the parallel trend assumption required for the validity of the DID estimation is satisfied, confirming that any observed post-intervention effects can be attributed to the industrial park development projects rather than pre-existing differences between the groups.

4.4.6. Impact of Industrial Parks Development Projects on the total number of persons employed in industrial enterprise

The following table presents the Difference-in-Differences (DID) estimation results on the impact of Ethiopian Industrial Park Development Projects on employment generation in industrial enterprises. Employment outcomes are measured using three indicators: the total number of employees engaged in industrial enterprises, the total number of female employees, and the average number of employees engaged per month. The models control for relevant firm-level characteristics and other covariates to estimate the effect of industrial park development on employment creation.

Table 7: Impact of Industrial Parks Development Projects on Total Number of Persons Employed in industrial enterprise

Variables	Total employees employed in industrial enterprise		Total Female employees employed in industrial enterprise		Variables	Total employees employed per months in industrial enterprise	
Treatment*Post	2117.28 (953.162)**	2242.383 (387.578)***	501.184 (196.545)**	403.324 (180.419)**	Treatment *Post	260.3733 (47.7817)***	119.246 (133.429)
Post	-3913.486 (1151.01)***	-1926.779 (393.7635)**	-292.350 (264.371)	-345.693 (169.427)**	Post	-270.224 (100.355)**	112.890 (61.1956)*
Treatment	-716.450 (892.532)	-1774.546 (522.116)***	-677.123 (472.341)	-335.634 (179.334)**	Treatment	-19.5819 (73.2532)	-14.2685 (47.5066)
Ln total value of production	571.190 (449.617)	39.8345 (247.450)	68.6233 (59.8360)	19.8390 (27.990)	Ln of total Value of Production	-566.079 (119.407)***	-267.394 (248.845)

Ln average Sales per unit in Birr	55.882 (52.358)	.58794 (24.846)	16.785 (19.875)	-12.113 (12.112)	Ln of average Sales per unit in Birr	417.322 (109.143)***	159.954 (197.107)
Constant	2275.253 (2631.715)	1125.33 (3134.863)	-858.237 (821.878)	-611.220 (661.623)	Constant	1031.522 (330.287)**	329.509 (301.811)
Fixed Effect	Yes	No	Yes	No	Fixed Effect	Yes	No
Additional Exogenous Covariates	Yes	Yes	Yes	Yes	Additional Exogenous Covariates	Yes	Yes
<i>Source authors' estimation</i>							
***, **, * one, five and ten per cent significance level, respectively							
Additional exogenous covariates controlled in the model are ln of the value of investment on fixed assets, ln of the value of products, ln of total wage values, the value of wage square, position of respondents and years of experience of responders							

The following table presents the Difference-in-Differences (DID) estimation results on the impact of Ethiopian Industrial Park Development Projects on employment generation in industrial enterprises. Employment outcomes are measured by the total number of employees engaged in industrial enterprises, total female employees, and average monthly employment. The DID estimates show that the establishment and operation of industrial parks significantly increased total employment by 2,117 employees, female employment by 501 employees, and monthly employment by 260 employees in treated zones relative to control zones, holding other factors constant. These findings indicate that industrial parks have contributed to labor demand expansion through increased industrial activities and investment. The results support agglomeration theory, which argues that industrial concentration enhances production capacity and employment opportunities through economies of scale and improved linkages (Marshall, 1890; Porter, 1998). They are also

Table 8: Parallel Line Test/Placebo test

Variables	Total employees employed in industrial enterprise			Total female employees employed in industrial enterprise			Total employees employed per months in industrial enterprise		
	2013-2014	2014-2015	2015-2016	2013-2014	2014-2015	2015-2016	2013-2014	2014-2015	2015-2016
Treatment* pseudo post	-312.3 (343.0)	-172.1 (271.9)	36.95 (325.5)	8.63 (25.4)	-16.54 (45.32)	101 (235)	43.3 (564.8)	-80.09 (193.4)	542.8 (3494)
Treatment	1059.5 (722.2)	166.2 (18.4)	-181.4 (479.1)	-61.1 (51.1)	181.0 (171.1)	-63.2 (374)	-237.9 (330.1)	-291.1 (197.4)	-1166 (2337)
Pseudo Post	295.4 (280.2)	-71.1 (54)	102.2 (147.5)	8.87 (16.6)	-12.3 (36.5)	22.8 (98.8)	12.9 (38.7)	12.86 (104.4)	-238.9 (1725)
Source of finance	-43.8 (45.9)	2.65 (18.2)	41.7 (25.1)	.334 (3.370)	8.260 (14.34)	27.8 (16.7) *	47.4 (72.3)	28.6 (37.17)	-470 (307)
Constant	1232 (506.2)	432.49 (281.5)	288.9 (580.9)	170.677 (54.360)* **	250.3 (170.5)	661.5 (492.2))	195.9 (271.7)	1169.5 (888.2)	-1717 (5985)
Zones exogenous variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

consistent with the study's conceptual framework and empirical evidence showing that industrial parks and special economic zones promote employment creation by attracting investment and expanding manufacturing activities (Farole, 2011; Wang, 2013; Newman et al., 2016).

Parallel Line Test /Placebo test

One of the key assumptions of the Difference-in-Differences (DID) estimation approach is that treated and control groups should follow similar trends before the implementation of the intervention. To test this assumption, a time-varying DID specification using pseudo-post periods is applied based on pre-intervention years. The placebo test examines whether employment outcomes, including total employees engaged in industrial enterprises, female employees, and monthly employment, had similar trends between treated and control zones before the establishment of industrial parks.

Zone and Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Source authors' estimation ***, **, * one, five and ten per cent significance level, respectively									

The results presented in the following table show that the interaction terms between treatment status and pseudo-post periods (Treatment $\times$ Pseudo Post) are statistically insignificant across all employment indicators and time periods. This indicates that there was no significant pre-existing difference in employment trends between treated and control zones before the implementation of industrial park development projects. Therefore, the parallel trend assumption is satisfied, confirming the validity of the DID estimation approach and suggesting that the estimated employment effects after the intervention are attributable to industrial park development rather than differences that existed before the program.

4. Conclusion and Policy Implication

4.1. Conclusion

This study examined the impact of industrial park development on labor market and domestic investment outcomes in Ethiopia using a Difference-in-Differences (DID) estimation approach with panel data from treated and control zones. The findings indicate that industrial park development has generated significant improvements in labor market outcomes by increasing employee wages, commissions and professional allowances, and employment opportunities, including female employment. These results suggest that industrial parks have contributed to expanding industrial employment and improving workers' compensation through increased industrial activity and investment. However, the analysis found no statistically significant impact on domestic investment outcomes, including the number of domestic investors, paid-up capital, and working capital. This implies that although industrial parks have successfully stimulated labor market performance, their expected spillover effects on domestic private investment remain limited. Overall, the findings suggest that industrial parks have been effective in promoting employment and improving labor market conditions, but complementary policy measures are required to strengthen domestic investor participation and enhance the broader economic benefits of industrial park development in Ethiopia.

4.1. Recommendation

The findings suggest that the Ethiopian government and the Ethiopian Industrial Parks Development Corporation should strengthen policies that enhance the labor market benefits of industrial parks while addressing the constraints that limit domestic investment. Given the significant improvements in employment and employee compensation, continued

investment in industrial park infrastructure, skills development, and workforce training is essential to sustain job creation and improve labor productivity. At the same time, the absence of a significant impact on domestic investment indicates the need for complementary policies that encourage greater participation of domestic investors. Improving access to finance, facilitating technology transfer, strengthening business development services, and promoting linkages between domestic firms and enterprises operating within industrial parks would help increase local investment and maximize spillover effects. In addition, creating a more supportive business environment through efficient administrative services and targeted investment incentives can enhance the contribution of industrial parks to inclusive and sustainable industrial development in Ethiopia.

5. References

- [1]. Aggarwal A (2005). Performance of Export Process Zones: A Comparative Analysis of India, Sri Lanka and Bangladesh. Working Paper No. 155 Indian Council for Research on International Economic Relations (ICRIER), New Delhi.
- [2]. Aggarwal A et al (2008). Special Economic Zones in South Asia: Industrial Islands or Vehicles for Diversification? Working Paper, International Trade Department, the World Bank.
- [3]. Ahrens J and Meyer Baudeck (1995). Special Economic Zones: Shortcut or Roundabout Way towards Capitalism. *Journal of Business and Economic Statistics*.
- [4]. Alder S, Shao L and Zilibotti F (2016). Economic Reforms and Industrial Policy in a Panel of Chinese Cities. *Journal of Economic Growth*.
- [5]. Alebel Bayrau Weldesilassie et al (2017). Study on Industrial Park Development: Issues, Practices and Lessons for Ethiopia. Ethiopian Development Research Institute.
- [6]. Allenby, Braden R and Deanna J Richards (1994). The Greening of Industrial Ecosystems. Washington DC National Academy of Engineer.
- [7]. Arkebe Oqubya (2018). The Structure and Performance of the Ethiopian Manufacturing Sector. *African Development Bank Group*.
- [8]. Chen J (1993). Social Cost-Benefit Analysis of China's Shenzhen Special Economic Zone. *Development Policy Review*.
- [9]. Cirera X and R Lakshman (2014). The Impact of Export Processing Zones on Employment, Wages and Labour Conditions in Developing Countries. In 3ie Systematic

Review 10. London: International Initiative for Impact Evaluation (3ie).

[10]. Cling et al (2005). Export Processing Zones in Madagascar: a Success Story under Threat? *Journal of World Development*.

[11]. Cling JP and Letilly G (2001). Export Processing Zones: A threatened instrument for global economy insertion. DIAL document de trabajo.

[12]. Eskider Atnafu (2018). Socio-Economic Contribution of Manufacturing Industrial Parks in Ethiopia: Prospects and Challenges from Stakeholder Perspectives. Addis Ababa Science and Technology University.

[13]. FIAS (2008). Special Economic Zones: Performance, Lessons Learned and Implications for Zone Development. Washington. World Bank.

[14]. Guendelman S and Silberg MJ (1993). The Health Consequences of Maquiladora Work: Women on the US-Mexican border. *American Journal of Public Health*.

[15]. Hamada K (1974). An Economic Analysis of Duty-Free Zones. *Journal of International Economics*.

[16]. Hamilton C and LO Svensson (1982). On the Welfare Effects of Duty-Free Zone. *Journal of International Economics*.

[17]. Heron T (2004). Export Processing Zones and Policy Competition for Foreign Direct Investment: The Offshore Caribbean Development Model.

[18]. Hossain MA (2001). Marketing Strategies of the Tourism Industry in Bangladesh: Implications for Bangladesh Parjatan Corporation. *Dhaka University Journal of Marketing*.

[19]. Humphrey J (2003). Globalization and Supply Chain Networks: The Auto Industry in Brazil and India. *Global Networks*.

[20]. International Labour Organization (1998). Labour and Social Issues Relating to Export Processing Zones. Working Papers of the Governing Body. Geneva.

[21]. International Labour Organization (2013). Working Conditions Laws Report 2012. *A Global Review/Naj Ghosheh ILO Office Geneva*.

[22]. Jae H Lee (2015). Research Notes on a Feasibility Study for the Development of Industrial Parks in Ethiopia. SGI Consulting Incorporated.

[23]. Jarmila Vidová (2010). Industrial Parks - History, Their Present and Influence on Employment. *Review of Economic Perspectives. Volume X*.

[24]. Jenkins M et al (1998). Export Processing Zones in Latin America. Harvard Institute for International Development, Development Discussion.

[25]. Johansson H (1994). The Economics of Export Processing Zones Revisited. *Development Policy Review*.

[26]. Johansson H and L Nilsson (1997). Export Process Zone as Catalysts. *Journal of World Development*.

[27]. Kaplinsky R (1993). Export Processing Zones in the Dominican Republic: Transforming Manufactures into Commodities. *Journal of World Development*.

[28]. Kemal AR (2001). Freedom of Association and Promotion of Social Dialogue in SEZs in Pakistan. International Labor Organization.

[29]. Khan (2004). State Failure in Developing Countries in Toward Pro-Poor Policies: Aid, Institution, and Globalization. World Bank New York.

[30]. Majumdar I (2001). Special Economic Zones (SEZs) and Their Workers in India: A Study of the Noida Processing Zone, in A.S. Oberoi, A. Sivananthiran and C.S.Venkata Ratnam, et al. (ed.) *Labour Issues in Export Processing Zones : Role of Social Dialogue, South Asian Multidisciplinary Team and Indian Industrial Relations Association, ILO, New Delhi*.

[31]. Mason PM, Steagall JW and Fabritius MM (1995). Student Evaluations of Faculty: A New Procedure for Using

[32]. Milberg W and Amengual M (2008). Economic Development and Working Conditions in Export Processing Zones: A Survey of Trends. Working Paper No. 3, International Labour Office. Geneva.

[33]. Miyagiwa Kaz F (1986). A Reconsideration of the Welfare Economics of a Free-Trade Zone. *Journal of International Economics Elsevier vol. 21*.

[34]. Mulu Gebreeyesu (2009). Industrial Policy and Development in Ethiopia: Evolution and Present Experimentation. United Nation University.

[35]. Needham B and Louw E (2006). Institutional Economics and Policies for Changing Land Markets: the Case of Industrial Estates in the Netherlands. *Journal of Property Research*.

[36]. Nils Bonde-Henriksen (1982). Industrial Park Development: An Overview and Case Study of Myles Standish Industrial Park, Taunton, Massachusetts University Of Rhode Island Strategy. Working Paper.

[37]. Rhee, Yung Whee, Katharina Katter Bach and Janette White (1990). Free Trade Zones in Export Strategies. Industry Series Paper. World Bank Washington DC.

[38]. Romero AT (1995). Labour Standards and Export Processing Zones: Situation and Pressures for Change. *Development Policy Review*.

[39]. Rouwendal J and Van der Straaten JW (2008). The Costs and Benefits of Providing Open Space in Cities. Tinbergen Discussion Paper.

[40]. Selam Gebeyehu (2017). The Challenges and Contributions of Industrial Park Development in Ethiopia: The Case of Eastern Industry Zone Plc, Dukem City, Oromiya, Ethiopia. MA Thesis. St. Mary's University.

[41]. Sen S and Dasgupta B (2008). Labor Under Stress: Findings from a Survey. *Economic and Political Weekly*.

[42]. Summerfield G (1995). The Shadow Price of Labour in Export Processing Zones: a Discussion of the social value of employing women in export processing in Mexico and China. *Review of Political Economy*.

[43]. Wang Jin (2013). The Economic Impact of Special Economic Zones: Evidence from Chinese Municipalities. *Journal of Development Economics*.

[44]. Wang X (2013). The Role of Economic Development Zones in National Development Strategies: The Case of

China. Doctoral dissertation, Pardee RAND Graduate School
China.

[45]. Xiaodi Zhang et al (2018). Industrial Park Development in Ethiopia: Case Study Report. United Nations Industrial Development Organization.

[46]. Yeung et al (2008). China's Special Economic Zones at 30. *Eurasian Geography and Economics*.

[47]. Zeng DZ (2015). Global Experiences with Special Economic Zones: With a Focus on China and Africa. Investing in Africa Forum, Addis Ababa, Ethiopia.

[48]. Zohir Salma Chaudhuri (2001). Social Impact of the Growth of Garment Industry in Bangladesh. Bangladesh Development Studies, Bangladesh Institute of Development Studies (BIDS).