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The Effect of Foreign Direct Investment on Employment in Manufacturing Industry Sectors in Sub-Saharan African Countries

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Abstract

Sub-Saharan Africa(SSA)'s labor market has long struggled—data from the past two decades show that vulnerable employment consists of more than two thirds of employment, and, closely related, that 60-80% of employment comes from the informal sector. Industry-wise, the highest share of employment is in agriculture while the least is in manufacturing, and this trend is not expected to change, since most of the new jobs created in the past two decades have been in agriculture. With the expectation of the working-age population in the region to experience a net increase of 20 million per year over the next two decades, the need for sustained employment creation becomes more critical. And much of the hope for a solution has been placed on the role of foreign direct investment (FDI). This paper looks at the effect of manufacturing FDI on manufacturing employment in Sub-Saharan African countries, by using annual data for 16 manufacturing industry sectors in 15 SSA countries from 2003 to 2018. We find that manufacturing FDI has a positive effect on manufacturing employment at the industry sector level, which include indirect employment effects through potential spillover effects. We also look at how the effect of manufacturing FDI on manufacturing employment differs by groups of industry sectors. The results show that the effect of manufacturing FDI on employment creation varies by industry sector groups; automotive related industries create the most, followed by business machines/electronics related industries, and lastly metals/minerals related industries. The result reflects both direct and indirect employment effects via spillovers and forward and backward linkages. The paper implies that SSA countries would improve their labor market by attracting manufacturing FDI, which should also contribute to their industrial diversification/structural transformation.

Keywords: economic development, labor, manufacturing, Africa

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1. Introduction

Job creation in Sub-Saharan Africa (SSA) has relatively kept pace with its population growth over the recent couple of decades, adding almost nine million new jobs per year. This has been attributable to general economic growth that was particularly evident in the 2000s due to the commodities boom. However, approximately six million of the nine million jobs created annually were self-employed, which is also defined as vulnerable employment. Self-employed workers are likely to operate in the informal economy with low productivity, are less likely to have formal work arrangements, are more likely to lack adequate social security and working conditions, and are often characterized by inadequate earnings. Similarly, most of the new jobs were added in the agriculture and traditional services sector, with the least created in the manufacturing sector (Abdychev et al., 2018). The SSA region currently has the lowest share of employment in manufacturing in the world. The lack of employment in manufacturing is problematic as it relates to the majority of workers being in vulnerable employment, but it is also indicative of how most SSA countries have not yet experienced significant industrialization (Chen et al., 2015).

The share of manufacturing value added as percentage of GDP in SSA has continuously declined in the last couple of decades, from 16.3 percent in 1990 to 11 percent in 2019, although it has slightly improved more recently. The development of manufacturing is seen as a critical step in the industrialization process, especially at the beginning stage; industrialization (and structural transformation) is typically followed by growth in the share of the manufacturing sector in national income, and a significant increase in the share of employment in manufacturing (Bagchi, 1976). Also, since industrialization is extensively recognized as having an important role in economic growth (Bagchi, 1976; Maddison, 1995), the lack of development

in manufacturing in SSA has been a concern for the continent's future development, a phenomenon that Rodrick (2015) also describes as "premature deindustrialization."[1]

Our interest in studying manufacturing foreign direct investment (FDI) in SSA lies in observing these problems of vulnerable employment and lack of industrialization in the region. While manufacturing FDI inflows into SSA only represent a fraction of the world total, it is rising at a fast rate—it has increased from $6.9 billion in 2003 to $21.5 billion in 2019—and it has the potential to stimulate SSA economies especially in reversing the trends just describe above. First, manufacturing FDI can play a catalytic role for the industrialization process (Chen et al., 2015). The Four Asian Tigers—Republic of Korea, Hong Kong, Singapore, and Taiwan—were the first countries that took advantage of globalization and FDI flows in the 1980s and diversified their industrial structures (UNCTAD, 2005). As these countries have now graduated into higher value-added manufacturing and service sectors, there is now an opportunity for latecomers such as SSA countries to benefit from manufacturing FDI, especially the labor-intensive kind (Lin, 2011). Second, manufacturing FDI can increase employment in the formal sector and alleviate the problem of vulnerable employment. Based on 2013–14 data, manufacturing FDI created more direct jobs than FDI in any other sector in SSA, (Chen et al., 2015); in addition, manufacturing FDI can also have extensive indirect effects on employment creation through spillover effects and forward and backward linkages. Manufacturing FDI is also found to have a clear positive effect on economic growth in contrast to what has been the observed effect of total FDI (Alfaro, 2003; Wang, 2009). In summary, the economic benefits manufacturing FDI can potentially bring to SSA countries are multifold.

[1] Premature deindustrialization describes the many developing nations that are becoming service dominant economies without having had a proper experience of industrialization.

Our two research questions based on the observations above are as following: First, what is the effect of manufacturing FDI on manufacturing employment in SSA countries, including indirect employment effects, which would lead to an increase in formal employment and structural transformation? Second, how does this effect differ by industry sector subgroups? To answer the first research question, this paper looks at the effect of greenfield manufacturing FDI on manufacturing employment at the industry sector level in SSA countries from 2003 to 2018, using fixed effects estimation that includes industry subgroup fixed effects and interactive fixed effects of country and year. For the second research question, we analyze how the effect of manufacturing FDI on manufacturing employment differs by industry subgroups, by interacting manufacturing FDI with the industry subgroups. Our results show that manufacturing FDI has a positive effect on manufacturing employment at the industry sector level, and by comparing models with different types of industry level fixed effects, the results also reflect indirect employment effects via potential spillover effects. Results from the second analysis show that the effect of manufacturing FDI on manufacturing employment varies by industry subgroups, of which the effect includes both direct employment effects and indirect employment effects from potential forward and backward linkages and spillover effects.

The rest of the paper is organized as following. Section two reviews the literature on FDI's effect on employment, including the specific cases of manufacturing FDI in developing countries. Section three discusses the data and the empirical framework and approach. Section four discusses the empirical results. In section five we conduct robustness checks, and we end with the conclusion in section six.

2. Literature Review

FDI's effect on Employment

The effect of FDI on employment takes place through several venues. There can be a direct or indirect effect, and quantitative or qualitative effects, which could either be positive or negative. To stay focused on the main research question of this paper, we will only discuss the quantitative effects, which can include both direct and indirect effects. Primarily, new jobs can be created through establishing foreign subsidiaries or investing and expanding on existing local firms (ILO, 1984). Greenfield investment has the greatest effect on direct employment creation, while mergers and acquisitions tend to have a negligible effect in the immediate term (Dunning, 2008). Jobs can also be created indirectly through forward and backward linkages or through distributors and suppliers (Golejewska, 2002). When the foreign firms source locally, demand of upstream sectors could increase (Javorcik, 2004) and stimulate employment. Local linkages can also lead to productivity spillovers from the foreign firms to the local firms and lead to potential job creation (Aitken and Harrison, 1999; Javorcik, 2004). In the medium term, employment can also increase through stimulated demand through restructuring and improved efficiency of competing firms, while acquisition of firms that would otherwise go bankrupt will preserve existing jobs. On the other hand, job loss can also happen through the restructuring of acquired firms or liberation of protected activities (ILO, 1984). It can also happen when there is an increased efficient use of labor, as multinationals usually have intangible firm-specific assets that enhance productivity. As this is transferred to the affiliates, they need less labor per unit of output, which leads to a negative impact on employment (Holland et al., 2000; Conyon et al., 2002; Girma et al., 2002).

Due to these dynamics, past studies have shown that FDI can have a positive or negative effect on employment; however, most of the studies focused on developing countries have shown positive effects. This is because foreign and domestic capital are not perfect substitutes in developing countries, and thus an increase in FDI would result in an increase in demand for labor (Grieco, 1985). Aaron (1999) estimated that FDI in developing countries created approximately 26 million jobs directly, and 41.6 million jobs indirectly in 1997, which indicates a multiplier effect of about 1.6. Iyanda (1999) found a higher multiplier estimate in Namibia, with 2 to 4 jobs created for each worker directly employed by foreign firms. Similarly, we expect that Sub-Saharan African countries that lack job creation and formal employment would experience an increase in employment as FDI comes into fill in the gap between the supply and demand for labor.

The following studies have found a positive relationship between FDI and employment. Coniglio, Prota, and Seric (2015) study the effect of FDI on employment and wages across 19 Sub-Saharan African countries using firm-level data from UNIDO's Africa Investor Survey 2010 and find that foreign-owned firms generate more jobs than domestic ones, though they are less skill intensive. They also find that nationality of ownership matters for job creation and wage premiums, while MNEs adopt generous wage policies in general.

Ajaga and Nunnenkamp (2008) analyze the long-term relationships between FDI and value added and employment at the state level in the U.S. using a cointegration technique and Granger causality tests for the period of 1977 to 2001. The results show that there is cointegration and also two-directional causality between FDI and the outcome variables, which holds for different measures of FDI and also states' overall economy versus the manufacturing sector alone.

Vacaflores (2011) observes the effect of FDI on employment generation in 12 Latin American countries from 1980 to 2006 using a dynamic panel model, and finds that FDI has a positive effect on employment, and that these effects are more important for less developed countries, and countries with a larger informal sector. This suggests that FDI's externalities may be maximized in countries with underutilized resources and can help the informal sector expand into formal markets.

On the other hand, some other studies have found conflicting results. Buffie (1993) looks at the impact of FDI on underemployment and capital accumulation based on a two-sector dual economy model. He finds that FDI in the high-wage manufacturing sector crowds out domestic capital and lowers employment in the long-run, while FDI in the primary export sector crowds in domestic capital and reduces underemployment. Rizvi and Nishat (2009) look at the effect of FDI on employment opportunities in Pakistan, India, and China during 1985-2008 using pooled data and Seemingly Unrelated Regression (SUR). They find that FDI does not lead to increased employment directly, and thus argue that other policy measures should be integrated to stimulate employment growth, but also caution that there may be a time lag in how FDI impacts employment through economic growth. Braunstein and Epstein (2002) find a relatively small positive impact of FDI on employment and wages, when they study FDI inflows into China from 1986 to 1999. Jude and Silaghi (2016) study the impact of FDI on employment using a dynamic labor demand model for 20 Central and Eastern European Countries from 1995 to 2012, and find results that imply "creative destruction;" there is an initial negative effect on employment due to labor saving techniques, after which there is a positive long run effect as foreign firms vertically integrate into the local economy. However, through robustness checks, the authors show that this phenomenon is only observed in EU countries.

Several studies have looked specifically at the effect of manufacturing FDI on employment in developing countries and have found positive effects. Abor and Harvey (2008) use a simultaneous panel regression model with data of the Ghanaian manufacturing sector covering the period 1992–2002 to estimate the effects of FDI on employment and wage levels and find that increased FDI flows generally lead to high levels of employment. They connect this to FDI's large-scale production that requires intensive labor. Nunnenkamp et al. (2007) look at the relationship of manufacturing FDI and employment in Mexico for 1994-2006 using the GMM estimator, and find a significantly positive effect, though a quantitatively modest one. Inekwe (2013) examines the links between FDI and employment in manufacturing and service sectors in Nigeria between 1990 and 2009 by using the vector error correction model (VECM), and finds that there is a positive relationship between FDI and employment in the manufacturing sector while there is a negative relationship in the service sector.

As such, while previous studies have looked at the effect of manufacturing FDI on employment, thus far, there have been no studies that look at this relationship in the context of SSA countries as a whole region (which is characterized by high structural unemployment and underemployment) or look at the effects at the industry sector level and by industrial sector groups, which include indirect effects via potential spillover effects and forward and backward linkages. While the labor-intensive sectors would generally lead to the most direct job creation (Jenkins, 2006), the indirect employment effects through spillover effects and forward and backward linkages can also be quite extensive. These are the gaps in the literature that the current paper aims to fill.

3. Data and Methodology

Our panel data set consists of 15 SSA countries[2] across the period 2003–18. The summary statistics are listed in Table 1.

Table 1. Summary Statistics

Variable	Obs.	Mean	Std.	Min	Max
Manufacturing FDI	3,840	20,300,000	195,000,000	0	6,000,000,000
GDP per Capita	3,840	5,281.329	5,261.95	718.333	22,208.1
Trade	3,712	67.827	26.218	27.376	172.092
Corruption	3,632	35.480	12.692	0	65
Infrastructure	3,840	22.735	18.082	0.37	79.63
Education Exp/Total Exp	2,976	18.673	4.731	5.03	37.521

The data come from several sources. Employment in manufacturing by sector is from UNIDO Industrial Statistics Database at the 2-digit level of ISIC Revision 3 (INDSTAT2), 2020 edition. Greenfield manufacturing FDI inflows into SSA countries by sector is from fDi Markets, where the capital investment amounts are in US dollars of that time. We made several adjustments to match the sectors that were categorized in these two data sets, such as combining various sectors together, and also dropped several that weren't available in the other data set. Table 2 shows the final set of sectors that were matched. GDP per capita is in 2017 constant international dollars; trade openness is proxied by the total of export and import as percentage of GDP, and both are from World Development Indicators (WDI). For corruption we use the Corruption Perceptions Index (CPI) from Transparency International; this index ranks 180 countries and territories' public sector corruption by how it is perceived by experts and business people, using a scale from 0 to 100.[3] For the proxy of infrastructure, we use the Africa

[2] The 15 SSA countries are: Botswana, Burundi, Cameroon, Cape Verde, Eswatini, Ethiopia, Gambia, Ghana, Kenya, Madagascar, Malawi, Mauritius, Niger, Senegal, and South Africa.

[3] The Corruption Perceptions Index was updated in 2012 by changing the index scale to 0-100 from 0-10. Thus, the data before and after 2012 are generally not comparable. While acknowledging this limitation, when we scaled all

Infrastructure Development Index (AIDI), which also has a scale from 0 to 100 and is a weighted average of indicators for the following four components: transportation, electricity, ICT (Information and Communications Technology), and water and sanitation. Education is proxied with education expenditure as percentage of total government expenditure, which is retrieved from UNESCO (UNESCO Institute for Statistics).[4]

Table 2. Matching Industry Sectors from fDi Markets and UNIDO Stat. Data Sets

fDi Markets	**UNIDO Stat.**
Automotive components & OEM	Motor vehicles, trailers, semi-trailers
Business machines & equipment	Office, accounting and computing machinery
Chemicals	Chemicals and chemical products
Coal, oil & gas	Coke,refined petroleum products,nuclear fuel
Communications & Consumer electronics	Radio,television and communication equipment
Electronic components	Electrical machinery and apparatus
Engines & turbines & Industrial equipment	Machinery and equipment n.e.c.
Food & Beverages	Food and beverages, Tobacco products
Medical devices	Medical, precision and optical instruments
Metals	Basic metals, Fabricated metal products
Ceramics & glass & minerals	Non-metallic mineral products
Non-automotive transport OEM & Space & defense & Aerospace	Other transport equipment
Paper, printing & packaging	Paper and paper products, Printing and publishing
Plastics & Rubber	Rubber and plastics products
Textiles	Textiles, Wearing apparel, fur, Leather, leather products and footwear
Wood products	Wood products (excl. furniture), Furniture; manufacturing n.e.c.

The base estimation model for our first analysis is as following:

$$\ln\left(ManEmp_{i,c,y}\right) = \beta_0 + \beta_1 \ln\left(ManFDI_{i,c,y} + 1\right) + \beta_x X_{c,y} + \gamma_{subgroup\_1} + \delta_c + \theta_y + \mu\delta_c * \theta_y + \varepsilon_{i,c,y} \quad (1)$$

the scores to 0-100, there was not a big change to the trend over the years, and hence chose to use this index for which most data were available.

[4] We acknowledge there are better indicators to proxy education attainment, such as number of students who completed secondary education, etc. However, there was a severe lack of data points for these other indicators.

The same model is tested with different industry subgroup fixed effects, and also with one that includes individual industry sector fixed effects:

$$\ln(ManEmp_{i,c,y}) = \beta_0 + \beta_1 \ln(ManFDI_{i,c,y} + 1) + \beta_x X_{c,y} + \gamma_{subgroup\_2} + \delta_c + \theta_y + \mu\delta_c * \theta_y + \varepsilon_{i,c,y} \quad (2)$$

$$\ln(ManEmp_{i,c,y}) = \beta_0 + \beta_1 \ln(ManFDI_{i,c,y} + 1) + \beta_x X_{c,y} + \gamma_{subgroup\_3} + \delta_c + \theta_y + \mu\delta_c * \theta_y + \varepsilon_{i,c,y} \quad (3)$$

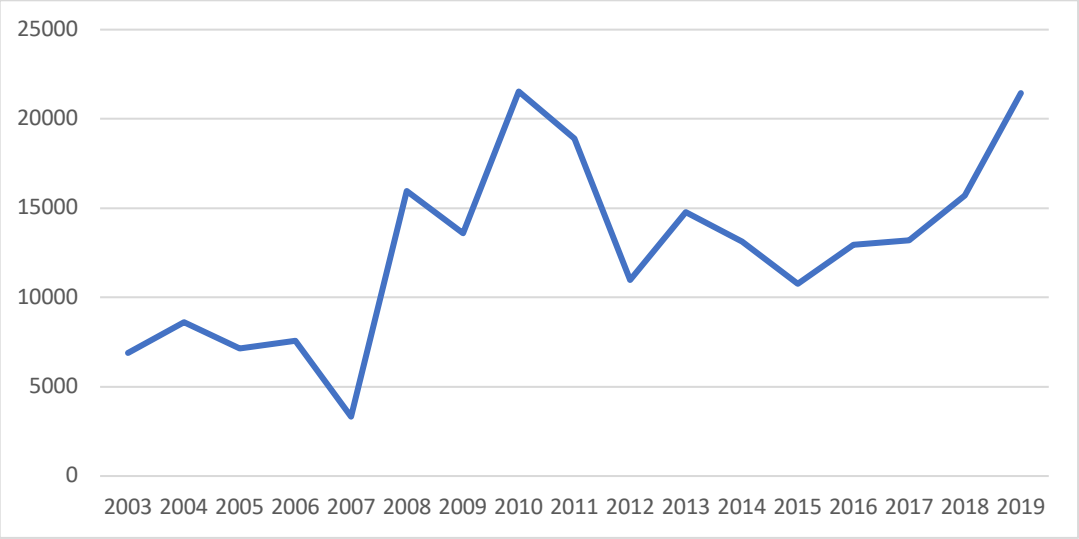
$$\ln(ManEmp_{i,c,y}) = \beta_0 + \beta_1 \ln(ManFDI_{i,c,y} + 1) + \beta_x X_{c,y} + \gamma_i + \delta_c + \theta_y + \mu\delta_c * \theta_y + \varepsilon_{i,c,y} \quad (4)$$

We use fixed effects regression that includes year, country, and industry—or subgroup of industries—fixed effects, and interactive fixed effects of country and year to look at the effect of manufacturing FDI on manufacturing employment at the industry sector level. The dependent variable $\ln(ManEmp_{i,c,y})$ is the log of employment numbers in manufacturing sector i, in country c, year y; $\ln(ManFDI_{i,c,y} + 1)$ is the log of FDI inflows of manufacturing sector i, in country c, year y. We add 1 to all the manufacturing FDI data points as a large portion of the data points of manufacturing FDI inflows are 0, due to the trend of manufacturing FDI inflows into SSA and especially because the data are disaggregated at the industry sector level. Adding 1 to all the data points allows these observations to remain after log transformation; this method is a common practice in data research, especially when the rest of the data are in units of millions, which is the case for our data set.

The interaction of country and year in both models is included to account for how macroeconomic time trends had varying effects on each country during the period 2003-2018, especially during the 2007-2008 economic crisis. The shock of the economic crisis caused abnormal spikes of FDI inflows into some of the SSA countries, as can be seen in Graph 1.[5]

[5] In 2008, FDI inflows to Africa peaked which was a continuation of the increasing trend from 2007, in which resource extracting FDI and manufacturing FDI both played a large part. The inflows were fueled by booming commodity prices, rising profitability of investments and policy environments conducive to FDI (UNCTAD, 2017).

Graph 1. Manufacturing FDI inflows to SSA countries (in US $ millions)



For industry sector fixed effects, we use different types of fixed effects for each model (1)~(4)—fixed effects for each sector, and fixed effects for subgroups of the sectors, for which we have three different types of categories. As listed in Table 3, subgroup (1) is grouped based on industrial similarities, and subgroup (2) and (3) are grouped based on similar K/L ratios. The K/L ratios were obtained from Diao et al. (2021)'s study, where they have calculated K/L ratios for Tanzanian and Ethiopian manufacturing firms by industry sector. We take the average of the Tanzanian and Ethiopian firms' K/L ratios as a proxy for the SSA countries in our sample. The K/L ratios are smallest in the 1st group, and increase in the order of the subsequent groups. More details are provided in Table A-1 and A-2 in Appendix.

After the recession started in December of 2007, oil prices spiked to $143.68 per barrel in mid 2008, which soon caused increase in other commodity prices such as wheat, gold, and other related future markets. This could have happened due to an influx of investment into commodity markets, as investors were retracting from the falling real estate and stock markets and diverting funds to oil futures (Amadeo, 2019).

Table 3. Subgroups of Industry Sectors used for Fixed Effects

	(1) Subgroup based on industrial similarity	(2) Subgroup based on K/L ratio	(3) Subgroup based on K/L ratio, with "Coal, oil, & gas" separately[6]
1	-Food & Beverages -Paper, printing & packaging -Textiles -Wood products	-Paper, printing & packaging -Plastics & Rubber -Textiles -Wood products	-Paper, printing & packaging -Plastics & Rubber -Textiles -Wood products
2	-Ceramics & glass & minerals -Chemicals -Coal, oil & gas -Metals -Plastics & Rubber	-Chemicals -Food & Beverages	-Chemicals -Food & Beverages
3	-Automotive components & OEM -Engines & turbines & Industrial equipment -Non-automotive transport OEM & Space & defense & Aerospace	-Automotive components & OEM -Engines & turbines & Industrial equipment -Non-automotive transport OEM & Space & defense & Aerospace	-Automotive components & OEM -Engines & turbines & Industrial equipment -Non-automotive transport OEM & Space & defense & Aerospace
4	-Business machines & equipment -Communications & Consumer electronics -Electronic components -Medical devices	-Business machines & equipment -Communications & Consumer electronics -Electronic components -Medical devices	-Business machines & equipment -Communications & Consumer electronics -Electronic components -Medical devices
5		-Ceramics & glass & minerals -Metals -Coal, oil & gas	-Ceramics & glass & minerals -Metals
6			-Coal, oil & gas

In our second analysis, we interact manufacturing FDI with the industry subgroups (2) and (3) in two separate models to look at how the effect of manufacturing FDI on manufacturing employment differ by industry subgroups:

$$\ln(ManEmp_{i,c,y}) = \beta_0 + \beta_1 \ln(ManFDI_{i,c,y} + 1) * Subgroup\_N^{7} + \beta_x X_{c,y} + \gamma_{subgroup\_N} + \delta_c + \theta_y + \mu\delta_c * \theta_y + \varepsilon_{i,c,y} \quad (5)$$

[6] The "Coal, oil & gas" industry was not included in Diao et al. (2021)'s paper, and thus we try two methods: we include it in the 5th subgroup in (2) based on industrial similarity, and separate it as an individual subgroup in (3).
[7] Subgroup_N refers to subgroup (2) and (3)

4. Empirical Results

The results for our first analysis are shown in Table 4.

Table 4. Effect of Manufacturing FDI on Manufacturing Employment

	(1) Ln(Man Emp)	(2) Ln(Man Emp)	(3) Ln(Man Emp)	(4) Ln(Man Emp)
Ln(Man FDI)	0.0389***	0.0298***	0.0266***	0.0181*
	(0.00426)	(0.00493)	(0.00526)	(0.00879)
Ln(GDPPC)	1.830***	1.663***	1.286***	0.511
	(0.272)	(0.262)	(0.324)	(0.551)
Trade Openness	0.00106	-0.00663**	-0.00610**	-0.00688*
	(0.00168)	(0.00290)	(0.00276)	(0.00390)
Corruption	0.0349***	0.0981***	0.0618**	0.00602
	(0.0949)	(0.222)	(0.248)	(0.279)
Infrastructure Index	0.0257***	-0.0320	-0.0144	0.00607
	(0.00637)	(0.0193)	(0.0186)	(0.0207)
Education Exp/Total Exp	-0.0106***	-0.0324***	-0.0259***	-0.0185**
	(0.00245)	(0.00731)	(0.00702)	(0.00787)
Observations	1,072	1,072	1,072	1,072
Number of countries	15	15	15	15
R-squared	0.562	0.545	0.571	0.668

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model (1), which is our base model, includes industry subgroup fixed effects that are based on industrial similarity (subgroup (1) from Table 3). The results mainly show the expected signs with statistically significant coefficients. In particular, a 1% increase in manufacturing FDI leads to a 0.039% increase in manufacturing employment at the industry sector level in a given year. A 1% increase in GDP per capita leads to a 1.83% increase in manufacturing employment of an industry sector, of which the magnitude may reflect the potential for a large job growth that could follow economic growth in SSA countries. One unit of less corruption—from an index of 0~100—leads to a 3.49% increase in manufacturing employment of an industry sector, which is a large magnitude and may indicate the crucial role of an uncorrupt government in SSA countries

for economies to develop. Corruption in SSA countries is perceived as one of the main problems that is preventing the countries from escaping long ridden and widely spread poverty issues, and our result highlights how governmental corruption can be detrimental to job creation in particular. Our results also show that one unit of better infrastructure—from an index ranging from 0~100—leads to 2.57% increase in manufacturing employment of an industry sector. This implies how businesses and industries would likely locate and create jobs in places with a stable infrastructure base; it could also imply the convenience it provides for people who are looking for jobs. Trade openness is not significant in the first model, but shows a negative effect on employment in subsequent models, with approximately 0.6% decrease in employment when exports and imports as a % of GDP increase by one percent. While trade openness is generally known to positively affect employment, this negative effect may have been caused by an increase in imports, which can have a negative effect on employment in developing countries by eliminating jobs that could have been generated if production happened locally. Raj and Sasidharan (2015)'s study shows how import penetration had a detrimental effect on employment generation in India, while they saw little evidence of export orientation's effect on employment. This is especially pertinent to our study, as the average import to export ratio as % of GDP in the countries included in our sample is 1.66.[8]

Education expenditure as a percentage of total expenditure, which was proxied for education levels, shows a negative effect on employment; 1% increase in education expenditure as a percentage of total expenditure leads to a 1.06% decrease in employment in the first model. The results may seem contrary to the general expectation, but there are several factors that may help explain it. Majgaard and Mingat (2012) observe that the rapid expansion of higher

[8] The average ratios of each country is listed in Table B of Appendix.

education in SSA with only moderate growth in formal sector employment opportunities has led to large unemployment numbers among graduates in low-income SSA countries, which suggests a skills mismatch and over-enrollment in post-basic education. The authors indicate that almost 80% of workers who attended higher education in the past currently work in the formal sector, but the younger generation with similar education educational backgrounds are now —at the time of their report—less likely to find a job in the formal sector than in the past. This implies that the problem with employment in SSA is not necessarily due to lack of education, but the unavailability of formal sector job opportunities that can absorb the increasing number of people who are graduating from higher education. Thus, our negative result may imply this mismatch of skills and job availability, and that due to the current lack in job creation, more spending on education does not necessarily lead to increase in employment. This also re-emphasizes the main implications of this paper: the critical need for foreign direct investment to create formal sector jobs and fill this gap.

Another factor that may have led to the negative coefficient for our education measure relates to the indicator that we use to proxy for education: education expenditure as percentage of total government expenditure. Majgaard and Mingat (2012) observe that low-income SSA countries allocate the largest share of government expenditure to education—compared to middle and high-income SSA countries—due to their small formal sector and consequently low tax base. This means that some of the differing magnitudes of our indicator may have merely reflected this dynamic, and not necessarily the comparable level of investment in education. Essentially, the negative coefficient for education may be reflecting the fact that low-income SSA countries that allocate the largest share of government expenditure to education generally have lower employment numbers.

Next, Model (2) which uses subgroup (2) industry fixed effects, Model (3) which uses subgroup (3) industry fixed effects, and Model (4) which uses individual sector fixed effects, all show similar results; however, the magnitudes differ, and trade openness and infrastructure change signs or turn insignificant in some of the models. The results are larger in magnitude and more statistically significant in Models (1)~(3) than in Model (4); the effect of manufacturing FDI on manufacturing employment especially shows a consistently gradual decrease in subsequent models. This may be due to a couple of reasons with regards to the different types of industry fixed effects included in each model. The unobserved and time-invariant industry sector level factors may include the following: K/L ratio, different skills or education needed for the work, different technology or resources used in the industry, different business practices or culture, different labor productivity levels, and so on. The subgroup industry fixed effects would control for these factors at the subgroup level (models (1)~(3)), while model (4) is controlling for them at the individual sector level. In this regard, the greater magnitudes of manufacturing FDI's effect on manufacturing employment in models (1)~(3) may reflect indirect employment created through spillover effects among similar industries, as we are controlling for industry factors—different skills, knowledge, technology etc.—at the subgroup level that are based on industrial similarity—or similar K/L ratios, but the categorization mostly overlap—and not at the individual sector level that may negate the spillover effects. This implication is also based on the fact that knowledge or technology spillovers happen more easily among sectors in similar industries.

Another reason the magnitudes of the effects are greater and more significant in the models including industry subgroup fixed effects with a smaller number of subgroups may be due to the less stringent control as opposed to the "excessive" control that comes from individual

sector fixed effects. A large portion of the data points of manufacturing FDI inflows into SSA countries disaggregated into 16 industry sectors are "0"s, providing us less data points to clearly observe causal relationships—while the dependent variable is total manufacturing employment by the same industry sectors—, and thus less stringently controlling for industry sector level factors would relax this limitation, and provide perhaps more relevant results.

Table 5-1. Effect of Manufacturing FDI on Manufacturing Employment by Industry Subgroup (2)

	Ln(Man Emp)	Standard Error
Ln(Man FDI)	-0.00753	(0.0191)
2nd group	0.576*	(0.323)
3rd group	-2.626***	(0.405)
4th group	-2.742***	(0.358)
5th group	-0.757***	(0.171)
2nd group*Ln(Man FDI)	0.00264	(0.0241)
3rd group *Ln(Man FDI)	0.0913**	(0.0340)
4th group *Ln(Man FDI)	0.0573*	(0.0292)
5th group *Ln(Man FDI)	0.0433**	(0.0202)
Ln(GDPPC)	2.407***	(0.703)
Trade Openness	-0.0175**	(0.00616)
Corruption	0.1089***	(0.279)
Infrastructure	-0.0826***	(0.0264)
Education Exp/Total Exp	-0.0495***	(0.00913)
Observations	1,072	
Number of countries	15	
R-squared	0.563	

Table 5-2. Effect of Manufacturing FDI on Manufacturing Employment by Industry Subgroup (3)

	Ln(Man Emp)	Standard Error
Ln(Man FDI)	-0.0101	(0.0204)
2nd group	0.589*	(0.323)
3rd group	-2.643***	(0.401)
4th group	-2.789***	(0.368)
5th group	-0.477**	(0.179)
6th group	-1.819***	(0.459)
2nd group *Ln(Man FDI)	0.00205	(0.0241)
3rd group *Ln (Man FDI)	0.0922**	(0.0340)
4th group *Ln(Man FDI)	0.0590*	(0.0302)
5th group *Ln(Man FDI)	0.0455**	(0.0207)
6th group *Ln(Man FDI)	0.00816	(0.0377)
Ln(GDPPC)	1.392	(0.934)
Trade Openness	-0.0181**	(0.00616)
Corruption	0.0638**	(0.237)
Infrastructure	-0.0679**	(0.0242)
Education Exp/Total Exp	-0.0447***	(0.00843)
Observations	1,072	
Number of countries	15	
R-squared	0.590	

In our second analysis, we look at how the effect of manufacturing FDI on manufacturing employment differs by industry subgroups by interacting manufacturing FDI with subgroups (2) and (3). Table 5-1 shows the results of interacting manufacturing FDI with subgroup (2), and Table 5-2 shows the results of interacting with subgroup (3). In both cases, manufacturing FDI has the greatest effect on manufacturing employment when interacted with the 3rd group of industry sectors, which includes automotive/transport and industrial equipment related industries; a 1% increase in manufacturing FDI leads to a 0.084% (0.0913-0.00753) or 0.082% (0.0922-0.0101) increase in manufacturing employment for these industry sectors.[9] The next largest

[9] By taking a derivative with manufacturing FDI, the equation becomes: -0.00753 + 0.00264*2nd group + 0.0913*3rd group + 0.0573*4th group + 0.0433*5th group, in the case of Table 5-1. To look at the effect of

effect is with the 4th group of industry sectors, which includes business machines, consumer electronics, and medical devices related industries; a 1% increase in manufacturing FDI leads to a 0.05% (0.0573-0.00753) or 0.049% (0.0590-0.0101) increase in manufacturing employment. The 5th group of industry sectors comes next, which includes ceramics, metal, glass and minerals (and also coal, oil, and gas in subgroup (2)); a 1% increase in manufacturing FDI leads to a 0.04% (0.0433-0.00753) or 0.035% (0.0455-0.0101) increase in manufacturing employment. The 1st group–plastics and rubber, textiles, wood products related industries—and 2nd group—chemicals, food and beverages— of industry sectors either show a much smaller negative or positive effect but are insignificant. The control variables are mostly significant and show the same signs as in our main model, except for infrastructure that has flipped to a negative effect, for which we cannot find a probable explanation, but the interactions with the groups of industry sectors may have mixed up the effects.

In summary, the results show that automotive/transport and industrial equipment related industries create the most jobs, next is the business machines, consumer electronics, and medical devices related industries, and lastly the ceramics, metal, glass & minerals, and coal, oil, & gas industries. In addition to direct employment creation, the results also reflect indirect employment creation through potential forward and backward linkages and technology or knowledge spillover effects that happen among industries in the same subgroups, which may also include local economic agents. Forward and backward linkages can happen, for example, among automotive components industries and OEM industries in the 3rd group, by stimulating the development of each other as part of being in different stages of the value chain. Technology or

manufacturing FDI by sector, we substitute 1 and 0 appropriately into the group dummy variables. The same is applied with Table 5-2.

knowledge spillovers can happen among industries that use similar technology or knowledge, for example, among automotive components, automotive OEM, engines & turbines, and industrial equipment industries in the 3rd group. This applies the same in the other groups.

The indirect employment effects are evident when we compare the results with the 1st analysis. The results of the 1st analysis showed that a 1% increase in manufacturing FDI leads to a 0.039% increase in manufacturing employment (main model) at the industry sector level, which represents the average across industries. Comparing this with the results of the 2nd analysis, which show 0.091%, 0.057%, and 0.043% increase in manufacturing employment for the 3rd, 4th, and 5th industry subgroups, respectively, we can observe the greater magnitudes in the 2nd analysis that reflect the additional indirect employment effects through spillovers and linkages. Also, we observe that the 1st and 2nd groups do not show significant results, despite the fact that they have smaller K/L ratios than the rest (the K/L ratios gradually increase across the groups, with the 1st group having the smallest). This may be due to the fact that the indirect effects from spillovers and forward and backward linkages in these industries are not strong enough to show overall significant employment effects.

5. Robustness Check

Table 6, 7-1, and 7-2 show the results of using lagged Ln(GDPPC) instead of Ln(GDPPC), to account for potential multicollinearity between manufacturing FDI and GDP per capita. The results for the main effects in both the 1st and 2nd analyses are exactly the same, while there are some variations in the estimated coefficients of the control variables.

Table 6. Robustness Check with Lagged Ln(GDPCC)

	(1) Ln(Man Emp)	(2) Ln(Man Emp)	(3) Ln(Man Emp)	(4) Ln(Man Emp)
Ln(Man FDI)	0.0389***	0.0298***	0.0266***	0.0181*
	(0.00426)	(0.00493)	(0.00526)	(0.00879)
Ln(GDPPC)	1.965***	1.786***	1.381***	0.548
	(0.292)	(0.281)	(0.348)	(0.592)
Trade Openness	0.00110	-0.00659**	-0.00606**	-0.00687
	(0.00169)	(0.00290)	(0.00276)	(0.00391)
Corruption	0.431***	1.055***	0.675**	0.0830
	(0.104)	(0.224)	(0.254)	(0.293)
Infrastructure Index	0.0267***	-0.0311	-0.0138	0.00633
	(0.00644)	(0.0194)	(0.0186)	(0.0208)
Education Exp/Total Exp	0.000830	-0.0220**	-0.0179**	-0.0153
	(0.00367)	(0.00802)	(0.00754)	(0.00956)
Observations	1,072	1,072	1,072	1,072
Number of countries	15	15	15	15
R-squared	0.562	0.545	0.571	0.668

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7-1. Robustness Check with Lagged Ln(GDPPC)

	Ln(Man Emp)	Standard Error
Ln(Man FDI)	-0.00753	(0.0191)
2nd group *Ln(Man FDI)	0.00264	(0.0241)
3rd group *Ln (Man FDI)	0.0913**	(0.0340)
4th group *Ln(Man FDI)	0.0573*	(0.0292)
5th group *Ln(Man FDI)	0.0433**	(0.0202)
Ln(GDPPC)	2.586***	(0.756)
Trade Openness	-0.0175**	(0.00616)
Corruption	1.196***	(0.299)
Infrastructure	-0.0814***	(0.0263)
Education Exp/Total Exp	-0.0345***	(0.00851)
Observations	1,072	
Number of countries	15	
R-squared	0.563	

Table 7-2. Robustness Check with Lagged Ln(GDPPC)

	Ln(Man Emp)	Standard Error
Ln(Man FDI)	-0.0101	(0.0204)
2nd group *Ln(Man FDI)	0.00205	(0.0241)
3rd group *Ln (Man FDI)	0.0922**	(0.0340)
4th group *Ln(Man FDI)	0.0590*	(0.0302)
5th group *Ln(Man FDI)	0.0455**	(0.0207)
6th group *Ln(Man FDI)	0.00816	(0.0377)
Ln(GDPPC)	1.496	(1.003)
Trade Openness	-0.0181**	(0.00616)
Corruption	0.700**	(0.248)
Infrastructure	-0.0671**	(0.0241)
Education Exp/Total Exp	-0.0360***	(0.0100)
Observations	1,072	
Number of countries	15	
R-squared	0.590	

Table 8, 9-1, and 9-2 show the results of using import as % of GDP instead of trade openness (defined as the total of import and export as % of GDP), as imports have been previously found to have a negative effect on employment and economic development of developing countries (Raj and Sasidharan, 2015; Onakoya et al., 2019). For the 1st analysis (Table 8), the results are mostly similar to the main results; the coefficients of manufacturing FDI and GDP per capita stay closely similar to the main result across all models. The results for corruption, infrastructure, and education also stay similar, while import has a negative effect across all models though it is insignificant. In the 2nd analysis (Table 9-1 and 9-2), the results again stay similar to the main results, while there are some variations in the magnitudes and significancy of the interaction terms—the interaction of manufacturing FDI with the 3rd group and 5th group show similar effects, while the interaction with the 4th group turns insignificant. The control variables all show similar results, while import shows a negative but insignificant effect.

Table 8. Robustness Check with Import

	(1) Ln(Man Emp)	(2) Ln(Man Emp)	(3) Ln(Man Emp)	(4) Ln(Man Emp)
Ln(Man FDI)	0.0365***	0.0276***	0.0244***	0.0172*
	(0.00553)	(0.00661)	(0.00695)	(0.00908)
Ln(GDPPC)	1.686***	1.757***	1.366***	0.635
	(0.272)	(0.272)	(0.333)	(0.471)
Import	-0.00576	-0.00773	-0.00731	-0.00254
	(0.00525)	(0.00507)	(0.00553)	(0.00416)
Corruption	0.271*	0.858***	0.501*	-0.0425
	(0.128)	(0.259)	(0.269)	(0.296)
Infrastructure Index	0.0248***	-0.0218	-0.00504	0.0180
	(0.00486)	(0.0188)	(0.0179)	(0.0177)
Education Exp/Total Exp	-0.0126***	-0.0318***	-0.0254***	-0.0157**
	(0.00287)	(0.00744)	(0.00743)	(0.00717)
Observations	1,086	1,086	1,086	1,086
Number of countries	15	15	15	15
R-squared	0.574	0.560	0.585	0.669

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9-1. Robustness Check with Import

	Ln(Man Emp)	Standard Error
Ln(Man FDI)	-0.0116	(0.0192)
2nd group *Ln(Man FDI)	0.0113	(0.0223)
3rd group *Ln (Man FDI)	0.0904**	(0.0326)
4th group *Ln(Man FDI)	0.0471	(0.0510)
5th group *Ln(Man FDI)	0.0477**	(0.0220)
Ln(GDPPC)	2.533*	(1.290)
Import	-0.00718	(0.00502)
Corruption	0.917**	(0.324)
Infrastructure	-0.0554*	(0.0269)
Education Exp/Total Exp	-0.0442***	(0.00938)
Observations	1,086	
Number of countries	15	
R-squared	0.575	

Table 9-2. Robustness Check with Import

	Ln(Man Emp)	Standard Error
Ln(Man FDI)	-0.0139	(0.0202)
2nd group *Ln(Man FDI)	0.0108	(0.0223)
3rd group *Ln (Man FDI)	0.0915**	(0.0331)
4th group *Ln(Man FDI)	0.0489	(0.0512)
5th group *Ln(Man FDI)	0.0478*	(0.0232)
6th group *Ln(Man FDI)	0.0167	(0.0360)
Ln(GDPPC)	1.617	(1.414)
Import	-0.00646	(0.00566)
Corruption	0.480*	(0.272)
Infrastructure	-0.0395	(0.0250)
Education Exp/Total Exp	-0.0387***	(0.00883)
Observations	1,086	
Number of countries	15	
R-squared	0.601	

6. Conclusion

The struggles of SSA's labor market have shown to be difficult to tackle, being a multifaceted problem, in terms of economic, political, and other societal aspects. More than ever, their economies are currently at a critical juncture, as the patterns that have led to large proportions of working poverty, informal and vulnerable employment are expected to persist, while the working-age population in the region is expected to increase 20 million per year over the next two decades. The results of our study indicate that attracting manufacturing FDI to the countries can be a key component of overcoming the difficulties.

The results from our first analysis show that manufacturing FDI has a positive and significant effect on manufacturing employment at the industry sector level in SSA countries. When we compare the results of the four models with different industry level fixed effects, there is evidence of potential spillover effects among similar industrial sectors that lead to additional indirect employment creation. The results from our second analysis show that the level of

manufacturing employment created by manufacturing FDI varies by industry groups; specifically, the automotive/transport and industrial equipment related industries create the most employment, followed by the business machines, consumer electronics related industries, and lastly the ceramics, metal, and glass and minerals related industries. The results also reflect indirect employment created through technology/knowledge/skill spillover effects and forward and backward linkages in the industry groups, in addition to the direct employment effects. This is especially evident when we compare the results with the first analysis; the effects in the second analysis, which show the average effect of manufacturing FDI on manufacturing employment in a particular group of industry sectors, are larger than in the first analysis, which show the average effect of manufacturing FDI on manufacturing employment of one sector. The differences in the magnitudes reflect indirect employment effects.

In conclusion, the results show that SSA countries would benefit from increased manufacturing FDI inflows for employment creation. In addition, the results provide evidence of indirect employment effects associated with spillover effects and forward and backward linkages. From a policy perspective, SSA countries could experience significant increase in employment by promoting projects and initiating policies that attract manufacturing FDI into their countries, preferably in the industry groups that are shown to create the most employment, as shown in our 2nd analysis. The positive effect of manufacturing FDI on manufacturing employment imply that it will contribute to not only increasing (formal) employment, but also industrial diversification/structural transformation that is currently critically needed in SSA countries.

The methodology and data used in this paper did not allow for us to look at the indirect employment effects through forward and backward linkages and spillovers effects that may

happen with non-manufacturing industries, such as those included in the agriculture or service sectors. Future studies could incorporate data and methods that can study this, as the effects can be extensive. For example, there is a huge potential for development of the food industry in Africa, when the agriculture sector can be incorporated with appropriate manufacturing developments and innovations in the value chain.

Appendix

Table A-1. Matching industry sectors from fDi Markets and Diao et al. (2021)

Industry sector categorization	fDi Markets	Diao et al. (2021)
1	Textiles	Apparel; Textiles; Leather
2	Wood products	Wood; Furniture
3	Plastics & Rubber	Rubber & plastics
4	Food & Beverages	Food products; Beverages
5	Chemicals	Chemicals
6	Paper, printing & packaging	Paper; Printing
7	Metals	Basic metals; Fabricated metal products
8	Engines & turbines & Industrial equipment; Automotive components & OEM; Non-automotive transport OEM & Space & defense & Aerospace	Vehicles
9	Communications & Consumer electronics; Electronic components; Business machines & equipment; Medical devices	Computer, electronic, & optical
10	Ceramics & glass & minerals	Non-metallic minerals

Table A-2. K/L ratio averages from Diao et al. (2012)

Group	Industry sectors	K/L ratio
1	Textiles	17.2850
	Wood products	21.9989
	Plastics & Rubber	24.8186
	Paper, printing & packaging	26.4955
2	Chemicals	28.2835
	Food & Beverages	44.1390
3	Engines & turbines & Industrial equipment; Automotive components & OEM; Non-automotive transport OEM & Space & defense & Aerospace	52.7282
4	Communications & Consumer electronics; Electronic components; Business machines & equipment; Medical devices	64.8580
5	Metals	88.0679
	Ceramics & glass & minerals	97.7826
6	Coal, oil & gas	

*Industry sector "coal, oil & gas" was not available in the Diao et al. (2021) paper.

Table B. Import to Export Ratios of Countries in Sample

	Import to Export Ratio
Botswana	0.9718
Burundi	3.9526
Cameroon	1.1666
Cape Verde	1.6649
Eswatini	1.0883
Ethiopia	2.6894
Gambia	1.6140
Ghana	1.4148
Kenya	1.5651
Madagascar	1.4083
Malawi	1.5090
Mauritius	1.1913
Niger	1.9369
Senegal	1.6592
South Africa	1.0083
Total Average	1.6560

*The ratios were calculated as the average of the ratios between 2003 and 2018 in each country, calculated as $\frac{\text{Import as \% of GDP}}{\text{Export as \% of GDP}}$

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