Trade and Value Chain Participation: Domestic Firms and FDI Spillovers in Africa

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and
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Bringing Rigour and Evidence to Economic Policy Making in Africa

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List of abbreviations and acronyms

DVX	Domestic Value-Added Exports
FDI	Foreign Direct Investment
FVA	Foreign Value-Added
GVCs	Global Value Chains
NAICS	North American Industry Classification System
UNCTAD	United Nations Conference on Trade and Development
WBES	World Bank Enterprise Surveys

Abstract

Data on the location of foreign direct investment (FDI) projects within and across African nations are combined with firm-level survey data and information on sectoral input-output relationships to assess what types of FDI are more likely to influence participation in global value chains (GVCs), and to investigate the relationship between FDI and the performance of proximate domestic firms. Firm-level analysis finds evidence of vertical spillovers from exposure to FDI, mainly in the manufacturing sector: domestic firms located near FDI projects that offer potential supply or demand linkages are more likely to engage in trade through imports or exports. Proximity to FDI projects in the same sector (horizontal linkage) is less likely to affect trade or GVC performance of domestic firms. Both vertical and horizontal FDI linkages are associated with higher labour productivity and other dimensions of performance.

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1. Introduction

In developing countries, foreign direct investment (FDI) is an important source of development finance and contributes to domestic employment, capital formation, and diffusion of external knowledge to the local economy. FDI is also a vehicle for domestic firms to join global value chains (GVCs), given that multinational corporations that engage in FDI also are at the core of many global production networks. Investment promotion policies increasingly aim to attract FDI projects that create quality jobs, foster local linkages, and facilitate access to global markets (Alfaro & Charlton, 2013; World Bank, 2020).[1] A key motivation underlying such policies is that FDI may give rise to a mix of vertical and horizontal spillover effects on domestic firms (Aitken & Harrison, 1999; Javorcik, 2004; Farole & Winkler, 2014). The incidence and magnitude of FDI spillover effects operate through a range of different channels, each of which may be influenced by the business environment, macroeconomic conditions, political and governance variables, and differences in managerial ability, access to finance and absorptive capacity of firms, among other factors.[2]

Domestic firms may integrate into GVCs by becoming suppliers to or buying from foreign affiliates. Internationalization may also occur through indirect channels involving learning and mobility of workers. By investing abroad, foreign multinationals expose local firms and workers to new technologies and know-how, as well as to competition, all of which may drive productivity improvements, reduce market shares of less competitive firms or induce exit by uncompetitive domestic firms. Joining the supply chain of foreign investors can generate large benefits for local suppliers (e.g., Newman et al., 2015, on Vietnam) that may persist over time (e.g., Alfaro-Urena et al., 2021, on Costa Rica). Domestic firms that are not linked to GVCs or foreign firms may also benefit, for example if they share suppliers (e.g., Kee, 2015, on Bangladesh). Competition from foreign investors may pressure domestic firms to become more productive, indirectly affecting their capacity to globalize (Fons-Rosen et al., 2017).

Empirical analysis that is granular enough to account for the heterogeneous features of FDI projects that may influence their potential to generate spillovers has been limited in the African context. Only a handful of studies provide evidence on the consequences of domestic firms' exposure to FDI. Most of the literature focuses on horizontal, intra-industry effects. In an analysis of Zambian manufacturing firms, Bwalya (2006) finds no support for horizontal productivity FDI spillovers. Waldkirch and Ofosu (2010) find that, FDI has a negative association with average total factor

productivity of a sample of domestic competing firms in the manufacturing sector. Also focusing on horizontal spillovers, a firm level analysis of FDI spillovers by Demena and van Bergeijk (2019) finds evidence for competition spillover effects, but not for learning and mobility spillover effects. Demena and Murshed (2018) use firm-level surveys for eight sub-Saharan Africa countries over the period 2006–2014, finding evidence for demonstration (learning) spillovers, but not for labour mobility-related technology diffusion or competition effects. Similarly, using an ad hoc survey on a cross-section of African countries, Sanfilippo and Seric (2016) find evidence of agglomeration spillovers when foreign firms co-locate in the same cities as domestic firms. Abebe et al. (2021) in contrast find that the entry of large scale FDI in manufacturing activities in Ethiopia has pro-competitive effects on domestic incumbents.

Evidence on vertical spillovers is even more limited. Bwalya (2006) is an exception, finding evidence for vertical spillovers from FDI on Zambian firms in the manufacturing sector. Newman et al. (2020) use survey data to investigate the prevalence of backward and forward vertical linkages associated with FDI and conclude these are rare in Africa[3], but argue that, conditional on establishing a linkage, spillovers and technology transfers are likely to be strong.

A feature of the literature on FDI spillovers in Africa is that it has not focused on the location of FDI within countries. We do so in this paper, using granular geolocation information to investigate the potential linkages between FDI, GVC participation, and domestic firm performance in Africa. We use finely disaggregated data that permit more robust assessment of the consequences of FDI projects conditional on their sector of operation and potential complementarities with the activities of domestic firms. Granular information on the specific activity undertaken by foreign investors (FDI projects), be it production of different types of goods or intangible (service) activities, helps to determine the potential for FDI to give rise to vertical linkages as well within-sector competition spillovers and knowledge diffusion. Specifically, we combine project-level information on FDI from fDiMarkets with firm-level data from the World Bank Enterprise Surveys (WBES) for all African countries for which survey data are available for the period 2006–2020. We link each firm in the WBES data set to FDI projects based on their geographic coordinates. Following the extant literature on FDI spillovers, we also link FDI to domestic firms using sectoral information, distinguishing whether foreign investors and domestic firms are linked horizontally, i.e., operate in the same industry and thus potentially compete with each other, or vertically, i.e., the FDI projects produce outputs that can be used as inputs by domestic firms or use inputs produced by domestic firms and thus could be sourced locally. The latter information is obtained from (national) input-output (I/O) tables made available by Eora.[4]

Given that exposure to FDI is likely to be non-random, we employ an identification strategy that exploits the spatial and temporal features of the FDI project and enterprise survey data. We do so by comparing the performance of domestic firms that are located in relative proximity to FDI projects—geographically (in space), in time (based on date of the survey), and economically, as reflected in sectoral input-output linkages—with that of firms in locations where FDI will occur in years subsequent to the

period in which the survey data were collected. The resulting difference-in-difference provides us with coefficient estimates that help control for possible selection effects.

The empirical results suggest that the relationship between FDI, GVC participation, and domestic firm performance is multifaceted. Using aggregate sectoral (I/O) data to characterize forward and backward participation in GVCs, FDI tends to replace GVC-related trade, especially in terms of backward participation. If anything, countries (and sectors) receiving more FDI projects are more likely to become part of GVCs in terms of forward linkages, i.e., by importing more intermediate goods. The firm-level analysis is partly in line with these aggregate findings on the relationship between FDI and GVC participation, but provides a richer picture of the heterogeneity across potential FDI spillover channels. When measuring how domestic firm performance changes following exposure to FDI projects, we find that firms that potentially have vertical linkages with proximate FDI projects are more likely to participate in trade, and that this is likely to happen only for manufacturing firms. Conversely, firms exposed to FDI projects that are in their sector of activity are less likely to be affected in terms of their involvement in GVCs.

The remainder of this paper proceeds as follows. Section 2 presents the data sources. Section 3 describes the methodology used to guide the empirical analysis and the identification strategy. Section 4 reports the main results, as well as several robustness tests. Section 5 concludes the study.

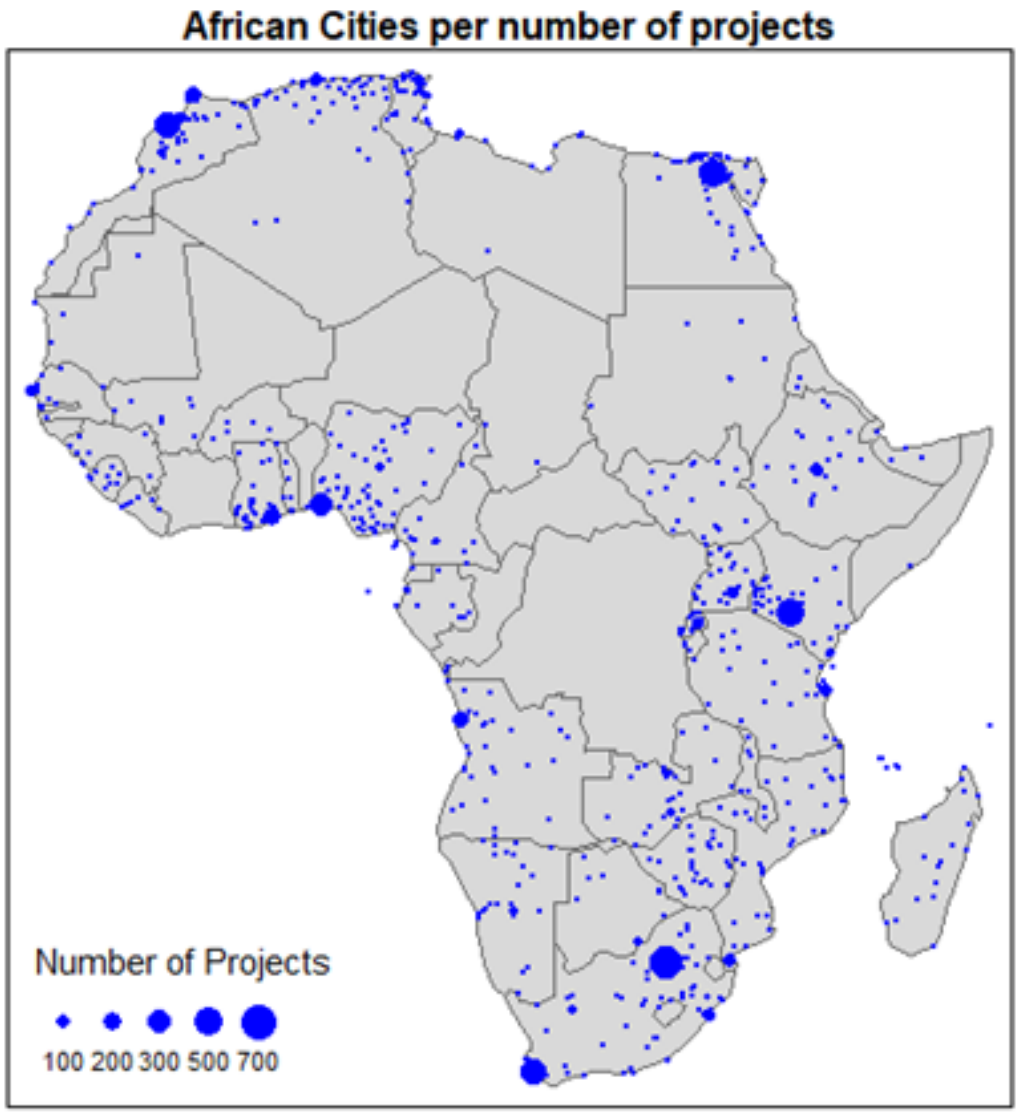
2. Data

The analysis is based on project-level data from ***fDiMarkets***,[5] a proprietary database that provides information on the distribution of Greenfield FDI. These data are gathered from various sources, including news media and investment promotion agencies. They include information on the location of each FDI project, the name of the investor, the country of origin, the size of the project,[6] as well as the sector (corresponding to the North American Industry Classification System (NAICS) 2007 classification) and activity performed by a foreign affiliate in the host country. The latter includes, among others, production, sales, business services, ICT services, extraction, construction, and logistics services.

Information on 11,478 projects located across Africa was collected for the period 2003–2020. During this period, South Africa, Egypt, and Morocco were the top three recipients of FDI (see Table A1 in the appendix) and the US, UK, and France the top three sources (Table A2 in the appendix). Many of the FDI projects involve services activities: financial, business, and communications sectors together account for almost 30% of the total (Table A3 in the appendix). Business services, production and sales are the most frequently observed activities (over 60% of projects).

Each FDI project for which information on location (city, province or region) is available was geocoded. This was possible for 82% of all projects.[7] The geographic distribution of the number of resulting FDI projects across Africa is plotted in Figure 1. The sectoral composition of these projects is plotted in Figure 2. Both graphs show a wide geographic spread of FDI projects during the period considered, and the prevalence of services activities in major urban areas.

Figure 1: FDI projects by number



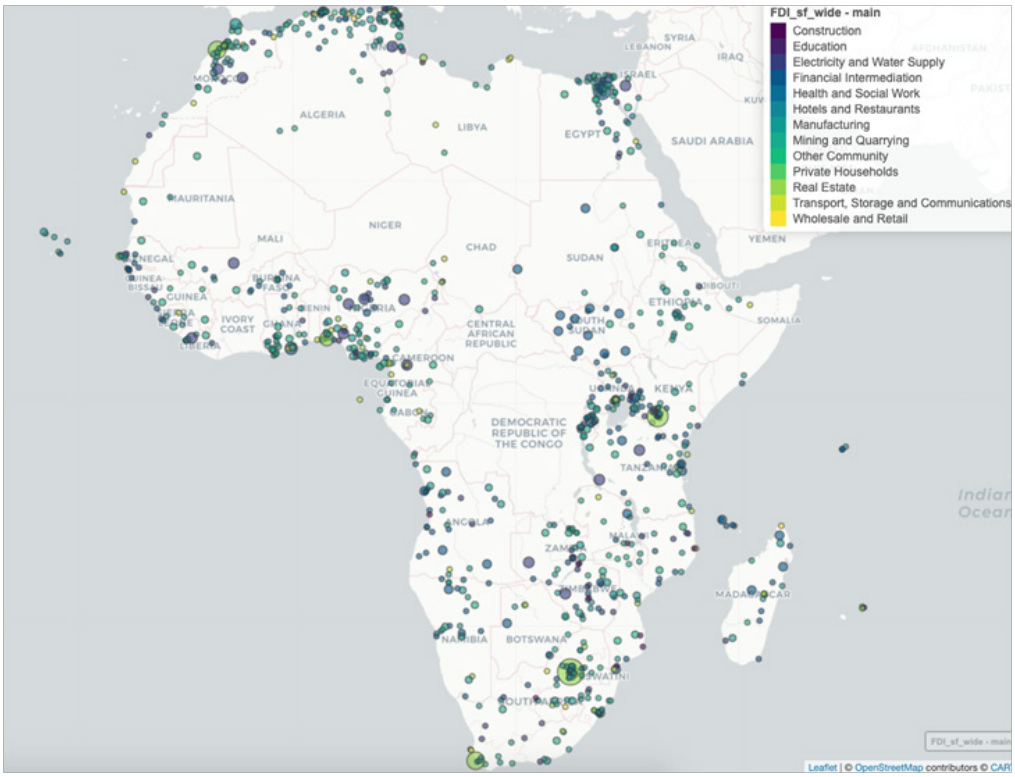
Source: Authors' own construction based on fDiMarkets data.

Firm-level data are obtained from the ***World Bank Enterprise Surveys***. This provides nationally representative firm-level information for many countries, including in Africa.[8] For the analysis, we use a harmonized version of the data set that provides standardized variables for the surveys run from 2006 to 2020. The resulting data set spans 46,145 firms in 48 African countries. Table A4 (in the appendix) lists the African countries covered during this time span, along with the number of firms included in each survey wave.

The WBES data sets include many variables that can be used to measure correlates of exposure to FDI by domestic firms. Along with standard measures of

firm performance, WBES includes indicators that can be used to measure the degree of a firm's involvement in international production and variables associated with GVC participation. On the latter dimension, we follow the literature and consider use of a dummy variable approach to classifying firms as: (1) exporters, including those involved in indirect exports (sales to another firm that exports); (2) importers of intermediate goods; and (3) GVC participants, if the firm both exports and imports at the same time (Van Biesebroeck & Mensah, 2019). The WBES reports information on the location of respondent firms, which is available up to the city level. As mentioned and discussed in more detail in Section 3, this information was geocoded and the location of each firm observed in WBES matched with that of each FDI project reported in fDiMarkets.

Figure 2: FDI projects by location and main sector



Source: Authors' own construction based on fDiMarkets data.

Finally, FDI and firm-level data are complemented by information on sectoral input-output linkages from the multi-region ***Eora database*** (Lenzen et al., 2013). These provide a descriptive snapshot of the relationship between FDI and GVC participation at the aggregate (country-sector) level, and are used to calculate the extent of backward and forward linkages across sectors on a country-by-country basis.

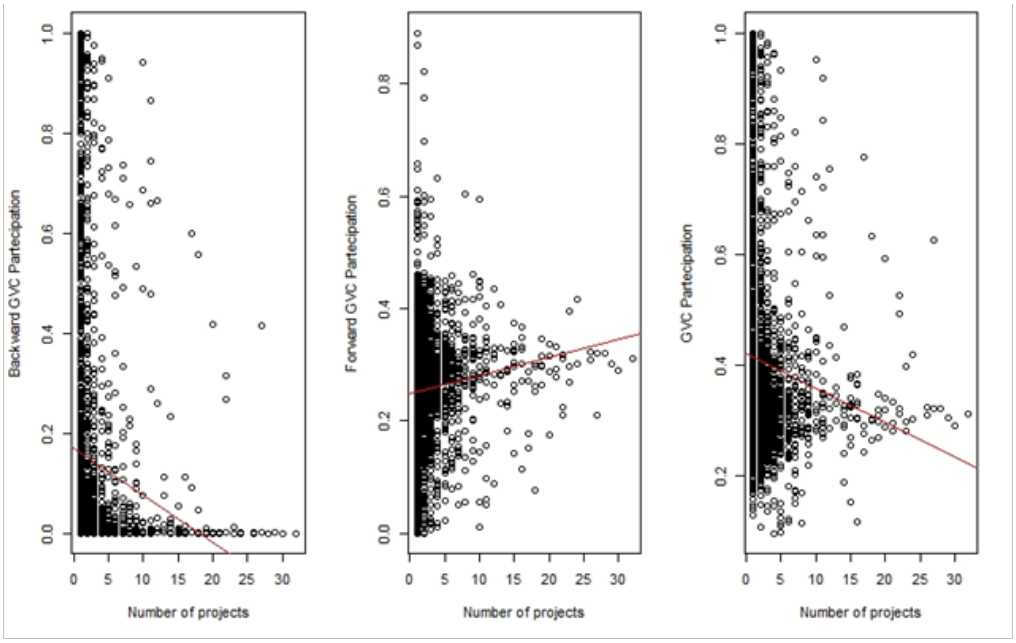
FDI and GVC participation: Sector level correlations

A first rough indication of the relationship between FDI and GVC participation can be obtained by using UNCTAD-Eora Global Value Chain Database, which provides data on foreign and domestic value-added in gross exports for most African economies for the period 1990–2018 (Casella et al., 2019).[9] For each of the sectors included in Eora, we construct the following three frequently used indicators:

- Backward GVC participation: FVA/Gross Exports.
- Forward GVC participation: DVX/Gross Exports.
- GVC participation: (DVX+FVA)/Gross Exports.

DVX and FVA are domestic and foreign value added in export, respectively. Backward participation accounts for each country's (and sector') specialization upstream, i.e., production of intermediates used by third countries in their exports (e.g., Kenya engages in backward participation when its exports of apparel use textiles produced in, say, Lesotho). Forward participation reflects specialization downstream, i.e., use of intermediates produced by other countries to manufacture final goods for exports (e.g., Lesotho engages in forward participation because its exports are used as intermediates by Kenya for the production of apparel that Kenya exports). All the indicators are computed at the country-sector pair level for each of the years for which the data are available.

Figure 3: Correlations between GVC indicators and FDI



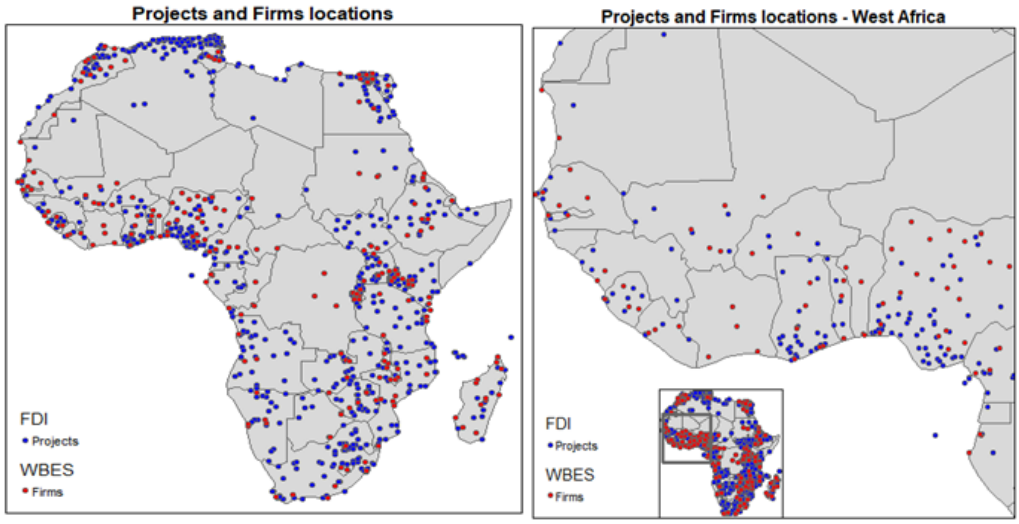
We correlate (unconditionally) these indicators with the number of FDI projects received by each corresponding country-sector pair. Figure 3 plots the results. Each dot in the graphs is a country-sector pair observed in any of the years considered (1998–2018).[10] The results point to a negative association between FDI and overall GVC participation (third panel). Underlying this is a positive relationship with forward participation that is more than offset by a negative relationship with backward linkages. Overall, this preliminary exercise is suggestive of the role of African countries as mostly relying on foreign inputs for their exports.

3. Empirical strategy: FDI, GVC participation, and I/O linkages

As noted, the empirical strategy revolves around determining the relationship between FDI, GVC participation, and the performance of domestic firms, using location and timing of FDI projects to identify potential spillover effects of FDI, using a measure of the potential salience of FDI projects as either suppliers of products used by domestic firms, or a source of demand for the output of local enterprises that are in proximity to FDI projects.

To assess firm-level spillovers of FDI, we exploit geo-localized information on each FDI project and match it to firm-level data from the WBES for all the African countries for which this is possible.[11] Figure 4 shows the outcome of this matching exercise.

Figure 4: Geographic location of WBES firms (red dots) and FDI projects (blue dots)



Source: Authors' elaboration on WBES and fDiMarkets data.

While agglomeration of domestic and foreign firms is frequent, the network of domestic firms is more geographically widespread than that of FDI projects.[12] Our empirical specification links exposure to FDI projects to firm-level indicators measuring (i) involvement in international production; and (ii) upgrading. More specifically, we are interested in understanding whether domestic firms that are sufficiently close to be exposed to FDI projects display differences in terms of the selected outcomes.

Proximity has two dimensions: (a) whether a firm operates in the geographic area in which FDI projects are located; and (b) the degree to which domestic firms and FDI projects are potentially "connected" economically, either through vertical (I/O) linkages or horizontal spillovers (competition or learning).

To identify the effects of exposure to FDI for domestic firms, we need to account for the fact that FDI location is not random, and thus that issues related to both reverse causation and omitted variables can bias identification. We identify the implications of FDI exposure for domestic firms by employing a method that exploits spatial and temporal variation in the entry of new FDI projects. This method, which has been applied in impact evaluation of aid projects (e.g., Brazys & Kotsadam, 2020; Isaksonn & Kotsadam, 2018), is based on a comparison between areas in which a FDI project has already started and those where a project has not yet been implemented at the time of the WBES, but that will be realized in subsequent periods. To implement this approach, we first define a buffer around the centroid of each of the places in which a firm included in WBES is located and then divide firms into three groups:

1. those within a certain cut-off distance from an FDI project that was received before the survey (which we label as *active*);
2. those within a certain cut-off distance from an FDI project that has not yet started but will start in a period following the survey year (*inactive*);[13] and
3. those outside the cut-off distance from either an active or an inactive project (*control group*).

Our empirical analysis is based on the following regression:

$$Y_{ijrt} = \beta_1 active_{jrt} + \beta_2 inactive_{jrt} + X'_{ijrt} + \theta_{rj} + \delta_{ct} + \varepsilon_{ijrt} \quad (1)$$

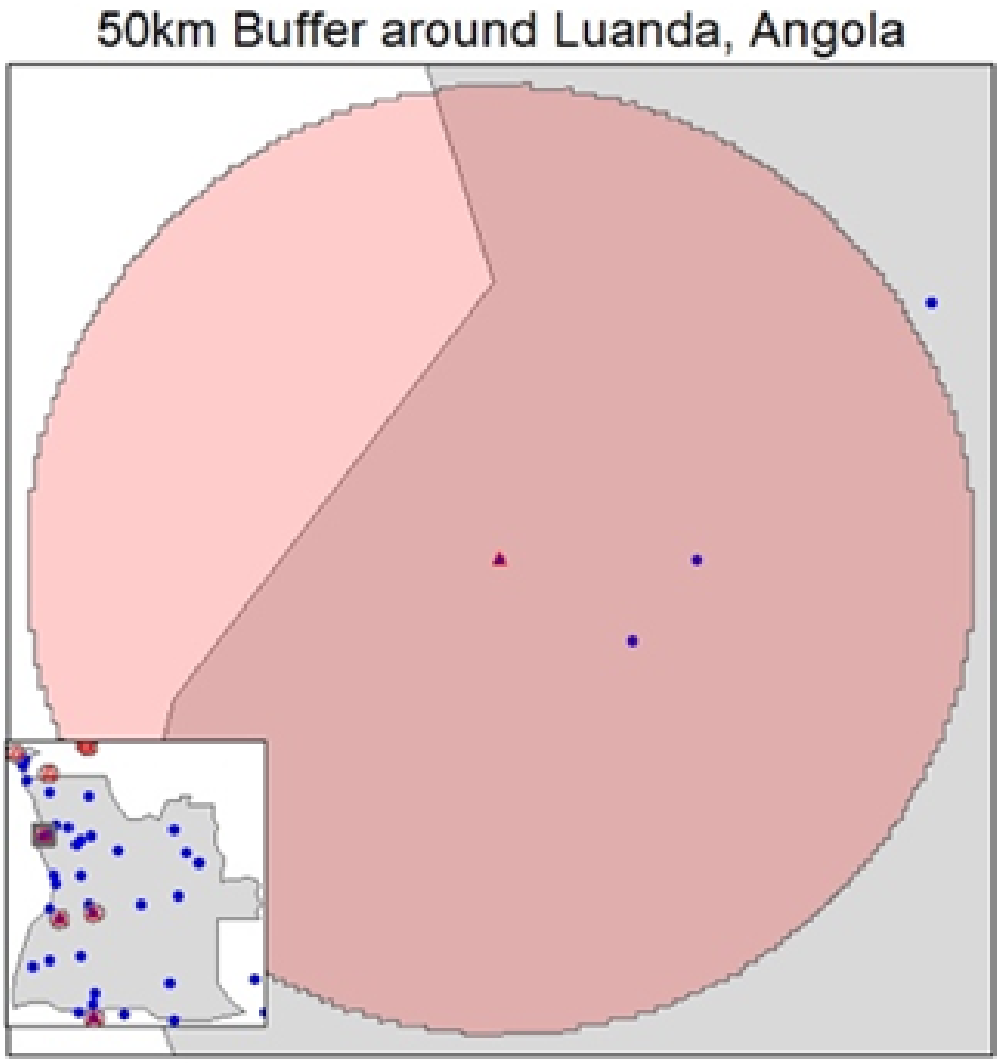
Where, Y_{ijrt} is an outcome of interest for firm *i* in industry *j*, location *r*, and time t,[14] and *X'* is a vector of firm characteristics (including age and size). Region-industry (θ_{rj}) and country-year (δ_{ct}) fixed effects account for common spatial and temporal trends, and spatial clustering,[15] across firms, as well as for country-specific time-contingent factors, such as regulations, that may affect the relationship. Standard errors are clustered at the region-industry level. In our main specifications, we use a buffer that extends for 50km around each firm's location. This distance has been adopted in studies using similar methods (e.g., Tolonen, 2019; Brazys & Kotsadam, 2020). As a robustness check, in Section 4, we consider the sensitivity of our results to different sizes of the buffer.

Figure 5 illustrates the identification approach, using the buffer around Luanda, in Angola, as an example. The red triangle in the middle of the circle represents a domestic firm. The blue dots are FDI projects that are located in the neighbourhood of the firm. The two blue dots inside the circle are considered in the definition of the treatment

(either as active or inactive, depending on when the projects are undertaken relative to a given WBES wave). The one outside the circle will be included in the control group.

This identification strategy relies on estimating two differences. The first difference ($\boldsymbol{\beta_1}$) captures the impact on a given outcome Y of FDI inclusive of any selection effect; the second difference ($\boldsymbol{\beta_2}$) is meant to capture only the selection effect. The coefficient of interest is the difference between these two coefficients (i.e., $\boldsymbol{\beta_1 - \beta_2}$). The inclusion of the "inactive" coefficient allows us to compare the outcome for firms in proximity of current FDI projects with those of firms that will receive a project in the future. The coefficient of interest should provide us with an estimate that accounts for unobservable time-invariant characteristics that may affect both firm outcomes and FDI location choice.

Figure 5: Example: The buffer around Luanda



Source: Authors' elaboration on WBES and fDiMarkets data.

Throughout the analysis, we employ a binary definition of treatment: whether a location is active or inactive depends on whether it hosts (or will host) at least one FDI project over the time span considered. Given the granularity of the data, this does not represent a major issue since the average number of FDI projects around each individual firm in our sample, conditional on being treated, is slightly greater than one for vertical FDI (backward and forward linkages) and around four for horizontal FDI. The approach has the drawback that it does not account for the size of the FDI projects. Although fDiMarkets provides information on the capital investment and employment associated with each project, these variables are mostly estimated (for 82% and 89% of the cases, respectively), precluding their use as they are likely to be unreliable. In addition, our baseline accounts for all the projects to which a given firm is exposed, independent of when they were implemented. Given that the FDI data start in 2003, we cannot be sure that the variable inactive is correctly defined.[16] We consider these concerns in the robustness checks presented in Section 4.

Following the large literature on the effects of FDI (e.g., Javorcik, 2019, Demena & Murshed, 2018; Godart et al., 2020), we consider the two canonical types of relationships through which FDI spillovers can occur for domestic firms: vertical and horizontal. We measure the latter by considering treated only, i.e., those firms that (a) operate in the same 4-digit (ISIC Rev. 3) industry; and (b) have FDI projects located within the buffer considered in our analysis (as in Figure 5). We expect this measure to capture competition effects as well as knowledge and technological spillovers due to the fact that foreign firms operate in the same narrowly defined industry, and thus may share similar production techniques (e.g., Fons-Rosen et al., 2017), and are in relatively close proximity, allowing more frequent exchanges of ideas and workers (e.g., Kee, 2015; Farole & Winkler, 2014; Newman et al., 2020).

To account for vertical spillovers, we rely on Eora I/O coefficients, which are available for most countries in our sample. We construct weights using the national I/O tables for 2010. For each country, we consider the (26x26) matrix of sectors included in Eora (Table A1, in the appendix, provides a listing of the sectors). After extracting this matrix, we calculate the gross value of domestic output for each of the 26 sectors, and for each sector, the share of other sectors' gross output (forward linkage), and the share of the sector's output used by other sectors (backward linkage). These coefficients are used to calculate measures of exposure to FDI weighted by their cross-sectoral dependence. To do this, we construct a concordance table that links the 26 Eora sectors to the sectors defined by WBES and fDiMarkets, using the 2-digit ISIC classification. Considering the number of foreign projects, we define backward (forward) linkages as the weighted sum of the number of foreign projects in each domestic firm's geographic buffer, the weights being the share of output sold by (bought from) the sector of firm i and the sector of the FDI project. These measures provide a proxy for the probability that domestic firms enter the supply chain of foreign investors and participate in GVC-related activities. In addition, in line with the literature, vertical and horizontal spillovers stemming from the activities of proximate foreign investors (FDI projects) may be associated with technology and knowledge transfers and measures that improve productivity performance.

4. Results

In this section, we first report findings on vertical and horizontal spillovers across all domestic firms, as well as separately for manufacturing and services firms. Our outcomes of interest are measures of firms' involvement in trade (exports or imports) and in GVCs (exports and imports). Second, we provide an additional set of estimates based on outcome variables related to firm upgrading strategies. Finally, we provide a battery of robustness checks.

Vertical FDI spillovers

Recall that our approach evaluates the *difference* in firm-level outcomes between (i) firms that are based less than 50km from at least one FDI project in a sector that is linked to that of the domestic firm, and (ii) firms based within a 50km radius of a FDI project in a related sector that will occur after the date of the WBES. What matters for our identification, therefore, is the coefficient measuring the difference between the betas in Equation 1. These coefficients are reported at the end of the tables that follow, along with their p-values.

Table 1: Results, vertical linkages

A. Backward Linkages				
	(1)	(2)	(3)	(4)
Variables	**Exporter**	**Indirect Exporter**	**Importer**	**GVC**
β_1	0.0525**	0.0365**	-0.0544	0.0163
	(0.0262)	(0.0158)	(0.0502)	(0.0220)
β_2	0.0205	0.0119	-0.244***	-0.00628
	(0.0280)	(0.0163)	(0.0725)	(0.0271)
Constant	-0.0236*	0.00299	0.233***	-0.0528***
	(0.0134)	(0.00851)	(0.0279)	(0.0125)
Observations	18,733	18,296	12,085	17,794
R^2	0.289	0.214	0.308	0.252
$\beta_1 - \beta_2$	0.0320	0.0246	**0.189**	0.0226
p-value	0.297	0.166	**0.00299**	0.443

continued next page

Table 1 Continued

B. Forward Linkages				
Variables	**(1)**	**(2)**	**(3)**	**(4)**
	Exporter	**Indirect Exporter**	**Importer**	**GVC**
β_1	0.0206	0.0141	-0.00301	0.0107
	(0.0202)	(0.0125)	(0.0378)	(0.0162)
β_2	-0.00203	-0.00305	-0.171**	0.00309
	(0.0266)	(0.0140)	(0.0751)	(0.0223)
Constant	-0.00595	0.0140**	0.202***	-0.0498***
	(0.0112)	(0.00696)	(0.0222)	(0.0104)
Observations	19,824	19,315	12,358	18,741
R^2	0.284	0.209	0.303	0.251
$\beta_1 - \beta_2$	0.0226	0.0171	**0.168**	0.00765
p-value	0.423	0.269	**0.0129**	0.758

Notes: All regressions include a dummy for firm size (small, medium, large), the age of the firm, and region-sector and country-year fixed effects. Standard errors clustered at the sector-industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 1 reports estimates of the effect of exposure to FDI in sectors that buy from or sell to the local firm's sector of activity. The results on backward and forward linkages are reported in panels A and B, respectively, for four variables: exports, indirect exports, imports, and GVC participation, defined as a firm both importing and exporting. The results are remarkably similar. Being exposed to FDI projects in sectors linked by I/O relationships in general has a positive association with involvement of domestic firms in international production. The coefficients are, however, mostly not statistically significant, something that might reflect differences in the propensity of firms in manufacturing and services sectors to internationalize. We do find consistent evidence that firms that we consider as being "treated" have a greater probability of being involved in trade in intermediate goods as importer. Overall, this first finding, based on the whole sample of firms, is consistent with the pattern reported in Figure 3 of FDI into African countries being associated with forward participation in GVCs (i.e., through imports of intermediate goods embodied in domestic production).

Horizontal FDI spillovers

Table 2 reports results in which we focus on horizontal linkages between FDI projects and domestic firms, i.e., cases in which firms operate in the same sector of activity as foreign investors. As might be expected, there is no evidence that horizontal linkages give rise to greater participation in international production and GVCs, with the exception of weak evidence on the probability of exporting. In contrast to the case of vertical linkages, a nexus with international production is less likely to arise because of direct competition from FDI projects.

Table 2: Results, horizontal linkages

Variables	(1)	(2)	(3)	(4)
	Exporter	**Indirect Exporter**	**Importer**	**GVC**
β_1	-0.00794	-0.00736	-0.0241	-0.00136
	(0.0139)	(0.0104)	(0.0211)	(0.0108)
β_2	-0.0381***	-0.0141	-0.00608	-0.0220**
	(0.0146)	(0.0107)	(0.0256)	(0.00964)
Constant	-0.0129	0.0112**	0.223***	-0.0579***
	(0.00867)	(0.00479)	(0.0107)	(0.00868)
Observations	32,172	31,360	20,773	30,399
R^2	0.257	0.170	0.276	0.241
$\beta_1 - \beta_2$	**0.0301**	0.00677	-0.0180	0.0206
p-value	**0.0920**	0.626	0.601	0.117

Notes: All regressions include a dummy for firm size (small, medium, large), the age of the firm, and region-sector and country-year fixed effects. Standard errors clustered at the sector-industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Manufacturing vs. Services

In this Section, we run our analysis separately for firms in the manufacturing and in the services sectors. The presumption is that the former group is more likely to get involved in external trade given that many services are produced and consumed locally. The results are summarized in Table 3. They reveal additional statistically significant relationships between FDI and firms' internationalization for the sample of manufacturing firms. This is especially true for results related to the vertical spillover channel. Proximity to foreign firms in related industries can spur domestic firms to participate in GVCs, both through the export and the import channel. The fact that there are weaker relationships between FDI and export performance for services firms is not unexpected, nor is the finding of a positive relationship for imports when considering vertical linkages.

Table 3: Results for manufacturing and services firms

Manufacturing Firms				
	Exporter	**Indirect Exporter**	**Importer**	**GVC**
	(a) Backward Linkages			
Difference	**0.0804**	**0.0552**	**0.234**	0.0919
p-value	**0.093**	**0.0272**	**0.00394**	0.11
	(b) Forward Linkages			
Difference	**0.0812**	**0.0552**	**0.235**	0.0926
p-value	**0.09**	**0.027**	**0.00382**	0.107

continued next page

Table 3 Continued

Manufacturing Firms				
	Exporter	**Indirect Exporter**	**Importer**	**GVC**
	(c) Horizontal linkages			
Difference	**0.049**	0.0148	0.0185	0.0361
p-value	**0.0428**	0.484	0.614	0.0752
Services Firms				
	Exporter	**Indirect Exporter**	**Importer**	**GVC**
	(a) Backward Linkages			
Difference	0.0236	-0.00592	0.17	0.00846
p-value	0.463	0.78	0.0174	0.607
	(b) Forward Linkages			
Difference	0.0203	-0.00446	0.113	0.00688
p-value	0.523	0.801	0.179	0.611
	(c) Horizontal linkages			
Difference	0.014	-0.00331	-0.119	-0.00132
p-value	0.61	0.846	0.3	0.907

Notes: The two tables summarize results of separate regressions on each of the outcomes of interest for firms in the manufacturing and in the services sectors. All regressions include a dummy for firm size (small, medium, large), the age of the firm, and region-sector and country-year fixed effects. Standard errors clustered at the sector-industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Robustness and extensions

Alternative outcome variables: Exploiting the richness of the WBES data, we replicate the analysis using additional outcome variables, based on data availability and salience to hypotheses that are common in the FDI literature regarding potential channels (mechanisms) through which FDI may impact on domestic firms. Outcomes included in this exercise include a variable measuring firms' (labour) productivity, and dummy variables taking the value 1 if a firm: (i) obtained one or more internationally recognized certifications; (ii) received some form of technology transfer from foreign firms; (iii) introduced a new product or service over the last three years. Most of these variables are relevant to GVC participation as they are proxies for upgrading or transfer of knowledge. The results are summarized in Table 4, again distinguishing among manufacturing and services firms.

Table 4: Results, alternative outcome variables

A. Manufacturing				
	Productivity	**Certification**	**Foreign Technology**	**Innovation**
Backward FDI Linkages				
Difference	**0.439**	-0.0412	**0.187**	**0.113**
p-value	**0.00682**	0.424	**0.000583**	**0.0151**
Forward FDI Linkages				
Difference	**0.437**	-0.0404	**0.188**	**0.113**
p-value	**0.00686**	0.432	**0.000568**	**0.0146**
Horizontal FDI Linkages				
Difference	**0.331**	**0.0545**	-0.0115	0.0267
p-value	**0.000688**	**0.0814**	0.577	0.335
B. Services				
	Productivity	**Certification**	**Foreign Technology**	**Innovation**
Backward FDI Linkages				
Difference	*0.542*	*0.0578*	0.255	-0.0693
p-value	*0.017*	*0.0971*	0.18	0.163
Forward FDI Linkages				
Difference	**0.35**	0.0375	0.18	**-0.0957**
p-value	**0.0894**	0.174	0.16	**0.023**
Horizontal FDI Linkages				
Difference	0.0699	0.00817	-0.00633	0.00513
p-value	0.618	0.7	0.916	0.869

Notes: The two tables summarize results of separate regressions on each of the outcomes of interest for firms in the manufacturing and in the services sectors. All regressions include a dummy for firm size (small, medium, large), the age of the firm, and region-sector and country-year fixed effects. Standard errors clustered at the sector-industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In the case of both backward and forward FDI linkages, exposure to FDI is associated with higher levels of (labour) productivity, both in manufacturing and in the services sectors. This is consistent with the literature, which finds that the productivity effects of FDI are likely to manifest especially in cases in which foreign firms can establish production linkages with domestic firms (e.g., Alfano-Urena et al., 2021, Newman et al., 2015). Although data constraints make it impossible to account for these linkages directly—a feature shared with most of the empirical literature—approximating relationships by considering geographical proximity and sectoral linkages is an improvement with respect to country-sector level analyses.

We also show that exposure to international firms that operate in the same market can push domestic firms to upgrade and improve their performance is supported by positive effect on labour productivity. Such a productivity-enhancing effect does not materialize for domestic service producers that compete with foreign investors. The

opposite obtains for manufacturing firms, whose productivity is enhanced once they become exposed to direct competition from foreign firms in their own industry. In the manufacturing sector, exposure to FDI with some linkage potential with domestic firms is likely to result in transfer of foreign technology (column 3) and the introduction of innovation (column 4), an occurrence which is fairly frequent in studies on the effects of linkages (e.g., Farole & Winkler, 2014; Fons-Rosen et al., 2017; Javorcik, 2019). If we focus on horizontal spillovers, we find a positive effect on successful adoption of certification and new investment—both potential mechanisms to enhance trade performance and productivity.

Different sized buffer zones: Our choice of buffer zone is in line with impact evaluations studies, which is the main reason for adopting the 50km criterion. Whether this is appropriate in our setting might be questioned, especially given studies finding that knowledge and learning/demonstration spillovers increase significantly with agglomeration and close proximity between firms as this increases the frequency of interactions between firms in the same sector (e.g., Bisztray et al., 2018). Hence, in this sub-section we present results replicating the main analysis but with different buffers. More specifically, we calculate a cut-off from each firm location to each FDI project that goes from 25km to 100km. The results for these two alternative buffers are summarized in Table A5 (in the appendix). It results in estimates that are substantially in line with the main results, though coefficients become less precisely estimated the larger the buffer considered.

Different timing: Our baseline specification does not account for the differential timing of entry of FDI projects, under the assumption that the implications of exposure to one or more FDI projects in related (relevant) sectors could be long lasting (as found recently by Alfano-Urena et al., 2021). We assess whether our results continue to obtain if we limit the time span of FDI exposure to five years in Table A6 (in the appendix). Doing so implies that our definition of treatment (the variables active and inactive) get a value of 1 only if at least one FDI project has materialized within the 50km buffer for each firm over the past five years. The results reported in Table A6 (in the appendix) are similar to our main findings.

5. Concluding remarks

Data on the geographic distribution of Greenfield FDI projects within and across African nations reveals an overall negative relationship between FDI projects and GVC participation indicators obtained from the Eora multi-region input-output database. This reflects a positive relationship with forward participation that is more than offset by a negative association with backward linkages. The analysis undertaken in this paper seeks to go beyond this broad sector-level characterization of the association between FDI and GVC participation by matching the location of Greenfield FDI projects with domestic firms included in the WBES for a large number of African countries. The results provide evidence of vertical spillovers from exposure to FDI: domestic firms geographically located near FDI projects that offer potential supply or demand linkages are more likely to engage in trade in intermediates through imports or indirect exports, and in the case of backward linkage FDI, to participate in GVCs (i.e., both export and import). Proximity to FDI projects in the same sector (horizontal linkage) does not affect trade or GVC performance of domestic firms, but is positively related with investment, technology transfer, and certification of domestic firms.

Distinguishing between domestic firms producing goods and firms operating in services sectors shows that our results for the vertical spillover channel are driven by the former set of firms. Proximity to FDI projects is not associated with export performance for services firms, but there is a positive relationship with imports and labour productivity when considering vertical linkages. Both vertical and horizontal FDI linkages are associated with higher labour productivity in the case of manufacturing firms; for services firms, this is only observed for vertically linked FDI projects. A productivity-enhancing effect of FDI does not materialize for domestic service producers that compete with foreign investors. The opposite obtains for manufacturing firms, with higher productivity for firms that become exposed to direct competition from foreign firms in their own industry.

The analysis in this paper contributes to the existing evidence on FDI spillovers in developing countries in two main ways. First, our focus on Greenfield FDI in non-resource sector activities, including services, is new. Most of the evidence on FDI spillovers in the region relates to the impact of large natural resource related projects, or major investments in manufacturing activities (e.g., Abebe et al., 2021). It is important that analysis also considers smaller FDI projects in high value-added activities as these are likely to generate I/O linkages with domestic firms and stimulate

their capacity to upgrade, including internationally. Second, our results provide some additional evidence on the way in which benefits from attracting FDI are likely to concentrate locally, around a project location, adding an important dimension that relates to potentially unequal regional development—to the extent that FDI concentrates geographically—to the literature on FDI spillovers. This is important in the developing countries in general, and Africa in particular, given instances where the growth of a few primary agglomerations has been found to outweigh the development of other areas (Bluhm & Krause, 2022).

Our research has limitations. Although comprehensive, the data on FDI that we employ may not be representative of the universe of foreign investment in Africa, and do not provide reliable information on the size of the projects or their relationships with other firms. Further analysis—including through more qualitative methods and country-specific field research—is needed to understand which types of domestic firms are likely to benefit more from the entry of FDI, how these relationship materialize, and the types of mechanisms that link FDI projects and domestic firms.

The policy implications of our analysis are likely to be country-specific and well as location-specific, providing another rationale for the type of additional, qualitative research just mentioned. More general policy implications of our research findings are consistent with those in the FDI literature. Given that FDI is associated with positive spillover effects, our findings support investment promotion and facilitation efforts as a component of national development strategies. These should target manufacturing and services activities, and include a focus on measures to encourage connecting potential local suppliers to FDI projects and promote indirect exports.

Notes

1. United Nations Conference on Trade and Development (UNCTAD, 2013) shows that the stock of inward FDI in a (developing) country correlates with GVC participation and the generation of more foreign value-added. Recent research finds evidence linking experiences of GVC upgrading in sectors targeted by FDI (Quiang et al., 2021), and high complementarities between GVC participation and FDI spillovers (Amendolagine et al., 2019; Mercer-Blackman et al., 2021).

2. See, e.g., Javorcik (2019), Lay and Tafese (2020), and Godart et al. (2020).

3. See also Morrissey (2012).

4. See https://www.worldmrio.com/#:~:text=The%20Eora%20global%20supply%20chain%20database%20consists%20of%20a%20multi,satellite%20accounts%20for%20190%20countries

5. https://www.fdimarkets.com/

6. Data on the size of the project includes both the capital involved with the original investment and the number of employees. Unfortunately, in most cases, these two variables are estimated using a proprietary econometric model. For this reason, we do not use these variables in this paper.

7. City and provinces are transformed into point coordinates using the OpenCage API.

8. WBES use stratified random samples of firms extracted from public registries. Stratification is by size, location, and sector.

9. Exceptions include Burkina Faso, Congo, Eritrea, Ethiopia, Guinea, Libya, Sudan, and Zimbabwe.

10. Outliers were removed from this exercise.

11. To do this, an R algorithm was developed that performed the following assignments: calculating the geographical distance between each FDI project and each WBES firm with the R function *geosphere::distm*; appending each firm's ID to the distance matrix; editing the format of the distance matrix to a long version; merging the distance matrix with

FDI data. This algorithm was applied to each country/wave sub-sample resulting in 77 country/wave sub-data sets. Each country/wave data set includes firm-level information (firm ID, ISIC code, geographical coordinates), and project-level information (project ID, distance from the firm, company data, ISIC codes, geographical coordinates).

12. Table A1 (in the appendix) reports information on the number of firms covered by the WBES data, and the corresponding number of FDI projects received by each country.

13. Note that when creating this group, locations in which there are already active projects are excluded.

14. Outcomes include indicators measuring firms' participation to trade and GVCs, as well as measures of upgrading (see Section 4).

15. Note that we do not include fixed effects at lower geographic levels, e.g., the city, since this will limit too much the extent of comparison across active and inactive locations.

16. We do not consider this a source of concern for two reasons. First, the earliest data on firms is for 2006, and most of the surveys are recent. Second, FDI flows only began to be more frequent in Africa at the end of the 2000s (Brazys & Kotsadam, 2020).

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Appendix

Table A1: Top FDI recipients, 2003-2020

Rank	Recipient Country	# Projects	% of Total
1	South Africa	2061	17.96%
2	Egypt	1274	11.10%
3	Morocco	1143	9.96%
4	Kenya	817	7.12%
5	Nigeria	773	6.73%
6	Ghana	555	4.84%
7	Algeria	471	4.10%
8	Tunisia	465	4.05%
9	Angola	393	3.42%
10	Tanzania	330	2.88%
11	Mozambique	324	2.82%
12	Ethiopia	280	2.44%
13	Uganda	254	2.21%
14	Zambia	245	2.13%
15	Libya	165	1.44%
16	Rwanda	163	1.42%
17	Namibia	152	1.32%
18	Senegal	150	1.31%
19	Zimbabwe	145	1.26%
20	Botswana	136	1.18%

Source: Authors' elaboration on fDiMarkets.

Table A2: Top FDI sources, 2003-2020

Rank	Investor Country	# of Projects	% on Total
1	United States	1396	12.16%
2	United Kingdom	1163	10.13%
3	France	1040	9.06%
4	Germany	558	4.86%
5	South Africa	543	4.73%
6	China	525	4.57%
7	India	478	4.16%
8	Spain	392	3.42%
9	Switzerland	354	3.08%
10	Japan	314	2.74%
11	Portugal	251	2.19%
12	Canada	248	2.16%
13	Kenya	241	2.10%
14	Italy	219	1.91%
15	Netherlands	204	1.78%
16	Nigeria	191	1.66%
17	Saudi Arabia	155	1.35%
18	Australia	151	1.32%
19	Russia	116	1.01%
20	Ireland	95	0.83%

Source: Authors' elaboration on fDiMarkets.

Table A3: FDI by main sectors, 2003-2020

Rank	Cluster	# of Projects	% of Total
1	Financial Services	1941	16.91%
2	ICT & Electronics	1438	12.53%
3	Agribusiness	870	7.58%
4	Transport Equipment	852	7.42%
5	Energy	746	6.50%
6	Professional Services	672	5.85%
7	Physical Sciences	653	5.69%
8	Industrial	584	5.09%
9	Construction	575	5.01%
10	Environmental Technology	573	4.99%
11	Transportation & Warehousing	511	4.45%
12	Creative Industries	472	4.11%
13	Tourism	425	3.70%
14	Retail Trade	388	3.38%
15	Life sciences	293	2.55%
16	Consumer Goods	280	2.44%
17	Wood, Apparel & Related Products	205	1.79%

Note: The grouping of sectors reported in this table is the one originally provided by fDiMarkets.
Source: Authors' elaboration on fDiMarkets.

Table A4: Summary of WBES and FDI combination

Country	WBES Waves	WBES firms	FDI projects
Angola	2006, 2010	785	271
Benin	2009, 2016	300	12
Botswana	2006, 2010	610	83
Burkina Faso	2009	394	28
Burundi	2006, 2014	427	12
Cameroon	2009, 2016	724	89
Cape Verde	2009	156	17
Central African Republic	2011	150	0
Chad	2009, 2018	303	17
Congo – Brazzaville	2009	151	0
Cote d'Ivoire	2009, 2016	887	0
D. R. of the Congo	2006, 2010, 2013	1228	0
Djibouti	2013	266	2
Egypt	2013, 2016, 2020	7786	829
Eritrea	2009	179	4
Ethiopia	2011, 2015	1492	174
Gabon	2009	179	33
Gambia	2006, 2018	325	15
Ghana	2007, 2013	1214	375
Guinea	2006, 2016	373	34
Kenya	2007, 2013, 2018	2439	624
Lesotho	2009, 2016	301	6
Liberia	2009, 2017	301	27
Madagascar	2009, 2013	977	36
Malawi	2009, 2014	673	10
Mali	2007, 2010, 2016	1035	23
Mauritania	2006, 2014	387	20
Mauritius	2009	398	36
Morocco	2013, 2019	1503	919
Mozambique	2007, 2018	1080	249
Namibia	2006, 2014	909	105
Nigeria	2007, 2014	4567	561
Rwanda	2006, 2011, 2019	813	119
Senegal	2007, 2014	1107	99
Sierra Leone	2009, 2017	302	21
South Africa	2007, 2020	2034	1731
South Sudan	2014	738	53

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Table A4 Continued

Country	WBES Waves	WBES firms	FDI projects
Sudan	2014	662	37
Tanzania	2006, 2013	1232	207
Togo	2009, 2016	305	31
Tunisia	2013, 2020	1207	155
Uganda	2006, 2013	1325	162
Zambia	2007, 2013, 2019	1805	161
Zimbabwe	2011, 2016	1199	93

Table A5: Alternative buffers

25km buffer				
	Exporter	**Indirect exporter**	**Importer**	**GVC**
(a) Backward Linkages				
Difference	0.0462	0.0381	**0.227**	0.0263
p-value	0.157	0.0573	**0.000143**	0.391
(b) Forward Linkages				
Difference	0.0381	**0.0348**	**0.212**	0.0118
p-value	0.206	**0.0505**	**0.000427**	0.651
(c) Horizontal Linkages				
Difference	**0.0363**	0.00759	-0.0135	0.0199
p-value	**0.0794**	0.609	0.693	0.167
100 km buffer				
	Exporter	**Indirect exporter**	**Importer**	**GVC**
(a) Backward Linkages				
Difference	0.0231	0.0108	**0.186**	0.0172
p-value	0.423	0.484	**0.00403**	0.586
(b) Forward Linkages				
Difference	0.0303	0.0168	**0.165**	0.00287
p-value	0.254	0.215	**0.0170**	0.914
(c) Horizontal Linkages				
Difference	**0.0416**	0.00569	-0.00790	**0.0207**
p-value	**0.0145**	0.656	0.807	**0.0798**

Notes: All regressions include a dummy for firm size (small, medium, large), the age of the firm, and region-sector and country-year fixed effects. Standard errors clustered at the sector-industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A6: Differential timing, 5 years

	Exporter	Indirect exporter	Importer	GVC
Backward FDI Linkages				
Difference	0.0262	0.00111	**0.154**	0.0278
p-value	0.297	0.945	**0.00429**	0.228
Forward FDI Linkages				
Difference	-0.00254	-0.0111	**0.125**	0.0150
p-value	0.926	0.525	**0.0289**	0.485
Horizontal FDI Linkages				
Difference	0.0277	0.00953	-0.00300	**0.0296**
p-value	0.181	0.542	0.937	**0.0322**

Notes: All regressions include a dummy for firm size (small, medium, large), the age of the firm, and region-sector and country-year fixed effects. Standard errors clustered at the sector-industry level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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