Received: 2 August 2023 | Accepted: 29 August 2023

DOI: 10.1111/twec.13505

ORIGINAL ARTICLE

The World Economy WILEY

Trade and value chain participation: Domestic firms and FDI spillovers in Africa

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Funding information
Consortium pour la recherche économique en Afrique

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.

KEYWORDS

Africa, foreign direct investment, spillovers, value chain participation, vertical linkages

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; Farole & Winkler, 2014; Javorcik, 2004). 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. Internationalisation 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., Alfano-Urena et al., 2022, 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 globalise (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. 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 the 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 African countries over the period 2006–2014, finding evidence for demonstration (learning) spillovers, but not for labour mobility-related technology diffusion or competition effects. The opposite is found by Görg and Strobl (2005), who find evidence of productivity improvements in domestic firms owned by workers with experiences in multinational firms in Ghana. Using a 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.

[1]The 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, for example, Javorcik (2019), Lay and Tafese (2020), and Godart et al. (2020).

Evidence on vertical spillovers is 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. Relatedly, Görg and Seric (2016) find that linkages between domestic African firms and foreign investors are associated with increases in productivity and greater innovation.

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 as within-sector competition spillovers and knowledge diffusion. Specifically, we combine project-level information on greenfield FDI from fDi Markets 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, that is, operate in the same industry and thus potentially compete, or vertically, that is, 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] The lack of information on other forms of FDI, including mergers and acquisitions (M&A), is unlikely to introduce a systematic bias in our analysis given the low relevance of such type of investment in Africa. According to the World Investment Report, in 2021, Africa accounted for 0.7% and 6% of global inflows of M&A and greenfield FDI, respectively (UNCTAD, 2022).

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 characterise forward and backward participation in GVCs, FDI tends to replace GVC-related trade,

[3]See also Morrissey (2012). Amendolagine et al. (2013) provide a detailed analysis of the firm and country factors that explain the generation of linkages between foreign and domestic firms in Africa.

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

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, that is, 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.

2 | DATA

The analysis is based on project-level data from *fDi Markets*,[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] and 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) and the United States, United Kingdom, and France were the top three sources (Table A2). Many of the FDI projects involve service activities: financial, business, and communication sectors together account for almost 30% of the total (Table A3). 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 service activities in major urban areas.

Firm-level data are obtained from the *World Bank Enterprise Surveys*. This provides nationally representative firm-level information for many countries, including Africa.[8] For the analysis, we

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

[6]Data on the size of the project include 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.

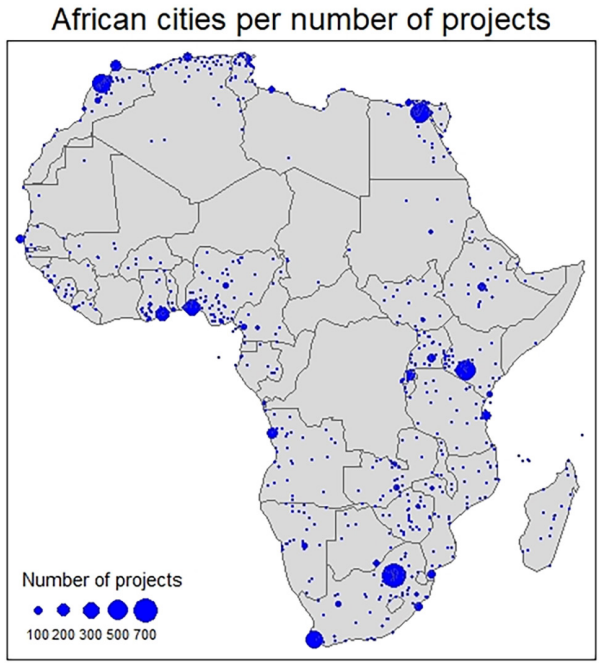

FIGURE 1 FDI projects by number. *Source*: Authors' construction based on fDi Markets data. [Colour figure can be viewed at wileyonlinelibrary.com]

use a harmonised version of the data set that provides standardised variables for the surveys run from 2006 to 2020. The resulting data set spans 46,145 firms in 48 African countries. Table A4 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 include 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 follows: (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 report information on the location of respondent firms, which is available up to the city level. As 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 fDi Markets.

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.

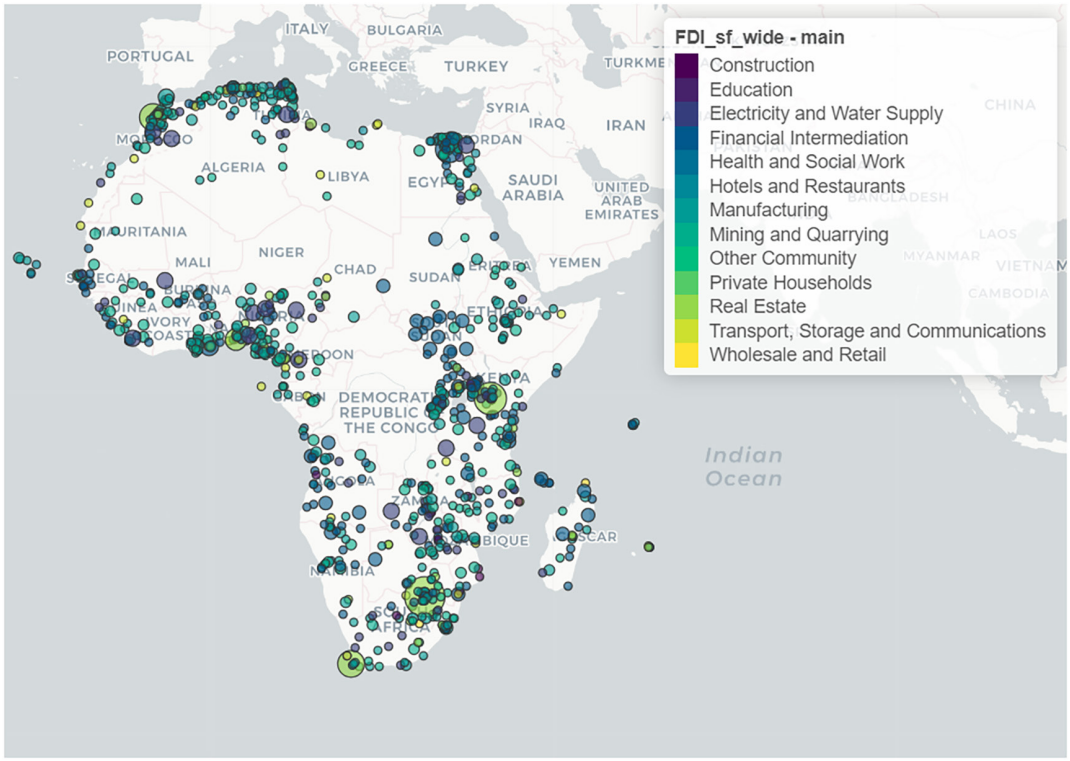

FIGURE 2 FDI projects by location and main sector. *Source*: Authors' own construction based on fDi Markets data. [Colour figure can be viewed at wileyonlinelibrary.com]

2.1 | 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 exports, respectively. Backward participation accounts for each country's (and sector's) specialisation upstream, that is, 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 specialisation downstream, that is, use of intermediates produced by other countries to manufacture

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

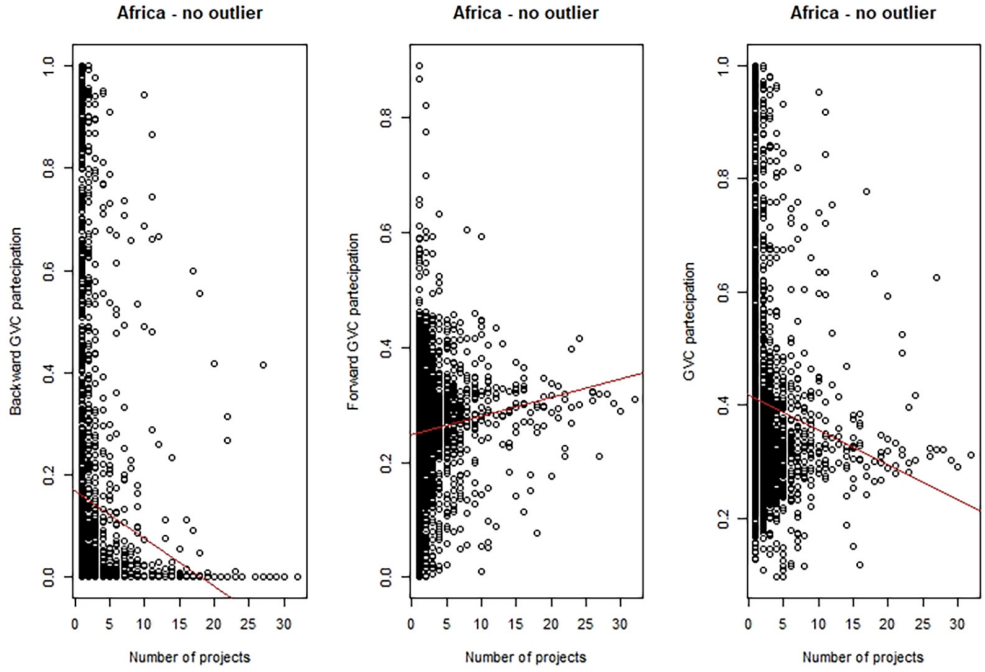

FIGURE 3 Correlations between GVC indicators and FDI. [Colour figure can be viewed at wileyonlinelibrary.com]

final goods for exports (e.g., Lesotho engages in forward participation because its exports are used as intermediates by Kenya to produce 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.

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.

[10]Outliers were removed from this exercise.

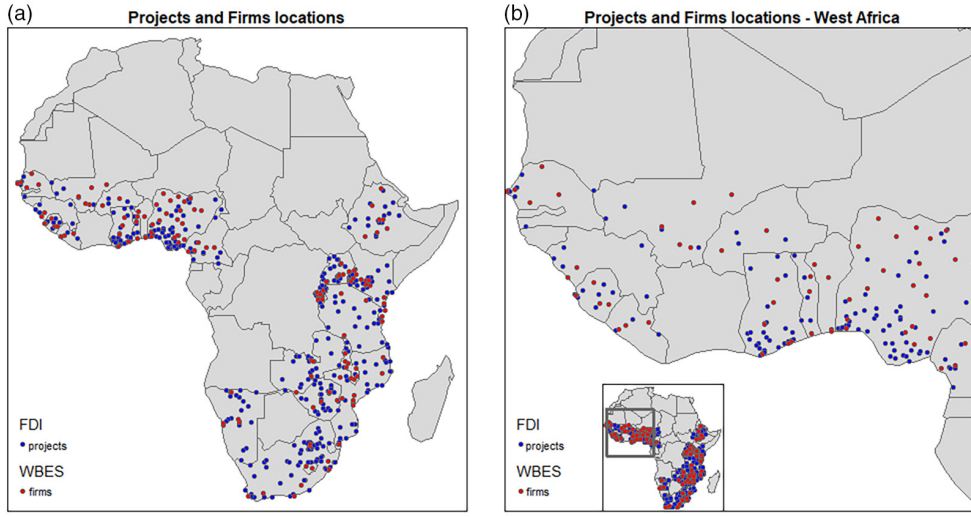

FIGURE 4 Geographic location of WBES firms (red dots) and FDI projects (blue dots). *Source*: Authors' elaboration on WBES and fDi Markets data. [Colour figure can be viewed at wileyonlinelibrary.com]

To assess firm-level spillovers of FDI, we exploit geo-localised 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.

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; Isaksson & 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 realised in subsequent periods. To implement this approach,

[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; and 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, and geographical coordinates) and project-level information (project ID, distance from the firm, company data, ISIC codes, and geographical coordinates).
[12]Table A1 reports information on the number of firms covered by the WBES data and the corresponding number of FDI projects received by each country.

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, which exploits a cross section of firms[14]:

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

where Y_{ijrt} is an outcome of interest for firm i in industry j, location r, and time t,[15] 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,[16] 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 50 km around each firm's location. This distance has been adopted in studies using similar methods (e.g., Brazys & Kotsadam, 2020; Tolonen, 2019). 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 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 (β_1) captures the impact on a given outcome Y of FDI inclusive of any selection effect; the second difference (β_2) is meant to capture only the selection effect. The coefficient of interest is the difference between these two coefficients (i.e., $\beta_1 - \beta_2$). 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

[13]Note that when creating this group, locations with active projects are excluded. This means that the dummy "inactive" identifies location–industry pairs that will only receive a new FDI project after the period in which the sample is observed.

[14]For a limited sample of firms in the WBES data, it is possible to observe enterprises in different waves. The information needed to link firms over different waves is not included in the harmonised version of the data set that we use in the paper. This prevents us from running, as a robustness check, a specification linking entry of FDI to within-firm changes over time. While a potential limitation of the analysis, the identification strategy that we adopt is best suited to compare firms across different locations in a cross-sectional setting.

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

[16]Note that we do not include fixed effects at lower geographic levels, for example, the city, since this will limit too much the extent of comparison across active and inactive locations.

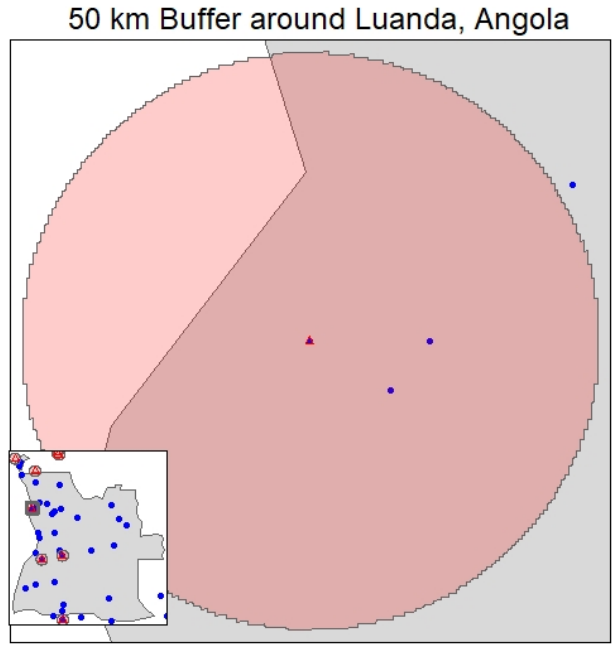

FIGURE 5 Example: The buffer around Luanda. *Source*: Authors' elaboration on WBES and fDi Markets data. [Colour figure can be viewed at wileyonlinelibrary.com]

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.

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 fDi Markets 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.[17] We consider these concerns in the robustness checks presented in Section 4.

Following the literature on the effects of FDI (e.g., Demena & Murshed, 2018; Godart et al., 2020; Javorcik, 2019), 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, that is, 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

[17]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).

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., Farole & Winkler, 2014; Kee, 2015; 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 (26×26) matrix of sectors included in Eora. Table A1 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 fDi Markets, 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 service 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.

4.1 | Vertical FDI spillovers

Recall that our approach evaluates the *difference* in firm-level outcomes between (i) firms that are based less than 50 km from at least one FDI project in a sector that is linked to that of the domestic firm and (ii) firms based within a 50 km radius of an 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 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,

TABLE 1 Results, vertical linkages.

Variables	(1) Exporter	(2) Indirect exporter	(3) Importer	(4) GVC
A. Backward linkages				
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	.289	.214	.308	.252
$\beta_1 - \beta_2$	0.0320	0.0246	0.189***	0.0226
p-Value	.297	.166	.00299	.443
B. Forward linkages				
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	.284	.209	.303	.251
$\beta_1 - \beta_2$	0.0226	0.0171	0.168**	0.00765
p-Value	.423	.269	.0129	.758

Note: All regressions include a dummy for firm size (small, medium, and large), the age of the firm, and region–sector and country–year fixed effects. Standard errors clustered at the sector–industry level in parentheses.

***$p < .01$; **$p < .05$; *$p < .1$.

mostly not statistically significant, something that might reflect differences in the propensity of firms in manufacturing and service sectors to internationalise. 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).

4.2 | Horizontal FDI spillovers

Table 2 reports results in which we focus on horizontal linkages between FDI projects and domestic firms, that is, cases in which firms operate in the same sector of activity as foreign

TABLE 2 Results, horizontal linkages.

Variables	(1) Exporter	(2) Indirect exporter	(3) Importer	(4) 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	.257	.170	.276	.241
$\beta_1 - \beta_2$	0.0301*	0.00677	−0.0180	0.0206
p-Value	.0920	.626	.601	.117

Note: All regressions include a dummy for firm size (small, medium, and large), the age of the firm, and region–sector and country–year fixed effects. Standard errors clustered at the sector–industry level in parentheses.

***$p < .01$; **$p < .05$; *$p < 0.1$.

investors. As might be expected, there is no evidence that horizontal linkages give rise to greater participation in international production and GVCs, except for 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.

4.3 | Manufacturing vs. services

In this Section, we run our analysis separately for firms in the manufacturing and in the service 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 summarised in Table 3. They reveal additional statistically significant relationships between FDI and firms' internationalisation 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 channel and the import channel. The fact that there are weaker relationships between FDI and export performance for service firms is not unexpected, nor is the finding of a positive relationship for imports when considering vertical linkages.

5 | ROBUSTNESS AND EXTENSIONS

5.1 | 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

TABLE 3 Results for manufacturing and service firms.

	Exporter	Indirect exporter	Importer	GVC
Manufacturing firms				
(a) Backward linkages				
Difference	0.0804*	0.0552**	0.234***	0.0919
p-Value	.093	.0272	.00394	.11
(b) Forward linkages				
Difference	0.0812*	0.0552*	0.235***	0.0926
p-Value	.09	.027	.00382	.107
(c) Horizontal linkages				
Difference	0.049**	0.0148	0.0185	0.0361*
p-Value	.0428	.484	.614	.0752
Service firms				
(a) Backward linkages				
Difference	0.0236	−0.00592	0.17**	0.00846
p-Value	.463	.78	.0174	.607
(b) Forward linkages				
Difference	0.0203	−0.00446	0.113	0.00688
p-Value	.523	.801	.179	.611
(c) Horizontal linkages				
Difference	0.014	−0.00331	−0.119	−0.00132
p-Value	.61	.846	.3	.907

Note: The two tables summarise the results of separate regressions on each of the outcomes of interest for firms in the manufacturing and in the service sectors. All regressions include a dummy for firm size (small, medium, and large), the age of the firm, and region–sector and country–year fixed effects. Standard errors clustered at the sector–industry level in parentheses.
***$p < .01$; **$p < .05$; *$p < .1$.

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 recognised certifications; (ii) received some form of technology transfer from foreign firms; and (iii) introduced a new product or service over the last 3 years. Most of these variables are relevant to GVC participation as they are proxies for upgrading or transfer of knowledge. The results are summarised in Table 4, again distinguishing among manufacturing and service firms.

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 service 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., 2022; 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.[18]

[18]Hoekman et al. (2023) analyse the impact of FDI on local labour markets in Africa.

TABLE 4 Results, alternative outcome variables.

	Productivity	Certification	Foreign technology	Innovation
A. Manufacturing				
Backward FDI linkages				
Difference	0.439***	−0.0412	0.187***	0.113**
p-Value	.00682	.424	.000583	.0151
Forward FDI linkages				
Difference	0.437***	−0.0404	0.188***	0.113**
p-Value	.00686	.432	.000568	.0146
Horizontal FDI linkages				
Difference	0.331***	0.0545*	−0.0115	0.0267
p-Value	.000688	.0814	.577	.335
B. Services				
Backward FDI linkages				
Difference	0.542**	0.0578*	0.255	−0.0693
p-Value	.017	.0971	.18	.163
Forward FDI linkages				
Difference	0.35*	0.0375	0.18	−0.0957**
p-Value	.0894	.174	.16	.023
Horizontal FDI linkages				
Difference	0.0699	0.00817	−0.00633	0.00513
p-Value	.618	.7	.916	.869

Note: The two tables summarise the results of separate regressions on each of the outcomes of interest for firms in the manufacturing and in the service sectors. All regressions include a dummy for firm size (small, medium, and large), the age of the firm, and region–sector and country–year fixed effects. Standard errors clustered at the sector–industry level in parentheses.
***$p < .01$; **$p < .05$; *$p < .1$.

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 materialise 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.

5.2 | Different-sized buffer zones

Our choice of buffer zone is in line with impact evaluation studies, which is the main reason for adopting the 50 km 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 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 subsection 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 25 to 100 km. The results for these two alternative buffers are summarised in Table A5. It results in estimates that are substantially in line with the main results, though coefficients become less precisely estimated the larger the buffer considered.

5.3 | 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., 2022). We assess whether our results continue to obtain if we limit the time span of FDI exposure to 5 years in Table A6. Doing so implies that the definition of treatment (the variables active and inactive) is set at a value of 1 only if at least one FDI project has materialised within the 50 km buffer for each firm over the past 5 years. The results, reported in Table A6, are similar to our main findings.

6 | CONCLUDING REMARKS

Data on the geographic distribution of Greenfield FDI projects within and across African nations reveal 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 characterisation 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 to investment, technology transfer, and certification of domestic firms.

Distinguishing between domestic firms producing goods and firms operating in service 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 service firms, but there is a positive relationship between 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 service firms, this is only observed for vertically linked FDI projects. A productivity-enhancing effect of FDI does not materialise 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 relationships materialise, and the types of mechanisms that link FDI projects and domestic firms.

The policy implications of our analysis are likely to be country-specific as 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 service activities and include a focus on measures to encourage connecting potential local suppliers to FDI projects and promote indirect exports.

ACKNOWLEDGEMENTS

We are grateful to Jaime de Melo, Marcelo Olarreaga, Dominique Njinkeu, Max Mendez-Parra, two anonymous reviewers, and participants in project workshops organised by the African Economic Research Consortium (AERC) in June and November 2021 and April 2022, as well as the 2021 UKTPO annual conference for helpful comments and suggestions. Nicolò Florenzio provided excellent research assistance.

DATA AVAILABILITY STATEMENT

Not applicable.

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How to cite this article: Hoekman, B., & Sanfilippo, M. (2023). Trade and value chain participation: Domestic firms and FDI spillovers in Africa. *The World Economy*, *46*, 3367–3391. https://doi.org/10.1111/twec.13505

APPENDIX 1

TABLE A1 Top FDI recipients, 2003–2020.

Rank	Recipient country	No. 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 fDi Markets.

TABLE A2 Top FDI sources, 2003–2020.

Rank	Investor country	No. projects	% of 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 fDi Markets.

TABLE A3 FDI by main sectors, 2003–2020.

Rank	Cluster	No. projects	% of total
1	Financial services	1941	16.91
2	ICT and 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 and 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, and related products	205	1.79

Note: The grouping of sectors reported in this table is the one originally provided by fDi Markets.

Source: Authors' elaboration on fDi Markets.

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
Ivory Coast	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

(Continues)

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.

	Exporter	Indirect exporter	Importer	GVC
25 km buffer				
(a) Backward linkages				
Difference	0.0462	0.0381*	0.227***	0.0263
p-Value	.157	.0573	.000143	.391
(b) Forward linkages				
Difference	0.0381	0.0348*	0.212***	0.0118
p-Value	.206	.0505	.000427	.651
(c) Horizontal linkages				
Difference	0.0363*	0.00759	−0.0135	0.0199
p-Value	.0794	.609	.693	.167
100 km buffer				
(a) Backward linkages				
Difference	0.0231	0.0108	0.186***	0.0172
p-Value	.423	.484	.00403	.586
(b) Forward linkages				
Difference	0.0303	0.0168	0.165**	0.00287
p-Value	.254	.215	.0170	.914
(c) Horizontal linkages				
Difference	0.0416**	0.00569	−0.00790	0.0207*
p-Value	.0145	.656	.807	.0798

Note: All regressions include a dummy for firm size (small, medium, and large), the age of the firm, and region–sector and country–year fixed effects. Standard errors clustered at the sector–industry level in parentheses.

***$p < .01$; **$p < .05$; *$p < .1$.

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	.297	.945	.00429***	.228
Forward FDI linkages				
Difference	−0.00254	−0.0111	0.125	0.0150
p-Value	.926	.525	.0289**	.485
Horizontal FDI linkages				
Difference	0.0277	0.00953	−0.00300	0.0296
p-Value	.181	.542	.937	.0322**

Note: All regressions include a dummy for firm size (small, medium, and large), the age of the firm, and region–sector and country–year fixed effects. Standard errors clustered at the sector–industry level in parentheses.

***$p < .01$; **$p < .05$; *$p < 0.1$.