Linked-in by FDI

The Role of Firm-Level Relationships for Knowledge Transfers in Africa and Asia

Newman, Carol; Page, John; Rand, John; Shimeles, Abebe; Söderbom, Måns; Tarp, Finn

Published in:
The Journal of Development Studies

DOI:
10.1080/00220388.2019.1585813

Publication date:
2020

Document version
Publisher's PDF, also known as Version of record

The Journal of Development Studies

ISSN: 0022-0388 (Print) 1743-9140 (Online) Journal homepage: https://www.tandfonline.com/loi/fjds20

Linked-in by FDI: The Role of Firm-Level Relationships for Knowledge Transfers in Africa and Asia

Carol Newman, John Page, John Rand, Abebe Shimeles, Måns Söderbom & Finn Tarp

To cite this article: Carol Newman, John Page, John Rand, Abebe Shimeles, Måns Söderbom & Finn Tarp (2020) Linked-in by FDI: The Role of Firm-Level Relationships for Knowledge Transfers in Africa and Asia, The Journal of Development Studies, 56:3, 451-468, DOI: 10.1080/00220388.2019.1585813

To link to this article: https://doi.org/10.1080/00220388.2019.1585813

The Journal of Development Studies, 2020
Vol. 56, No. 3, 451–468, https://doi.org/10.1080/00220388.2019.1585813

Linked-in by FDI: The Role of Firm-Level Relationships for Knowledge Transfers in Africa and Asia

CAROL NEWMAN*, JOHN PAGE**, JOHN RAND†, ABEBE SHIMELES‡, MÅNS SÖDERBOM§ & FINN TARP†

*Department of Economics, Trinity College Dublin, Dublin, Ireland, **Global Economy and Development, Brooking Institution, Washington, DC, USA, †Department of Economics, University of Copenhagen, Copenhagen, Denmark, ‡Development Research, African Development Bank, Abidjan, Côte d'Ivoire, §School of Economics, University of Gothenburg, Gothenburg, Sweden

(Original version submitted March 2018; final version accepted January 2019)

ABSTRACT *This study combines evidence from interviews in seven countries with (i) government institutions responsible for attracting Foreign Direct Investment (FDI), (ii) 102 multinationals (MNEs), and (iii) 226 domestic firms linked to these foreign affiliates as suppliers, customers, or competitors, to identify whether relations between MNEs and domestic firms lead to direct transfers of knowledge/technology. We first document that there are relatively few linkages between MNEs and domestic firms in sub-Saharan Africa compared with Asia. However, when linkages are present in sub-Saharan Africa they raise the likelihood of direct knowledge/technology transfers from MNEs to domestic firms as compared to linked-in firms in Asia. Finally, we do not find that direct knowledge/technology transfers are more likely to occur through FDI than through trade. As such our results are not consistent with the view that tacit knowledge transfers are more likely to occur through localised linkages.*

1. Introduction

Governments in developing countries allocate significant public funds to attract foreign direct investment (FDI). The rationale relies on the premise that FDI (besides bringing more jobs and foreign capital) brings superior know-how, managerial skills, and technologies that can diffuse into the domestic sector through various mechanisms.[1] These intangible assets are seen as an important source of productivity growth for domestic firms in the developing world. They help emerging industries catch up to the technology frontier.

Knowledge/technology transfers from foreign affiliates to domestic firms have received a lot of attention in the academic literature, and there are many well-explored theoretical mechanisms through which such spillovers may be realised. Existing studies typically consider spillovers through horizontal (intra-sector) or vertical (inter-sector) linkages. Horizontal spillovers occur when knowledge/technology used by the multinational enterprise (MNE) is 'transferred' to competing local

Correspondence Address: John Rand, Department of Economics, University of Copenhagen, Oster Farimagsgade 5, Building 26, DK-1353 Copenhagen K, Denmark. Email: John.Rand@econ.ku.dk
Supplementary Materials are available for this article which can be accessed via the online version of this journal available at https://doi.org/10.1080/00220388.2019.1585813

domestic firms in the same sector. Vertical spillovers are transfers of intangible assets through the supply chain from foreign intermediate suppliers to domestic producers (referred to as forward linkages) or from MNEs to domestic input suppliers (referred to as backward linkages). The empirical literature is inconclusive as to the nature and range of FDI spillovers. Estimates of the impact depend to a large extent on the specific country context, the data used, and the methods applied.

A common feature of the FDI spillover literature is the indirect approach to measuring knowledge/technology spillovers. Giroud (2012) provides a critique highlighting that this literature has only considered FDI spillovers as externalities of MNE activities, which occur strictly through indirect mechanisms such as competition, demonstration effects, and labour mobility. More specifically, focus has been on uncovering indirect evidence of externalities. This has been done by looking for associations between the increased presence of multinational enterprises (MNEs) in a sector and productivity improvements in local domestic firms in the same sector (horizontal spillovers) or in local domestic firms in other sectors through upstream or downstream mechanisms (vertical spillovers). We argue that the effect of these indirect spillover mechanisms depends on inter-industry linkages and underlying industrial structures. Lack of economic complexity will limit the scope for knowledge/technology diffusion of FDI spillover externalities (Hidalgo, Klinger, Barabasi, & Hausmann, 2007; Bahar, Hausmann, & Hidalgo, 2014). This means that the way in which knowledge/technology spillovers is typically measured leads us to hypothesise that FDI spillover externalities (all else equal) are less likely to occur in countries where absorptive capacity is weak (Africa) as compared to countries with more complex industrial structures (Asia) (Marin & Bell, 2006).

Yet, direct linkages may also be at play. Arrow (1969) highlights that knowledge diffusion often requires direct (inter-personal) interaction, and that knowledge diffusion is not an automatic process; the potential for actual linkages is also dependent on the absorptive capacity of local domestic firms as well as the MNE objectives and activities (Marin & Bell, 2006). To get a more complete picture of MNE knowledge/technology transfers, we therefore need to understand both direct linkages and indirect spillover effects of FDI. Arguably, treating these concepts separately in empirical studies may yield insights to help unpack the heterogeneous country effects of FDI knowledge/technology transfers found in the literature. Due to data limitations only a few studies have focused on studying the nature and existence of direct FDI linkages (Jindra, Giroud, & Scott-Kennel, 2009; Giroud, Jindra, & Marek, 2012; Newman, Rand, Talbot, & Tarp, 2015), and to our knowledge no study has tried to verify information of direct FDI linkages using information from both MNEs and linked local domestic firms, respectively.

The aim of this study is to provide new evidence on the existence of direct FDI linkages in developing country contexts. We rely on a specially designed survey instrument implemented in seven countries (Cambodia, Ethiopia, Ghana, Kenya, Mozambique, Vietnam, and Uganda) enabling us to identify direct linkages between domestic and foreign affiliates. We use data triangulation to identify direct MNE–local domestic firm links. This is done to obtain as accurate a measure of direct knowledge/technology transfers as possible using information from both 'nodes' forming the relationship. To distinguish possible MNE spillover effects from vertical linkages stemming from international trade, additional domestic firms not directly linked to MNEs within the country were included in the sampling frame if they engaged vertically with a foreign company outside the country. We obtained information from seven central government bodies responsible for national FDI relations, data from 102 MNEs linked to 132 domestically owned firms either as suppliers or customers, and 94 domestically owned firms vertically linked to MNEs through trade.[2] Our approach helps identify whether relations between MNEs and domestic firms lead to recognised direct transfers of knowledge/technology. As such, the contribution of our paper is twofold: (i) conditional on having MNE client or supplier relations, we document the extent of which direct technology/knowledge transfers between MNEs and domestic firms actually take place, and (ii) analyse firm attributes likely to be associated with these direct transfers.

We document relatively few linkages between MNEs and domestic firms in sub-Saharan Africa as compared to Asia. The few linkages documented in the sub-Saharan African countries is puzzling since MNEs in this study were selected using a purposive sampling approach, where national

investment promotion agencies (IPAs) in each country were asked to select the foreign affiliates most likely to be linked to domestic clients and suppliers. As such, the documented linkages are likely to be upper bound estimates. However, when these linkages are present the likelihood of direct knowledge/technology transfers from MNEs to domestic firms is relatively higher in Africa as compared to Asia. Our results, therefore, suggest that in the absence of sufficient economic complexity, that would normally facilitate indirect technology spillover externalities, establishing direct linkages between foreign and domestic partners through binding contractual agreements may be an effective policy in helping to ensure that MNE presence leads to technology spillovers in Africa. Finally, our evidence also seems to suggest that direct knowledge/technology transfers are not more likely to occur through FDI than through trade – a result that is inconsistent with the view that tacit knowledge transfers are more likely to occur through localised linkages.

The paper is structured as follows: in Section 2 we provide an overview of the most recent literature. Section 3 presents our triangulation approach and describes the data used for the econometric analysis. Section 4 presents the results regarding direct horizontal transfers, and Section 5 investigates direct vertical linkages. Section 6 offers concluding remarks.

2. Background and related literature

The empirical literature on the effects of indirect FDI spillovers/externalities in transition and developing countries is large and has been discussed in several reviews (examples are Caves, 1996; Blomström and Kokko, 1998; Markusen and Venables, 1999; Görg and Greenaway, 2004; Javorcik and Spatareanu, 2005; Moran, 2007; Javorcik, 2008; Smeets, 2008; and Alfaro, 2014). This literature suggests that the potential for positive FDI technology externalities depends on the mechanism through which the knowledge transfers occur.

Analysis of whether FDI can help develop Africa's industrial capacity is typically pursued along two dimensions: (i) **Horizontal** linkages analysing whether the presence of foreign-owned firms within the same industry leads to knowledge/technology upgrading in local domestic firms, and (ii) **Vertical** linkages looking at foreign-owned firm effects on probabilities of knowledge transfers to local domestic input suppliers and/or customers of MNEs. Most literature, as already noted, measures linkages indirectly by exploring the extent to which the dominance of foreign firms within and across sectors impacts on the productivity of domestic firms through externalities. Only a few studies have considered the extent to which self-reported knowledge moves between firms along the supply chain, and whether such transfers are directly related to interactions with foreign-invested firms. As such, most studies do not separate out direct knowledge transfers from more indirect externalities associated with FDI. The distinction between indirect and direct effects is important given that different industrial policy recommendations will emerge depending on which mechanism dominates. In economies with relatively high levels of intermediary competition and a relatively high degree of economic complexity, conditions for indirect spillovers are such that incoming knowledge and capabilities from FDI in a specific sector are highly likely to spread naturally both horizontally and vertically. On the contrary, in economies characterised by low levels of competition and economic complexity, industry policies facilitating direct knowledge transfers between specific partners may be necessary to ensure that knowledge and capabilities are transferred to industries that subsequently have the largest opportunity gains (Hausmann et al., 2013).

Horizontal spillovers within sectors may arise when workers move from MNEs to local domestic firms, bringing knowledge with them. Similarly, domestic firms may observe MNEs operating in their sector and copy their technologies. Finally, within sector competition between MNEs and domestic firms may force domestic firms to increase efficiency to survive, even though MNEs may have an incentive to prevent their embodied knowledge and technologies from leaking to local domestic competitors. These effects can also lead to the least efficient firms exiting, thereby improving overall productivity within sectors. This could lead to observed productivity improvements within sectors with a large dominance of MNEs, but should not automatically be interpreted as evidence of positive technology externalities/spillovers. In general, the empirical literature on intra-

industry externalities has failed to find robust evidence for productivity gains accruing to local domestic firms through horizontal spillovers.

Effects through vertical spillovers/externalities are, on the other hand, more likely to be positive, since conflicts of interest between MNEs and their suppliers/customers are less likely. Positive spillovers through backward linkages occur when domestic firms that supply inputs to MNEs experience productivity improvements. This can happen through a number of different channels. First, it can increase possibilities for scale economies among domestic suppliers due to greater demand for intermediates produced by local domestic firms. Second, domestic suppliers may get better incentives to improve the quality of their inputs and increase the efficiency with which they are provided, due to increased requirements from MNEs and competition from other local firms for foreign customers. Third, there is also the direct effect, focusing on the deliberate knowledge transfers from MNEs to domestic input suppliers. However, in the literature this direct effect is generally not separated from the indirect effects of MNE presence. It is also possible that backward linkages could have negative externalities, and the literature finds that a pre-condition for positive spillovers through backward linkages is that domestic input suppliers produce varieties that are similar to the input requirements of MNEs. This means that the absorptive capacity and adaptability of local domestic firms matter for the nature of spillovers through backward linkages.

Forward spillovers from MNE suppliers of inputs to downstream local domestic firms have been studied less in the literature. However, intermediates provided by an MNE may embody new advanced technologies from which local domestic firms can gain knowledge and improve efficiency. These inputs could be accompanied by services or other forms of support that impact upon the productivity of domestic users, and in contrast to imported intermediates, the tacit knowledge in these intermediates may only be realisable in localised settings through direct interactions (Arrow, 1969). In addition, increased competition among input suppliers due to increased MNE presence may benefit downstream local domestic firms due to more efficiently produced inputs by all upstream firms.

Much of the recent empirical research investigates the existence of such FDI externalities with a focus on vertical linkages; particularly backward linkages. And on average (according to the review papers cited above) the studies support the presence of positive vertical FDI spillovers. In this literature, FDI spillovers are often inferred from associations between the intensity of presence of MNEs in a sector and productivity in local domestic firms in other sectors (using aggregate input-output information to support sector inter-linkages). As highlighted in Javorcik and Spatareanu (2011), this standard approach assumes a positive linear relationship between the share of local inputs sourced by MNEs and the extent of non-pecuniary knowledge (or technology) externalities through backward linkages to domestic suppliers in linked industries. Giroud et al. (2012) highlights that more competitive and complex value chain relationships may limit direct transfers of knowledge along vertical dimensions. This is so even if they may facilitate indirect spillovers. Direct and indirect linkages should, therefore, be analysed separately as also emphasised above.

Newman et al. (2015) try to overcome this by using self-reported firm information on knowledge/technology transfers, to uncover whether vertical effects are more likely to emerge from direct (self-reported) MNE linkages or whether effects are more likely to be driven by indirect FDI spillovers. They find, in the case of Vietnam, that indirect FDI spillovers are more likely to drive local domestic firm productivity improvements as compared to knowledge transfers through direct linkages between MNEs and domestic firms. This finding is consistent with Hirschman (1958), and Vietnam has a relatively complex industrial structure with well-established inter-sector linkages. However, in countries (Africa) that lack economic complexity there will be less absorptive capacity and weaker industrial linkages and so MNEs are less likely to generate positive indirect externalities. Instead, MNE presence is more likely to generate what Hirschman refers to as enclave economies. But, given that location decisions by MNEs reflect location fundamentals, an MNE choosing to locate in a country with limited scope for indirect knowledge/technology externalities must do so on the basis that they (i) do not find the effects of externalities sufficiently important for their business (for

example, the case where MNEs source inputs from abroad and focus primarily on export markets) or (ii) believe that the MNE through direct knowledge transfers can facilitate the necessary initial technology upgrading of local suppliers/customers (and start a process for a future increase in local value chain dynamics).[3] In the latter case, we would expect that direct knowledge/technology transfers are more likely to occur in locations with less industrial linkages. This is what we test in the remainder of this study.

3. Data and descriptive statistics

Data used in this study was collected using a data triangulation approach. Based on comparable semi-structured interviews with (i) each country's investment promotion agency (IPA), (ii) 102 MNEs, and, (iii) 226 firm owners or managers of domestic firms, we obtained insights into the determinants of and cross-country differences in direct FDI spillovers. Structured interview guides ensured comparability of the information across source and country. For logistical purposes, the interviews were carried out in major cities only.

The sample of firms was selected as follows (purpose sampling combined with a sequential/snowball sampling technique): First, a semi-structured interview of the central government authorities in charge of attracting foreign investment was carried out. The investment agency targeted was the one feeding into UNCTADs *World Investment Report* with information for its annual survey. We therefore targeted institutions at the same level of responsibility. The identical semi-structured survey instrument provides systematic and comparable insights into government perceptions about possible FDI technology linkages from existing partnerships.[4] When asked about ways in which technology transfers from MNEs to domestic producers are likely to occur, the IPAs generally commented on the potential for generating direct linkages between MNEs and local domestic firms, and were less focused on describing policies to facilitate increasing FDI impact from externalities. Moreover, the country with the fewest identified direct linkages (Kenya) was the most optimistic about the potential for positive technology spillovers.

As part of the IPA interview the enumerator, in collaboration with the government FDI agency, identified up to 20 MNEs in the manufacturing sector with majority foreign ownership to be subsequently interviewed, and in most cases the government MNE agency was helpful in facilitating the interviews. In some countries, 20 manufacturing MNEs with majority foreign ownership could not be identified (or interviewed) in the chosen city. In such cases a broader industry definition was applied (including in addition to manufacturing, mining, electricity and water, and construction). Even with this expanded industry definition it was sometimes difficult to identify the targeted number of MNEs operating in the industrial sector. In countries/locations where there were numerous MNEs to select from, MNEs producing intermediates for the domestic market were preferred. In the end, information from a total of 102 industrial MNEs across the seven countries were available for analysis.[5]

Second, based on this MNE identification, enterprises were interviewed using a pre-designed interview guide, focusing on location choice determinants and local technology transfer. As part of the interview the enumerator, in collaboration with each MNE, identified: (i) up to three domestically owned industrial firms, which are customers of the MNE, and (ii) up to three domestically owned industrial firms which are suppliers to the MNE. Moreover, whenever possible each MNE should mention three in-country direct competitors to the MNE. With 102 MNEs this could in principle have resulted in 606 (3*2*102) interviews with domestic firms vertically linked to the MNEs as either customers or suppliers. However, only 132 vertically linked firms were identified. The explanation for this can be found in Table 1(A) and 1(B) in the Supplementary Materials which provide examples of the MNE responses for Kenya and Vietnam, respectively (where firm identifying details are removed from the table to ensure anonymity).

To distinguish possible vertical MNE spillover effects from backward and forward linkages stemming from international trade, additional domestic firms not directly linked to the identified

MNEs were purposely included in the sampling frame if they engaged (i) in supplier relationships with a foreign company outside the country (direct export) in another sector (defined at the four digit ISIC level), or (ii) in purchaser relationships with a foreign company outside the country (direct import) in another sector. To identify these firms, assistance from the country IPAs was relied upon. Combined with domestic firms identified as having direct links with MNEs within the country, a total of 226 domestic firms across the seven countries ended up being available for analysis. Of these, 132 were directly vertically linked (supplier or customer) to an MNE with a branch within the country.

It should be highlighted that this sampling approach was highly ambitious, and in itself gave some important insights. First, it was confirmed that many MNEs (especially in the five African countries) are not linked with any domestic manufacturing firms, that is, that they only have links to other MNEs within the country. Several MNEs are sole producers of particular/niche products, and thus have no competitors; others rely solely on imports, and thus do not source intermediate inputs from the domestic market. A large majority of MNEs produce wholly for the export market, implying that direct domestic forward linkages will be non-existent for these firms. Second, and more surprising, MNEs engaged with domestic suppliers and/or customers identified those on a day-to-day basis and very few had long-term relationships with domestic suppliers/customers. Consequently, limited information about names, location, and other contract details were available.

Figure 1(A) and 1(B) in the Supplementary Materials illustrate (taking again the cases of Kenya and Vietnam) country differences in the composition of sampled firms and their relations, and Tables 1 and 2 document selected summary statistics by country obtained from the semi-structured interviews with the 102 MNEs (Table 1) and 226 domestic firms (Table 2) with links to a multinational company.

MNEs are, as expected, large firms, but the sampled domestic firms are also relatively large. The average number of employees across the seven countries is 850 (MNE) and 275 (Domestic), respectively, with the majority of these being full-time employed. Moreover, most MNE employees are 'local'. In terms of ownership structure, we find that most MNEs in the sample are wholly foreign-owned. We note that this does not mean that Joint Ventures (JVs) between foreign and domestic firms are not a growing part of the enterprise population. Most MNEs entered through Greenfield Investments (76%), while the remaining firms have either acquired or merged with existing businesses. There is an indication that MNEs in Africa use mergers and acquisitions (M&A) more frequently as an entry mode than in the two Asian countries.

Interestingly, we observe major cross-country differences in the main reasons for the location choices of MNE. Resource-seeking FDI (host country rich in minerals, raw materials, lower labour costs, and so forth) is highlighted as the main reason in Ethiopia, Uganda, and Vietnam whereas market-seeking FDI is mentioned as a main determinant of location choice in Ghana, Kenya, and Mozambique. We note that very few MNEs chose their location due to expectations of improving production efficiency.

Tables 1 and 2 also show that around 40 per cent of the MNEs and 28 per cent of domestic firms with MNE links are located in Special Economic Zones (SEZs), respectively. This SEZ average masks major cross-country differences (Cambodia, Ghana, and Kenya with very few firms located in SEZs and Ethiopia and Vietnam with more focused SEZ policies). In addition, we also asked more specific questions about firms' reasons for choosing their current production site. Again, a lot of variation is observed cross-country. In some countries, several firms state that the production site was allocated by the government (Ethiopia), whereas a location close to its customers is the dominating location 'choice' criteria in other cases (Vietnam). Good infrastructure is also highlighted as one of the main drivers of location choice, both for domestic and foreign-owned firms.

Table 3 documents summary statistics about firm-level technology and the modes through which this new technology is acquired for both MNEs and domestic firms. The first row of each panel in the table shows the firms' self-evaluations of their technology in comparison with their competitors. Some, 49 per cent of MNEs and 26 per cent of the domestic firms, claim to have a technology advantage compared to their competitors. At the same time, only around 30 per cent of both types of firms cited that they would be able to increase capacity by more than 25 per cent using existing production structures.

Table 1. Summary statistics, MNE

	Total	Cambodia	Ethiopia	Ghana	Kenya	Mozamb	Uganda	Vietnam
Average number of employees (in country)	850	2814	389	347	1116	321	286	598
Share full-time permanent employees (per cent)	82	99	84	87	87	79	74	68
Share local employees (per cent)	81	98	96	64	99	93	89	50
Sectors best represented in the sample	..	Textiles	Food	Food	Mixed	Mixed	Mixed	Mixed
	..	Garments	Textiles	Rubber	..	..	..	..
	..	..	Garments	Plastics	..	..	..	..
Share 100 per cent foreign ownership (per cent)	84	100	80	78	73	89	80	89
Mode of entry								
M&A	21	7	40	25	18	56	13	0
Greenfield	76	93	60	50	82	44	81	100
Other/Not specified	3	0	0	25	0	0	6	0
Main reason for choosing country (per cent)								
Resource seeking	37	27	58	11	9	33	42	50
Market seeking	36	13	32	44	46	56	37	39
Efficiency seeking	9	7	5	22	0	0	21	6
Capabilities/strategic assets	4	0	0	0	18	11	0	5
Other/Not specified	14	53	5	22	27	0	0	0
Firms with more than one production facility in the country (per cent)	32	40	20	33	36	56	40	17
Main production facility located in a SEZ (per cent)	40	20	40	11	18	44	42	78
Main reason for choosing production location **within** country (per cent)								
Allocated by authorities	18	0	35	0	27	11	15	17
Availability of cheap labour	12	27	10	0	0	0	15	11
Good infrastructure	24	60	0	66	36	22	15	17
Location close to input suppliers	10	13	15	0	18	0	15	0
Location close to customers	25	0	25	0	0	45	30	50
Location close to competitors	2	0	5	0	10	0	0	0
Other reasons/Not specified	9	0	10	33	9	22	10	5
Number of MNEs	102	15	20	9	11	9	20	18

Note: Based on a total of 102 interviews.

Table 2. Summary statistics, domestic firms

	Total	Cambodia	Ethiopia	Ghana	Kenya	Mozamb	Uganda	Vietnam
Average number of employees (in country)	275	444	248	296	317	2,702	200	165
Full-time permanent employees	213	443	208	193	296	1,453	177	123
Share single ownership (per cent)	37	47	21	45	15	60	14	49
Firms with more than one production facility in the country (per cent)	24	16	20	14	38	20	11	33
Main production facility located in a SEZ (per cent)	28	0	53	0	15	0	47	26
Main reason for choosing production location **within** country (per cent)								
Allocated by authorities	17	0	38	23	15	0	14	12
Availability of cheap labour	7	5	10	5	0	20	6	9
Good infrastructure	20	5	35	23	8	0	22	18
Location close to input suppliers	16	32	5	9	23	40	11	19
Location close to customers	23	11	3	14	15	0	22	40
Location close to competitors	4	0	3	9	0	0	6	3
Other reasons/Not specified	13	47	8	18	38	40	19	0
Number of domestic firms	226	19	40	22	13	5	36	91

Note: Based on a total of 226 interviews.

Table 3. Technology and innovation

	Total	Cambodia	Ethiopia	Ghana	Kenya	Mozamb	Uganda	Vietnam
MNEs								
Share that would characterise the technological level/capacity of the firms' existing machinery and equipment above the level of its main competitors	49	67	45	44	64	78	35	33
Capacity utilisation (Share of firms that would you be able to increase production by more than 25 per cent using existing equipment/machinery only?)	39	27	65	0	45	71	40	22
Introduced a new technology/production process within the past two years	63	80	55	67	55	86	70	44
Share of firms that obtain machinery and equipment from local suppliers	16	0	20	13	0	..	40	6
Does the firm undertake in-house R&D	50	20	40	78	45	88	65	39
Does the firm hold internationally recognised patents	43	0	30	33	73	89	65	6
Introduced new product (at the ISIC 4 digit level) within the past two years	25	0	5	63	27	44	40	22
Domestic Firms								
Share that would characterise the technological level/capacity of the firms' existing machinery and equipment above the level of its main competitors	26	42	28	35	69	0	31	10
Capacity utilisation (Share of firms that would you be able to increase production by more than 25 per cent using existing equipment/machinery only?)	31	58	43	38	50	40	39	10
Introduced a new technology/production process the past two years	46	58	58	62	38	60	67	24
Share of firms that obtain machinery and equipment from local suppliers	25	0	10	35	8	25	20	42
Introduced new product (at the ISIC 4 digit level) within the past two years	30	11	25	40	46	20	59	22

Note: MNE and Domestic Firm information based on 102 and 226 observations, respectively.

Moreover, two-thirds of MNEs and almost half of the domestic firms mentioned that they introduced new technology or production processes in the last two years.[6] As such, both MNEs and domestic firms seem highly dynamic in terms of technological upgrading and most are utilising their capacity fairly well. The tables also show that these dynamic technological features translate into relative high levels of innovative capacity. Some 25 per cent of MNEs and 30 per cent of domestically owned firms have introduced new product groups (defined at the four-digit ISIC code level) in the last two years.

The focus of this study is on how these dynamic features come about and whether the domestic firms get 'additional' technology that is directly transferred from linked MNEs or whether technology upgrading continues to be driven through other mechanisms.[7] An observation that could lead to questioning whether technology spillovers between 'linked-in' MNEs and domestic firms are likely to lead to direct production technology upgrading is that very few firms source new technology locally/domestically (16% of MNEs and 25% of domestic firms). Most firms acquire their technology through direct import, and a significant amount of MNEs acquire technology from headquarters located abroad. Indeed, learning new production technologies and processes from abroad seems critical in building greater firm-level technological capability.

4. Direct technology transfers through horizontal spillover channels

One mechanism through which domestic firms may experience a direct technology transfer is through horizontal mechanisms as described in Section 2. Table 4 illustrates the presence or lack of potential direct technology transfers along the horizontal dimension from MNEs to linked domestically-owned firms. Some 57 per cent (49 out of 86) of MNEs reported that they observed that main domestic competitors changed production techniques and processes as a direct result of the competitive pressure from the MNE. The share was 37 per cent (81 out of 221) when asking linked domestic firms. However, when zooming in on linked domestic firms listed as competitors, there is an almost perfect correspondence between answers for the linked MNE and the domestic firm listed as a competitor. Use Table 1(A) in the Supplementary Materials (Vietnam) as an example: it documents that FDI firm number three (Location: Hanoi, Investor: Singapore, Sector: Tyres and tubes) named a domestic competitor (competitor number one), which the survey team approached for an interview. If the MNE and the domestic competitor gave answers in accordance with each other to similar questions we label this as corresponding link information.

These numbers indicate that the presence of MNEs indirectly act as a technology 'push' factor for domestic firm technology upgrading. This is confirmed in the second row of Table 4, which documents that 59 per cent of the MNEs that had observed changed production techniques in other firms due to competitive pressure also observed direct adoption of production techniques/processes (by observing or copying) from the MNE. Again there is consistency between corresponding links. Regional differences do exist (not documented in the table for reasons of exposition), with the African firm sample experiencing the competition and demonstration related spillovers more frequently than in Cambodia and Vietnam. Especially in the Vietnamese case, MNEs 'feel' the competition pressure from domestic firms and state that they have every incentive to prevent their embodied knowledge and technologies from leaking to these domestic competitors, a feature also found in the manufacturing sector in Eastern Europe (Javorcik, 2004).

Table 4 also explores direct linkages between MNEs and domestically owned firms, manifested in terms of labour market competition and the importance of spin-offs (former employees of FDI firms) in the domestic firms. Some 33 per cent of MNEs report that they have experienced employees leaving to set-up local enterprises directly connected to the FDI. However, not all former employees have set-up competing businesses. They have instead exploited existing opportunities (and local information) and have become either customers or suppliers of the MNE. Corresponding link consistency is weaker in this case, which is also illustrated by the relatively low share (27%) of linked domestic firms reporting that they have hired employees initially trained in MNEs. Contrary to the demonstration/competition effects, the data do not show any

Table 4. Horizontal spillovers

MNE responses: COMPETITION/DEMONSTRATION SPILLOVERS				
		Yes		No
FDI observed domestic firms (competitors within the same ISIC 4-digit code) changing production techniques/processes as a direct result of competitive pressure from the firm.		49(57)		37(43)
	Yes	No	NA	
FDI observed domestic firms trying to directly adopt production techniques/ processes (by observing or copying) from the FDI?	29(59)	17(35)	3(6)	
MNE responses: LABOUR SPILLOVERS				
		Yes		No
Experienced employees leaving to set up a local enterprise directly connected to the FDI		33(33)		67(67)
Share as competitors	15		(45)	
Share as customers	19		(58)	
Share as suppliers	18		(56)	
Domestic firm responses: COMPETITION/DEMONSTRATION SPILLOVERS				
		Yes		No
Firm changed production techniques/processes due to competitive pressure from MNEs within the same sector		81(37)		140(63)
		Yes		No
Directly adopted production techniques/processes from these MNE competitors		34(46)		47(54)
Domestic firm responses: LABOUR SPILLOVERS				
		Yes		No
Firm hired employees initially trained in an MNE		57(27)		154(73)
		Yes		No
The engagement of these employees directly result in changes in production techniques/processes		30(53)		27(47)

Note: Percentages in parenthesis.

immediate cross-country differences in horizontal spillovers along the labour mobility dimension. An interesting observation occurred when the survey teams inquired with domestically owned firms whether hiring spin-offs have resulted in any meaningful impact on the firm's production process or technique. Some 53 per cent reported that the recruitment of former employees of MNEs has had such an impact.

Summarising, domestic firm technology choice decisions seem to be influenced by MNEs technology levels and dynamics along the highlighted horizontal dimensions (demonstration/competition and labour/spin-off effects). However, this type of analysis does not provide insights into whether these horizontal influences from MNEs are more pronounced than influences from other local domestic competitors, an issue to which we now turn.

5. Direct technology transfers through vertical spillover channels

In the previous section, we documented that horizontal spillovers (within sectors) to some degree arise when workers move from MNEs to domestic firms, bringing with them knowledge learnt that influences firm technology choices. Similarly, domestic firms observe and copy/adapt MNE technologies, and it also seems that competition from MNEs forces domestic firms to increase efficiency to survive (especially in the sample of African firms).

According to our literature review, direct technology spillovers between sectors are more likely to bring productivity improving benefits to domestic firms through vertical spillover mechanisms. Yet, the literature has been focusing on vertical spillovers through externalities that are studying direct links, which are in focus here. Figure 1 shows how technology spillovers from MNEs to domestic firms in other sectors are defined.

Spillovers through *backward* linkages occur when domestic firms that supply inputs to MNEs experience significant productivity changes (positive/negative) due to the interaction between the two parties. Most of the literature on backward linkages is only suggestive about how these backward linkages happen, and direct technology transfers, that is deliberate knowledge/technology transfers from MNEs to domestic input suppliers have, to our knowledge, only been studied in a few cases.[8]

Grossman and Helpman (1991) document that *forward* linkages also have the potential to lead to direct positive knowledge/technology spillovers from MNEs supplying inputs to downstream domestic firms. The idea is that intermediates provided by MNEs embody new and more advanced technologies from which domestic firms can learn. In contrast to imported intermediates, these inputs are accompanied by services (or other forms of support) that impact on the productivity of domestic users (Javorcik, 2004).

In what follows we aim to disentangle the characteristics of domestic firms experiencing direct vertical spillovers. Table 5 summarises some of these characteristics, combining information from MNEs and linked domestic firms. Around 25 per cent of the MNEs interviewed do not have any interactions with domestic firms. This corresponds fairly well with the observation that 15 per cent of the domestic firms report not having customer/supplier relations with MNEs (either domestic links or through direct exports/imports). Focusing on the variables of interest, we asked MNEs directly whether their relations with domestic customers/suppliers required a direct technology transfer from the MNE to the customer/supplier. It can be seen from Table 5 (Panel A) that on average 18 per cent of interviewed MNEs reported experiencing backward linkages. Of these, 36 per cent stated that the knowledge/technology transfers were directly stipulated in the contracts with their domestic customers. In addition, 21 per cent of firms experienced forward linkages, with 47 per cent of these stating that transfers of capabilities were stipulated directly in formal contracts. This supports the case study findings by Moran (2001). Moreover, the summary statistics show that direct forward linkages are more frequently observed than direct backward linkages. As illustrated with the Kenya versus Vietnam cases and the spline plots of the fraction of direct technology transfers by country (Figure 3) in the Supplementary Materials, we see that direct technology transfers are more likely to take place among the sample of African MNEs than in the Asian region. The same patterns are generally found from the interviews with linked domestic firms (Table 5 – Panel B).

We now proceed to take a closer look at the association between region and the probability of receiving a direct knowledge/technology transfer either upstream or downstream using a traditional probability model, controlling for firm size and age, customer/supplier relations, production characteristics, and location. Hence, we estimate log-odds-ratios from a logit-specification describing the probability of a domestic firm receiving a direct technology transfer. The model is formulated as

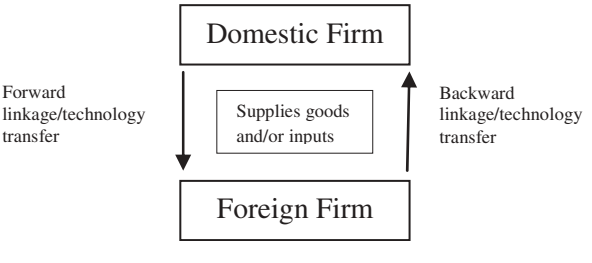

Figure 1. Definition of vertical linkages/technology transfers.
Note: Direction of linkages is defined from the perspective of foreign firms.

Table 5. Vertical spillovers

		Customers (forward linkages)	Suppliers (backward linkages)
Panel A: MNE responses: Vertical spillovers		Per cent	Per cent
Produces mainly for final consumption		53	..
100 per cent sales to or import from other FDIs or through direct exports/imports		24	33
Share with 5 or less customers/suppliers		27	60
Relations with domestic customers/suppliers required a direct technology transfer from the FDI to the customer/supplier	All	21	18
	Kenya	50	30
	Vietnam	6	6
Transfer stipulated directly in contract	All	47	36
	Kenya	50	67
	Vietnam	0	0
		Suppliers (forward linkages)	Customers (backward linkages)
Panel B: Domestic firm responses: Vertical spillovers		Per cent	Per cent
Produces mainly for final consumption		..	46
Customer/supplier relations with MNEs either domestic links or through direct exports/imports		85	84
Share with 5 or less customers/suppliers		53	15
Relations with customers/suppliers required additional investments in order to obtain contract	All	19	30
	Kenya	31	38
	Vietnam	9	21
Relations with customers/suppliers required resulted in a direct technology transfer from the customer/supplier to the firm	All	76	41
	Kenya	75	80
	Vietnam	14	5
Share of firms receiving the technology transfer from an MNE		56	27

Note: Numbers based on 102 MNEs and 226 linked local domestic firms.

$$\Pr(y_{ic} = 1|x_{ic}, c) = \Lambda(\beta' x_{ic} + \alpha_c), i, ..., N_c, c = 1, ..., 7. \quad (1)$$

where y_{ic} equals one if firm i in country c receives a knowledge/technology transfer; x_{ic} are the firm-specific technology linkage determinants; while $\alpha_c$is the country specific term; and Λ is the logistic distribution function. Controls more specifically include firm size (log employees), firm age (establishment year in logs), ownership structure (indicator for single owner firm), production characteristics (indicator for production for final goods use), location (indicator for only one production facility, indicators for special economic zone, country), and customer/supplier relations (size of customer/supplier base, and indicators for engagements with MNEs both within and/or outside the country). Based on the above we are especially interested in establishing whether direct vertical spillovers are more likely to occur in our sample of African countries as compared to our selected Asian countries.

Table 6 reports the regression results dividing the table into transfers from backward linkages (panel A) and forward linkages (panel B), respectively. The results in column (1) indicate that, conditional on firm size and age, local domestic firms are less likely to receive a direct knowledge/technology transfer if they have an MNE (within the country) as a customer than if they have a foreign firm abroad, or a domestic firm, as a customer. This result is rather striking, given the purposive sampling approach applied, where results are expected to be biased towards over-estimating vertical transfers occurring through within country firm linkages. Adding a regional control in column (2) shows that the negative

Table 6. Vertical spillover determinants

	Panel A: Backward linkages			Panel B: Forward linkages		
	1	2	3	4	5	6
Firm size	0.030**	0.025**	0.020*	0.006	−0.003	−0.005
(Number of employees, log)	(2.19)	(2.11)	(1.73)	(0.36)	(0.25)	(0.36)
Firm age	0.032	0.018	0.032**	0.061*	0.030	0.019
(Years, log)	(1.54)	(1.17)	(2.05)	(1.70)	(1.20)	(0.58)
MNC/FDI customer/supplier	−0.126***	−0.042	−0.005	−0.144***	0.043	0.012
(Yes = 1, No = 0)	(2.56)	(0.90)	(0.17)	(2.75)	(0.76)	(0.21)
Africa		0.110**	0.123**		0.287***	0.279***
(Yes = 1, No = 0)		(2.20)	(2.12)		(3.24)	(2.76)
Other controls	No	No	Yes	No	No	Yes
Observations	189	189	170	171	171	164
Pseudo R2	0.170	0.218	0.322	0.103	0.200	0.208

Note: The dependent variable is the indicator of firms receiving a direct knowledge/technology transfer. Robust t-statistics. *Significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

coefficient on the MNE customer relations indicator is driven by differences across the African and Asian samples. African firms are generally more likely to receive direct knowledge/technology transfers and less likely to have an MNE as a customer, than Asian firms. Including the additional controls described above does not change this result (column (3)).

A similar pattern is found for forward linkages. This suggests that when local domestic firms are being supplied inputs by an MNE within the country this is negatively associated with an increase in the likelihood of receiving a direct knowledge transfer through forward linkages. At the same time, operating in Africa (ceteris paribus) increases this probability as compared to firms in Asia. These results are consistent with the information obtained from the 102 interviews with MNEs, and it suggests that MNEs in Africa are more likely to engage in direct contractual arrangements both upstream and downstream regarding transfers of technology and know-how as compared to Asian MNEs. However, it should be highlighted that even in our African sample of domestic firms purposively selected to have a higher likelihood of being vertically integrated with an MNE, direct technology/knowledge transfers through FDI are not more likely to be observed than direct technology/knowledge transfers through trade (results available in the Supplementary Materials).

The differential size effect for African and Asian firms may be a sign of general differences in the parameters. If so, the total regional effect on the probability of receiving an MNE knowledge transfer cannot be estimated by simply adding country dummies in the non-linear regression. We, therefore, estimate the total regional effect using a generalised Oaxaca-Blinder decomposition.[9] The generalised Oaxaca-Blinder decomposition can identify two components of the unconditional vertical knowledge technology transfer gap by region (that is the difference between the probability of firms receiving a vertical technology transfer in Africa and Asia, respectively). The first component is a measure of the importance of differences in observable characteristics between African and Asian firms. We refer below to this component as the 'characteristics effect'. The second component is a measure of the importance of differences in parameters for the two regions, capturing variation in the returns to the characteristics between African and Asian firms. We refer to this as the 'regional effect' because this is the estimated average effect on probabilities of receiving a direct vertical knowledge/technology transfer for African firms.

Algebraically, the direct vertical knowledge/technology transfer gap between African and Asian firms can be described by decomposition into two components:

$$\Delta = \frac{1}{n}\sum_{i=1}^{n}(\Lambda(\hat{\beta}'_{SSA,i}x_{SSA,i} + \hat{\alpha}_{SSA}) - \Lambda(\hat{\beta}'_{SSA,i}x_{A,i} + \hat{\alpha}_{SSA}) + \frac{1}{n}\sum_{i=1}^{n}(\Lambda(\hat{\beta}'_{SSA,i}x_{A,i} + \hat{\alpha}_{SSA}) - \Lambda(\hat{\beta}'_{A,i}x_{A,i} + \hat{\alpha}_{A,i}) \quad (2)$$

where Δ is the gap between the probability of receiving a vertical technology transfer for African and Asian firms, respectively. The first term on the RHS is an estimate of the difference in probabilities of receiving a direct vertical technology transfer for African (*SSA*) and Asian (*A*) firms where the expectation is evaluated under the African parameters (β_{SSA},α_{SSA}). This is the characteristics effect as it extracts the importance of differences in firm characteristics and aggregates these differences using equal weights. The second term is an estimate of the difference in expected probability of a direct vertical knowledge/technology transfer for African firms when the expectation is evaluated under the Asian and African parameters, respectively. This is the regional effect.

Table 7 shows the results of generalised Oaxaca-Blinder decompositions by region. Panel A reports the results without additional controls while Panel B controls for all firm attributes described above. Samples are divided into three categories: (i) Full sample – column (1); (ii) sample excluding domestic firms vertically linked through trade – column (2); and (iii) sample excluding firms vertically linked to MNEs (within country) – column (3). In all columns the reported direct vertical knowledge transfer differences in means are positive, and direct vertical transfers are more likely to be observed in Africa as compared with Asia, independent of whether the knowledge transfer comes from within the country or through trade relations. In column (1) Panel A and B, the differences in firm characteristics are small and statistically insignificant. This indicates that there should not be regional differences in probabilities of receiving direct vertical knowledge transfers, based on information about differences in firm attributes. The positive and statistically significant regional effect is driving the differences in means. Accordingly, it would appear that the probability of vertical linkages depend on differences in underlying regional characteristics and is not due to differences in firm-specific attributes. Comparing results in columns (2) and (3), we see that the conclusion using all firms is consistent with results considering only within country linkages (column 2). In contrast, differences in trade-related vertical knowledge transfers are explained by differences in firm characteristics (column 3). This result suggests that we should expect differential regional effects (for 'identical' firms) of direct vertical knowledge transfers through FDI, whereas the probability of receiving technology transfers through the trade channel is likely to be driven by individual firm level attributes.

Table 7. Generalised Blinder Oaxaca decomposition of the regional vertical knowledge/technology transfer gap

	All firms		Only MNE linkages		Only Trade linkages	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Panel A: Without controls						
Difference in means	0.406***	(6.70)	0.393**	(2.18)	0.278**	(2.10)
Characteristics effect	0.048	(0.53)	−0.015	(0.54)	0.616	(1.40)
Regional effect	0.358***	(3.17)	0.408**	(2.18)	−0.339	(0.79)
Panel B: With controls						
Difference in means	0.425***	(6.32)	0.464***	(2.65)	0.288**	(2.35)
Characteristics effect	0.009	(0.08)	−0.033	(0.39)	0.495**	(2.40)
Regional effect	0.416***	(3.44)	0.497**	(2.44)	−0.207	(1.01)

Note: 'MNE or trade linkages' restricts the sample to firms with direct relations with either a foreign firm outside the country or foreign firm within the country. 'Only MNE linkages' restricts the sample to firms with direct relations with a foreign firm within the country. Panel A reports regressions without additional controls, whereas Panel B includes controls. t-statistics (in parenthesis) based on bootstrapped standard errors (500 replications). *Significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

6. Conclusion and discussion

A common feature of the FDI spillover literature is that an indirect approach is used to measure the effect of knowledge spillovers. Associations between the increased presence of MNEs and productivity improvements in local domestic firms are interpreted as a result of technology transfers from foreign affiliates to domestic firms. Mechanisms through which these transfers happen are many, but they all depend on inter-industry linkages and underlying industrial structures. Lack of economic complexity limits the scope for knowledge/technology diffusion of FDI, that is, sets a limit on the extent of spillover externalities. We hypothesise that FDI spillover externalities (ceteris paribus) are less likely to occur in countries where enterprise inter-linkages are weak (Africa) as compared to countries with more complex industrial structures (Asia).

Knowledge diffusion is not an automatic process, and it often requires direct interaction between involved parties. In this study, we have argued that to come to grips with the complete potential of MNE knowledge/technology transfers, we need to better understand the direct linkages associated with MNE presence. Due to data limitations, only a few studies have focused on studying the nature and existence of direct FDI linkages. To our knowledge, no study has so far tried to verify information of direct FDI linkages using information from both MNEs and linked local domestic firms, respectively. This is the challenge we have addressed here; triangulating information from seven countries (Cambodia, Ethiopia, Ghana, Kenya, Mozambique, Vietnam, and Uganda) to establish whether there is systematic evidence of the relationship between foreign direct investment (FDI) and the existence of knowledge/technology transfers from multinational enterprises (MNEs) to domestic firms.

Combining evidence from interviews with multinationals (MNEs) and linked local domestic firms we identified whether direct relations between MNEs and domestic firms lead to recognised direct transfers of knowledge/technology. Our results confirm that there are relatively few linkages between MNEs and domestic firms in sub-Saharan Africa as compared to Asia. However, when these linkages are present they are more likely to lead to direct knowledge/technology transfers from MNEs to domestic firms as compared to linked-in firms in Asia, where competition effects are more likely to erode possibilities for direct spillovers. However, controlling for traditional firm attributes we do not find that direct knowledge/technology transfers are more likely to occur through FDI than through trade. As such, our results are not consistent with the view that tacit knowledge transfers are more likely to occur through localised linkages. However, we do find that a large part of the direct vertical transfers of knowledge is done by formal contractual arrangements. This signals that IPA legal assistance to domestic firms could help facilitate increases in direct knowledge transfers from MNEs to domestic firms. Finally, our results could indicate that lack of economic complexity in African industry makes direct linkages a non-negligible aspect of MNE presence, in the absence of industrial structures normally facilitating externalities from FDI technology spillovers. A deeper analysis of this aspect would no doubt move the literature forward, and coming to grips with these characteristics is, in our assessment, critically important in formulating effective industrial policy in the years to come.

Disclosure statement

No potential conflict of interest was reported by the authors.

Acknowledgement

The paper was prepared as part of the UNU-WIDER research programme entitled ‘Learning to Compete (L2C)’. Data and replication code is available upon request. The usual caveats apply.

Notes

1. See Caves (1996), Rodriguez-Clare (1996), Markusen and Venables (1999), and Yeaple (2013) on the theoretical underpinnings of productivity spillovers from foreign to domestic firms.
2. The data gathered for the 94 domestic firms vertically linked to MNEs through trade relies only on answers provided by one side of the node forming the relationship. We assume in the following that accurateness of the information about direct knowledge spillovers provided by these firms is as accurate as information provided by the domestic firms linked to MNEs within the country.
3. This is in line with the 2012 UNIDO study (see Amendolagine, Boly, Coniglio, Prota, and Seric, 2013) which finds that foreign subsidiaries in Africa are aware of the lack of initial linkages but that they seek through direct interactions with local domestic firms to increase economy-wide inter-linkages with local firms over time.
4. Most IPAs are part of traditional line ministries, with a mandate to promote investment through attracting and retaining MNEs. The IPAs' core function is often to act as a 'one-stop shop' where any investor can obtain all necessary information needed to establish an enterprise fully facilitated without encountering any facilitation costs. Moreover, most countries have created documents that specify (to various degrees) the extent to which FDI is prohibited, restricted, allowed, or encouraged, and what FDI-related policy instruments the government intends to apply in the future. Currently, the majority of FDI policy measures taken have been within liberalising, facilitating, and promoting investments. Most countries in the sample have undertaken several policy measures directly affecting FDI, and countries are generally speeding up formal signings of International Investment Agreements (IIA), albeit from a low base. Bilateral Investment Treaties (BITs) are generally the preferred IIA, but Double Taxation Treaties (DTTs) are also becoming more and more common. However, several countries highlight that the countries lack competent professionals in government that are specialised in international law in general and in IIAs in particular, which is slowing down the process. All countries in the sample have established Special Economic Zones (SEZs) as a central part of the countries' investment and industrial policy, and the location placement of MNEs are often an integral part of SEZ policies. According to the IPA, the most common way of MNE entry is through Greenfield investments in SEZs. Most of these SEZs in the African sample have been established with a focus on lower value added sectors like food and agro processing, and textiles, garments, and leather products. All IPAs in the sample state that the creation of SEZs has been a success, but that the success is through export diversification and growth that is employment generation. Only in the case of Vietnam have the benefits and efficiency of SEZs begun to be questioned at this level.
5. Due to the selection procedure (purpose sampling), the MNEs chosen cannot generally be said to be representative of the total pool of manufacturing MNEs in the countries under study. However, the degree of representativeness will differ from country to country. For example, in some countries/cities (Uganda – Kampala and Ethiopia – Addis) the data is almost capturing the population of manufacturing enterprises, whereas in other countries/cities (Cambodia – Phnom Penh and Vietnam – Hanoi) the data is not representative of manufacturing MNE presence in the selected location.
6. Some two-thirds of the MNEs introducing new technologies/production processes found it necessary to carry out a technical adaption of the equipment/machinery to fit local conditions. Adaption was primarily done in order to facilitate the use of local inputs or to adjust to the skill level of employees.
7. For example, improvements in technology may take the form of transfer of technological progress through imports through imitation, reverse engineering, reconditioning and modification of machinery and equipment that is through supplier/customer links to local MNEs.
8. Moran (2001) uses a number of different case studies to show that deliberate technology transfers are relatively common. This happens through MNEs offering technical assistance, management experience, or quality assurance systems to their suppliers.
9. Kline (2011, 2014) has documented the close link between the decomposition and estimation of average treatment effects. He shows that the Oaxaca-Blinder decomposition is equivalent to a reweighting impact estimator in which the odds of treatment are a linear function of the control variables.

References

Alfaro, L. (2014). *Foreign direct investment: Effects, complementarities and promotion* (Harvard Business School Working Paper 15–006). Boston, MA: Harvard Business School.

Amendolagine, V., Boly, A., Coniglio, N. D., Prota, F., & Seric, A. (2013, October). FDI and local linkages in developing countries: Evidence from sub-saharan Africa. *World Development*, *50*, 41–56.https://doi.org/10.1016/j.worlddev.2013.05.001

Arrow, K. (1969). Classificatory notes on the production and transmission of technological knowledge. *American Economic Review*, *59*(2), 29–35.

Bahar, D., Hausmann, R., & Hidalgo, C. A. (2014). Neighbors and the evolution of the comparative advantage of nations: Evidence of international knowledge diffusion. *Journal of International Economics*, *92*, 111–123.

Blomström, M., & Kokko, A. (1998). Multinational corporations and spillovers. *Journal of Economic Surveys*, *12*(3), 247–277.

Caves, R. E. (1996). *Multinational enterprise and economic analysis*. Cambridge: Cambridge University Press.

Giroud, A. (2012). Mind the gap: How linkages strengthen understanding of spillovers. *European Journal of Development Research*, *24*(1), 20–25.

Giroud, A., Jindra, B., & Marek, P. (2012). Heterogeneous FDI in transition economies – a novel approach to assess the developmental impact of backward linkages. *World Development*, *40*(11), 2206–2220.

Görg, H., & Greenaway, D. (2004). Much ado about nothing? Do domestic firms really benefit from foreign direct investment? *World Bank Research Observer*, *19*(2), 171–197.

Grossman, G., & Helpman, E. (1991). *Innovation and growth in the global economy*. Cambridge, MA: MIT Press.

Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M., Chung, S., Jimenez, J., … Yildirim, M. A. (2013). *The atlas of economic complexity. Mapping paths to prosperity*. Cambridge, MA: MIT Press.

Hidalgo, C. A., Klinger, B., Barabasi, A. L., & Hausmann, R. (2007). The product space conditions the development of nations. *Science*, *317*(5837), 482–487.

Hirschman, A. (1958). *The Strategy of Economic Development*. New Haven, CT: Yale University Press.

Javorcik, B., & Spatareanu, M. (2011). Does it matter where you come from? Vertical spillovers from foreign direct investment and the origin of investors. *Journal of Development Economics*, *96*(1), 126–138.

Javorcik, B. S. (2004). Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. *American Economic Review*, *94*(3), 605–627.

Javorcik, B. S. (2008). Can survey evidence shed light on spillovers from foreign direct investment? *World Bank Research Observer*, *23*(2), 139–159.

Javorcik, B. S., & Spatareanu, M. (2005). Disentangling FDI spillover effects: What do firm perceptions tell us? In T. Moran, E. Grahan, & M. Blomström (Eds.), *Does foreign direct investment promote development?* (pp. 45–72). Washington, DC: Institute for International Economics.

Jindra, B., Giroud, A., & Scott-Kennel, J. (2009). Subsidiary roles, vertical linkages and economic development. *Journal of World Business*, *44*(2), 167–179.

Kline, P. (2011). Oaxaca–blinder as a reweighting estimator. *American Economic Review*, *101*(3), 532–537.

Kline, P. (2014). A note on variance estimation for the oaxaca estimator of average treatment effects. *Economics Letters*, *122* (3), 428–431.

Marin, A., & Bell, M. (2006). Technology spillovers from Foreign Direct Investment (FDI): The active role of MNC subsidiaries in Argentina in the 1990s. *Journal of Development Studies*, *42*(4), 678–697.

Markusen, J., & Venables, A. J. (1999). Foreign direct investment as a catalyst for industrial development. *European Economic Review*, *43*(3), 335–338.

Moran, T. (2001). *Parental supervision: The new paradigm for foreign direct investment and development*. Washington, DC: Institute for International Economics.

Moran, T. (2007). How to investigate the impact of foreign direct investment on development and use the results to guide policy. In S. Collins (Ed.), *Brookings trade forum* (pp. 1–60). Washington, DC: Brookings Institute Press.

Newman, C., Rand, J., Talbot, T., & Tarp, F. (2015). Technology transfers, foreign investment and productivity spillovers: Evidence from Vietnam. *European Economic Review*, *76*, 168–187.

Rodriguez-Clare, A. (1996). Multinationals, linkages, and economic development. *American Economic Review*, *86*(4), 852–873.

Smeets, R. (2008). Collecting the pieces of the FDI knowledge spillovers puzzle. *World Bank Research Observer*, *23*(2), 107–138.

Yeaple, S. (2013). The multinational firm. *Annual Review of Economics*, *5*, 193–217.