

Foreign affiliates with and without intra-firm trade: Evidence from sub-Saharan Africa*

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Abstract

We juxtapose the main characteristics and activities of 2403 foreign affiliates with and without intra-firm trade in 19 sub-Saharan-African countries in 2010. Affiliates with intra-firm trade are relatively few, but bigger, more productive, with greater intangible assets intensity and a relatively large and geographically dispersed network of sister affiliates. Their greater knowledge intensity is in line with their greater tendency to receive assistance from their parent in several areas. They also rely more on their parent in order to finance their working capital and acquire capital goods. Their greater knowledge intensity determines their lower decision making power and their higher probabilities to be created through Greenfield FDI and cancel or not enter local procurement due to concerns over retention of their intellectual property. They also have higher extensive and intensive margins of foreign content of their production but lower extensive and intensive margins of direct and indirect imports which implies that they source inputs mostly from affiliated parties outside the host country. The combination of their size and productivity premia with their geographically dispersed network of sister affiliates can explain their higher extensive margin of direct and indirect exports, while their greater advertising intensity their higher intensive margin of domestic and direct export sales.

Keywords: foreign affiliates, intra-firm trade, complex FDI, sub-Saharan Africa

JEL Classification: F14, F23, L21, L23, L24, L25

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1 Introduction

Multinational Companies (henceforth MNCs) constitute the main locomotive in the current process of internationalisation of production and markets. This stylised fact has spawned numerous theoretical and empirical studies on different types of FDI (i.e., horizontal¹, vertical², and export-platform³ FDI) and MNCs, as well as combinations of these (Carr et al., 2001; Grossman et al., 2006; Irarrazabal et al., 2013). UNCTAD (1998) is the first to report empirical evidence on such combinations. In addition, Feinberg and Keane (2001) study US MNCs with affiliates in Canada and find that only 12% of these are of purely horizontal type and only 19% of purely vertical. Thus, terms such as “complex integration strategies” and “complex FDI” have been coined (UNCTAD, 1998; Yeaple, 2003a; Helpman, 2006).

The latest evidence generate a cascade of questions whose answers could allow for a more realistic approach of foreign affiliates’ main features and activities. Since foreign affiliates with intra-firm trade are not necessarily of purely vertical type, then how do they differ from those which do not trade with their parent or their sister affiliate(s)? Are there any differences in terms of main firm characteristics, transfer of knowledge and capabilities, the level of dependence on their parent, the availability and geography of sister affiliates, local and international procurement activities, and domestic and export market behaviour? To the best of our knowledge, such questions have not yet been addressed.⁴ The main objective of this paper is to fill this void in the extant literature.

To this purpose, by employing data from the UNIDO Africa Investor Survey 2010 we juxtapose the main characteristics and activities of 2403 foreign affiliates with and without intra-firm trade located in 19 countries in sub-Saharan Africa (SSA) in 2010. Their parent companies are based either in high-income, or non-SSA low/middle-income, or SSA countries. In contrast to the vast majority of previous theoretical and empirical studies which take into consideration only the manufacturing sector, this study covers all three main sectors of the economy (i.e., primary, secondary, and tertiary). Our analysis allows to shed light on many dimensions in which the two firm types differ, and elaborate further on their very existence and the business purposes that they serve.

It also allows for a more precise identification of the host-country effects of FDI. The main shortcoming of this strand of the literature is that, by making no distinction between different types of MNCs, it treats all foreign-owned firms in the host country

¹The MNC serves the foreign market by setting up a foreign affiliate rather than through exports. In doing so, the production process of the parent company is *replicated* in the foreign affiliate. Among others, see Caves (1982), Markusen (1984), Brainard (1997), Helpman et al. (2004), Horstmann and Markusen (1992), Markusen and Venables (2000), Ramondo et al. (2013).

²The MNC takes advantage of international factor differentials by transferring *part* of its production process to countries where factor prices are lower (Helpman, 1984; Helpman and Krugman, 1985, Yeaple, 2003b and Yeaple, 2008). In this case, intra-firm trade is created, as has been observed by several recent empirical studies (Hanson et al., 2001; Hanson et al., 2005; Borga and Zeile, 2004; OECD, 2002; Alfaro and Charlton, 2009).

³An affiliate located in a foreign country is used as platform for serving other markets nearby via exports (Ekholm et al., 2007; Badinger and Egger, 2010).

⁴In this direction are Hanson et al. (2001) and Ramondo et al. (2011). The first examine imports of foreign affiliates from their US parent companies by using a measure of affiliate size, while the second, find that “vertical” affiliates are of bigger size than “horizontal” ones.

as homogeneous. This approach could be problematic for two main reasons. First, it implies that the effects from their presence in the country are identical and second, even if they are indeed identical, it implies that their contribution to these aggregate effects is the same.

Given the well-documented rise in MNC activity in Africa and especially, in sub-Saharan Africa, our findings can prove to be very useful for policy makers in host countries to implement such industrial, trade, investment and development policies so that their countries benefit the most from the presence of MNCs.

Africa and in particular, sub-Saharan Africa, still lag behind other developing regions like Asia and Latin America, regarding their FDI inflows and their participation in regional and global value chains (UNCTAD, 2013, p. 39). However, since FDI could be an essential source of finance for industrialisation of the region, Africa is increasingly tapping into it. According to UNCTAD and UNIDO (2011, p. 77), its FDI inflows increased from \$2.8 billion to \$58.6 billion between 1990 and 2009, while the share of FDI in gross fixed capital formation increased from 3.2% to 24.1% between 1990 and 2007. Although most of FDI inflows by value are concentrated in Mining, important investment activities have taken place in Manufacturing between 2003 and 2009. UNCTAD (2010b) reports that 41% of the total number of Greenfield investment projects in Africa were accounted for by the manufacturing sector.

Although developed countries account for the bulk of the FDI flows into Africa, non-African developing countries – especially Brazil, China, India, and Turkey – are increasingly important sources. Their share in total FDI inflows to Africa increased from an average of 17.7% during the period 1995 - 1999 to 20.8% over the period 2000 - 2008 (UNCTAD, 2010a, p. 81). According to the same study, FDI from non-African developing countries is mostly in natural resources but there are significant investments in infrastructure,⁵ finance, agriculture and light manufacturing. UNCTAD (2013, p. 127) reports that there has also been a remarkable increase over the past decade in intra-African investment, with 68% of Greenfield investment being accounted for by the services sector.

As regards trade activity which is very closely linked to FDI, Africa has experienced a significant rise in total merchandise trade, from \$7 billion in 1995 to \$86 billion in 2008. This has been accompanied by increasing trade with other non-African developing countries. Also, its share of global trade rose from 2.2% in 2000 to 3.3% in 2008 (UNCTAD, 2010a, p. 29).

We study a broad range of firm characteristics and activities in which the foreign affiliates with and without intra-firm trade may differ and thus, rely on several streams of the literature. In particular, we rely on the literature on the transfer of knowledge and capabilities within the multinational (Atalay et al., 2014), on the span of control within the firm (Rajan and Zingales, 1998) and especially, within an international production team such the multinational firm (Antràs et al., 2006), on the cumulative process of making new contacts (Chaney, 2014), on the mode of foreign investment (Nocke and Yeaple, 2007), on the roles of firm heterogeneity in terms of size and productivity

⁵Between 2001 and 2007, China's infrastructure finance commitment in sub-Saharan Africa rose from \$470 million to \$4.5 billion. Other countries with significant investments in infrastructure are India, Kuwait, Saudi Arabia, and the United Arab Emirates (UNCTAD, 2010b, p. 81; UNCTAD, 2010a).

(Melitz, 2003) and of trade contacts (Chaney, 2014) in the extensive margin of local and international procurement activities and of export activities, as well as, on the role of advertising (Arkolakis, 2010) in the intensive margin of domestic and export sales.

Our data analysis reveals that the big majority of foreign affiliates do trade, but they mostly do so outside the boundaries of the firm (i.e., at arm’s length). Roughly half of the total number of firms in the sample have actually only arm’s length trade. Trade at arm’s length is also a very popular activity even among foreign affiliates with intra-firm trade. These findings are essential in two ways. First, they are indicative of the complexity that characterises import and export activities of foreign affiliates and justifies terms that have been coined in the literature, such as “complex” FDI. Second, it shows how opaque the firm boundaries remain despite the great progress that has been made in recent years both in theory (Antràs, 2003) and in empirics (Nunn and Trefler, 2013; Corcos et al., 2013). Unfortunately, in our data we do not observe firm-to-firm transactions by product and therefore, we cannot look into this issue further. In sharp contrast to arm’s length trade, foreign affiliates with intra-firm trade account for only a small fraction in the sample.

From the regression analysis we find that the main firm characteristics that distinguish the average foreign affiliate with intra-firm trade from the one without are size, productivity and knowledge intensity. In particular, foreign affiliates with intra-firm trade tend to be bigger, more productive and to have a greater intensity of intangible assets and capabilities.⁶

In more detail, we report size and productivity premia of 31.5% and 25.4%, respectively. We also find a clear sorting pattern of firms in terms of size and productivity with different intra-firm flows. On average, foreign affiliates with both intra-firm imports and exports seem to be the biggest and most productive firms, those with only intra-firm exports smaller and less productive, those with only intra-firm imports even smaller and less productive, while those with only arm’s length trade are bigger and more productive only than those without intra-firm trade, which are the smallest and least productive firms. Reporting/Documenting these premia becomes even more important after we show that foreign affiliates with only arm’s length trade differ from domestic firms which engage in international trade in terms of size and productivity. They are bigger and more productive by 11.9% and 25.7%, respectively. The sorting pattern can be easily explained theoretically based on the Melitz (2003) model of firm heterogeneity in which the fixed cost of arm’s length trade is smaller than the fixed cost of intra-firm imports, which in turn, is smaller than the fixed cost of intra-firm exports.

The results on size and productivity hold when we restrict the sample to manufacturing in which intra-firm trade is more popular, when we focus only on majority-owned foreign affiliates (MOFAs) (i.e., the percentage of ownership of the foreign investor is at least 50%), and the combination of the two. A possible concern about the results on knowledge intensity is that they may be driven by the services sector given that trade in services may be considered as transfer of intangibles. After dropping from the sample

⁶In this paper we use terms such as intangibles, knowledge and capabilities interchangeably given the various forms of intangibles that can be found in the literature: capabilities (Atalay et al., 2014), knowledge capital (Markusen, 1984), technology capital (McGrattan and Prescott, 2010), organisational capital (Garicano and Rossi-Hansberg, 2006), core capabilities (Bernard et al., 2012), managerial ability (Bloom and Van Reenen, 2007).

all firms operating in this sector, we find that the results remain largely unchanged.

The scarcity of intra-firm trade and its positive correlation with size are in line with the main findings of [Ramondo et al. \(2011\)](#) who, by employing the BEA data for US affiliates abroad, report that intra-firm trade is concentrated among a small number of relatively large foreign affiliates. [Hanson et al. \(2001\)](#) also link positively intra-firm imports from the parent to the affiliate's size.

The relatively small number of foreign affiliates with intra-firm trade poses the critical question as to why firm boundaries exist if not for the transfer of physical goods. According to [Atalay et al. \(2014\)](#), who use data on domestic firms in the US, they exist mainly because they facilitate the transfer of intangibles.⁷

This argument gives a hint of potential inefficiencies when knowledge is mediated through the market (e.g. incomplete contracts), similar to inefficiencies in market transactions of physical goods. According to the Property Rights Theory (PRT) ([Grossman and Hart, 1986](#); [Hart and Moore, 1990](#); [Antràs, 2003](#)), such inefficiencies can be mitigated when knowledge transfers occur within the boundaries of the firm because the owner has residual rights of control over relationship-specific assets.

Our evidence on the greater intensity of intangibles of foreign affiliates with intra-firm trade serves as a complement to this argument in the sense that even if firm boundaries exist mainly for the transfer of intangibles, the existence of intra-firm trade makes this transfer more intense.

The intuition for this finding is that, in addition to the flow of intangibles which is attributed only to firm boundaries ([Atalay et al. \(2014\)](#)), there is a flow which stems from the production sharing between the parent firm and the foreign affiliate. What intra-firm trade means in practice is that effective production can be achieved only under the condition that each of the two entities has access to the physical production inputs of the other. With the same logic, when production sharing occurs, the foreign affiliate needs to have access to knowledge that is utilised in the production stage of the parent. That is, there occurs a “technical dialogue” between the two entities ([Grant, 1996](#)) which may include any kind of knowledge (e.g. patents, copyrights, any other kind of intellectual property, know-how, information about past and current implementation of technologies, marketing, trade contacts, etc.).

In accord with the positive association between intra-firm trade and transfer of intangibles, foreign affiliates with intra-firm trade have a greater tendency to receive assistance from their parent in several areas (e.g. use of patents, trademarks and brand names, technology and know-how transfer, access to foreign supplier network, global market access, etc.). This can also be viewed as a higher level of dependence on their parent. We find extra evidence on the latter. Foreign affiliates with intra-firm trade are more likely to have their parent as a source of finance of working capital and as their main source of acquisition of capital goods.

In turn, as we show theoretically, intra-firm trade, due to its positive association with knowledge intensity, seems to have implications for their level of autonomy in decision making, the mode of investment of their parent, the extensive and intensive margins of their sister affiliates and their engagement in local and international procurement activities.

⁷[Bloom et al. \(2012\)](#) also find that parent companies partially “transplant” their best practices abroad (i.e., into their foreign affiliates).

Ownership and control of relationship-specific assets are not the same notions and should not be considered as such. As [Rajan and Zingales \(1998\)](#) show, control can take the form of ownership, but ownership can be compatible with grant of current access to relationship-specific assets. According to the PRT, and this is its main advantage over the Transactions Cost Approach (TCA), inefficiencies and opportunistic behaviour of agents in the integrated party do not disappear under vertical integration ([Antràs and Rossi-Hansberg, 2009](#); [Antràs and R.Yeaple, 2013](#)). This means that the agents to whom current access to a critical resource is granted, may engage in opportunistic behaviour and act in ways that are in the benefit of the owner (e.g. set up a rival firm).

We perceive the parent firm and the foreign affiliate as an international production team with knowledge-based hierarchy ([Antràs et al., 2006](#)) and show that the more intense transfer of knowledge to the foreign affiliate due to intra-firm trade can potentially give disproportionately high positional power to (the CEO and middle managers) managers in the foreign affiliate. Top managers in the parent company can anticipate this and in order to curb their positional power without a loss in production efficiency, they increase their span of control (i.e., number of managers under their supervision). In our case, this is translated into a lower level of autonomy of the foreign affiliate in decision making. Indeed, in the empirical analysis we find that foreign affiliates with intra-firm trade tend to have less power in decision making over several activities (e.g. product introduction and modification, introduction of new production and processing systems, export market entry, pricing policy, marketing strategy, supplier selection, etc.).

We also find that they are more likely to be created by their parent as wholly-owned firms through Greenfield FDI. According to the resource-based view of the firm, there is an interplay between a firm's endowments and complementary capabilities or intangible assets in possession of other firms ([Nocke and Yeaple, 2007](#); [Antràs and R.Yeaple, 2013](#); [Grant, 1996](#); [Simon, 1991](#)) which are not perfectly mobile (e.g. marketing, distribution, country-specific institutional competency). Therefore, the acquisition of a firm in a foreign country so that the acquiring firm can complement its own capabilities with those of the acquired firm is the main motive for Mergers and Acquisitions (M&As). Instead, when a firm intends to make (almost exclusive) use of its own capabilities in a foreign country, it opts for setting up an affiliate in the country through Greenfield FDI.

The greater flow of capabilities into the foreign affiliate with intra-firm trade implies that it is mostly the parent firm's capabilities that are utilised in the host country and therefore, the parent firm is more likely to set up a foreign affiliate with which it plans to trade through Greenfield FDI.

Moreover, we find that foreign affiliates with intra-firm trade tend to have a relatively large and geographically dispersed network of sister affiliates. The theoretical explanation that we provide is predicated upon the concept of the cumulative process of acquisition of (new) contacts as in [Chaney \(2014\)](#). The firm obtains information about the partners of its contacts and searches remotely for other contacts that are new to the firm and to any of its existing contacts. However, a key distinguishing feature in our approach as compared to [Chaney \(2014\)](#) is that we make a clear distinction between affiliated and unaffiliated contacts, as well as, between affiliated contacts which trade with each other and those that do not. Given that information about new contacts

lies in the category of transfer of knowledge, it is subject to inefficiencies when it is mediated through the market and thus, it is expected to flow less intensely between unaffiliated parties than between affiliated ones and/or to be of lower quality. Even more importantly, information sharing between two affiliated parties that trade with each other is expected to be more intense as compared to those that do not.

Assuming that the information foreign affiliates with and without intra-firm trade receive from their unaffiliated contacts is subject to the same market inefficiencies, the probability they create a new contact by exploiting such information is the same. The number of contacts created which is positively linked to this probability is also expected to be the same. In contrast, foreign affiliates which trade with their affiliated parties tend to receive more information than those which do not trade with their affiliated parties which makes more likely that the first type of affiliate adds a new contact to its network. Also, the number of new contacts created, which is positively associated with this probability, tends to be greater for the same type of firm.

As regards local and international procurement activities, we find that foreign affiliates with intra-firm trade are more likely to develop backward linkages and especially linkages with suppliers overseas. They are less likely, though, to import production inputs directly. In addition, they tend to have lower shares of domestic inputs in total production inputs and of inputs imported directly and indirectly. Instead, they seem to have a higher share of foreign inputs in total production inputs and a greater number of suppliers overseas. It is very unlikely that the size and productivity advantage of foreign affiliates with intra-firm trade can explain these results. They are rather better explained by their higher extensive and intensive margins of sister affiliates. In other words, their backward linkages, especially the international ones, seem to be developed to a great extent with affiliated, rather than unaffiliated, parties.

Two additional results on local procurement seem to be in line with our finding that foreign affiliates with intra-firm trade tend to have a greater intensity of intangibles and capabilities. In particular, foreign affiliates with intra-firm trade are less likely to enter local procurement in order to develop a closer relationship with suppliers and more likely to cancel or not enter local procurement due to concerns over retention of their intellectual property. Hence, it seems that the greater knowledge intensity of foreign affiliates with intra-firm trade makes them more concerned about diffusion and expropriation of knowledge. Interestingly, though, we find that they tend to have higher expenditures on the provision of assistance to local suppliers, aiming at the improvement of their operations. That is, although they are more reluctant to develop relationships with local suppliers, on condition that they do so, they tend to allocate more funds for this purpose.

In the final set of results, we report evidence on differences in market orientation, with a particular focus on exporting, and on the main source of competition for the main product/service. The probability the average foreign affiliate with intra-firm trade has direct and indirect export sales is higher, while the probability that it has domestic sales is lower. It seems also to have a more even sales distribution across domestic and export markets. In addition, the same type of firm is also more likely to have exports to contiguous and distant markets, to be continuing exporter and importer-exporter, and less likely to be non-exporter. All these results are in line with its size and productivity

advantage⁸, as well as, with its relatively large and geographically dispersed network of sister affiliates.⁹

As regards the intensive margin of domestic and export sales, we find that the same type of firms tend to have higher shares of domestic, direct and indirect export sales in their total sales, as well as, higher ratios of these shares to their mean. Their export shares within each market examined tend to be higher as well and the distribution of their export shares across the same markets tends to be more even. The greater intensive margin of sales in the domestic and most of the export markets examined can possibly be explained by their higher expenditures on advertising so that they can cover the (fixed) marketing cost required to reach an additional consumer within each market (Arkolakis, 2010).

In terms of the main source of competition for their main product/service, this seems to come mostly from imports and less so from locally-owned firms in the host country.

We draw some novel and useful conclusions about the host-country effects of FDI based on the results that we obtain. The greater size of foreign affiliates with intra-firm trade, as well as their higher extensive and intensive margins of sister affiliates in the same country, can be translated into a greater number of vacancies to be filled by local job-market seekers.

Their greater knowledge intensity makes them more concerned about knowledge diffusion and expropriation and subsequently, more reluctant to develop linkages with local suppliers. Nevertheless, as soon as they initiate a collaboration with a local supplier, they tend to spend higher amounts in order to assist them to improve their operations, which means that these suppliers can benefit more from productivity and knowledge spill-overs. We should be cautious though with this conclusion since our analysis can exclude the possibility a local supplier is taken over by the multinational firm once they start their collaboration.

Moreover, local banks and other lenders and local distributors of capital goods are less likely to benefit from the presence of foreign affiliates with intra-firm trade in the country, since the probabilities the latter have their parent a source of finance of working capital and as the main source of acquisition of capital goods are higher. Finally, their higher extensive and intensive margins of exporting can make the host-country itself more export-oriented and more integrated into the regional and global economy.

All results in this paper are also robust to alternative estimation techniques (i.e., logistic and linear probability regressions).

The remainder of this paper is as follows. In Section 2 we describe the data and report several stylised facts on the host countries, industries and parent locations of the two types of affiliates, as well as on intra-firm flows by sector and parent location. In an attempt to motivate the econometric analysis, we also compute size and productivity premia of foreign affiliates with intra-firm trade. In Section 3 we examine theoretically

⁸The literature on the strongly positive association of firm size and productivity with export performance is by now vast and highly influential (e.g. Bernard and Jensen, 1994; Bernard and Jensen, 1999; Bernard et al., 2005; Melitz, 2003; Bernard et al., 2007).

⁹Chaney (2014) shows how the geographically dispersed network of contacts can explain the extensive margin of exports. The concept is that firms can sell only in markets where they have a contact because in this way they can overcome informational barriers. Firms can search for trading partners directly or through their existing network of contacts.

the potential differences between foreign affiliates with and without intra-firm trade in terms of main characteristics and activities, while in Section 4 we present the benchmark econometric model and the additional variables which is augmented with. Section 5 discusses the empirical results, while Section 6 concludes.

2 Data and stylised facts

In this section we describe the main dataset to be employed in the econometric analysis and juxtapose foreign affiliates with and without intra-firm trade in terms of the host countries in which they are located and all possible combinations of the origin of their parent company and the industries in which they operate. We also provide statistics on the percentage of foreign affiliates with different types of trade flows (i.e., intra-firm and/or arm's length) and try to quantify any size and productivity premia of foreign affiliates with intra-firm trade.

2.1 Data

We draw all firm-level data from the UNIDO Africa Investor Survey 2010. The main aim of this survey is to collect information at the firm level directly from business owners and senior managers about their business and their assessment of the current business environment. It includes information about 2403 foreign affiliates in 19 sub-Saharan-African countries for the last financial year (i.e., 2009). All monetary variables are in national currencies and in order to convert these into US dollars (USD), we rely on the exchange rate data of the World Bank World Development Indicators (WDI).

As regards intra-firm trade, this is directly observed in the data and therefore, we do not need to construct ourselves any proxy for vertical relationship based on Input-Output (I-O) tables or disaggregated classifications of products/services produced in the parent and the foreign affiliate (Alfaro and Charlton, 2009). In particular, we claim that a foreign affiliate has intra-firm imports if its percentage of production inputs by value that was imported through the parent company is greater than 0 and less than or equal to 100. Similarly, a foreign affiliate has intra-firm exports if its percentage of direct exports by value is supplied to its parent and/or its sister affiliates is greater than 0 and less than or equal to 100. Consequently, a foreign affiliate with intra-firm trade is an entity that satisfies one of the two or both of the aforementioned conditions (i.e., the firm has either intra-firm imports, or intra-firm exports, or both).

2.2 Foreign affiliates with and without intra-firm trade

Table 1 portrays the 19 countries in sub-Saharan Africa where foreign affiliates with and without intra-firm trade are located. Among firms with intra-firm trade, the biggest number of these are based in Kenya, Uganda, Tanzania, Ghana and Cameroon (17.3%, 16.2%, 8%, 5.9%, and 5.7%, respectively), while the smallest number in Niger (0.8%), Burundi (1%), Burkina Faso (1.1%), Mali (2.5%), and Malawi (2.7%). Among firms without intra-firm trade, the biggest number of these are based in Uganda (17.1%), Kenya (10.7%), Ghana (8%), Nigeria (6.3%) and Mozambique (6.1%), and the smallest

number in Niger (1%), Burkina Faso (1.2%), Malawi (1.8%), Burundi (2.2%), Lesotho and Rwanda (2.9% each).

Table 1: Locations of foreign affiliates with and without intra-firm trade

Name	Code	with intra-firm trade		without intra-firm trade	
		# of firms	% of firms	# of firms	% of firms
Burundi	BDI	5	1	41	2.2
Burkina Faso	BFA	6	1.1	23	1.2
Cameroon	CMR	30	5.7	103	5.5
Cape Verde	CPV	22	4.2	82	4.4
Ethiopia	ETH	24	4.6	109	5.8
Ghana	GHA	31	5.9	151	8
Kenya	KEN	91	17.3	200	10.7
Lesotho	LSO	22	4.2	54	2.9
Madagascar	MDG	27	5.1	96	5.1
Mali	MLI	13	2.5	78	4.2
Mozambique	MOZ	16	3	114	6.1
Malawi	MWI	14	2.7	34	1.8
Niger	NER	4	0.8	18	1
Nigeria	NGA	30	5.7	119	6.3
Rwanda	RWA	18	3.4	55	2.9
Senegal	SEN	23	4.4	87	4.6
Tanzania	TZA	42	8	113	6
Uganda	UGA	85	16.2	321	17.1
Zambia	ZMB	23	4.4	79	4.2
Total		526	100	1877	100

Notes: Authors' calculations.
Source: UNIDO Africa Investor Survey 2010.

Table 2 reports the number of firms with and without intra-firm trade by sector and parent location. Regarding sectors, we consider the whole economy (ISIC between 1 and 99), Agriculture (ISIC between 1 and 5), Mining (ISIC between 10 and 14), Manufacturing (ISIC between 15 and 39), Resource-based manufacturing (ISIC: 15, 16, 20, 21, 23, 25, 26, 27), Low-tech manufacturing (ISIC: 17, 18, 19, 22, 28, 36), Medium/High-tech manufacturing (ISIC: 24, 29, 30, 31, 32, 33, 34, 35, 37, 38), Electricity, gas and water supply (EGW supply) and Construction (ISIC 40 and 45, respectively), and Services (ISIC between 50 and 99). We distinguish between three different types of parent location based on the income level of the country in which the parent company is situated (i.e., high-income countries (HI), low/middle-income excluding sub-Saharan-African ones (LMI), and those in sub-Saharan Africa (SSA)). In order to classify each parent location by the level of income we rely upon the World Bank Historical Country Classification for the year 2010.¹⁰

By focusing only on sectors, we find that firms without intra-firm trade operate in more industries than those with intra-firm trade (56 industries Vs 41 industries). This is mostly driven by the absence of affiliates with intra-firm trade from many services industries. This is in line with Ramondo et al. (2011) who find that intra-firm trade occurs primarily in goods, rather than services. Among affiliates with intra-firm trade, the highest percentages of these are to be found in industries with ISIC 15 (11.8%), 25 (8.6%), 1 (8.4%), 24 and 51 (8.2% each), 18 (7.6%), 52 (6.3%), and 45 (5.1%), while the lowest in industries with ISIC 2, 33, 41, 63, 71, 72, and 92 (0.2% each). Among

¹⁰Low/middle-income countries are those which are classified by the World Bank for the corresponding year as either low-income, or lower-middle-income, or upper-middle-income.

affiliates without intra-firm trade, the highest percentages of these operate in industries with ISIC 15 (8.4%), 51 (6.7%), 74 (5.6%), 45 (5.4%), 25 and 55 (5.2% each), 65 (5.1%), and 28 (4.9%), while the lowest in industries with ISIC 12, 30, 73, 85, and 93 (0.1% each). These descriptive statistics are in tables relegated to the Online Appendix.

Table 2: Foreign investors' origin

Parent location	with intra-firm trade		without intra-firm trade	
	# of firms	% of firms	# of firms	% of firms
Whole economy				
High-income country	265	52.4	871	49.4
Low/middle-income country	169	33.4	653	37
sub-Saharan African country	72	14.2	240	13.6
Total	506	100	1764	100
Agriculture				
High-income country	35	74.5	37	60.7
Low/middle-income country	6	12.8	13	21.3
sub-Saharan African country	6	12.8	11	18
Total	47	100	61	100
Mining				
High-income country	8	53.3	20	58.8
Low/middle-income country	7	46.7	14	41.2
sub-Saharan African country	0	0	0	0
Total	15	100	34	100
Manufacturing				
High-income country	162	50.6	347	44.9
Low/middle-income country	116	36.3	334	43.3
sub-Saharan African country	42	13.1	91	11.8
Total	320	100	772	100
Resource-based manufacturing				
High-income country	78	52.3	165	43.9
Low/middle-income country	47	31.5	163	43.4
sub-Saharan African country	24	16.1	48	12.8
Total	149	100	376	100
Low-tech manufacturing				
High-income country	36	36.4	107	44.8
Low/middle-income country	53	53.5	107	44.8
sub-Saharan African country	10	10.1	25	10.5
Total	99	100	239	100
Medium/High-tech manufacturing				
High-income country	48	66.7	75	47.8
Low/middle-income country	16	22.2	64	40.8
sub-Saharan African country	8	11.1	18	11.5
Total	72	100	157	100
EGW supply/Construction				
High-income country	14	50	61	56
Low/middle-income country	10	35.7	39	35.8
sub-Saharan African country	4	14.3	9	8.3
Total	28	100	109	100
Services				
High-income country	46	47.9	406	51.5
Low/middle-income country	30	31.3	253	32.1
sub-Saharan African country	20	20.8	129	16.4
Total	96	100	788	100

Notes: Authors' calculations. Firms with intra-firm trade are those with either intra-firm imports, or intra-firm exports or both. Resource-based manufacturing industry codes: 15, 16, 20, 21, 23, 25, 26, 27. Low-tech manufacturing industry codes: 17, 18, 19, 22, 28, 36. Medium/High-tech manufacturing industry codes: 24, 29, 30, 31, 32, 33, 34, 35, 37, 38. EGW supply: Electricity, gas and water supply (ISIC: 40). SSA: Foreign investors' country of origin is sub-Saharan African. Foreign investors' country of origin is classified as high-income (HI) and non-SSA low/middle-income (LMI) based on the World Bank historical country classification for the year 2010, and for the very few firms which answered the questionnaire in 2009, for that specific year. Low/Middle-income countries are those which are classified by the World Bank for the corresponding year as either low-income, or lower-middle-income, or upper-middle-income.
Source: UNIDO Africa Investor Survey 2010.

For the whole economy, the parent firms of the highest percentage of affiliates with intra-firm trade are located in high-income countries, of the second highest in

low/middle-income countries, while those of the lowest in sub-Saharan Africa (52.4%, 33.4%, and 14.2%, respectively).¹¹ This is also true for Agriculture (74.5%, 12.8%, 12.8%, respectively), Mining (53.3%, 46.7%, 0%, respectively), Manufacturing (50.6%, 36.3%, 13.1%, respectively), Resource-based manufacturing (52.3%, 31.5%, 16.1%, respectively), Medium/High-tech manufacturing (66.7%, 22.2%, 11.1%, respectively), EGW supply and Construction (50%, 35.7%, 14.3%, respectively), and Services (47.9%, 31.3%, 20.8%, respectively). The only exception is the low-tech manufacturing sector in which the parents of the highest percentage of foreign affiliates with intra-firm trade are based in low/middle-income countries (36.4%, 53.5%, and 10.1%, respectively).

As far as foreign affiliates without intra-firm trade are concerned, the parents of the smallest percentage of these are located in sub-Saharan Africa. This holds for the whole economy and for any other sector examined. The differences in the percentages of affiliates whose parents are located in high- and non-SSA low/middle-income countries are much smaller than before (Whole economy: 49.4% Vs 37%, Manufacturing: 44.9% Vs 43.3%, Resource-based manufacturing: 43.9% Vs 43.4%, Medium/High-tech manufacturing: 47.8% Vs 40.8%) or even vanished (Low-tech manufacturing: 44.8% Vs 44.8%). Sectors for which there are still quite big differences are: Agriculture (60.7% Vs 21.3%), Mining (58.8% Vs 41.2%), EGW supply and Construction (56% Vs 35.8%) and Services (51.5% Vs 32.1%).

Panel A in Table 3 reveals that intra-firm trade is a relatively rare activity. Only 526 out of the 2403 foreign affiliates (21.9% of the total) trade with their parent company (i.e., they have either intra-firm imports or intra-firm exports, or both). The rest 1877 (78.1% of the total) do not have any intra-firm trade flows. Among the firms with intra-firm trade, 77.8% of these have intra-firm imports (Panel B), 39.4% have intra-firm exports (Panel C), 17.1% have both intra-firm imports and exports (Panel D), 60.6% have only intra-firm imports (Panel E), while 22.2% have only intra-firm exports (Panel F).¹²

The fact that most of the foreign affiliates in our sample do not engage in intra-firm trade does not mean that they do not trade at all. They do trade, but they only do so outside the boundaries of the firm (i.e., at arm's length), as shown in Table 4. According to Panel A, 1743 out of 2403 foreign affiliates (72.5% of the total) have either type of trade (i.e., either intra-firm or arms' length) and according to Panel B, 1217 or 50.6% of the total trade only at arms' length. Panels C and D reveal that arms' length trade is a popular activity also among foreign affiliates with intra-firm trade. Only 177 out

¹¹As for individual countries, parents of the highest percentage of affiliates with intra-firm trade are located in India (10%), South Africa (9.5%), France and the United Kingdom (8.7% each), Kenya (6.9%), the US (4.8%), China and the Netherlands (4.1% each), Portugal (3.7%), Lebanon and Mauritius (2.5% each), Germany and Switzerland (2.5%), Hong Kong and Taiwan (1.9%), Italy (1.7%), Japan (1.5%), Denmark, Spain and the United Arab Emirates (1.4%), Belgium, Senegal, Uganda and Tanzania (1%). Parents of the highest percentage of affiliates without intra-firm trade are located in India (14%), France (9.8%), the United Kingdom (9.7%), South Africa (6.3%), China and Kenya (6% each), Portugal (4.4%), Italy (4%), Lebanon (3.9%), the US (3.6%), the Netherlands (2.1%), Switzerland (1.8%), Mauritius (1.7%), Germany (1.6%), Canada (1.2%), and Belgium (0.9%).

¹²In the Online Appendix, we provide the same statistics by sector and sector-parent location pairs. The main message conveyed is that there is important variation in the number of foreign affiliated with intra-firm trade by sector and by sector-parent location pairs. In most sectors, the highest percentages of foreign affiliates with intra-firm trade are owned by investors who are located in high-income countries.

of the 526 have only intra-firm trade, the rest 349 have a combination of both.

Table 3: Foreign affiliates with and without intra-firm trade

Panel A: With intra-firm trade	# of firms	% of firms
No	1877	78.1
Yes	526	21.9
Total	2403	100
Panel B: With intra-firm imports	# of firms	% of firms
No	117	22.2
Yes	409	77.8
Total	526	100
Panel C: With intra-firm exports	# of firms	% of firms
No	319	60.6
Yes	207	39.4
Total	526	100
Panel D: With both intra-firm imports and exports	# of firms	% of firms
No	436	82.9
Yes	90	17.1
Total	526	100
Panel E: With intra-firm imports only	# of firms	% of firms
No	207	39.4
Yes	319	60.6
Total	526	100
Panel F: With intra-firm exports only	# of firms	% of firms
No	409	77.8
Yes	117	22.2
Total	526	100

Notes: Authors' calculations. Firms with intra-firm trade are those with either intra-firm imports, or intra-firm exports or both.

Source: UNIDO Africa Investor Survey 2010.

In the Online Appendix, we provide evidence on foreign affiliates with various combinations of intra-firm and arms' length trade flows. We show that 15.4% of the 1743 foreign affiliates with trade have both intra-firm and arms' length imports, 8.8% have both intra-firm and arms' length exports, 4.2% have intra-firm and arms' length imports and exports, 6.4% have intra-firm imports and only arms' length exports, 4.6% have intra-firm exports and only arms' length imports, 4.5% have intra-firm and arms' length imports and only arms' length exports, 3.8% have intra-firm and arms' length exports and only arms' length imports, 3.8% have intra-firm and arms' length imports and intra-firm exports, 3.4% have intra-firm and arms' length exports and intra-firm imports, 0.7% have intra-firm and arms' length imports and only intra-firm exports, and finally, 0.4% have intra-firm and arms' length exports and only intra-firm imports. We also produce the tables for those with intra-firm and/or arms' length trade, for those which trade only at arms' length, as well as for those which trade only intra-firm by sector and by sector-parent location pairs. The tables reveal a salient heterogeneity across sectors and across sector-parent location pairs. Foreign affiliates which trade only at arms' length are the majority in all sectors and for almost all sector-parent location pairs.

In sum, although most of the foreign affiliates in our sample engage in trade activities, they do so mostly at arms' length. Foreign affiliates with intra-firm trade are relatively few and most of them trade also at arms' length.

Table 4: Foreign affiliates with different types of trade

Panel A: With trade	# of firms	% of firms
No	660	27.5
Yes	1743	72.5
Total	2403	100
Panel B: With 100% arms' length trade	# of firms	% of firms
No	1186	49.4
Yes	1217	50.6
Total	2403	100
Panel C: With 100% intra-firm trade	# of firms	% of firms
No	2226	92.6
Yes	177	7.4
Total	2403	100
Panel D: With both intra-firm and arms' length trade	# of firms	% of firms
No	2054	85.48
Yes	349	14.52
Total	2403	100.00

Notes: Authors' calculations. Firms with trade are those with either imports, or exports or both.
Source: UNIDO Africa Investor Survey 2010.

A very important question arises from the observation that foreign affiliates with intra-firm trade are relatively few in the sample and is pertinent to the internalisation issue (i.e., inefficiencies in transactions through the market that are mitigated when these occur within the firm). Why do firm boundaries exist if not for the transfer of physical goods between affiliated parties? [Atalay et al. \(2014\)](#) argue that they exist mainly because they facilitate the transfer of intangibles and not necessarily the transfer of physical goods. In the same direction, [Bloom et al. \(2012\)](#) find that parent companies partially “transplant” their best practices abroad (i.e., into their foreign affiliates).

Same as for physical goods, the argument of [Atalay et al. \(2014\)](#) is based on the existence of inefficiencies when knowledge is mediated through the market and therefore, can be explained by the Property Rights Theory (PRT) ([Grossman and Hart, 1986](#); [Hart and Moore, 1990](#); [Antràs, 2003](#)), according to which such inefficiencies can be mitigated when knowledge transfers occur within the boundaries of the firm because the owner has residual rights of control over relationship-specific assets.

Although this reasoning seems to be well-founded, a complementary question arises: even if firm boundaries mainly exist for the transfer of intangibles, is this transfer of the same intensity between affiliated parties that share the same production process and trade with each other and between affiliated parties that do not? We investigate this issue theoretically and empirically in sections 3.2 and 5.

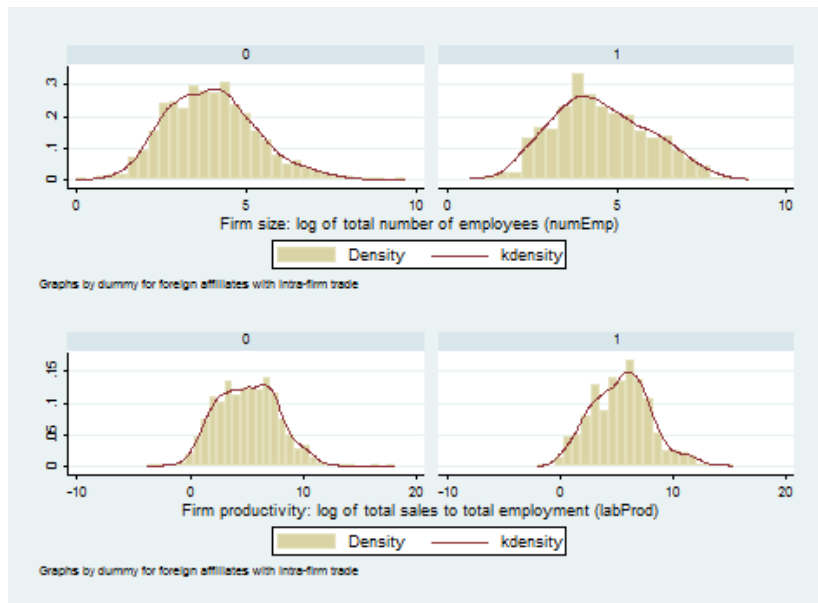
The observation that arm’s length trade is a popular activity even among foreign affiliates with intra-firm trade reveals the complexity that characterises import and export activities of foreign affiliates and justifies terms that have been coined in the literature, such as “complex” FDI. It also shows that, despite the great progress that has been made in recent years both in theory ([Antràs, 2003](#)) and in empirics ([Nunn and Trefler, 2013](#); [Corcos et al., 2013](#)) on the determinants of firm boundaries, further investigation would be useful and desirable. Unfortunately, the data available to us lack firm-to-firm transactions by product and therefore, we cannot look into this issue.

2.3 Selection into intra-firm trade

Helpman et al. (2004) and Bernard et al. (2007) find that US exporters have a productivity advantage over US non-exporters in 1996 and 1997, respectively. The second study also reports productivity and employment premia for importers over non-importers, as well as for importers-exporters over those without imports and exports. Employment, sales and productivity premia of importers over non-importers are also found by Antràs et al. (2014).¹³

Before quantifying any size and productivity premia of foreign affiliates with intra-firm trade, we compare the distributions of foreign affiliates with and without intra-firm trade in terms of their size and productivity level. The top panel of Figure 1 plots the kernel densities of the two firm types in terms of their size, proxied by the log of the total number of employees, while the bottom panel the densities in terms of their level of productivity, proxied by the log of the ratio of total sales to total number of employees. Both panels show that the distribution of foreign affiliates with intra-firm trade is more skewed to the right compared to the distribution of those without intra-firm trade. In other words, the density of foreign affiliates with intra-firm trade is greater for higher values of size and productivity.

Figure 1: Density of foreign affiliates by productivity and size

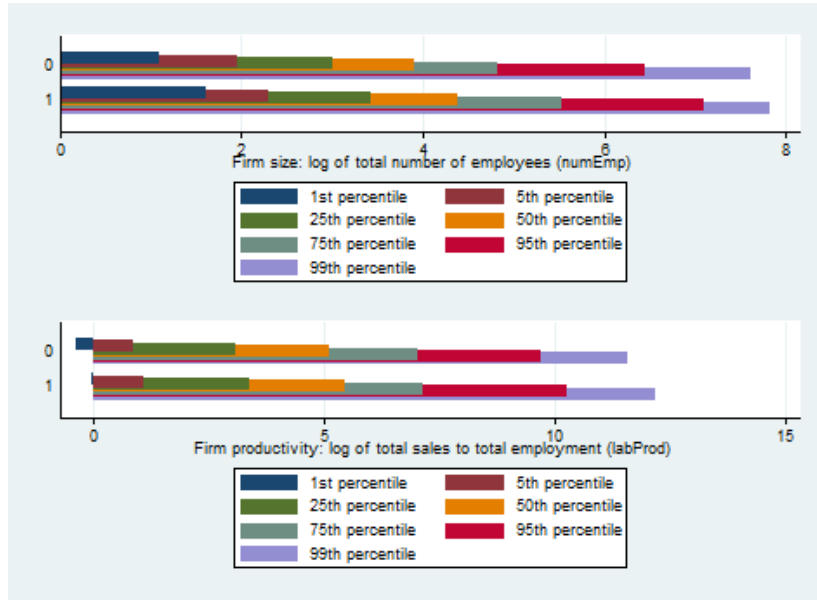


We draw the same conclusions from Figure 2 which plots the percentile distributions of the two firm types in terms of size (top panel) and productivity (bottom panel). Foreign affiliates with intra-firm trade have higher size and productivity values at all seven percentiles examined. We obtain very similar kernel densities and percentile

¹³Given that importing activities may result in an increase in firm productivity (Amity and Konings, 2007), they also show that these premia existed before these firms began importing. Since we don't have data for any year prior to the one examined (i.e., 2010), we are not able to test this either for imports or exports.

distributions in graphs that we plot with alternative proxies for size and productivity. We proxy size with total sales and productivity with the ratio of value added to total number of employees and total factor productivity. We relegate these graphs to the Online Appendix to save on space.

Figure 2: Foreign affiliates by productivity and size in percentiles



The graphical analysis shows that foreign affiliates with intra-firm seem to have an advantage in terms of size and productivity. In Table 5, we show the results from OLS regressions which quantify size and productivity premia. In Panel A, we regress the log of each proxy for firm productivity and size on a dummy for intra-firm trade (i.e., it takes value 1 if the foreign affiliates has either intra-firm imports, or exports, or both) and additional controls such as: skill intensity, capital intensity, input intensity, total employment, host-country, parent-location and industry dummies.¹⁴ The proxies for firm productivity are the following: ratio of total sales to total employment (column 1), ratio of value added to total employment (column 3), and total factor productivity (column 5). The proxies for firm size are: total employment (column 2) and total sales (column 4). We find that the productivity premia are between 25.4% (column 1) and 30.7% (column 5), while the size premia are between 31.5% (column 2) and 56.3% (column 4).

In Panel B, we run the same regressions as in Panel A after controlling for firms with only arms' length trade. We do this by adding a dummy with value 1 if the firm has either imports or exports or both, but only at arms' length (D_{armt}). Not surprisingly, we observe the same sorting pattern and even greater size and productivity premia.

¹⁴Firm size regressions omit the log of total employment as a covariate.

Table 5: Productivity and size premia of foreign affiliates with intra-firm and arm’s length trade

Panel A: Foreign affiliates with intra-firm trade					
	(1)	(2)	(3)	(4)	(5)
	<i>Productivity</i>	<i>Size</i>	<i>Productivity</i>	<i>Size</i>	<i>Productivity</i>
D_{ift}	0.254***	0.315***	0.255**	0.563***	0.307***
	[0.066]	[0.066]	[0.10]	[0.090]	[0.067]
Obs	1815	1831	1348	1815	1812
Panel B: Foreign affiliates with intra-firm and arm’s length trade					
	(1)	(2)	(3)	(4)	(5)
	<i>Productivity</i>	<i>Size</i>	<i>Productivity</i>	<i>Size</i>	<i>Productivity</i>
D_{ift}	0.292***	0.606***	0.334**	0.888***	0.376***
	[0.094]	[0.093]	[0.14]	[0.13]	[0.096]
D_{armt}	0.0450	0.348***	0.0958	0.390***	0.0820
	[0.083]	[0.079]	[0.11]	[0.12]	[0.084]
Obs	1815	1831	1348	1815	1812
Panel C: Foreign affiliates with different intra-firm flows					
	(1)	(2)	(3)	(4)	(5)
	<i>Productivity</i>	<i>Size</i>	<i>Productivity</i>	<i>Size</i>	<i>Productivity</i>
$D_{ifimonly}$	0.255**	0.489***	0.164	0.732***	0.342***
	[0.10]	[0.11]	[0.16]	[0.15]	[0.11]
$D_{ifezonly}$	0.282**	0.719***	0.504***	0.992***	0.358***
	[0.12]	[0.13]	[0.17]	[0.17]	[0.13]
D_{ifimez}	0.453***	0.869***	0.559**	1.308***	0.536***
	[0.17]	[0.15]	[0.24]	[0.23]	[0.17]
D_{armt}	0.0479	0.353***	0.103	0.397***	0.0848
	[0.083]	[0.079]	[0.11]	[0.12]	[0.084]
Obs	1815	1831	1348	1815	1812

Notes: OLS estimations with control variables in both panels and all columns: skill intensity, capital intensity, input intensity, total employment, host-country, parent-location and industry dummies. Firm size regressions omit the log of total employment as a covariate. Standard errors are clustered at the firm level. Productivity (column 1): log of the ratio of total sales to total employment. Size (column 2): total employment. Productivity (column 3): log of the ratio of value added to total employment. Size (column 4): log of total sales. Productivity (column 5): log of total factor productivity. Panels A and B: D_{ift} : firm has intra-firm imports or exports, or both (dummy). Panels B and C: D_{armt} : firm with arms’ length trade only (i.e., either arms’ length imports or exports or both but with no intra-firm trade). Panel C: $D_{ifimonly}$: firm has intra-firm imports only (dummy), $D_{ifezonly}$: firm has intra-firm exports only (dummy), D_{ifimez} : firm has both intra-firm imports and exports (dummy). Dummies take value 1 if the statement holds, and 0 otherwise. All variables are in logs except for dummies.

In Panel C, we regress the same dependent variables on dummies for intra-firm imports only (i.e., it takes value 1 if the firm has only intra-firm imports), intra-firm exports only (i.e., it takes value 1 if the firm has only intra-firm exports), for both intra-firm imports and exports (i.e., it takes value 1 if the firm has both intra-firm imports and exports), for arm’s length trade only, and the same control variables as in Panels A and B. Column 1 shows that foreign affiliates with only intra-firm imports, with only intra-firm exports and with both intra-firm imports and exports have a productivity advantage of 25.5%, 28.2%, and 45.3%, respectively, over those without intra-firm trade. The same sorting pattern arises when we use the other two proxies for firm productivity in columns 3 and 5. In all three columns, we fail to find any statistically significant premia for foreign affiliates which trade only at arm’s length. In terms of size premia, these are: 48.9% for foreign affiliates with intra-firm imports only, 71.9% for foreign affiliates with intra-firm exports only, and 86.9% for foreign affiliates with both intra-firm imports and exports (column 2). Those with arm’s length trade have the smallest size premia, of 35.3%. We obtain the same sorting pattern with even larger premia with the alternative proxy for firm size in column 4. We also find the same sorting pattern when we drop from the regressions the dummy for only arm’s length trade but, as expected, the productivity and size premia are smaller.

We check the robustness of these results with the following tests. First, we confine our analysis to firms in manufacturing. The sorting pattern still exists. When we do

not control for firms with arms' length trade the premia are slightly smaller. When we control for these, they become greater. Second, these premia may have been driven by the fact that foreign affiliates with only arm's length trade have very similar size and productivity levels with locally-owned firms which engage in international trade. To this purpose, we compute size and productivity premia of these two firm types and find that foreign affiliates with only arm's length trade are dissimilar from domestic firms which trade. More precisely, they are bigger and more productive by 11.9% and 25.7%, respectively. We relegate all tables with robustness checks to the Online Appendix.

According to additional results that we report in the Online Appendix, foreign affiliates with intra-firm trade seem to have an advantage in terms of input intensity and average wage. This is not the case for skill and capital intensity. Nonetheless, for all four variables we fail to find any clear sorting pattern as the one that we find for firm productivity and size. We draw the same conclusions from the estimation of premia for the restricted sample of firms belonging to manufacturing. When controlling for the dummy for firms with only arms' length trade, we find weak evidence of capital intensity premia and a clear sorting pattern for input intensity. That is, affiliates with both intra-firm imports and exports have the highest input intensity premia, those with intra-firm imports the second highest, while those with intra-firm exports the lowest. The results hold for the whole and the restricted samples.

In sum, foreign affiliates with both intra-firm imports and exports have the largest productivity and employment premia, those with only intra-firm exports the second largest, while those with only intra-firm imports, the smallest. Interestingly, this sorting pattern is identical to the one in [Bernard et al. \(2007\)](#), whose sample, however, includes all importers and exporters (i.e., those which import and export from and to affiliated and non-affiliated parties). In the Online Appendix, we show that foreign affiliates with intra-firm and/or arms' length trade have size but not productivity premia and that the aforementioned sorting pattern is found only for size and not for productivity. In addition, we find that those which trade only at arms' length are less productive. We get very similar results when we restrict the sample to manufacturing firms.

3 Theoretical background

In this section we describe in detail the theoretical background of our subsequent econometric analysis. Motivated by our findings in section 2.3 for size and productivity premia of foreign affiliates with intra-firm trade, we start by providing a theoretical explanation for the selection of foreign affiliates into intra-firm trade. In addition, we study theoretically the potential differences between foreign affiliates with and without intra-firm trade in the following areas: stock and flow of intangibles, delegation of authority and grant of rights of control, extensive and intensive margins of sister affiliates, mode of foreign investment of the parent company, extensive and intensive margins of local and international procurement activities and of exporting activities.

3.1 Selection into intra-firm trade

In order to explain the selection of foreign affiliates into intra-firm and arm's length trade, we rely on the concept of firm heterogeneity in terms of productivity introduced by Melitz (2003). We plausibly assume that the fixed cost of engaging in intra-firm trade is greater than the fixed cost of engaging in arm's length trade since the first includes the cost of set-up of a new affiliate or the takeover of an existing firm, while the second the cost of search and match with an unaffiliated supplier or buyer (Antras and Helpman, 2004). Although the first fixed cost is initially borne by the parent company which is in charge of building a network of domestic and foreign affiliates, we assume that this cost is shared with its affiliates through intra-firm trade.

In sum, we plausibly assume that the fixed cost of selling in or buying from the host-country market is lower than the fixed cost of arm's length trade, which in turn, is lower than the fixed cost of intra-firm trade ($f_D < f_{armt} < f_{ift}$). The productivity cutoffs above which a firm can incur each of these fixed costs have the following order: ($\Theta_D < \Theta_{armt} < \Theta_{ift}$). Hence, only the most productive foreign affiliates, with productivity level of at least Θ_{ift} are able to engage in intra-firm trade. Those with intermediate levels of productivity ($\Theta_{armt} \leq \Theta < \Theta_{ift}$) engage in arm's length trade, while those with lower productivity levels ($\Theta_D \leq \Theta < \Theta_{armt}$) only sell in or buy from the host country. Foreign affiliates with productivity below Θ_D exit the market.

After decomposing intra-firm trade into different flows (i.e., imports, exports, both), we assume the following order for their fixed costs: $f_{ifim} < f_{ifex} < f_{ifimex} = f_{ifim} + f_{ifex}$. Similarly the order of their corresponding productivity cutoffs are: $\Theta_{ifim} < \Theta_{ifex} < \Theta_{ifimex}$. Eventually, the following sorting pattern arises: the biggest and most productive foreign affiliates engage in both intra-firm imports and exports, smaller and less productive in intra-firm exports, even smaller and even less productive in intra-firm imports, while among those whose size and productivity do not allow them to engage in any type of intra-firm trade, the biggest and most productive have only arm's length trade, smaller and less productive only sell into and source from the host-country market and the least productive exit.

3.2 Stock and flow of intangible assets

According to the Property Rights Theory (PRT) developed by Grossman and Hart (1986) and Hart and Moore (1990) and recently incorporated into international trade models (Antràs, 2003), ownership is a source of power when contracts are incomplete and there are inefficiencies in transactions through the market. When parties encounter contingencies that were not foreseen in the initial contract, the owner of relationship-specific assets has the residual rights of control over these assets and can maximise her payoff at the possible expense of the integrated party.

Emphasising the role of intangibles, Grant (1996) conceptualises the firm as an institution for integrating knowledge. In line with this argument, Atalay et al. (2014) find empirical evidence that firm boundaries mainly exist for the transfer of intangible assets rather than the transfer of physical goods. This argument is also adopted by Ramondo et al. (2011).

Hence, relationship-specific assets can be either tangible (e.g. machines, buildings,

inventories) or intangible (e.g. intellectual property, patents, copyrights, information about past and current implementation of technologies, trade contacts and competitors, marketing, brand names) and are subject to the same inefficiencies when transacted through the market. If at least one of the two types of assets is subject to market inefficiencies, the firm will opt for vertical integration.

Especially, when it comes to knowledge diffusion, the internalisation/vertical integration decision should be viewed not only as a double-sided hold-up problem, but rather, as a way for firms to prevent rivals from knowledge expropriation (Antràs and Rossi-Hansberg, 2009).

As a complement to these argumentation, we aim at studying theoretically the potential association between intra-firm trade and the level of integration of knowledge within the multinational firm. Put differently, we try to identify any potential differences between foreign affiliates with and without intra-firm trade in terms of their inflow and stock of intangibles. In so doing, we focus exclusively on knowledge application within the foreign affiliate rather than knowledge creation (Grant, 1996).

The key idea in our approach is that when production sharing between the parent firm and the foreign affiliate occurs and there exists intra-firm trade, the production stage within the foreign affiliate (e.g. assembly/fabrication) requires access to knowledge utilised in the production stage of the parent firm (e.g. design) (Demsetz, 1988). This can be perceived as the intense technical dialogue that is required between the two stages of production (Grant, 1996). The term “technical dialogue” may include any form of capabilities (e.g. patents, copyrights, any other kind of intellectual property, know-how, information about past and current implementation of technologies). By contrast, an intense technical dialogue between two entities which do not share the same production process and have no intra-firm trade, is unnecessary and thus, does not take place.

In short, for both types of foreign affiliates there is an inflow of intangibles that is solely attributed to firm boundaries. However, for foreign affiliates which trade with their parent, there is an additional inflow of intangibles which stems from the efficiency requirements of fragmentation of production.

Therefore, the total flow of intangibles into a foreign affiliate with intra-firm trade during a given financial year is given by $(1 + \gamma) * f$, where $\gamma > 0$ captures the additional inflow of intangibles due to intra-firm trade. For foreign affiliates without intra-firm trade, $\gamma = 0$ and thus, their total inflow of intangibles in a given financial year is given by f . Hence, the total inflow of intangibles of the average foreign affiliate with intra-firm trade is expected to be greater: $flow(\gamma > 0) = (1 + \gamma) * f > flow(\gamma = 0) = f$.

The values of the stock of intangibles of foreign affiliates with and without intra-firm trade at the end of the financial year are given by the following expressions:

$$stock^{EY}(\gamma > 0) = stock^{BY}(\gamma > 0) + flow(\gamma > 0)$$

$$stock^{EY}(\gamma = 0) = stock^{BY}(\gamma = 0) + flow(\gamma = 0)$$

Assuming that the value of stock of intangibles at the beginning of the financial year is the same for both firm types ($stock^{BY}(\gamma > 0) = stock^{BY}(\gamma = 0)$), then the difference between the two in the value of stock at the end of the financial year is determined by their difference in the inflow of intangibles. Since $flow(\gamma > 0) > flow(\gamma = 0)$, we get that the stock of intangibles of foreign affiliates with intra-firm trade at the end of the financial year is greater:

$$stock^{EY}(\gamma > 0) > stock^{EY}(\gamma = 0)$$

3.3 Span of control in the multinational firm

According to the PRT, and this is its main advantage over the Transactions Cost Approach (TCA), inefficiencies and opportunistic behaviour of agents in the integrated party do not disappear under vertical integration (Antràs and Rossi-Hansberg, 2009; Antràs and R. Yeaple, 2013). Ownership of a relationship-specific asset gives power to the owner because it implies the legal right to make away with it in the future. However, current access to this asset is more pertinent to control rather than ownership in the sense that the owner decides whether she wants to keep control of the asset or cede control rights by granting access to others.¹⁵

We perceive the parent firm and the foreign affiliate as an international production team with knowledge-based hierarchy (Antràs et al., 2006). There are three layers in the parent firm and two in the foreign affiliate. The bottom and intermediate layers in both entities comprise production workers and middle managers, respectively. The top managers of the multinational firm are in the top layer of the parent firm. There is one-to-many matching where a manager is endogenously matched with a potential large number of workers. Production workers perform routine tasks and middle managers supervise production workers in each entity and solve routine problems whenever production workers ask for their help. Similarly, top managers supervise middle managers in the parent firm and if their span of control is wide enough, they also supervise middle managers in the foreign affiliate.¹⁶ In case the span of control is narrow, a top manager/CEO is appointed in the foreign affiliate. Hence, the width of the span of control is reverberated to the addition of a top layer/CEO in the foreign affiliate, as in Antràs et al. (2006).

The main goal of our analysis in this section is to describe how intra-firm trade can be potentially associated with the span of control of top managers within a multinational firm. In other words, does the span of control of top managers of a parent firm which

¹⁵The importance of control is well understood if we consider that the ability to control access today may be enough to project control rights of a unique critical resource into the future. Even though a critical resource cannot be owned but only controlled, even temporarily, it can offer similar residual rights as ownership does and allow the emergence of organisations (e.g. law and consulting firms) (Rajan and Zingales, 1998).

¹⁶Note that the description of the knowledge-based hierarchy reveals that it differs from hierarchies considered in models of delegation of authority (Acemoglu et al., 2007) since they assume that top managers act based on past information, while subordinate managers know how to act because of their superior knowledge than that of top managers.

trades with its foreign affiliate differ from that of top managers of a parent firm for which trade with its foreign affiliate is not observed?

According to [Antràs et al. \(2006\)](#), the span of control is determined by the difference between local and international communication costs and the opportunistic behaviour of agents in the foreign affiliate (i.e., agents can expropriate knowledge and start their own business). We abstract from any differences in the gap between local and international communication costs by assuming that both types of foreign affiliates are based in the same host country and have a common parent location. We also assume that the communication costs are low enough in both cases so that the span of control can increase easily if it is deemed appropriate by the top management in the parent firm.

The common parent location also excludes from our analysis any other factors that may play a role in determining the span of control such as business culture, while the common host country, excludes any potential differences in the distribution of skills.¹⁷

For the purpose of the analysis, we adopt the structural elements of the model of [Rajan and Zingales \(1998\)](#). In terms of technology, we assume that this is identical for the two types of foreign affiliates. The time frame we consider is a single financial year which comprises five stages. Access to the critical resource is granted from top managers in the parent company to middle managers and/or a CEO in the foreign affiliate (stage 1). Direct and indirect access to the critical resource by those in the foreign affiliate is the only way that they produce effectively. After managers in the foreign affiliate are granted access, they make a decision whether they specialise to the critical resource and, subsequently, to top managers in the parent company, so as to add value to the production team, or compete (i.e., behave in an opportunistic way by expropriating the critical resource and set up a rival company/production team) (stage 2). In case of competition, only the team which can produce the most survives (stage 3). The parent firm bargains over future surplus and signs sharing contracts (stage 4). Then, production takes place and at the end of the financial year the payoff for each contract is distributed (stage 5).

Specialisation implies that managers and workers in the foreign affiliate familiarise themselves with the critical resource and learn how to work with their superiors. The effort that they make in order to do so is deemed as the cost of specialisation. A manager or worker who specialises once, does not need to specialise again since she has already familiarised herself with the critical resource and knows how to collaborate effectively with her superior(s).

Competition implies that direct access to the critical resource provides managers in the foreign affiliate with positional power which they can exercise in order to expropriate the critical resource and set up their own business. Theoretically, production workers in the foreign affiliate will also have to exit since, due to their specialisation to middle managers, they cannot produce effectively by themselves. In reality, it is rare to see top managers in large corporations to depart by taking with them all their subordinates who have specialised to them. However, this does not prevent them from taking advantage

¹⁷As [Antràs et al. \(2006\)](#) show, the distribution of skills is an important factor for attracting offshoring. In particular, countries which are relatively abundant in middle managers are good offshoring destinations because the presence of middle managers in foreign affiliates can act as a shield for top managers in the parent company from having to deal with routine problems faced by production workers in the host country.

of the dependence of subordinate workers on them and try to extract higher rents from the multinational firm in the bargaining stage. Hence, the basic trade-off between granting control rights to increase production efficiency and limiting access to reduce or eliminate the positional power of managers in the foreign affiliate still holds. In short, competition is a metaphor for a situation that allows managers to appropriate part of the value of the firm.

In the bargaining stage, the end-of-period payoff from production is not contractible until immediately before production begins since contracts are not easily enforced and sophisticated commitment mechanisms are not available (Grossman and Hart, 1986). As a consequence, top managers in the parent company who engage in a relationship-specific investment bargain with managers in the foreign affiliate over their payoff after a successful production.

Assume that the total output from the relationship-specific investment is Q and is equal in both firm types. For parents and foreign affiliates which trade with each other is straightforward that they have a joint output. This is also true for parents and foreign affiliates which do not trade with each other, since according to the proximity-concentration trade-off (Markusen, 1984) and the definition of horizontal FDI, the parent serves the host-country market through its foreign affiliate rather than through direct exports from the home country.

The payoff of managers in the foreign affiliate is the difference of the effort they make in order to specialise to top managers in the parent firm and produce effectively (i.e., cost of specialisation) (e) from the benefit from their positional power which captures the likelihood of an opportunistic behaviour of theirs (i.e., the higher the p , the more likely middle managers will adopt opportunistic behaviour by expropriating unique critical resources and set up their own firm, rival to the incumbent):

$$p(\text{flow}(\gamma), c(\gamma)) - e(\text{flow}(\gamma), c(\gamma))$$

Positional power p is non-decreasing in the transfer of critical resources (i.e., intangibles and capabilities) to the foreign affiliate, whose intensity depends on intra-firm trade (γ) and non-increasing in the span of control, which is also dependent on intra-firm trade. The first implies that the positional power of managers in the foreign affiliate increases with a more intense transfer of critical resources. The second implies that the wider the span of control of top managers of the parent company reduces the positional power of managers in the foreign affiliate.

The reverse is true for effort e . It is non-increasing in the transfer of critical resources and non-decreasing in the span of control. In other words, a more intense transfer of critical resources to the foreign affiliate acts as a disincentive for its managers to specialise to their superiors of the parent company, while an increase in the span of control increases their specialisation effort. In short, when the transfer of critical resources is intensified and the span of control is narrow, the payoff of managers in the foreign affiliate is relatively high.

The residual amount between total output (Q) and the payoff of managers ($p - e$) in foreign affiliates with and without intra-firm trade is the payoff of top managers of their parent company:

$$U^{topman}(flow(\gamma > 0), c(\gamma > 0)) = Q$$

$$- [p(flow(\gamma > 0), c(\gamma > 0)) - e(flow(\gamma > 0), c(\gamma > 0))]$$

$$U^{topman}(flow(\gamma = 0), c(\gamma = 0)) = Q$$

$$- [p(flow(\gamma = 0), c(\gamma = 0)) - e(flow(\gamma = 0), c(\gamma = 0))]$$

The greater intensity of transfer of critical resources to the average foreign affiliate with intra-firm trade ($flow(\gamma > 0) > flow(\gamma = 0)$) results in a higher increase in the positional power of its managers and a higher decrease of their effort. If the span of control is the same in both firm types and held constant, the payoff of managers in the foreign affiliate will be higher, at the expense of top managers in its parent.

However, top managers of the parent can anticipate this and therefore, are willing to engage in production sharing and the subsequent transfer of critical resources only under the condition that their payoff is at least the same as the payoff that they would have if they had kept all stages of production in house:

$$U^{topman}(flow(\gamma > 0), c(\gamma > 0)) \geq U^{topman}(flow(\gamma = 0), c(\gamma = 0))$$

This condition is satisfied only if they widen their span of control in the foreign affiliate. In this way, they curb the positional power of managers in the foreign affiliate and, at the same time, maintain the efficiency level of production sharing.

Hence, we conclude that the span of control of top managers of the parent company is wider when there exists intra-firm trade ($c(\gamma > 0) > c(\gamma = 0)$). As we show in this paper, this is translated into a lower level of autonomy in decision making of foreign affiliates with intra-firm trade.

3.4 Extensive and intensive margin of sister affiliates

In this section, we study theoretically any differences between foreign affiliates with and without intra-firm trade in terms of the probability of having a sister affiliate in a given country (extensive margin) and in terms of the number of these in this country (intensive margin). We adopt the concept of the cumulative process of making contacts introduced by Chaney (2014). A firm makes new contacts after obtaining relevant information from its existing contacts or searches itself remotely from the location of its existing contacts.

However, a key difference from Chaney (2014) is that we make a clear distinction between affiliated and unaffiliated contacts and link this to the flow of information. Due to incomplete contracts and market inefficiencies, we assume that the flow of information between the firm and its affiliated contacts is less obstructed as compared to the flow of information between the same firm and its unaffiliated contacts. This can be perceived

as the intensity of the flow of information and/or as the quality of information. More importantly, as we explain theoretically in Section 3.2, intra-firm trade intensifies the transfer of intangibles. Information acquired from existing contacts is a prominent form of intangible assets. Therefore, the flow of information between affiliated parties which trade with each other tends to be more intense than the flow of information between affiliated parties that do not.

We assume that foreign affiliates with and without intra-firm trade are located in the same host country and that the locations of related and unrelated parties are also identical. This is to exclude any country factors (cross-country differences in law enforcement, etc.) from the analysis and focus exclusively on the role played by intra-firm trade in the transfer intensity of information.

3.4.1 Extensive margin of sister affiliates

Starting with the extensive margin, we first assume that the number of affiliated and non-affiliated parties is the same for foreign affiliates with and without intra-firm trade: $N^{RP}(\gamma > 0) = N^{RP}(\gamma = 0)$ and $N^{URP}(\gamma > 0) = N^{URP}(\gamma = 0)$. The probability the average foreign affiliate of either type has a contact is equal to the weighted average of probabilities a foreign affiliate acquires information about new contacts from related and unrelated parties, where the weights are the shares of the number of affiliated and unaffiliated contacts in the total number of contacts:

$$Pr(N^{add}/\gamma) = \frac{N^{RP}(\gamma)}{N^{RP}(\gamma) + N^{URP}(\gamma)} * Pr(I^{RP}(\gamma)) + \frac{N^{URP}(\gamma)}{N^{RP}(\gamma) + N^{URP}(\gamma)} * Pr(I^{URP})$$

The weighted probabilities are non-decreasing in I and $I^{RP}(\gamma)$ is non-decreasing in γ which implies that the flow of information is more intense between affiliated contacts that trade with each other: $I^{RP}(\gamma > 0) > I^{RP}(\gamma = 0)$. Then, the probability a foreign affiliate makes a new contact based on information obtained from an affiliated party with which it trades is greater than the probability of making a new contact based on information obtained from an affiliated party with which it does not trade: $Pr(I^{RP}(\gamma > 0)) > Pr(I^{RP}(\gamma = 0))$. Instead, the probability of making a new contact from information obtained from an unaffiliated party is identical for either type of foreign affiliate since it does not depend on γ . In turn, the probabilities foreign affiliates with and without intra-firm trade make a new contact based on information from an unaffiliated party are identical as well. Then, we get that the probability the average foreign affiliate with intra-firm trade makes a new contact is greater:

$$\frac{Pr(N^{add}/\gamma > 0)}{Pr(N^{add}/\gamma = 0)} > 1 \text{ or}$$

$$Pr(N^{add}/\gamma > 0) > Pr(N^{add}/\gamma = 0)$$

3.4.2 Intensive margin of sister affiliates

We study the intensive margin of sister affiliates within a single financial year. The number of contacts at the end of the financial year is the number of contacts acquired during the financial year based on the probability of acquiring information from related and unrelated parties, added to the number of contacts at the beginning of the financial year:

$$N^{EY}(\gamma) = N^{RP,URP} + N^{BY}(\gamma)$$

where $N^{RP,URP}(\gamma) = N^{RP}(Pr(I^{RP}(\gamma))) + N^{URP}(Pr(I^{URP}(\gamma)))$. We assume that the number of contacts at the beginning of the financial year is the same for both firm types: $N^{BY}(\gamma > 0) = N^{BY}(\gamma = 0)$. The contacts created in a given financial year based on information from affiliated and unaffiliated parties are non-decreasing in the probabilities of obtaining such information from either party type. From Section 3.4.1 we have that: $Pr(I^{RP}(\gamma > 0)) > Pr(I^{RP}(\gamma = 0))$ and $Pr(I^{URP}(\gamma > 0)) = Pr(I^{URP}(\gamma = 0))$. Hence, the total number of contacts created based on information from affiliated and unaffiliated parties is greater for foreign affiliates with intra-firm trade:

$$N^{RP,URP}(\gamma > 0) > N^{RP,URP}(\gamma = 0)$$

Consequently, the number of contacts at the end of the end of the financial year is greater for foreign affiliates with intra-firm trade: $N^{EY}(\gamma > 0) > N^{EY}(\gamma = 0)$

3.5 Mode of foreign investment of the parent company

In this section, we study theoretically the link between intra-firm trade and the mode of investment. We consider a parent firm which wants to make an investment in a foreign country either by setting up a foreign affiliate (Greenfield FDI) or by taking over an existing one in the host country (M&A).

According to the resource-based view of the firm, there is an interplay between a firm's endowments and complementary capabilities or intangible assets in the possession of other firms (Nocke and Yeaple, 2007; Antràs and R. Yeaple, 2013; Grant, 1996; Simon, 1991). Due to the fact that some capabilities may be imperfectly mobile (e.g. marketing, distribution, country-specific institutional competency), cross-border M&As allow the acquiring firm to complement its intangible technological advantages with a local firm's country-specific capabilities. For simplicity, we assume that the transfer of capabilities in each of the two cases is unidirectional. In the case of Greenfield FDI, the transfer of capabilities is from the parent to the foreign affiliate, while in the case of M&A, it is from the foreign affiliate to the parent.

We assume that there are no practical difficulties in identifying resources and the extent to which in practice an acquiring firm can combine its capabilities with those of the acquired firm is foreseeable. Also, the structure and the systems which can help an

acquiring firm implement the strategies based on acquired resources have already been set up (Wernerfelt, 1984).

The probability a parent firm engages in Greenfield FDI is equal to the probability it transfers capabilities into the newly-founded affiliate in the host country:

$$Pr(GFDI/\gamma) = Pr((1 + \gamma) * f + stock^{BY}(\gamma)) \quad (1)$$

where, as in Section 3.2, $(1 + \gamma) * f$ is the transfer of capabilities from the parent to the foreign affiliate ($f > 0$) and $stock^{BY}(\gamma)$ is the stock of capabilities available in the foreign affiliate at the beginning of the financial year, assuming that it's the time of its set-up. Since Greenfield FDI implies the creation of a new firm, we can plausibly assume that it has no capabilities at the beginning of the financial year ($stock^{BY}(\gamma) = 0$). Then, equation 1 becomes:

$$Pr(GFDI/\gamma) = Pr((1 + \gamma) * f)$$

$Pr((1 + \gamma) * f)$ is non-decreasing in the transfer of capabilities, $(1 + \gamma) * f$, that is, the higher the transfer, the higher probability the foreign affiliate is created through Greenfield FDI.

The probability a foreign affiliate with intra-firm trade engages in Greenfield FDI is $Pr(GFDI/\gamma > 0) = Pr((1 + \gamma) * f)$, while that of a foreign without intra-firm trade is $Pr(GFDI/\gamma = 0) = Pr(f)$. Taking the ratio of the two, we get:

$$\frac{Pr(GFDI/\gamma > 0)}{Pr(GFDI/\gamma = 0)} = \frac{Pr((1 + \gamma) * f)}{Pr(f)}$$

Given that $(1 + \gamma) * f > f$, we have that: $Pr((1 + \gamma) * f) > Pr(f)$. That is, we get that the probability the average foreign affiliate with intra-firm trade engages in Greenfield FDI is higher:

$$\frac{Pr(GFDI/\gamma > 0)}{Pr(GFDI/\gamma = 0)} > 1 \text{ or}$$

$$Pr(GFDI/\gamma > 0) > Pr(GFDI/\gamma = 0)$$

Given that we consider only the two main alternative modes of foreign investment, Greenfield FDI and M&As, the sum of the probability a firm engages in Greenfield FDI and the probability it opts for M&A is equal to 1 ($Pr(GFDI/\gamma) + Pr(M\&A/\gamma) = 1$). Since we have shown that $Pr(GFDI/\gamma > 0) > Pr(GFDI/\gamma = 0)$, the probability the

average foreign affiliate with intra-firm trade takes over an existing firm in the foreign country is lower: $Pr(M\&A/\gamma > 0) < Pr(M\&A/\gamma = 0)$.

We get this result below also after following the same procedure as with Greenfield FDI. The probability a parent firm engages in M&A is equal to the probability it receives capabilities from the acquired firm in the host country:

$$Pr(M\&A/\gamma) = Pr((1 + \gamma) * f + stock^{BY}(\gamma))$$

where $(1 + \gamma) * f$ is the transfer of capabilities from the foreign affiliate to the parent company ($f < 0$) and $stock^{BY}(\gamma)$ is the stock of capabilities available in the foreign affiliate at the beginning of the financial year, assuming that it's the time of the takeover. Since an M&A implies the acquisition of an existing firm, a foreign affiliate, regardless of trading with its parent or not, has a sufficient stock of capabilities at the beginning of the financial year, part of which is transferred to the parent (i.e., $(1 + \gamma) * f + stock^{BY}(\gamma) > 0$ or equivalently, $-(1 + \gamma) * f < stock^{BY}(\gamma)$). We assume that the available stock of capabilities at the beginning of the year is the same for both firm types: $stock^{BY}(\gamma > 0) = stock^{BY}(\gamma = 0)$.

As above, $Pr((1 + \gamma) * f + stock^{BY}(\gamma))$ is non-decreasing in $(1 + \gamma) * f + stock^{BY}(\gamma)$, that is, the higher the transfer of capabilities from the foreign affiliate to the parent (i.e., f gets more negative values), the lower the probability the foreign affiliate is created through an M&A.

The probability a foreign affiliate with intra-firm trade engages in M&A is $Pr(M\&A/\gamma > 0) = Pr((1 + \gamma) * f + stock^{BY}(\gamma))$, while that of a foreign without intra-firm trade is $Pr(M\&A/\gamma = 0) = Pr(f + stock^{BY}(\gamma))$. Taking the ratio of the two, we get:

$$\frac{Pr(M\&A/\gamma > 0)}{Pr(M\&A/\gamma = 0)} = \frac{Pr((1 + \gamma) * f + stock^{BY}(\gamma))}{Pr(f + stock^{BY}(\gamma))}$$

Given that $(1 + \gamma) * f < f$ and $stock^{BY}(\gamma > 0) = stock^{BY}(\gamma = 0)$, we have that: $Pr((1 + \gamma) * f + stock^{BY}(\gamma > 0)) < Pr(f + stock^{BY}(\gamma = 0))$. That is, we get that the probability the average foreign affiliate with intra-firm trade engages in M&A is lower:

$$\frac{Pr(M\&A/\gamma > 0)}{Pr(M\&A/\gamma = 0)} < 1 \text{ or}$$

$$Pr(M\&A/\gamma > 0) < Pr(M\&A/\gamma = 0)$$

3.6 Extensive and intensive margin of local and international procurement activities

On the one hand, given their size and productivity advantage, foreign affiliates with intra-firm trade could have a higher extensive margin of local and international procurement activities since they can more easily incur any fixed cost associated with input sourcing. On the other hand, intra-firm trade and their relatively large and geographically dispersed network of sister affiliates may deter them to search for alternative modes of input sourcing such as sourcing from local suppliers or importing directly and/or indirectly. Also, their intensive margin may be driven by their greater dependence on their parent for input sourcing. Hence, it is theoretically indeterminate how intra-firm trade and the extensive and intensive margins of local and international procurement activities are associated.

3.7 Extensive and intensive margin of exporting

3.7.1 Extensive margin of exporting

Similar to sections 2.3 and 3.1 in which we provide empirical evidence and a theoretical explanation for self-selection of foreign affiliates into intra-firm trade, the size and productivity premia of foreign affiliates with intra-firm trade can explain the extensive margins of domestic and export sales. Given that the average foreign affiliate with intra-firm trade is bigger and more productive, it is more likely to have sales in export markets rather than in the domestic market.

By providing such an explanation, we implicitly assume, same as in Melitz (2003), that size and productivity heterogeneity across foreign affiliates account fully for their ability to enter export markets. However, Armenter and Koren (2014) show that size and productivity differences can only partly explain participation in export activities. To this purpose, Chaney (2014) builds a model of trade frictions in which firms enter sequentially into geographically dispersed markets. The concept is that firms can sell only in markets where they have a contact because in this way they can overcome informational barriers. Firms can search for trading partners directly or through their existing network of contacts.

As we show theoretically in Section 3.4, the average foreign affiliate with intra-firm trade is more likely to have a contact, in the form of affiliated or non-affiliated party, in a given market. Hence, we expect that this will also determine their engagement in export activities. In short, the combination of size and productivity premia along with a relatively large and geographically dispersed network of sister affiliates seem to explain why foreign affiliates with intra-firm trade are expected to have a greater probability of export market entry.

The concept of Chaney (2014) is very useful in order to tackle two more essential issues, the mode of export market entry (i.e., directly or indirectly) and the distribution of sales across the domestic and export markets. Starting with the first, Ahn et al. (2011) build a model of firm heterogeneity à la Melitz (2003) and show that the most productive firms engage in direct exports, the less productive firms in indirect exports (i.e., through intermediaries) and the least productive in domestic sales. That is, indirect exporting is an activity adopted by firms with intermediate levels of productivity.

In our setting firms with intermediate productivity levels are mostly those with arm's length trade and maybe those which marginally engage intra-firm trade. However, by associating the concept of Chaney (2014) with indirect exporting, the existence of a contact in the host country, in the form of intermediary, may facilitate the export market entry. Since foreign affiliates with intra-firm trade are more likely to have a contact in the host country, they may also be more likely to engage in indirect exporting. Hence, whether size and productivity differences or the extensive and intensive margins of contacts in the same host country are more important in order to explain indirect export entry is an empirical question.

As regards the distribution of sales across domestic and export markets, we can plausibly assume that it will be determined by the likelihood a firm has a geographically dispersed network of contacts. The higher the geographical dispersion of a network of contacts, the more even the distribution of sales across markets. Therefore, we expect foreign affiliates with intra-firm trade to have a less skewed geographical distribution of sales.

3.7.2 Intensive margin of exporting

So far, we have examined only the extensive margin of exporting. Neither size and productivity differences nor a geographically dispersed network of contacts can explain the intensive margin of exports. For this reason, we rely on the concept of the (fixed) marketing cost to be incurred so that the firm can reach an additional consumer *within* a given market, either the domestic or a foreign one (Arkolakis, 2010). The marginal cost of marketing increases with the number of consumers reached. Given that the average foreign affiliate with intra-firm trade is bigger and more productive, it can cover relatively easily the increasing marginal cost of marketing in order to reach additional consumers and thus, this type of firm is expected to have a bigger amount of sales in the domestic and any export market.

4 Econometric model

We use the theoretical background developed in the previous section as a guide for the econometric analysis and therefore, build the econometric model accordingly. In particular, we estimate a probit model in order to investigate which firm characteristics and activities are more likely to be pertinent to one of the two firm types.

The benchmark probit model incorporates variables which capture the main firm characteristics. Hence, for firm j in (host) country c and industry k , whose parent company is located in country p , the estimating benchmark model is the following:

$$\begin{aligned}
 D_{ift,jckp} = & \alpha + \beta_1 * skillInt_{jckp} + \beta_2 * capInt_{jckp} + \beta_3 * numEmp_{jckp} \\
 & + \beta_4 * wageEmp_{jckp} + \beta_5 * labProd_{jckp} + \beta_6 * inpInt_{jckp} \\
 & + \beta_7 * D_{training_{jckp}} + \beta_c * D_c + \beta_k * D_k + \beta_p * D_p + \epsilon_{jckp}
 \end{aligned} \tag{2}$$

where the dependent variable, $D_{ift,jckp}$, is a dummy taking value 1 if firm j has any type of intra-firm trade flows (i.e., either intra-firm imports, or intra-firm exports, or both),

and 0 otherwise; *skillInt* is the log of skill intensity (i.e., share of technical, supervisory and managerial employees in total number of employees), *capInt* is the log of capital intensity (i.e., ratio of capital stock to total number of employees), *numEmp* is the log of total number of employees as a proxy for firm size, *wageEmp* is the log of wage per employee (i.e., total wage bill over total number of employees), *labProd* is the log of labour productivity (i.e., ratio of total sales to total number of employees), *inpInt* is the log of input intensity (i.e., ratio of value of inputs to total number of employees), *D_{training}* is a dummy which takes value 1 if firm *j* provides formal internal/external training to its employees and 0 otherwise, *D_c* is a set of host-country dummies, *D_k* a set of industry dummies, and *D_p* a set of parent-location dummies (i.e., country of origin of the parent company).

The host-country dummies control for any unobserved heterogeneity across the countries which receive foreign investment (e.g. cross-country differences in institutional quality and business environment). By adding industry dummies, we control for any unobserved heterogeneity across industries (e.g. technology and knowledge intensity of industries). The parent-location dummies account for any unobserved heterogeneity across the countries of origin of the investors (e.g. cross-country differences in corporate culture).

The interpretation of the coefficient estimates is as follows. A positive and statistically significant coefficient estimate indicates that foreign affiliates with intra-firm trade are more likely to acquire the respective characteristic as compared to those without intra-firm trade. Likewise, a negative coefficient estimate implies that the probability foreign affiliates with intra-firm trade have the respective characteristic is lower.

As mentioned in Section 3, according to Atalay et al. (2014) and Ramondo et al. (2011) the boundaries of the firm are crucial for facilitating the transfer of intangible assets and not necessarily of physical goods because they mitigate the inefficiencies that may arise when such a transfer is mediated through the market. However, there may still exist differences in the intensity of this transfer which may be relevant to the existence of intra-firm trade, as we show in Section 3.2. For this reason, as a complement to the argument of Atalay et al. (2014), we try to investigate such potential differences by augmenting the benchmark model with the log ratios of the stock and flow of intangible assets to total number of employees (*intangStockEmp* and *intangFlowEmp*, respectively). The two variables enter the model separately. The stock of intangibles is the value of intellectual property assets (including patents, software, copyrights) at the end of the financial year, while the flow of intangibles is the value of intellectual property assets that are acquired during the financial year (i.e., the difference between the value of stock at the end and the beginning of the financial year).

We construct additional proxies for the transfer of intangible assets and capabilities from the parent to the foreign affiliate. They capture the importance of assistance that the parent provides to the foreign affiliate in several areas. The importance of assistance as evaluated by the foreign affiliate ranges between 0 and 5. Value 0 indicates that the foreign affiliate received no assistance from the parent, value 1 that the assistance received was not important, value 2 that it was slightly important, value 3 that it was important, value 4 that it was very important, and value 5 that it was crucial. The areas in which the foreign affiliate is assisted and the corresponding variables are the following: 1) use of patents, trademarks and brand names (*assParUsePat*), 2)

technology and know-how transfer (*assParTechTrans*), 3) upgrading quality of staff (*assParUpqQual*), 4) access to finance (*assParAccFin*), 5) access to foreign supplier network (*assParForSuppNet*), 6) global market access (*assParGlMarketAcc*). We also compute the overall measure of assistance as the average level of assistance provided by the parent in the six aforementioned areas (*assParOv*).

These variables can also be viewed as proxies for the level of dependence of the foreign affiliate on its parent. The parent company as a source of finance of working capital can act as an extra proxy. There are 7 additional sources. In total, we construct 8 dummies, one dummy per source of finance of working capital, which capture the extensive margin, as well as, 8 variables which capture the intensive margin. The sources of finance along with their relevant dummies and shares are the following: 1) internal funds/retained earnings ($D_{WCIIntFund}$, $WCIIntFund$), 2) borrow from banks in the host country ($D_{WCBorBankIns}$, $WCBorBankIns$), 3) borrow from banks outside the host country ($D_{WCBorBankOuts}$, $WCBorBankOuts$), 4) borrow from family/friends/individual lenders ($D_{WCBorFam}$, $WCBorFam$), 5) borrow from non-bank financial institutions (e.g. equity funds) ($D_{WCBotNonBank}$, $WCBotNonBank$), 6) purchases on credit from suppliers and advances from customers ($D_{WCPurchCredit}$, $WCPurchCredit$), 7) issued new equity shares or new debt (including commercial paper and debentures) ($D_{WCIssNewEq}$, $WCIssNewEq$), 8) the parent company ($D_{WCParent}$, $WCParent$). Each dummy takes value 1 if the firm makes use of the corresponding source of finance of working capital (i.e., the share of the source is greater than 0 and less than or equal to 100), and 0 otherwise.

The final set of variables related to the level of dependence on the parent company represent three different modes of acquisition of capital goods (e.g. machine tools, production machinery, IT hardware), among which is that these are imported from the parent company ($D_{acqCapPar}$). The two alternative modes are that capital goods are imported directly by the firm ($D_{acqCapImp}$) and that they are acquired from local distributors in the host country ($D_{acqCapLoc}$).

In Section 3.3, we show that the greater intensity of knowledge transfer from the parent company to the foreign affiliate with which it trades, induces top managers of the parent to have a larger span of control (i.e., number of subordinates under their supervision) in the foreign affiliate in order to curb the potential increase in the positional power of its managers.

We use a set of variables for the decision making power of the foreign affiliate over several activities in order to capture the span of control. The level of autonomy in decision making ranges between 1 (lowest level of autonomy) and 5 (highest level of autonomy). Value 1 implies that all decisions regarding the local unit come from the headquarters, value 2 that the foreign affiliate has a minor role in decision making, value 3 that the foreign affiliate and its parent have equal power in decision making, value 4 that the foreign affiliate dominates in decision making, and value 5 that the foreign affiliate has absolute decision making power. There are 9 activities if the firm operates in non-services sectors and 10 activities if it operates in the services sector. The 8 activities common to all firms in the economy and their corresponding variables, are the following: 1) introduction/modification of products and services (*autProdMod*), 2) generating new business in the host country (*autGenNewBus*), 3) capital expenditure, including acquisitions (*autCapExp*), 4) pricing policy (*autPricing*), 5) entering new

export markets (*autEntNewExp*), 6) supplier selection (*autSuppSel*), 7) definition of marketing strategy (*autMarkStrat*), 8) recruitment/selection (*autRecruit*). For firms in non-services sectors, the extra activity is: introduction of new production and processing systems (*autIntroNewProd*). For firms in the services sector, the additional 2 activities are: retail/wholesale format (e.g. shop design) (*autRW*) and introduction of new IT system (e.g. inventory system) (*autIntroIT*). Similar to the overall measure of parental assistance, we compute the overall level of aut or overall decision making power of the foreign affiliate as the average level of aut in decision making on the aforementioned activities (*autOv*).

As described in sections 3.4 and 3.5, differences in knowledge intensity due to intra-firm trade are also expected to be associated with the extensive and intensive margins of sister affiliates and the mode of investment of the foreign investor (i.e., Greenfield FDI Vs M&As).

We study empirically the extensive margin of sister affiliates by adding to the model three dummies, one at a time. The first is equal to 1 if the parent company of the foreign affiliate examined owns at least one more affiliate in the same host country ($D_{sisterInCountry}$), the second is equal to 1 if it owns at least one in another sub-Saharan-African country ($D_{sisterInSSA}$), while the third is equal to 1 if it owns at least one in any country outside sub-Saharan-Africa (i.e., in the rest of the world) ($D_{sisterOutSSA}$). All three dummies take value 1 if the number of sister affiliates in each category is non-zero or non-missing. We also study the intensive margin by adding the number of sister affiliates in the same host country ($N_{sisterInCountry}$), in another country in sub-Saharan Africa ($N_{sisterInSSA}$), and in any country outside sub-Saharan Africa ($N_{sisterInSSA}$).

Regarding the mode of investment, we incorporate one at a time in the benchmark model the following variables: a dummy with value 1 if the firm was created as a wholly-owned enterprise through Greenfield investment (D_{GFDIWO}), a dummy with value 1 if the firm was created as a joint venture through Greenfield FDI (D_{GFDIJV}), a dummy with value 1 if the firm was created through purchase of pre-existing assets from local private owners ($D_{M\&ALocPr}$), a dummy with value 1 if the firm was created through purchase of pre-existing assets from foreign private owners ($D_{M\&AForPr}$), and a dummy with value 1 if the firm was created through purchase of pre-existing state-owned assets ($D_{M\&AState}$).

An important aspect of foreign affiliates' activities are those related to their local and international procurement. We add numerous proxies for the extensive and intensive margins of such kind of activities. Starting with the extensive margin, we construct dummies for backward linkages (D_{bLink}), domestic backward linkages (D_{dbLink}), source of production inputs which are manufactured locally ($D_{prodLoc}$), the age of the firm which is less than or equal to 5 years ($D_{fAgeLEQ5}$) and greater than 5 years ($D_{fAgeGT5}$)¹⁸, for the existence of domestic suppliers of raw materials, components or finished goods (D_{dSupp}), the existence of domestic suppliers with long-term arrangement ($D_{dLTsupp}$), the availability of special department for local sourcing (D_{dptLS}), the availability of special department for local supplier development (D_{dptLSD}), for closer supplier relationship as the most important factor in favour of local procurement ($D_{locProcSuppRel}$), for con-

¹⁸The intuition is that the older an affiliate, the more likely to develop backward linkages with suppliers within or outside the host country and substitute its procurement from non-affiliated parties for the whole or part of its procurement from the parent and/or the sister affiliate(s), if any.

cerns over retention of intellectual property as the most important deterrent factor for local procurement ($D_{cancProcIntProp}$), for international backward linkages (D_{ibLink}), direct imports of production inputs ($D_{impDirect}$), source of production inputs through a local importer (i.e., indirect importing) (D_{impLoc}), the existence of suppliers of raw materials, components or finished goods overseas (D_{fSupp}), and for the existence of suppliers overseas with long-term arrangement ($D_{fLTSupp}$). All dummies take value 1 if the relevant statement holds, and 0 otherwise.

The dummy for backward linkages is equal to 1 if at least one of the following conditions is met: 1) the firm contracts out work to other companies in the host country, 2) the firm has domestic suppliers with and/or without long-term arrangement (i.e., the number of domestic suppliers with and/or without long-term arrangement is non-zero or non-missing), 3) the firm has suppliers overseas with and/or without long-term arrangement (i.e., the number of suppliers overseas with and/or without long-term arrangement is non-zero or non-missing), 4) the firm sources production inputs directly from abroad (i.e., the percentage of production inputs by value which are imported directly is greater than 0 and less than or equal to 100), 5) the firm sources production inputs from a local importer (i.e., the percentage of production inputs by value which are sourced through a local importer is greater than 0 and less than or equal to 100), 6) the firm sources production inputs from a local producer (i.e., the percentage of production inputs by value which are locally manufactured is greater than 0 and less than or equal to 100), 7) the share of local production inputs in total production is greater than 0 and less than or equal to 100, 8) the share of foreign production inputs in total production is greater than 0 and less than or equal to 100.

The dummy for domestic backward linkages is equal to 1 if at least one of the conditions 1, 2, 5, 6 and 7 is met. Similarly, the dummy for international backward linkages is equal to 1 if at least one of the conditions 3, 4 and 8 holds.

We study the intensive margin by augmenting the benchmark model with the following variables: the total value of contracted-out work in the host country ($dbLink1$) and the share of local inputs in aggregate production ($dbLink2$) (i.e., domestic backward linkages), the number of domestic suppliers of raw materials, components or finished goods (N_{dSupp}), the number of domestic suppliers with long-term arrangement ($N_{dLTSupp}$), the annual budget for local sourcing ($dptLSBud$), the annual budget for local supplier development ($dptLSDBud$), the annual expenditure on provision of assistance to local suppliers ($expAssLocSupp$), the share of foreign inputs in aggregate production ($ibLink$) (i.e., international backward linkages), the share of directly-imported inputs in total production inputs ($dirImp$), the share of inputs imported indirectly (i.e., from a local importer) in total production inputs ($indImp$), the number of suppliers of raw materials, components or finished goods overseas (N_{fSupp}), the number of suppliers overseas with long-term agreement ($N_{fLTSupp}$).

We study any differences between the two firm types in terms of their market orientation, as well as, their main source of competition by augmenting the benchmark model with two groups of dummy variables. In the first group, the first dummy equals 1 if the firm has sales in the domestic (i.e., host-country) market ($D_{salesDom}$), the second equals 1 if the firm has direct sales in an export market ($D_{salesExpDir}$), and the third equals 1 if the firm has indirect sales (e.g. through intermediaries) in an export market ($D_{salesExpInd}$). In the second group, the first dummy equals 1 if competition for the

main product of the firm comes mostly from imports ($D_{compImp}$), the second equals 1 if competition comes mostly from locally-owned firms ($D_{compLocFirms}$), and the third equals 1 if competition comes mostly from other foreign-owned firms based in the (host) country ($D_{compForFirms}$).

The availability of data on aggregate export sales for the last two financial years allows us to examine the export status of each firm. In particular, we construct a dummy with value 1 if the firm is not an exporter (i.e., no export sales in any of the last two financial years) ($D_{noExporter}$), a dummy with value 1 if the firm is an export starter (i.e., the firm had direct export sales during the last financial year but not two financial years ago) ($D_{expStarter}$), a dummy with value 1 if the firm is an export exiter (i.e., the firm had direct export sales two financial years ago but not during the last financial year) ($D_{expExitier}$), and a dummy with value 1 if the firm is a continuing exporter (i.e., the firm had direct export sales during the past two financial years) ($D_{expContinue}$). The importer-exporter status of the firm (i.e., a firm engaged simultaneously in export and import activities during the last financial year) is captured by an additional dummy (D_{impExp}).

As regards the intensive margin of market orientation, we add to the model the ratios of domestic, direct and indirect export sales to total sales ($domSales$, $dirExpToSales$, $indirExpToSales$). We also add the Herfindahl and Theil indices of the distribution of domestic, direct and indirect exports sales ($salesHerf$, $salesTheil$).

By exploiting information on the geographical breakdown of direct exports, we construct and add to the model 9 variables for each margin. The extensive margin of exports to each destination is captured by dummies which take value 1 if the firm's percentage of exports to a destination in aggregate exports is greater than 0 and less than or equal to 100. The percentage of exports captures the intensive margin. The nine destinations available and the variables which capture the extensive and intensive margins are: South Africa (D_{expSA} , $expSA$), sub-Saharan Africa (D_{expSSA} , $expSSA$), European Union (D_{expEU} , $expEU$), US (D_{expUS} , $expUS$), China ($D_{expChina}$, $expChina$), India ($D_{expIndia}$, $expIndia$), Asia other than China and India (D_{expOA} , $expOA$), Middle-East and North Africa ($D_{expMENA}$, $expMENA$), and the rest of the world ($D_{expOther}$, $expOther$).

As discussed in Section 3.7, firm heterogeneity with respect to size and productivity (Melitz, 2003) and the cumulative process of acquisition of contacts (Chaney, 2014) can explain any differences in the extensive margin of exports but are silent about the intensive margin. In order to provide a convincing explanation for any differences in the intensive margin of export sales in each destination, we use the concept of the marketing cost to be paid by the firm to reach each consumer *within* each export market (Arkolakis, 2010). We use advertising intensity (i.e., shares of advertising expenditure in total employment and total sales) as proxies for the firms' expenditures in order to cover the marketing costs required to reach consumers in each market ($advertExpToEmp$, $advertExpToSales$). We also add to the model the extensive margin of advertising as a proxy for headquarter intensity (D_{advert}). The dummy variable equals 1 if the firm's advertising expenditure is non-zero or non-missing.

Finally, we study the skewness of export sales within each of the 9 market destinations, as well as, across these markets. For the skewness of export sales within each market, we incorporate in the benchmark model the ratios of export sales in a market

to the mean of export sales in this market ($expToM_SA$, $expToM_SSA$, $expToM_EU$, $expToM_US$, $expToM_China$, $expToM_India$, $expToM_OA$, $expToM_MENA$, $expToM_Other$). For the skewness of export sales across the 9 destination markets, we incorporate the Herfindahl and Theil indices of the distribution of exports across these markets ($expHerf$, $expTheil$).

5 Empirical results

The results from the probit estimation of equation 2 are portrayed in column 1 of Table 6. The coefficient estimates of firm size and labour productivity are positive and significant at the level of 1%. The estimated coefficients of skill and capital intensity are negative but not statistically significant. Those of the average wage, input intensity, and the dummy for provision of training to employees are all positive and insignificant.

In column 2, we use a broader definition of parent location. That is, we construct dummies for whether the parent is domiciled in a high-income, or non-SSA low/middle-income, or SSA country. The results are very similar to those in column 1. The main difference is that the coefficient estimate of the average wage becomes significant at the level of 5%. In column 3, we use total sales as an alternative proxy for firm size and drop labour productivity in order to avoid collinearity. Its coefficient estimate is still positive and highly significant. In column 4, we run the same probit regression as in column 1, with the only difference that we substitute total factor productivity for labour productivity. By and large, the results are the same with those in column 1. The magnitude of the coefficient estimate of the main proxy for firm size is smaller and significant only at 5%.

In column 5, we re-estimate the benchmark model by having as dependent variable a dummy which takes value 1 if the foreign affiliate has intra-firm exports (D_{ifex}). The results are very similar to those in column 1. Affiliates with intra-firm exports seem to be bigger and more productive than those without intra-firm exports. The first finding is in line with that of Ramondo et al. (2011) who use the same dependent variable. According to the authors, a key difference between “horizontal” and “vertical” affiliates is their size. In particular, they find that only a small number of relatively large affiliates have intra-firm trade. In contrast, the median affiliate, which is smaller in size, has no sales to its parent but mostly sales to unaffiliated parties in the host country.

The same authors use imports of foreign affiliates from their parent as dependent variable. In the same direction, Hanson et al. (2001) study the flows of intermediate goods from the parent to the foreign affiliate by using a measure of the affiliate size. In addition, as already discussed in Section 2, we find that, among foreign affiliates with intra-firm trade, the number of these with intra-firm imports is exceptionally high in many sectors of the economy (Mining, Low-tech and Medium/High-tech manufacturing, EGW supply and Construction, Services). Hence, we estimate the benchmark model with a dummy as dependent variable, which is equal to 1 if the foreign affiliate has intra-firm imports. The results remain unchanged and are shown in column 6.

Using the narrow definition of “vertical” FDI, according to which the foreign affiliate has both intra-firm imports and exports, we re-estimate the benchmark model after replacing the dependent variable with a dummy which takes value 1 if the affiliate has

both intra-firm flows. The main results still hold and are shown in column 7.

Table 6: Main characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	D_{ift}	D_{ift}	D_{ift}	D_{ift}	D_{ifex}	D_{ifim}	D_{ifimex}	D_{ift}	D_{ift}
<i>skillInt</i>	-0.0153 [0.014]	-0.0122 [0.014]	-0.0198 [0.013]	-0.0169 [0.014]	-0.00840 [0.0086]	-0.00241 [0.012]	-0.00102 [0.0050]	-0.0110 [0.017]	-0.0136 [0.015]
<i>capInt</i>	-0.00580 [0.0077]	-0.00329 [0.0075]	-0.00667 [0.0076]	-0.00113 [0.0075]	-0.00179 [0.0050]	-0.00351 [0.0065]	-0.000100 [0.0029]	-0.0161 [0.011]	-0.0178** [0.0088]
<i>numEmp</i>	0.0476*** [0.010]	0.0480*** [0.010]		0.0283** [0.012]	0.0352*** [0.0069]	0.0232*** [0.0087]	0.0146*** [0.0041]	0.0562*** [0.012]	0.0517*** [0.012]
<i>wageEmp</i>	0.0170 [0.012]	0.0217* [0.012]	0.0148 [0.011]	0.0147 [0.012]	0.000245 [0.0075]	0.0178* [0.0100]	0.00267 [0.0044]	0.00943 [0.015]	0.0108 [0.014]
<i>labProd</i>	0.0332*** [0.0099]	0.0310*** [0.0099]			0.0231*** [0.0071]	0.0216** [0.0087]	0.0109** [0.0048]	0.0311** [0.013]	0.0323*** [0.011]
<i>inpInt</i>	0.00442 [0.0080]	0.00463 [0.0078]	0.00132 [0.0075]	0.00278 [0.0079]	-0.00233 [0.0052]	0.00739 [0.0072]	0.00205 [0.0033]	0.00465 [0.010]	0.00859 [0.0085]
<i>D_training</i> (d)	0.0219 [0.023]	0.0313 [0.022]	0.0241 [0.023]	0.0187 [0.023]	-0.0126 [0.014]	0.0355* [0.019]	-0.00395 [0.0088]	0.0265 [0.028]	0.0386 [0.026]
<i>totSales</i>			0.0403*** [0.0072]						
<i>tfp</i>				0.0394*** [0.010]					
<i>intangStockEmp</i>								0.0153* [0.0081]	
<i>intangFlowEmp</i>									0.0157** [0.0074]
Obs	1581	1639	1581	1580	1247	1555	940	1135	1229
<i>Pseudo - R²</i>	0.20	0.14	0.20	0.21	0.28	0.17	0.30	0.22	0.24
<i>Log - likelihood</i>	-730.0	-805.1	-730.5	-728.1	-382.1	-644.2	-194.0	-517.9	-540.2

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. In column (2) parent-location dummies are replaced by dummies for whether the parent is located in a high-income country (HI), or in a non-SSA low/middle-income country (LMI), or in a sub-Saharan African country (SSA). In column (3) total employment is replaced by total sales while dropping labour productivity to avoid multicollinearity. In column (4) labour productivity is replaced by total factor productivity. D_{ift} : firm has intra-firm imports or exports, or both (dummy), D_{ifex} : firm has intra-firm exports (dummy), D_{ifim} : firm has intra-firm imports (dummy), D_{ifimex} : firm has both intra-firm imports and exports (dummy). *skillInt*: skill intensity, *capInt*: capital intensity, *numEmp*: firm size (total number of employees), *numEmp*: firm size (total sales), *wageEmp*: wage per employee, *labProd*: labour productivity, *tfp*: total factor productivity, *inpInt*: input intensity, *D_training*: firm provides formal internal/external training to its employees (dummy), *intangStockEmp*: value of stock of intangible assets over total employment, *intangFlowSales*: value of flow of intangible assets over total employment. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

The most important results that we have obtained so far from the data and regression analyses are that foreign affiliates with intra-firm trade are relatively few, of larger size and higher productivity level. As mentioned above, the first two findings are in accord with those of Ramondo et al. (2011). The latter, based on Atalay et al. (2014), argue that the concentration of intra-firm trade among a small number of relatively large foreign affiliates indicates that firms set up affiliates mostly in order to transfer intangible assets, rather than physical goods. Indeed, as we have already discussed in this paper, knowledge transfer is subject to inefficiencies when is made through the market. These inefficiencies are mitigated within firm boundaries. As we show in Section 3.2, even if firm boundaries facilitate the transfer of intangibles, intra-firm trade may be associated with the intensity of this transfer.

In order to test this empirically, we augment the benchmark model with the ratios of the stock and flow of intangibles to total employment. Columns 8 and 9 display the results from the two regressions. The coefficient estimate in column 8 is positive and significant only at 10%, while that in column 9 is positive and significant at 5%. The results imply that foreign affiliates with intra-firm trade tend to have a higher stock and flow of intangibles. Put differently, although firm boundaries facilitate the transfer of intangibles, intra-firm trade makes this transfer more intense.

For robustness checks, we estimate all nine equations of Table 6 after restricting the sample to the manufacturing sector, for the whole sample while considering only majority-owned foreign affiliates (MOFAs) (i.e., those owned by their parent by at least 50%) and for MOFAs in the manufacturing sector. We also compute intangible asset intensities by normalising the stock and flow of intangibles with total sales, and re-estimate the probit regressions in columns 8 and 9. In order to account for the possibility that intra-firm trade of firms in the services sector is mostly in services which lie in the category of intangibles, we re-estimate the regressions in columns 8 and 9 after dropping the services sector from the sample.

In addition, in the benchmark case we construct the dummy for intra-firm trade by assuming that any missing observations of intra-firm imports and exports are due to the fact that the firm did not have any intra-firm flows and the respondent of the questionnaire left the relevant questions unanswered. However, it may also be the case that the respondent did not want to disclose such kind of information. We control for this possibility by dropping all missing observations of intra-firm flows. Then, we estimate the benchmark model for the whole economy, the manufacturing sector, for MOFAs in the whole economy and manufacturing, and for the whole sample save of the services sector. By and large, the regressions pass all these tests unscathed. To save on space, all these robustness checks are shown in the Online Appendix.

One concern with the use of the stock of intangibles is that it is computed cumulatively over time. Hence, it may be biased either upwards or downwards in a given year, depending on whether the net inflow of intangibles is positive or negative between the start year of the operations of the firm and the year examined (i.e., 2010). The flow of intangibles is not subject to such a potential bias. For this reason, we re-estimate the regression with the stock of intangibles while controlling for the age of the firm (i.e., the number of years since its set-up). The results are very similar to those in column 8.

In additional tables included in the Online Appendix, we estimate the benchmark model after replacing the average wage for all employees with the average wage by employee type. The average wage of each employee type enters separately in the regression. In total, we construct the average wage for production workers, manual workers, production and manual workers together, clerical and administrative employees, sales employees, clerical, administrative and sales employees together, production, manual, clerical, administrative and sales employees together, and for technical, supervisory and managerial employees. The results show that foreign affiliates with intra-firm trade tend to pay lower wages to manual workers.

We do the same exercise for the dummy for provision of training to employees. That is, we construct one dummy capturing internal training and another one capturing external training. We also construct dummies for provision of training to the aforementioned types of employees. We find that foreign affiliates with intra-firm trade are more likely to provide training to production workers and to technical, supervisory and managerial employees. Given that the aim of training is human capital development so that the quality gap, if any, between workers in the parent and their counterparts in the foreign affiliate narrows and eliminates, it can be viewed as transfer of intangibles. Indeed, workers in the foreign affiliate are trained in order to develop existing skills, acquire new ones and become familiar with business practices and technical methods of the parent company.

In robustness checks related to firm productivity and performance, we examine any differences regarding the most important reason for production capacity under-utilisation under normal circumstances. We find that the probability of foreign affiliates with intra-firm trade not having their production capacity under-utilised under normal circumstances is higher. Motivated by the literature on credit constraints and export performance (e.g. [Chor and Manova, 2012](#)) and the vulnerability of SSA to financial crises mostly through the disruption of the finance of trade channels ([Berman and Martin, 2010](#)), we also try to identify any differences in the change in their performance after the financial crisis of 2007-2008. We use two different measures. The first is based on the firm’s performance compared to overall expectations before the crisis and compared to *revised* expectations after the crisis. The second is the average level of capacity utilisation of the firm three years before the crisis and immediately after. There do not seem to be any statistically significant differences in terms of firm performance either before or after the global financial crisis.

Transfer pricing is a common practice of MNCs in order to evade taxation and therefore, part of the transfer of intangibles such as intellectual property to the foreign affiliate may be primarily for this purpose. Although our analysis is based on relative terms and we cannot find a plausible reason for which transfer pricing, aiming at tax evasion, should differ between foreign affiliates with and without intra-firm trade, we use numerous additional proxies for the transfer of intangibles from the parent to the foreign affiliate which deal with any concerns of this kind.

In [Table 7](#), we find that foreign affiliates with intra-firm trade tend to consider assistance from their parent in terms of use of patents, trademarks and brand names, technology and know-how transfer, access to foreign supplier network, and global market access as more important. The positive and highly significant coefficient estimate in the last column indicates that this is also true for the overall assistance received from the parent.

Table 7: Assistance from the parent company in several areas

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
D_{ijt}	<i>assPar1</i>	<i>assPar2</i>	<i>assPar3</i>	<i>assPar4</i>	<i>assPar5</i>	<i>assPar7</i>	<i>assParOv</i>
	0.0860***	0.0625*	-0.0391	0.0193	0.0612*	0.0816***	0.139***
	[0.030]	[0.035]	[0.028]	[0.034]	[0.033]	[0.029]	[0.036]
Obs	1357	1466	1462	1473	1465	1369	1538
Pseudo – R ²	0.21	0.21	0.21	0.21	0.22	0.21	
Log – likelihood	-644.5	-681.3	-667.6	-690.5	-679.5	-641.0	-708.3

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See [Table 6](#) for a description of variables capturing main firm characteristics. *assParUsePat* (*assPar1*): level of assistance provided by the parent in use of patents, trademarks, brand names, *assParTechTrans* (*assPar2*): level of assistance provided by the parent in technology and know-how, *assParUppQual* (*assPar3*): level of assistance provided by the parent in upgrading the quality of staff, *assParAccFin* (*assPar4*): level of assistance provided by the parent in access to finance, *assParForSuppNet* (*assPar5*): level of assistance provided by the parent in access to foreign supplier network, *assParGIMarketAcc* (*assPar6*): level of assistance provided by the parent in access to global markets, *assParOv*: overall assistance provided by the parent. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

The previous table provides strong evidence for a more intense transfer of intangibles and capabilities from the parent to the average foreign affiliate with intra-firm trade. These results can also be interpreted as a greater level of dependence on their parent. The results in the next two tables are in line with this finding.

Panel A of [Table 8](#) shows that foreign affiliates with intra-firm trade are less likely

to finance their working capital through internal funds and retained earnings (column 1) and through borrowing from banks in the host country (column 2), while more likely to have the parent company as a source of finance of working capital (column 8). Given that the coefficient estimates of the relevant dummies in the rest of the columns are not significant, we do not observe any differences between the two types of affiliates in other sources of finance of working capital. Panel B of Table 8 also shows that foreign affiliates with intra-firm trade, on condition that they finance working capital through their parent, tend to have a greater share of this source in the total. Instead, internal funds/retained earnings and the amount borrowed from domestic banks seem to account for lower shares in the total.

Table 8: Source of finance of working capital (extensive and intensive margin)

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{ift}	D_{WC1}	D_{WC2}	D_{WC3}	D_{WC4}	D_{WC5}	D_{WC6}	D_{WC7}	D_{WC8}
	-0.154***	-0.0397*	-0.0275	-0.0180	-0.0709	-0.00711	0.0939	0.478***
	[0.035]	[0.023]	[0.036]	[0.043]	[0.053]	[0.027]	[0.093]	[0.045]
Obs	1581	1581	1581	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.27
$Log - likelihood$	-718.4	-728.6	-729.8	-729.9	-729.2	-730.0	-729.5	-668.3
Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{ift}	$WC1$	$WC2$	$WC3$	$WC4$	$WC5$	$WC6$	$WC7$	$WC8$
	-0.190***	-0.117**	-0.104	-0.101	-0.302	0.0769	0.363	0.776***
	[0.042]	[0.057]	[0.11]	[0.14]	[0.23]	[0.077]	[0.23]	[0.070]
Obs	1562	1560	1558	1559	1558	1559	1558	1559
$Pseudo - R^2$	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.27
$Log - likelihood$	-711.4	-718.2	-718.4	-719.6	-717.3	-718.7	-717.4	-655.5

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. Panel A: $D_{WCIntFund}$ (D_{WC1}): internal funds/retained earnings (dummy), $D_{WCBorBankIns}$ (D_{WC2}): borrow from banks in the host country (dummy), $D_{WCBorBankOuts}$ (D_{WC3}): borrow from banks outside the host country (dummy), $D_{WCBorFam}$ (D_{WC4}): borrow from family/friends/individual lenders (dummy), $D_{WCBotNonBank}$ (D_{WC5}): borrow from non-bank financial institutions (e.g. equity funds) (dummy), $D_{WCPurchCredit}$ (D_{WC6}): through purchases on credit from suppliers and advances from customers (dummy), $D_{WCIssNewEq}$ (D_{WC7}): through new equity shares or new debt (including commercial paper and debentures) (dummy), $D_{WCParent}$ (D_{WC8}): through the parent company (dummy). Panel B: $WCIntFund$ ($WC1$): share of finance from internal funds/retained earnings, $WCBorBankIns$ ($WC2$): share of finance from borrowed funds from banks in the host country, $WCBorBankOuts$ ($WC3$): share of finance from borrowed funds from banks outside the host country, $WCBorFam$ ($WC4$): share of finance from borrowed funds from family/friends/individual lenders, $WCBotNonBank$ ($WC5$): share of finance from borrowed funds from non-bank financial institutions (e.g. equity funds), $WCPurchCredit$ ($WC6$): share of finance from funds raised through purchases on credit from suppliers and advances from customers, $WCIssNewEq$ ($WC7$): share of finance from funds raised through new equity shares or new debt (including commercial paper and debentures), $WCParent$ ($WC8$): share of finance from funds received from the parent company. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

For robustness checks, we examine any differences regarding sources of finance of fixed assets. The available sources of finance are identical to those of working capital. We find that foreign affiliates with intra-firm trade are less likely to finance their fixed assets through internal funds and retained earnings, as well as, through non-bank financial institutions (e.g. equity funds). On condition that they finance fixed assets through these two sources, their shares in the total tend to be lower. By contrast, the same type of firms are more likely to have the parent as a source of finance of fixed assets and this source tends to account for a greater share in the total. In additional robustness checks, we show that foreign affiliates with intra-firm trade are more likely to have their parent as the main source of information for (new) investment opportunities. See the Online Appendix for the tables with the two groups of robustness checks.

As regards the mode of acquisition of capital goods, Table 9 reveals that foreign affiliates with intra-firm trade are more likely to acquire capital goods from the parent (column 3), and less so to acquire these from distributors overseas and local ones

(columns 1 and 2, respectively).

Table 9: Mode of acquisition of capital goods

	(1)	(2)	(3)
D_{ift}	$D_{acqCapImp}$ -0.105*** [0.027]	$D_{acqCapLoc}$ -0.108*** [0.027]	$D_{acqCapPar}$ 0.499*** [0.055]
Obs	1581	1581	1581
$Pseudo - R^2$	0.21	0.21	0.26
$Log - likelihood$	-722.3	-725.0	-676.8

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $D_{acqCapImp}$: capital goods are imported directly by the firm (dummy), $D_{acqCapLoc}$: capital goods are acquired through local distributors (dummy), $D_{acqCapPar}$: capital goods are imported through the parent company (dummy). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

In Table 10 we study any differences in the span of control within the multinational firm. We find that foreign affiliates with intra-firm trade seem to have lower level of autonomy in making decisions over all business activities examined, except for the retail/wholesale format, which is applicable only to firms in the services sector. The lower level of overall autonomy is indicated by the negative and highly significant coefficient in the last column of this table. In effect, the curbed decision making power of the average foreign affiliate with intra-firm trade is translated into a larger span of control of top managers of the parent company over its managers. As we show in Section 3.3, this is because intra-firm trade is associated with greater knowledge intensity which in turn, can increase disproportionately the positional power of managers in the foreign affiliate. A wider span of control of top managers of the parent firm is an effective way for them to keep the balance between production efficiency and relatively small positional power of managers in the foreign affiliate.

Table 10: Decision-making power over several activities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
D_{ift}	$aut1$ -0.233*** [0.023]	$aut2$ -0.300*** [0.033]	$aut3$ -0.199*** [0.024]	$aut4$ -0.193*** [0.022]	$aut5$ -0.239*** [0.028]	$aut6$ -0.197*** [0.022]	$aut7$ -0.232*** [0.027]	$aut8$ -0.219*** [0.027]	$aut9$ -0.170*** [0.031]	$aut10$ -0.0483 [0.030]	$aut11$ -0.103*** [0.025]	$autOv$ -0.315*** [0.033]
Obs	1550	1325	1552	1555	1554	1534	1554	1552	1557	959	969	1558
$Pseudo - R^2$	0.26	0.25	0.24	0.25	0.25	0.25	0.25	0.24	0.22	0.23	0.25	0.26
$Log - likelihood$	-667.2	-582.3	-683.0	-677.2	-678.0	-669.8	-679.5	-683.5	-706.9	-323.5	-317.0	-670.8

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $autProdMod$ ($aut1$): decision making power over introduction/modification of products and services, $autIntroNewProd$ ($aut2$): decision making power over introduction of new production and processing systems (only for firms in non-services sectors), $autGenNewBus$ ($aut3$): decision making power over generating new business in the country, $autCapExp$ ($aut4$): decision making power over capital expenditure, including acquisitions, $autPricing$ ($aut5$): decision making power over pricing, $autEntNewExp$ ($aut6$): decision making power over entering new export markets, $autSuppSel$ ($aut7$): decision making power over supplier selection, $autMarkStrat$ ($aut8$): decision making power over marketing strategy, $autRecruit$ ($aut9$): decision making power over recruitment selection, $autRV$ ($aut10$): decision making power over retail/wholesale format (e.g. shop design) (only for firms in non-services sectors), $autIntroIT$ ($aut11$): decision making power over introduction of new IT system (e.g. inventory system) (only for firms in non-services sectors), $autOv$: overall autonomy level of the firm. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

In Table 11, the coefficient estimate in column 1 is positive and significant at 5%, while in the next four, the coefficient estimates are negative but insignificant at all conventional levels. We conclude that the probability a foreign affiliate with intra-firm trade is created by the parent as a wholly-owned firm through Greenfield FDI is higher. This is in line with our argument in Section 3.5.

Table 11: Mode of foreign investment

	(1)	(2)	(3)	(4)	(5)
D_{ift}	D_{GFDIWO}	D_{GFDIJV}	$D_{M\&ALocPr}$	$D_{M\&AForPr}$	$D_{M\&ASate}$
	0.0470**	-0.0143	-0.0425	-0.0533	-0.0543
	[0.023]	[0.031]	[0.039]	[0.037]	[0.057]
Obs	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.21	0.21	0.21	0.21	0.21
$Log - likelihood$	-728.0	-729.9	-729.6	-729.3	-729.6

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. D_{GFDIWO} : creation of a new operation as wholly-owned enterprise (dummy), D_{GFDIJV} : creation of a new operation as joint venture (dummy), $D_{M\&ALocPr}$: purchase of pre-existing assets from local private owners (dummy), $D_{M\&AForPr}$: purchase of pre-existing assets from private foreign owners (dummy), $D_{M\&ASate}$: purchase of pre-existing state-owned assets (dummy). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

In Table 12, we examine the extensive and intensive margins of sister affiliates in the same host country, in another sub-Saharan African country, or any other country outside sub-Saharan Africa. The positive and highly significant coefficient estimates in Panel A indicate that foreign affiliates which trade with their parent are more likely to have sister affiliates in the same country in which they are located, and in another country inside and outside sub-Saharan Africa. According to Panel B, on condition that there exist sister affiliates in the same host country or in any country inside and outside sub-Saharan Africa, the number of these tends to be greater for foreign affiliates with intra-firm trade. In short, foreign affiliates with intra-firm trade tend to have a relatively large and geographically dispersed network of sister affiliates.

Table 12: Extensive and intensive margin of sister affiliates

Panel A	(1)	(2)	(3)
D_{ift}	$D_{sisterInCountry}$	$D_{sisterInSSA}$	$D_{sisterOutSSA}$
	0.328***	0.282***	0.384***
	[0.074]	[0.061]	[0.041]
Obs	1581	1581	1581
$Pseudo - R^2$	0.22	0.22	0.26
$Log - likelihood$	-717.7	-716.2	-680.1
Panel B	(1)	(2)	(3)
D_{ift}	$N_{sisterInCountry}$	$N_{sisterInSSA}$	$N_{sisterOutSSA}$
	0.182***	0.0813***	0.0728***
	[0.047]	[0.025]	[0.013]
Obs	1581	1581	1581
$Pseudo - R^2$	0.21	0.21	0.23
$Log - likelihood$	-721.7	-723.1	-707.4

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $D_{sisterInCountry}$: sister affiliate(s) in the same country (dummy), $D_{sisterInSSA}$: sister affiliate(s) in another sub-Saharan African country (dummy), $D_{sisterOutSSA}$: sister affiliate(s) in another country outside sub-Saharan Africa (dummy), $N_{sisterInCountry}$: number of sister affiliates in the same country, $N_{sisterInSSA}$: number of sister affiliates in another sub-Saharan African country, $N_{sisterOutSSA}$: number of sister affiliates in another country outside sub-Saharan Africa. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

In Table 13, we study any potential differences between the two firm types with respect to the extensive margin of local and international procurement activities. The results indicate that affiliates with intra-firm trade are more likely to have backward

linkages (column 1 of Panel A) and in particular, international backward linkages (column 4 of Panel B), suppliers overseas and suppliers overseas with long-term arrangement (columns 7 and 8 of Panel B, respectively).¹⁹ However, they are less likely to engage in direct imports of production inputs (column 5 of Panel B). Although one would expect that their size and productivity advantage would lead to the opposite outcome, this is probably explained by their dependence on their parent for input sourcing and their relatively large and geographically dispersed network of sister affiliates. The coefficient estimate of indirect importing is positive but insignificant (column 6 of Panel B).

Interestingly, we fail to find any statistically significant differences between the two firm types in terms of domestic backward linkages (columns 2 and 3 of Panel A), domestic suppliers and domestic suppliers with long-term arrangement (columns 6 and 7 of Panel A), availability of departments for local sourcing (column 8 of Panel A) and for local supplier development (column 1 of Panel B).

Table 13: Local and international procurement (extensive margin)

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>D_{ifit}</i>	<i>D_{ibLink}</i>	<i>D_{dbLink}</i>	<i>D_{prodLoc}</i>	<i>D_{fAgeLEQ5}</i>	<i>D_{fAgeGT5}</i>	<i>D_{dSupp}</i>	<i>D_{dLTsupp}</i>	<i>D_{dptLS}</i>
	0.214***	0.0305	-0.0311	0.0762*	-0.0762*	-0.0326	0.0122	-0.0311
	[0.018]	[0.030]	[0.023]	[0.040]	[0.040]	[0.032]	[0.027]	[0.031]
Obs	1581	1581	1581	1581	1581	1581	1581	1581
<i>Pseudo – R²</i>	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21
<i>Log – likelihood</i>	-718.3	-729.5	-729.2	-728.1	-728.1	-729.5	-729.9	-729.5
Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>D_{ifit}</i>	<i>D_{dptLSD}</i>	<i>D_{favProcSuppRel}</i>	<i>D_{cancProcIntProp}</i>	<i>D_{ibLink}</i>	<i>D_{impDirect}</i>	<i>D_{impLoc}</i>	<i>D_{fSupp}</i>	<i>D_{fLTSupp}</i>
	-0.0399	-0.0636*	0.383***	0.200***	-0.189***	0.00410	0.130***	0.159***
	[0.034]	[0.036]	[0.14]	[0.021]	[0.032]	[0.025]	[0.029]	[0.028]
Obs	1581	1581	1581	1581	1581	1581	1581	1581
<i>Pseudo – R²</i>	0.21	0.21	0.21	0.22	0.23	0.21	0.22	0.22
<i>Log – likelihood</i>	-729.4	-728.8	-725.5	-713.1	-708.2	-730.0	-720.4	-711.8

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. Panel A: *D_{ibLink}*: the firm has backward linkages (dummy), *D_{dbLink}*: the firm has domestic backward linkages (dummy), *D_{prodLoc}*: the firm sources production inputs manufactured locally (dummy), *D_{fAgeLEQ5}*: less or equal to 5 years since setup of the firm, *D_{fAgeGT5}*: more than 5 years since setup of the firm, *D_{dSupp}*: the firm has domestic suppliers of raw materials, components or finished goods (dummy), *D_{dLTsupp}*: the firm has domestic suppliers of raw materials, components or finished goods with long-term arrangement (dummy), *D_{dptLS}*: availability of special department for local sourcing (dummy). Panel B: *D_{dptLSD}*: availability of special department for local supplier development (dummy), *D_{locProcSuppRel}*: closer supplier relationship (dummy), *D_{cancProcIntProp}*: concerns over retention of intellectual property (dummy), *D_{ibLink}*: the firm has international backward linkages (dummy), *D_{impDirect}*: the firm imports itself production inputs (dummy), *D_{impLoc}*: the firm sources production inputs through local importer (dummy), *D_{fSupp}*: the firm has suppliers of raw materials, components or finished goods overseas (dummy), *D_{fLTSupp}*: the firm has suppliers of raw materials, components or finished goods overseas with long-term arrangement (dummy). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

The coefficient estimates in columns 2 and 3 of Panel B imply that foreign affiliates with intra-firm trade are less likely to consider the development of relationship with a local supplier as the most important factor to enter local procurement and more likely to cancel or not enter local procurement due to concerns over retention of their intellectual property. These two findings may be explained by their greater knowledge intensity.

Regarding firm age, firms up to 5 years old are more likely to be those with intra-firm trade (column 4), while those of more than 5 years are more likely to be those without intra-firm trade (column 5). As already mentioned in Section 4, assuming that

¹⁹Although the term “long-term arrangement” implies a closer relationship between the foreign affiliate and its supplier, it is unknown to us if and how many among these suppliers are affiliated parties.

firm age can proxy for local and international procurement (i.e., the older a firm, the more integrated can become into local supply chains, as well as, into international ones as an alternative to sourcing from the parent company and/or sister affiliates), affiliates without intra-firm trade are more likely to source inputs from third parties, while affiliates with intra-firm trade are more likely to source inputs from their parent.^{20,21}

Table 14: Local and international procurement (intensive margin)

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
<i>D_{ift}</i>	<i>dbLink1</i>	<i>dbLink2</i>	<i>N_{dSupp}</i>	<i>N_{dLTSupp}</i>	<i>dptLSBud</i>	<i>dptLSDBud</i>
	-0.0128**	-0.198***	-0.0126	0.00347	0.00232	0.00387
	[0.0055]	[0.056]	[0.0088]	[0.012]	[0.0027]	[0.0036]
Obs	1581	1581	1581	1581	1581	1581
<i>Pseudo - R²</i>	0.21	0.21	0.21	0.21	0.21	0.21
<i>Log - likelihood</i>	-727.3	-724.0	-729.0	-730.0	-729.6	-729.5
Panel B	(1)	(2)	(3)	(4)	(5)	(6)
<i>D_{ift}</i>	<i>expAssLocSupp</i>	<i>ibLink</i>	<i>dirImp</i>	<i>indImp</i>	<i>N_{fSupp}</i>	<i>N_{fLTSupp}</i>
	0.00865***	0.418***	-0.439***	-0.205***	0.0195*	0.0422***
	[0.0031]	[0.052]	[0.040]	[0.074]	[0.011]	[0.013]
Obs	1581	1581	1581	1581	1581	1581
<i>Pseudo - R²</i>	0.21	0.24	0.28	0.21	0.21	0.21
<i>Log - likelihood</i>	-726.4	-695.3	-664.8	-726.5	-728.4	-724.7

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. Panel A: *dbLink1*: total value of contracted-out work in the host country, *dbLink2*: share of local inputs in aggregate production (i.e., domestic backward linkages), *N_{dSupp}*: number of domestic suppliers of raw materials, components or finished goods, *N_{dLTSupp}*: number of domestic suppliers with long-term arrangement, *dptLSBud*: the annual budget for local sourcing, *dptLSDBud*: annual budget for local supplier development, *expAssLocSupp*: annual expenditure on provision of assistance to local suppliers, *ibLink*: share of foreign inputs in aggregate production (i.e., international backward linkages), *dirImp*: share of directly-imported inputs in total production inputs, *indImp*: share of inputs imported indirectly (i.e., from a local importer) in total production inputs, *N_{fSupp}*: number of suppliers of raw materials, components or finished goods overseas, *N_{fLTSupp}*: number of suppliers overseas with long-term agreement. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Panel A of Table 14 shows that the share of locally-sourced inputs in total production inputs seems to be smaller for foreign affiliates with intra-firm trade (columns 1 and 2). We do not find any statistically significant differences in terms of the number of all domestic suppliers, of those with long-term arrangement, and of the annual budgets of departments for local sourcing and local supplier development (columns 3, 4, 5, and 6 of Panel A, respectively). By contrast, we find that foreign affiliates with intra-firm trade tend to have higher expenditures on provision of assistance to local suppliers (column 1 of Panel B). In addition, their share of foreign inputs in total production inputs, the number of all their suppliers overseas, as well as, those overseas with long-term arrangement, tend to be greater (columns 2, 5 and 6, respectively). Finally, the

²⁰The firm age may also capture the level of an affiliate's responsiveness to local and regional sales opportunities (i.e., the older a firm, the more integrated into the local economy, and the higher the level of responsiveness). Hence, affiliates without intra-firm trade tend to be more responsive to local sales opportunities. Similar findings with better proxies for the level of responsiveness of affiliates to local demand are reported in Table 15.

²¹In the Online Appendix, we look into any differences regarding the types of assistance provided to local suppliers and sub-contractors with whom they collaborate. In total, there are six different types of assistance: 1) efficiency upgrade of production process of supplier, 2) quality upgrade of supplier's products, 3) improved access of supplier to working capital, finance, and equity, 4) quality upgrade of supplier's workforce, 5) transfer of technology or know-how through designs or process know-how to supplier, and 6) conduct product design/production development/specification jointly with supplier. We do not find any statistically significant differences in this respect.

negative and highly significant coefficient estimates in columns 3 and 4 imply that the same type of firms have a greater share of directly- and indirectly-imported inputs in total production inputs.

Having identified the differences in the extensive and intensive margins of local and international procurement activities, we now examine any differences with respect to market orientation and the main source of competition for the main product or service. The coefficient estimates of the corresponding dummy variables in Table 15 indicate that firms with intra-firm trade are more likely to have direct and indirect export sales (columns 2 and 3), while less likely to have sales in the domestic market (column 1). They also tend to face competition for their main product mostly from imports (column 4) and less so from locally-owned firms (column 5). There do not seem to be any differences regarding competition from other foreign-owned firms domiciled in the host country.

Table 15: Market orientation and source of competition

	(1)	(2)	(3)	(4)	(5)	(6)
D_{ift}	$D_{salesDom}$ -0.173*** [0.030]	$D_{salesExpDir}$ 0.0560** [0.026]	$D_{salesExpInd}$ 0.261*** [0.063]	$D_{compImp}$ 0.0605** [0.029]	$D_{compLocFirms}$ -0.0702*** [0.022]	$D_{compForFirms}$ 0.0204 [0.024]
Obs	1581	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.23	0.21	0.22	0.21	0.21	0.21
$Log - likelihood$	-711.5	-727.6	-718.7	-727.6	-725.3	-729.7

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $D_{salesDom}$: sales in the domestic (host-country) market (dummy), $D_{salesExpDir}$: sales in an export market directly (dummy), $D_{salesExpInd}$: sales in an export market indirectly (dummy), $D_{compImp}$: competition for the main product comes mostly from imports (dummy), $D_{compLocFirms}$: competition for the main product comes mostly from locally-owned firms (dummy), $D_{compForFirms}$: competition for the main product comes mostly from other foreign-owned firms based in the country (dummy). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Table 16 shows that firms with intra-firm trade are less likely to be non-exporters (columns 1), while more likely to be continuing exporters and (column 4) and to engage simultaneously in import and export activities (column 5).

Table 16: Export and import-export status

	(1)	(2)	(3)	(4)	(5)
D_{ift}	$D_{noexporter}$ -0.151*** [-5.70]	$D_{expstarter}$ 0.0575 [1.11]	$D_{expexiter}$ -0.0929 [-0.83]	$D_{expcontinue}$ 0.138*** [5.00]	D_{impexp} 0.186*** [6.60]
Obs	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.22	0.21	0.21	0.22	0.23
$Log - likelihood$	-713.6	-729.3	-729.7	-716.9	-705.6

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $D_{noexporter}$: no export activities in any of the last two financial years (dummy), $D_{expstarter}$: no export activities two financial years ago but export activities during the previous financial year (dummy), $D_{expexiter}$: export activities two financial years ago but no export activities during the previous financial year (dummy), $D_{expcontinue}$: export activities two financial years ago and during the last financial year (dummy), D_{impexp} : import and export activities during the previous financial year (dummy). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Having examined the extensive margin of sales, we now turn to the intensive margin. Based on Table 17, we argue that foreign affiliates with intra-firm trade seem to have

greater shares of domestic, direct and indirect export sales in total sales (columns 1, 2 and 3, respectively). We find that the ratios of domestic, direct and indirect export sales to their respective means are greater for foreign affiliates with intra-firm trade (columns 4, 5 and 6, respectively). These findings suggest that the sales of foreign affiliates within each type of sales are more skewed. We also find that the Herfindahl and Theil indices of the distribution of domestic, direct and indirect export sales tend to be greater for the same type of firms. This suggests that sales in the domestic and export markets tend to be more evenly distributed for foreign affiliates with intra-firm trade.

Table 17: Domestic and export sales (intensive margin)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{ift}	$domSales$	$dirExpToSales$	$indExpToSales$	$domSalesToM$	$dirExpToM$	$indExpToM$	$salesHerf$	$salesTheil$
	0.205***	0.307***	0.522***	0.369***	0.553***	0.906***	0.312***	2.240***
	[0.047]	[0.058]	[0.17]	[0.087]	[0.11]	[0.31]	[0.043]	[0.40]
Obs	1581	1581	1581	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.22	0.22	0.21	0.21	0.22	0.21	0.23	0.22
$Log - likelihood$	-720.6	-716.1	-725.1	-721.2	-717.0	-725.4	-703.3	-714.8

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $domSales$: ratio of domestic sales to total sales, $dirExpToSales$: ratio of direct export sales to total sales, $indExpToSales$: ratio of indirect export sales to total sales, $domSalesToM$: ratio of share of domestic sales to its mean, $dirExpToM$: ratio of share of direct export sales to its mean, $indExpToM$: ratio of share of indirect export sales to its mean, $salesHerf$: Herfindahl index of distribution of domestic, direct and indirect export sales, $salesTheil$: Theil index of distribution of domestic, direct and indirect export sales. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Table 18: Exports with geographical breakdown (extensive and intensive margin)

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
D_{ift}	D_{expSA}	D_{expSSA}	D_{expEU}	D_{expUS}	$D_{expChina}$	$D_{expIndia}$	D_{expOA}	$D_{expMENA}$	$D_{expOther}$
	0.142**	0.0854***	0.0945**	0.0657	0.0377	0.186**	0.150**	0.119*	0.110**
	[0.058]	[0.031]	[0.045]	[0.053]	[0.067]	[0.074]	[0.070]	[0.067]	[0.055]
Obs	1581	1581	1581	1581	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
$Log - likelihood$	-726.4	-725.6	-727.4	-729.2	-729.9	-726.2	-727.4	-728.1	-727.6
Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
D_{ift}	$expSA$	$expSSA$	$expEU$	$expUS$	$expChina$	$expIndia$	$expOA$	$expMENA$	$expOther$
	0.432***	0.145***	0.265***	0.0594	0.157	0.343	0.921***	0.486**	0.0818
	[0.14]	[0.042]	[0.069]	[0.12]	[0.18]	[0.28]	[0.26]	[0.21]	[0.12]
Obs	1581	1581	1581	1581	1581	1581	1581	1581	1581
$Pseudo - R^2$	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
$Log - likelihood$	-724.4	-724.3	-722.8	-729.9	-729.6	-729.2	-723.7	-727.6	-729.8

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. Panel A: D_{expSA} : exporting to South Africa (dummy), D_{expSSA} : exporting to sub-Saharan Africa (dummy), D_{expEU} : exporting to the European Union (dummy), D_{expUS} : exporting to the United States of America (dummy), $D_{expChina}$: exporting to China (dummy), $D_{expIndia}$: exporting to India (dummy), D_{expOA} : exporting to Asia other than China and India (dummy), $D_{expMENA}$: exporting to Middle East and North Africa (dummy), $D_{expOther}$: exporting to the rest of the world (Other) (dummy). Panel B: $expSA$: export share to South Africa, $expSSA$: export share to sub-Saharan Africa, $expEU$: export share to the European Union, $expUS$: export share to the United States of America, $expChina$: export share to China, $expIndia$: export share to India, $expOA$: export share to Asia other than China and India, $expMENA$: export share to Middle East and North Africa, $expOther$: export share to the rest of the world (Other). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Studying the differences in terms of direct exporting in more depth, Panel A of Table 18 shows that firms with intra-firm trade are more likely to export to contiguous countries and regions such as sub-Saharan-Africa (SSA), South Africa (SA), Middle-East and North Africa (MENA) (columns 1, 2 and 8, respectively), as well as, to more distant ones such as the European Union (EU), India, Asia save of China and India (Other Asia), and the rest of the world (Other) (columns 3, 4, 6, 7, and 9, respectively). We fail to find any statistically significant differences in terms of exports to the US and China (columns 4 and 5, respectively).

As for the intensive margin of exports with geographical breakdown, the same type of firms seem to have greater shares of exports to South Africa, sub-Saharan Africa, EU, Asia other than China and India, and Middle-East and North Africa (columns 1, 2, 3, 7 and 8, respectively).

In sum, we find that foreign affiliates with intra-firm trade tend to have greater shares of domestic, direct and indirect export sales in total sales, as well as, greater direct export shares to most of the market destinations examined. While size and productivity premia (Melitz, 2003) and the extensive margin of a geographically-dispersed network of sister affiliates (i.e., availability of contacts in the terminology of Chaney (2014) can explain the extensive margin of direct and indirect exports, they are unable to explain our evidence for the intensive margin with and without the geographical breakdown.

To this purpose, we rely on the concept of Arkolakis (2010), according to which, a firm has to incur a (fixed) marketing cost each time it wants to reach an additional consumer in a given market (see also Section 3.7). We test this empirically by identifying any differences in terms of advertising expenditures. Table 19 shows that foreign affiliates with intra-firm trade are less likely to engage in advertising activities (column 1), which proxy for headquarter intensity, but on condition they do so, they tend to have higher advertising intensity (i.e., ratio of advertising expenditures to total sales) (column 3).

Table 19: Advertising (extensive and intensive margin)

	(1)	(2)	(3)
D_{ift}	D_{advert}	$advertExpToEmp$	$advertExpToSales$
	-0.0560**	0.00650	0.00777**
	[0.026]	[0.0058]	[0.0037]
Obs	1581	1581	1581
$Pseudo - R^2$	0.21	0.21	0.21
$Log - likelihood$	-727.6	-729.4	-727.8

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. D_{advert} : firm has expenditure on advertising (dummy), $advertExpToEmp$: ratio of expenditure on advertising to total employment, $advertExpToSales$: ratio of expenditure on advertising to total sales. Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Table ?? displays the skewness of export sales within each of the nine market destinations examined (columns 1 to 9), as well as, across these markets (columns 10 and 11). We find that foreign affiliates with intra-firm trade tend to have higher ratios of export shares to their mean in all destination markets except for the US, China, India and the rest of the world (columns 5, 6, 7 and 9). The positive and highly significant coefficient estimates of the Herfindahl and Theil indices in columns 10 and 11 imply that the same types of firms tend also to have a more equal distribution of their sales across the 9 market destinations. Put differently, the distribution of their sales across these markets is less skewed.

Table 20: Exports with geographical breakdown (skewness)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
D_{ijt}	$expToM_SA$	$expToM_SSA$	$expToM_EU$	$expToM_US$	$expToM_China$	$expToM_India$	$expToM_OA$	$expToM_MENA$	$expToM_Other$	$expHerf$	$expTheil$
	0.762***	0.269***	0.465***	0.0908	0.282	0.618	1.711***	0.886**	0.124	0.656***	4.778***
	[0.26]	[0.078]	[0.12]	[0.22]	[0.32]	[0.51]	[0.49]	[0.38]	[0.21]	[0.094]	[0.83]
Obs	1581	1581	1581	1581	1581	1581	1581	1581	1581	1581	1581
Pseudo - R ²	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.23	0.22
Log - likelihood	-724.7	-724.2	-723.1	-729.9	-729.6	-729.2	-723.6	-727.6	-729.8	-705.8	-713.9

Notes: Probit estimations with host-country, parent-location and industry dummies in all columns. Standard errors are clustered at the firm level. See Table 6 for a description of variables capturing main firm characteristics. $expToM_SA$: ratio of export share to South Africa to its mean, $expToM_SSA$: ratio of export share to sub-Saharan Africa to its mean, $expToM_EU$: ratio of export share to the EU to its mean, $expToM_US$: ratio of export share to the US to its mean, $expToM_China$: ratio of export share to China to its mean, $expToM_India$: ratio of export share to India to its mean, $expToM_OA$: ratio of export share to Asia other than China and India to its mean, $expToM_MENA$: ratio of export share to Middle East and North Africa to its mean, $expToM_Other$: ratio of export share to the rest of the world to its mean, $expHerf$: Herfindahl index of exports to nine destinations (SA, SSA, EU, US, China, India, OA, MENA, Other), $expTheil$: Theil index of exports to nine destinations (SA, SSA, EU, US, China, India, OA, MENA, Other). Dummies take value 1 if the statement holds, and 0 otherwise. (d): discrete change of dummy variable from 0 to 1. All variables are in logs except for dummies.

Finally, we test the robustness of all results included in this section and in the Online Appendix to alternative estimating models, such as the logistic and linear probability models. The vast majority of the results remain unaltered.

We summarise the main findings of the empirical analysis as follows. Foreign affiliates with intra-firm trade are relatively few, of larger size and higher productivity level. They also seem to have a greater inflow and stock of intangibles and capabilities, as well as, a relatively large and geographically dispersed network of sister affiliates. Their greater inflow and stock of intangibles is in accord with their greater tendency to receive assistance from their parent in several areas (e.g. use of patents, trademarks and brand names, technology and know-how transfer, global market access, etc.). This can also be interpreted as a greater level of dependence on their parent. We report extra evidence on the latter. Foreign affiliates with intra-firm trade are more likely to have their parent as a source of finance of working capital and as their main source of acquisition of capital goods. They also tend to have higher shares of working capital financed by their parent.

The more intense transfer of intangibles to foreign affiliates with intra-firm trade seems also to explain why they tend to have a lower level of autonomy in decision making over several activities (e.g. introduction/modification of new product, marketing strategy, supplier selection, new export market entry, etc.) and why they are more likely to be set up by their parent through Greenfield FDI. It seems also to explain why the same type of firms are less likely to enter local procurement in order to develop closer supplier relationships and more likely to cancel or not enter local procurement due to concerns over retention of their intellectual property.

As regards local and international procurement activities, we find that foreign affiliates with intra-firm trade are more likely to engage in backward linkages and in particular, in linkages through suppliers overseas. They are less likely, though, to import inputs directly themselves which may indicate their greater reliance on their parent and on their network of sister affiliates for input sourcing. As for the intensive margin of procurement activities, foreign affiliates with intra-firm tend to have lower shares of domestic inputs in aggregate production and of inputs imported directly and indirectly. Instead, they tend to have a higher share of foreign inputs in aggregate production, a greater number of suppliers overseas and higher expenditures on assisting their local suppliers to improve their operations. The last finding reveals that although foreign affiliates with intra-firm trade are more reluctant to initiate a collaboration with an unaffiliated supplier, as soon as they do, they tend to reserve more funds for the improvement of their operations.

The combination of their size and productivity premia and their geographically dispersed network of foreign affiliates seem to explain their higher probability of having direct and indirect sales in export markets, both contiguous and more distant ones, and their lower probability of having sales in the domestic market. Importantly, they also tend to have higher shares of domestic, direct and indirect export sales in aggregate sales, as well as, higher direct export shares in the majority of market destinations examined. The findings on the intensive margin of domestic and export sales seem to be explained by the greater amount spent by this type of firms on advertising.

Moreover, they seem to have a more even distribution between domestic, direct and indirect export sales, more skewed export sales within a market but less skewed export sales across markets. They are less likely to be non-exporters, while more likely to be continuing exporters and importers-exporters. Finally, they tend to face competition for their main product mostly from imports and less so from locally-owned firms.

The results that we have obtained allow us to better identify host-country effects of FDI based on differences in main firm characteristics and activities between foreign affiliates with and without intra-firm trade.

The main drawback of the literature on the host-country effects of FDI is that it tries to examine how host-country economies are impacted by the presence of MNCs without taking into account of different types of MNCs which result, as we show in this paper, in differences in terms of main firm characteristics and activities. In other words, the identification of host-country effects of FDI presupposes the identification of the differences in terms of main firm characteristics and activities between different types of foreign affiliates (e.g. with and without intra-firm trade). Such an analysis is particularly useful for policy makers in host countries who would like to know in advance the pros and cons from the presence of specific types of foreign-owned firms and target those foreign investors from whom the local economy will benefit the most. In addition, they can reform their economies in such a way so that they can attract investment from their targeted foreign investors.

The greater size of foreign affiliates with intra-firm trade implies that their presence in host countries can increase job opportunities by more. This can be also attributed to their higher extensive and intensive margins of sister affiliates in the same country. Although their greater intangible intensity and dependence on their parent for input sourcing decrease the likelihood of a collaboration between them and local suppliers, on condition that they do so, local suppliers can reap more benefits from productivity and knowledge spill-overs, given their productivity advantage and their higher expenditures on assisting local suppliers to improve their operations.

What is more, the greater dependence of foreign affiliates with intra-firm trade on their parent for finance of working capital and acquisition of capital goods implies that local banks and other lenders and local distributors of capital goods are less likely to benefit from their presence in the host country. However, the fact that foreign affiliates with intra-firm trade have higher extensive and intensive margins of exporting can make the host-country itself more export-oriented and more integrated into the regional and global economy.

The latter holds on condition that barriers to trade are limited or lifted. In tables that we relegate to the Online Appendix, we study any differential impact of export barriers within and outside Africa and of Regional Trade Agreements (RTAs) on the two

firm types. Foreign affiliates with intra-firm trade are more likely to consider general infrastructure problems, bureaucracy and regulation, and the high cost of production for export markets as the most important barriers to starting or expanding their export activities *within* Africa. They are also more likely to deem general infrastructure problems, tariff and non-tariff barriers, bureaucracy and regulation, and inadequate export support services as the most important barriers to starting or expanding their export activities *outside* Africa.

As regards the most important benefits from RTAs, the same firms are more likely to reap the benefits from an RTA in the form of access to finance on better terms, improved transport and communications infrastructure, improved access to raw materials and other inputs, and increased regional investment opportunities. The only dummy whose coefficient estimate is negative, albeit insignificant, is the one according to which the firm reaps no benefits from an RTA.

6 Concluding remarks

In this paper we study the differences in terms of main firm characteristics and activities between foreign affiliates with and without intra-firm trade located in 19 countries in sub-Saharan Africa in 2010.

Foreign affiliates with intra-firm trade are relatively few, of bigger size and higher productivity level. We report size and productivity premia of 31.5% and 25.4%, respectively. Further analysis reveals that foreign affiliates self-select into intra-firm and arm's length trade. On average, foreign affiliates with both intra-firm imports and exports seem to be the biggest and most productive firms, those with only intra-firm exports smaller and less productive, those with only intra-firm imports even smaller and less productive, while those with only arm's length trade are bigger and more productive only than those without intra-firm trade, which are the smallest and least productive firms.

As a complement to the argument of [Atalay et al. \(2014\)](#) that firm boundaries exist mainly for the transfer of intangibles rather than the transfer of physical goods, we find that foreign affiliates with intra-firm trade tend to have a greater intensity of inflow and stock of intangible assets. In other words, even if firm boundaries mainly exist for the transfer of intangibles, intra-firm trade tends to make this transfer more intense. This is in line with their greater tendency to receive assistance in several areas.

The last finding reveals a higher level of dependence on the parent. We report additional evidence for the latter. Foreign affiliates with intra-firm trade seem to have a higher extensive and intensive margins of finance of working capital through the parent firm and are also more likely to acquire capital goods from it.

Their lower level of autonomy in decision making and the higher probability these firms are set up by their parent through Greenfield FDI are in accord with the greater intensity with which they acquire intangibles. Their greater knowledge intensity seems also the main reason for the same type of firms to be less likely to enter local procurement in order to develop closer supplier relationships and more likely to cancel or do not enter local procurement due to concerns over retention of their intellectual property.

They also have higher extensive and intensive margins of international backward

linkages but lower intensive margins of direct and indirect imports. The combination of their size and productivity premia with their geographically dispersed network of sister affiliates can explain their higher extensive margin of direct and indirect exports, while their greater advertising intensity their higher intensive margin of direct exports.

Our main findings help us to identify more precisely the host-country effects of FDI because, in contrast to the existing literature, we allow for the distinction between different types of foreign affiliates and therefore, for different effects from their presence in the host-country.

Despite the novelty of all results set out above, some intriguing issues can be studied in more depth while others remain unexplored. Upon information on transactions between buyers and sellers by product, one could investigate further the differences between the two affiliate types regarding the extensive and intensive margins of domestic and international backward linkages and of direct and indirect export activities.

Other issues that need to be addressed require the time dimension. In this paper, we could only study potential correlations between intra-firm trade and main firm characteristics and activities. However, the issue of causality is essential and could make this analysis more complete. Exploiting the time dimension could allow one to answer additional intriguing questions. For instance, do foreign affiliates with and without intra-firm trade need an adjustment period after their set-up until they engage in arms' length import and export activities or in local procurement activities? Does the adjustment period between the two firm types differ? For firms with intra-firm trade, how does the level of dependence on their parent evolve over time? Does the span of control and management practices within the multinational firm change over time? Given that our analysis is based on cross-sectional data, we leave these topics for future work.

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Table 21: Description of variables

Variable	Description
D_{ift}	the firm has intra-firm trade (imports, exports, or both) (dummy)
D_{armt}	the firm has only arms' length trade (dummy)
$D_{ifimonly}$	the firm has only intra-firm imports (dummy)
$D_{ifexonly}$	the firm has only intra-firm exports (dummy)
D_{ifimez}	the firm has both intra-firm imports and exports (dummy)
$skillInt$	skill intensity
$capInt$	capital intensity
$numEmp$	total number of employees (firm size)
$wageEmp$	wage per employee
$labProd$	labour productivity
tfp	total factor productivity
$inpInt$	input intensity
$D_{training}$	the firm provides formal internal/external training to its employees (dummy)
$intangStocksEmp$	stock of intangible assets to total number of employees
$intangStockSales$	stock of intangible assets to total sales
$assParUsePat$	level of assistance provided by the parent in use of patents, trademarks, brand names
$assParTechTrans$	level of assistance provided by the parent in technology and know-how
$assParUpqQual$	level of assistance provided by the parent in upgrading the quality of staff
$assParAccFin$	level of assistance provided by the parent in access to finance
$assParForSuppNet$	level of assistance provided by the parent in access to foreign supplier network
$assParGIMarketAcc$	level of assistance provided by the parent in access to global markets
$assParOv$	overall assistance provided by the parent
$D_{WCIntFund}$	internal funds/retained earnings (dummy)
$D_{WCBorBankIns}$	borrow from banks in the host country (dummy)
$D_{WCBorBankOuts}$	borrow from banks outside the host country (dummy)
$D_{WCBorFam}$	borrow from family/friends/individual lenders (dummy)
$D_{WCBotNonBank}$	borrow from non-bank financial institutions (e.g. equity funds) (dummy)
$D_{WCPurchCredit}$	through purchases on credit from suppliers and advances from customers (dummy)
$D_{WCIssNewEq}$	through new equity shares or new debt (including commercial paper and debentures) (dummy)
$D_{WCParent}$	through the parent company (dummy)
$WCIntFund$	share of finance from internal funds/retained earnings
$WCBorBankIns$	share of finance from borrowed funds from banks in the host country
$WCBorBankOuts$	share of finance from borrowed funds from banks outside the host country
$WCBorFam$	share of finance from borrowed funds from family/friends/individual lenders
$WCBotNonBank$	share of finance from borrowed funds from non-bank financial institutions (e.g. equity funds)
$WCPurchCredit$	share of finance from funds raised through purchases on credit from suppliers and advances from customers
$WCIssNewEq$	share of finance from funds raised through new equity shares or new debt (including commercial paper and debentures)
$WCParent$	share of finance from funds received from the parent company
$D_{acqCapImp}$	capital goods are imported directly by the firm (dummy)
$D_{acqCapLoc}$	capital goods are acquired through local distributors (dummy)
$D_{acqCapPar}$	capital goods are imported through the parent company (dummy)
$autProdMod$	decision making power over introduction/modification of products and services
$autIntroNewProd$	decision making power over introduction of new production and processing systems (only for firms in non-services sectors)
$autGenNewBus$	decision making power over generating new business in the country
$autCapExp$	decision making power over capital expenditure, including acquisitions
$autPricing$	decision making power over pricing
$autEntNewExp$	decision making power over entering new export markets
$autSuppSel$	decision making power over supplier selection
$autMarkStrat$	decision making power over marketing strategy
$autRecruit$	decision making power over recruitment selection
$autRW$	decision making power over retail/wholesale format (e.g. shop design) (only for firms in non-services sectors)
$autIntroIT$	decision making power over introduction of new IT system (e.g. inventory system) (only for firms in non-services sectors)
$autOv$	overall autonomy level of the firm
D_{GFDIWO}	creation of a new operation as wholly-owned enterprise (dummy)
D_{GFDIJV}	creation of a new operation as joint venture (dummy)
$D_{M&ALocPr}$	purchase of pre-existing assets from local private owners (dummy)
$D_{M&AForPr}$	purchase of pre-existing assets from private foreign owners (dummy)
$D_{M&ASate}$	purchase of pre-existing state-owned assets (dummy)
$D_{sisterInCountry}$	sister affiliate(s) in the same country (dummy)
$D_{sisterInSSA}$	sister affiliate(s) in another sub-Saharan African country (dummy)
$D_{sisterOutSSA}$	sister affiliate(s) in another country outside sub-Saharan Africa (dummy)
$N_{sisterInCountry}$	number of sister affiliates in the same country
$N_{sisterInSSA}$	number of sister affiliates in another sub-Saharan African country
$N_{sisterOutSSA}$	number of sister affiliates in another country outside sub-Saharan Africa
D_{bLink}	the firm has backward linkages (dummy)
D_{dbLink}	the firm has domestic backward linkages (dummy)
$D_{prodLoc}$	the firm sources production inputs manufactured locally (dummy)
$D_{fAgeLEQ5}$	less or equal to 5 years since setup of the firm
$D_{fAgeGT5}$	more than 5 years since setup of the firm
D_{aSupp}	the firm has domestic suppliers of raw materials, components or finished goods (dummy)
$D_{aLTsupp}$	the firm has domestic suppliers of raw materials, components or finished goods with long-term arrangement (dummy)
D_{spLS}	availability of special department for local sourcing (dummy)
D_{spLSD}	availability of special department for local supplier development (dummy)
$D_{locProcSuppRel}$	most important factor in favour of local procurement: closer supplier relationship (dummy)
$D_{ancProcIntProp}$	most important factor against local procurement: concerns over retention of intellectual property (dummy)
D_{ibLink}	the firm has international backward linkages (dummy)
$D_{impDirect}$	the firm imports itself production inputs (dummy)
D_{impLoc}	the firm sources production inputs through local importer (dummy)
D_{fSupp}	the firm has suppliers of raw materials, components or finished goods overseas (dummy)
$D_{fLTSupp}$	the firm has suppliers of raw materials, components or finished goods overseas with long-term arrangement (dummy)

Description of variables (continue)

Variable	Description
<i>dbLink1</i>	total value of contracted-out work in the host country
<i>dbLink2</i>	share of local inputs in aggregate production (i.e., domestic backward linkages)
<i>N_{dSupp}</i>	number of domestic suppliers of raw materials, components or finished goods
<i>N_{LTSupp}</i>	number of domestic suppliers with long-term arrangement
<i>dptLSBud</i>	the annual budget for local sourcing
<i>dptLDBud</i>	annual budget for local supplier development
<i>expAssLocSupp</i>	annual expenditure on provision of assistance to local suppliers
<i>ibLink</i>	share of foreign inputs in aggregate production (i.e., international backward linkages)
<i>dirImp</i>	share of directly-imported inputs in total production inputs
<i>indImp</i>	share of inputs imported indirectly (i.e., from a local importer) in total production inputs
<i>N_{fSupp}</i>	number of suppliers of raw materials, components or finished goods overseas
<i>N_{LTSupp}</i>	number of suppliers overseas with long-term agreement
<i>D_{salesDom}</i>	sales in the domestic (host-country) market (dummy)
<i>D_{salesExpDir}</i>	sales in an export market directly (dummy)
<i>D_{salesExpInd}</i>	sales in an export market indirectly (dummy)
<i>D_{compImp}</i>	competition for the main product comes mostly from imports (dummy)
<i>D_{compLocFirms}</i>	competition for the main product comes mostly from locally-owned firms (dummy)
<i>D_{compForFirms}</i>	competition for the main product comes mostly from other foreign-owned firms based in the country (dummy)
<i>D_{noExporter}</i>	no export activities in any of the last two financial years (dummy)
<i>D_{expStarter}</i>	no export activities two financial years ago but export activities during the previous financial year (dummy)
<i>D_{expExiter}</i>	export activities two financial years ago but no export activities during the previous financial year (dummy)
<i>D_{expContinue}</i>	export activities two financial years ago and during the last financial year (dummy)
<i>D_{impExp}</i>	import and export activities during the previous financial year (dummy)
<i>domSales</i>	ratio of domestic sales to total sales
<i>dirExpToSales</i>	ratio of direct export sales to total sales
<i>indExpToSales</i>	ratio of indirect export sales to total sales
<i>domSalesToM</i>	ratio of share of domestic sales to its mean
<i>dirExpToM</i>	ratio of share of direct export sales to its mean
<i>indExpToM</i>	ratio of share of indirect export sales to its mean
<i>salesHerf</i>	Herfindahl index of distribution of domestic, direct and indirect export sales
<i>salesTheil</i>	Theil index of distribution of domestic, direct and indirect export sales
<i>D_{expSA}</i>	exporting to South Africa (dummy)
<i>D_{expSSA}</i>	exporting to sub-Saharan Africa (dummy)
<i>D_{expEU}</i>	exporting to the European Union (dummy)
<i>D_{expUS}</i>	exporting to the United States of America (dummy)
<i>D_{expChina}</i>	exporting to China (dummy)
<i>D_{expIndia}</i>	exporting to India (dummy)
<i>D_{expOA}</i>	exporting to Asia other than China and India (dummy)
<i>D_{expMENA}</i>	exporting to Middle East and North Africa (dummy)
<i>D_{expOther}</i>	exporting to the rest of the world (Other) (dummy)
<i>expSA</i>	export share to South Africa
<i>expSSA</i>	export share to sub-Saharan Africa
<i>expEU</i>	export share to the European Union
<i>expUS</i>	export share to the United States of America
<i>expChina</i>	export share to China
<i>expIndia</i>	export share to India
<i>expOA</i>	export share to Asia other than China and India
<i>expMENA</i>	export share to Middle East and North Africa
<i>expOther</i>	export share to the rest of the world (Other)
<i>D_{advert}</i>	firm has expenditure on advertising (dummy)
<i>advertExpToEmp</i>	ratio of expenditure on advertising to total employment
<i>advertExpToSales</i>	ratio of expenditure on advertising to total sales
<i>expToM_SA</i>	ratio of export share to South Africa to its mean
<i>expToM_SSA</i>	ratio of export share to sub-Saharan Africa to its mean
<i>expToM_EU</i>	ratio of export share to the EU to its mean
<i>expToM_US</i>	ratio of export share to the US to its mean
<i>expToM_China</i>	ratio of export share to China to its mean
<i>expToM_India</i>	ratio of export share to India to its mean
<i>expToM_OA</i>	ratio of export share to Asia other than China and India to its mean
<i>expToM_MENA</i>	ratio of export share to Middle East and North Africa to its mean
<i>expToM_Other</i>	ratio of export share to the rest of the world to its mean
<i>expHerf</i>	Herfindahl index of exports to nine destinations (SA, SSA, EU, US, China, India, OA, MENA, Other)
<i>expTheil</i>	Theil index of exports to nine destinations (SA, SSA, EU, US, China, India, OA, MENA, Other)

Notes: Authors' notation. Each dummy takes value 1 if the statement holds, and 0 otherwise. All non-dummy variables are in logs.