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# The Heterogeneity of FDI in Sub-Saharan Africa: How Do the Horizontal Productivity Effects of Emerging Investors Differ from Those of Traditional Players?

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# The Heterogeneity of FDI in Sub-Saharan Africa – How Do the Horizontal Productivity Effects of Emerging Investors Differ from Those of Traditional Players?

**Abstract**

This paper analyzes the horizontal productivity effects of foreign direct investment (FDI) from industrialized and developing countries in 10 sub-Saharan African countries. We establish a unique data set by combining data from the World Bank Enterprise Surveys that allow us to distinguish between foreign investors from sub-Saharan Africa, Asia, Europe, the Middle East, and North Africa. We find strong evidence of horizontal productivity spillovers to domestic firms derived from foreign-firm presence. However, these effects are clearly dependent on domestic firms' absorptive capacity. The largest productivity effects seem to be driven by investors from sub-Saharan Africa. Our analysis also shows that productivity effects differ according to the income level of host countries. Overall, the strongest productivity effects seem to materialize in lower-middle-income countries. These key findings emphasize the increasing importance of emerging investors, beyond the traditional players from industrialized countries, in sub-Saharan Africa.

Keywords: foreign direct investment, productivity, South–South firms, spillovers, sub-Saharan Africa

JEL codes: F23

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# The Heterogeneity of FDI in Sub-Saharan Africa – How Do the Horizontal Productivity Effects of Emerging Investors Differ from Those of Traditional Players?

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**Article Outline**



## 1 Introduction

It is generally accepted by policymakers that outward foreign direct investment (FDI) can contribute to economic development in host countries via knowledge spillovers to the domestic economy. Given that multinational corporations (MNCs) possess technological or managerial advantages, they can generate positive externalities through the diffusion of knowledge to domestic firms. This knowledge transfer can occur horizontally, if firms in the

same sector benefit from the presence of multinationals, or vertically, if upstream or downstream domestic sectors gain from the presence of foreign investors. Yet, whereas the FDI literature has reached a certain level of agreement that vertical relationships with local suppliers generate positive productivity spillovers, the evidence on horizontal spillovers is still mixed and inconclusive, and estimates differ in terms of statistical significance and magnitude (Havranek and Irsova 2013).[1] These inconsistencies derive largely from differences in the measurement of foreign presence and the type of data used – cross-sectional versus panel – across studies (Görg and Strobl 2001). Further, there are determining factors at the firm and country level that enhance the realization of spillovers and need to be taken into account. Görg and Greenaway (2004) show that studies accounting for the heterogeneity of domestic firms, and especially their absorptive capacity, tend to report positive results.

Some consensus has now been reached among researchers that domestic firms' absorptive capacity is a crucial precondition for these firms' ability to capture gains from FDI. Importantly, absorptive capacity depends not only on domestic-firm capabilities but also on the appropriateness of the foreign knowledge in terms of complexity as well as product and process similarity. In this regard, for local firms to be able to benefit from the presence of MNCs, a certain knowledge base is needed. Moreover, technological differences with respect to foreign firms need to be relatively small. As empirical studies have consistently found, overly large technological gaps hinder the materialization of positive horizontal spillovers.[2] Therefore, and as concluded by Havranek and Irsova (2013), the nationality of foreign investors matters for spillovers as the technology endowments of firms differ across source countries. This suggests that the effects of South–South FDI flows – that is, FDI flows originating from and going to developing countries – may be different from those of North–South FDI flows, which are FDI flows from industrialized to developing countries.

In the last decade, FDI from developing countries has increased dramatically. In 2012, emerging multinationals represented 31 percent of global FDI outflows. Most outward FDI from developing countries flows to developing countries. Specifically, FDI inflows to sub-Saharan African countries are on the rise and becoming more widespread in the manufactur-

1 See Javorcik (2004), Görg and Greenaway (2004) and Havranek and Irsova (2011) for comprehensive literature reviews on FDI spillovers. For the case of sub-Saharan Africa, the results are similarly mixed. Managi and Bwalya (2010) analyzed regional, intra- and inter-industry spillovers in Kenya, Tanzania and Zimbabwe between 1993 and 1995, and Bwalya (2006) did the same for Zambia. They found evidence of positive horizontal spillovers in Kenya and Zimbabwe, but not in Tanzania and Zambia. The authors interpret the insignificant results for Tanzania and Zambia at the horizontal level as deriving from the discriminatory provision of fiscal incentives, which are awarded to foreign firms but not to local firms. This discriminatory practice thus translates into an enhanced hegemony of foreign firms over potentially competitive local firms that do not receive the incentives.

2 Kinoshita (2001), Konings (2001), Sinani and Meyer (2002), Narula and Marin (2003), Chundnovsky et al. (2003), Blalock and Gertler (2005), Ben Hamida and Gugler (2009), and Farole and Winkler (2014), inter alia, provide evidence of the key role of absorptive capacity.

ing sector (UNCTAD 2013). Moreover, knowledge transfers from FDI are considered to be crucial to the process of structural change and industrialization in sub-Saharan Africa; however, the region still faces significant challenges regarding the development of domestic-firm capabilities and the overall business climate (Farole and Winkler 2014).

Since South–South and North–South FDI differ in terms of motivation and technological content, it seems reasonable to expect that they entail different potentials for horizontal spillovers. Accordingly, we argue that southern FDI flows may be a particularly relevant source of capital, technology, and management skills for the sub-Saharan African region, as the technologies and business models of foreign firms from developing countries may be better adapted to local markets and better fit domestic-firm needs than those from more industrialized countries. Therefore, given the smaller technology gap, technology absorption and other beneficial linkages in sub-Saharan African countries are expected to be greater in the case of South–South investments (UNCTAD 2006).

We compile a unique panel data set of manufacturing firms in 10 sub-Saharan African countries, taken from the World Bank Enterprise Surveys, and we analyze how horizontal productivity spillovers to domestic firms from South–South FDI compare with those from North–South FDI.[3] Also, thanks to the richness of the data set, we are able to provide detail on the specific productivity effects according to investors' region of origin and to account for a number of domestic firm characteristics. Our findings, which are consistent with the literature, suggest that firms in sub-Saharan Africa generally benefit from the presence of foreign firms in terms of horizontal productivity spillovers if they have sufficient absorptive capacity. Additionally, we find a slight advantage for regional South–South FDI in the magnitude of the spillovers.

The contribution of the study to the literature is threefold: First, we shed light on the host-country horizontal effects of heterogeneous FDI – an area where the empirical evidence is still inconclusive and presents mixed results, particularly regarding developing countries. Second, we are able to provide evidence of FDI effects in sub-Saharan Africa, a least developed region where FDI is expected to be a crucial catalyst for structural change and industrialization. Previous empirical work on this question has been limited due to firm-level data-availability constraints. Third, we contribute to the still-scarce literature on the effects of South–South FDI by accounting for the role of investors' origin.

The rest of the paper is organized as follows: In Section 2 we present our analysis and relate it to the extant literature. Section 3 describes the data and the methodology. Section 4 describes the estimation results, and Section 5 concludes.

3 While the manufacturing sector is still small on average in sub-Saharan Africa (IMF 2012), our focus on manufacturing firms is a response to the sector's potential to generate FDI-related spillovers, as pointed out by Nunnenkamp and Spatz (2003).

## 2 Horizontal Spillovers from FDI: Channels and Determinants

Of the numerous ways that foreign firms can impact the productivity of their domestic counterparts, the empirical literature has identified three major channels for the realization of horizontal spillovers: demonstration or imitation effects, competition effects, and labor turnover effects.[4] The relationships between these channels are complex, and the extent of positive externalities to domestic firms is a result of the interaction and overlapping of several mechanisms.

Demonstration effects from MNCs are perhaps the most direct channel driving domestic productivity gains. Domestic firms that are exposed to the technology of foreign competitors can imitate and learn from the more advanced foreign technology and adapt it to their production processes. Additionally, domestic firms can learn from more efficient managerial or organizational techniques. The exposure of domestic firms to foreign knowledge in the same sector occurs, for instance, at trade fairs or through advertising or patents. Reverse engineering practices are a good example of learning from new, externally generated technologies. However, foreign investors have significant incentives to avoid any leakage of knowledge to their domestic competitors in order to protect their specific technological advantage. Indeed, as Farole and Winkler (2014) have shown, the spillover scope from demonstration is rather limited in sub-Saharan African countries given the negligible collaboration between domestic and foreign firms in the same sector. Hence, how much domestic firms benefit from demonstration effects depends on how effective MNCs are at protecting their knowledge, the degree of product sophistication, and the ability of domestic firms to incorporate the potential knowledge into their production and management processes.

Competition effects derived from the presence of MNCs can be positive or negative. On the one hand, competition from MNCs can have a negative effect and crowd out domestic firms. If foreign investors are able to offer higher-quality or lower-price goods, shifting demand away from domestic products, firms will have to produce at a lower, less efficient capacity level and move up in their average cost curves. In this case, competition translates into domestic productivity losses as it has a crowding-out or market-stealing effect (Harrison 1994; Aitken and Harrison 1999). On the other hand, competition from foreign investors holds potential for positive externalities if domestic firms are able to upgrade and to compete. Competition puts pressure on domestic firms to use existent technology more efficiently or to more quickly learn and adapt new production techniques (Glass and Saggi 2002, Blomström and Kokko 1997, Wang and Blomström 1992). Kosova (2010) finds that the negative effect of crowding out has an impact only in the short term and that the positive effects of competition arise with the time. The net effect of competition will then depend on the degree

4 An additional channel that has received relatively less attention in the literature is the learning-to-export channel, according to which domestic firms might capture MNCs' knowledge about foreign markets and upgrade their capabilities in order to exploit new business opportunities (Görg and Greenaway 2004, Crespo and Fontoura 2007).

to which domestic firms are able to compete with MNCs and how effective the foreign investor is at consolidating its market share.

Additionally, a number of firm- and country-level determinants and mediating factors shape the potential that horizontal spillovers will arise through these mechanisms. The empirical literature appears to agree that the fundamental determinant for the realization of horizontal spillovers is the absorptive capacity of domestic firms.[5] Narula and Marin (2003) define absorptive capacity as firms' "ability to internalize knowledge created by others and modifying it to fit their own specific application, processes and routines." A similar definition by Ben Hamida and Gugler (2009) describes it as the "firm's ability to recognize valuable new knowledge, integrate it into the firm and use it productively." Accordingly, absorptive capacity depends not only on domestic-firm capabilities but also on the appropriateness of the foreign knowledge in terms of complexity and product and process similarity. Therefore, absorptive capacity is determined by technology or productivity gaps between domestic and foreign investors.[6]

In this regard, empirical research has found – with few exceptions[7] – that overly large technology gaps between foreign and domestic firms deter positive spillovers to domestic firms (see, for example, Girma 2005, Blalock and Gertler 2009, Havranek and Irsova 2011, Farole and Winkler 2014). However, as Kokko (1994) points out, a moderate technology gap might be needed to allow for spillovers. The arguments behind the negative impact of large technological differences on spillover realization are described well in early works by Glass and Saggi (1998) and Kokko et al. (1996). Large technology gaps imply that domestic firms might lack the necessary human capital and technological capabilities to access and benefit from foreign knowledge. According to these arguments, technological differences do matter for spillovers and thus the MNCs' origin – that is, whether it is from a developed or a developing country – influences the potential for knowledge absorption. This statement directly connects with the literature on South–South FDI determinants and effects.

5 As Görg and Greenaway (2004) have found, positive horizontal spillovers tend to be identified by studies that account for the heterogeneity of domestic firms in terms of absorptive capacity. Kinoshita (2001), Konings (2001), Sinani and Meyer (2002), Narula and Marin (2003), Chundnovsky et al. (2003), Blalock and Gertler (2005), Ben Hamida and Gugler (2009), and Farole and Winkler (2014), inter alia, provide evidence of the key role of absorptive capacity.

6 Other domestic-firm characteristics such as export capacity, R&D capabilities, or firm size are directly related to a firm´s productivity and therefore captured by the productivity gap. Additional factors that affect the magnitude of spillovers include foreign-investor characteristics such as the degree of ownership or the motives for investing in the country. Also, host-country characteristics such as property-rights protection, financial development, and overall business climate affect the materialization of spillovers. See surveys by Crespo and Fontoura (2007), Havranek and Irsova (2011), or Farole and Winkler (2014) for a detailed description of spillover determinants.

7 Findlay (1978) and Wang and Blomström (1992) find evidence that a larger technology gap increases the scope for horizontal spillovers.

Traditional theories of FDI in line with Dunning's (1980) eclectic theory do a good job of explaining the competitive advantages of developed-country multinationals and their motives for investing in developing countries. However, the advantages and motivations of developing-country multinationals differ from those of the traditional players. Southern MNCs may not be characterized by state-of-the-art technology, but they may exploit advantages stemming from a similar level of economic development; similar business conditions; or their locally adapted business models, skills, and technologies (Aykut and Goldstein 2006, Cuervo-Cazurra 2008). They may more easily overcome problems such as the absence of specialized intermediaries or weak mechanisms for contract enforcement because of their familiarity with such conditions in their home country (Khanna and Palepu 2006). Developing-country FDI may then be a particularly relevant source of capital, technology, and management skills for the sub-Saharan region, as the technologies and business models of foreign firms from developing countries may be better adapted to local markets and better fit domestic firms' needs than those from better-developed countries. Therefore, technology absorption and other beneficial linkages in sub-Saharan African countries are expected to be greater in the case of South–South investments (UNCTAD 2006). Southern multinationals often apply technologies that are better adapted to developing-country markets, thereby adopting an intermediary function in international technology transfer. As explained above, a smaller technological gap between domestic and multinational firms translates into the relatively higher absorptive capacity of domestic firms and therefore facilitates the transfer, absorption, and diffusion of knowledge (UNCTAD 2006, FIAS 2006).

Indeed, the notion of the appropriateness of technology and its relevance for technology transfer and development was already advanced in early FDI studies. Lapan and Bardhan (1973) pointed out that "technical advances that are applicable to the factor-proportions of capital-rich developed countries are hardly of any use in improving techniques of low-capital intensity in less developed countries." Consistently, Kokko (1994) found, in the case of Mexico, that spillovers were more likely to materialize in industries with a greater concentration of low-capital-intensive MNCs.

The appropriateness of technology affects horizontal spillovers through the three main channels described above. First, for spillovers to occur through demonstration effects, domestic firms should be able to imitate and to adapt the acquired knowledge to their own processes and routines. Knowledge imitation and adaptation will be facilitated if the knowledge fits the firm's needs and if there are similarities between domestic and foreign firms, not only regarding technological capabilities but also in terms of the market segment targeted, plant size, capacity utilization, or external factors such as climate or institutional backgrounds. Also, similarities in managerial and organizational techniques that are more appropriate for dealing with developing-market particularities or bureaucracy may facilitate demonstration effects (Narula and Marin 2003, Gelb 2005). Second, the competition channel is more likely to bring positive results when the technology gap with foreign investors is rela-

tively small. Local firms will be able to upgrade to compete with foreign firms on an equal footing only if the technological distance is not too great. If the technological advantage of the MNCs is too large, domestic firms might not be able to manage the upgrading process and will have to exit the market. Finally, spillovers through labor market turnover are also more likely to occur when the knowledge and skills acquired by working in an MNC are more adapted to local market conditions and the technology available in the country.

Firm-level literature on the effects of South–South FDI is quite novel and evidence is still scarce – especially with regard to sub-Saharan Africa – but the research topic has become more important in recent years. For example, the Africa Investor Report (UNIDO 2011) describes, using data from the 2010 Africa Investor Survey,8 the main facts and trends related to FDI externalities in a cross-section of 19 sub-Saharan African countries. In short, the report finds evidence that negative horizontal productivity spillovers from FDI are mostly associated with the presence of firms from industrialized countries. The authors identify positive correlations between domestic productivity and the presence of Southern investors, mainly within low-tech industries. Although the study provides an overall look at FDI trends and effects in sub-Saharan Africa, its cross-sectional and general approach does not allow it to go into depth regarding the determinants and sources of horizontal externalities.

A number of papers study productivity spillovers for the case of China, distinguishing between FDI flows from the Hong Kong, Macau, and Taiwan group (HMT) and from OECD economies. Abraham, Konings, and Slootmaekers (2010) point out that HMT investment differs from that from OECD countries in terms of the technological component and the fact that HMT firms tend to locate in more-labor-intensive industries with less advanced technology. Given that there exist important cultural and linguistic similarities between continental China and the HMT group, FDI from these countries could facilitate the diffusion of technology to local industries. Nevertheless, the results from this literature stream are mixed. On the one hand, Du, Harrison, and Jefferson (2010) and Lin et al. (2009) find that given its export-driven nature, HMT investment hurts or has no impact on the companies' domestic counterparts, whereas OECD MNCs, on the other hand, have positive productivity effects. However, Abraham, Konings, and Slootmaekers (2010) report positive spillover effects associated with the presence of both groups of foreign investors, with the magnitude of the effect greater for HMT investment. From a regional perspective, Huang (2004) finds that HMT firms have positive spillover effects in less-technologically-advanced regions, while invest-

8 Using the same data, two studies with a focus on vertical relationships between foreign investors and local suppliers account for MNCs' origin effects: Amendolagine et al. (2010) look at determinants of domestic linkages on the part of MNCs and find that diaspora investments tend to generate more linkages whereas investors from other African countries and China tend to source less locally. Perez-Villar and Seric (2014) find that institutional distance in terms of contract enforcement deters local sourcing by foreign investors; this suggests that institutional and cultural similarities play a significant role in South–South supply-chain relationships.

ments from other foreign enterprises improve productivity in regions with a low technology gap.

Additional evidence that South–South investments enhance spillovers is provided by Takii (2011) for Indonesia, where foreign investors from East Asian economies make a greater contribution to productivity than Japanese firms do. Gorodnichenko et al. (2007) find that horizontal spillovers in 17 emerging economies are greater for non-OECD than OECD investors. Finally, Monastiriotis and Alegria (2011) find positive spillovers derived from Greek FDI for the case of Bulgaria; these spillovers are significantly larger than those from other European countries' FDI, especially in less dynamic and more-labor-intensive sectors.

To summarize, the literature on horizontal productivity spillovers derived from South–South FDI has generally found, except for the mixed results in studies about China and HMT economies, that South–South investment generates positive spillovers, and that these are more likely in labor-intensive and less-technology-intensive sectors. Our analysis builds on the hypothesis that the origin of the investor may play a particularly relevant role in the realization of horizontal spillovers in sub-Saharan Africa – a least developed region where technological gaps are significant and where, as Farole and Winkler (2014) point out, the lack of absorptive capacity hinders potential benefits from FDI. Despite their importance, the horizontal effects of South–South FDI in sub-Saharan Africa have not been addressed by the literature.[9] We aim to fill this gap and contribute to a better understanding of FDI dynamics in the sub-Saharan African region by simultaneously considering both investor origin and domestic firms' absorptive capacity.

## 3 Data and Stylized Facts

In order to analyze firm characteristics and the effects of foreign firms on the productivity of domestic firms in sub-Saharan Africa, we use data from the World Bank Enterprise Survey (WBES), provided in late 2012. Our analysis includes firm-level data from 10 sub-Saharan African countries: Angola, Burkina Faso, Botswana, Cameroon, Democratic Republic of Congo (DRC), Madagascar, Mali, Senegal, South Africa, and Zambia. These countries are characterized by different levels of economic development: four are low-income countries, four are lower-middle-income countries, and two are upper-middle-income countries.[10] This sample is the result of our attempt to use panel data from two survey waves in each country, as well as surveys that include questions about the origin of firms. As most of the WBES questionnaires are comparable across countries and years, a matching of the firm-level data is possible. The two survey waves have been accomplished in different years across countries (see Appendix A). To facilitate the analysis, we have standardized the two different years in which

9 Except for the descriptive analysis by the Africa Investor Report (UNIDO 2011) mentioned above.

10 See Table A1a in the appendix for the respective income level of each country.

the surveys were carried out in each country, making them into a first and a second survey year. We have established a cross-sectional data set and a panel data set. While the cross-sectional data set may be more representative, the panel data set allows for the analysis of firm performance over time and accounts for problems associated with unobserved firm-specific productivity differences. Our descriptive analysis in the following sections is based on the cross-sectional data set.

Our cross-sectional sample includes approximately 4,300 small, medium-sized and large firms from the manufacturing sectors presented in the first row of Table 1. To obtain a reasonable sample size for sector-specific estimations, we aggregate certain related sectors such as textiles and garments (see also, e.g., Mühlen 2013). Table 2 shows that the sample size is very different across countries; for example, the number of firms interviewed is relatively high in South Africa, while it is much smaller in Burkina Faso. This reflects the different size of the countries, as well as the varying levels of economic development and economic activity. Quite a large number of firms are active in "other manufacturing" as they cannot be assigned to a particular sector because of limited information in the survey. While the food, textiles, and garments sectors are relatively large, the nonmetallic mineral products and basic metal sectors are very small.

**Table 1: Average Number of Firms in the Cross-Sectional Data Set, by Country and Sector**

| | Other Manufacturing | Food | Textiles and Garments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery | Total |
|---|---|---|---|---|---|---|---|
| Angola | 74 | 51 | 14 | 3 | 7 | 31 | 178 |
| Botswana | 39 | 10 | 25 | 10 | 6 | 12 | 101 |
| Burkina Faso | 21 | 17 | 6 | 9 | 8 | 12 | 72 |
| Cameroon | 41 | 31 | 12 | 13 | 5 | 12 | 113 |
| DRC | 59 | 41 | 12 | 13 | 4 | 7 | 135 |
| Madagascar | 90 | 45 | 73 | 20 | 3 | 10 | 240 |
| Mali | 18 | 69 | 90 | 13 | 8 | 17 | 212 |
| Senegal | 70 | 80 | 31 | 31 | 4 | 27 | 243 |
| South Africa | 207 | 88 | 83 | 100 | 20 | 126 | 622 |
| Zambia | 68 | 64 | 38 | 21 | 14 | 29 | 234 |
| Total | 684 | 493 | 382 | 231 | 77 | 281 | 2147 |

Notes: Numbers averaged over survey years.
Source: Authors' own calculation based on WBES data.

A key step in constructing our data set was to determine the country of origin of all firms in the sample. According to the questionnaires, firms are classified as either domestic or foreign based on the majority shareholder. Domestic firms also include a limited number of majority

state-owned firms. Firms that are jointly owned by owners with equal shares are defined as joint ventures (JV). In order to examine the productivity effects of South–South versus North–South FDI, we have further distinguished between AFRICAN (firms from a sub-Saharan African country other than that where the firm is located), ASIAN, Lebanese and Middle Eastern (MENAN), European/Caucasian (EUROPEAN), and other foreign-owned firms (OTHER). As the WBES data does not allow us to determine the home country of a couple of foreign firms – mostly for the first survey wave (see Appendix A1 for details about the construction of the data set) – we have had to include a group of foreign firms with unknown ownership (UNKNOWN).

In terms of numbers, the share of foreign firms in our sample is approximately 18 percent (Table 2). European firms are the most important foreign investors on average and are very common in Cameroon and Madagascar. African investors are most active in Angola and Botswana. Asian firms have a relatively large presence in Botswana and Madagascar, while MENAN firms more often invest in DRC.

**Table 2: Share of Foreign Firms According to Origin, Cross-Section, by Country**

| | FOREIGN | AFRICAN | ASIAN | EUROPEAN | MENAN | OTHER | UNKNOWN | JV |
|---|---|---|---|---|---|---|---|---|
| Angola | 17 | 9 | 0 | 6 | 2 | 1 | 0 | 3 |
| Botswana | 40 | 14 | 10 | 9 | 2 | 2 | 2 | 5 |
| Burkina Faso | 13 | 0 | 1 | 6 | 3 | 0 | 3 | 0 |
| Cameroon | 19 | 0 | 0 | 11 | 4 | 1 | 2 | 0 |
| DRC | 25 | 1 | 7 | 7 | 7 | 1 | 2 | 0 |
| Madagascar | 33 | 2 | 9 | 15 | 0 | 2 | 4 | 2 |
| Mali | 5 | 3 | 0 | 0 | 1 | 0 | 0 | 0 |
| Senegal | 11 | 1 | 0 | 6 | 1 | 0 | 3 | 2 |
| South Africa | 14 | 1 | 1 | 4 | 0 | 2 | 5 | 1 |
| Zambia | 21 | 3 | 5 | 5 | 1 | 0 | 7 | 1 |
| Average | 18 | 3 | 3 | 6 | 2 | 1 | 3 | 1 |

Notes: Numbers averaged over survey years.
Source: Authors' own calculation based on WBES data.

According to a recent UNCTAD report (2013), FDI inflows to sub-Saharan Africa in recent years have tended to be concentrated in consumer-related manufacturing. This is reflected to some degree in the distribution of foreign investors across sectors in our data set (see Table 3). For example, African firms are very common in the food sector and in the textiles and garments sector, as well as in other manufacturing. Asian firms also often operate in the textiles and garments sector. European firms mostly invest in other manufacturing or the food sector, where MENAN firms are also well represented. However, MENAN firms also have a significant presence in the chemicals, plastics, and rubber sector.

**Table 3: Sector Shares of Firms, by Origin (in %)**

| | Other Manufacturing | Food | Textiles and Garments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery | Total |
|---|---|---|---|---|---|---|---|
| DOMESTIC | 32 | 23 | 18 | 10 | 3 | 13 | 100 |
| FOREIGN | 29 | 21 | 17 | 14 | 5 | 13 | 100 |
| AFRICAN | 29 | 21 | 21 | 7 | 6 | 16 | 100 |
| ASIAN | 30 | 19 | 26 | 12 | 5 | 8 | 100 |
| EUROPEAN | 28 | 25 | 17 | 12 | 4 | 14 | 100 |
| MENAN | 24 | 30 | 3 | 26 | 8 | 9 | 100 |
| OTHER | 33 | 14 | 12 | 21 | 2 | 17 | 100 |
| UNKNOWN | 32 | 15 | 15 | 19 | 4 | 15 | 100 |
| JV | 39 | 27 | 10 | 8 | 6 | 10 | 100 |
| Total | 32 | 23 | 18 | 11 | 4 | 13 | 100 |

Notes: Numbers averaged over countries and survey years.
Source: Authors' own calculation based on WBES data.

Our next step is to determine the foreign share in total employment – a commonly applied measure of foreign-firm presence (e.g. Aitken and Harrison 1999), which we use later in the analysis. In particular, we develop an indicator $FDI\ FOREIGN_{jst}$ that relates the number of full-time employees of foreign firms $f$ in survey year $t$ in country $j$ in sector $s$ to the total employment provided by domestic and foreign firms in the same sector, country, and year. This measure captures intra-industry (horizontal) spillover effects. In the same manner, we calculate the employment shares for each different group of foreign investors for each country, sector, and year. Table 4 summarizes the employment shares of each group according to sector, averaged over countries and survey years based on the cross-sectional data set. We find that foreign-firm presence is, on average, approximately 32 percent in the sample of sub-Saharan African countries. European firms have the highest employment shares in all sectors (if we leave out foreign firms with unknown ownership), followed by Asian and African firms.

In order to analyze whether there are differences in foreign-firm presence across income-based groups of host countries, we tabulate the employment shares for low-income, lower-middle-income, and upper-middle-income countries (Table 5). The statistics indicate that foreign firms are more common in our sample of the four low-income countries, followed by the four upper-middle-income countries.

**Table 4: Employment Shares across Ownership Groups and Sectors, Cross-Section, in %, averaged over survey years and countries**

| | Other Manufacturing | Food | Textiles and Garments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery | Manufacturing |
|---|---|---|---|---|---|---|---|
| FDI FOREIGN | 34,6 | 26,9 | 30,7 | 35,1 | 39,9 | 31,5 | 32,0 |
| FDI AFRICAN | 2,4 | 3,3 | 3,4 | 2,1 | 2,7 | 6,1 | 3,2 |
| FDI ASIAN | 7,4 | 2,1 | 10,3 | 3,6 | 4,8 | 1,8 | 5,5 |
| FDI EUROPEAN | 11,4 | 14,3 | 10,0 | 13,7 | 9,9 | 14,7 | 12,4 |
| FDI MENAN | 2,7 | 2,7 | 0,2 | 5,0 | 9,3 | 2,2 | 2,7 |
| FDI OTHER | 1,5 | 0,8 | 0,5 | 3,7 | 0,7 | 1,3 | 1,3 |
| FDI UNKNOWN | 9,2 | 3,8 | 6,4 | 6,9 | 12,5 | 5,4 | 6,9 |

Notes: Figures averaged over countries and survey years.
Source: Authors' own calculation based on WBES data.

**Table 5: Employment Shares across Income Groups, Cross-Section, in %, averaged over survey years and countries**

| | Low Income | Lower-Middle Income | Upper-Middle Income |
|---|---|---|---|
| FDI FOREIGN | 36,2 | 27,2 | 33,2 |
| FDI AFRICAN | 3,6 | 3,6 | 2,5 |
| FDI ASIAN | 6,6 | 3,1 | 6,9 |
| FDI EUROPEAN | 13,5 | 11,9 | 12,1 |
| FDI MENAN | 4,3 | 2,6 | 1,2 |
| FDI OTHER | 1,3 | 0,8 | 2,0 |
| FDI UNKNOWN | 6,9 | 5,2 | 8,5 |

Notes: Figures averaged over countries and survey years.
Source: Authors' own calculation based on WBES data.

As we have argued above, technological differences do matter in the realization of spillovers; therefore, the foreign firm's country of origin may have an influence on the extent of domestic firm's knowledge absorption. Therefore, we now analyze whether technology gaps between domestic and Southern firms are indeed narrower than those between domestic and Northern firms by comparing labor-productivity levels. Following Takii (2011), we relate productivity measures to dummies of firm origin. We estimate the following equation:

$$\ln Y_{ijt} = \alpha_0 + \alpha_{1j}\mathrm{D}_{\mathrm{AFRICAN}} + \alpha_{2j}\mathrm{D}_{\mathrm{ASIAN}} + \alpha_{3j}\mathrm{D}_{\mathrm{EUROPEAN}} + \alpha_{5j}\mathrm{D}_{\mathrm{MENAN}} + \alpha_{6j}\mathrm{D}_{\mathrm{OTHER}} + \alpha_{7j}\mathrm{D}_{\mathrm{UNKNOWN}} + \alpha_{8j}\mathrm{D}_{\mathrm{JV}} + \alpha_9 D_{SY} + \alpha_{10} D_{CY} + \varepsilon_{ijt} \quad (1)$$

where Y refers to labor productivity (sales per employee) of firm i in country j in survey year t. The various dummy variables $D_{AFRICAN}$, $D_{ASIAN}$, etc. indicate whether the firm is African, Asian, European, MENAN, other foreign-owned, of unknown ownership, or a JV. The coeffi-

cients of the dummy variable can be interpreted as the percentage difference between foreign firms from different home countries and domestic firms. The dummy variables $D_{SY}$ and $D_{CY}$ control for year- and country-specific effects, respectively. All models are estimated separately for each sector to account for sectoral differences in using input factors. We apply robust standard errors in each case. We also provide the results for the aggregated manufacturing sector.

Indeed, our results, presented in Table 6, show that foreign firms of all the origins considered here are significantly more productive than domestic firms in the manufacturing sector as an aggregate. Looking at the particular sectors, we find that European firms are more productive than domestic firms in all sectors sampled. Sub-Saharan African firms are more productive in the chemicals, plastics, and rubber sector, and also in other manufacturing. Asian firms have significantly higher labor productivity compared to domestic firms in these sectors, and in the food sector. MENAN firms are only significantly more productive in the textiles and garments sector, where the differential is above 100 percentage points. Other foreign-owned firms also show higher labor productivity in the food and chemicals, plastics, and rubber sectors. Generally, it is reasonable to assume that the technological gap is smaller between domestic firms and developing-country investors than between domestic firms and industrialized-country multinationals. This is also partly reflected in our data: We find that the largest productivity gap (in overall manufacturing) is between European and domestic firms (leaving out firms with unknown ownership). The smallest gap seems to be between Asian and domestic firms. This contradicts our expectations somewhat, as sub-Saharan African is considered to be the least developed region of the world, which would suggest that the smallest gap would exist between domestic firms and investors from this region.

This productivity comparison may look different when made according to countries' income levels. Table 7 shows the regression results for equation (1), estimated separately for aggregate manufacturing in low-income, lower-middle-income and upper-middle-income countries. In low-income and lower-middle-income countries, the productivity differences look largely the same as those estimated for the whole sample. An exception is the coefficient for OTHER FOREIGN in low-income countries and for AFRICAN in lower-middle-income countries, both of which are very high. In upper-middle-income countries, we do not find positive and significant productivity differences between domestic firms and investors from sub-Saharan Africa and Asia. This finding is reasonable if we assume that domestic firms in upper-middle-income countries are more advanced than those in lower-income countries and are not too different from foreign investors from other developing countries.

Our productivity comparison analysis confirms the arguments made above and motivates further analysis of productivity effects according to firm origin and technological differences.

**Table 6: Labour Productivity Across Sectors**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | Other Manufacturing | Food | Textiles and Garments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery | Manufacturing |
| AFRICAN | 0.72* | 0.61 | 0.068 | 2.15*** | 0.94 | 0.66* | 0.71*** |
| ASIAN | 0.64** | 0.32* | 0.060 | 0.89* | -0.045 | 0.18 | 0.41*** |
| EUROPEAN | 0.43** | 0.86*** | 0.91*** | 0.56*** | 1.60*** | 1.02*** | 0.85*** |
| MENAN | 0.50 | 0.70 | 1.00*** | 0.10 | 0.33 | 0.35 | 0.69*** |
| OTHER | 0.15 | 1.80** | 0.89* | 1.19** | | -0.063 | 0.75** |
| UNKNOWN | 1.10*** | 0.87*** | 0.63* | 0.72*** | 1.19*** | 0.78*** | 0.86*** |
| JV | 0.13 | -0.079 | -0.30 | -0.023 | -0.21 | -0.32 | -0.014 |
| constant | 9.49*** | 9.44*** | 9.05*** | 8.58*** | 8.98*** | 9.09*** | 9.34*** |
| year effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| country effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1298 | 942 | 729 | 443 | 147 | 547 | 4106 |
| F | 25.6 | 12.8 | 27.2 | 8.10 | 5.39 | 16.8 | 85.3 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | | |

Source: Authors' own calculation based on WBES data. The coefficients multiplied by 100 can be interpreted as percentage differentials.[11]

**Table 7: Labour Productivity Across Different Income Levels, Aggregate Manufacturing**

| | (1) | (2) | (3) |
|---|---|---|---|
| | Low Income | Lower-Middle Income | Upper-Middle Income |
| AFRICAN | 0.78** | 1.05*** | 0.28 |
| ASIAN | 0.56** | 0.38** | 0.20 |
| EUROPEAN | 0.92*** | 0.97*** | 0.62*** |
| MENAN | 0.57* | 0.81** | 0.76*** |
| OTHER | 1.71** | -0.53 | 0.41 |
| UNKNOWN | 1.23*** | 0.91*** | 0.70*** |
| JV | -0.72** | 0.23 | 0.085 |
| constant | 9.33*** | 9.34*** | 9.57*** |
| year effects | Yes | Yes | Yes |
| country effects | Yes | Yes | Yes |
| N | 1200 | 1488 | 1418 |
| F | 13.2 | 10.0 | 15.3 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | |

Source: Authors' own calculation based on WBES data. The coefficients multiplied by 100 can be interpreted as percentage differentials.

11 For the sectors nonmetallic products and basic metals we had to drop the dummy for other foreign-owned firms as this dummy is only nonzero for one observation in this sector.

## 4 Empirical Analysis: Productivity Effects of FDI and the Origin of Foreign Investors

### *4.1 Empirical Model*

We perform our analysis of the pooled cross-sectional data first, since they constitute a larger and more representative sample. We then estimate a model with panel data that accounts for unobserved firm-specific productivity differences. We follow the literature and estimate this in two steps. The first step of our analysis is to estimate the TFP of all the firms in our sample as the residual in a log-linearized Cobb-Douglas production function. In a second step, we use the TFP residual to estimate the spillover and competition effects of foreign firms in the market.

We start by estimating TFP as the residual of the following log-transformed conventional production function:

$$\begin{aligned} \ln SALES_{ijt} = {} & \alpha_0 + \beta_C \ln CAPITAL_{ijt} + \beta_L \ln LABOUR_{ijt} \\ & + \beta_M \ln MATERIAL_{ijt} + \ln TFP_{ijt} + \alpha_1 D_{\text{FOREIGN}} + \alpha_2 D_{CY} + \alpha_3 D_{SY} \end{aligned} \quad (2)$$

where the subscripts i, j, and $t$ refer to firm refer to firm, country, and survey year, respectively. In equation (2), a firm's output is measured by SALES, while CAPITAL is proxied by the net book value (value of assets after depreciation) of machinery and vehicles.[12] The variable LABOR is given by the number of employees. A firm's material costs are the total annual cost of raw materials and intermediate goods used in production. The residual of this equation is a firm- and year-specific TFP (in logs). While the dummy $D_{FOREIGN}$ takes a value of one if the firm is foreign-owned and zero otherwise, the dummies $D_{CY}$ and $D_{SY}$ account for country- and year-specific effects.

In a subsequent step, we use the log of the TFP of domestic firms based on the residuals of the above estimates as the dependent variable and relate it to a measure of foreign-firm presence in each sector and country, as described in the data section. We use data on employment shares across ownership groups and sectors to determine whether foreign-firm presence creates productivity effects for domestic firms. In particular, we estimate:

$$\begin{aligned} \ln(TFP)_{ijt} = {} & \gamma_1 FDI\ FOREIGN_{jst} + \gamma_2 FDI\ FOREIGN_{jst} * ABC_{jst} \\ & + D_{STATE} + D_{CY} + D_S + \mathrm{D}_{SY} + \varepsilon_{ijt} \end{aligned} \quad (3)$$

where the dummy $D_{STATE}$ takes a value of one if domestic firms are state-owned and zero otherwise. The dummy variables $\mathrm{D}_{CY}$, $\mathrm{D}_S$, and $\mathrm{D}_{SY}$ control for country-, sector-, and year-specific effects, respectively. The model therefore accounts for the consistent finding in the literature that the presence of foreign firms (FDI FOREIGN) may only induce positive productivity effects if domestic firms have sufficient absorptive capacity (ABC) – that is, the ability to adopt foreign technologies or to compete with foreign multinationals. The meas-

12 The original monetary values are given in local currency units (LCUs). For standardization, we convert them into US dollars and deflate them using the US GDP deflator with the base year 2005.

urement of a "firm´s abilities" is by nature problematic, since there is not an observable variable that captures this feature. Researchers have therefore relied on measures of technological capability as proxies for absorptive capacity, with R&D expenditures being the most commonly employed. Farole and Winkler (2014) additionally include an alternative measure of absorptive capacity, defined as the domestic firm's labor productivity relative to the labor productivity of multinational firms in the same sector.[13] They find that the impact of this measure on spillover effects is greater and more robust than that of other proxies such as R&D expenditure, exports, or firm size. Thus, we follow this approach and compute absorptive capacity $ABC_{jst}$ as a domestic firm's labor productivity relative to the median labor productivity of multinational firms per sector and survey year in natural logarithms.[14] Higher values indicate a smaller productivity gap and therefore a higher absorptive capacity on the part of domestic firms. We interact $ABC_{jst}$ with our measures of foreign-firm presence. The total effect of FDI is then given by $\gamma_1 + \gamma_2 * ABC$. Further, to analyze the effects of foreign firms from different home countries, we estimate the following equation (3) using the employment shares of each group of foreign-owned firms and the respective interaction terms with ABC.[15]

### *4.2 Cross-Sectional Perspective*

In this subsection we use the two pooled cross-sections of data described above. In order to account for sectoral heterogeneity in our estimation of TFP, we estimate equation (1) separately for each sector using all firms in the cross-sectional sample by pooled ordinary least squares (OLS) with robust standard errors. Table 8 provides the estimated coefficients across sectors. The results look reasonable, as we find positive coefficients for most of our input factors in all sectors. An exception is the coefficient for capital, which is not significant in three subsectors, likely due to the relatively small number of observations.

13 This measure has also been used in earlier studies by Kokko (1996) and Ben Hamida and Gugler (2009).

14 We focus our discussion on interaction effects as the simple effect of $\gamma_1$ is only relevant if ABC is zero, which only occurs in a few cases in our sample.

15 We cannot use the absorptive capacity of domestic firms in relation to each group of foreign firms as not all groups are present in each country. If we were to do so, we would lose too many observations.

**Table 8: Sector-Specific TFP Estimates, Cross-Section**

| OLS | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Other Manufacturing | Food | Textiles and Garments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery |
| LN CAPITAL | 0.088*** | 0.011 | 0.12*** | 0.12*** | 0.11 | 0.046 |
| | [0.00] | [0.80] | [0.00] | [0.00] | [0.20] | [0.23] |
| LN EMPLOYEES | 0.50*** | 0.49*** | 0.46*** | 0.43*** | 0.58*** | 0.42*** |
| | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| LN MATERIAL | 0.52*** | 0.59*** | 0.51*** | 0.55*** | 0.48*** | 0.59*** |
| | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| FOREIGN | 0.20* | 0.32** | 0.24** | 0.25** | -0.18 | 0.13* |
| | [0.05] | [0.01] | [0.04] | [0.03] | [0.51] | [0.09] |
| constant | 4.79*** | 5.08*** | 4.41*** | 5.06*** | 4.90*** | 4.89*** |
| | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| year effects | Yes | Yes | Yes | Yes | Yes | Yes |
| country effects | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1011 | 735 | 541 | 343 | 114 | 447 |
| R-sq | 0.779 | 0.793 | 0.920 | 0.848 | 0.832 | 0.808 |
| F | 426.8 | 308.3 | 518.1 | 190.8 | 89.7 | 318.2 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | |

Notes: OLS estimation. Dependent variable is the natural log of sales. t-values obtained from robust standard errors in parentheses.

Source: Authors' own calculation based on WBES data.

As indicated above, we then estimate equation (2) to account for productivity effects derived from foreign presence. The results are presented in Table 9. In our baseline specification, which includes firms from all the countries in our sample, we find an overall positive association between foreign-firm presence and the productivity of domestic firms (Table 9, column 1). These productivity effects increase with a higher absorptive capacity on the part of domestic firms. The point estimates suggest that domestic firms' productivity, given a median level of absorptive capacity,[16] improves by 0.0029 if foreign-firm presence increases by 1 percent. However, domestic firms with an absorptive capacity below -1.3 (approximately 23 percent of domestic firms) may respond negatively to foreign-firm presence in terms of productivity. We also find positive coefficients of interaction terms for the presence of sub-Saharan African, Asian, and European firms.[17] The strongest effects seem to be induced by foreign firms from sub-Saharan Africa. While the total productivity effect of a 1 percent increase in their presence is approximately 0.0058, the effects of other foreign investors are between -0.005 (Asian investors) and 0.008 (foreign firms with unknown ownership). Thus, firms with a

16 Calculated as 0.0052+0.004*(-0.5743). The median of ABC is (-0.5743).

17 We disregard foreign firms with unknown ownership.

median or lower absorptive capacity do not experience positive spillover effects due to Asian firms' presence. Again, the total effect depends on domestic firms' absorptive capacity.

**Table 9: Productivity Effects on Domestic Firms, Cross-Section**

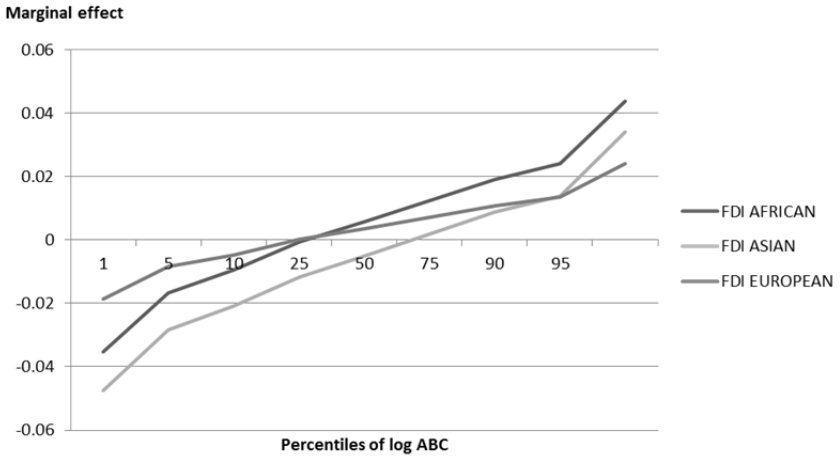
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | all | all | LIC | LIC | LMIC | LMIC | UMIC | UMIC |
| FDI FOREIGN | 0.0052*** | | 0.0073*** | | 0.017*** | | 0.0019** | |
| | [0.00] | | [0.00] | | [0.00] | | [0.03] | |
| FDI AFRICAN | | 0.011*** | | 0.0023 | | 0.048*** | | 0.0014 |
| | | [0.00] | | [0.73] | | [0.00] | | [0.69] |
| FDI ASIAN | | 0.00035 | | -0.0086** | | -0.0098** | | 0.0042* |
| | | [0.83] | | [0.04] | | [0.03] | | [0.07] |
| FDI EUROPEAN | | 0.0064*** | | 0.0095** | | 0.013*** | | 0.0018* |
| | | [0.00] | | [0.04] | | [0.00] | | [0.10] |
| FDI MENAN | | -0.0041 | | -0.0039 | | 0.0083* | | 0.0061*** |
| | | [0.11] | | [0.44] | | [0.09] | | [0.00] |
| FDI OTHER | | 0.0047 | | 0.073*** | | 0.061*** | | 0.0016 |
| | | [0.54] | | [0.01] | | [0.00] | | [0.73] |
| FDI UNKNOWN | | 0.012*** | | 0.032*** | | 0.015*** | | -0.0012 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.44] |
| STATE | -0.0057 | -0.056 | -0.10 | -0.27* | -0.30 | -0.40 | 0.0049 | -0.028 |
| | [0.98] | [0.80] | [0.69] | [0.08] | [0.25] | [0.10] | [0.97] | [0.82] |
| FDI FOREIGN * ABC | 0.0040*** | | 0.0027*** | | 0.010*** | | 0.0074*** | |
| | [0.00] | | [0.00] | | [0.00] | | [0.00] | |
| FDI AFRICAN * ABC | | 0.0089*** | | 0.010*** | | 0.022*** | | 0.0078*** |
| | | [0.00] | | [0.01] | | [0.00] | | [0.00] |
| FDI ASIAN * ABC | | 0.0092*** | | 0.0087** | | 0.0054*** | | 0.0082*** |
| | | [0.00] | | [0.02] | | [0.00] | | [0.00] |
| FDI EUROPEAN * ABC | | 0.0048*** | | 0.0056*** | | 0.011*** | | 0.0071*** |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| FDI MENAN * ABC | | 0.0010 | | 0.00039 | | 0.0083*** | | 0.0034*** |
| | | [0.50] | | [0.90] | | [0.00] | | [0.00] |
| FDI OTHER * ABC | | -0.0067* | | -0.0014 | | 0.031*** | | 0.013*** |
| | | [0.06] | | [0.81] | | [0.00] | | [0.00] |
| FDI UNKNOWN * ABC | | 0.0061*** | | 0.0061 | | 0.0048*** | | 0.0073*** |
| | | [0.00] | | [0.23] | | [0.00] | | [0.00] |
| constant | -0.42*** | -0.42*** | -0.17 | -0.33** | -0.53*** | -0.62*** | 0.16** | 0.16 |
| | [0.00] | [0.00] | [0.26] | [0.05] | [0.00] | [0.00] | [0.02] | [0.14] |
| country effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| sector effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| year effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 2389 | 2389 | 581 | 581 | 838 | 838 | 970 | 970 |
| R-sq | 0.143 | 0.206 | 0.085 | 0.298 | 0.298 | 0.395 | 0.454 | 0.468 |
| F | 10.2 | 17.6 | 4.32 | 7.62 | 18.2 | 21.1 | 67.6 | 40.4 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | | | |

Notes: OLS estimation. Robust standard errors in parentheses. Firms with productivity below the 1st and above the 99th percentile are excluded from the sample. The variable ABC is in logs.

Source: Authors' own estimation based on WBES data.

Figure 1 shows the relationship between absorptive capacity and marginal productivity effects. It clearly indicates that domestic firms may respond negatively to foreign-firm presence if they do not have sufficient absorptive capacity. While the turning point is in the 25th percentile of log ABC for sub-Saharan African and European firms, it is in the 75th percentile for Asian firms.

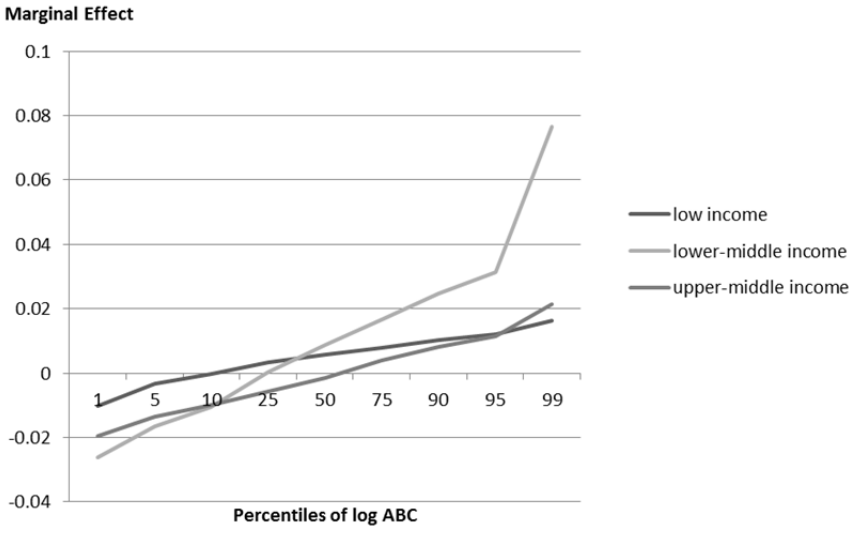
**Figure 1: Marginal Productivity Effects on Domestic Firms, Cross-Section**




Source: Authors' own illustration based on estimations using WBES data.

In a subsequent step, we estimate equations (3) and (4) based on our three samples of countries of different income levels, as domestic firms may respond differently to foreign-firm presence (see Table 9, columns 3–8). We again find significant evidence of positive spillover effects from foreign multinationals to domestic firms across all income groups. In lower-income and upper-middle-income countries, the interaction terms are always significant. The strongest overall effects of foreign-firm presence are reported for domestic firms in lower-middle-income countries (Figure 2).

**Figure 2: Marginal Productivity Effects on Domestic Firms across Income Levels of Host Countries, Cross-Section**




Source: Authors' own illustration based on estimations using WBES data.

### *4.3 Panel Perspective*

Next, we only include those firms in the sample that have been interviewed in two survey waves. Using panel data, we can follow firms over time and control for unobserved heterogeneity at the firm level. Moreover, we can deal with the problem of simultaneity bias in the TFP estimation. This problem arises because of the potential correlation between input factors and firm productivity: firms may respond to productivity shocks by changing factor inputs (Levinsohn and Petrin 2003). To overcome the problem of biased estimates of productivity, we estimate TFP using the fixed effects estimator and controlling for unobserved firm-specific fixed effects and input decisions in a first step. The results of the TFP estimation using fixed effects are presented in Appendix A2. However, when we use this methodological approach, a large part of the information from the data is lost as the estimator only uses within variation. Thus, in a second step, we follow the methodology proposed by Levinsohn and Petrin (2003).[18] To do this, we use intermediate inputs (electricity costs) as a proxy of unobservable productivity shocks. We take value added instead of sales as the dependent variable, as we would otherwise have insufficient variation in the data. The estimation results using the Levinsohn and Petrin (2003) methodology are also presented in Appendix A2.

In Table 10, we present the estimation results relating domestic firms' productivity to foreign-firm presence based on our panel data set.[19] We provide the results for our complete sample of 10 countries and for low-income, lower-middle-income, and upper-middle-income countries. Again, we focus the analysis on the interaction effects. Columns 1 and 2 of Table 10 again provide evidence of positive productivity spillovers from foreign firms to domestic firms. We also report positive effects for all types of foreign investors except for MENAN firms. If domestic firms' absorptive capacity has a value of zero, the effects of MENAN firms are negative and significant. We only find a positive association between domestic firms' productivity and the presence of Asian and European firms in low-income countries. In lower-middle-income and upper-middle-income countries all types of foreign investors appear to have positive effects on domestic firms' productivity (except for MENAN in the lower-middle-income countries).

18 Another proposed methodology is from Olley and Pakes (1996). It solves the simultaneity problem by using a firm's investment as a proxy of unobservable productivity shocks, arguing that investment represents an increase in productivity. This approach requires positive, nonzero investment data. In our panel data set, a large number of firms (approximately 37 percent) report zero investment. Thus, we refrain from using the methodology proposed by Olley and Pakes (1996) in order not to lose too many observations.

19 As some firms do not provide information for each variable used in the estimations, the panel is unbalanced. However, the results do not change if we balance our panel data set.

**Table 10: Productivity Effects, based on TFP from Fixed Effects Estimation, Panel**

| Fixed Effects | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | all | all | LIC | LIC | LMIC | LMIC | UMIC | UMIC |
| FDI FOREIGN | 0.0077** | | 0.033** | | 0.018*** | | -0.0025 | |
| | [0.04] | | [0.02] | | [0.01] | | [0.33] | |
| FDI AFRICAN | | 0.037*** | | -0.015 | | 0.16*** | | -0.0023 |
| | | [0.01] | | [0.88] | | [0.00] | | [0.83] |
| FDI ASIAN | | -0.0055 | | -0.068* | | -0.015 | | 0.0039 |
| | | [0.43] | | [0.09] | | [0.12] | | [0.53] |
| FDI EUROPEAN | | 0.010** | | 0.0036 | | 0.022*** | | -0.0081* |
| | | [0.04] | | [0.90] | | [0.00] | | [0.08] |
| FDI MENAN | | -0.028*** | | -0.17*** | | -0.0078 | | 0.045 |
| | | [0.01] | | [0.00] | | [0.52] | | [0.25] |
| FDI OTHER | | 0.069*** | | -0.074 | | 0.013 | | 0.033** |
| | | [0.00] | | [0.38] | | [0.73] | | [0.03] |
| FDI UNKNOWN | | 0.013*** | | -0.019 | | 0.027** | | -0.00096 |
| | | [0.01] | | [0.30] | | [0.02] | | [0.81] |
| STATE | 0.37 | 0.49 | 0 | 0 | 0 | 0 | -0.085 | -0.28 |
| | [0.73] | [0.61] | [.] | [.] | [.] | [.] | [0.86] | [0.61] |
| FDI FOREIGN * ABC | 0.0086*** | | 0.0051*** | | 0.017*** | | 0.012*** | |
| | [0.00] | | [0.00] | | [0.00] | | [0.00] | |
| FDI AFRICAN * ABC | | 0.021*** | | 0.057 | | 0.041*** | | 0.014** |
| | | [0.00] | | [0.23] | | [0.00] | | [0.02] |
| FDI ASIAN * ABC | | 0.012*** | | 0.045** | | 0.023*** | | 0.013*** |
| | | [0.00] | | [0.03] | | [0.00] | | [0.00] |
| FDI EUROPEAN * ABC | | 0.0073*** | | 0.0096** | | 0.014*** | | 0.0067*** |
| | | [0.00] | | [0.04] | | [0.00] | | [0.00] |
| FDI MENAN * ABC | | -0.0032 | | -0.0022 | | 0.016 | | 0.047* |
| | | [0.60] | | [0.87] | | [0.18] | | [0.09] |
| FDI OTHER * ABC | | 0.027*** | | 0.013 | | 0.044*** | | 0.049*** |
| | | [0.00] | | [0.47] | | [0.00] | | [0.01] |
| FDI UNKNOWN * ABC | | 0.012*** | | 0.013* | | 0.011* | | 0.018*** |
| | | [0.00] | | [0.06] | | [0.09] | | [0.00] |
| constant | -0.17 | -0.17 | -1.80*** | 1.48 | -0.12 | -0.61*** | 0.67*** | 0.62*** |
| | [0.16] | [0.14] | [0.00] | [0.13] | [0.48] | [0.00] | [0.00] | [0.00] |
| year effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 756 | 756 | 236 | 236 | 241 | 241 | 274 | 274 |
| R-sq | 0.282 | 0.471 | 0.298 | 0.746 | 0.494 | 0.807 | 0.586 | 0.669 |
| F | 20.3 | 12.5 | 5.24 | 6.10 | 21.2 | 17.7 | 33.2 | 12.1 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | | | |

Notes: Estimation by Fixed Effects. Firms with productivity below the 1st and above the 99th percentile are excluded from the sample. The variable ABC is in logs.

Source: Authors' own estimation based on WBES data.

In Table 11, we present the regression results using domestic firms' TFP, estimated by applying the methodology proposed by Levinsohn and Petrin (2003). The results confirm the positive association between domestic firms' productivity and foreign-firm presence. For our sample of domestic firms in low-income countries, our estimates using fixed effects are also largely confirmed. In lower-middle-income countries, we do not find a positive and significant association between domestic firms' productivity and Asian investors. Domestic firms in upper-middle-income countries do not appear to be positively affected by the presence of MENAN and other foreign-owned firms.

To summarize our findings from the cross-sectional and panel sample, we have identified robust evidence for positive productivity spillovers from foreign firms to domestic firms in our sample of sub-Saharan African countries. However, these positive effects are very much dependent on domestic firms' absorptive capacity. An examination of the country of origin of foreign investors shows that these positive effects are mainly driven by sub-Saharan African, European, and other foreign-owned investors. Domestic firms in low-income countries may primarily benefit from the presence of European and Asian investors, given sufficient absorptive capacity, especially if they compete with Asian firms. In lower-middle-income countries, sub-Saharan African, European, and other foreign-owned firms appear to have positive effects on domestic firms' productivity. We also report positive interaction terms for sub-Saharan African, European, and Asian firm presence in upper-middle-income countries.

**Table 11: Productivity Effects – based on TFP estimation using methodology of Levinsohn and Petrin (2003), Panel**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | all | all | LIC | LIC | LMIC | LMIC | UMIC | UMIC |
| FDI FOREIGN | 0.0076 | | 0.034* | | 0.022*** | | -0.0081* | |
| | [0.11] | | [0.09] | | [0.00] | | [0.07] | |
| FDI AFRICAN | | 0.055*** | | -0.16 | | 0.14*** | | 0.015 |
| | | [0.00] | | [0.21] | | [0.00] | | [0.41] |
| FDI ASIAN | | -0.012 | | -0.20*** | | -0.0051 | | -0.0014 |
| | | [0.16] | | [0.00] | | [0.68] | | [0.90] |
| FDI EUROPEAN | | 0.015** | | -0.069* | | 0.023** | | -0.00074 |
| | | [0.02] | | [0.06] | | [0.03] | | [0.93] |
| FDI MENAN | | -0.035*** | | -0.22*** | | 0.012 | | -0.028 |
| | | [0.01] | | [0.00] | | [0.43] | | [0.80] |
| FDI OTHER | | 0.087*** | | -0.034 | | 0.069 | | 0.013 |
| | | [0.00] | | [0.69] | | [0.18] | | [0.63] |
| FDI UNKNOWN | | 0.0094 | | -0.065*** | | 0.023 | | -0.011 |
| | | [0.14] | | [0.00] | | [0.15] | | [0.12] |
| STATE | 1.51 | 1.74 | 0 | 0 | 0 | 0 | 0.94 | 0.52 |
| | [0.27] | [0.16] | [.] | [.] | [.] | [.] | [0.26] | [0.59] |
| FDI FOREIGN * ABC | 0.011*** | | 0.0077*** | | 0.018*** | | 0.013*** | |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | all | all | LIC | LIC | LMIC | LMIC | UMIC | UMIC |
| | | [0.00] | | [0.75] | | [0.00] | | [0.01] |
| FDI ASIAN * ABC | | 0.0086* | | 0.061** | | 0.0057 | | 0.011* |
| | | [0.08] | | [0.01] | | [0.46] | | [0.08] |
| FDI EUROPEAN * ABC | | 0.012*** | | 0.0091* | | 0.013*** | | 0.0085** |
| | | [0.00] | | [0.05] | | [0.00] | | [0.03] |
| FDI MENAN * ABC | | -0.0091 | | -0.0025 | | 0.024 | | 0.0061 |
| | | [0.23] | | [0.86] | | [0.14] | | [0.92] |
| FDI OTHER * ABC | | 0.028*** | | 0.032** | | 0.062*** | | 0.043 |
| | | [0.00] | | [0.03] | | [0.00] | | [0.21] |
| FDI UNKNOWN * ABC | | 0.0074 | | 0.017** | | 0.011 | | 0.012* |
| | | [0.13] | | [0.04] | | [0.22] | | [0.07] |
| constant | 7.07*** | 7.03*** | 5.24*** | 11.5*** | 7.13*** | 6.67*** | 8.01*** | 7.94*** |
| | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| year effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 752 | 752 | 238 | 238 | 244 | 244 | 273 | 273 |
| R-sq | 0.400 | 0.554 | 0.293 | 0.835 | 0.649 | 0.825 | 0.520 | 0.562 |
| F | 33.8 | 17.1 | 5.39 | 11.3 | 40.1 | 19.9 | 24.6 | 7.43 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | | | |

Notes: Estimation by Fixed Effects. Firms with productivity below the 1st and above the 99th percentile are excluded from the sample. The variable ABC is in logs.
Source: Authors' own estimation based on WBES data.

## 5 Conclusion

FDI inflows to sub-Saharan African countries are on the rise. These investments are not just made by foreign firms from industrialized countries. In fact, investors from developing countries are becoming increasingly important as sources of outward FDI. This paper has considered both trends. We have constructed a unique data set using firm-level data for 10 sub-Saharan African countries drawn from the World Bank Enterprise Surveys. The data have allowed us to distinguish between domestic firms and foreign investors from sub-Saharan Africa, Asia, Europe, the Middle East and North Africa, and other foreign-owned firms. We have thus been able to undertake an in-depth analysis of the host-country effects of heterogeneous foreign investors.

We have concentrated on the analysis of horizontal spillovers to domestic firms and have found strong evidence of an overall positive effect of foreign-firm presence on domestic firms' productivity. However, this effect is very much dependent on domestic firms' absorptive capacity. With regard to whether the scope for productivity spillovers to domestic firms is greater with North–South or South–South FDI, we have shown that South–South investments may be slightly more advantageous. Based on our most robust findings across income

groups and samples, we report the largest productivity effects for investors from sub-Saharan Africa. Domestic firms may find it easier to adopt technologies and to compete with foreign firms from the same region. The positive effect of European firm presence could also be the result of some vertical spillover effects, which may have been captured by our horizontal measure since the sectors are broadly defined (also see Farole and Winkler 2012). Domestic firms may learn from European suppliers or as customers in a production chain. The materialization of positive productivity effects from Asian investors is much more dependent on the absorptive capacity of domestic firms than is the case with sub-Saharan African or European investors.

Even if our sample of sub-Saharan African countries is limited in number, our analysis suggests that foreign investment policy should promote South–South investment flows to sub-Saharan Africa. Future micro-level research on FDI in (more) sub-Saharan African countries is very much dependent on the availability and quality of data on other countries within the region.

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# APPENDIX

## *A1 Construction of the Data Set*

Our data set has been constructed from the World Bank Enterprise Surveys (WBES). We have used data on manufacturing firms in 10 different countries published by the World Bank at the end of 2012.[20]

The selection of countries considered in this paper is based on (a) the type of questionnaire (details about the country of origin of the firm), (b) the availability of panel data, and (c) the data quality. For most of the countries, standardized survey data were available. It was missing for the first wave of the survey in Madagascar, Senegal, South Africa, and Zambia as these surveys were carried out before 2005/2006. However, the surveys provided similar questionnaires, and we linked the firms to the second survey wave by using a panel identifier for each country. We were very careful when collecting the variables from the first survey wave in order to ensure that they matched the data from the standardized questionnaires. The most important steps of cleaning, standardization, and consolidation are described below.

Table A1a provides a general overview of our sample. We have included firms from low-income, lower-middle-income, and upper-middle-income countries. The respective survey years (with the reference fiscal year of firms' business operations given as the previous year) differ between certain countries, but we have defined a first and a second survey year across countries. We have also included the total number of firms in each country in Table A1a.

**Table A1a: General Overview of the Sample**

| Country | Income Level | Survey Years | Number of Firms in Sample |
|---|---|---|---|
| Angola | LMIC | 2006; 2010 | 356 |
| Botswana | UMIC | 2006; 2010 | 201 |
| Burkina Faso | LIC | 2006; 2009 | 143 |
| Cameroon | LMIC | 2006; 2010 | 225 |
| DRC | LIC | 2006; 2010 | 270 |
| Madagascar | LIC | 2006; 2009 | 479 |
| Mali | LIC | 2007; 2010 | 424 |
| Senegal | LMIC | 2003; 2007 | 485 |
| South Africa | UMIC | 2003; 2007 | 1244 |
| Zambia | LMIC | 2002; 2007 | 467 |

Source: Classification in income levels is based on Beck et al. (2010). The survey years and the number of firms in the sample are summarized from the WBES.

20 We have had to exclude Cape Verde, Malawi, and Niger from the sample because of insufficient data quality and a lack of observations.

We have used each firm's screened business sector to determine its sector of activity. Generally, the World Bank Enterprise Surveys are stratified according to distinctions between manufacturing and services, or more disaggregated sector definitions. Disaggregated sector information was missing for the first wave in Senegal, South Africa, and Zambia. For these firms, we have determined the detailed business sector by using the ISIC Rev. 3.1 product codes. If sector information was not standardized for the first survey wave, we have standardized the data to the sectors defined in the second survey wave. We have excluded agriculture, fishing, mining and quarrying, electricity, retail, wholesale, IT firms, hotels and restaurants, firms for servicing motorcycles, construction and transport firms, and firms without attributed sectors. In particular, we have analyzed firms from the manufacturing sectors presented in Table A1b. To obtain a reasonable sample size for sector-specific estimations, we have aggregated certain related sectors such as textiles and garments (see also, e.g., Mühlen 2013).

**Table A1b: Manufacturing Sectors**

| *ISIC Rev. 3.1* | *Sector* |
|---|---|
| 2 | other manufacturing; incl. electronics (31-32) |
| 15 | food |
| 17; 18 | textiles; garments |
| 24; 25 | chemicals; plastics & rubber |
| 26; 27 | nonmetallic mineral products; basic metals |
| 28; 29 | fabricated metal products; machinery and equipment |

Source: WBES.

Our sample includes small, medium-sized, and large firms. Where information about firm size was not available, we have calculated the composite measure of permanent and temporary workers, which is also used in the questionnaires to determine the size of a firm. We have dropped a couple of micro firms as well as firms without information on employees or size and their 20 correspondent panel firms. To determine the owner and origin of each firm, we have concentrated on the majority shareholder. We have determined whether a firm can be considered majority domestic, foreign, state, or other owned. Firms that are jointly owned with equal ownership shares held by domestic, foreign, state, and/or other owners have been defined as joint ventures (JV). The WBES data also provide information about the nationality of origin (nationality at birth) of the current largest owner.[21] The available response options in the questionnaires include African, Indian, Lebanese/Middle Eastern, other Asian, European/Caucasian, and other, which may be US firms, for example. We have aggregated Indian

21 Although the database provided information about the share owned by the largest shareholder (much data is missing though), we could not simply use the nationality of origin of the largest owner to determine whether a company was domestic- or foreign-owned. As some firms were majority domestic-owned but the nationality at birth of the largest owner may have been different, we first had to determine whether the firm was majority domestic- or foreign-owned.

and other Asian firms. For simplicity, majority domestic state-owned firms have been treated as domestic. If information about majority ownership was missing and we did not have information about the firm for the other survey year, we have dropped it from the sample. There were a couple of foreign firms that did not provide information about the foreign owners' nationality at birth or where the nationality could not be precisely identified because the questionnaires asked for the nationality at birth of all shareholders – not just the majority owner – which was a blurring of the first survey wave. For firms in Zambia, the survey provided no information about the nationality at birth of shareholders in the first survey year.

We have used the ownership information from the other survey year of panel firms whenever available and applicable. In some cases, the owner changed from domestic to foreign or the other way around and we could not use the ownership information from the other survey year. These foreign and other-owned firms have been defined as "foreign with unknown origin" or "other with unknown origin" whenever we did not have information about the nationality at birth for any of the two survey years. We have dropped all other-owned firms with unknown origin as we could not adequately integrate them into the analysis; this has left us with few foreign firms with unknown ownership. After the completion of all the data-cleaning steps, we have been able to distinguish between domestic firms; foreign firms from sub-Saharan Africa, Asia, Europe, and MENA; and other foreign-owned firms. Due to limited data availability, we have had to include foreign firms of unknown origin in our analysis.

We have used different proxies for capital input across countries, as not all surveys provided information for a unique category. For firms in Botswana, Burkina Faso, DRC, Mali, and Senegal we have used the costs of machinery, vehicles, and equipment if they were purchased in their current condition for both survey years. We have used the net book value (value of assets after depreciation) as a measure of capital for firms in Angola, Cameroon, Madagascar, South Africa, and Zambia. We have not used capital values for land in the regressions as too many firms do not provide information on this variable. The original monetary values used in the production function estimation (for example, sales, capital, and material costs) have been given in local currency units (LCUs). For standardization, we have converted them into US dollars and deflated them using the US GDP deflator with the base year 2005.

After all the data-cleaning steps, our sample includes 4,294 cross-section firms, of which 788 are panel firms. More details about the construction of the data set are available on request.

## *A2 TFP Estimates*

### Table A2a: Sector-Specific TFP Estimates, Panel, Fixed Effects

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Other Manufacturing | Food | Textiles and Garments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery |
| LN CAPITAL | 0.027 | -0.11 | 0.17** | 0.047 | 0.13 | 0.028 |
| | [0.64] | [0.25] | [0.02] | [0.34] | [0.36] | [0.84] |
| LN EMPLOYEES | 0.79*** | 0.45 | 0.068 | -0.099 | 0.56* | 0.31 |
| | [0.01] | [0.12] | [0.76] | [0.67] | [0.07] | [0.41] |
| LN MATERIAL | 0.32*** | 0.46*** | 0.22** | 0.40*** | 0.18 | 0.17 |
| | [0.00] | [0.00] | [0.04] | [0.01] | [0.41] | [0.32] |
| FOREIGN | -0.14 | 1.26 | -1.13** | -0.0077 | 0.77 | 0.014 |
| | [0.66] | [0.20] | [0.02] | [0.98] | [0.22] | [0.97] |
| constant | 6.09*** | 6.98*** | 8.26*** | 8.98*** | 7.74*** | 10.1*** |
| | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] | [0.00] |
| year effects | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 328 | 257 | 159 | 145 | 43 | 178 |
| R-sq | 0.308 | 0.342 | 0.333 | 0.416 | 0.469 | 0.182 |
| F | 13.9 | 8.85 | 4.63 | 8.07 | . | 12.7 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | |

Notes: Fixed effects estimation. Dependent variable is the natural log of sales.
Source: Source: Authors' own calculation based on WBES data.

### Table A2b: Sector-Specific TFP Estimates, Panel, Levinsohn and Petrin (2003)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Other Manufacturing | Food | Textiles and Gar-ments | Chemicals, Plastics and Rubber | Nonmetallic Products and Basic Metals | Fabricated Metal Products and Machinery |
| LN EMPLOYEES | 0.46*** | 0.63*** | 0.37*** | 0.36** | 1.17*** | 0.50*** |
| | [0.00] | [0.00] | [0.00] | [0.02] | [0.01] | [0.00] |
| LN MATERIAL | 0.16* | 0.21* | 0.21** | 0.41*** | -0.11 | 0.15 |
| | [0.06] | [0.05] | [0.02] | [0.00] | [0.68] | [0.20] |
| FOREIGN | 0.031 | 0.37 | -0.031 | 0.18 | 0.43 | -0.11 |
| | [0.84] | [0.17] | [0.92] | [0.44] | [0.66] | [0.51] |
| LN CAPITAL | 0.19 | -0.043 | 0.21** | 0.013 | -0.090 | 0.12 |
| | [0.10] | [0.72] | [0.03] | [0.91] | [0.80] | [0.45] |
| N | 316 | 252 | 158 | 140 | 40 | 173 |
| p-values in brackets<br>* p<0.10, ** p<0.05, *** p<0.01 | | | | | | |

Source: Authors' own calculation based on WBES data.

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