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Labor-Related Knowledge Transfers from Chinese Foreign Direct Investment in Ethiopia and Tanzania

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Abstract

We examine worker training by Chinese manufacturing firms using nationally representative firm-level data from both Ethiopia and Tanzania. While Chinese firms make up a relatively small portion of the manufacturing industry in both Ethiopia and Tanzania, at the firm-level they contribute significantly to both domestic employment and labor training. In both countries more than 85 percent of the workers employed by Chinese firms are local, and Chinese firms (and other foreign firms) are more likely to offer labor training than their domestic counterparts. However, we find evidence that Chinese firms underperform relative to other foreign firms in the share of local workers employed, and in Tanzania the difference is especially large for managerial positions.

Keywords: Ethiopia, Tanzania, labor training, Chinese FDI, manufacturing

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1. Introduction

Chinese investment in African manufacturing is growing increasingly common. Estimates put the stock of Chinese manufacturing FDI in Africa at 12.6 percent of its' investment in the continent second only to mining and construction or USD 5.6 billion (MOFCOM 2021). This investment may play an important role in Africa's ongoing structural transformation by creating jobs and developing capability in the manufacturing sector. Tanzania and Ethiopia are both increasingly destinations for Chinese FDI—from 2006-2019, FDI inflows from China to Tanzania and Ethiopia grew by 15 and 12 percent, respectively.

The potential benefits associated with this Chinese FDI depend in part on whether Chinese firms hire domestic workers, whether these workers are trained by Chinese firms and whether this knowledge is transferred to the rest of the economy. We assess this potential in a comparative context. We begin by examining Chinese firm performance relative to other foreign and domestic firms in terms of the number and share of domestic workers they hire and whether they provide training.

To determine whether working for a Chinese firm is likely to have positive externalities, we examine labor turnover. Labor turnover is one of the most important ways in which knowledge is transferred from foreign to the rest of the economy. This can happen if workers use their training in Chinese firms to start their own firms. For example, Rhee (1990) credits the Daewoo-trained workers for jumpstarting the domestic garment industry in Bangladesh. More recent examples of the benefits of labor turnover include Poole (2013) who finds evidence of knowledge transfer from foreign to domestic plants and Serafinelli (2019) who finds evidence that transfers arise from hiring local workers from highly productive firms. In the context of Ethiopia, around 7 percent of domestic firms report benefitting from hiring workers who previously worked at foreign firms (Abebe et al. 2018).

Our data come from two sources, a technology transfer survey which asks about labor training and manufacturing census data which includes operating information for all manufacturing establishments with 10 or more workers. The technology transfer surveys were administered by Tanzania's National Bureau of Statistics (NBS) in conjunction with their Annual Survey of Industrial Production (ASIP) in 2016 and by Ethiopia's Central Statistical Agency in conjunction with their annual Survey of Large and Medium Scale Manufacturing Industries (LMSM) in 2017. Both the manufacturing censuses and the technology transfer surveys were administered to plant managers. For a detailed description of the census data, see Diao, Ellis, McMillan and Rodrik (2021). For a detailed description of the technology transfer survey, see Abebe, McMillan and Serafinelli (2021).

While Chinese and other foreign firms combined make up less than 15 percent of total firms in either country, we find that at the firm-level, they make important contributions to both local employment and labor training. In both countries and across all ownership types, the share of domestic workers in total employment is above 85 percent. However, we do find significant differences in the share of local workers according to firm ownership—specifically, foreign firms employ a significantly lower share of local workers than domestic firms, and Chinese firms underperform relative to other foreign firms.

Labor training appears to be common among all ownership categories in both countries. An estimation based on the number of firms offering training and the share of workers trained indicates that 9.4 percent and 5.6 percent of manufacturing workers receive training in Tanzania and Ethiopia. These numbers compare relatively well to the U.S. where the share of workers who received on the job training was 8.4 percent in 2008 (CEA 2015). The share of Chinese firms that provide labor training in Ethiopia is relatively high at 31 percent compared to 27 percent for other foreign firms and 20 percent for domestic firms. The share of Chinese firm that provide labor training in Tanzania is even higher at 37 percent but lower than the share of foreign firms that provide labor training in Tanzania which is 44 percent. Only 20 percent of domestic firms in Tanzania provide labor training.

Turning to the potential for externalities, we examine data of where workers go after leaving Chinese and other foreign firms. Unfortunately, we do not have data on worker separations so for this exercise, we rely on reports by firm managers about where workers go after they leave their job with the foreign firm. We find that workers leaving foreign firms (Chinese or otherwise) are more likely, relative to those leaving domestic firms, to end up at another foreign firm.

The remainder of this paper is organized in the following way: Section 2 presents the economic context of Chinese FDI in Africa and discusses this paper's contributions to related literature. Section 3 describes the data in greater detail and describes the summary statistics, while section 4 explores the employment and labor training characteristics of Chinese firms, as compared to other foreign and domestic firms. Section 5 discusses the possibilities for indirect spillovers of labor training to the local economy and section 6 concludes.

2. Context of Chinese FDI in Africa

China represents an important source of FDI in Africa and has been growing its role over the last two decades. In 2019 the estimated total value of Chinese FDI stock in Africa was over USD 40 billion and the total value of inflows to Africa was estimated to be USD 2.5 billion. While China still only accounts for a small portion of total FDI to the continent—around 4.7 percent of FDI stock in 2019—it has attracted attention for its increasing pace (UNCTAD 2020, 2021). FDI

inflows from China to Africa grew by approximately 5 percent per year on average from 2006-2019 (MOFCOM 2021).

Tanzania and Ethiopia have been no exception to this trend. Both countries are pursuing ambitious industrialization strategies that include improving the domestic investment climate and attracting FDI. Tanzania's 2016 National Five Year Development Plan and Ethiopia's 2015 five-year Growth and Transformation Plan both identify FDI as a top priority (NPC 2016, URT 2016). Annual FDI inflows to Tanzania have averaged USD 1.6 billion from 2006-2019, while annual inflows to Ethiopia averaged 1.8 billion over the same period. China is a critical partner for both countries, in 2019 accounting for around 10 percent of average annual FDI inflows to Tanzania and 15 percent to Ethiopia (MOFCOM 2021, UNCTAD 2020). The value of Chinese FDI inflows to both countries has also been growing, by about 15 and 12 percent in Tanzania and Ethiopia, respectively, per year from 2006-2019 (MOFCOM 2021).

Manufacturing FDI inflows are an important part of this growth in FDI. In Tanzania, manufacturing is the industry that receives the second-most FDI, second only to mining (URT 2016). From 2011-2014, average annual greenfield manufacturing FDI in the country was USD 194 million (Chen, Geiger, and Fu 2015). In Ethiopia, from 2011-2014, average annual greenfield manufacturing FDI in the country was a little over USD 1 billion (Chen et al. 2015). Meanwhile, statistics from the Chinese Ministry of Commerce suggests that manufacturing is now the third largest sector of Chinese FDI in Africa, accounting for 12.6 percent of Chinese total FDI stock in the continent, or USD 5.6 billion in stock values (MOFCOM 2021). Taken together, these statistics indicate that Chinese investment is playing an increasingly important role in manufacturing FDI in both countries.

Overall, Chinese investment is generally perceived as 'positive' in terms of economic impact by host countries. A 2020 report using Afrobarometer surveys covering 18 African countries found that around 6 in 10 Africans have a positive view of China's economic and political influence in their countries, while 55 percent say that China's economic activities have "some" or "a lot" of influence on their economy (Sanny and Selormey 2020). However, both proportions have declined over the last five years. This slight decline in the perception of Chinese investment is consistent with some of the bad press on the topic.

Recent research has found evidence that Chinese FDI may be a boon to the local economy through upgrading and skills transfer in manufacturing. For example, Abebe et al. (2018) find evidence that foreign firms introduce a new form of competition for local enterprises, forcing domestic firms to maintain profitability by searching for competitive advantages, such as better marketing and managerial techniques. Furthermore, backward and forward linkages between

foreign and domestic firms facilitate the transfer of new technologies or processes to suppliers of intermediate goods or buyers of their goods (Abebe et al. 2018).

Skills, knowledge, and technology may also be transferred from foreign firms to the local economy through labor turnover. Chinese FDI, especially among small and medium sized firms, is concentrated in skill-intensive sectors in skill-abundant countries but in capital-intensive sectors in capital-scarce countries (Chen et al. 2015). A study specific to Ethiopia and Tanzania found that Chinese factories in Ethiopia produce building materials, leather and shoes, plastics, and other consumer products (Brautigam et al. 2018). Chinese factories in Tanzania also engage in several entry-stage manufacturing sectors, including textiles and apparel, plastic products (shoes, utensils, plastic recycling, and bag production), building and construction materials (steel, glass, gypsum, paint, aluminum tiles), and agro-processing (tannery, cashews, honey, sisal) (Brautigam et al. 2018).

Driven to Africa in part by rising labor costs in China, Chinese-owned firms in Africa may be seeking cheap labor to operate hardware and machinery for industrial upgrading and other activities (Chen et al. 2015). Foreign firms may offer formal training to these workers, or they may gain skills and knowledge on-the-job. A recent study of Chinese FDI in Nigerian manufacturing by Chen et al. (2016) found that Chinese firms in labor intensive industries promote skills transfer through both formal and informal training depending on the specific requirements of production. In their study of Chinese construction FDI, Corkin et al. (2008) find that skilled Chinese expatriates tend to provide training to locally hired low skilled workers. A comparison of skills development among Chinese, foreign, and domestic construction firms in Ghana by Meng and Nyantakyi (2019) suggests that both Chinese and other-foreign enterprises out-contribute domestic firms in local skill development through training of local employees. Compared to domestic firm employees, local workers at a Chinese construction enterprise are 27 percent more likely to receive long-term, skill specific training and 2 percent more likely to receive short-term safety training (Meng and Nyantakyi 2019).

In general, greater technological training translates to a larger likelihood of spillover. Firm training results in accumulation of firm technological capability, which in turn determines the magnitude of potential knowledge spillovers (Chen et al. 2015, Winkler 2013, Gachino 2011). Therefore, it is possible that when foreign firms transfer skills and knowledge to their workers through employee training, this has positive benefits for the local economy. Poole (2013) finds evidence of knowledge sharing through labor movements from foreign to domestic plants irrespective of industry. And Bloom et al. (2018) report that knowledge spillovers from large manufacturing plants in the U.S. enhance the management practices of smaller manufacturing plants in a variety of industries. Recent evidence indicates that managerial skills that are not a priori

industry specific are a key determinant of plant productivity, which suggests that the skills workers gain in foreign firms may generate productivity improvements even after the worker moves on (Bloom and Van Reenen 2010).

This paper adds to the literature regarding African human capital development and Chinese FDI by using newly collected data on labor training to evaluate the formal training practices of Chinese firms relative to other foreign and domestic firms in the context of Ethiopian and Tanzanian manufacturing.

3. Baseline evidence on local employment and labor training

3.1 Measuring labor training

Our analysis draws on cross-sectional firm-level data collected in conjunction with state authorities in Ethiopia and Tanzania. This technology transfer (TT) module was developed in cooperation with the Central Statistical Agency (CSA) in Ethiopia and the National Bureau of Statistics (NBS) in Tanzania and is described in detail in Abebe et al (2021). The module was administered to firms as part of Tanzania's Annual Survey of Industrial Production (ASIP) in 2016 and Ethiopia's annual Survey of Large and Medium Scale Manufacturing Industries (LMSM) in 2017. Both the ASIP and LMSM are censuses, and they aim to cover the entire set of manufacturing firms operating with 10 or more workers.

The TT module that was included in each industrial survey is organized into six sections, asking about 1) respondent information; 2) ownership and firm location; 3) horizontal linkages; 4) vertical linkages; 5) technology and innovation; and 6) labor training. In this paper, we use the information on ownership from the survey module to define firms as Chinese, other foreign, or domestic and information from the labor training section to measure labor training and identify labor linkages between FDI and domestic firms.

Each firm is asked whether they sent their workers to formal training run by local organizations in the last three years, and whether the establishment sends workers overseas for training. If firms respond yes to either, they are then asked to identify the type of training, provider, percentage of workers receiving training, and the average length of training (in days). Options for type of training include production technique, marketing management, finance management, quality control, and other. In Ethiopia the additional option of Kaizen is provided. Options for provider of training include NGOs, government, private companies, association, cooperatives, and others. In Ethiopia the additional options of TVETs and Ethiopian Kaizen Institute are provided.[1]

[1] Kaizen is a business and management philosophy originating in Japan that translates to "continuous improvement" that has been adopted by companies worldwide.

We define binary variables for local and overseas training that are equal to one if the firm responded yes to offering training, and zero if they responded no. We then define a measure of 'any labor training' that is equal to one if a firm reported either type of training and zero otherwise. Finally, we use information from the main survey data to measure employment, which is defined as the total number of workers engaged.

3.2 Summary statistics for analysis sample

In Tanzania, the 2016 round of the ASIP has information from 1,705 firms, 1,416 of which filled out the technology transfer module. In Ethiopia, the 2017 round of the LMSM had 1,903 respondents, 1,874 of which completed the technology transfer module. The relatively higher response rate in Ethiopia is likely because response to the LMSM is legally mandated. In the case of Ethiopia, we further excluded nine firms missing either employment, industry, or region (location) information—no Tanzanian firms in the ASIP TT sample were missing these variables. This leaves us with a final sample of 1,416 firms in Tanzania and 1,865 firms in Ethiopia.

Appendix table A.1 compares relevant statistics for the analysis sample with the firms that did not respond to the technology transfer module.[2] In the case of Tanzania, 334 observations are out-of-sample because they did not respond to the TT module. In Ethiopia, on the other hand, just 29 firms responding to the LMSM did not fill out the TT module. In Tanzania, the out-of-sample firms are significantly more likely to be foreign owned. In the case of Ethiopia, the out-of-sample firms are smaller on average, which is reasonable given that the LMSM is legally mandated and firms that do not complete the survey may have limited resources.

In Table 1 we present summary statistics for our sample of respondents, including a breakdown of firms in terms of ownership—Chinese, other foreign, and domestic. In Tanzania, just 3 percent of plants are Chinese owned; 9 percent are owned by other foreign sources, and 87 percent are wholly domestically owned. In Ethiopia, 2 percent of firms were Chinese owned, while 12 percent had other foreign ownership and 86 percent were wholly domestically owned firms. The analysis in this paper is somewhat limited by the low proportion and total number of Chinese firms, though we do have 42 and 37 Chinese firms to analyze in Tanzania and Ethiopia, respectively—however, these levels are consistent with current estimates of Chinese investment in Africa.[3]

[2] We test for differences in the means of continuous variables and distribution of categorical variables using t-tests and Chi-2 tests, respectively.

[3] Chen et al. (2018) aggregates data across 49 African countries and reveals that China accounts for roughly 3% of the stock of direct investment in Africa. These numbers are also consistent with the share of Chinese FDI stock in Africa estimated from UNCTAD World Investment Reports (2020, 2021).

Table 1 shows the mean number of workers per firm in both countries, as well as workers broken down by worker nationality. In both countries, more than 90 percent of total workers are local, even when we look at worker types. Table 1 also has information on the share of manufacturing firms offering labor training in Tanzania and Ethiopia. In Tanzania, 23 percent of firms report offering some type of labor training; 20 percent offer local training, while 9 percent offer overseas training. For Ethiopia, Table 1 shows that 21 percent of firms offer some type of labor training, with 20 percent offering local training and 3 percent offering overseas training.

4. Identifying differences in local employment and labor training by ownership

We begin by using evidence from the TT module detailing how the employment and labor training characteristics of Chinese firms compare to other foreign and domestic firms. We consider measures of local employment because the benefits of labor training depend on both the level of employment and the share of domestic workers that are gaining skills. Using a simple OLS regression model, we test 1) whether there are differences in local employment and labor training according to ownership and, 2) whether this changes after controlling for employment size, region, and industry. We use OLS to compare the simple means across ownership for ease of comparing the results when we introduce controls. The relationship is modeled by the following equation:

$$y_i = \alpha + \beta_1 \text{Chinese}_i + \beta_2 \text{OtherForeign}_i + \text{X}_i + \epsilon_i \quad (1)$$

where y_i is an outcome variable that measures: 1) the share of domestic workers in total firm employment (Tables 2-3); and 2) labor training as a binary variable that is equal to one if the firm offers labor training, and zero if no training is offered (Table 4). In Tables 2 (Tanzania) and 3 (Ethiopia), we include alternate versions of y_i based on type of worker—the worker types for Tanzania are managerial staff, skilled operatives, and unskilled operatives, and for Ethiopia are administrative workers and production workers.[4] We also test two additional measures of labor training in Tables 5 (Tanzania) and 6 (Ethiopia), which are binary measures indicating whether the firm offered 1) local labor training, or 2) overseas labor training.

The primary coefficients of interest are β_1 and β_2, which measure the relationship between Chinese and other foreign ownership, respectively, with domestic ownership in terms of y_i. We also introduce a vector of firm controls X_i, which include a categorical employment size variable (firm may have 10-19 workers, 20-49, 50 to 99, 100-499 or more than 500 workers) and industry

[4] These categories are based on data availability. In the Tanzania ASIP, the survey divides paid workers into the following categories: 1) managerial, professional, semiprofessional, and clerical staff (managerial, technical, clerical, and other office workers); 2) skilled operatives (foremen, machine operators, fitters); and 3) unskilled operative (manual workers). In the Ethiopia LMSM, paid workers are divided into just two categories, administrative, technical, clerical, and office workers, and production workers. Using these groupings, we create measures of the share of local workers in total managerial positions, the share of local workers in total skilled operatives, and so on.

and region dummies. Employment size is defined according to the total number of persons engaged in the current year.

4.1 Local Employment

Firms in both Tanzania and Ethiopia employ primarily local workers, and the share of domestic workers in total employment is over 95 percent in both countries (Table 1). However, the results in Tables 2 (Tanzania) and 3 (Ethiopia) reveal significant differences among ownership type. In 2016 in Tanzania, 99 percent of workers in domestic firms were locals, compared to 87 percent in Chinese firms and 93 percent in other foreign firms. The difference in share of local employment is even greater when we look at the share of local workers in managerial positions (column 2)—96.5 percent of workers are local in domestic firms, compared to 64 percent in Chinese firms and 79 percent in other foreign firms. For skilled workers, Chinese firms' share of local workers is lower by 7.5 percentage points and for other foreign firms the difference is 3.9 percentage points.

Even after controlling for employment size, industry, and region (columns 5-8), the results are very similar, with only a slight reduction in the difference that is explained by the ownership types. This suggests that the differences in the share of local workers that we see among the different ownership types in Tanzania are not primarily explained by differences in employment size, industry, or region among the three groups.

Table 3 reveals a similar result for Ethiopia, though the difference is less—99 percent of workers in domestic firms are locals, while in Chinese firms it is 95 percent and in other foreign firms is 98 percent. Compared to domestic firms, Chinese firms' share of local administrative workers is lower by 7 percentage points, while other foreign firms' share is lower by 3.4 percentage points. For production workers, Chinese firms' share of local workers is lower by 3.7 percentage points and for other foreign firms the difference is 1.3 percentage points. Similar to Tanzania, when we control for employment size, industry, and region, the coefficients on the ownership types become smaller in magnitude but remain significant.

These results make clear that relative to domestic firms, foreign firms are significantly more likely to employ foreign workers. Furthermore, in all cases, Chinese firms perform worse relative to other foreign firms in terms of the share of domestic workers employed. These trends appear even after we control for employment size, industry, and region, though the differences explained by ownership are slightly reduced. The difference is most pronounced among managers in Tanzania, suggesting there is room for foreign firms to improve in terms of hiring local workers for managerial positions. While we find some evidence of a similar pattern among administrative

workers in Ethiopia, the LMSM survey does not ask about managerial positions separately so we cannot conclude whether this finding holds in Ethiopia.

4.2 Labor Training

We next explore the relationship between labor training and firm ownership, again controlling for firm size, sector, and region. Table 4 reports the results for both countries where the outcome is a binary variable measuring whether a firm offered any labor training. 20 percent of domestic firms offer any labor training in Tanzania, compared to 37 percent of Chinese firms and 44 percent of other foreign firms (column 1). However, it seems that the difference between Chinese and domestic firms may be attributable to employment size, industry, and region rather than origin of ownership, as the significance of the differences go away when we control for these factors in column 2. Specifically, the coefficients on the employment size dummies are positive, significant, and increase with size. Because Chinese (and other foreign firms) tend to employ more workers on average, it seems that this may be part of the explanation for higher rates of labor training among foreign firms in Tanzania. However, the difference between the likelihood of training in other foreign and domestic firms remains significant even after controlling for these factors.

In Ethiopia, 20 percent of domestic firms offer any labor training, compared to almost 31 percent of Chinese firms and 27 percent of other foreign firms (column 3). However, only the difference between domestic and other foreign firms is found to be statistically significant. When we control for firm characteristics (employment size, industry, and region), the results no longer indicate any statistically significant differences in the likelihood of offering labor training by ownership in Ethiopia. Unlike in Tanzania however, the coefficients on the employment size dummies are not significant, indicating that the differences among ownership type are more so explained by industry and region.

Tables 5 and 6 present the results looking at local labor training (columns 1-2) and overseas labor training (columns 3-4) separately. In Tanzania, column 1 of Table 5 indicates that on average, 18 percent of domestic firms offer local labor training, compared to 35 percent of Chinese firms and 40 percent of other foreign firms (column 1). However, once we control for employment size, industry, and region (column 2), the coefficient for Chinese ownership is no longer significant. As for any training, it seems that Chinese firms' greater likelihood of offering local labor training is explained by employment size (larger firms are significantly more likely to offer local training). However, foreign firms have a 7.8 percentage point greater likelihood of offering local training even after these controls. Other foreign firms are also significantly more likely to offer overseas labor training on average (column 3), but this result becomes insignificant when we control for

firm size, while larger firms are significantly more likely to offer overseas labor training (column 4).

In Ethiopia, column 1 of Table 6 shows that 19 percent of domestic firms offer local labor training, compared to 28 percent of Chinese firms and 25 percent of other foreign firms. However, the difference between Chinese and domestic firms is not identified as statistically significant. And similar to Table 4, the result in column 1 disappears when we control for firm characteristics. However, this result is not driven by differences in employment size, as seems to be the case in Tanzania, and instead seems to be related primarily to differences by industry and region. The results for overseas labor training are somewhat similar, except that the result is not as affected by controlling for firm characteristics. Instead, other foreign firms are significantly more likely to offer overseas labor training than domestic or Chinese firm even after controlling for employment size, industry, and region.

In both countries, a greater share of Chinese and other foreign firms than domestic firms offer labor training on average. Based on the above evidence, in Tanzania, differences in the share of foreign and domestic firms providing training can largely be attributed to factors other than ownership, especially employment size. In Ethiopia, the only significant difference in labor training offered among ownership types is that other foreign firms are slightly more likely to offer overseas training.

5. Local Spillovers

We now briefly consider the potential for positive spillovers of labor training from FDI to the broader economy. The idea underpinning this is that workers receiving training in foreign firms can benefit the local economy when they eventually leave that foreign firm and rejoin a domestic firm and transfer the knowledge that they gained from training to that domestic firm. The technology transfer module asks firms whether they have ever hired workers from foreign firms and what benefits they received from doing so. We find that 5.8 percent of domestic firms in Tanzania and 9.6 percent of domestic firms in Ethiopia report hiring workers who previously worked at foreign firms, and a majority of those domestic firms reported receiving benefits to production technologies as a result of the workers' knowledge. If workers tend to join local firms when they leave a Chinese (or other foreign) firm or otherwise continue operating within the local economy, this may be evidence for potential positive spillovers.

The technology transfer module asked firms where they thought workers who left ended up, either: 1) a local firm; 2) a foreign firm; 3) start their own business; 4) unemployment; or 5) other. The results are presented in Figure 1 and show the breakdown between these options for Chinese, other foreign, and domestic firms, respectively. In Tanzania, 41 percent of workers

leaving Chinese firms ended up at a local firm while 26 percent worked for another foreign firm. Similarly, 39 percent of other foreign firms report that workers who left ended up at a local firm while 13 percent said they went to a foreign firm. However, 49 percent of domestic firms reported that their workers went to a local firm and just 5 percent reported workers went to another foreign firm. This indicates that workers leaving foreign firms are more likely, relative to those leaving domestic firms, to end up at another foreign firm. Furthermore, workers leaving Chinese firms are relatively more likely to end up working at another foreign firm than workers leaving other foreign firms, which may indicate that labor training in other foreign firms offers relatively more potential indirect benefits.

Figure 1(b) shows that also in Ethiopia, workers leaving domestic firms are less likely to end up a foreign firm than those leaving foreign firms. Among domestic firms in Ethiopia, 50 percent said that workers leaving went to a local firm while just 3 percent said they went to a foreign firm. Among Chinese firms, 48 percent reported that workers who left ended up at a local firm while 7 percent reported that they went to work for a foreign firm. Meanwhile, 43 percent of other foreign firms said workers left for local firms, while 11 percent said they left for foreign firms. This indicates that in Ethiopia, workers leaving other foreign firms are more likely than those leaving Chinese firms to end up at another foreign firm. This may indicate that relative to other foreign firms, labor training in Chinese firms offers more potential indirect benefits to the local economy.

6. Conclusion

The technology transfer surveys analyzed in this paper reveal that while Chinese firms represent a small share of total manufacturing firms operating in Tanzania and Ethiopia, they do contribute to both local employment and labor training. In both countries and across all ownership types, the share of domestic workers in total employment is above 85 percent. This indicates that Chinese firms, and other foreign firms, are making significant contributions to local employment.

Despite the overall high rates of local employment, analyses in Section 3 find that foreign firms do employ a significantly lower share of local workers when compared to domestic firms, a result that persists even after controlling for employment size, industry, and region. Furthermore, other foreign firms perform slightly better than Chinese firms in terms of the share of local workers employed. The difference in share of local workers between foreign and domestic firms is even greater when measuring the share of local workers in managerial positions in Tanzania and in administrative positions in Ethiopia.

The results on labor training suggest that in both countries, Chinese and other foreign firms are more likely to offer labor training than domestic firms on average. However, there is

evidence that this is largely explained by factors other than ownership. In Tanzania, employment size explains some of the difference the rates of training observed among ownership types, as labor training is positively and significantly associated with employment size, and Chinese and other foreign firms have more workers on average. However, even after controlling for these factors, other foreign firms are significantly more likely than domestic firms to offer any labor training.

In Ethiopia, we find that other foreign firms are significantly more likely than domestic firms to offer local labor training, but this result seems driven by employment size, industry, and regional differences. For overseas labor training, however, other foreign firms are significantly more likely to offer training even when we control for firm characteristics, suggesting the difference is more likely to be due to ownership.

In terms of potential for local spillovers, we find that workers leaving foreign firms are more likely, relative to those leaving domestic firms, to end up at another foreign firm. This is relevant as a greater share of workers that report working within the local economy would indicate more potential for spillover benefits. Comparing Chinese and other foreign firms, in Tanzania workers leaving Chinese firms are relatively more likely to end up working at another foreign firm. In Ethiopia, the reverse is true—workers leaving other foreign firms are more likely than those leaving Chinese firms to end up at another foreign firm. This may indicate that in Tanzania, labor training in other foreign firms offers relatively more potential indirect benefits to the local economy than labor training in Chinese firms, while in Ethiopia training in Chinese firms may be relatively more advantageous.

Based on these findings, we conclude that there are significant differences in local employment and labor training among Chinese, other foreign, and domestic firms in Tanzania and Ethiopia. Regardless of these differences, and the degree to which they are explained by ownership as opposed to other firm characteristics, it is also clear that foreign firms are contributing to both local employment and labor training. Along with other foreign investors, Chinese firms will continue to train their workers to meet new technological advances and regulatory standards. The recent political push and accompanying rise in quantity of Chinese firms in Africa will increase both the incidences of training and R&D and the availability of data. Future studies on Chinese FDI in Africa will be able to exploit data from larger quantities of firms. Regardless of its origin, FDI matters to economic productivity and labor spillover.

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Tables

Table 1: Summary statistics by firm ownership

	No. Obs	Mean	SD	Min	Max
Tanzania 2016					
Domestic firms	1,416	0.88	0.33	0	1
Chinese firms	1,416	0.03	0.18	0	1
Other foreign firms	1,416	0.09	0.28	0	1
No. of workers	1,416	54	202	10	4,064
Share of domestic workers in total (%)	1,416	0.98	0.06	0	1
Share of domestic managers in total (%)	1,138	0.93	0.18	0	1
Share of domestic skilled workers in total (%)	1,173	0.98	0.09	0	1
Share of domestic unskilled workers in total (%)	1,136	1.00	0.04	0	1
Offers any training (% of firms)	1,416	0.23	0.42	0	1
Offers local training (% of firms)	1,416	0.09	0.28	0	1
Offers overseas training (% of firms)	1,416	0.20	0.40	0	1
Ethiopia 2017					
Domestic firms	1,865	0.86	0.35	0	1
Chinese firms	1,865	0.02	0.15	0	1
Other foreign firms	1,865	0.12	0.32	0	1
No. of workers	1,865	86	244	2	5,017
Share of domestic workers in total (%)	1,865	0.99	0.04	0	1
Share of domestic administrative workers in total (%)	1,681	0.99	0.08	0	1
Share of domestic production workers in total (%)	1,822	1.00	0.03	0.3	1
Offers any training (% of firms)	1,865	0.21	0.41	0	1
Offers local training (% of firms)	1,865	0.04	0.19	0	1
Offers overseas training (% of firms)	1,865	0.20	0.40	0	1

Sources: Ethiopia Survey of Large and Medium Scale Manufacturing Industries, 2017 and Tanzania Annual Survey of Industrial Production, 2016

Notes: This table reports summary statistics related to employment and labor training by firm ownership for the sample of firms that responded to the technology transfer module (1,416 firms in Tanzania and 1,865 in Ethiopia). We report the average firm-level number of persons engaged in the reporting year.

Table 2: Relationship between Share of Domestic Labor and Ownership, Tanzania 2016

VARIABLES	(1) Share of domestic workers	(2) Share of domestic managers	(3) Share of domestic skilled workers	(4) Share of domestic unskilled workers	(5) Share of domestic workers	(6) Share of domestic managers	(7) Share of domestic skilled workers	(8) Share of domestic unskilled workers
Firm is Chinese owned	-0.119***	-0.322***	-0.085**	-0.001	-0.093***	-0.247***	-0.067*	-0.000
	(0.018)	(0.049)	(0.034)	(0.002)	(0.017)	(0.051)	(0.035)	(0.002)
Firm is foreign, non-Chinese owned	-0.065***	-0.179***	-0.045***	-0.004	-0.057***	-0.114***	-0.032*	-0.003
	(0.009)	(0.025)	(0.015)	(0.003)	(0.011)	(0.028)	(0.017)	(0.004)
20-49 workers					0.000	-0.019	0.004	-0.003
					(0.004)	(0.012)	(0.005)	(0.004)
50-99 workers					0.007	-0.049**	-0.004	0.002
					(0.007)	(0.022)	(0.014)	(0.002)
100-499 workers					0.003	-0.126***	-0.015	0.000
					(0.008)	(0.027)	(0.017)	(0.003)
500+ workers					0.022*	-0.107*	0.002	0.002
					(0.012)	(0.064)	(0.022)	(0.003)
Share of domestic workers in domestic firms	0.992	0.965	0.991	0.999	0.992	0.965	0.991	0.999
	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.059)	(0.024)	(0.006)
P-value for region controls	n/a	n/a	n/a	n/a	0.000	0.000	0.270	1.000
P-value for industry controls	n/a	n/a	n/a	n/a	0.001	0.020	0.060	0.999
Observations	1,416	1,416	1,416	1,416	1,416	1,416	1,416	1,416
R-squared	0.241	0.867	0.955	0.994	0.328	0.884	0.958	0.994

Notes: In this table we regress the share of local workers in total employment on firm ownership type. In columns 2-4 we use the share of local workers in the following types of work: col 2 - managerial, professional, semiprofessional, and clerical staff (managerial, technical, clerical, and other office workers; col 3 - skilled operatives (foremen, machine operators, fitters); and col 4 - unskilled operative (manual workers). If a firm does not employ any of a given type of worker, we replace their share as zero and include a binary variable to capture the effect of these firms, which is not included for brevity. The reference ownership category is domestic firms and we report the average share of local workers (for each worker type) employed by domestic firms, for ease of interpreting the meaning of the coefficients on Chinese and other foreign ownership. We include employment size dummies as well as industry and regional controls in columns 5-8, but do not report the coefficients on industry or region for brevity. The reference employment size category is 10-19 workers. Employment size is defined by the total number of persons engaged in the current year. We use F-test to test for joint significance of the industry and regional dummies and report the associated p-values. Robust SEs in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Relationship between Share of Domestic Labor and Ownership, Ethiopia 2017

VARIABLES	(1) Share of domestic workers	(2) Share of domestic admin workers	(3) Share of domestic production workers	(4) Share of domestic workers	(5) Share of domestic admin workers	(6) Share of domestic production workers
Firm is Chinese owned	-0.038***	-0.070***	-0.037***	-0.038***	-0.056**	-0.035***
	(0.011)	(0.022)	(0.014)	(0.011)	(0.023)	(0.013)
Firm is foreign, non-Chinese owned	-0.014***	-0.034***	-0.013***	-0.015***	-0.025***	-0.012***
	(0.004)	(0.010)	(0.004)	(0.004)	(0.009)	(0.005)
20-49 workers				0.005**	-0.002	-0.001
				(0.002)	(0.003)	(0.002)
50-99 workers				0.004	-0.009	-0.005
				(0.004)	(0.007)	(0.004)
100-499 workers				0.013***	-0.009	0.005*
				(0.003)	(0.007)	(0.003)
500+ workers				0.013***	-0.001	0.003
				(0.004)	(0.015)	(0.003)
Share of domestic workers in domestic firms	0.993	0.993	0.998	0.993	0.993	0.998
	(0.000)	(0.000)	(0.000)	(0.006)	(0.017)	(0.006)
P-value for region controls	n/a	n/a	n/a	0.000	0.001	0.020
P-value for industry controls	n/a	n/a	n/a	0.000	0.002	0.010
Observations	1,865	1,865	1,865	1,865	1,865	1,865
R-squared	0.038	0.938	0.951	0.076	0.941	0.953

Notes: In this table we regress the share of local workers in total employment on firm ownership type. In columns 2-4 we use the share of local workers in two different types of work: col 2 - administrative, technical, clerical, and office workers and col 3 - production workers. If a firm does not employ any of a given type of worker, we replace their share as zero and include a binary variable to capture the effect of these firms, which is not included for brevity. The reference ownership category is domestic firms and we report the average share of local workers (for each worker type) employed by domestic firms, for ease of interpreting the meaning of the coefficients on Chinese and other foreign ownership. We include employment size dummies as well as industry and regional controls in columns 5-8, but do not report the coefficients on industry or region for brevity. The reference employment size category is 10-19 workers. Employment size is defined by the total number of persons engaged in the current year. We use F-test to test for joint significance of the industry and regional dummies and report the associated p-values. Robust SEs in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Relationship between Labor Training and Firm Ownership, Tanzania (2016) and Ethiopia (2017)

	(1) Tanzania, 2016	(2) Column 1 w/ controls	(3) Ethiopia, 2017	(4) Column 3 w/ controls
Chinese	0.149**	0.008	0.106	0.112
	(0.071)	(0.080)	(0.072)	(0.075)
Other foreign	0.249***	0.090*	0.068**	0.052
	(0.046)	(0.047)	(0.032)	(0.034)
20-49 workers		0.075**		0.017
		(0.030)		(0.023)
50-99 workers		0.218***		0.046
		(0.051)		(0.036)
100-499 workers		0.263***		0.038
		(0.054)		(0.034)
500+ workers		0.256**		-0.037
		(0.125)		(0.053)
Share of domestic firms offering labor training	0.199 (0.000)	0.199 (0.158)	0.204 (0.000)	0.204 (0.048)
P-value for region controls	n/a	0.000	n/a	0.000
P-value for industry controls	n/a	0.000	n/a	0.000
Observations	1,416	1,416	1,865	1,865
R-squared	0.031	0.176	0.004	0.021

Notes: In columns 1 and 3 we regress a binary variable indicating whether a firm offers any labor training on a categorical indicator for ownership; the reference category is domestic firms. The constant in these columns can be interpreted as the share of domestic firms that offer any labor training. In columns 2 and 4 we introduce employment controls; the reference employment size category is 10-19 workers and employment size is defined by the total number of persons engaged in the current year. In addition to the employment dummies, we include industry and regional controls, but do not report the coefficients for brevity. We use F-test to test for joint significance of the industry and regional dummies and report the associated p-values. Robust SEs in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Relationship between Local and Overseas Labor Training and Firm Ownership, Tanzania 2016

VARIABLES	(1) Local labor training	(2) Column 1 w/ controls	(3) Overseas labor training	(4) Column 3 w/ controls
Chinese	0.173**	0.038	0.053	-0.021
	(0.071)	(0.080)	(0.050)	(0.055)
Other foreign	0.233***	0.078*	0.099***	0.046
	(0.045)	(0.045)	(0.035)	(0.034)
20-49 workers		0.055*		0.048**
		(0.029)		(0.021)
50-99 workers		0.199***		0.032
		(0.050)		(0.035)
100-499 workers		0.254***		0.074**
		(0.054)		(0.037)
500+ workers		0.223*		0.243**
		(0.124)		(0.106)
Share of domestic firms offering labor training	0.175 (0.000)	0.175 (0.150)	0.077 (0.000)	0.077 (0.090)
P-value for region controls	n/a	0.000	n/a	0.000
P-value for industry controls	n/a	0.001	n/a	0.000
Observations	1,416	1,416	1,416	1,416
R-squared	0.032	0.176	0.011	0.120

Notes: See the notes on table 4. These results follow the same format, but in columns 1-2 we use the outcome binary variable for local labor training, and in columns 3-4 we use a binary variable for overseas labor training. Robust SEs in parentheses. *** p<0.01, ** p<0.05, * p<0.1

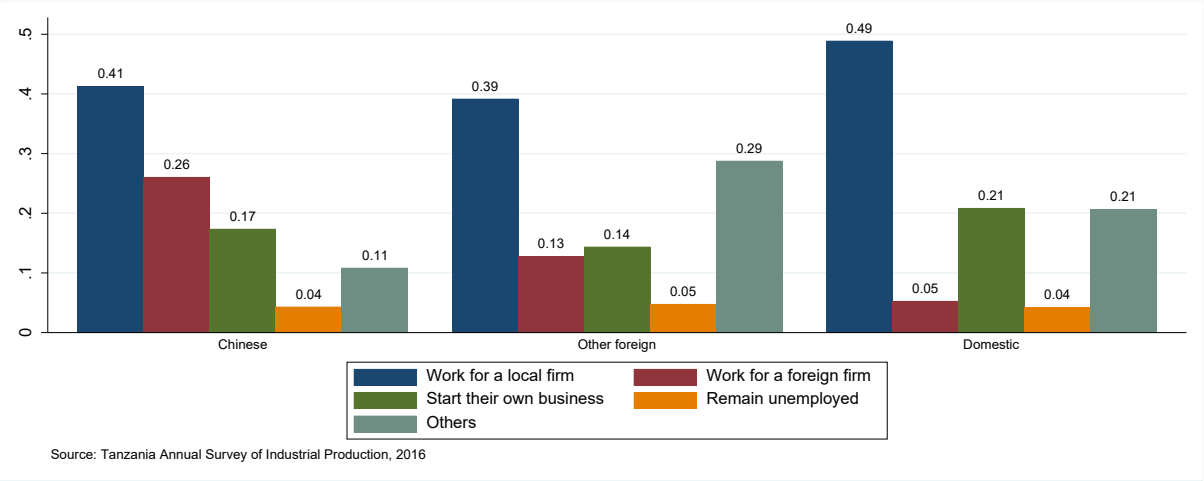
Table 6: Relationship between Local and Overseas Labor Training and Firm Ownership, Ethiopia 2017

VARIABLES	(1) Local labor training	(2) Column 1 w/ controls	(3) Overseas labor training	(4) Column 3 w/ controls
Chinese	0.092	0.102	0.065	0.068
	(0.070)	(0.073)	(0.046)	(0.048)
Other foreign	0.055*	0.040	0.047**	0.046**
	(0.031)	(0.033)	(0.018)	(0.020)
20-49 workers		0.016		-0.017*
		(0.022)		(0.010)
50-99 workers		0.024		0.027
		(0.035)		(0.020)
100-499 workers		0.027		0.013
		(0.033)		(0.018)
500+ workers		-0.027		-0.054***
		(0.053)		(0.013)
Share of domestic firms offering labor training	0.194 (0.000)	0.194 (0.049)	0.030 (0.000)	0.030 (0.028)
P-value for region controls	n/a	0.000	n/a	0.001
P-value for industry controls	n/a	0.000	n/a	0.002
Observations	1,865	1,865	1,865	1,865
R-squared	0.003	0.021	0.009	0.032

Notes: See the notes on tables 4 and 5. Robust SEs in parentheses. *** p<0.01, ** p<0.05, * p<0.1

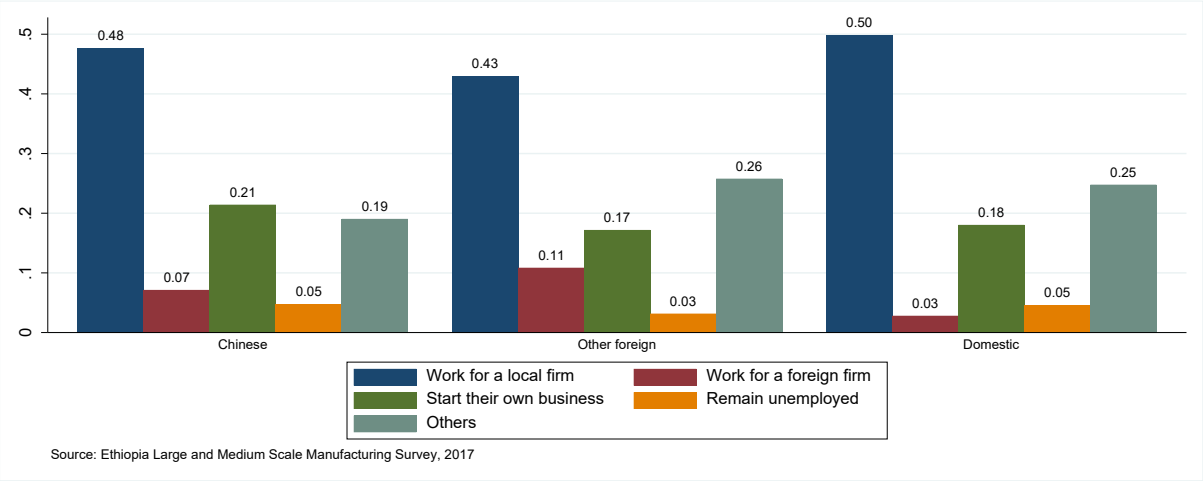
Figures

Figure 1(a): Where workers end up after leaving a firm, Tanzania 2016



Source: Tanzania Annual Survey of Industrial Production, 2016

Figure 1(b): Where workers end up after leaving a firm, Ethiopia 2017



Source: Ethiopia Large and Medium Scale Manufacturing Survey, 2017

Notes: These numbers represent answers from firms to the question "To your knowledge, where do you think most of the workers who leave your enterprise for various reasons (for example, quit, fired or contract expired) end up?".

Appendix

Table A.1 Comparing Means of Firm Characteristics for In-sample and out-of-sample firms

Tanzania 2016			
	In sample mean	**Out of sample mean**	**Difference**
Firm is foreign or joint venture owned (% of firms)	0.12	0.22	-0.10***
No. of workers	53.9	73.7	-19.8
No. of domestic workers	52.5	71.0	-18.5
No. of foreign workers	1.4	2.7	-1.3***
Food processing, beverages, tobacco (% of firms in sector)	0.44	0.40	0.04
Textiles, wearing apparel, leather	0.04	0.06	-0.02
Paper, printing	0.04	0.06	-0.03**
Wood and furniture	0.17	0.15	0.03
Coke, refined petrol, chemicals, pharmaceuticals, and rubber and plastics	0.06	0.08	-0.02
Non-metallic minerals, basic metals, fabricated metals except machinery and equipment	0.19	0.18	0.01
Computer and electric, machinery, motor vehicles and other transport equipment	0.03	0.04	-0.01
Other manufacturing	0.03	0.03	0.00
Ethiopia 2017			
	In sample mean	**Out of sample mean**	**Difference**
Firm is foreign or joint venture owned (% of firms)	0.05	0.00	0.05
No. of workers	86.3	62.0	24.3
No. of domestic workers	85.6	61.9	23.7
No. of foreign workers	0.67	0.08	0.59
Food processing, beverages, tobacco (% of firms in sector)	0.27	0.07	0.20**
Textiles, wearing apparel, leather	0.12	0.17	-0.05
Paper, printing	0.05	0.10	-0.06
Wood and furniture	0.15	0.14	0.01
Coke, refined petrol, chemicals, pharmaceuticals, and rubber and plastics	0.08	0.07	0.02
Non-metallic minerals, basic metals, fabricated metals except machinery and equipment	0.31	0.45	-0.14
Computer and electric, machinery, motor vehicles and other transport equipment	0.02	0.00	0.02
Other manufacturing	0.00	0.00	0.00

Notes: In this table we use alternate measures of foreign ownership that do not come from the technology transfer module, so they are comparable across groups. We also look at number of workers (also domestic and foreign workers), and industry (in aggregations of ISIC 2-digit categories). We use t-tests and Chi-2 tests to evaluate the significance of the difference in means and distributions of the continuous and categorical variables, respectively, between the in-sample and out-of-sample groups. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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