Identifying the Local Effects of FDI: Evidence from Ethiopia *

Girum Abebe, Margaret McMillan, Michel Serafinelli, Inigo Verduzco†

PRELIMINARY AND INCOMPLETE, FOR COMMENTS ONLY

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Abstract

Little is known about the local effects of foreign direct investment (FDI). This paper presents direct evidence on the effect of FDI on domestic plants at the local level. In particular, we evaluate the changes in total factor productivity (TFP) and the rate of entry of domestic plants when a large FDI plant is added to a locality. We use Ethiopian manufacturing establishment data from 1997 to 2013 combined with a survey module designed by us. Our identification strategy exploits the government designation of locations for large greenfield FDI plants, in combination with an event study research design. Using this strategy, we show that the entry of a large FDI plant in a locality increases the TFP of domestic plants by 13 percent. We also find positive net entry of firms in treated localities. The estimated spillover effect does not appear to reflect higher output prices. Descriptive evidence from the survey module clearly indicates the existence of technology transfer via backward and forward linkages in the supply chain, labor flows from FDI to domestic plants and communication externalities.

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1 Introduction

A prominent feature of the global economic landscape in the past few decades has been the significant increase in the international flow of foreign direct investment (FDI). The annual inflow of FDI in the world has grown from 54 billion USD in 1980 to 1.7 trillion USD in 2015 (UNCTAD, 2014, 2016). Many developing countries today offer special incentives to foreign companies, under the rationale that FDI can generate positive spillover effects within the host economy.

Researchers have long speculated that domestic manufacturing plants may indeed benefit from the presence of FDI - eg. Markusen (2001); Fosfuri, Motta, and Rønde (2001); Gorg and Strobl (2001); Dasgupta (2011). And a large body of work has been devoted to estimating the effects of FDI on host country outcomes - eg. Haddad and Harrison (1993); Aitken and Harrison (1999); Javorcik (2004); Haskel, Pereira, and Slaughter (2007). The existing empirical literature on FDI typically estimates a production function in which the variable of interest is the share of FDI in a given industry or large region\(^1\). Little is known about the local effects of FDI.

This paper is to our knowledge the first to present direct evidence on the effect of FDI on domestic plants at the local level. In particular, we evaluate the changes in total factor productivity (TFP) and the rate of entry of domestic plants when a large FDI plant is added to a locality. Our setting is the Ethiopian manufacturing sector. Since the late 1990s, the Ethiopian government has made the expansion of the labor intensive manufacturing sector a priority. FDI has been viewed by the government as critical to technology upgrading in this sector. As a result, laws concerning investment have been amended several times since the late 1990s and a variety of incentives have been put in place in order to attract FDI. The result has been a dramatic increase in FDI flows to Ethiopia’s manufacturing sector; net

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FDI inflows to Ethiopia have increased from 135 million USD in 2000 to 2 billion USD in 2015 (UNCTAD, 2014; FDRE, 2016) with manufacturing FDI accounting for 72 percent of foreign capital invested in 2015 (EIC, 2016).

In order to study the extent to which Ethiopian plants are affected by the presence of FDI in their locality, we use two data sources: manufacturing establishment survey data for the period 1997 to 2013 collected by Ethiopia’s Central Statistics Agency (CSA), and a technology transfer survey module designed by us and administered with the 2013 round of CSA manufacturing establishment survey. The manufacturing establishment data enable us to evaluate how domestic plants’ output changes when a large FDI greenfield plant opens in their locality. The survey module has three key functions: (a) it informs the research design, by giving us key information on government designation of locations for large greenfield FDI plants, as detailed below, (b) it complements the quantitative evidence and (c) it allows us to explore microeconomic mechanisms that can account for observed changes.

We first estimate augmented Cobb-Douglas production functions that allow the output of domestic plants to depend on the presence of a new large FDI plant in the locality. Our geographic unit of observation is a Woreda, an administrative district comparable to a U.S. county. A plant is defined as large if it accounts for more than 1 percent of the district’s total manufacturing workforce. Since a new large FDI plant’s location is chosen to maximize profits, the selected district should be better than an average district in terms of local cost shifters which are difficult to quantity, such as the quality of the labor force and transportation infrastructures. Our solution to this identification challenge is to exploit the government designation of locations for large greenfield FDI plants, in combination with an event study research design. Specifically in our survey module we asked plants why they chose a given location for their production facility. We consider as valid events the openings of large FDI plants reporting that their location was allocated by the authorities. Then we compare

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2 The Ethiopia administrative subdivisions are, in order of size: Regions, Zones, Woreda, Kebele (municipalities).
changes in the outcomes of treated districts (i.e. localities that received a large FDI plant whose location is designated by the government) both to districts that have not yet been treated and districts that will never be treated during our sample period.

Our estimates show that incumbent domestic plants in treated localities experience a 13 percent increase in plant total factor productivity (TFP) after the entry of large FDI plants. In addition, we find positive net entry of firms in treated localities, which theory predicts will happen if the benefits are large enough to produce a rise in profits. A concern for the validity of our interpretation of the estimates arises from the observation that the dependent variable in the econometric model is the value of output. The estimated spillover effect may therefore reflect higher output prices driven by increased demand, instead of higher productivity. We show that our estimates are largely unchanged when we remove domestic plants in a supply link with FDI plants. Moreover, we fail to reject the null hypothesis of no local impact of the opening of large domestic plants whose location is designated by the government, which might have a comparable impact on demand for domestic plants’ output. These exercises suggest that higher output prices are not an important source of our estimated spillover effects.

We then turn to an analysis of responses to our survey module. The module contains a set of questions on FDI and FDI-domestic firm interactions for 1,708 manufacturing plants, interviewed when the 2013 CSA data were collected, in February 2014. Tabulations of survey responses indicate show that 13 percent of domestic plants report to have directly adopted production processes by observing FDI firms. Plants with linkages to FDI firms (backward and forward) and that have employed workers previously employed by FDI firms (labor-linked) are significantly more likely to report such occurrence. Similar evidence emerges concerning the use of technology licensed from FDI firms. Moreover, 65 percent of domestic plants report to have changed production technologies as a result of hiring workers previously employed by FDI firms. In particular, 65 percent of the domestic plants report
to have changed production technologies as a result of hiring from FDI. Overall, the des-
criptive evidence from the survey clearly indicates the existence of knowledge diffusion via
backward and forward linkages in the supply chain, labor flows from foreign to domestic
plants and communication externalities (defined as face-to-face meetings, word-of-mouth
communication and direct interactions between skilled workers from different firms).³

As discussed above, our paper is closely related to the body of work in international trade
and development economics analyzing FDI spillovers. In addition to the studies already
discussed our findings are also related to two convincing firm-level empirical analyses of
knowledge transfer through labor mobility from foreign to domestic plants. Balsvik (2011)
show productivity gains due to worker flows from foreign multinationals to domestic firms
in Norway. Poole (2013) finds a positive effect of the share of new workers previously
employed by foreign-owned firms on wages paid in domestic firms in Brazil. Furthermore,
this study is related to Figlio and Blonigen (2000) who investigate the effects of FDI on local
communities in South Carolina and find that FDI raises local real wages much more than does
domestic investment. It is also related to Javorcik (2008) who, using data collected through
enterprise surveys conducted in the Czech Republic and Latvia, finds evidence suggesting
that the entry of multinationals affects domestic enterprises through knowledge spillovers.

In addition, our paper adds to the empirical literature in urban economics examining pro-
ductivity advantages through agglomeration, a literature reviewed in Rosenthal and Strange
(2004) and Combes and Gobillon (2015). Despite the difficulties involved in estimating
agglomeration effects, a consensus has emerged, from analysis using data for developed
countries, that significant advantages of agglomeration exist for many industries (Rosenthal
and Strange, 2003; Ellison, Glaeser, and Kerr, 2010; Arzaghi and Henderson, 2008; Green-
stone, Hornbeck, and Moretti, 2010a; Combes, Duranton, Gobillon, Puga, and Roux, 2012;
Baum-snow, 2013). We contribute to this literature by shedding light on how agglomeration

³See Charlot and Duranton (2004)
operates within a developing country context.\textsuperscript{4} Of course, we may expect different local effects in our context with the entry of a FDI plant in a developing country where the baseline TFP level is lower and market frictions are more severe.\textsuperscript{5}

While the issues analyzed in this paper are of general interest, the specific case of Ethiopia is also important. Until the late 1990s, FDI companies had a limited presence. The recent growth in FDI is among the most important structural changes the country has undergone. Industrialization is a relatively recent development, spurred, to some extent, by the government’s drive to expand the manufacturing sector. Attracting quality FDI that can generate spillovers to the domestic economy is an integral part of this strategy. Our work can therefore also be seen as validation of a cornerstone in the industrial policy of the Ethiopian government.

The remainder of this paper is organized as follows. Section 2 introduces the identification strategy and the econometric model. Section 3.1 discusses some background and the data sources. Section 4 describes the results. Section 5 concludes.

\section{Research Design and Econometric Model}

\subsection{Government Designation of FDI Plants’ Location}

Since a new large FDI plant’s location choice is made to maximize profits, selected districts should typically be better than an average district in terms of local cost shifters which are difficult to quantity, such as the quality of the labor force and transportation infrastructure.

\textsuperscript{4}Our findings regarding the channels echo those in Serafinelli (2015) of labor market-based knowledge spillovers for the Veneto region of Italy and those in Charlot and Duranton (2004) of communications externalities for France.

\textsuperscript{5}Our empirical approach is somewhat similar to Greenstone, Hornbeck, and Moretti (2010b). In their paper, U.S. counties compete for a large industrial plant to locate within their jurisdictions, and the "losing" counties are used as counterfactual for the "winning" ones. In our strategy, the government designates the location, resulting in a different set of issues to be explored, related to the growing literature on place-based policies (Glaeser and Gottlieb, 2008; Kline, 2010; Kline and Moretti, 2014; Neumark and Simpson, 2015).
This paper’s solution is to this important identification challenge is to exploit the government designation of locations for certain large greenfield FDI plants.

One of the most important tools the Ethiopian government is using to promote investment in the manufacturing sector is the allocation of land at cheap (nominal) prices.6 In order to foster equitable regional growth, the government often encourages FDI firms to invest in areas with lower levels of pre-existing investment. The investment proclamation, for example, grants a range of incentives including additional years of income tax exemption for projects located outside of Addis Ababa and its surrounding areas, which is home to more than 80 percent of manufacturing investment (FDRE, 2102).

Using our survey module, we can identify large FDI projects that strictly followed the government’s recommendation to invest in a specified location. We asked plant managers what the most important reason for choosing the location for the production facility was. We consider as valid events for our identification strategy the openings of large FDI plants reporting "Did not choose the location, was allocated by the authorities".7 We then compare changes in the outcomes of treated districts (i.e. localities that received a large FDI plant whose location is designated by the government) both to districts that have not yet been treated and districts that will never be treated during our sample period. Section 3.2 provide more details on the definition of events.

It is important to note that government designation is not a forced measure.8 In addi-

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6In Ethiopia, land is publicly owned and both local and foreign firms can enter into lease-hold or rental arrangements to acquire land for investment.
7The other possible answers are “Cheap labour”, ”Good infrastructure”, ”Located close to raw materials and input suppliers”, ”Located close to customers”, ”Located close to producers of similar products”, ”Expected that many more producers would be located in this site”, ”Others (specify)”.
8In an email interview, the General Director of Policy and Program Studies explained the role played by the government:

The Ministry of Industry only provides advice as to which area is best suited for a particular project. If the potential investor is interested in the options of locations provided, the Ministry contacts the Regional officials to facilitate land. The region then provides information on the land availability and locations and arrange visits. Then if the investor is interested, negotiations take place on the price and terms of lease. ”Allocation” of land by Regional Governments/City administrations follow their own master plans or industrial development designated
tion, the government selects potential locations based on several observable characteristics of interest to them. These include (but are not limited to) employment size, sector, and the exporting and local linkages potential of the industry. However, the fact that plant managers report that location was not chosen but allocated provides support to our strategy of using government designation to obtain some quasi-experimental variation in the treatment. Moreover, the subsequent analysis provides evidence that the treated localities are not on a relative positive trend in productivity before the treatment. If anything, the designated localities appear to display a negative trend, suggesting that the government operates in a way to address regional imbalances.

2.2 Econometric Model

We evaluate the local impact of FDI using an "event-study" research design - see for instance Kline (2011). This design allows us to test for the presence of differential pre-trends and recover any dynamics of the FDI plant opening effect.

The regression equation that forms the basis of our empirical analysis on the sample of domestic plants is:

\[
\ln(Y_{pijt}) = \beta_L \ln(L_{pijt}) + \beta_K \ln(K_{pijt}) + \beta_M \ln(M_{pijt}) + \sum_\tau \beta_\tau D_{jt}^\tau + \alpha_j + \mu_{it} + \varepsilon_{pijt},
\]

where \( p \) references plant, \( i \) industry, \( j \) locality, and \( t \) year; \( Y_{pijt} \) is the value of total plant production and we allow total number of employees \( L_{pijt} \), total capital inputs \( K_{pijt} \) and materials inputs \( M_{pijt} \) to have separate impacts on output; we also allow for permanent differences across districts \( \alpha_j \), industry-specific time-varying shocks \( \mu_{it} \) and a stochastic error term \( \varepsilon_{pijt} \). The \( D_{jt}^\tau \) are a sequence of "event-time" dummies that equal one when the
entry of a large, government-assigned FDI plant is \( \tau \) years away in a district. Formally:

\[
D_{jt}^\tau \equiv I[t - e_j = \tau],
\]

where \( I[.] \) is an indicator function for the expression in brackets being true, and \( e_j \) is the year of the plant entry. Therefore the \( \beta_x \) coefficients characterize the time path of output (controlling for inputs) relative to the date of the FDI plant opening for "treated" districts, conditional on the unobserved variance components \( \alpha_j + \mu_{it} + \epsilon_{pijt} \).

The results are obtained by estimating Equation (1) by OLS. Standard errors are clustered at the district level.

3 Background and Data

3.1 Data

This study uses two data sources: manufacturing establishment data for the years 1997-2013 collected by Ethiopia’s Central Statistics Agency (CSA)\(^9\), and a technology transfer survey module designed by us. The data consists of enterprises engaged in “the mechanical, physical, or chemical transformation of materials, substances, or components into new products and the assembling of component and parts of manufactured products” (CSA, 2015). The available information includes employment, material and non-material inputs, capital stock, financing, taxes, sales, exports, geographic location, date of establishment. This dataset is one of the few comprehensive ones in Africa that collects detailed information about manufacturing establishments over time covering a broad range of topics with a consistent survey instrument. See Section A.I for details on the data construction.

The module contains a set of questions on FDI and FDI-domestic firm interactions for

\(^9\)Data for 1996/97 are not available.
1,708 manufacturing plants belonging to the CSA dataset, interviewed in February 2014. In our analysis, we exploit a categorization of domestic plants in three groups: (a) labor-linked, if they have employed former workers of FDI firms (Balsvik, 2011; Poole, 2013); (b) backward-linked, if they generate 25 percent or more of their sales revenue from directly selling to FDI firms (Javorcik, 2004); and (c) forward-linked, if 25 percent or more of their inputs are purchased directly from FDI firms.

Table 1 shows that around 7 percent of domestic plants are labor-linked, 3 percent are backward-linked and [...] percent are forward-linked. Table ?? shows that the degree of linkages varies considerably by industry type. Labor linkages are more common in wearing apparel, rubber and plastic products, and textiles. Backward linkages are more common in rubber and plastic products, chemical products, and fabricated metal products. Forward linkages are more common in [...] 10

3.2 Definition of Events

We define an event as a new FDI plant opening in a district whenever the following two conditions are met: a) The FDI plant’s labour force constitutes at least 1% of total employment in the local labour market at entry; and b) The plants reports having been assigned its location by the Ethiopian government. In order to cleanly identify any treatment effects, we further restrict our sample to districts that do not receive any other "large" FDI (employing >1% of the local labour force), whether their location was mandated by the government or chosen by the firms’ owners, within 3 years before and 3 years after the event.

There are 238 FDI plants that appear in our sample. Of these, 135 meet the threshold of employing at least 1% of the local workforce and of the latter, 60 report having been

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10 The Table shows 9 industries in which more than 90% of the domestic plants in our sample are operating in.
assigned their location by the government. Lastly, 10 of these firms began operations prior to or in 1997, which makes them unsuitable to our event study, which leaves us with 50 large FDI firms that began operations post-1997 and report having been assigned their location by the government. Some of these firms are located in the same districts, however, in our event study, we further exclude any plants that open in the same district within 3 years of one another, which drops our final count of usable events from 50 to 32.

4 Results

4.1 Using CSA manufacturing establishment data

Baseline Estimates Figure 1 plots the estimated $\beta_r$ coefficients from a regression of the form given in Equation (1). There is a large rise in the productivity of local plants after the entry of a large, government-assigned FDI plant. While the visual pattern is clear, some of the individual $\beta_r$ coefficients are not estimated very precisely. We therefore offer more formal tests of the null hypothesis that the large FDI plant entry has no impact on local plants’ TFP. To increase statistical power, we test hypotheses about averages of the $\beta_r$ coefficients over various time intervals. The estimates are shown in Table 2: the entry of a large FDI plant in a locality increases the TFP of domestic plants by 13 percent. Figure 2 show that the estimates are similar when we test for the presence of differential pre-trends and recover the dynamics of the FDI plant opening effect over a longer horizon.

Firm Entry as Indirect Test of Spillovers If the benefits are large enough to produce an increase in profits, we should observe a corresponding increase in entry of firms within treated localities. We now turn to exploring this empirical prediction. Specifically, the re-
gression equation that forms the basis of our empirical analysis of firm entry is:

\[ \ln(Plants_{jt}) = \sum_{\tau} \beta_{\tau} D_{jt}^{\tau} + \psi_t + \alpha_j + \varepsilon_{jt}, \]  

(2)

where \( Plants_{jt} \) is the count of domestic plants, and \( \psi_t \) is a year effect. Results are shown in Figure 3 and Table 3: the entry of a large FDI plant in a locality increases the TFP of domestic plants by 22 percent.

4.2 Using the technology transfer survey module

We now turn to the analysis of responses to our survey module. Table 4 shows that about 13 percent of domestic plants report having directly adopted production techniques/processes by observing (or copying) FDI firms in the same industry, indicating the presence of knowledge transfer. Linked firms are significantly more likely to report learning having occurred from FDI plants: the share is about 38 percent for labor-linked, 26 percent for backward-linked and 25 percent for forward-linked plants. This suggests that the likelihood of knowledge transfer increases with the degree of interaction. Table 4 also shows that 11 percent of domestic plants report using technology licensed from FDI firms, and the share is significantly higher for labor-linked plants (32 percent). Overall, the findings in Table 4 echo those in Charlot and Duranton (2004) who, using data for France, find evidence of various forms of communication externalities: face-to-face meetings, word-of-mouth communication and direct interactions between skilled workers from different firms. Interestingly, the vast majority of firms that copied technology from FDI indicated that FDI firms did not try to block the technology learning from happening, similar to the findings in von Hippel (1987)’s case-study of the US steel minimill industry.

We now investigate the extent to which domestic plants benefit from hiring workers from FDI firms. Table 5 reports the perceived benefits experienced by domestic plants that em-
ployed skilled workers from FDI firms: 65 percent of the domestic plants report having
changed production technologies as a result of hiring from FDI plants; this hiring is also per-
ceived as helpful to obtain managerial, organizational and exporting knowledge. Overall, this
evidence lends support to the idea that the strong localized aspect of knowledge spillovers
discussed in the agglomeration literature arises – at least in part – from the propensity of
workers to change jobs within the same local labor market\textsuperscript{11}: knowledge is partly embedded
in workers and diffuses when workers move between firms. The findings from Table 5 are in
line with previous evidence from developed countries. In a case study of the British Motor
Valley, (Henry and Pinch, 2000, p.5) argue that

\begin{quote}
as personnel move, they bring with them knowledge and ideas about how
things are done in other firms helping to raise the knowledge throughout the in-
dustry...The crucial point is that whilst this process may not change the pecking
order within the industry, this ‘churning’ of personnel raises the knowledge base
of the industry \textit{as a whole within the region}. The knowledge community is con-
tinually reinvigorated and, synonymous with this, so is production within Motor
Sport Valley.
\end{quote}

In a similar vein, (Saxenian, 1994, p.37) maintains that the geographic proximity of high-
tech firms in Silicon Valley is associated with a more efficient flow of new ideas ("When

\textsuperscript{11}There exist at least two reasons why geographic proximity might be important for observed worker flows. First, distance may act as a barrier for workers’ job mobility because of commuting costs or idiosyncratic preferences for location. Descriptive statistics in Combes and Duranton (2006) show that labor flows in France are mostly local: about 75\% of skilled workers remain in the same employment area when they switch firms. The degree of geographical mobility implied by this figure is small, since the average French employment area is comparable to a circle of radius 23 kilometers. In Dal Bo’, Finan and Rossi (2013), randomized job offers produce causal estimates of the effect of commuting distance on job acceptance rates. Distance appears to be a very strong (and negative) determinant of job acceptance: applicants are 33\% less likely to accept a job offer if the municipality to which they are assigned is more than 80 kilometers away from their home municipality. The estimates in Manning and Petrongolo (2013) also suggest a relatively fast decay of job utility with distance. Another reason geographical proximity may be an important determinant of job mobility is that the firm’s informational cost of identifying the “right” employee are larger across localities than within them. A similar argument can be made for the informational costs for workers.
engineers moved between companies, they took with them the knowledge, skills, and experience acquired at their previous jobs”). Finally, Serafinelli (2015) finds evidence of labor market-based knowledge spillovers in the Veneto region of Italy.

It is important to notice that thick labor markets and thick markets for intermediate inputs are also commonly hypothesized sources of the productivity advantages of agglomeration (Glaeser and Gottlieb, 2009; Moretti, 2011). These mechanisms cannot be directly tested with these data. However the fact that we fail to reject the null hypothesis of no local impact of the opening of large *domestic* plants (discussed below) suggest that better matches between workers and firms and higher availability of specialized intermediate inputs are not very relevant in this context. In other words, the local productivity effect attributed to FDI firms is not associated with a general increase in the size of the labor market. Large productivity gains linked to changes in the intensity of local economic activity are realized only when the new entrants are firms with superior technology, which further confirms the role of technology transfer via communication externalities and labor flows from foreign to domestic plants.

5 Conclusions and Future Work

This paper presents direct evidence on the effect of FDI on domestic plants at the local level. In particular, we evaluate the changes in total factor productivity (TFP) and the rate of entry of domestic plants when a large FDI plant is added to a locality. We use Ethiopian manufacturing establishment data from 1996 to 2013 combined with a survey module designed by us. Our identification strategy exploits the government designation of locations for large greenfield FDI plants, in combination with an event study research design. Using this strategy, we show that the entry of a large FDI plant in a locality increases the TFP of domestic plants by 13 percent. We also find positive net entry of firms in treated localities. Descriptive
evidence from the survey module clearly indicates the existence of technology transfer via backward and forward linkages in the supply chain, labor flows from FDI to domestic plants and communication externalities.

In future work, we plan to implement two alternative identification strategies. The first strategy relies on a comparison of geographic locations surrounding ‘planned’ investments to geographic locations that received ‘actual’ investments. The second strategy compares “winning” districts that attracted a large FDI manufacturing plant and “losing” districts that were the new plant’s runner-up choice (Greenstone, Hornbeck, and Moretti, 2010b). Moreover, we plan to conduct another round of the technology transfer module in February 2017.
References


Figure 1: Domestic plants’ productivity in treated districts, relative to the year of a large FDI plant opening.

Note: the figure plots point estimates for leading and lagging indicators for the large FDI plant opening. Event time indicator "-3" set to 1 for periods up to and including 3 periods prior to the event and 0 otherwise. Event time indicator "+3" set to 1 for all periods 3 periods after the event and 0 otherwise. The omitted category is one period prior to the large FDI plant opening. Vertical bars correspond to 90 percent confidence intervals with district-clustered standard errors.
Figure 2: Domestic plants’ productivity in treated districts, relative to the year of a large FDI plant opening.

Local plants' output (conditional on K,L and M)

Note: the figure plots point estimates for leading and lagging indicators for the large FDI plant opening. Event time indicator "-5" set to 1 for periods up to and including 5 periods prior to the event and 0 otherwise. Event time indicator "+5" set to 1 for all periods 5 periods after the event and 0 otherwise. The omitted category is one period prior to the large FDI plant opening. Vertical bars correspond to 90 percent confidence intervals with district-clustered standard errors.

Table 1: FDI-domestic Plant Linkages

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Labor-Link</th>
<th>Backward-Link</th>
<th>Forward-Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of domestic plants</td>
<td>1398</td>
<td>98</td>
<td>46</td>
<td>49</td>
</tr>
</tbody>
</table>
Figure 3: Changes in Districts’ Number of Domestic Plants Following a Large FDI Plant Opening

![Graph showing the changes in number of domestic plants over years since plant opening.](image)

Note: the figure plots point estimates for leading and lagging indicators for the large FDI plant opening. Event time indicator “-3” set to 1 for periods up to and including 5 periods prior to the event and 0 otherwise. Event time indicator “+3” set to 1 for all periods 5 periods after the event and 0 otherwise. The omitted category is one period prior to the large FDI plant opening. Vertical bars correspond to 90 percent confidence intervals with district-clustered standard errors.

Table 2: Total Effect on TFP

<table>
<thead>
<tr>
<th></th>
<th>( \tau = 0 )</th>
<th>Average ( \tau = [0, 2] )</th>
<th>Aver. ( \tau = [3, 4] )</th>
<th>Aver. ( \tau = [0, 4] )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.146***</td>
<td>0.131***</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Plant FE</td>
<td>0.134***</td>
<td>0.098**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( \tau = [-5, +5] )</td>
<td>0.129***</td>
<td>0.105***</td>
<td>0.070</td>
<td>0.090**</td>
</tr>
</tbody>
</table>

This table accompanies Figure 1.
Table 3: Total Effect on Number of Domestic Plants

<table>
<thead>
<tr>
<th></th>
<th>( \tau = 0 )</th>
<th>Average ( \tau = [0, 2] )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td>0.123</td>
<td>0.224*</td>
</tr>
<tr>
<td><strong>District Specific Trends</strong></td>
<td>0.199</td>
<td>0.313***</td>
</tr>
</tbody>
</table>

This table accompanies Figure 3

Table 4: Knowledge Diffusion

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Labor-Link</th>
<th>Backward-Link</th>
<th>Forward-Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>p-value of difference between (2) and (3)</td>
<td>Yes</td>
</tr>
<tr>
<td>Directly adopted production processes by observing FDI firms in same industry (% of domestic plants)</td>
<td>12.59</td>
<td>37.76</td>
<td>0.000</td>
<td>26.09</td>
</tr>
<tr>
<td>Use technology licensed from FDI firms (% of domestic plants)</td>
<td>10.77</td>
<td>31.63</td>
<td>0.000</td>
<td>15.22</td>
</tr>
<tr>
<td>Number of domestic plants</td>
<td>1398</td>
<td>98</td>
<td>1300</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 5: Perceived benefits experienced by domestic plants that employed skilled workers from FDI firms (% of plants)

<table>
<thead>
<tr>
<th>Employed Labor from FDI firms</th>
<th>(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed production technologies</td>
<td>65.3</td>
</tr>
<tr>
<td>Changed managerial practices</td>
<td>7.14</td>
</tr>
<tr>
<td>Adopted better organizational structure</td>
<td>7.14</td>
</tr>
<tr>
<td>Obtained knowledge of how to export</td>
<td>9.18</td>
</tr>
<tr>
<td>Experienced other benefits</td>
<td>11.22</td>
</tr>
<tr>
<td>Number of observations</td>
<td>98</td>
</tr>
</tbody>
</table>
Appendix

A.I Dataset construction

We faced three main challenges trying to link IDs across years: 1) verifying that, pre-2011/12, unique IDs were consistent across years, that is, that they identify the same establishment across the different rounds of the LMSM (which they mostly were not, particularly for the latter years in that period); 2) doing the same for the 2011/12 and 2012/13 rounds independently of the pre-2011/12 data (mainly IDs for this part matched across years, but, there were several cases of mismatch), and; 3) linking establishments between these two separate datasets (which was one of the most difficult tasks of the process).

During the first stage of creating the LMSM panel we checked the consistency of the existing unique establishment ID numbers across pre-2011/12 and post 2011/12 rounds of the LMSM – independently, as there is no ID variable in the raw LMSM data to link establishments between these two rounds. For each period (pre- or post- 2011/12), we pooled together all LMSM rounds and used as much information in the data as possible to determine the validity of the existing unique establishment IDs. We relied on any information available on some key variables such as: phone numbers, information about the location of the establishment (e.g. region, zone, woreda, etc.), if and when available, the Ethiopian Electric Power Corporation (EEPCO) number of the establishment, P.O. box number, etc.

As a further consistency check, we used the business directory that CSA compiled as a “framework” for the census for 2008/09. This list is compiled by CSA every year.

\[\text{\footnotesize Due to political reasons, CSA is only concerned with gathering and publishing data at the regional level and not at the level of smaller geo-political units (like zones or woredas). As a result, enumerators are only required to fill-in information about the establishment’s region, effectively leaving the option open for the enumerator to record or not the rest of the locational information of the establishment. Thus, it is not uncommon to see, for the same establishment, years for which all locational information is present and years for which only the region was recorded.}\]

\[\text{\footnotesize Unfortunately, similar lists for other rounds of the LMSM are not available and, thus, CSA could not share them with us. According to the Director of the Business Statistics Directorate, due to changes in management and issues with the storing of data, the lists for other years have been lost.}\]
with data from different ministries and government agencies as a reference to identify which establishments exist and should be part of the LMSM for the year was compiled by CSA. The list includes the name and establishment number that CSA assigns to each establishment during that LMSM round, as well as phone number and locational information (i.e. region, zone, woreda, town, etc.). This information was useful to determine which establishment numbers may be duplicated or incorrect, at least circa 2008/09.

While there is typically no electronic record of the establishment’s name in the LMSM database, it is possible to compile this information directly from the paper questionnaires. CSA’s staff went through all available paper questionnaire for the LMSM that CSA had in storage, collected establishment’s name from each paper questionnaire, and linked establishments across available years using this information. Unfortunately, CSA staff was only able to retrieve paper questionnaires for the last 5 rounds of the LMSM – it is CSA’s policy to store paper questionnaires for no more than 5 years. This effort was crucial in creating the panel identifiers for the LMSM for two reasons. First, it provided a link between the pre- and post-2011/12 LMSM rounds. Second, it provided us with additional information to validate unique establishment IDs for rounds between 2008/09 and 2010/11.

During the final stage we evaluated the different matches obtained from all methods described above and determined which matches were valid. This was done using Stata to the extent possible but, in most cases, a visual inspection of the validity of each match was necessary to ascertain the match provided by Stata. If matches did not seem valid then, a case-by-case match was done manually. If no valid match was found, the observation was left unmatched and a new unique ID was created for those individual establishments – these cases were flagged so they could be dropped if necessary during the analysis.