

# The Effects of Joining Multinational Supply Chains: New Evidence from Firm-to-Firm Linkages\*

Alonso Alfaro-Urena,<sup>†</sup> Isabela Manelici,<sup>‡</sup> and Jose P. Vasquez<sup>§</sup>

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This paper investigates the effects of becoming a supplier to multinational corporations (MNCs) using administrative data tracking all firm-to-firm transactions in Costa Rica. Event-study estimates reveal that after starting to supply to MNCs, domestic firms experience strong and persistent improvements in performance, including the expansion of their workforce by 26% and gains in standard measures of total factor productivity (TFP) of 6-9% four years after. Moreover, the sales of domestic firms to buyers other than the first MNC buyer grow by 20%, both through a larger number of buyers and larger sales per buyer. We propose a simple model by which TFP and reputation affect the number of buyers, but TFP alone affects sales conditional on buying. We find a model-based increase in TFP of 3% four years after. Finally, we collect survey data from managers in both domestic firms and MNCs for further insights on mechanisms. Our surveys suggest that becoming suppliers to MNCs is transformative for domestic firms, with changes ranging from new managerial practices to better reputation.

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<sup>†</sup>Banco Central de Costa Rica and Universidad de Costa Rica. Email: [alfaroua@bccr.fi.cr](mailto:alfaroua@bccr.fi.cr)

<sup>‡</sup>University of California, Berkeley. Email: [imanelici@berkeley.edu](mailto:imanelici@berkeley.edu)

<sup>§</sup>University of California, Berkeley. Email: [jpvazquez@berkeley.edu](mailto:jpvazquez@berkeley.edu)

# 1 Introduction

Governments around the world compete to attract foreign direct investment – typically in the form of affiliates of multinational corporations (MNCs) – through costly public programs such as tax holidays or subsidized industrial infrastructure.<sup>1</sup> The expectation of these governments is that MNCs are not only high-performers themselves, but that they also help improve the performance of domestic firms. This latter prospect is particularly appealing for developing countries, where most firms are small and low-performing.<sup>2</sup> While there are other channels by which MNCs may affect domestic firms, both scholars and policy-makers view direct supply chain linkages as one of the most promising channels for performance gains.<sup>3</sup>

In this paper, we ask what are the effects of becoming a supplier to MNCs on domestic firms. A complete answer to this question has so far proven elusive for three related reasons. First, it has been exceedingly difficult to observe direct business linkages between domestic suppliers and MNCs in conventional data, especially for the entire economy. Past research has thus relied on sector (or sector-by-region) level variation in the degree of foreign ownership in downstream sectors. Second, firm supply linkages may be endogenous. Without observing actual linkages, it is difficult to tease out the direction of causality between supplying to MNCs and changes in firm performance. Third, the same inability to directly observe suppliers has limited previous research from painting a complete picture of the effects of becoming a supplier to MNCs.

To make progress on these three challenges, we bring together a rich collection of microdata from Costa Rica that includes the universe of firm-to-firm transactions in the country. This makes it possible to observe the actual linkages between MNCs and their domestic suppliers.<sup>4</sup> Second, we adopt an event-study strategy to estimate the effects of starting to supply to MNCs. Third, we provide a detailed account of the changes faced by first-time suppliers to MNCs. We begin with standard measures of firm performance using typical balance sheet data, such as firm size or total factor productivity (TFP) from production function estimations. We then leverage the firm-to-firm transaction data and a simple model to infer changes in TFP from changes in sales to buyers other than the first MNC buyer. Finally, we conduct a new survey of managers in a representative sample of 164 domestic firms and MNCs. These surveys reveal key mechanisms by which first-time suppliers to MNCs improve firm performance.

<sup>1</sup>The competition in investment incentives (fiscal, financial, and other) for MNCs is so high that governments are adopting ever more sophisticated approaches such as special tax incentives focused on intangible assets ([UNCTAD, 2018a](#)). Moreover, the number of Special Economic Zones – the mainstay of investment promotion and facilitation policies – rose from 76 in 1986 (spread across 47 countries) to over 4,500 in 2018 (spread widely across the world) ([UNCTAD, 2018b](#)).

<sup>2</sup>See [Tybout \(2000\)](#); [Bloom, Mahajan, McKenzie, and Roberts \(2010\)](#); [Hsieh and Klenow \(2014\)](#).

<sup>3</sup>See the reviews of [Harrison and Rodríguez-Clare \(2010\)](#); [Havránek and Iršová \(2011\)](#); [Alfaro \(2017\)](#). For instance, [Alfaro \(2017\)](#) concludes that “FDI can play an important role in economic growth, most likely via suppliers.” The World Bank [2020 World Development Report](#) on “Global Value Chains: Trading for Development” announces that it will assess the typical tools used by policy-makers to “form [...] linkages and networks in GVCs”: incentive packages offered to foreign investors, and other policies meant to encourage investors to create “backward in-country linkages” post-investment.

<sup>4</sup>The data cover the universe of all firm-to-firm relationships whose transactions in a year amount to more than 4,200 U.S. dollars. See Section 2 for additional details.

The analysis proceeds in four steps. In the first step, we introduce the new database that we assemble for this research and the empirical context. Most of our progress relies on the firm-to-firm transaction data collected by the Ministry of Finance since 2008. We match this data with corporate income tax data and foreign ownership data. We can then identify MNCs and domestic firms in buyer-supplier relationships and characterize these firms and relationships. Our event of interest is the first time a domestic firm sells to an MNC in Costa Rica. We focus on events occurring between 2010 and 2015, for which we observe the transition of domestic firms into their new role as suppliers of MNCs. During this period, there are 3,697 domestic firms who start supplying to one of 444 MNCs. These relationships constitute a significant fraction of each domestic firm's output, where the average (median) amount first sold to an MNC is 62,400 (18,590) U.S. dollars and represents 19% (6%) of all sales that year.

In addition to this rich data environment, Costa Rica offers a number of additional advantages to study the effects of MNCs. Ever since the entry of Intel in 1997, the country has attracted a large and diverse set of MNCs.<sup>5</sup> This feature of our setting allows us to characterize the linkages that most benefit domestic suppliers. Second, a Costa Rican public agency (Procomer) implements “Productive Linkages,” a program aimed at mediating linkages between MNCs and domestic suppliers.<sup>6</sup> We use the variation granted by the rules of this program for a robustness check to our main event-study results.

In the second step, we describe and implement our main event-study design to estimate the effects of starting to supply to MNCs. Our baseline results use the sample that includes both domestic firms who supply for the first time to an MNC in Costa Rica sometime between 2010 and 2015, and domestic firms who never supply to an MNC between 2008 and 2017. Credible estimates hinge on the assumption that firms yet to supply to MNCs form a credible counterfactual for first-time suppliers to MNCs, after accounting for time-invariant differences between firms (through firm fixed effects) and common shocks (through fixed effects at the four-digit sector by province by calendar year level). As we can estimate event-study coefficients for the four years before a first supplying experience, this method allows us to transparently show that first-time suppliers do not exhibit pre-trends in observables.

The main concern for identification is that firms experience unobservable firm-specific shocks that affect both the timing of their first supplying transaction with an MNC and their subsequent performance. We provide several pieces of evidence to alleviate this concern, including evidence against the effects being driven by a change in managers just before the event. Moreover, we conduct a battery of additional robustness checks that demonstrate that our results are robust to only keeping the first-time suppliers in the analysis, varying the set of fixed effects, and balancing the sample of first-time suppliers around the event year.

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<sup>5</sup>In 2017, the Costa Rican foreign direct investment (FDI) stock per capita was the second largest in Latin America.

<sup>6</sup>Programs similar to “Productive Linkages” have become increasingly popular among governments looking to improve the local integration of (multinational or large) corporations (see the [American Supplier Initiative](#) in the U.S. or the Local Content Unit in Rwanda, [Steenbergen and Sutton, 2017](#)). Typically, the aim of these programs is not to replace unmediated market-based linkages between MNCs and domestic suppliers with linkages mediated by the program, but to create additional opportunities for linkages (e.g., by lowering informational barriers on the capabilities of domestic suppliers). Only about 1% of the number (value) of linkages between MNCs and domestic suppliers occurring economy-wide in Costa Rica are mediated by the “Productive Linkages” program.

Our baseline results show that first-time suppliers experience large and long-lasting improvements in firm size. Four years after their first sale to an MNC buyer, firms have 33% higher sales, 26% more employees, 22% more net assets, and 23% higher total input costs. We find no evidence of selection into supplying to MNCs based on past firm growth. As these firms were provided with a positive demand shock, one natural concern is that this expansion is purely mechanical. We exploit the firm-to-firm transaction data to show that four years after starting to supply to MNCs, sales to buyers other than the first MNC buyer increase by 20%, sales to other corporate buyers grow by 45%, the number of corporate buyers rises by 36%, and the average sales to other corporate buyers increase by 14%.<sup>7</sup>

We then examine standard measures of TFP, ranging from the residual of ordinary least squares (OLS) estimates of a Cobb-Douglas production function to those from standard methods that account for the potential endogeneity of firm-level input choices. We continue to find no evidence of selection into supplying to MNCs, this time based on past TFP growth. In contrast, after their first MNC sale, domestic firms experience sizable and lasting gains in TFP, such that their TFP is between 6 and 9% higher than in the year before the event. While we do not observe prices directly, we provide evidence that mark-up effects are unlikely to explain this observed TFP growth. Under certain assumptions, such as that no output or input price variation is correlated with the event, these results capture the behavior of true TFP.

We also implement an alternative event-study design that leverages the rules of the “Productive Linkages” program. The program evaluates the ability of domestic firms to supply to MNCs and assigns them scores. Scores assess a firm’s readiness to supply to MNCs on aspects unobserved in conventional administrative data (such as whether the firm is ISO 9001 certified or not). Based on these scores, Procomer proposes shortlists to MNCs. A small subset of deals lends itself to the implementation of a “winner vs. losers” research design in the spirit of [Greenstone, Hornbeck, and Moretti \(2010\)](#). We find that winners and losers are not statistically different before the event, both in scores and other observables. Also, by their very participation in the program, all contenders are interested in supplying to MNCs and deem themselves ready to do so. This design yields results that are qualitatively similar to those from the main event-study design. While the main economy-wide design and this design have different advantages and disadvantages, they paint a very consistent picture.

In the third step, we propose alternative measures of firm performance that leverage our findings from firm-to-firm transaction data. Specifically, we develop a simple framework that allows us to interpret the behavior of sales to buyers other than the first MNC buyer (hereafter, *sales to others*). Under fairly general demand and total cost curves, changes in sales to others are informative regarding changes in supply-side parameters (here, TFP and reputation). These sales can grow both through sales conditional on buying (the intensive margin) and the number of buyers (the extensive margin). We assume that TFP affects both margins: higher-TFP firms sell more because they have a cost advantage and are better at finding buyers. We use the term *reputation* as an umbrella term over a set of firm-level features other than TFP that

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<sup>7</sup>The *corporate buyers* of a firm are those whose purchases in a year amount to more than \$4,200 U.S. dollars (the reporting threshold of the form behind the firm-to-firm transaction data).

only affect the number of buyers. Some of these features are not about reputation *per se* but refer instead to the marketing technology or search costs, among others.

In our model, increases in a measure we call *adjusted sales to others* reflect increases in *composite TFP* (TFP, reputation, and the interaction between the two). The adjustment is done via a parameter  $\delta$  that controls for both potential returns to scale and the effects of the MNC demand shock on prices. To estimate the increase in TFP alone, our model leads us to a measure of *average adjusted sales to others*. We bring our theoretical results to the data in two steps. First, we estimate  $\delta$  using an instrumental variable strategy based on government demand shocks. Second, we use the main event-study design to estimate the effect of becoming a supplier to MNCs on (average) adjusted sales to others. We conclude that four years after, composite TFP increases by 6%, while TFP alone increases by 3%. This highlights the potential of the extensive margin to magnify differences in TFP. We obtain similar results across reasonable ranges of the main parameters of the model ( $\delta$  and the elasticity of demand,  $\sigma$ ).

In the fourth and final step, we document additional evidence on the mechanisms behind performance gains to suppliers to MNCs. First, we explore treatment effect heterogeneity using our administrative data. For instance, we find that suppliers in manufacturing see their performance improve twice as much as suppliers in retail and services. Conversely, MNCs in manufacturing and MNCs in high-tech sectors trigger the highest performance gains for their suppliers. We conjecture that MNCs are likely to devote more attention to relationships where the supplied input has a direct bearing on their core activity. Also, suppliers might receive more support from MNCs whose product is of high quality (or complex), as imperfections in inputs can be particularly costly.

We then rely on surveys conducted on a representative sample of MNCs and domestic suppliers. Both MNCs and domestic firms recognize how consequential it is for a domestic firm to start supplying to MNCs. After becoming suppliers to MNCs, most firms undergo a series of interrelated changes, which include expansions in product scope with higher-quality products, better managerial and organizational practices, and improved reputation. These changes arise from interactions during which MNCs communicate expectations and advice, and from the significant efforts exerted by new suppliers to deliver on their contracts.

Our work is related to several literatures. At its core, this article contributes to an extensive literature studying interventions aimed at improving firm performance in developing countries. In a recent review, [Woodruff \(2018\)](#) notes that most of this literature focuses on interventions that alleviate supply-side constraints (e.g., programs granting access to credit or training). Despite the popularity of supply-side interventions, literature reviews suggest that the evidence is mixed as to whether they can actually alter the long-term growth of firms.<sup>8</sup>

While notably scarcer, there is increasing evidence that demand is an important determinant of (small) firm dynamics. In particular, improving access to foreign buyers – through

<sup>8</sup>For examples of papers in this strand of the literature, see [De Mel, McKenzie, and Woodruff \(2008\)](#); [Bloom, Eifert, Mahajan, McKenzie, and Roberts \(2013\)](#); [Fafchamps, McKenzie, Quinn, and Woodruff \(2014\)](#); [Banerjee, Duflo, Goldberg, Karlan, Osei, Parienté, Shapiro, Thuysbaert, and Udry \(2015\)](#). For reviews, see [Banerjee \(2013\)](#); [McKenzie and Woodruff \(2013\)](#).

trade<sup>9</sup> or foreign direct investment (FDI) – is believed to hold great promise for firms in developing countries.<sup>10</sup> The expectation is that foreign buyers do not only provide demand shocks but also provide valuable learning opportunities.

By studying the effects of supplying to foreign buyers, this paper relates to a voluminous literature on learning-from-exporting.<sup>11</sup> There are three key differences between exporting and supplying to MNCs locally. First, exporting is only possible for firms selling tradable goods and services, and even further, only possible for firms competitive enough to overcome trade costs.<sup>12</sup> Second, the proximity between buyers and suppliers is likely to facilitate learning. Finally, MNCs are exceptional firms - globally and even more so in a developing country.<sup>13</sup> Hence, MNCs are likely to be more sophisticated buyers than the usual importer.<sup>14</sup>

By studying the effects of supplying to MNCs in one's country, this paper is also closely related to a vast literature on the effects of FDI on firm performance. Papers on this topic generally combine firm-level panel data with sector-level input-output (I-O) tables and find that an increase in FDI at the sector (or sector-by-region) level is associated with increases in standard measures of TFP of (nearby) domestic firms in upstream sectors (commonly referred to as spillovers from backward linkages).<sup>15</sup> Moving from variation in sector-level proxies of exposure to FDI to variation in the actual linkage status of a firm presents new opportunities for precision and insight on the process of joining MNC supply chains.<sup>16</sup>

Finally, this paper also relates to empirical work made possible by the recent availability

<sup>9</sup>There is a long literature linking the exposure to trade to the performance of firms (see review in De Loecker and Goldberg, 2014). On developing countries in particular, see Clerides, Lach, and Tybout (1998); Pavcnik (2002); Verhoogen (2008); Goldberg, Khandelwal, Pavcnik, and Topalova (2010); Topalova and Khandelwal (2011); Bustos (2011); Atkin and Donaldson (2018); Atkin, Faber, and Gonzalez-Navarro (2018); Fieler, Eslava, and Xu (2018).

<sup>10</sup>Other ways in which governments can improve demand conditions include building infrastructure (see Faber, 2014; Ghani, Goswami, and Kerr, 2016; Asher and Novosad, 2018; Donaldson, 2018) and expanding public procurement (see Ferraz, Finan, and Szerman, 2016; Lee, 2017; Carrillo, Donaldson, Pomeranz, and Singhal, 2018).

<sup>11</sup>Recent papers find strong positive causal effects of exporting on firm performance (De Loecker, 2007, 2013; Atkin, Khandelwal, and Osman, 2017).

<sup>12</sup>Only 7% of the domestic firms studied here have ever exported before starting to supply to MNCs in Costa Rica. Our surveys suggest that supplying to MNCs locally is seen as a stepping stone to exporting in the future.

<sup>13</sup>MNCs disproportionately populate the right tail of the TFP distribution in Costa Rica (see Figure A1, [Online Appendix A](#)). For papers on the exceptional nature and practices of MNCs, see Helpman, Melitz, and Yeaple (2004); Harrison and Scorse (2010); Ramondo and Rodríguez-Clare (2013); Antràs and Yeaple (2014). On global value chains, see Gereffi, Humphrey, and Sturgeon (2005); Alfaro, Antràs, Chor, and Conconi (2015); Taglioni and Winkler (2016); Antràs and de Gortari (2017).

<sup>14</sup>In addition – while not a difference *per se* between exporting and supplying to MNCs – our data also allows us to explore treatment effect heterogeneity based on buyer characteristics (other than its country and purchases, the typical information present in customs data).

<sup>15</sup>For classic papers in the FDI literature, see Haddad and Harrison (1993); Aitken and Harrison (1999); Blomström and Sjöholm (1999); Djankov and Hoekman (2000); Javorcik (2004); Alfaro, Chanda, Kalemli-Özcan, and Sayek (2004); Helpman, Melitz, and Yeaple (2004); Haskel, Pereira, and Slaughter (2007); Blalock and Gertler (2009); Keller and Yeaple (2009). In their meta-analysis of the literature, Havránek and Iršová (2011) find robust evidence for increases in the performance of domestic firms in supplier sectors (backward spillovers), small increases for firms in customer sectors (forward spillovers), and no effect for firms in the same sector (horizontal spillovers).

<sup>16</sup>Using our firm-to-firm transaction data, we find that sector-level backward linkages predict less than 1% of the actual firm-level linkages (see Figure A2, [Online Appendix A](#)). This may explain why estimates of spillovers from backward linkages vary broadly across studies, from strongly positive to negative (Havránek and Iršová, 2011).

of domestic firm-to-firm transaction data.<sup>17</sup> This paper studies in detail the effects of establishing a specific type of firm-to-firm linkage: the one with the first MNC buyer. After this new linkage, domestic firms improve their performance in two equally important ways: through the number of buyers (the extensive margin) and the sales per buyer (the intensive margin).<sup>18</sup>

This paper proceeds as follows. Section 2 describes the data and context. Section 3 introduces our event-study strategy and Section 4 presents its results. Section 5 introduces a theoretical framework that allows us to interpret our event-study findings, in particular those on sales to buyers other than the first MNC buyer. Section 6 draws on heterogeneity analyses and surveys for more insights on mechanisms. Section 7 concludes.

## 2 Data and Description of Supplying Linkages

### 2.1 Data

*Economy-wide administrative data.* The main dataset tracks the universe of firm-to-firm relationships in Costa Rica between 2008 and 2017. This information is collected by the Ministry of Finance of Costa Rica through the D-151 tax form. Firms must report the tax identifier (ID) of all their suppliers and buyers with whom they generate at least 2.5 million Costa Rican colones (around 4,200 U.S. dollars) in transactions that year, in addition to the total amount transacted. Given the third-party reporting nature of the D-151, it is used by the Ministry of Finance to enforce corporate income tax compliance.<sup>19</sup> We keep for our analysis approximately 92% of all transactions and 88% of the value of all transactions, which were either filled in correctly or with minor mistakes that could be fixed (e.g., misreporting of decimal points).

We merge this dataset with two other administrative datasets that track the universe of formal firms in Costa Rica over the same time period. The first of these is built from yearly corporate income tax returns and contains typical balance sheet variables. The second dataset comes from the Social Security Fund and includes firms' wage bill and number of workers.

Additionally, we construct a comprehensive dataset on the foreign ownership of firms. In Costa Rica there is no source which provides centralized and exhaustive reporting of the country of origin of firms' capital. To overcome this data limitation, we combine information from five different sources. The first three are annual surveys conducted by BCCR and inquir-

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<sup>17</sup>Alfaro-Ureña, Fuentes, Manelici, and Vasquez (2018) show that the main stylized facts established for the production networks of Belgium and Japan (the countries most studied thus far) also hold for the Costa Rican network. Dhyne, Kikkawa, Mogstad, and Tintelnot (2018b) and Dhyne, Kikkawa, and Magerman (2018a) are examples of papers studying the production network of Belgium. For Japan, see for example Bernard, Moxnes, and Saito (2019); Furusawa, Inui, Ito, and Tang (2017); Miyauchi (2018). Contemporaneous papers studying the production networks of Ecuador, Chile, and Turkey are Carrillo, Donaldson, Pomeranz, and Singhal (2018); Huneeus (2018); Demir, Javorcik, Michalski, and Örs (2018).

<sup>18</sup>Our findings on the importance of the extensive margin of sales in firm growth are in line with the findings of Bernard, Dhyne, Magerman, Manova, and Moxnes (2017). The authors use firm-to-firm transaction data from Belgium to show that firms can be large due to their higher productivity (or product quality) or their selling to more and/or larger buyers (among other factors). Cross-sectionally, 81% of the variation in firm sales within narrowly-defined sectors is explained by firms' ability to attract many and/or large buyers.

<sup>19</sup>In the D-151 one can identify firms who reduce their taxes by over-reporting purchases or under-reporting sales.

ing on the foreign ownership of firms. These surveys tend to oversample large firms. The fourth source is the organization responsible for drawing FDI to Costa Rica (CINDE), which provides information on the foreign ownership of firms they attracted. Finally, we bring in ORBIS data, which has a high coverage of firms in Costa Rica and allows us to identify firms in the country that are affiliates of MNCs.

A last challenge in building the final administrative dataset is to assign tax IDs to firm groups and properly turn tax ID-level information into group-level information.<sup>20</sup> In [Online Appendix F.1](#) we discuss how we overcome this challenge, in addition to providing more details on data construction and summary statistics.

*“Productive Linkages” program data.* Since 2001, Costa Rica’s trade promotion agency (Procomer) has implemented a matchmaking program called “Productive Linkages.” Its main objective has been to insert local firms into export supply chains, where the exporter is usually an MNC affiliate in Costa Rica. Procomer has built a comprehensive database of local firms that are suitable and willing to supply to MNCs. Procomer staff visit firms and evaluate them on criteria that are typically unobservable in tax records but are nonetheless relevant to MNCs. Each firm is then assigned an aggregate score. When MNCs approach Procomer with an input need, Procomer identifies which suppliers can produce that input, ranks them based on their score, and shares with the MNC a shortlist of the highest ranked suppliers.<sup>21</sup>

[Online Appendix F.2](#) describes the historical records shared by Procomer with BCCR, the steps undertaken to digitize them, the interviews we carried out with former and current Procomer staff to uncover missing institutional details, and the sample construction. We learned that, while the program was not designed as an experiment, by applying sensible restrictions to the universe of deals mediated by Procomer, one can retrieve a set of deals with a quasi-experimental setup. Specifically, we focus on deals between domestic suppliers and MNCs that are first-time deals with an MNC for the domestic firm, occur in our sample period, and where the shortlisted contenders had not yet supplied to an MNC either.

*Survey data.* In the summer of 2018, we conducted surveys of both MNCs and their domestic suppliers. Our main objective was to shed light on typically unobservable aspects of relationships between the two types of firms. We targeted both firms involved in deals mediated by the “Productive Linkages” program and deals that happened unmediated, in the broader economy. This allowed us to also inquire about the potential benefits of mediation.

The surveys were administered in two versions: a longer field survey conducted at the main location of the firm and a shorter web-based one. Core questions were mirrored between surveys to both domestic firms and MNCs. Given the retrospective nature of some of the topics covered, the ideal respondent was the founder or general manager of the domestic firm and

<sup>20</sup>A firm can split its reporting across several tax IDs (e.g., by assigning all workers to one tax ID and all sales to another). If they share ownership and make decisions as a unit, tax IDs should not be treated as independent firms but should be aggregated into firm groups. Throughout the paper we use *firms* to refer to *firm groups*.

<sup>21</sup>Procomer has a strong reputation both in Costa Rica and abroad. In several years, the [International Trade Centre](#) granted Procomer the title of “Best Trade Promotion Organization from a Developing Country.” The World Bank frequently mentions the “Productive Linkages” program as a role model for its ability to improve the local integration of MNC affiliates (see for example [Akhlaque, Lopez, Chua, and Coste, 2017](#)).

the supply chain manager of the MNC. The need to reach specific employees compounded the already difficult task of establishing a first contact with these firms.

We gathered responses from a total of 164 firms, of which 38 were surveyed in person and 126 online. 106 respondents are domestic suppliers to MNCs and 58 are MNCs based in Costa Rica. When pooling survey answers from both buyers and sellers, these 164 responses cover at least one side of the buyer-seller pair for about 20% of the pairs of interest. Comparisons of the firms that did and did not respond suggest that a response bias is unlikely. [Online Appendix G](#) describes the surveys in detail.

## 2.2 Description of MNCs, Domestic Suppliers, and Their First Linkage

*MNCs in Costa Rica.* We start from the 2,171 firms in Costa Rica that belong to corporate groups where at least one firm is partially foreign-owned.<sup>22</sup> From this set of firms, we create three mutually exclusive subsets: firms that are fully domestically-owned (despite being part of a corporate group where another firm is partially foreign-owned), firms that are themselves at least partially foreign-owned but whose median number of workers is under 100 (across all years of activity in the country), and firms that are themselves at least partially foreign-owned and whose median number of workers is over 100.<sup>23</sup>

In this paper we focus on the effects of starting to supply to the 622 firms in the third category.<sup>24</sup> All 622 firms are MNC affiliates, with known global ultimate ownership and a substantial presence in Costa Rica.<sup>25</sup> From the universe of firm-to-firm transactions in Costa Rica we learn that between 2010 and 2015, 444 of these 622 MNCs became the first MNC buyer from one of 3,697 domestic firms. 47% of these MNCs are from the United States, with the other 53% coming from either Latin America and the Caribbean or Western Europe.

These 444 MNCs differ from one another in ways that are potentially relevant to the outcomes of first-time suppliers. While manufacturing is the most frequent sector among these MNCs (covering 40% of these MNCs), the remaining 60% of MNCs fall into sectors as diverse as retail, agriculture, and information and communication. Alternatively, 66% of these MNCs are in low-tech or medium low-tech sectors (as classified by the OECD), with the other 34%

<sup>22</sup>A corporate group is a set of firms that share ownership, but do not necessarily behave as one business.

<sup>23</sup>This size threshold is less restrictive than other choices in the literature. The average annual sales of the plants from [Greenstone, Hornbeck, and Moretti \(2010\)](#) are 11 times larger than the average sales of our 622 MNCs. [Abebe, McMillan, and Serafinelli \(2017\)](#) consider only openings of FDI plants in manufacturing where, in the year of the plant opening or in the year that follows, the plant hires at least 100 workers or at least 1% of the workers in local manufacturing.

<sup>24</sup>Firms in the first category (fully domestically-owned firms) operate in different sectors than those of firms that are partially foreign-owned and part of their same corporate group. Given the loose connection between firms part of the same corporate group, particularly when in different sectors, we exclude them from the analysis. The typical firm in the second category is not an MNC affiliate (but a single location firm with partial foreign ownership) and serves local demand, either in service sectors (e.g., hotels) or in sectors with low domestic input requirements (e.g., import/export retail or real estate agencies). We focus on firms in the third category to also circumvent issues related to FDI statistics, such as the rising use of shell companies. These firms hire 75% of the workers and export 90% of the totals across firms in the three categories combined. See [Online Appendix F.1.3](#).

<sup>25</sup>As customary ([Antràs and Yeaple, 2014; Caves, 2007](#)), we define an MNC as “an enterprise that controls and manages production establishments/plants located in at least two countries.” We focus on MNCs with their parent in a foreign country and affiliates in Costa Rica (as opposed to MNCs whose parent is Costa Rican).

split between medium high-tech and high-tech sectors. Moreover, while Costa Rica's Free Trade Zone (FTZ) regime is the mainstay of its export and investment promotion strategy, 61% of these 444 MNCs operate outside FTZs. In Section 6 we ask whether differences in these characteristics of the first MNC buyer may affect subsequent supplier outcomes.

*Domestic suppliers to MNCs.* We start from the universe of domestic firms in Costa Rica and restrict our attention to those that have at least a median of three workers and median yearly revenues of 50,000 U.S. dollars (CPI-deflated to 2013 dollars) across all years of activity. We remove firms that are state-owned, registered as households, NGOs, or part of the financial, construction, and education sectors. This leaves us with 24,370 firms. Of these firms, we use the universe of firm-to-firm transactions between 2008 and 2017 to identify and keep only two types of firms: the 3,697 firms that become first-time suppliers to an MNC sometime between 2010 and 2015,<sup>26</sup> and the 14,338 firms never supplying to an MNC between 2008 and 2017. Our interest lies in the firms in the first category, but we also use firms in the second category to construct counterfactuals.

Across the 3,697 first-time suppliers to an MNC, the average (median) firm is small or medium-sized, hiring 19.5 (7.8) workers in 2009.<sup>27</sup> 72% of firms operate in low-tech or medium low-tech sectors, such as retail (including repair and maintenance) or accommodation and food services. The remaining 28% are split between medium high-tech and high-tech sectors, such as the manufacturing of machinery and equipment, or professional, scientific, and technical services. In Section 6, we check whether the sector of first-time suppliers may help or hinder their ability to benefit from supplying to MNCs.

Figure 1 contains photographs of four domestic firms that belong to and are representative of our sample of first-time suppliers to MNCs. These photographs are meant to provide an illustration of their size, activity, and organization. The first two firms supply automotive mechanic services and retail and maintenance of cutting tools. They hire less than five full-time workers, their facilities are modest and space-constrained, and their processes seem artisanal. The other two firms specialize in tailored precision machining and industrial supplies. They hire between 10 and 20 full-time workers, the layout of their plants is more spacious and organized, and exhibit more capital stock and standardization in processes.

*Relationships between MNCs and their domestic suppliers.* In Costa Rica, MNCs and domestic firms can establish a buyer-seller relationship either independently, unmediated by any government institution or mediated by Procomer through the "Productive Linkages" program.

Because more than 99% of relationships between MNCs and domestic firms (both in number and value) are formed without mediation, we prioritize the analysis of unmediated relationships. As mentioned above, we find 3,697 domestic firms who supply to an MNC for the first time sometime between 2010 and 2015, and do so in an unmediated fashion. We refer to these first-time supplying instances as (unmediated economy-wide) events. Across these

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<sup>26</sup>We start in 2010 to ensure we measure correctly the first year when a firm supplies an MNC. After 2015, we are no longer able to observe at least two years after each first-time linkage. See [Online Appendix F.1.2](#) for details.

<sup>27</sup>In 2009 the average (median) never-supplier hires 11.6 (6.0) workers. These statistics for first-time and never-suppliers do not yet account for different sectoral and provincial compositions of the two samples.

events, the average (median) first sale to an MNC is of 62,400 (18,590) U.S. dollars and represents an average (median) share of 19 (6) % of that year's total sales. The relationship with the first MNC buyer lasts on average (median) 2.76 (2) years. These values and durations suggest that the relationship with the first MNC buyer is plausibly consequential for the supplier.

We contrast these statistics with those for the sample of events mediated by the "Productive Linkages" program and find them to be comparable.<sup>28</sup> In our field surveys, we asked domestic suppliers with deals through Procomer about why they sought such deals in addition to their unmediated deals. For 60% of these firms, Procomer granted better access to MNCs, for 53%, Procomer deals were no different from their other deals but provided another source of business, and for 40%, Procomer lent them credibility in front of MNCs. Hence, it seems that whether first deals with MNCs are mediated or not is not a first-order feature of these deals. On the grounds of these similarities, we use the "Productive Linkages" analysis as a robustness check to our main economy-wide analysis.

Our surveys provide context on the expectations of both MNCs and domestic suppliers ahead of a first linkage. When evaluating a supplier in Costa Rica, MNCs pay particular attention to four aspects: the quality of the inputs delivered, the willingness or ability of the supplier to adapt to the needs of the MNC, the price, and organizational traits such as reliability or the traceability of inputs. MNCs cannot afford a slow learning curve of the domestic supplier; their expectations need to be met soon after establishing the contract (or else the contract is discontinued). Before their first MNC buyer, all domestic firms expected MNCs to differ from domestic buyers. The largest expected differences involved MNCs placing larger orders, being more reliable payers, offering longer contracts, and helping suppliers to adopt better management practices. Despite expecting differences, domestic firms were still taken by surprise by the quick pace, breadth and depth of the changes necessary to supply to MNCs. For many of them, what followed after their first MNC deal was "*as if being thrown into the water without knowing how to swim and having to learn fast*" (direct quote from one business owner).

### 3 Event-Study Designs

#### 3.1 Economy-Wide Event-Study Design

In our main empirical analysis, we study the effects of becoming a first-time supplier to an MNC in Costa Rica. Between 2010 and 2015, 3,697 such events occur across the Costa Rican economy.<sup>29</sup> More specifically, we estimate the following event-study specification:

$$y_{it} = \alpha_i + X_{it}^\top \beta + \lambda_{spt} + \sum_{k=C}^{\bar{C}} \theta_k D_{it}^k + \varepsilon_{it}, \quad (1)$$

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<sup>28</sup>For descriptive statistics on the events mediated by "Productive Linkages", see [Online Appendix F.2.2](#).

<sup>29</sup>There are 3,813 domestic firms that became first-time suppliers to 471 MNCs. However, in the main event-study regression (1) studying the impact on total sales, only 3,697 of these domestic firms are used in the estimation, with the rest being dropped due to the fine set of fixed effects used. For consistency, in Section 2.2 we present summary statistics only for those 3,697 firms and their associated 444 first MNC buyers.

where  $y_{it}$  is an outcome variable for firm  $i$  in calendar year  $t$ ,  $\alpha_i$  is a firm fixed effect, and  $X_{it}$  is a vector with firm-level time-varying characteristics.  $\lambda_{spt}$  are four-digit sector  $\times$  province  $\times$  calendar year fixed effects. We define the event-time dummies as  $D_{it}^k := \mathbb{1}[t = \tau_i + k]$   $\forall k \in (\underline{C}, \bar{C})$ ,  $D_{it}^{\bar{C}} = \mathbb{1}[t \geq \tau_i + \bar{C}]$ , and  $D_{it}^{\underline{C}} = \mathbb{1}[t \leq \tau_i + \underline{C}]$ , where  $\mathbb{1}[\cdot]$  is the indicator function and  $\tau_i$  is the first year when firm  $i$  sells to an MNC.  $\varepsilon_{it}$  is an error term. We normalize  $\theta_{-1} = 0$  and set  $\underline{C} = -5$  and  $\bar{C} = +5$ .

The interpretation of the  $\theta_k$  sequence depends on the sample over which we run the event-study regression. In all our economy-wide regressions, we use two samples: the *full sample* includes both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC in the firm-to-firm transaction data, whereas the *restricted sample* contains only the firms that eventually become first-time suppliers to MNCs. With the full sample, we compare the outcomes of first-time suppliers in event year  $k$  to the outcomes in event year  $-1$  of firms that are yet to supply to an MNC (future first-time suppliers and never-suppliers alike) and that are in the same narrowly-defined sector and province.<sup>30</sup> With the restricted sample, we compare the outcomes of suppliers in event year  $k$  to the outcomes of future first-time suppliers in the same narrowly-defined sector and province in the year before their event (in excess of fixed effects).<sup>31</sup>

Identification of the event-study coefficients hinges on the assumption that firms yet to supply to MNCs form a credible counterfactual for firms that start supplying to MNCs, after accounting for time-invariant (observed and unobserved) differences between firms and common sector-by-province-by-year shocks.<sup>32</sup> One might be concerned that – even when chosen from the same four-digit sector and province – never-suppliers do not provide a suitable counterfactual for first-time suppliers. With the restricted sample we can directly test if our estimates are explained by the contrast to never-suppliers or by the staggered timing of a first transaction with MNCs. To preview the results, we find similar estimates across samples, which points to the event as the primary driver of our estimated effects.

Implicit in attributing these effects to becoming a supplier to MNCs is the assumption that there is no selection of firms into supplying to MNCs based on transitory firm-specific shocks that can determine outcomes (Blundell and Dias, 2009).<sup>33</sup> More specifically, shocks with the following three characteristics can pose a threat to identification: (i) they affect the

<sup>30</sup>For never-suppliers,  $D_{it}^k := 0, \forall t$  and  $\forall k$ . The outcomes of never-suppliers are thus part of the set of outcomes assigned to event year  $-1$ , together with the outcomes of first-time suppliers in event year  $-1$ . We cluster standard errors at the two-digit sector  $\times$  province level to account for possible correlations in outcomes among firms in these cells. We cannot add event-year clustering as never-suppliers do not have an event year.

<sup>31</sup>With this sample, we cluster standard errors at the province  $\times$  event year level. Event year clustering is recommended whenever event dates are concentrated on a few values, as in our case from 2010 to 2015.

<sup>32</sup>This design is not challenged by selection on levels, observable or not. For instance, even before starting to supply to MNCs, first-time suppliers hire on average 19% more workers than never-suppliers in the same four-digit sector and province. In addition, a consistent estimate of the average treatment effect requires that treated and control firms experience the same macro shocks (Blundell and Dias, 2009). Differential trends might arise if treated and controls operate in different markets. We limit comparison firms to nearby firms in the same four-digit sector to control for common shocks, such as those to factor markets or transportation networks.

<sup>33</sup>In other words, “the availability of panel data allows us to consistently estimate treatment effects without assuming ignorability of treatment and without an instrumental variable, provided the treatment varies over time and is uncorrelated with time-varying unobservables that affect the response” (Wooldridge, 2002).

timing of the event, (ii) they affect firm performance after the event, but (iii) they do not affect firm performance before the event. The last condition is important, as we do not find any evidence of pre-existing differential trends for first-time suppliers to MNCs.

Without exhaustive information on first-time suppliers beyond what is available in tax data, it is hard to dismiss this threat definitively. To make progress on this, Section 4.2.1 conducts a battery of checks on its plausibility, such as whether results are driven by changes in firm management contemporaneous with the event. We ultimately conclude that there is limited scope for results to be driven by firm-specific time-varying unobservables satisfying the three conditions above. That is, the event-study design appears suitable for our context and intention to identify the treatment effects of joining MNC supply chains.

### 3.2 Robustness Check: “Winner vs. Losers” Event-Study Design

We use Procomer’s “Productive Linkages” program as a robustness check. Its rules generate quasi-experimental variation in opportunities to supply to MNCs among firms short-listed for a given deal with an MNC. Procomer undertakes thorough evaluations of domestic firms willing to supply to MNCs and assigns them an overall score of readiness to do so. Based on scores, Procomer proposes shortlists of candidate suppliers to MNCs. As most of the information behind scores is typically not available in tax data, these shortlists are likely to provide stronger control groups than those based on tax data alone.<sup>34</sup>

The shortlists of Procomer are similar in spirit to the location rankings for “million dollar plants” (MDP) from [Greenstone, Hornbeck, and Moretti \(2010\)](#). Our argument parallels theirs: shortlisted firms (counties) missing a deal with an MNC (MDP) offer a valid counterfactual to what would have happened with the winners’ performance had they not won the deal. In contrast to [Greenstone, Hornbeck, and Moretti \(2010\)](#), we observe the Procomer scores behind the ranking shared with MNCs. In Section 4.2.2, we show the similarity between winners and losers in scores, in addition to other observable characteristics.

The “winner vs. losers” event-study design is a generalized triple-difference design where firms experience a first deal with an MNC in different years. We modify equation (1) to allow for an extra interaction between event dummies  $D_{idt}^k$  and an indicator dummy of winning deal  $d$ ,  $\mathbb{1}\{\text{Winner}\}_{id}$ . We label the winner and losers of the same deal with the same  $d$  subscript. We investigate the effect of being considered for deal  $d$  on both the winner and losers of that deal by running the following regression:

$$y_{idt} = \alpha_i + X_{it}^\top \beta + \gamma_d + \lambda_t + \sum_{k=\underline{C}}^{\bar{C}} \theta_k^L D_{idt}^k + \sum_{k=\underline{C}}^{\bar{C}} \theta_k^{Diff} \mathbb{1}\{\text{Winner}\}_{id} D_{idt}^k + \varepsilon_{idt}, \quad (2)$$

where  $y_{idt}$  is the outcome of firm  $i$  part of deal  $d$  in year  $t$ ,  $\lambda_t$  is the calendar year fixed effect, and  $\mathbb{1}\{\text{Winner}\}_{id}$  is an indicator function that equals 1 if firm  $i$  is the winner of deal  $d$ .  $\gamma_d$  are

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<sup>34</sup>For instance, Procomer asks whether the firm uses an enterprise resource planning software or whether it carries out financial feasibility studies for its projects. See Figure F6 ([Online Appendix F.2.1](#)) for more examples.

deal fixed effects that force the effects on the winner to be measured with respect to those on the actual contenders to the same deal. Our coefficients of interest are  $\theta_k^L$  and  $\theta_k^{Diff}$ , which are interpreted as the effect of the event on the losers and on the difference in outcomes between winners and losers, respectively. All other variables are defined the same as for equation (1).

## 4 Event-Study Results on Improvements in Firm Performance

### 4.1 Baseline Results

We implement the event-study specification (1) to estimate the effects of starting to supply to an MNC on firm scale and standard measures of TFP. We also bring in the firm-to-firm transactions to study the effects on the sales made to buyers other than the first MNC buyer. These results characterize the 3,697 domestic firms who become first-time suppliers to an MNC in Costa Rica between 2010 and 2015. Hereafter, we mention the results from the full sample that includes both first-time suppliers and firms never supplying to an MNC. For completeness, all tables also report the results for the restricted sample that excludes never-suppliers.

*Firm scale.* Figure 2 plots the event-study coefficients for total sales, the number of workers, net assets, and input costs. Reassuringly, we find no evidence of selection into supplying based on past firm growth. It is only after firms start supplying to MNCs that they experience strong and lasting growth. These effects already manifest themselves in the year of their first transaction with an MNC, when the average growth relative to the previous year is of 16% in sales, 6% in the number of workers, and 9% in input costs. Firms continue expanding over the next two years to plateau thereafter at 33% higher sales, 26% more workers, 22% more assets, and 23% higher input costs. Table 1 provides additional details. In particular, it shows that the full sample estimates hold up to dropping the never-suppliers. This suggests that the driver of our baseline results is the event, and not the comparison to never-suppliers.

The magnitude and long-run nature of these effects are noteworthy. The average (median) first sale to an MNC is of 62,400 (18,590) U.S. dollars and represents an average (median) share of 19% (6%) of that year's total sales. In other settings where firms receive demand shocks that are comparable (or even bigger), firms do not grow as much. For instance, [Atkin, Khandelwal, and Osman \(2017\)](#) find that Egyptian firms who receive large export orders for rugs (with cumulative payments of 155,682 U.S. dollars for 11 weeks of work) did not increase their number of employees and capital usage. Similarly, supply-side interventions such as business training can also fail to boost firm scale ([Karlan and Valdivia, 2011](#)).

*Business with other buyers.* The natural concern with these findings of firm growth is that they are largely explained by the addition of a new (MNC) buyer. We now leverage the firm-to-firm transaction data to investigate this possibility. In addition to the pattern of total sales, Figure 3 shows the patterns of sales to all buyers *except* the first MNC buyer (*sales to others*), all corporate buyers (*total corporate sales*), and all corporate buyers *except* the first MNC buyer (*corporate sales to others*). The *corporate buyers* of a firm in a given year are those reported in the

firm-to-firm transaction data, i.e., firms in Costa Rica whose purchases of goods or services exceed 4,200 U.S. dollars that year. Sales to others are equal to total sales minus the sales to the first MNC buyer. Total corporate sales are those made to all corporate buyers. Corporate sales to others exclude the sales to the first MNC buyer.<sup>35</sup>

Across these four sets of buyers, we find no evidence of differential trends in sales before the event of a first sale to an MNC. However, we find large and lasting increases in the four types of sales after the event. Most importantly, these increases are maintained even after we exclude the sales to the first MNC buyer. In the year of the event, sales to others decrease by 19%. This suggests that firms may be capacity-constrained in the short-run. Four years after the event, sales to others increase by 20%, while corporate sales to others increase by 45%.<sup>36</sup>

Next, we ask whether these changes in sales to others work through the change in the number of buyers (extensive margin) or average sales (intensive margin). Figure 3 (Panel 3e) plots the event-study coefficients from a regression where the dependent variable is the log number of corporate buyers (except the MNC triggering the event). We find no differential trends in the number of corporate buyers in the years preceding a first contract with an MNC. There is clear evidence, however, of a gradual increase in the number of other corporate buyers after the event, such that, four years later these firms have about 36% more corporate buyers.<sup>37</sup>

To study responses along the intensive margin, we study the average value of transactions across corporate buyers in each event year. The year when firms make their first sale to an MNC, they see a large decline in their average transaction with other corporate buyers. However, in the next four years, the average transaction becomes 14% higher than in the year before the event. Table A4 ([Online Appendix A](#)) shifts to an event-study where each observation is the transaction value associated to a supplier-buyer-year triad. With supplier×buyer fixed effects, we show that four years after the event of the supplier, sales within supplier-buyer pairs are 5% higher. Tables 2 and 3 provide more details and robustness checks to our results in Figure 3 (e.g., we show that results are not driven by demand from buyers who themselves started supplying to MNCs).<sup>38</sup>

*Standard measures of TFP.* We first estimate TFP using OLS, assuming either a Cobb-Douglas or a translog production function. To this end, in specification (1), we use log sales

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<sup>35</sup> Aside from total corporate sales, total sales contain exports and sales to end consumers (general public) and firms in Costa Rica whose purchases that year sum up to less than the reporting threshold. We call this difference *non-corporate sales*. Total sales come from corporate income tax returns. Corporate sales and corporate sales to others come from the firm-to-firm transaction data.

<sup>36</sup> Sales to others increase less than corporate sales to others due to a slower increase of 16% in non-corporate sales (see column (1) in Table A3, [Online Appendix A](#)). Figure A3 ([Online Appendix A](#)) shows how the composition of the sales of first-time suppliers to MNCs changes with the event time. Sales are assigned to five types of buyers: the government, domestic buyers, partially foreign-owned buyers (but not MNC affiliates), MNCs, and exports.

<sup>37</sup> Figure A4 ([Online Appendix A](#)) reveals that part of these new buyers are MNCs other than the first MNC buyer. While the lack of pre-trends is mechanical, the continued increase in the number of new MNC buyers is not.

<sup>38</sup> Our findings of increased sales to others suggest that suppliers may not be the only ones who benefited from their new supplying relationship, but that these other buyers benefited as well. Kee (2015) uses a representative sample of Bangladeshi garment firms to show that domestic firms who share suppliers with foreign-owned firms experience both expansions in product scope and productivity. Kee's paper provides empirical support for the theory of Rodríguez-Clare (1996) and Carluccio and Fally (2013). While these potential gains to domestic buyers are certainly relevant to any estimation of the aggregate effects of MNCs, they are beyond the scope of this paper.

as the outcome variable and the logs of the number of workers, net assets, and input costs as the time-varying controls. We also construct a TFP index for the Cobb-Douglas production function. Instead of estimating input coefficients, we “residualize” sales by subtracting firm-level inputs used, weighted by their respective two-digit-level cost shares.<sup>39</sup> As OLS does not account for the potential endogeneity of firm-level input choices, we also use the methods proposed by [Levinsohn and Petrin \(2003\)](#) and [Ackerberg, Caves, and Frazer \(2015\)](#).

Figure 4 summarizes these results and Table 4 provides details. Reassuringly, firms that start supplying to MNCs do not display a history of TFP growth. After their events however, suppliers exhibit large increases in TFP, such that four years later, TFP is 6 to 9% higher than in the year before the event.<sup>40</sup> Under certain assumptions, we can interpret these estimates as capturing the behavior of true TFP. In particular, if we assume away input and output price variations correlated with the event, then the methods of [Levinsohn and Petrin \(2003\)](#) and [Ackerberg, Caves, and Frazer \(2015\)](#) already address the other main concern of TFP estimation (input choice endogeneity) and provide credible estimates of true TFP.

We now address the likelihood of one specific type of price variation that could be triggered by the event and lead to an overestimation of true TFP: higher mark-ups charged by the domestic firm after becoming a first-time supplier to an MNC. While we cannot directly rule out this possibility – as we do not observe prices and quantities separately – we provide several pieces evidence against it.

We first use the empirical model of [De Loecker and Warzynski \(2012\)](#), that allows for the estimation of mark-ups by relying on standard cost minimization conditions for variable inputs free of adjustment costs. Table A2 ([Online Appendix A](#)) points to a decline in the mark-up of domestic firms, after they become suppliers to MNCs. Hence, if anything, mark-up effects would lead to an underestimation of the true TFP gain.

Further, the answers from our surveys to domestic suppliers and MNCs are compatible with these mark-up estimates. Out of 106 domestic firms, 43 firms found that it was particularly challenging to find a first MNC buyer. Among the three biggest challenges was the fact that MNCs expected lower prices than these firms could offer. Of the 49 domestic firms who assessed that they were explicitly helped by their first MNC buyer to adjust, 34 firms said that MNCs expected in return either unchanged prices (for improving quality) or lower prices (for unchanged quality or even for improving quality).

We then asked domestic firms about their pricing practices for the same order (defined as same product, quality, and quantity) coming from either MNC or domestic buyers. 58% replied that they usually charge the same price to both types of buyers, with the other 42% split in half between whether they charge MNCs more or less. During the in-person surveys, we asked domestic firms if they had ever incurred losses from deals with MNCs. 11 of 15 firms

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<sup>39</sup>The dependent variable for the Cobb-Douglas TFP index is  $Y_{ist} - \alpha_{k,s2D} \times K_{ist} - \alpha_{l,s2D} \times WB_{ist} - \alpha_{m,s2D} \times M_{ist}$ , where  $\alpha_{l,s2D} = (\text{two-digit sectoral wage bill}) / (\text{two-digit sectoral revenues})$ ,  $\alpha_{m,s2D} = (\text{two-digit sectoral input costs}) / (\text{two-digit sectoral revenues})$ , and  $\alpha_{k,s2D} = 1 - \alpha_{l,s2D} - \alpha_{m,s2D}$  (to avoid the need to measure capital costs).

<sup>40</sup>Table A1 ([Online Appendix A](#)) shows results for more measures of performance, e.g., profits or sales per worker.

stated that they have made deals at a loss, particularly among the first MNC deals.<sup>41</sup>

From surveys of 58 MNCs, we learn that prices are among the top three criteria in choosing a local supplier. Of the 40 MNCs that claimed to provide explicit help to their new domestic suppliers, 27 expect, in return, prices that either remain unchanged or fall (for an improving quality). MNCs have a privileged access to imports (particularly those in FTZs, which are exempted from custom duties) and, through their corporate commodity manager, are well-informed on suitable suppliers abroad. This suggests that there is little room for domestic suppliers to obtain higher mark-ups from MNCs. Overall, irrespective of the angle of the questions and whether they were addressed to MNCs or domestic firms, we find no indication that suppliers extract higher mark-ups from MNCs. To the contrary, MNCs expect lower mark-ups. Our survey evidence (see [Online Appendix G.3](#)) is in line with previous evidence.<sup>42</sup>

Finally, we have just seen that starting to supply to MNCs improves the business performance of domestic firms with other buyers, both on the extensive and intensive margins. While this can occur despite price hikes, it suggests that the appeal of the products offered by these suppliers must have increased more than their prices. We conclude that it is unlikely that mark-ups explain the strong and persistent gains in standard measures of TFP.

## 4.2 Robustness Checks to the Baseline Results

### 4.2.1 Main Economy-Wide Event-Study Design

There is one remaining threat to identification that is not entirely addressed by our findings thus far: the selection of firms into supplying to MNCs based on transitory firm-specific shocks that can determine outcomes. We now investigate the plausibility of this threat.

To start, we asked in our surveys whether domestic firms took special measures to get ready for or attract their first MNC buyer. 44% of domestic firms replied that they did not. Of the other 56%, the most common measures taken ahead of a first sale to MNCs involved efforts to contact MNCs (in-person, online, at business fairs etc.). These efforts are likely to increase the probability of a first deal with an MNC, but unlikely to directly affect TFP. Our surveys also asked domestic firms whether there was any notable change that happened in the firm just before the first contract with the MNC. To the extent that this change can explain the wide-ranging effects just documented, then we would be misattributing these effects to the first deal with the MNC. 100 of the 106 domestic firms denied that such a change took place. None of the six positive answers challenges the interpretation of our estimates as measuring the treatment effect of becoming a supplier to MNCs. See [Online Appendix G.3](#) for details.

<sup>41</sup>The typical domestic supplier seems to bear most of the risk. For one supplier: “when the MNC develops a prototype for an input, they send us a blueprint. They have a budget for that input, which we agree with. During the process of development (more meetings, R&D processes and follow-ups), there are a lot of changes and improvements that increase the initial cost. We sometimes have to absorb this extra cost to keep the deal and the buyer, and to be taken into account in the future.”

<sup>42</sup>[Javorcik, Keller, and Tybout \(2008\)](#) interview suppliers to Wal-Mart in Mexico who describe the bargaining style of Wal-Mart as “take-or-leave-it.” To sell to Wal-Mart, firms must accept lower profit margins. Surveys from the Czech Republic find that 40% of suppliers to MNCs had to lower prices 1-30% ([Javorcik, 2008](#)).

Moreover, we use administrative data from the Costa Rican Social Security Fund to rule out what we believe to be the most plausible confounding factor: a change in management preceding the first contract with an MNC buyer. A well-connected and talented manager can bring in both this contract and improvements in firm performance. Of the 3,697 first-time suppliers, we identify those having replaced one of their top two earners (plausibly the top tier of managers) in either the year of the first transaction with an MNC or the year before. For this replacement to qualify as a threat, we focus on workers that are new-hires (as opposed to internal promotions). Reassuringly, our estimates are robust to excluding those domestic firms having hired new managers just before their event (see Table B4 in [Online Appendix B.2](#)).

We also probe the robustness of our baseline event-study results to other common concerns about the event-study methodology. Results are qualitatively similar when we vary the set of fixed-effects used in our baseline regressions (see Tables B1 to B3 in [Online Appendix B](#) and the discussion that precedes them). Results are also similar when we estimate the regressions on a balanced sample in event time (see Table B5 in [Online Appendix B.3](#)). Finally, to accommodate the possibility that the treatment onset is the first contact with an MNC and such contacts occur a year before the first transaction, we redefine the event-year as the year before the first transaction. Results only change in their almost mechanical delay by a year (see [Online Appendix B.4](#)). These alternate specifications corroborate the suitability of our event-study specification to estimate the effects of interest.

#### 4.2.2 “Winner vs. Losers” Event-Study Design

As argued in Section 3.2, the “Productive Linkages” program delivers plausible quasi-experimental variation in opportunities to supply to MNCs. Moreover, as described in Section 2.2, deals with MNCs mediated by this program appear to be similar along several key characteristics to economy-wide deals. We now examine whether our findings from the economy-wide event-study design are similar to those obtained from the “Productive Linkages” design.

We first compare winners and losers before the relevant deal (i.e., the deal won by the winner and the deal to which the loser was a contender). Figure 5a shows the histograms of winners’ and losers’ scores (based on which Procomer established the short-lists), while Figure 5b plots the histogram of within-deal differences between winners’ score and the average of losers’ scores. In both figures there is no systematic tendency for the winners’ scores to be larger than the losers’. One might interpret this finding as the scores being uninformative. Various pieces of evidence contradict this interpretation, however. First, Procomer scores are positively correlated with firm performance, measured with administrative data.<sup>43</sup> Second, Procomer aims to establish a good reputation for both domestic suppliers and its ability to identify them; assigning uninformative scores would undermine the confidence of MNCs. Table F8 ([Online Appendix F.2.2](#)) compares winners and losers in the year before the deal and fails to find statistically significant differences between winners and losers. Last, all firms that

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<sup>43</sup>Figure F7 ([Online Appendix F.2.2](#)) plots Procomer scores against firm value-added per worker. We find similar positive correlations for other measures of firm performance.

were losers in some deal ultimately became suppliers to MNCs. We conclude that the only meaningful difference between winners and losers is the timing of a first deal with an MNC.

We then proceed to estimating the “winner vs. losers” event-study specification from equation (2). Figure 6 plots the estimates of the  $\theta_k^L$  and  $\theta_k^{Diff}$  coefficients, where the  $\theta_k^L$  estimates depict the average behavior of losers to a deal and the  $\theta_k^{Diff}$  estimates depict the average behavior of winners relative to that of losers to their same deal. We look into five measures of firm performance: total sales, the number of workers, the TFP index, the sales to others, and the number of other corporate buyers. Reassuringly, winners do not exhibit pre-existing trends with respect to the losers. In contrast, after winning their first deal, winners improve their performance. While estimates are noisy due to the small sample size, they are comparable to those obtained from the main economy-wide analysis. As estimates of  $\theta_k^L$  for  $k > 0$  suggest, the gains in winner performance do not come at the expense of the losers’ performance, whose performance is left unscathed by the loss of the deal. Table 5 provides more details.

While the main economy-wide design and the “winner vs. losers” design have different advantages and disadvantages, it is comforting to see that their results are qualitatively similar.

#### 4.2.3 Robustness Check on Interpretation: Improvements in Third-Party Reporting

One might worry that domestic firms starting to supply to MNCs improve their tax compliance in ways that cast doubt on the interpretation of our baseline results. The third-party reporting structure of the firm-to-firm transaction data offers a unique opportunity to evaluate this concern. In theory, third-party reporting has self-enforcing properties. However, when tax authorities lack resources to pursue inconsistencies between the reports of the buyer and supplier of a transaction, the odds of being audited are not equally distributed across transactions and firms. This weakens the incentives of compliance for transactions or firms under lower scrutiny. If domestic suppliers believe that MNCs are more prone to audits than domestic buyers, these suppliers may pay additional attention to their D-151 reporting.<sup>44</sup>

Firms can improve their D-151 reporting by reducing gaps in reported values for transactions declared by both firms in a buyer-seller pair and/or by lowering the share of transactions only reported by one party. We construct three proxies of reporting quality. The first is a weighted average of the within-pair percentage difference between the larger and the smaller of the two values reported, across all pairs where a given firm is the seller. If buyers consistently report larger amounts than sellers (as tax evasion incentives would suggest), then this measure captures the extent of under-reporting of one’s sales compared to the reports of one’s buyers. The second measure keeps only pairs where a firm is the buyer and is meant to quantify the extent of over-reporting of its purchases. Finally, we construct a measure of the frequency of transactions found only in the D-151 forms of one firm in the pair.

In Online Appendix B.5 we show that becoming a supplier to MNCs is unlikely to have a bearing on either measure of third-party reporting quality, and if it does, the effect is the

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<sup>44</sup>Pomeranz (2015) finds that randomly-assigned audit announcements lead to an increase in value-added tax payments by both treated firms and their suppliers. The increase is higher for treated firms than for their suppliers.

opposite to that predicted by a reduction of tax-evasive behaviors. Hence, we do not ascribe our results to changes in third-party reporting behavior.

## 5 Alternative Model-Based Measures of Firm Performance

In Section 4.1 we studied standard measures of TFP recovered from production function estimations that use sales and expenditure data. These measures already address key challenges of TFP estimation, such as the potential endogeneity of input choices. Nonetheless, an important concern that is not addressed by these measures is that of unobserved variation in prices across firms (De Loecker and Goldberg, 2014). While we find evidence against increases in mark-ups, input and output prices can still change with the event. Not accounting for such changes in prices can bias the estimation of input elasticities in the production function and confound changes in prices or returns to scale with changes in true TFP.

In the absence of disaggregated firm-level data on prices and quantities, we make progress via a simple model that exploits the richness of our transaction data to deliver model-consistent estimates of TFP. The model allows for firm-level changes in prices and scale effects by assuming a fairly general structure for demand and cost functions. The intuition is analogous to that of revealed preferences approaches used to infer TFP and/or quality adjustments from demand estimation.<sup>45</sup> We first infer changes in a *composite TFP* (TFP and other factors, such as reputation, that improve the appeal of the firm) from changes in a measure of adjusted sales to buyers other than the first MNC buyer (hereafter, *adjusted sales to others*). The adjustment controls for potential returns to scale and effects of the MNC demand shock on prices. We then decompose the sales to others into the intensive (average sales, conditional on buying) and extensive (number of buyers) margins. Increases in *average adjusted sales to others* are informative on changes in TFP alone. Among others, this approach has the advantage that it does not require the estimation of production function elasticities.<sup>46</sup>

We summarize the model and its results here, and present more details on derivations and robustness checks in [Online Appendix C](#) and [Online Appendix D](#), respectively.

### 5.1 Model Environment

Let us consider a domestic supplier firm (henceforth, the supplier) selling a variety of a good to a number of buyers indexed by  $i$ . The supplier produces a total quantity of the variety  $Q = \sum_i q_i$  with a total cost  $TC(Q) = \kappa \left( \frac{Q}{\phi} \right)^{\frac{1}{\gamma}}$ , where  $\kappa$  is a constant,  $\phi$  is a productivity shifter (TFP), and  $\gamma > 0$  is the returns to scale parameter of the production function.<sup>47</sup>

<sup>45</sup>See [Broda and Weinstein \(2006, 2010\)](#); [Khandelwal \(2010\)](#); [Hallak and Schott \(2011\)](#); [Feenstra and Romalis \(2014\)](#); [Hottman, Redding, and Weinstein \(2016\)](#); [Bartelme, Costinot, Donaldson, and Rodríguez-Clare \(2018\)](#).

<sup>46</sup>We circumvent the need to estimate production function elasticities by using transaction data to indirectly infer TFP changes. This is one way in which our approach differs from that of [De Loecker \(2011\)](#). To control for price variation, [De Loecker \(2011\)](#) combines a CES demand system with production function estimation.

<sup>47</sup>In the case of perfectly competitive input markets, our expression for the total cost function encompasses both Cobb-Douglas and general returns to scale CES production functions.

We assume that the supplier uses a market penetration technology such that in equilibrium, a higher TFP supplier has a higher probability to sell to any buyer  $i$  (therefore selling to more buyers in equilibrium). This can be microfounded with either marketing (Arkolakis, 2010) or search costs (Bernard, Moxnes, and Saito, 2019). Additionally, there can be other factors such as the reputation or visibility of the supplier that, while potentially related to TFP, can also improve the probability of selling to a buyer. We will generically call all these factors *reputation* and denote them by  $r$ . We define the probability of selling to buyer  $i$  as  $n_i \equiv n_i(\phi, r) \in [0, 1]$ . We refer to  $\phi$  and  $r$  as the *supply-side parameters*.

Each buyer combines a continuum of differentiated varieties according to a CES aggregator with elasticity  $\sigma > 1$ . At price  $p(\phi)$ , the effective demand for the variety of the supplier is given by  $q_i(\phi, r) = n_i(\phi, r)b_i p(\phi)^{-\sigma}$ . Here,  $b_i = \frac{y_i}{P_i^{1-\sigma}}$ , where  $y_i$  is the budget and  $P_i$  is the price index faced by buyer  $i$ . Implicitly, the supplier is free to supply to buyers other than the first MNC buyer (we rule out exclusivity clauses) and does not price discriminate among buyers. Both assumptions are motivated by our surveys. We also abstract from interactions between the market for this good and other markets, acting through general equilibrium effects.<sup>48</sup>

## 5.2 The Effect of the Event on Model-Based Measures of Firm Performance

As in our empirical analysis, consider the event where the supplier starts selling to its first MNC buyer ( $MNC_0$ ). The event *may* lead to changes in one or both of the supply-side parameters ( $\phi$  and  $r$ ). Our model aims to help us estimate the change in  $\phi$  (TFP).

We define  $\tilde{Q} = \sum_{i \neq MNC_0} q_i$  and  $\tilde{B} = \sum_{i \neq MNC_0} n_i b_i$  as the quantity sold to and the aggregate demand shifter of all other buyers (i.e., all buyers other than  $MNC_0$ ). Using the structure of our model, we show in [Online Appendix C](#) that sales to other buyers can be written as:

$$\ln(p\tilde{Q}) = \kappa' + \delta \ln(pQ) + \ln(\tilde{B}) + (\sigma - 1)\ln(\phi), \quad (3)$$

where  $\kappa'$  is a constant and  $\delta \equiv \delta(\gamma, \sigma) = (\gamma - 1)(\sigma - 1) \in (1 - \sigma, 1)$ .

This  $\delta$  parameter captures the effect of returns to scale interacted with the demand curve parameter.  $\delta$  plays a key role in defining what we call the adjusted sales to others. When  $\delta \neq 0$  ( $\gamma \neq 1$ ), sales to other buyers depend on firm scale (i.e., total sales), as a change in firm scale affects the optimal price even when TFP remains constant. This parameter is similar to a parameter defined in [Bartelme, Costinot, Donaldson, and Rodríguez-Clare \(2018\)](#), which is used to estimate external economies of scale at the sector level.

We then take the total derivative of both sides of equation (3) and rearrange terms such that the left-hand side depends only on information observable in firm-to-firm transaction data and  $\delta$ . We then assume that the demand shifters of buyers  $i$  other than  $MNC_0$  ( $b_i = y_i/P_i^{1-\sigma}$ )

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<sup>48</sup>Under these assumptions, the profit-maximizing price is equal to the familiar mark-up over marginal cost,  $p = \frac{\sigma}{\sigma-1} MC(Q)$ . The second order condition for profit maximization asks for the returns to scale to not be “too large,” i.e.  $1 - \frac{1}{\gamma} < \frac{1}{\sigma} < 1$ .

do not change systematically due to the event.<sup>49</sup> Finally, we take expectations over all domestic firms that become first-time suppliers to an MNC and find that:

$$\mathbb{E} \left[ \text{dln} \left( \frac{p\tilde{Q}}{(pQ)^\delta} \right) \right] = (\sigma - 1)\varepsilon_\phi + \varepsilon_{\tilde{n}}, \quad (4)$$

where  $\varepsilon_\phi = \mathbb{E} [\text{dln}(\phi)]$  and  $\varepsilon_{\tilde{n}}$  is the expectation of a weighted average of  $\text{dln}(n_i) \forall i \neq \text{MNC}_0$ .<sup>50</sup> The left-hand side of equation (4) is the expectation of the change in adjusted sales to others.

Let us now define  $\varepsilon_{\phi'} = \varepsilon_\phi + \frac{1}{(\sigma-1)}\varepsilon_{\tilde{n}}$  and call it *composite TFP*. The following result emphasizes what needs to be known to estimate changes in composite TFP via equation (4).<sup>51</sup>

**Result 1.** *With values for  $\delta$  (the parameter capturing the effect of returns to scale interacted with the demand curve parameter),  $\sigma$  (the elasticity of demand),  $pQ$  (total sales), and  $p\tilde{Q}$  (sales to others, before and after the event of interest), one can estimate  $\varepsilon_{\phi'}$  (the change in composite TFP) after an event. Specifically,  $\varepsilon_{\phi'} = \frac{1}{(\sigma-1)}\mathbb{E} \left[ \text{dln} \left( \frac{p\tilde{Q}}{(pQ)^\delta} \right) \right]$ .*

**Proof.** See [Online Appendix C](#).

We can think of changes in composite TFP as measuring changes in supply-side features that affect suppliers' growth both through their number of buyers (extensive margin) and through their average sales made to actual buyers (intensive margin). Composite TFP is thus akin to a multi-dimensional productivity which includes TFP to reputation.

There are (at least) three ways to relate  $\varepsilon_{\phi'}$  with  $\varepsilon_\phi$ . First, note that  $\varepsilon_{\phi'} = \varepsilon_\phi$  only if  $\varepsilon_{\tilde{n}} = 0$ . That is, increases in composite TFP and TFP would be equal only when the increase in adjusted sales to others occurs uniquely through the intensive margin. Given that we find an increase of 36% in the number of buyers, we expect the increase in composite TFP to be larger than the increase in TFP alone. Second, whenever  $\varepsilon_{\tilde{n}}$  depends only on firm-level features other than  $\phi$  (say, reputation), then changes in composite TFP not only capture changes in TFP but also changes in these other features that affect the appeal of the firm. This case motivates the interpretation of  $\varepsilon_{\phi'}$  as multi-dimensional productivity. Finally, it is very plausible that  $\varepsilon_{\tilde{n}}$  does depend on  $\phi$  as well. In the likely case that  $\varepsilon_\phi$  positively affects  $\varepsilon_{\tilde{n}}$ , then an increase in composite TFP is likely to "double-count" the increase in TFP.<sup>52</sup>

To estimate the increase in TFP alone ( $\varepsilon_\phi$ ), we make two additional assumptions. First, we assume that there is a large number of potential buyers in the country. Second, we assume that for any changes in  $\phi$  and/or  $r$ , all buyers  $i$  equally adjust their probability to buy from the

<sup>49</sup>More precisely, we assume  $\varepsilon_{\tilde{b}} = 0$ , where  $\varepsilon_{\tilde{b}}$  is the expectation of a weighted average of  $\text{dln}(b_i)$ ,  $\forall i \neq \text{MNC}_0$ . This does not rule out changes in the composition of buyers (thus changes in the average  $b_i$  of the actual buyers). It only rules out systematic changes in the  $b_i$ s of all other potential buyers due to the event of the supplier.

<sup>50</sup>The weight for buyer  $i$  is equal to  $n_i / (\sum_{k \neq \text{MNC}_0}^N n_k b_k)$ .

<sup>51</sup>Note that if one is only interested in whether the event leads to an overall improvement in supply-side parameters ( $\phi$  and/or  $r$ ), one does not need to take a stand on the value of  $\sigma$ . Formally,  $\mathbb{E} \left[ \text{dln} \left( p\tilde{Q}/(pQ)^\delta \right) \right] > 0$  if and only if there are overall improvements in supply-side parameters ( $\phi$  and/or  $r$ ).

<sup>52</sup>For example, in the *ad hoc* case where  $\varepsilon_{\tilde{n}} = (\sigma - 1)\varepsilon_\phi$ , then  $\varepsilon_{\phi'} = 2\varepsilon_\phi$  (i.e. the increase in composite TFP overestimates the increase in actual TFP by 100%).

supplier, i.e.,  $d\ln(n_i) = d\ln(n)$ ,  $\forall i \neq MNC_0$ . Under these conditions,  $\varepsilon_{\tilde{N}} = \mathbb{E} [\ln(\tilde{N})]$ , where  $\tilde{N}$  is the number of buyers other than  $MNC_0$ .<sup>53</sup> This leads us to Result 2.<sup>54</sup>

**Result 2.** *With values for  $\delta$  (the parameter capturing the effect of returns to scale interacted with the demand curve parameter),  $\sigma$  (the elasticity of demand),  $pQ$  (total sales),  $p\bar{Q}$  (sales to others), and  $\tilde{N}$  (the number of other buyers, before and after the event of interest), one can estimate  $\varepsilon_\phi$  (the change in TFP) after an event. Specifically,  $\varepsilon_\phi = \frac{1}{(\sigma-1)} \mathbb{E} \left[ \ln \left( \frac{p\bar{Q}/(pQ)^\delta}{\tilde{N}} \right) \right]$ .*

**Proof.** See [Online Appendix C](#).

Given that our administrative data allows us to track total sales, sales to others, and the number of other buyers, the remaining step before bringing these results to the data is to settle on credible estimates of  $\delta$  and  $\sigma$ . In the following section we describe our IV approach to estimating  $\delta$ . With its estimate in hand, we use the event-study specification in equation (1) with adjusted sales and average adjusted sales as dependent variables. Last, we follow [Broda and Weinstein \(2006\)](#) and set  $\sigma$  equal to 6, which is a standard value in the trade literature.

### 5.3 IV Estimation of the $\delta$ Parameter

Our preferred estimate of  $\delta$  comes from an IV strategy. Consider a buyer  $j$  and the same assumptions of our model. Denote by an overline all variables that aggregate across all buyers other than  $j$ . We can write the expectation of the total differential of log sales to buyers different from  $j$  divided by the number of buyers different from  $j$  as:

$$\mathbb{E} \left[ \ln \left( \frac{p\bar{Q}}{\tilde{N}} \right) \right] = \delta \mathbb{E} [\ln(pQ)] + (\sigma - 1)\varepsilon_\phi + \varepsilon_{\bar{b}},$$

The empirical counterpart of this equation is given by the following linear regression:

$$\Delta \ln \left( \frac{p\bar{Q}}{\tilde{N}} \right)_{it} = \alpha_i + \lambda_{spt} + \delta \Delta \ln(pQ)_{it} + \nu_{it}, \quad (5)$$

where the structural error  $\nu_{it}$  contains both a multiple of the change in firm TFP and changes in the aggregate demand shifter of other buyers (net of firm and four-digit sector  $\times$  province  $\times$  year fixed effects,  $\alpha_i$  and  $\lambda_{spt}$  respectively).

The OLS estimate of  $\delta$  is likely to be inconsistent, as the error term (e.g., its component coming from a potential change in TFP) may not only affect average sales to other buyers

<sup>53</sup>The first assumption implies that with a large number of potential buyers, the total number of other buyers of the supplier ( $\tilde{N}$ ) is given by the sum of their probabilities of buying from the supplier ( $n_i$ ):  $\tilde{N} = \sum_{i \neq MNC_0}^N n_i$ . A weaker version of the second assumption would suffice, but for the sake of exposition we proceed with this stronger version. We provide a discussion of this assumption and its implications in [Online Appendix D.5](#).

<sup>54</sup>Similar to the case for Result 1, if one is only interested in testing whether the event leads to an increase in TFP, then one does not need to take a stand on  $\sigma$ .  $\mathbb{E} \left[ \ln \left( \frac{p\bar{Q}/(pQ)^\delta}{\tilde{N}} \right) \right] > 0$  if and only if  $\varepsilon_\phi > 0$ .

directly through prices, but may also be correlated to total sales. We can overcome this endogeneity via an IV approach. We require the instrument (a) to shift the total sales of firm  $i$ , and (b) to affect the average sales to buyers different from  $j$  only through a potential scale effect. The ideal instrument would not be correlated with either changes in the TFP of firm  $i$ , or changes in the demand parameters from buyers other than buyer  $j$ . We propose a special case where buyer  $j$  is the government. Our instrument exploits the moment in which a supplier gets a first procurement contract from the government. More precisely, our proposed instrument for the change in log total sales of supplier  $i$  at time  $t$  is a dummy variable indicating whether supplier  $i$  is awarded a procurement contract at time  $t - 1$  or not.

The exclusion restriction is plausible because (i) the government is a buyer which is unlikely to provide learning opportunities to suppliers (so that supplying to the government at  $t - 1$  is uncorrelated with changes in firm TFP at  $t$ ), and (ii) it is unlikely that supplying to the government at  $t - 1$  is systematically correlated with changes in average demand shifters of other buyers at time  $t$ .<sup>55</sup> Moreover, our instrument is relevant, as procurement contracts with the government in year  $t - 1$  affect the change in total sales from  $t - 1$  to  $t$ . See [Online Appendix D.1](#) for additional details.

Table [D2 \(Online Appendix D.2\)](#) reports the results from this IV strategy. Our preferred estimate of  $\delta$  is of  $-0.22$  and stems from the full sample including both firms that experience the event of starting to supply to the government and firms that never supply to the government. That said, if we use  $\delta = -0.08$ , the estimate from the restricted sample, results do not change significantly. The first-stage F-statistic is 50 (110 for the restricted sample).

## 5.4 Model-Based Results

*Result 1.* In columns (1) and (2) of Table [6](#), we study the behavior of composite TFP before and after domestic firms become first-time suppliers to an MNC. The dependent variable of these event-studies is  $1/(\sigma - 1)$  times the log of adjusted sales to others. We construct adjusted sales to others in two ways: one combines corporate income tax returns data with the firm-to-firm transaction data, the other uses only the firm-to-firm transaction data.<sup>56</sup> In both cases, we find no evidence of differential trends before the event and a strong and positive growth afterwards. Four years later, composite TFP is 6% higher than in the year before the event.<sup>57</sup>

Figure [7](#) compares this model-based measure of composite TFP to those from three stan-

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<sup>55</sup>Note that the structural error  $v_{it}$  does not depend on  $r$ . Equation [\(5\)](#) already takes into account the extensive margin, hence any supply-side parameter other than  $\phi$  affecting the probability of selling to new buyers. Even if starting to sell to the government induces an improvement in one's reputation, this does not invalidate our instrument. One concern is that changes in TFP might drive procurement contracts with the government in the first place. This is partially alleviated by using the instrument with a lag, as future changes in TFP are less likely to predict past contracts. In addition, Table [D1 \(Online Appendix D.1\)](#) shows event-study regressions where the event is defined as the first time a domestic firm gets a procurement contract with the government. We do not find evidence of selection based on pre-trends in TFP. We only find small and short-lived changes in TFP after the event, lending support to our exclusion restriction. See [Online Appendix D.1](#) for more details.

<sup>56</sup>The total sales from firm-to-firm transaction data are the total corporate sales defined in Section [4.1](#), whereas the sales to others from firm-to-firm transaction data are the corporate sales to others defined in the same section.

<sup>57</sup>We prefer the estimate in column (1) because it captures the behavior of sales to *all* other buyers, not only those recorded in the firm-to-firm transaction data.

dard measures of TFP: a Cobb-Douglas TFP index, and Cobb-Douglas and translog production function estimation residuals. For direct comparability, all estimates use total sales (to others) from corporate income tax returns data. The message from this figure is clear: estimates from all four measures of TFP are statistically similar.<sup>58</sup>

*Result 2.* Column (3) of Table 6 shows the effect of becoming a supplier to MNCs on TFP alone (as opposed to composite TFP). The dependent variable is now  $1/(\sigma - 1)$  times the log of average adjusted sales to others. We construct average adjusted sales to others only from firm-to-firm transaction data, as this allows us to track changes in the intensive and extensive margin for the same set of buyers. Again, we find no evidence of differential trends in TFP before the event and strong and positive growth after.

Contrasting these results with those from *Result 1* informs us on the importance of the extensive margin (recall that composite TFP and TFP are only equal when  $\varepsilon_{\tilde{n}} = 0$ ). To this end, we compute (one minus) the ratio of the TFP gain according to *Result 2* (0.047 from column (3) from Table 6) over the gain in composite TFP according to *Result 1* (0.109 from column (2)). This exercise indicates that the increased ability to get new buyers (the extensive margin) accounts for 57% of the change in composite TFP. One limitation of the TFP estimates from column (3) is that they describe the behavior of transactions with corporate buyers alone.

To make statements that describe TFP based on the average sales to *all* other buyers (not just those recorded by the firm-to-firm transaction data) one requires additional assumptions on the pattern of the number of buyers whose transactions are under the reporting threshold. Under the proportionality assumption that the extensive margin matters as much for the sales to corporate buyers above the threshold as to those below, the TFP estimate from *Result 2* would become 43% of the 6% estimate from *Result 1* (column (1) from Table 6), or around 3%.

Estimating the share of these extensive margin effects uniquely due to changes in TFP ( $\phi$ ) or reputation ( $r$ ) is outside the scope of this paper. We therefore remain agnostic on how  $\phi$  and  $r$  relate to each other and to the probability of selling to a new buyer ( $n_i$ ). We only assume that both  $\phi$  and  $r$  have a positive effect on this probability. That said,  $\phi$  is likely to be positively correlated with  $r$ ; a firm that reveals itself as able to learn and adapt fast is likely to improve its reputation, and vice versa. Section 6 provides intuition on this relationship from our surveys.

An exhaustive anatomy of the changes undergone by first-time suppliers to MNCs requires significantly more data than what is commonly recorded for an entire economy (e.g., data on prices, product quality, product scope, reputation). Nonetheless, the findings in this section represent a step forward in terms of understanding these changes, relative to what can be known from corporate income tax returns data alone. In particular, we have shown that by combining firm-to-firm transaction data with a simple model, we can learn about the potential role of the extensive margin. While part of the improved ability to sell to more buyers may be

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<sup>58</sup>The only difference that is statistically significant pertains to the year of the event. During that year, suppliers experience a net increase in total sales and a concomitant fall in sales to others. While standard measures of TFP only take into account the net increase in total sales, our model rationalizes the decrease in sales to others as a decrease in composite TFP. This fall in sales to others is likely to be driven by adjustment frictions upon starting to supply to MNCs, outside the scope of this model.

a consequence of gains in TFP, the extensive margin seems able to compound these gains.

## 5.5 Robustness Checks for the Model-Based Results

Our baseline model-based results use  $\delta = -0.22$  and  $\sigma = 6$ , which imply returns to scale  $\gamma = 0.96$ . [Online Appendix D](#) explores their sensitivity to both parameters. We first vary  $\delta$  between -1.2 and 0.3, keeping  $\sigma$  at 6. For this  $\sigma$  and range of  $\delta$ , the returns to scale of the production function lie between 0.76 and 1.06. Tables [D3](#) and [D4](#) implement Result 1 using balance sheet and firm-to-firm transaction data to construct the adjusted sales to others, whereas Table [D5](#) implements Result 2 using firm-to-firm transaction data to construct the average adjusted sales to others. As expected, the more negative (positive) the  $\delta$  – i.e., the more decreasing (increasing) the returns to scale,  $\gamma$  – the larger (smaller) are the implied TFP gains from the event. For values of  $\delta$  close to -0.22, results remain largely unchanged.

Figure [D5](#) shows how results vary not only with  $\gamma$  (or  $\delta$ ) but also with  $\sigma$ . As one would expect, the more elastic the demand curve (the larger the  $\sigma$ ), the more sensitive are the sales to others to changes in prices. This means that a larger  $\sigma$  requires a smaller TFP gain to rationalize a given increase in sales to others. At the same time, the more decreasing the returns to scale (the smaller the  $\gamma$ ), the higher prices will get after a given increase in the scale of the supplier. For this reason, the smaller the  $\gamma$ , the larger is the increase in TFP that generates a given increase in sales to others. That said, our baseline results are robust to values of  $\gamma$  and  $\sigma$  around our preferred values of 0.96 and 6, respectively.

Finally, we also infer  $\sigma$  and  $\gamma$  from estimates of mark-ups and input elasticities of the production function of first-time suppliers to MNCs (following [De Loecker and Warzynski, 2012](#)). This can be done since our model implies a one-to-one relationship between the mark-up  $\mu$  and the demand elasticity  $\sigma$  ( $\mu = \sigma/(\sigma - 1)$ ). Moreover, the returns to scale  $\gamma$  can be computed as the sum of the input elasticities of the production function. This approach gives us  $\sigma = 5.03$  and  $\gamma = 0.92$  (hence  $\delta = -0.33$ ). Results for these values are similar to our baseline results. See [Online Appendix D.3](#) for details.

## 6 Additional Evidence on Mechanisms

In this section, we present additional evidence on the ways in which domestic firms interact with MNCs and how they adjust in response to their new status as suppliers to MNCs.

*Evidence from administrative data on heterogeneous effects.* We use the administrative data and the economy-wide event-study to characterize the heterogeneity of effects by sector. We split domestic firms based on either their sector or that of their first MNC buyer and run separate regressions on each sector-specific sample. Sectors fall into one of four categories: manufacturing, retail (including repair and maintenance), services, or agriculture. Table [8](#) looks into the Cobb-Douglas TFP index. Suppliers in manufacturing benefit most from starting to supply to MNCs, with an 11% higher TFP four years later, while suppliers in retail and services

attain only half of this gain. Suppliers in agriculture see no effect. When we split firms by the sector of the MNC buyer, only those starting to supply to an MNC in manufacturing see their TFP grow. Our overall estimate of a 6% higher TFP index four years later is therefore driven by suppliers whose first MNC buyer was in manufacturing, or by suppliers in manufacturing and – to a lesser extent – in retail and services.

Table 7 divides firms based on the technological (knowledge) intensity of the sector of either the supplier or the first MNC buyer. We categorize sectors as high- or low-tech according to OECD classifications. The high- (low-)tech category also includes high (low) knowledge-intensive services.<sup>59</sup> Suppliers in low-tech sectors are those who benefit the most from starting to supply to MNCs. Conversely, suppliers whose first MNC buyer is in a high-tech sector are those whose performance improves the most. We also split suppliers depending on whether their first MNC buyer is under the Free Trade Zone (FTZ) regime or not. First-time suppliers to an MNC in FTZs experience stronger performance gains. The findings on the high-tech or FTZ nature of the MNC are compatible with each other and with those from Table 8, given the sizable overlap between MNCs in FTZs, high-tech MNCs, and MNCs in manufacturing. The findings on suppliers' sectoral splits are reconciled by the fact that 87% of suppliers in high-tech sectors operate in knowledge-intensive services (e.g., professional, scientific and technical services), while 58% of suppliers in low-tech sectors are in manufacturing and retail.

This heterogeneity analysis suggests that the nature of inputs supplied can affect the extent to which suppliers can learn from MNCs and improve their performance. MNCs are more likely to be invested in the success of supplying relationships where the input has a direct bearing on their core output. Also, suppliers might receive more support from MNCs whose product is high-quality (or complex), as imperfections in inputs can be particularly costly. This might explain why high-tech (or manufacturing) MNCs trigger the highest performance gains and particularly so for domestic firms in manufacturing.<sup>60</sup>

*Evidence from surveys to managers in domestic suppliers and MNCs.* We now summarize the key takeaways from our surveys, inviting readers to [Online Appendix G](#) for details.

To set the stage, our surveys first asked MNCs about the factors that were important to their decision to open an affiliate and later stay and/or expand in Costa Rica. To both questions, the local availability of suitable suppliers ranked only sixth among the eight options.<sup>61</sup> We then asked MNCs about the corporate hierarchy of sourcing decisions. The headquarters (HQ) is involved in all sourcing decisions and particularly so in those involving core inputs. In theory, local affiliates show interest in having more domestic suppliers. In practice, they seem

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<sup>59</sup>The OECD classifies manufacturing sectors as high-tech, medium high-tech, medium low-tech or low-tech, and service sectors as high- or low-knowledge intensive. We label as *high-tech* the high-tech or medium high-tech manufacturing sectors and high knowledge-intensive service sectors, all others are referred to as *low-tech*.

<sup>60</sup>This intuition is supported by survey responses of MNCs on the explicit or direct help extended to domestic suppliers. Of the 31% of MNCs who denied providing any explicit help, 78% are in low-tech sectors, whereas of the 69% of MNCs who claimed providing help, 58% are in high-tech sectors. MNCs in manufacturing are more likely to grant several types of support at once (e.g., reciprocated visits, sharing of blueprints and best practices, putting the domestic firm in contact with suppliers to other affiliates).

<sup>61</sup>The five factors weighting more heavily in the decision of MNCs to invest in Costa Rica were the education of workers, the tax incentives, the distance to target markets, the Costa Rican market, and wages.

reluctant to trust domestic firms with critical inputs and prefer, instead, the global suppliers recommended by the HQ. Domestic firms are more likely to be considered for secondary inputs. Domestic firms echoed a difficulty to establish a first contract with MNCs. For the 43 of the 106 domestic firms for whom it was particularly difficult to start supplying to MNCs, the three most frequent reasons were that MNCs did not know or trust them, that MNCs were difficult to contact, and that MNCs expected lower prices than they could offer.

Against a backdrop of relatively low integration in Costa Rica, we asked MNCs whether, once they agree to be supplied by a domestic firm, they offer the firm any explicit support to boost its ability to supply to them successfully. A total of 40 out of 58 MNCs (69%) replied positively. The three most frequent ways in which MNCs claimed to help domestic firms were the sharing of *blueprints* or clear details about the expected product or services, visits of the supplier to the MNC to learn about the processes where its input is used, and visits of the MNC to the supplier to carry out audits and offer guidance on improvements. We also asked the mirror questions to domestic firms. In terms of explicit help, 47 of 106 domestic firms (44%) acknowledged receiving such help. The three most important forms of help coincided with those mentioned by MNCs. What follows is a quote where the general manager of a domestic supplier describes the usefulness of the help offered by their first MNC buyers:

We felt that, while working with a multinational, we could tap into a “global catalog” of best practices. On the spot, we were learning a lot, not having to go through the same struggles as suppliers to other affiliates in the past, skipping hardships, and having a steeper learning curve.

MNCs are more likely to perceive these interactions as direct help than domestic suppliers for two reasons. First, MNCs are particularly demanding with their suppliers and new suppliers have a short period of time to adapt. Second, domestic suppliers declared that most of the efforts to adapt to the expectations of MNCs are born by the domestic firm alone. When we asked MNCs what they assess to be the biggest disadvantage or risk for domestic firms that become their suppliers, the pressure to adapt fast was among the most frequent answers. In the words of the supply chain manager of one MNC:

The biggest disadvantage of starting to work with us has to do with our “zero tolerance” policy. There is no forgiving of mistakes in the “major league.” [...] New suppliers can have some failures at the beginning, but very fast they need to succeed in delivering whatever they committed to deliver. We cannot afford to be the sponsor of a supplier that does not rise to the occasion. We are willing to help them, and we do help them, but cannot be a charitable benefactor forever and ever. Suppliers are under a lot of pressure to adapt fast, to change all their paradigms of how to do business.

We then surveyed domestic firms about the changes that they experienced after their first supplying relationship with an MNC. 62% of the 106 domestic respondents mentioned having expanded their product scope, in particular with higher-quality goods and services demanded

by MNCs.<sup>62</sup> These higher-quality products required firm-wide changes; for instance, introducing a quality management system. Also, higher-quality products require better inputs. This explains why 39% of suppliers had to change their sourcing strategy, 44% hired more high-skilled workers, and 27% had existing workers work harder. 50% of firms improved their managerial and organizational practices, in part advised by MNCs, in part prompted by pressure from MNCs to meet the agreed standards and to do so consistently.<sup>63</sup>

Overall, domestic firms implemented several interrelated changes as a consequence of becoming suppliers to MNCs. When asked about the most important of them, respondents typically struggled to isolate one change as being distinctively more important than the rest. The testimonial of the general manager of one domestic supplier emphasizes the interrelated nature of these changes:

The biggest change came with the expansion of the portfolio of goods and services we offered. This part has been the most challenging and the riskiest. That said, this change implied many others. One must be very agile in the organization of production, have inventories for very different inputs, improve financing etc. It can be a wild experience, far from one's comfort zone.

Did starting to supply to MNCs also help the reputation of these domestic firms? Our surveys suggest that it did. When asked whether it was easier to find more MNC buyers after the first such buyer, 83 domestic firms (78%) responded positively. Of these, 86% stated that it became easier to gain the trust of new MNCs. Similarly, their improved visibility in the domestic market also helped with domestic buyers. That said, earning a reputation does not automatically imply that this reputation is positive and thus helpful in selling to new buyers. Domestic firms were motivated to learn and adapt quickly to the expectations of their first MNC buyers, in order to avoid being characterized as bad suppliers. In fact, MNCs believed that one of the biggest risks for suppliers was to be revealed as incapable of coping with the standards of MNCs and for this information to be shared with other potential clients, particularly other MNCs. This points to an important relationship between a firm's reputation and TFP. While investigating this relationship is outside the scope of this paper, it suggests that reputation can magnify the importance of differences in TFP on overall firm performance.

## 7 Conclusion

In this paper, we show that upon becoming suppliers to MNCs, domestic firms in Costa Rica experience strong and persistent gains in firm performance. For instance, four years after,

<sup>62</sup>It is plausible that if domestic firms expand their offer of goods or services, they become attractive to buyers in more areas of activity. Table A5 (Online Appendix A) uses the main economy-wide samples (based on administrative data) to show that, four years after having a first MNC buyer, domestic firms sell to buyers in 25% more two-digit sectors and 29% more four-digit sectors. These increases are beyond those mechanically granted by increases in firm size, as we already control for the total sales of the domestic firm. We also find weaker evidence of an increase in the number of sectors from which domestic firms purchase their own inputs.

<sup>63</sup>According to the supply chain manager of one MNC: "A big risk for domestic firms that start supplying to MNCs comes from failing to deliver consistently their product or service at the expected parameters. The product or service supplied is continuously assessed. Suppliers cannot miss the mark, not even once. If they supplied everything correctly one time, then in theory they have the technical ability to do that again. But this consistency has to do, more than anything, with a managerial vision of excellence."

domestic firms hire 26% more workers and experience gains of 6 to 9% in standard measures of TFP. We then exploit the fact that we can observe all firm-to-firm sales of first-time suppliers to explore additional measures of firm performance. Sales to buyers other than the first MNC buyer increase by 20%, with this growth occurring both on the extensive (number of buyers) and intensive (sales conditional on buying) margins. We propose a simple model wherein TFP and reputation affect the extensive margin, but TFP alone affects the intensive margin. We find a model-based increase in TFP of 3% four years after. Finally, we collect survey data from managers in both domestic firms and MNCs, from which we learn that first-time suppliers experience wide-ranging improvements such as those to their managerial practices and reputation. These insights from surveys corroborate our model-based findings.

We highlight four avenues for future research. To start, our surveys underscore the interdependence of the upgrades made by domestic firms upon becoming suppliers to MNCs. For example, successful expansions in product scope (typically with higher-quality products) need to go hand in hand with a higher efficiency, so that firms can switch seamlessly between products requiring different inputs and processes. Separately estimating the contributions of changes in efficiency, product scope, and quality to changes in TFP requires information not available in tax data. An environment closer to a randomized control trial would make it possible to disentangle these interrelated effects of supplying to MNCs.

Given the importance of finding new buyers for firm performance, new work could also investigate the factors that affect the number of buyers. One challenge is to separately identify the role of TFP (or reputation, broadly construed) on the probability of selling to new buyers. The plausible correlation between TFP and reputation (on top of well-known difficulties to measure them both) compounds any such attempt. In addition, increases in TFP (or reputation) are likely to increase the probability of selling to specific buyers, adding another layer of complexity to the role of new buyers in explaining firm performance.

Another question that arises is to what extent our results come from the multinational nature of buyers, as opposed to their managerial expertise or technological level. For instance, we find that firms who start supplying to MNCs in high-technology sectors experience the strongest TFP gains. The main obstacle faced here is that in the developing world, there are rarely any comparable domestic buyers. In countries with a sufficient number of comparable domestic buyers, one could ask whether MNC buyers trigger larger TFP boosts than otherwise similar domestic buyers. This also relates to the question of why only supplying to certain types of MNCs leads to TFP gains. Although these questions are beyond the scope of this paper, they are fruitful avenues for future work.

Finally, a natural next step is to study the general equilibrium effects of forming relationships with MNCs. A comprehensive evaluation of the benefits of MNC entry requires not only credible estimates of their effects on domestic suppliers but also estimates of their actual integration in the domestic economy. Firm-to-firm transaction data allow one to circumvent the use of I-O tables and provide such credible measures of integration.

## References

- Abebe, Girum, McMillan, Margaret, and Serafinelli, Michel. Foreign Direct Investment and Knowledge Diffusion in Poor Locations: Evidence from Ethiopia. Working Paper, 2017.
- Ackerberg, Daniel A., Caves, Kevin, and Frazer, Garth. Identification Properties of Recent Production Function Estimators. Econometrica, 83(6):2411–2451, 2015.
- Aitken, Brian J. and Harrison, Ann E. Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. American Economic Review, 89(3):605–618, 1999.
- Akhlaque, Asya, Lopez, Ong, Chua, Anne Beline, and Coste, Antoine. Vietnam - Enhancing Enterprise Competitiveness and SME Linkages: Lessons from International and National Experience. World Bank Working Paper 119861, 2017.
- Alfaro, Laura. Gains from Foreign Direct Investment: Macro and Micro Approaches. World Bank Economic Review 30, pages S2–S15, 2017.
- Alfaro, Laura, Chanda, Areendam, Kalemli-Özcan, Sebnem, and Sayek, Selin. FDI and Economic Growth: The Role of Local Financial Markets. Journal of International Economics, 64(1):89–112, 2004.
- Alfaro, Laura, Antràs, Pol, Chor, Davin, and Conconi, Paola. Internalizing Global Value Chains: A Firm-level Analysis. Technical report, National Bureau of Economic Research, 2015.
- Alfaro-Ureña, Alonso, Fuentes, Mariany, Manelici, Isabela, and Vasquez, Jose. The Costa Rican Production Network: Stylized Facts. Research Paper Series, 2018.
- Antràs, Pol and de Gortari, Alonso. On the Geography of Global Value Chains. NBER Working Paper No. 23456, 2017.
- Antràs, Pol and Yeaple, Stephen R. Multinational Firms and the Structure of International Trade, volume 4, pages 55–130. Elsevier, 2014.
- Arkolakis, Costas. Market Penetration Costs and the New Consumers Margin in International Trade. Journal of Political Economy, 118(6):1151–1199, 2010.
- Asher, Sam and Novosad, Paul. Rural Roads and Local Economic Development. Working Paper, 2018.
- Atkin, David and Donaldson, Dave. Who's Getting Globalized? The Size and Implications of Intratemporal Trade Costs. Working Paper, 2018.
- Atkin, David, Khandelwal, Amit K., and Osman, Adam. Exporting and Firm Performance: Evidence from a Randomized Experiment. Quarterly Journal of Economics, 132(2):551–615, 2017.
- Atkin, David, Faber, Benjamin, and Gonzalez-Navarro, Marco. Retail Globalization and Household Welfare: Evidence from Mexico. Journal of Political Economy, 126(1), 2018.
- Banerjee, Abhijit, Duflo, Esther, Goldberg, Nathanael, Karlan, Dean, Osei, Robert, Parienté, William, Shapiro, Jeremy, Thuysbaert, Bram, and Udry, Christopher. A Multifaceted Program Causes Lasting Progress for the Very Poor: Evidence from Six Countries. Science, 348(6236), 2015.
- Banerjee, Abhijit Vinayak. Microcredit Under the Microscope: What Have We Learned in the Past Two Decades, and What Do We Need to Know? Annual Review of Economics, 5(1):487–519, 2013.
- Bartelme, Dominick, Costinot, Arnaud, Donaldson, Dave, and Rodríguez-Clare, Andrés. External Economies of Scale and Industrial Policy: A View from Trade. Working Paper, 2018.
- Bernard, Andrew, Dhyne, Emmanuel, Magerman, Glenn, Manova, Kalina, and Moxnes, Andreas. The Origins of Firm Heterogeneity: A Production Network Approach. Working Paper, 2017.
- Bernard, Andrew, Moxnes, Andreas, and Saito, Yukiko U. Production Networks, Geography and Firm Performance. Journal of Political Economy, 2019.
- Blalock, Garrick and Gertler, Paul J. How Firm Capabilities Affect who Benefits from Foreign Technology. Journal of Development Economics, 90(2):192 – 199, 2009.
- Blomström, Magnus and Sjöholm, Fredrik. Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter? European Economic Review, 43(4-6):915–923, 1999.

- Bloom, Nicholas, Mahajan, Aprajit, McKenzie, David, and Roberts, John. Why Do Firms in Developing Countries Have Low Productivity? *American Economic Review*, 100(2):619–23, 2010.
- Bloom, Nicholas, Eifert, Benn, Mahajan, Aprajit, McKenzie, David, and Roberts, John. Does Management Matter? Evidence from India. *Quarterly Journal of Economics*, 128(1):1–51, 2013.
- Blundell, Richard and Dias, Monica Costa. Alternative Approaches to Evaluation in Empirical Microeconomics. *Journal of Human Resources*, 44(3):565–640, 2009.
- Broda, Christian and Weinstein, David E. Globalization and the Gains from Variety. *Quarterly Journal of Economics*, 121(2):541–585, 2006.
- Broda, Christian and Weinstein, David E. Product Creation and Destruction: Evidence and Price Implications. *American Economic Review*, 100(3):691–723, 2010.
- Bustos, Paula. Trade Liberalization, Exports and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinean Firms. *American Economic Review*, 101 (1):304–340, 2011.
- Carluccio, Juan and Fally, Thibault. Foreign Entry and Spillovers with Technological Incompatibilities in the Supply Chain. *Journal of International Economics*, 90:123–135, 2013.
- Carrillo, Paul, Donaldson, Dave, Pomeranz, Dina, and Singhal, Monica. The Bigger the Better? Using Lotteries to Identify the Allocative Efficiency Effects of Firm Size. *Working Paper*, 2018.
- Caves, Richard E. *Multinational Enterprise and Economic Analysis*. Cambridge Surveys of Economic Literature. Cambridge University Press, 3 edition, 2007.
- Clerides, Sofronis K, Lach, Saul, and Tybout, James R. Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco. *Quarterly Journal of Economics*, 113(3): 903–947, 1998.
- De Loecker, Jan. Do Exports Generate Higher Productivity? Evidence from Slovenia. *Journal of International Economics*, 73(1):69–98, 2007.
- De Loecker, Jan. Product Differentiation, Multiproduct Firms, and Estimating the Impact of Trade Liberalization on Productivity. *Econometrica*, 79(5):1407–1451, 2011.
- De Loecker, Jan. Detecting Learning by Exporting. *American Economic Journal: Microeconomics*, 5(3): 1–21, 2013.
- De Loecker, Jan and Goldberg, Pinelopi Koujianou. Firm Performance in a Global Market. *Annual Review of Economics*, 6(1):201–227, 2014.
- De Loecker, Jan and Warzynski, Frederic. Markups and Firm-Level Export Status. *American Economic Review*, 102(6):2437–71, May 2012.
- De Mel, Suresh, McKenzie, David, and Woodruff, Christopher. Returns to Capital in Microenterprises: Evidence from a Field Experiment. *Quarterly Journal of Economics*, 123(4):1329–1372, 2008.
- Demir, Banu, Javorcik, Beata, Michalski, Tomasz K., and Örs, Evren. Financial Constraints and Propagation of Shocks in Production Networks. *Working Paper*, 2018.
- Dhyne, Emmanuel, Kikkawa, Ken, and Magerman, Glenn. Imperfect Competition in Firm-to-Firm Trade. *Working Paper*, 2018a.
- Dhyne, Emmanuel, Kikkawa, Ken, Mogstad, Magne, and Tintelnot, Felix. Trade and Domestic Production Networks. *Working Paper*, 2018b.
- Djankov, Simeon and Hoekman, Bernard. Foreign Investment and Productivity Growth in Czech Enterprises. *World Bank Economic Review*, 14(1):49–64, 2000.
- Donaldson, Dave. Railroads of the Raj: Estimating the Impact of Transportation Infrastructure. *American Economic Review*, 108(4-5):899–934, 2018.
- Faber, Benjamin. Trade Integration, Market Size, and Industrialization: Evidence from China's National Trunk Highway System. *Review of Economic Studies*, 81(3):1046–1070, 2014.
- Fafchamps, Marcel, McKenzie, David, Quinn, Simon, and Woodruff, Christopher. Microenterprise Growth and the Flypaper Effect: Evidence from a Randomized Experiment in Ghana. *Journal of*

- Development Economics, 106:211–226, 2014.
- Feenstra, Robert C and Romalis, John. International Prices and Endogenous Quality. Quarterly Journal of Economics, 129(2):477–527, 2014.
- Ferraz, Claudio, Finan, Frederico, and Szerman, Dimitri. Procuring Firm Growth: The Effects of Government Purchases on Firm Dynamics. NBER Working Paper 21219, 2016.
- Fieler, Ana Cecília, Eslava, Marcela, and Xu, Daniel Yi. Trade, Quality Upgrading, and Input linkages: Theory and Evidence from Colombia. American Economic Review, 108(1):109–46, 2018.
- Furusawa, Taiji, Inui, Tomohiko, Ito, Keiko, and Tang, Heiwei. Global Sourcing and Domestic Production Networks. Working Paper, 2017.
- Gereffi, Gary, Humphrey, John, and Sturgeon, Timothy. The Governance of Global Value Chains. Review of International Political Economy, 12(1):78–104, 2005.
- Ghani, Ejaz, Goswami, Arti Grover, and Kerr, William R. Highway to Success: The Impact of the Golden Quadrilateral Project for the Location and Performance of Indian Manufacturing. Economic Journal, 126(591):317–357, 2016.
- Goldberg, Pinelopi Koujianou, Khandelwal, Amit Kumar, Pavcnik, Nina, and Topalova, Petia. Imported Intermediate Inputs and Domestic Product Growth: Evidence from India. Quarterly Journal of Economics, 125(4):1727–1767, 2010.
- Greenstone, Michael, Hornbeck, Richard, and Moretti, Enrico. Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings. Journal of Political Economy, 118(3): 536–598, 2010.
- Haddad, Mona and Harrison, Ann. Are There Positive Spillovers from Direct Foreign Investment?: Evidence from Panel Data for Morocco. Journal of Development Economics, 42(1):51–74, 1993.
- Hallak, Juan Carlos and Schott, Peter K. Estimating Cross-country Differences in Product Quality. Quarterly Journal of Economics, 126(1):417–474, 2011.
- Harrison, Ann and Rodríguez-Clare, Andrés. Trade, Foreign Investment, and Industrial Policy. Handbook of Development Economics, 5, 2010.
- Harrison, Ann and Scorse, Jason. Multinationals and Anti-Sweatshop Activism. American Economic Review, 100(1):247–73, 2010.
- Haskel, Jonathan E, Pereira, Sonia C, and Slaughter, Matthew J. Does Inward Foreign Direct Investment Boost the Productivity of Domestic Firms? Review of Economics and Statistics, 89(3):482–496, 2007.
- Havránek, Tomas and Iršová, Zuzana. Estimating Vertical Spillovers from FDI: Why Results Vary and What the True Effect Is. Journal of International Economics, 85(2):234 – 244, 2011.
- Helpman, Elhanan, Melitz, Marc J, and Yeaple, Stephen R. Export Versus FDI with Heterogeneous Firms. American Economic Review, 94(1):300–316, 2004.
- Hottman, Colin J, Redding, Stephen J, and Weinstein, David E. Quantifying the Sources of Firm Heterogeneity. Quarterly Journal of Economics, 131(3):1291–1364, 2016.
- Hsieh, Chang-Tai and Klenow, Peter J. The Life Cycle of Plants in India and Mexico. Quarterly Journal of Economics, 129(3):1035–1084, 2014.
- Huneeus, Federico. Production Network Dynamics and the Propagation of Micro Shocks. Working Paper, 2018.
- Javorcik, Beata S. Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. American Economic Review, 94(3):605–627, 2004.
- Javorcik, Beata S. Can Survey Evidence Shed Light on Spillovers from Foreign Direct Investment? World Bank Research Observer, 23(2):139–159, 2008.
- Javorcik, Beata S., Keller, Wolfgang, and Tybout, James. Openness and Industrial Response in a Walmart World: A Case Study of Mexican Soaps, Detergents and Surfactant Producers. World Economy, 2008.

- Karlan, Dean and Valdivia, Martin. Teaching Entrepreneurship: Impact of Business Training on Micro-finance Clients and Institutions. *Review of Economics and Statistics*, 93(2):510–527, 2011.
- Kee, Hiau Looi. Local Intermediate Inputs and the Shared Supplier Spillovers of Foreign Direct Investment. *Journal of Development Economics*, 112(Supplement C):56 – 71, 2015.
- Keller, Wolfgang and Yeaple, Stephen R. Multinational Enterprises, International Trade, and Productivity Growth: Firm-level Evidence from the United States. *Review of Economics and Statistics*, 91 (4):821–831, 2009.
- Khandelwal, Amit. The Long and Short (of) Quality Ladders. *Review of Economic Studies*, 77(4):1450–1476, 2010.
- Lee, Munseob. Government Purchases, Firm Growth and Industry Dynamics. *Working Paper*, 2017.
- Levinsohn, James and Petrin, Amil. Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies*, 70(70):317–341, 2003.
- McKenzie, David and Woodruff, Christopher. What Are We Learning from Business Training and Entrepreneurship Evaluations around the Developing World? *World Bank Research Observer*, 29(1): 48–82, 2013.
- Miyauchi, Yuhei. Matching and Agglomeration: Theory and Evidence from Japanese Firm-to-Firm Trade. *Working Paper*, 2018.
- OECD. Costa Rica: Good Governance - From Process to Results. Technical report, OECD, 2015.
- OECD. Tax Policy Reviews: Kazakhstan 2017. Technical report, OECD, 2017.
- Pavcnik, Nina. Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants. *Review of Economic Studies*, 69(1):245–276, 2002.
- Pomeranz, Dina. No Taxation without Information: Deterrence and Self-enforcement in the Value Added Tax. *American Economic Review*, 105(8):2539–2569, 2015.
- Ramondo, Natalia and Rodríguez-Clare, Andrés. Trade, Multinational Production, and the Gains from Openness. *Journal of Political Economy*, 121(2):273–322, 2013.
- Rodríguez-Clare, Andrés. Multinationals, Linkages, and Economic Development. *American Economic Review*, 86(4):852–873, 1996.
- Steenbergen, Victor and Sutton, John. Establishing a Local Content Unit for Rwanda. Policy Note. Technical report, International Growth Centre, 2017.
- Taglioni, Daria and Winkler, Deborah. Making Global Value Chains Work for Development. *World Bank Trade and Development Series*, 2016.
- Topalova, Petia and Khandelwal, Amit. Trade Liberalization and Firm Productivity: The Case of India. *Review of Economics and Statistics*, 93(3):995–1009, 2011.
- Tybout, James R. Manufacturing Firms in Developing Countries: How Well Do They Do, and Why? *Journal of Economic literature*, 38(1):11–44, 2000.
- UNCTAD. Trade, Investment and Taxation: Policy Linkages. Technical report, United Nation Conference on Trade and Development, 2018a.
- UNCTAD. World Investment Report 2018. Technical report, United Nation Conference on Trade and Development, 2018b.
- Verhoogen, Eric. Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector. *Quarterly Journal of Economics*, 123(2):489–530, 2008.
- Woodruff, Christopher. Addressing Constraints to Small and Growing Businesses. *Working Paper*, 2018.
- Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge and London, 2002.

# Figures



Figure 1: Four Examples of Domestic Suppliers to MNCs

*Notes:* Figure 1 is a collage of four photographs taken by the authors during visits to four domestic suppliers to MNCs. All four firms have responded to the in-person long survey. Firms in the top row supply automotive mechanic services (left-hand side firm), and retail and maintenance of precision cutting tools (right-hand side firm). These firms have under five full-time employees, their facilities are modest and space-constrained. Their deals with MNC buyers are discontinuous, occurring mostly when MNCs have an emergency. Firms in the bottom row specialize in tailored precision machining (left-hand side firm), and tailored industrial supplies (right-hand side firm). These firms hire between 10 and 20 full-time employees, the layout of their plant is more spacious and organized, and they display more capital and standardization in processes. Their relationships with MNCs are longer-lasting and involve products or services that relate to the core activity of the MNC.

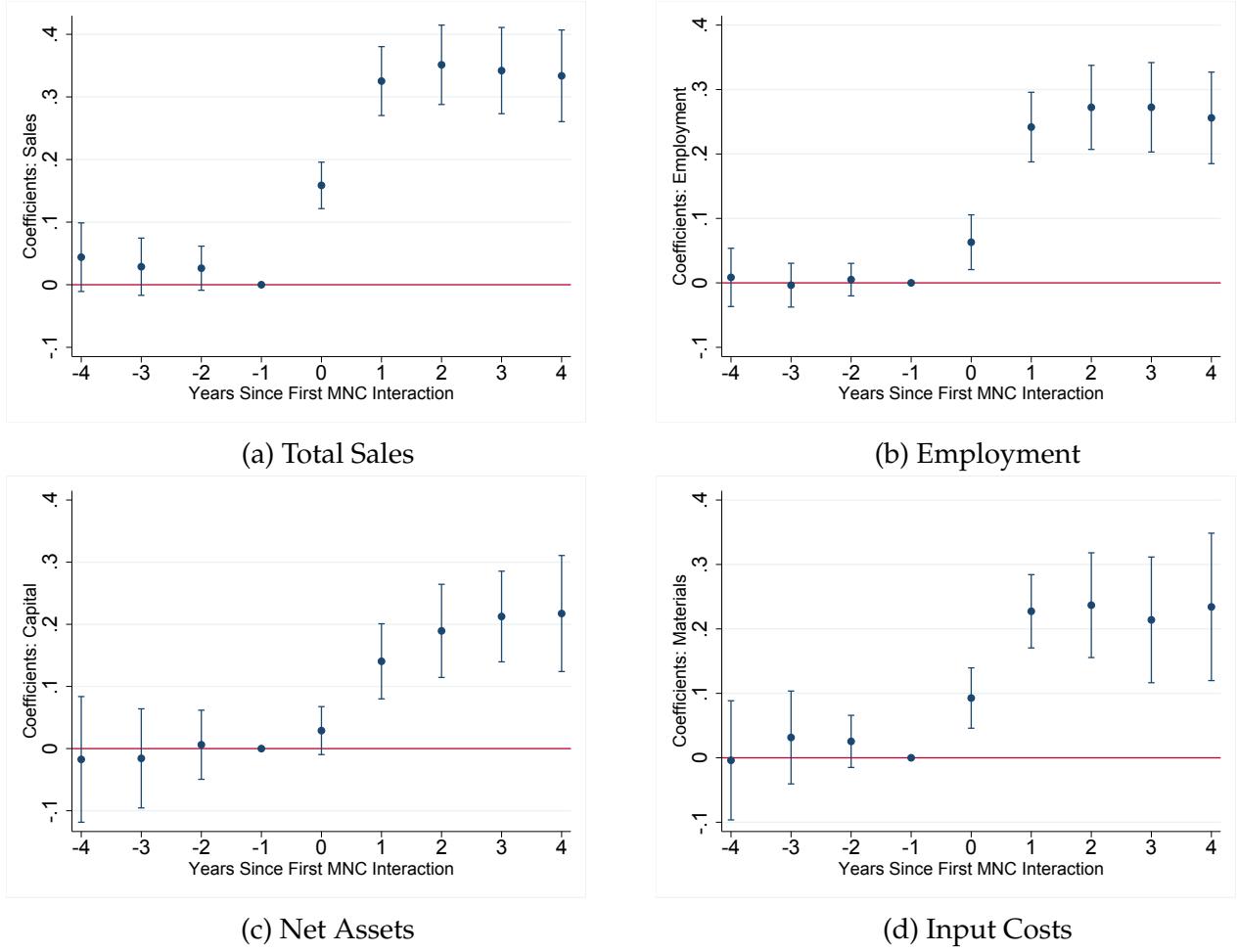


Figure 2: Domestic Firms Increase Their Scale after Starting to Supply to MNCs

*Notes:* Figure 2 plots the estimated  $\theta_k$  event-study coefficients from a regression of the form given in equation (1), where the dependent variable is, in turn, log total sales (Panel 2a), log employment (Panel 2b), log net assets (Panel 2c), and log input costs (Panel 2d). The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and four-digit sector  $\times$  province  $\times$  calendar year fixed effects. The vertical lines reflect the 95% confidence intervals. The coefficients plotted correspond to columns (1)-(4) in Table 1, obtained from the full sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017.

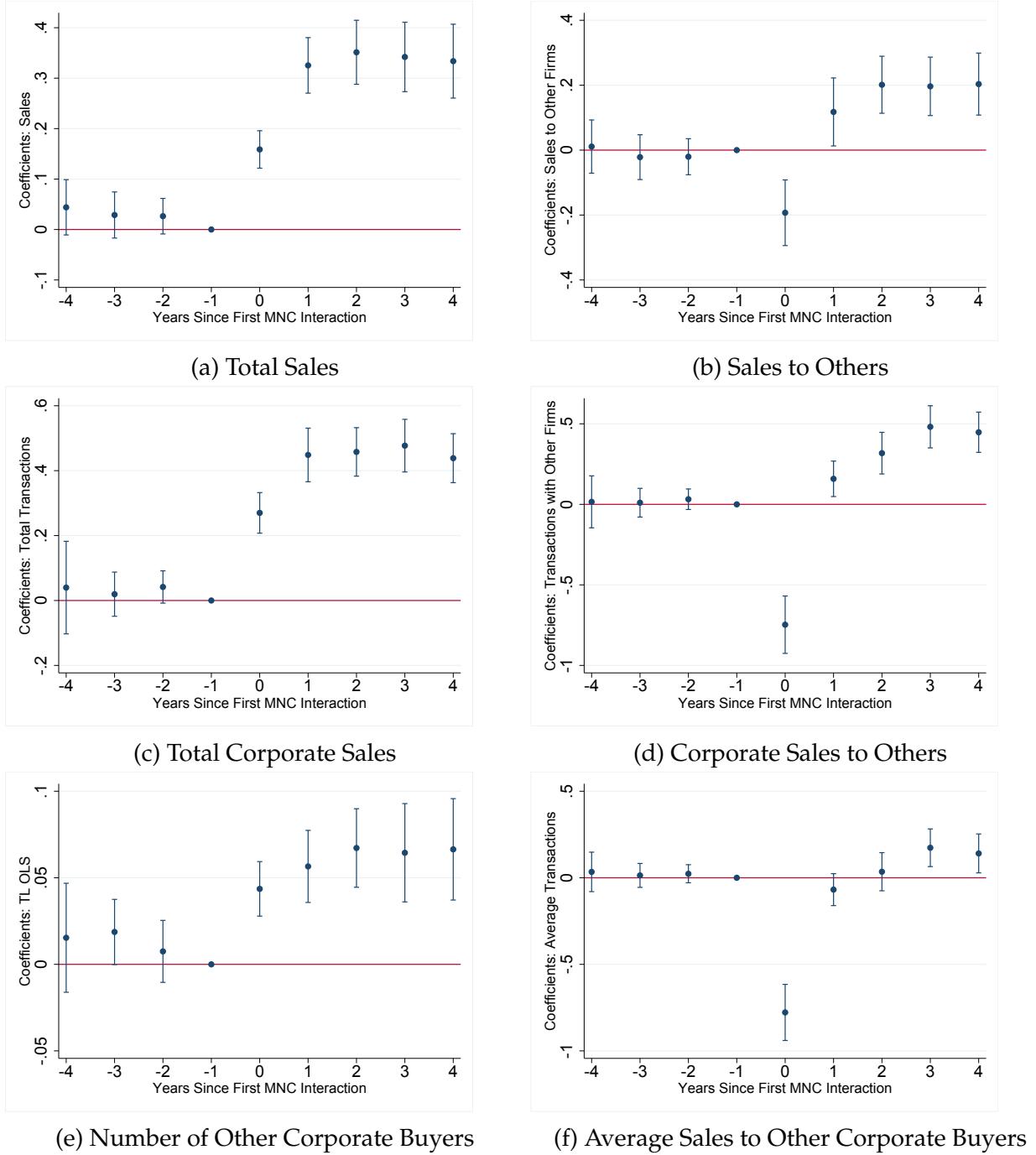


Figure 3: Domestic Firms Improve Their Sales to Others after Starting to Supply to MNCs

*Notes:* Figure 3 plots the estimated  $\theta_k$  event-study coefficients from a regression of the form given in equation (1), where the dependent variable is, in turn, log total sales (Panel 3a), log sales to buyers other than the first MNC buyer (Panel 3b), log total sales to corporate buyers (Panel 3c), log sales to corporate buyers other than the first MNC buyer (Panel 3d), log number of other corporate buyers (Panel 3e), and log average value of sales to other corporate buyers (Panel 3f). The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and four-digit sector  $\times$  province  $\times$  calendar year fixed effects. The vertical lines reflect the 95% confidence intervals. The coefficients plotted correspond to columns (1)-(2) in Table 2 and columns (1)-(4) in Table 3, obtained from the sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017.

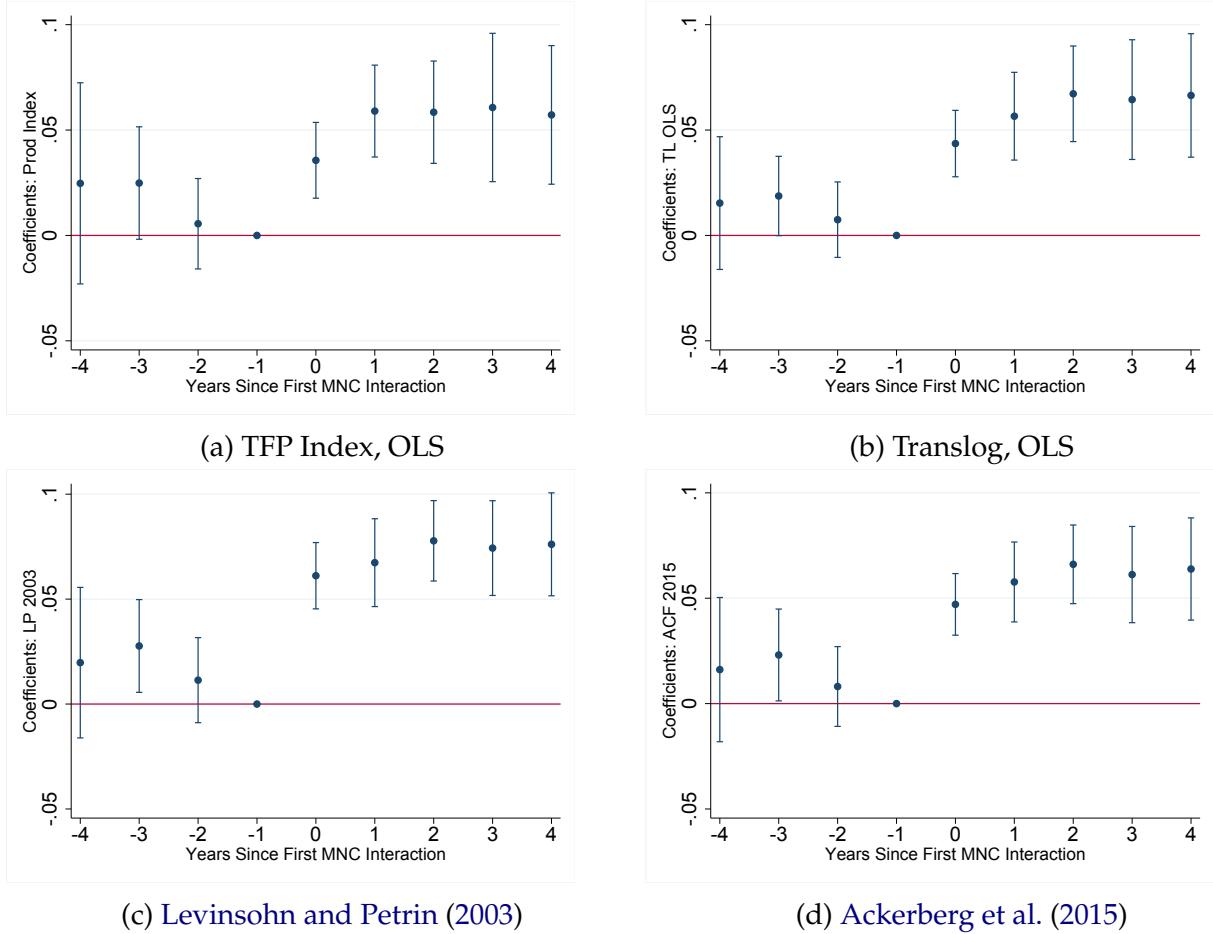


Figure 4: Domestic Firms Improve Their TFP after Starting to Supply to MNCs

*Notes:* Figure 4 plots the estimated  $\theta_k$  event-study coefficients from specification (1) adapted to four measures of TFP. In Panel 4a we use as dependent variable a TFP index constructed assuming a Cobb-Douglas production function. This method “residualizes” sales by subtracting firm-level inputs used, weighted by the respective two-digit-level cost shares. Panels 4b use measures of TFP resulting from OLS production function estimation, under the translog functional form assumption. Panels 4c and 4d estimate TFP using the methods proposed by Levinsohn and Petrin (2003) and Ackerberg, Caves, and Frazer (2015). The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. The vertical lines reflect the 95% confidence intervals. The coefficients plotted correspond to columns (1), (3), (4), and (5) in Table 4 obtained from the sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017.

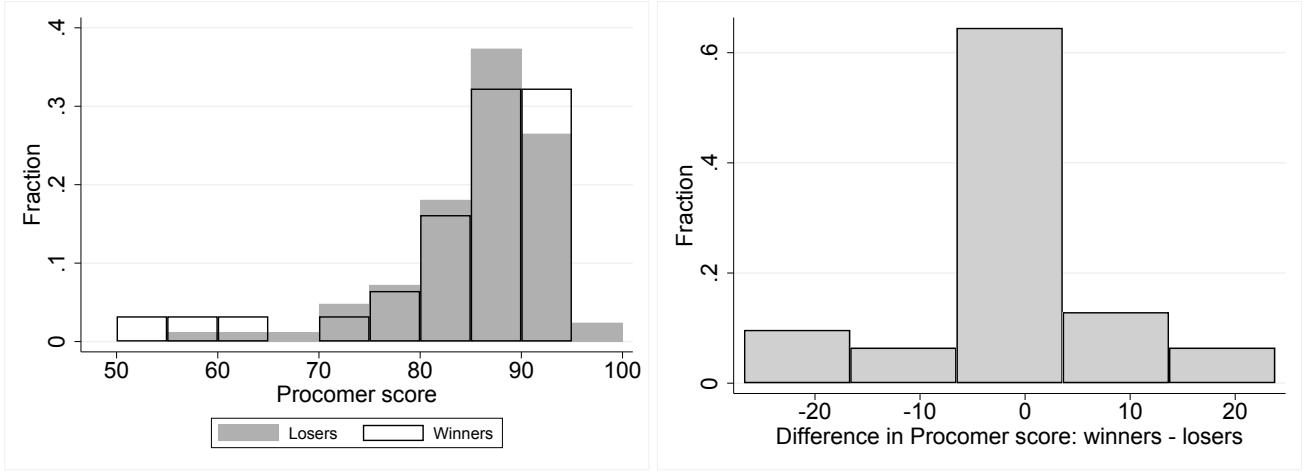


Figure 5: Robustness Check: Scores of Firms in the “Productive Linkages” Program

Notes: Figure 5 compares the Procomer scores of winning and losing firms in our sample of first-time deals with MNCs mediated through the “Productive Linkages” program of Procomer. Panel 5a shows the histogram of Procomer scores for winners (white bars) and losers (grey bars). Panel 5 presents a histogram of differences between winner and loser scores. This difference is constructed by subtracting from the score of the winner the average score of the losing contenders to the same deal. These histograms characterize the sample of 31 “Productive Linkages” deals, involving 31 winners and 84 losers. This exercise is part of a robustness check to the baseline event-study results plotted in Figures 2, 3, 4 and 7.

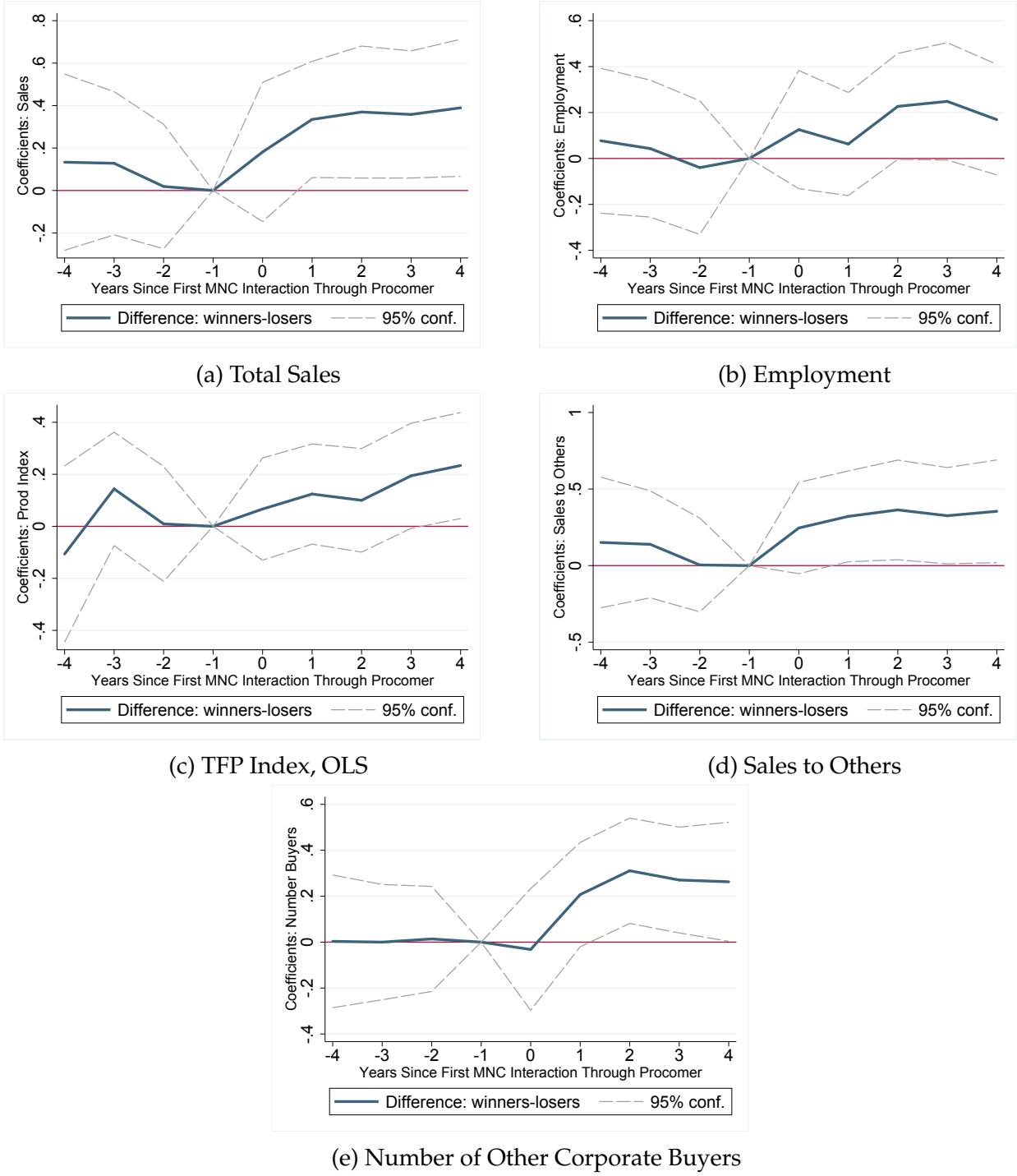


Figure 6: Robustness Check: Domestic Firms Improve their Performance after First “Productive Linkages” Deal

*Notes:* Figure 6 plots the estimated  $\theta_k^{Diff}$  event-study coefficients from a regression of the form given in equation (2), where the dependent variable is, in turn, log total sales (Panel 6a), log employment (Panel 6b), log TFP index (Panel 6c), log sales to others (Panel 6d), and log number of other corporate buyers (Panel 6e). The event is defined as the first time a domestic firm experiences a deal with an MNC buyer, mediated by the “Productive Linkages” program.  $\theta_{-1}^{Diff}$ , the coefficient of the year prior to the event, is normalized to zero. The dashed lines delimit the 95% confidence intervals. The coefficients plotted correspond to columns (1)-(5) in Table 5. These regressions are run on the sample of 31 “Productive Linkages” deals, involving 31 winners and 84 losers. This exercise is part of a robustness check to the baseline event-study results plotted in Figures 2, 3, 4 and 7.

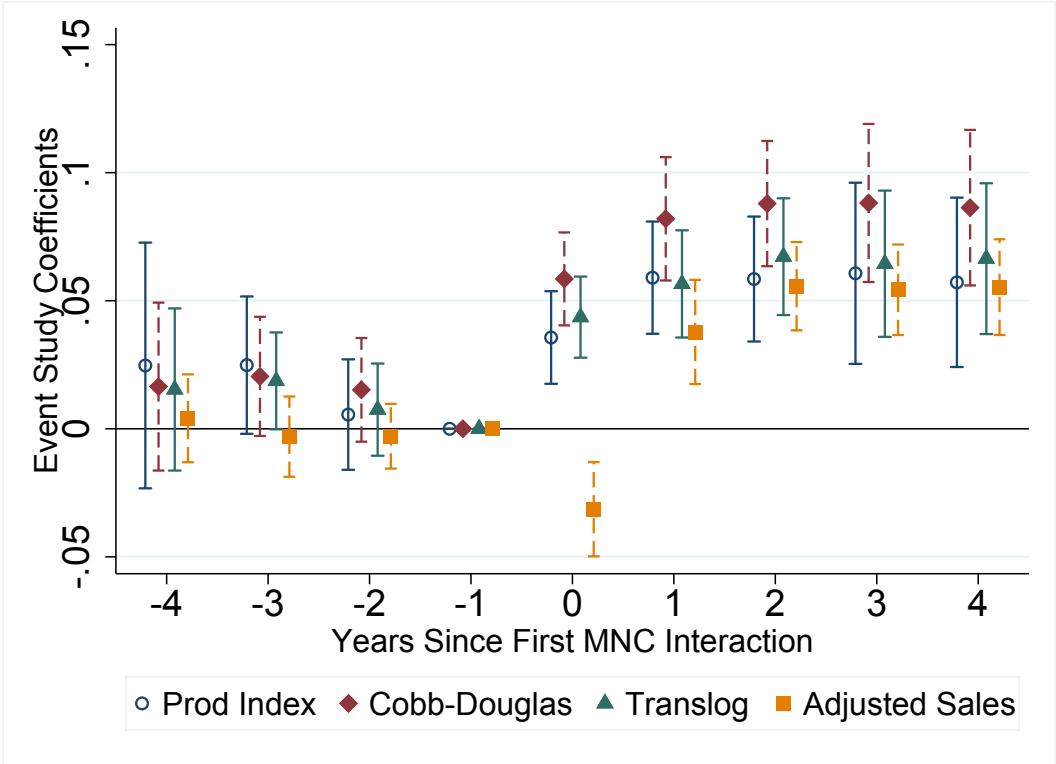


Figure 7: Standard Measures of TFP vs. Model-Based Measure of Composite TFP

*Notes:* Figure 7 plots the estimated  $\theta_k$  event-study coefficients from specification (1) adapted to four different measures of TFP. The circular, rhomboid, and triangular sequences pertain to standard measures of TFP. “Prod Index” is the TFP index that uses as dependent variable a residualized version of sales. “Cobb-Douglas” and “Translog” come from OLS production function estimations assuming a Cobb-Douglas and translog specification for the production function. These three sets of coefficients can be found (in order) in columns (1), (2), and (3) of Table 4. The rectangular markers (“Adjusted Sales”) depict the evolution of our model-based estimates of changes in composite TFP (which, in our model, encompasses true TFP, reputation, and their interaction). These estimates are the empirical application of Result 1, which states that changes in adjusted sales to others are informative on changes in composite TFP. The adjustment controls for both potential returns to scale and effects of the MNC demand shock on prices (via a parameter,  $\delta$ ). These model-based estimates pertain to our preferred values for  $\delta = 0.22$  and the elasticity of demand  $\sigma = 6$ . These estimates can be found in Column (1) of Table 6. The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. The vertical lines reflect the 95% confidence intervals. For direct comparability all the four sequences of event-study coefficients use total sales (to others) from corporate income tax returns data. Also, all estimates are obtained from the sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017.

# Tables

Table 1: Domestic Firms Increase Their Scale after Starting to Supply to MNCs

	Sales (1)	Employment (2)	Capital (3)	Materials (4)	Sales (5)	Employment (6)	Capital (7)	Materials (8)
<i>4 years before event</i>	0.044 (0.028)	0.009 (0.023)	-0.017 (0.052)	-0.004 (0.047)	-0.022 (0.053)	-0.054 (0.049)	-0.067 (0.053)	0.003 (0.069)
<i>3 years before event</i>	0.029 (0.023)	-0.004 (0.017)	-0.016 (0.041)	0.032 (0.037)	0.001 (0.041)	-0.027 (0.035)	-0.049 (0.044)	0.057 (0.049)
<i>2 years before event</i>	0.026 (0.018)	0.005 (0.013)	0.006 (0.028)	0.025 (0.021)	0.007 (0.023)	-0.010 (0.019)	-0.005 (0.025)	0.036 (0.030)
<i>Year of event</i>	0.159*** (0.019)	0.063*** (0.022)	0.029 (0.020)	0.093*** (0.024)	0.191*** (0.021)	0.088*** (0.019)	0.092*** (0.027)	0.110*** (0.026)
<i>1 year after event</i>	0.325*** (0.028)	0.242*** (0.028)	0.140*** (0.031)	0.227*** (0.029)	0.377*** (0.035)	0.286*** (0.031)	0.212*** (0.045)	0.252*** (0.044)
<i>2 years after event</i>	0.351*** (0.032)	0.272*** (0.033)	0.189*** (0.038)	0.237*** (0.041)	0.408*** (0.054)	0.317*** (0.046)	0.281*** (0.063)	0.255*** (0.072)
<i>3 years after event</i>	0.342*** (0.035)	0.272*** (0.035)	0.213*** (0.037)	0.214*** (0.050)	0.389*** (0.072)	0.313*** (0.061)	0.321*** (0.076)	0.241** (0.095)
<i>4 years after event</i>	0.334*** (0.037)	0.256*** (0.036)	0.217*** (0.048)	0.234*** (0.058)	0.382*** (0.089)	0.295*** (0.074)	0.336*** (0.095)	0.252** (0.115)
Mean Dep. Var. (level)	0.85	13.2	2.93	0.78	1.45	18.9	0.96	1.40
SD Dep. Var. (level)	2.54	32.6	712.8	2.68	4.50	45.1	3.91	4.74
Firm FE	Yes							
Year-4DSect-Prov FE	Yes							
Never Suppliers	Yes	Yes	Yes	Yes	No	No	No	No
Adjusted R <sup>2</sup>	0.77	0.74	0.81	0.83	0.80	0.77	0.82	0.86
# Observations	116,683	116,683	94,038	67,194	23,961	23,961	21,792	14,199
# Fixed Effects	25,174	25,174	21,480	15,894	7,366	7,366	7,019	4,870
# Firms	18,035	18,035	14,804	10,834	3,482	3,482	3,287	2,195

Notes: Table 1 shows the results of running the event-study specification (1) adapted to four dependent variables capturing firm size: log total sales, log total number of workers, log net assets, and log input costs. The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and four-digit sector  $\times$  province  $\times$  calendar year fixed effects. Columns (1)-(4) pertain to the full sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017. Clustering of standard errors is at the two-digit sector by province level. Columns (5)-(8) focus only on the restricted sample of domestic firms becoming first-time suppliers to an MNC between 2010 and 2015 and use standard error clustering at event by province level. For sales, net assets, and input costs, means (in levels) are reported in millions of U.S. dollars (CPI-deflated to 2013 dollars). Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2: Domestic Firms Improve Their Sales to Others after Starting to Supply to MNCs

	Total Sales (1)	Sales to Others (2)	Sales to Others Untreated (3)	Total Sales (4)	Sales to Others (5)	Sales to Others Untreated (6)
<i>4 years before event</i>	0.044 (0.028)	0.011 (0.042)	0.014 (0.042)	-0.022 (0.053)	-0.047 (0.119)	-0.034 (0.124)
<i>3 years before event</i>	0.029 (0.023)	-0.022 (0.035)	-0.021 (0.036)	0.001 (0.041)	-0.041 (0.076)	-0.037 (0.078)
<i>2 years before event</i>	0.026 (0.018)	-0.020 (0.028)	-0.021 (0.029)	0.007 (0.023)	-0.028 (0.036)	-0.026 (0.037)
<i>Year of event</i>	0.159*** (0.019)	-0.193*** (0.052)	-0.189*** (0.051)	0.191*** (0.021)	-0.122* (0.062)	-0.125* (0.063)
<i>1 year after event</i>	0.325*** (0.028)	0.118** (0.053)	0.122** (0.052)	0.377*** (0.035)	0.205** (0.090)	0.201** (0.092)
<i>2 years after event</i>	0.351*** (0.032)	0.201*** (0.045)	0.199*** (0.049)	0.408*** (0.054)	0.320*** (0.115)	0.308** (0.119)
<i>3 years after event</i>	0.342*** (0.035)	0.196*** (0.046)	0.203*** (0.044)	0.389*** (0.072)	0.333** (0.147)	0.326** (0.154)
<i>4 years after event</i>	0.334*** (0.037)	0.203*** (0.049)	0.204*** (0.048)	0.382*** (0.089)	0.380** (0.171)	0.358* (0.181)
Mean Dep. Var. (level)	0.85	0.84	0.84	1.45	1.42	1.40
SD Dep. Var. (level)	2.54	2.54	2.52	4.50	4.51	4.47
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-4DSect-Prov FE	Yes	Yes	Yes	Yes	Yes	Yes
Never Suppliers	Yes	Yes	Yes	No	No	No
Adjusted R <sup>2</sup>	0.77	0.70	0.69	0.80	0.64	0.63
# Observations	116,683	116,683	116,683	23,961	23,961	23,961
# Fixed Effects	25,174	25,174	25,174	7,366	7,366	7,366
# Firms	18,035	18,035	18,035	3,482	3,482	3,482

Notes: Table 2 shows the results of running the event-study specification (1) adapted to three dependent variables: log total sales (across all buyers, including the first MNC buyer), log sales to others (all buyers with the exception of the first MNC buyer), and log sales to others untreated (across all buyers with the exception of the first MNC buyer and other buyers that started supplying to MNCs themselves). The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and four-digit sector  $\times$  province  $\times$  calendar year fixed effects. Columns (1)-(3) pertain to the full sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017. Clustering of standard errors is at the two-digit sector by province level. Columns (4)-(6) focus only on the restricted sample of domestic firms becoming first-time suppliers to an MNC between 2010 and 2015 and use standard error clustering at event by province level. Means (in levels) are reported in millions of U.S. dollars (CPI-deflated to 2013 dollars). Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Domestic Firms Increase Their Corporate Sales to Others after Starting to Supply to MNCs

	Total Corp Sales (1)	Corp Sales Others (2)	Number Other Buyers (3)	Av. Sales Other Buyers (4)	Total Corp Sales (5)	Corp Sales Others (6)	Number Other Buyers (7)	Av. Sales Other Buyers (8)
<i>4 years before event</i>	0.040 (0.073)	0.016 (0.082)	-0.034 (0.024)	0.034 (0.058)	-0.051 (0.072)	-0.139 (0.148)	-0.037 (0.039)	-0.096 (0.137)
<i>3 years before event</i>	0.020 (0.035)	0.010 (0.045)	-0.007 (0.018)	0.014 (0.035)	-0.029 (0.053)	-0.103 (0.100)	-0.007 (0.024)	-0.088 (0.094)
<i>2 years before event</i>	0.042 (0.025)	0.032 (0.033)	-0.009 (0.015)	0.023 (0.027)	-0.001 (0.036)	-0.029 (0.045)	-0.012 (0.016)	-0.031 (0.048)
<i>Year of event</i>	0.270*** (0.032)	-0.747*** (0.091)	0.015 (0.019)	-0.778*** (0.083)	0.290*** (0.028)	-0.636*** (0.074)	0.013 (0.019)	-0.667*** (0.071)
<i>1 year after event</i>	0.448*** (0.042)	0.159*** (0.056)	0.251*** (0.023)	-0.068 (0.047)	0.491*** (0.047)	0.295*** (0.095)	0.241*** (0.030)	0.069 (0.089)
<i>2 years after event</i>	0.458*** (0.038)	0.318*** (0.066)	0.319*** (0.025)	0.035 (0.056)	0.520*** (0.061)	0.484*** (0.121)	0.300*** (0.041)	0.202* (0.112)
<i>3 years after event</i>	0.477*** (0.041)	0.481*** (0.067)	0.349*** (0.025)	0.173*** (0.056)	0.552*** (0.072)	0.683*** (0.164)	0.324*** (0.051)	0.370** (0.161)
<i>4 years after event</i>	0.438*** (0.039)	0.448*** (0.064)	0.356*** (0.029)	0.141** (0.057)	0.534*** (0.089)	0.704*** (0.201)	0.327*** (0.062)	0.383* (0.191)
Mean Dep. Var. (level)	0.39	0.37	7.94	0.038	0.59	0.56	16.8	0.033
SD Dep. Var. (level)	1.20	1.21	29.1	0.056	1.79	1.81	53.8	0.045
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-4DSect-Prov FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Never Suppliers	Yes	Yes	Yes	Yes	No	No	No	No
Adjusted R <sup>2</sup>	0.75	0.63	0.86	0.57	0.74	0.59	0.84	0.51
# Observations	63,793	63,793	63,793	63,793	21,200	21,200	21,200	21,200
# Fixed Effects	16,833	16,833	16,833	16,833	6,925	6,925	6,925	6,925
# Firms	10,985	10,985	10,985	10,985	3,379	3,379	3,379	3,379

Notes: Table 3 uses only firm-to-firm transaction data and shows the results of running the event-study specification (1) adapted to four dependent variables: log total sales to corporate buyers (including the first MNC buyer), log sales to corporate buyers other than the first MNC buyer, log number of other corporate buyers + 1 (number of corporate buyers tracked by the firm-to-firm transaction data, excluding the first MNC buyer, + 1), and log average sales to other corporate buyers (total sales to other corporate buyers, divided by the number of other corporate buyers + 1). The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and four-digit sector  $\times$  province  $\times$  calendar year fixed effects. Columns (1)-(4) correspond to the full economy-wide sample (including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017), columns (5)-(8) correspond to the restricted economy-wide sample (including only first-time suppliers to MNCs). Except for the number of buyers, means (in levels) are reported in millions of U.S. dollars (CPI-deflated to 2013 dollars). Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Domestic Firms Improve in Standard Measures of TFP after Starting to Supply to MNCs

	Prod Index (1)	CD OLS (2)	TL OLS (3)	LP (4)	ACF (5)	Prod Index (6)	CD OLS (7)	TL OLS (8)	LP (9)	ACF (10)
<i>4 years before event</i>	0.025 (0.024)	0.016 (0.017)	0.015 (0.016)	0.020 (0.018)	0.016 (0.017)	-0.009 (0.021)	-0.012 (0.022)	0.017 (0.018)	0.028 (0.023)	0.027 (0.020)
<i>3 years before event</i>	0.025* (0.014)	0.020* (0.012)	0.019* (0.010)	0.028** (0.011)	0.023** (0.011)	-0.002 (0.015)	-0.004 (0.015)	0.020 (0.015)	0.034* (0.017)	0.032* (0.016)
<i>2 years before event</i>	0.006 (0.011)	0.015 (0.010)	0.007 (0.009)	0.011 (0.010)	0.008 (0.010)	-0.002 (0.012)	0.010 (0.013)	0.010 (0.011)	0.015 (0.013)	0.013 (0.011)
<i>Year of event</i>	0.036*** (0.009)	0.059*** (0.009)	0.044*** (0.008)	0.061*** (0.008)	0.047*** (0.007)	0.040*** (0.011)	0.061*** (0.009)	0.041*** (0.007)	0.060*** (0.008)	0.043*** (0.008)
<i>1 year after event</i>	0.059*** (0.011)	0.082*** (0.012)	0.057*** (0.011)	0.067*** (0.011)	0.058*** (0.010)	0.072*** (0.015)	0.090*** (0.013)	0.051*** (0.012)	0.068*** (0.013)	0.053*** (0.013)
<i>2 years after event</i>	0.058*** (0.012)	0.088*** (0.012)	0.067*** (0.012)	0.078*** (0.010)	0.066*** (0.010)	0.076*** (0.020)	0.097*** (0.017)	0.054*** (0.017)	0.064*** (0.017)	0.050*** (0.017)
<i>3 years after event</i>	0.061*** (0.018)	0.088*** (0.016)	0.064*** (0.014)	0.074*** (0.012)	0.061*** (0.012)	0.080*** (0.026)	0.101*** (0.021)	0.049** (0.020)	0.056** (0.021)	0.041* (0.021)
<i>4 years after event</i>	0.057*** (0.017)	0.086*** (0.015)	0.066*** (0.015)	0.076*** (0.013)	0.064*** (0.012)	0.083** (0.031)	0.099*** (0.027)	0.043* (0.025)	0.047* (0.026)	0.036 (0.027)
Mean Dep. Var. (level)	0.93	1.12	1.12	1.12	1.12	0.90	2.00	2.00	2.00	2.00
SD Dep. Var. (level)	0.56	3.17	3.17	3.17	3.17	0.52	5.74	5.74	5.74	5.74
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-4DSect-Prov FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Never Suppliers	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Adjusted R <sup>2</sup>	0.72	0.95	0.97	0.63	0.62	0.74	0.96	0.97	0.64	0.64
# Observations	64,419	64,419	64,419	64,419	64,419	13,706	13,706	13,706	13,706	13,706
# Fixed Effects	15,464	15,464	15,464	15,464	15,464	4,774	4,774	4,774	4,774	4,774
# Firms	10,492	10,492	10,492	10,492	10,492	2,144	2,144	2,144	2,144	2,144

Notes: Table 4 shows the results of running the event-study specification (1) adapted to five measures of TFP. The event is defined as a first time sale to an MNC. Columns (1) and (6) use as dependent variable a TFP index constructed under the assumption a Cobb-Douglas production function. This method “residualizes” sales by subtracting firm-level inputs used, weighted by the respective two-digit-level cost shares. Columns (2) and (7) use a measure of TFP resulting from OLS production function estimation. These columns assume a Cobb-Douglas technology, with revenues (CPI-deflated to 2013 U.S. dollars) as the output measure and total net assets, number of workers, and input costs as input measures for  $K$ ,  $L$ , and  $M$  respectively. Columns (3) and (8) differ from columns (2) and (7) in their assumption of a translog functional form. For both Cobb-Douglas and translog, we estimate the coefficients on factors of production over the entire sample of domestic firms, controlling for narrowly defined fixed effects. Columns (4) and (9) show results of production function estimation following Levinsohn and Petrin (2003). Columns (5) and (10) show results of production function estimation following Ackerberg, Caves, and Frazer (2015).  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. Columns (1)-(5) report event study estimates for the sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017. Clustering of standard errors is at the two-digit sector by province level. Columns (6)-(10) focus only on the sample of domestic firms becoming first-time suppliers to an MNC and use standard error clustering at event by province level. Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Robustness Check: Domestic Firms Improve their Performance after First “Productive Linkages” Deal

	Employment (1)	Total Sales (2)	Productivity Index (3)	Sales to Others (4)	Number of Other Buyers (5)
<u>Losers (<math>\theta_k^L</math>)</u>					
4 years before event	-0.145 (0.204)	-0.199 (0.277)	-0.038 (0.195)	-0.216 (0.281)	-0.135 (0.160)
3 years before event	-0.100 (0.151)	-0.119 (0.205)	-0.037 (0.124)	-0.126 (0.209)	-0.071 (0.117)
2 years before event	-0.074 (0.102)	-0.048 (0.133)	0.057 (0.085)	-0.057 (0.135)	-0.019 (0.085)
Years of event	-0.040 (0.103)	-0.010 (0.123)	0.018 (0.066)	-0.005 (0.124)	-0.007 (0.080)
1 year after event	-0.038 (0.127)	-0.038 (0.179)	-0.010 (0.114)	-0.039 (0.181)	0.017 (0.103)
2 years after event	-0.116 (0.183)	-0.101 (0.250)	0.025 (0.168)	-0.097 (0.254)	-0.011 (0.144)
3 years after event	-0.137 (0.238)	0.018 (0.323)	-0.017 (0.224)	0.020 (0.329)	0.020 (0.185)
4 years after event	-0.074 (0.286)	0.041 (0.386)	0.005 (0.273)	0.041 (0.393)	0.043 (0.219)
<u>Winners-Losers (<math>\theta_k^{Diff}</math>)</u>					
4 years before event	0.077 (0.161)	0.133 (0.212)	-0.107 (0.173)	0.151 (0.218)	0.004 (0.147)
3 years before event	0.043 (0.152)	0.128 (0.172)	0.144 (0.111)	0.139 (0.178)	-0.012 (0.128)
2 years before event	-0.040 (0.148)	0.019 (0.150)	0.009 (0.113)	0.004 (0.156)	0.011 (0.117)
Years of event	0.126 (0.131)	0.182 (0.167)	0.066 (0.100)	0.246 (0.152)	-0.001 (0.136)
1 year after event	0.063 (0.115)	0.335** (0.140)	0.124 (0.098)	0.322** (0.151)	0.215* (0.117)
2 years after event	0.227* (0.118)	0.370** (0.159)	0.100 (0.102)	0.364** (0.166)	0.312*** (0.117)
3 years after event	0.249* (0.130)	0.358** (0.153)	0.194* (0.103)	0.326** (0.161)	0.280** (0.118)
4 years after event	0.169 (0.123)	0.389** (0.165)	0.234** (0.104)	0.355** (0.171)	0.265** (0.132)
Firm FE	YES	YES	YES	YES	YES
Deal FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Adjusted R <sup>2</sup>	0.88	0.83	0.37	0.83	0.90
# Observations	1,097	1,111	1,087	1,100	1,101
# Winners	31	31	31	31	31
# Losers	84	84	83	83	83

Notes: Table 5 shows the results of running the event-study specification (2) adapted to five dependent variables: log total sales, log employment, log TFP index, log sales to others, and log number of other corporate buyers. We report the estimates for both the  $\theta_k^L$  and  $\theta_k^{Diff}$  coefficients, which measure the effects of the event on the outcomes of losers and on the difference between the outcomes of the winner and losers’ to a deal, respectively. The event is defined as the first time a domestic firm experiences a deal with an MNC buyer, mediated by the “Productive Linkages” program. These regressions are run on the sample of 31 “Productive Linkages” deals, involving 31 winners and 84 losers.  $\theta_{-1}$ , the coefficients of the year prior to a first sale to an MNC, are normalized to zero. All regressions include firm, deal, and year fixed effects. Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively. This exercise is part of a robustness check to the baseline event-study results presented in Tables 1 to 4 and 6 to 8.

Table 6: Model-Based Estimates of Gains in Composite TFP and TFP Alone after Domestic Firms Start Supplying to MNCs

Result	1 Bal. Sh. (1)	1 Trans. (2)	2 Trans. (3)	1 Bal. Sh. (4)	1 Trans. (5)	2 Trans. (6)
Source of Sales to Others						
<i>4 years before event</i>	0.004 (0.009)	0.005 (0.019)	0.008 (0.014)	-0.010 (0.025)	-0.029 (0.031)	-0.021 (0.028)
<i>3 years before event</i>	-0.003 (0.008)	0.003 (0.010)	0.004 (0.008)	-0.008 (0.016)	-0.021 (0.021)	-0.018 (0.020)
<i>2 years before event</i>	-0.003 (0.006)	0.008 (0.007)	0.007 (0.006)	-0.005 (0.008)	-0.005 (0.010)	-0.006 (0.010)
<i>Year of event</i>	-0.031*** (0.010)	-0.136*** (0.019)	-0.142*** (0.017)	-0.016 (0.013)	-0.113*** (0.015)	-0.119*** (0.014)
<i>1 year after event</i>	0.038*** (0.011)	0.052*** (0.013)	0.006 (0.011)	0.058*** (0.019)	0.080*** (0.020)	0.035* (0.018)
<i>2 years after event</i>	0.056*** (0.010)	0.084*** (0.015)	0.027** (0.013)	0.082*** (0.024)	0.119*** (0.026)	0.063*** (0.023)
<i>3 years after event</i>	0.054*** (0.010)	0.117*** (0.015)	0.056*** (0.012)	0.084** (0.031)	0.160*** (0.034)	0.098*** (0.033)
<i>4 years after event</i>	0.055*** (0.011)	0.109*** (0.014)	0.047*** (0.012)	0.093** (0.036)	0.163*** (0.042)	0.099** (0.039)
Mean Dep. Var.	1.27	0.98	0.63	1.32	1.03	0.60
SD Dep. Var.	0.31	0.50	0.40	0.44	0.68	0.56
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-4DSect-Prov FE	Yes	Yes	Yes	Yes	Yes	Yes
Never Suppliers	Yes	Yes	Yes	No	No	No
Adjusted R <sup>2</sup>	0.72	0.65	0.59	0.67	0.61	0.53
# Observations	116,536	63,078	63,078	23,801	20,491	20,491
# Fixed Effects	7,132	5,794	5,794	3,860	3,451	3,451
# Firms	18,024	10,895	10,895	3,468	3,291	3,291

Notes: Table 6 implements Results 1 and 2 for our preferred values of  $\delta = -0.22$  and  $\sigma = 6$ . Results 1 and 2 propose model-based formulas for changes in composite TFP and TFP. The first line in the column title specifies the result whose empirical application we report in that column. The second line in the column title indicates the main data source used to construct the dependent variable. “Bal. Sh.” stands for balance sheet and refers to the construction of sales to others as the total sales from balance sheet data (specifically, corporate income tax returns data), from which we subtract the amounts sold to the first MNC buyer. “Trans” refers to the firm-to-firm transaction data, which is used to construct the total sales to other corporate buyers. Note that Result 2 calls for the use of firm-to-firm transaction data, where we can observe the number of corporate buyers.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and four-digit sector  $\times$  province  $\times$  calendar year fixed effects. Columns (1)-(3) correspond to the full economy-wide sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017. Columns (4)-(6) focus only on the restricted sample of domestic firms becoming first-time suppliers to an MNC between 2010 and 2015. Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Heterogeneity in Performance Gains Based on Domestic Firm (MNC) Sector and FTZ Status (MNCs only)

	DOM Low-Tech (1)	DOM High-Tech (2)	DOM Low-Tech (3)	DOM High-Tech (4)	MNC Low-Tech (5)	MNC High-Tech (6)	MNC Not in FTZ (7)	MNC In FTZ (8)
<i>4 years before event</i>	0.03* (0.02)	-0.07 (0.07)	-0.00 (0.03)	-0.08 (0.11)	-0.00 (0.04)	-0.02 (0.06)	0.02 (0.04)	-0.06 (0.05)
<i>3 years before event</i>	0.02 (0.01)	-0.05 (0.06)	-0.01 (0.02)	-0.03 (0.09)	-0.01 (0.03)	0.00 (0.04)	0.01 (0.03)	-0.03 (0.04)
<i>2 years before event</i>	0.01 (0.01)	-0.02 (0.05)	0.00 (0.01)	0.03 (0.06)	0.00 (0.02)	0.01 (0.03)	0.02 (0.02)	-0.01 (0.03)
<i>Year of event</i>	0.03*** (0.01)	0.03 (0.04)	0.04*** (0.01)	0.02 (0.05)	0.03* (0.02)	0.09*** (0.03)	0.02 (0.02)	0.09*** (0.03)
<i>1 year after event</i>	0.06*** (0.01)	0.05 (0.04)	0.08*** (0.02)	0.02 (0.08)	0.06** (0.02)	0.12*** (0.04)	0.04* (0.03)	0.11*** (0.04)
<i>2 years after event</i>	0.06*** (0.01)	0.04 (0.04)	0.08*** (0.03)	0.01 (0.11)	0.07** (0.03)	0.11** (0.05)	0.05 (0.04)	0.11** (0.05)
<i>3 years after event</i>	0.05*** (0.01)	0.07* (0.04)	0.09** (0.04)	0.03 (0.14)	0.08* (0.04)	0.14* (0.07)	0.03 (0.05)	0.16** (0.07)
<i>4 years after event</i>	0.05*** (0.01)	0.07 (0.04)	0.10** (0.05)	0.02 (0.17)	0.07 (0.05)	0.15* (0.09)	0.03 (0.06)	0.18** (0.08)
Mean Dep. Var. (level)	0.90	1.28	0.87	1.23	0.90	0.96	0.88	0.97
SD Dep. Var. (level)	0.53	0.69	0.51	0.65	0.55	0.50	0.53	0.54
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-2DSect-Prov FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Never Suppliers	Yes	Yes	No	No	No	No	No	No
Adjusted R <sup>2</sup>	0.69	0.73	0.71	0.72	0.73	0.77	0.74	0.70
# Observations	60,497	5,762	13,376	2,111	11,933	2,925	10,476	4,340
# Fixed Effects	11,024	1,813	3,009	792	3,020	993	2,678	1,408
# Firms	9,673	1,088	1,982	395	1,819	479	1,579	704

Notes: Table 7 shows the results of running the event-study specification (1) adapted to the TFP index (constructed under the assumption of a Cobb-Douglas production function) as the dependent variable. All regressions have the same dependent variable, but differ in the sample over which the regression is run. Columns (1) and (4) separate domestic firms (DOM) based on the sector of the domestic firm and whether the OECD classifies this sector as high- or low-tech. The OECD classifies manufacturing sectors as high-tech, medium high-tech, medium low-tech or low-tech, and service sectors as high- or low-knowledge intensive. Manufacturing sectors that are high-tech or medium high-tech, and service sectors that are high-knowledge intensive are labeled as *high-tech*, all others as *low-tech*. Columns (5)-(8) separate domestic firms based on characteristics of the first MNC buyer. This second separation can only be done in the restricted sample (as never-suppliers do not have a first MNC buyer). Columns (5) and (6) separate domestic firms based on whether the sector of their first MNC buyer is high- or low-tech, whereas columns (7) and (8) separate domestic firms based on whether their first MNC buyer was part of a Free Trade Zone (FTZ) or not. The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and two-digit sector  $\times$  province  $\times$  calendar year fixed effects. Columns (1) and (2) pertain to the full sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017. Columns (3)-(8) use the restricted sample, including only first-time suppliers. Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Heterogeneity in Performance Gains Based on Domestic Firm (MNC) Sector

	DOM MFG (1)	DOM RET (2)	DOM SER (3)	DOM AGR (4)	DOM MFG (5)	DOM RET (6)	DOM SER (7)	DOM AGR (8)	MNC MFG (9)	MNC RET (10)	MNC SER (11)	MNC AGR (12)
<i>4 years before event</i>	-0.03 (0.04)	0.02 (0.02)	0.06 (0.04)	0.06 (0.09)	-0.04 (0.08)	-0.02 (0.03)	0.08 (0.09)	-0.11 (0.15)	-0.05 (0.05)	-0.07 (0.08)	-0.00 (0.06)	0.04 (0.10)
<i>3 years before event</i>	-0.03 (0.03)	0.01 (0.01)	0.04 (0.04)	0.04 (0.08)	-0.02 (0.05)	-0.01 (0.02)	0.04 (0.07)	-0.11 (0.11)	-0.08** (0.04)	-0.01 (0.05)	-0.00 (0.04)	0.05 (0.08)
<i>2 years before event</i>	-0.00 (0.03)	0.01 (0.01)	-0.00 (0.03)	0.01 (0.06)	0.00 (0.04)	0.00 (0.01)	0.03 (0.04)	-0.06 (0.08)	-0.00 (0.02)	-0.00 (0.03)	-0.01 (0.03)	0.04 (0.05)
<i>Year of event</i>	0.04** (0.02)	0.04*** (0.01)	0.04* (0.03)	-0.06 (0.05)	0.06* (0.03)	0.05*** (0.01)	0.02 (0.04)	0.00 (0.08)	0.08*** (0.02)	0.01 (0.03)	0.03 (0.03)	0.02 (0.05)
<i>1 year after event</i>	0.10*** (0.02)	0.05*** (0.01)	0.06** (0.02)	-0.04 (0.06)	0.13** (0.05)	0.07*** (0.02)	0.02 (0.06)	0.08 (0.11)	0.12*** (0.03)	0.03 (0.05)	0.07* (0.04)	-0.02 (0.08)
<i>2 years after event</i>	0.09*** (0.02)	0.05*** (0.01)	0.06** (0.03)	-0.03 (0.06)	0.13* (0.07)	0.08** (0.03)	0.01 (0.08)	0.15 (0.15)	0.13*** (0.05)	0.04 (0.07)	0.08 (0.05)	0.01 (0.10)
<i>3 years after event</i>	0.07** (0.03)	0.05*** (0.01)	0.08*** (0.03)	0.03 (0.07)	0.12 (0.09)	0.08** (0.04)	0.01 (0.11)	0.23 (0.20)	0.16*** (0.06)	0.05 (0.09)	0.07 (0.07)	-0.06 (0.12)
<i>4 years after event</i>	0.11*** (0.03)	0.04*** (0.01)	0.06* (0.03)	0.02 (0.09)	0.18* (0.11)	0.08 (0.05)	-0.02 (0.13)	0.24 (0.25)	0.17** (0.07)	0.04 (0.11)	0.07 (0.08)	-0.03 (0.16)
Mean Dep. Var. (level)	0.96	0.73	1.22	1.16	0.96	0.74	1.22	1.00	0.92	0.86	0.94	0.82
SD Dep. Var. (level)	0.41	0.34	0.67	0.91	0.44	0.33	0.72	0.73	0.54	0.44	0.54	0.64
Firm FE	Yes	Yes	Yes									
Year-2DSect-Prov FE	Yes	Yes	Yes									
Never Suppliers	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Adjusted R <sup>2</sup>	0.60	0.57	0.71	0.67	0.60	0.57	0.75	0.68	0.73	0.69	0.77	0.79
# Observations	9,806	33,550	17,998	4,929	2,792	7,836	3,822	1,039	5,904	2,920	4,489	837
# Fixed Effects	2,076	5,374	4,498	894	910	1,306	1,340	246	1,797	957	1,407	314
# Firms	1,424	5,164	3,389	788	396	1,099	722	161	923	451	716	120

*Notes:* Table 8 shows the results of running the event-study specification (1) adapted to the TFP index (constructed under the assumption of a Cobb-Douglas production function) as the dependent variable. All regressions have the same dependent variable, but differ in the sample over which the regression is run. Columns (1)-(8) separate firms based on the sector of the domestic firm (DOM). The four largest sectoral groups are manufacturing (MFG), retail (including repair and maintenance, RET), services (SER), and agriculture (AGR). Columns (9)-(12) separate firms based on the sector of the first MNC buyer. The event is defined as a first time sale to an MNC.  $\theta_{-1}$ , the coefficient of the year prior to a first sale to an MNC, is normalized to zero. These regressions do not include the vector of firm-level time-varying characteristics,  $X_{it}$ , but include firm and two-digit sector  $\times$  province  $\times$  calendar year fixed effects. Columns (1)-(4) pertain to the full sample including both domestic firms that become first-time suppliers to an MNC between 2010 and 2015 and domestic firms never observed as supplying to an MNC between 2008 and 2017. Columns (5)-(12) focus only on the restricted sample of first-time suppliers. Robust standard errors in parentheses. \*\*\*, \*\*, \* denotes statistical significance at the 1%, 5%, and 10% levels, respectively.