THE EFFECTS OF JOINING MULTINATIONAL SUPPLY CHAINS: NEW EVIDENCE FROM FIRM-TO-FIRM LINKAGES*

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We study the effects of becoming a supplier to multinational corporations (MNCs) using tax data tracking firm-to-firm transactions in Costa Rica. Event study estimates reveal that domestic firms experience strong and persistent gains in performance after supplying to a first MNC buyer. Four years after, domestic firms employ 26% more workers and have a 4% to 9% higher total factor productivity (TFP). These effects are unlikely to be explained by demand effects or changes in tax compliance. Moreover, suppliers experience a large drop in their sales to all other buyers except the first MNC buyer in the year of the event, followed by a gradual recovery. The dynamics of adjustment in sales to others suggests that firms face short-run capacity constraints that relax over time. Four years later, the sales to others grow by 20%. Most of this growth comes from the acquisition of new buyers, which tend to be "better buyers" (e.g., larger and with more stable supplier

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relationships). Finally, we collected survey data from domestic firms and MNCs to provide further insights into the wide-ranging benefits of supplying to MNCs. According to our surveys, these benefits range from better managerial practices to a better reputation. *JEL Codes:* F14, F23, F61, O12, D22, D24.

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I. 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.[1] The expectation of these governments is that MNCs not only are high performers but 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 (Tybout 2000). Although direct supply chain linkages are not the only channel through which MNCs may improve the performance of domestic firms, they are viewed as one of the most promising (Alfaro 2017).

In this article, 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 observe suppliers directly has limited previous research from painting a complete picture of the effects of interest.

To make progress on these three challenges, we bring together a rich collection of microdata from Costa Rica (CR) that includes the near universe of formal firm-to-firm transactions.[2] This makes

1. The competition in investment incentives 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).

2. The data cover all formal firm-to-firm transactions that amount to more than US$4,200 in a year. During our study period (2008–2017), these data were collected for general sales tax and corporate income tax enforcement.

it possible to observe the actual linkages between MNCs and their domestic suppliers. Second, we adopt an event study strategy to estimate the effects of starting to supply to MNCs. We probe the robustness of our baseline estimates to four alternative control groups. Third, we provide a detailed account of the changes faced by first-time suppliers to MNCs (shortened to "first-time suppliers" hereafter). We begin with standard measures of firm performance such as firm size or total factor productivity (TFP). We then leverage the firm-to-firm transaction data to document the adjustments in business with others. We uncover changes in the average sales per buyer, the number of other buyers, and other buyers' characteristics. We show that mere demand effects or changes in tax compliance are unlikely to explain our findings. Finally, for a more nuanced interpretation of our results, we conduct a survey of managers in a representative sample of domestic firms and MNCs.

The analysis proceeds in four steps. First we introduce the new database that we have assembled and the context. Most of our progress relies on the firm-to-firm transaction data collected by the Ministry of Finance since 2008. We match these data with corporate income tax data and foreign ownership data, among others. We can then identify MNCs and domestic firms in buyer-supplier relationships and characterize these firms and relationships. In addition to this data advantage, ever since Intel's entry in 1997, CR has attracted a large and diverse set of MNCs. We exploit this feature in the heterogeneity analysis.

Our event of interest is the first time a domestic firm sells to an MNC in CR. 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, 3,697 domestic firms start supplying to one of 444 MNCs. On average, first-time suppliers employ 16.9 workers in the years before their event. MNCs are notably larger, averaging 481 workers between 2008 and 2017. Both sets of firms span a wide range of economic activities, although domestic suppliers are more likely to be found in services and MNCs in manufacturing. The first relationships with an MNC are plausibly consequential, as the average amount first sold to an MNC is US$62,400 and represents 19% of all sales that year.

In the second step, we introduce our baseline event study design to estimate the effects of starting to supply to MNCs. The baseline sample includes both domestic firms that supply for the

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first time to an MNC in CR sometime between 2010 and 2015 and domestic firms that never supply to an MNC between 2008 and 2017 (henceforth referred to as "never suppliers"). The identification assumption underlying this research design is that firms yet to supply to MNCs together with firms that started to supply MNCs in earlier periods form a credible counterfactual for first-time suppliers to MNCs, after we account for time-invariant differences between firms and shocks common to firms in the same four-digit sector and province. Because we can estimate event study coefficients for four years before an event, this method allows us to transparently show that first-time suppliers do not exhibit pretrends in observables.

We show that first-time suppliers experience strong and persistent 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 (all relative to the year before the event). We examine various measures of TFP, ranging from the residual of ordinary least squares (OLS) estimates of a Cobb-Douglas production function to an adapted version of the De Loecker (2013) estimation procedure (which accommodates endogenous productivity processes such as learning by supplying to MNCs). After their event, domestic firms experience sizable and lasting gains in TFP, such that their TFP is 4% to 9% higher four years later. Finally, while our TFP estimates may partly reflect markups, our evidence strongly suggests that at least part of the estimated TFP effects capture an actual increase in productivity and quality.

Next, with the aid of the firm-to-firm transaction data, we explore the business patterns of first-time suppliers with all their other buyers (all except the first MNC buyer). In the year of the event, the sales to others decrease by 19%; of these sales, those made to other corporate buyers (those buyers whose purchases must be reported in the firm-to-firm transaction forms) decrease by 75%. In time, however, the business with other buyers flourishes. Four years after starting to supply to MNCs, sales to (corporate) buyers other than the first MNC buyer increase by 20% (45%), the number of corporate buyers rises by 31%, and the average sales per buyer increase by 14%.

Because we have merged the firm-to-firm transaction data with several other firm-level data sets, we can identify the buyers whose purchases have been most affected by the event. We show that after the event, first-time suppliers to an MNC churn

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their old buyers more than never suppliers that are randomly assigned a fake event year. Although most of their new buyers are domestic, first-time suppliers also manage to secure new MNC buyers (other than their first one). Four years after the event, first-time suppliers sell to 1.2 new MNC buyers. On average, the new buyers of first-time suppliers are "better buyers," in the sense of being larger, more engaged in international trade, and having more stable supplier relations.

Our baseline results survive four alternative strategies that use different control groups for first-time suppliers. The first is an event study design that leverages the rules of Productive Linkages, a program that mediates linkages between MNCs and domestic suppliers. Procomer (the government agency implementing this program) assesses the ability of domestic firms to supply to MNCs and assigns them scores. Based on these scores, Procomer proposes to MNCs short lists of comparable contenders. These short lists create the opportunity for a "winner versus losers" design. One concern of the Productive Linkages exercise is its sample size. We overcome this concern with three matching techniques applied to the baseline sample of economy-wide first-time linkages to an MNC: matching based on predicted Procomer scores, propensity score matching, and nearest-neighbor matching. These matching techniques share with Productive Linkages the benefit of generating contenders to each MNC deal. Reassuringly, all four alternative strategies deliver results consistent with our baseline results.

A lingering concern for identification is that firms may receive unobservable firm-specific shocks that affect the timing of their first supplying relationship with an MNC and their subsequent performance. To alleviate this concern, we show that our results are robust to excluding firms that had recently hired either a new manager (regardless of her previous employment), a former worker for an MNC, or a supplier to an MNC (irrespective of her new position). Finally, our results are robust to keeping only never suppliers to MNCs that are nevertheless suppliers to a large domestic firm, dropping all never suppliers to MNCs, varying the fixed effects, and balancing the sample of first-time suppliers around the event year.

In the third step, we use administrative data to further inform our interpretation of the baseline results. We first show that the long-term effects of placebo demand shocks (from the government, a large domestic buyer, or a domestic exporter) diverge decisively from those of demand shocks from an MNC. Second, the

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short-term fall in sales to others (which affects first-time suppliers to MNCs and suppliers to other placebo buyers) suggests that domestic firms face steep short-run marginal-cost curves—most likely because of capacity constraints or inflexible inputs. Third, we provide evidence that our results are unlikely to be explained by changes in tax reporting after the first linkage with an MNC. Last, we show that on average, domestic firms in manufacturing, who supply a core input to the MNC or have a stronger first interaction with the MNC, are those who gain most from their event. Moreover, it is most useful to supply MNCs in manufacturing and services, smaller MNC affiliates, or MNCs whose headquarters country has a higher GDP per capita and better management practices.

In the fourth and final step, we rely on surveys we conducted on a representative sample of MNCs and domestic suppliers. Both types of 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 better managerial and organizational practices, expansions in product scope with higher-quality products, and improved reputation. These changes arise from interactions during which MNCs communicate expectations and advice and from the effort exerted by new suppliers to deliver on their contracts. Overall, these insights match the story painted by the main results from the administrative data.

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. 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 such interventions, literature reviews suggest that the evidence is mixed as to whether they can actually alter the long-term growth of firms.[3] Though notably scarcer, there is increasing evidence that demand is an important determinant of (small) firm dynamics. In particular, improving access to foreign buyers—through trade[4] or foreign direct investment (FDI)—is believed to hold great promise for firms in developing countries. The expectation is that beyond

3. For reviews on this strand of the literature, see Banerjee (2013) and McKenzie and Woodruff (2013).

4. De Loecker and Goldberg (2014) review the literature linking trade exposure to firm performance.

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increasing demand, foreign buyers provide valuable learning opportunities.

By studying the effects of selling to foreign buyers, this article relates to a voluminous literature on learning from exporting.[5] In contrast to standard trade, global value chains (GVCs) (joined upon starting to supply to an MNC) typically involve longer-term firm-to-firm relationships. "This relational nature of GVCs makes them a particularly powerful vehicle for technology transfer along the value chain. Firms have a shared interest in specializing in specific tasks, exchanging technology, and learning from each other" (World Bank 2020, 70). This stronger alignment in incentives between buyers and suppliers, along with the increasing prevalence of GVCs, makes studying the effects of joining a GVC intrinsically interesting. Several other reasons justify this separate study. One such reason is the proximity between buyers and suppliers, which is likely to facilitate learning. Another is that exporting is only possible for firms selling tradables and competitive enough to overcome trade costs. Also, MNCs are plausibly more sophisticated buyers than the modal importer (Bernard et al. 2012). Finally, countries devise generous tax breaks to explicitly attract MNC affiliates. Estimating their effects on local firms is directly valuable for policy makers, who can then compare these estimates with those for alternative policies (e.g., export promotion).

By studying the effects of supplying to domestic affiliates of MNCs, this article is also closely related to a vast literature on the effects of FDI on firm performance.[6] 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). Moving from variation in sector-level proxies for exposure to FDI to variation in the actual linkage status of a firm presents new opportunities

5. Atkin, Khandelwal, and Osman (2017) provide causal evidence of learning from exporting for a sample of rug producers in Egypt.

6. For classic papers in the FDI literature, see Haddad and Harrison (1993); Aitken and Harrison (1999); Alfaro et al. (2004); Javorcik (2004); Haskel, Pereira, and Slaughter (2007); and Keller and Yeaple (2009). Contemporaneous papers on the wider effects of FDI include Abebe, McMillan, and Serafinelli (2020), Alfaro-Ureña, Manelici, and Vasquez (2021), and Méndez-Chacón and Van Patten (2021).

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for precision and insight into the effects of joining MNC supply chains.[7]

Finally, this study relates to empirical work made possible by the recent availability of domestic firm-to-firm transaction data.[8] We study in detail the effects of establishing a first linkage with an MNC buyer. Four years after this first linkage, domestic firms substantially improve their sales to other buyers. Two-thirds of this improvement comes from acquiring new buyers. This echoes the finding that the number of buyers explains the majority of firm size heterogeneity (Bernard et al. 2020). Moreover, we use the firm-to-firm transaction data in three novel ways. First, we show that first-time suppliers to MNCs not only acquire new buyers, they acquire buyers that are better performing (e.g., larger and with longer supplier relationships). Second, we compare the medium-run effects of demand shocks from MNCs against those from three types of placebo buyers (the government, large domestic firms, and domestic exporters) and highlight the unique nature of MNCs as buyers. Third, we contrast the dynamics of adjustment for first-time suppliers to MNCs with that of suppliers to these placebo buyers. We bring evidence consistent with suppliers (to both MNCs and placebo buyers) having steep short-run marginal cost curves that flatten over time.[9]

The article proceeds as follows. Section II describes the data and context. Section III introduces our baseline event study strategy and four alternative strategies. Section IV.A presents our baseline results, and Section IV.B probes their robustness. Section V provides additional evidence from the administrative data to guide interpretation. Section VI draws on surveys for more

7. Using our firm-to-firm transaction data, we find that sector-level backward linkages predict less than 1% of the actual firm-level linkages with MNCs. This may explain why estimates of spillovers from backward linkages vary broadly across studies, from strongly positive to negative (Havránek and Iršová 2011). Online Appendix Table E1 reports the TFP estimates for CR using sector-level and firm-level measures of backward linkages (echoing the methodology of the previous FDI spillovers literature). We find that the standard measure of backward linkages is only significant when based on actual firm-level linkages but not on the sector-level ones.

8. See Huneeus (2018), Brugues (2020), and Dhyne et al. (2021).

9. This insight resembles those of other papers that explain the interdependence of firm-level sales across markets through increasing marginal costs (Ahn and McQuoid 2017; Sun and Zhang 2018; Almunia et al. 2021). We take advantage of the staggered timing of the event to estimate the marginal-cost elasticity at different time horizons.

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insights into the drivers of improvements in firm performance. Section VII concludes.

II. Data and Description of Supplying Linkages

II.A. Data

1. *Economy-Wide Administrative Data.* The main data set tracks the near universe of formal firm-to-firm relationships in CR between 2008 and 2017. This information is collected by the CR Ministry of Finance 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 US$4,200) in transactions that year, in addition to the total amount transacted. This declaration is compulsory not only for private businesses but also for all actors in the economy (e.g., individuals providing professional services, public entities). Thanks to the third-party reporting nature of the D-151 form, this data plays a crucial role in the enforcement of the general sales tax and corporate income tax.

We merge the firm-to-firm transaction data with the yearly corporate income tax returns from the Ministry of Finance for the same 2008–2017 time period. These returns cover the universe of formal firms in the country and contain typical balance sheet variables (e.g., total sales, net assets, input costs). We add matched employer-employee data from the Costa Rican Social Security Fund, which tracks the labor earnings and occupations of all workers engaged in formal employment.[10] In some robustness checks, we also bring in data on firm-level imports and exports from Costa Rican customs declarations.

In addition, we construct a comprehensive data set on the foreign ownership of firms by cross-checking information from six different sources. The first three are annual surveys conducted by the Central Bank of Costa Rica (BCCR) and inquiring about the foreign ownership of firms. These surveys tend to oversample large firms. The fourth source is the reporting of firms that are active under the Free Trade Zone regime. The fifth source is the organization responsible for drawing FDI to CR (CINDE), which provides information on the foreign ownership of firms

10. Informal workers represent 27.4% of all workers in CR. Although sizable, this share is smaller than the 53.1% average for Latin America (ILO 2018). Sections V.C and Online Appendix A.1.4 address the issue of informality.

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they attracted. Finally, we bring in Orbis data, which has a high coverage of firms in CR and allows us to confirm which foreign firms in the country are part of an MNC group.

A last step in building the final administrative data set is to assign tax IDs to firm groups and properly turn tax ID–level information into group-level information.[11] Online Appendix A.1 discusses how we approach this step, in addition to providing more details on data construction and summary statistics for the administrative data sets mentioned above.

2. *Productive Linkages Data.* Since 2001, Procomer (CR's trade promotion agency) has implemented a matchmaking program called Productive Linkages. The program aims to insert local firms into export supply chains, where the exporter is usually an MNC affiliate. 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 assigned an overall score. When an MNC approaches Procomer with an input need, Procomer identifies the suppliers that can produce that input, ranks them based on their score, and shares a short list of the highest-ranked suppliers. Online Appendix A.2 describes the Procomer data.

We leverage the Procomer data in two ways. First, while the program was not designed as an experiment, by applying sensible restrictions to the universe of deals mediated by Procomer, we can retrieve a subset with a quasi-experimental setup. Specifically, we study the 31 deals (i) that are first-time deals with an MNC for one of 31 domestic firms, (ii) that occur in our sample period (between 2009 to 2015), and (iii) where all 84 contenders had not yet supplied to an MNC before the deal for which they were shortlisted. Second, we use the universe of Procomer scores to learn about their predictors from the administrative data. We generate predicted Procomer scores for all firm-years in our economy-wide sample and apply a matching technique based on similarity in predicted Procomer scores.

11. 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 article, we use firms to refer to firm groups.

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3. *Survey Data.* In 2018, we conducted surveys of MNCs and their domestic suppliers. Our main objective was to shed light on typically unobservable aspects of relationships between the two types of firms. 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 domestic firms and MNCs. Given the retrospective nature of some of the topics covered, the ideal respondents were the founder of the domestic firm and the supply chain manager of the MNC. The need to reach specific employees compounded the already difficult task of establishing 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 CR. Combined, the responses from buyers and sellers cover at least one side of the buyer-seller pair for about 20% of the pairs of interest. Comparing the firms with and without a response suggests that a response bias is unlikely. See Online Appendix F for more details.

II.B. Description of MNCs, Domestic Suppliers, and Their First Linkage

1. *MNCs in CR.* We start from the 2,156 firms in CR that belong to corporate groups where at least one firm is partially foreign-owned.[12] From this set, 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 employment across all years of activity in the country is under 100, and firms that are themselves at least partially foreign-owned and whose median employment is over 100. We study the 622 firms in the third category.[13]

12. A corporate group is a set of firms that share ownership but do not necessarily behave as one business. For instance, some firms in the same corporate group may operate in different economic sectors.

13. The typical foreign-owned firm in the second category is not an MNC affiliate but a single-location firm that serves local demand, either in service sectors (e.g., hotels) or sectors with low local input requirements (e.g., import/export retail or real estate agencies). Although our baseline results pertain to the 100-worker size restriction for foreign-owned firms, we show in Online Appendix D.4 that results are robust to removing it and including firms in the second category as well.

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All the 622 firms we focus on are MNC affiliates, with known global ultimate ownership and a substantial affiliate presence in CR. We use the customary definition of an MNC as "an enterprise that controls and manages production establishments/plants located in at least two countries" (see Antràs and Yeaple 2014, 56). Our size threshold also enables us to circumvent issues related to FDI statistics, such as the rising use of shell companies. These 622 firms employ 76% of the workers and export 91% of the totals across firms in the three categories combined (see Online Appendix A.1.3).

From the universe of firm-to-firm transactions in CR, we learn that between 2010 and 2015, 444 of these 622 MNCs became the first MNC buyer from one of 3,697 domestic firms. Of the 444 MNCs, 46% are from the United States, with the other 54% coming mainly from either Latin America or Western Europe. Although manufacturing is the most frequent sector (covering 38% of the 444 MNCs), the remaining 62% of MNCs fall into sectors as diverse as retail, agriculture, and information and communication. For more detailed summary statistics on these MNCs, see Online Appendix Tables B1 and B2.

2. *Domestic Suppliers to MNCs.* Among all the domestic firms in CR, we restrict our attention to those with at least a median of three workers and median yearly revenues of US$50,000 (CPI-deflated to 2013 dollars) across all years of activity. We remove firms that are state owned, registered as households, nongovernmental organizations (NGOs), or part of the financial, construction, and education sectors.[14] This leaves us with 24,370 firms. Of these, we use the firm-to-firm transaction data 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,[15] and the 14,338 firms never supplying

14. While we justify these restrictions in Online Appendix A.1, our baseline results are robust to discarding them (see discussion in Section IV.B and corresponding tables in Online Appendix D.4).

15. 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. Also, there are 3,813 domestic firms that became first-time suppliers to 471 MNCs. However, in the main event study regression (1) studying the effect 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, we present summary statistics only for those 3,697 firms and their associated 444 first MNC buyers.

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to an MNC between 2008 and 2017. Our interest lies in the firms in the first category, but we use firms in the second category to construct counterfactuals.

For the 3,697 first-time suppliers to an MNC, the average number of workers in the years before the event is 16.9. Around 11% of these firms operate in manufacturing, and around 32% work in wholesale and retail trade (including repair and maintenance). Among the service sectors, the most common sectors are professional, scientific, and technical services (14%), administrative and support services (10%), transportation and storage (9%), and accommodation and food services (6%). For more summary statistics on the first-time suppliers (e.g., on their productivity, trade activity, age, and number of buyers) see Online Appendix Table B3.

3. *Relationships between MNCs and Their Domestic Suppliers.* In CR, 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. The aim of programs such as Productive Linkages 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). This program mediates only 1% of the number and value of linkages between MNCs and domestic suppliers occurring economy-wide in CR. For this reason, we prioritize the analysis of unmediated relationships.

As mentioned already, we find 3,697 domestic firms that supply to an MNC for the first time sometime between 2010 and 2015 in an unmediated fashion. We refer to these first-time supplying instances as (unmediated economy-wide) events. Across these events, the average amount first sold to an MNC is US$62,400 and represents 19% of all sales that year. While the average relationship of first-time suppliers lasts 1.99 years, the relationship with the first MNC buyer lasts on average 2.77 years. This suggests that the relationship with the first MNC buyer is plausibly consequential for the supplier. For more summary statistics on the events, see Online Appendix Tables B4 and B5.

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III. Empirical Strategy

III.A. Baseline Empirical Strategy: Economy-Wide Event Studies

In what follows, we present our baseline empirical strategy to study the effects of becoming a first-time supplier to an MNC in CR. Between 2010 and 2015, 3,697 such events occur across the Costa Rican economy. More specifically, we estimate the following event study specification:

$$y_{it} = \alpha_i + \lambda_{spt} + \sum_{k=\underline{C}}^{\overline{C}} \theta_k D_{it}^k + \varepsilon_{it}, \tag{1}$$

where y_{it} is an outcome of firm i in calendar year t, α_i is a firm fixed effect, and λ_{spt} are four-digit sector $\times$ province $\times$ calendar year fixed effects. We define the event time dummies as $D_{it}^k := \mathbb{1}[t = \tau_i + k]$ $\forall k \in (\underline{C}, \overline{C})$, $D_{it}^{\overline{C}} = \mathbb{1}[t \geqslant \tau_i + \overline{C}]$, and $D_{it}^{\underline{C}} = \mathbb{1}[t \leqslant \tau_i + \underline{C}]$, where $\mathbb{1}[.]$ is the indicator function and τ_i is the first year when firm i sells to an MNC. ε_{it} is an error term. We normalize $\theta_{-1} = 0$ and set $\underline{C} = -5$ and $\overline{C} = +5$. We cluster standard errors at the two-digit sector $\times$ province level.

Our baseline economy-wide regressions use a sample that includes domestic firms that become first-time suppliers to an MNC sometime between 2010 and 2015 and domestic firms that never supply to an MNC between 2008 and 2017. Identifying the event study coefficients θ_k hinges on the assumption that firms yet to supply to MNCs and firms that started to supply in earlier years form a credible counterfactual for firms that start supplying to MNCs, after accounting for time-invariant differences between firms and common sector-by-province-by-year shocks.[16] The panel data allow us to consistently estimate treatment effects without assuming treatment exogeneity and without an instrumental variable, provided that the treatment varies over time

16. This design is not challenged by selection on levels, observable or not. For instance, even before starting to supply to MNCs, first-time suppliers employ 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 control units operate in different markets. We limit control firms to nearby firms in the same four-digit sector to account for common shocks, such as those to factor markets or transportation networks.

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and is uncorrelated with transitory firm-specific shocks that can determine outcomes (Wooldridge 2002; Blundell and Dias 2009). Section IV.B provides evidence in support of these identification assumptions.

III.B. Alternative Empirical Strategies

1. *Productive Linkages Event Studies.* The rules of the Productive Linkages program generate quasi-experimental variation in opportunities to supply to MNCs among firms shortlisted for a 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. These scores reflect information that is relevant to MNCs but not available in typical tax data (e.g., whether the firm employs at least one English speaker). Based on scores, Procomer proposes short lists of candidates to MNCs.[17]

The Productive Linkages event study 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^k_{idt} and an indicator dummy of winning deal d, $\mathbb{1}\{Winner\}_{id}$. We label the winner and losers of a given deal with the same d subscript. We investigate the effect of being considered for deal d on the winner and losers of that deal by running the following regression:

(2)
$$y_{idt} = \alpha_i + \gamma_d + \lambda_t + \sum_{k=\underline{C}}^{\overline{C}} \theta^L_k D^k_{idt} + \sum_{k=\underline{C}}^{\overline{C}} \theta^{Diff}_k \mathbb{1}\{Winner\}_{id} D^k_{idt} + \varepsilon_{idt},$$

where y_{idt} is the outcome of firm i part of deal d in year t, λ_t is the calendar year fixed effect, and $\mathbb{1}\{Winner\}_{id}$ is an indicator function that equals 1 if firm i is the winner of deal d. γ_d are 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 θ^L_k and θ^{Diff}_k, 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).

17. Online Appendix A.2.1 provides more background information on the program history and functioning.

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Identification relies on the assumption that shortlisted firms missing a deal with an MNC offer a valid counterfactual to what would have happened with the winners' performance had they not won the deal. As we observe the scores behind the ranking shared with MNCs, we can compare the scores of winners and losers. In Online Appendix A.2.2, we provide evidence indicating that the only meaningful difference between winners and losers is the timing of a first deal with an MNC (as opposed to ex ante differences in scores or other observables).

2. *Event Studies Combined with Matching Estimators.* One advantage of the baseline exercise with economy-wide event studies is its sample size of 3,697 treated firms (in contrast to the 31 treated firms in the Productive Linkages exercise). Where the Productive Linkages exercise dominates the baseline exercise is in its ability to compare the outcomes of treated firms with the contemporaneous outcomes of similar firms (as witnessed by their scores). In what follows, we present three techniques which combine these two advantages, that is, which use the same sample of 3,697 economy-wide first-time suppliers as the treated firms and compare their outcomes with the contemporaneous outcomes of control firms which are similar in one of three ways defined below.

i. Matching by Predicted Procomer Scores. This exercise starts from the 630 Procomer scores assigned to 613 distinct firms in the years with administrative data (2008–2017). We regress the Procomer score of a firm-year on 14 potential predictors of that score (in addition to 20 broad sector fixed effects). Among the predictors are measures of firm size, the share of college-educated workers, and indicators for whether the firm is an exporter, employs workers with experience at an MNC, or supplies to a big domestic firm. We use the estimated coefficients (see Online Appendix Table D2) to predict Procomer scores for all firm-years in the full economy-wide sample. The control group for each first-time supplier contains the three never suppliers in the same four-digit sector that have the closest predicted Procomer score to that of the first-time supplier in its event year.

We then estimate for each outcome a modified version of the event study specification in equation (1). The modification involves an extra interaction between event time dummies and an indicator dummy of becoming a first-time supplier in the year of the event. This version of equation (1) resembles equation (2) in that they both include a contemporaneous "winner versus

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losers" comparison captured by the θ_k^{Diff} coefficients (estimating the effect of the event on the difference in outcomes between the first-time suppliers and their control group, this time constructed based on the predicted Procomer score). As in equation (1), we include firm fixed effects and four-digit sector × province × calendar year fixed effects.

ii. Propensity Score Matching. We also implement the standard propensity score matching. In our case, the propensity score—denoted by $e(X_{it})$—is the conditional probability that firm i is chosen as a first-time supplier to an MNC in year t. To obtain $e(X_{it})$ we estimate a year-by-year flexible probit model for the full economy-wide sample. X_{it} includes the same characteristics of firm i in year t that we used to predict the Procomer scores in the matching method described above (in addition to four-digit sector, year, and province fixed effects). Online Appendix Table D2 reports the results of the probit regression. We fix as the control group of a given first-time supplier the three never suppliers in its four-digit sector with the closest propensity score in the event year of that supplier. We compare the outcomes of all economy-wide first-time suppliers to those of firms in their personalized control group. We do so by estimating the same modified version of equation (1) described already.

iii. Nearest Neighbors Matching. In this exercise, we match first-time suppliers with control firms that did not supply to MNCs based on the similarity of their pre-event outcomes. For each first-time supplier, potential control firm, and outcome, we compute a loss function equal to the sum of squares of the deviations of the standardized outcome of the first-time supplier from that of the potential control firm. This sum is across the three years before the event, where the deviation of each year is equally weighted. We then select as the nearest neighbors the three firms in the four-digit sector of the first-time supplier with the lowest value of the loss function. These nearest neighbors serve as a counterfactual for first-time suppliers in a generalized difference-in-differences estimation. Namely, our difference-in-differences estimate reflects the average difference in the outcomes of the first-time suppliers and their controls in the same event year, relative to the average difference in the year leading up to a first-time supplying event. For more details on this method, see Online Appendix D.1.1.

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IV. First-Time Suppliers to MNCs Improve Their Performance

IV.A. Baseline Economy-Wide Event Study Results

1. *Standard Measures of Firm Performance.* In what follows we rely on the event study specification (1) and the economy-wide full sample to estimate the effects of starting to supply to an MNC on firm size and measures of TFP. These results characterize the 3,697 domestic firms that become first-time suppliers to an MNC in CR sometime between 2010 and 2015.

i. Firm Size. Figure I, Panels A–D plot the event study coefficients for log total sales, number of workers, net assets (as a proxy for capital),[18] and input costs (as a proxy for materials). 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. This growth already starts in the year of their first transaction with an MNC, with the average growth that year relative to the previous year being 16% in sales, 6% in the number of workers, and 9% in input costs. Net assets react with a one-year lag. Firms keep growing over the next years until reaching a plateau at 33% higher sales, 26% more workers, 22% more assets, and 23% higher input costs. Table I provides additional details.

The magnitude and long-run nature of these effects are noteworthy. In other settings where firms receive demand shocks that are comparable or larger, firms do not grow as much. For instance, Atkin, Khandelwal, and Osman (2017) find that Egyptian microenterprises that receive large export orders for rugs (with cumulative payments of US$155,682 for 2.5 years of work) did not increase their employment and capital usage. Similarly, supply-side interventions such as business training can also fail to boost firm scale (Karlan and Valdivia 2011).

ii. Measures of TFP. We first estimate TFP using OLS, assuming either a Cobb-Douglas or translog technology. To this end, we extend specification (1) by using log sales as the outcome variable and the logs of the number of workers, net assets (as a proxy for capital), and input costs (as a proxy for materials) as time-

18. The net assets variable is the sum of (i) cash and other liquid assets, (ii) shares/stocks, (iii) inventories, and (iv) total fixed assets. In the terminology of the Costa Rican Ministry of Finance, the "net" designation means that the fixed assets part of this variable is already net of depreciation, amortization, and depletion.

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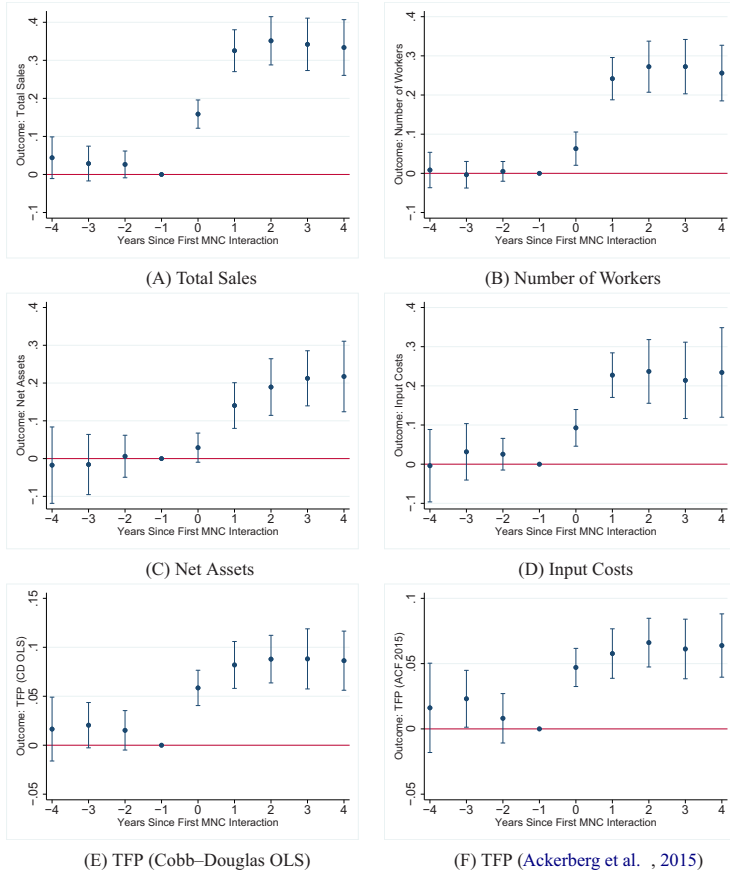


FIGURE I

Domestic Firms Increase Their Size and TFP after Starting to Supply to MNCs

Figure I plots the estimated θ_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 A), log number of workers (Panel B), log net assets (as a proxy for capital, Panel C), and log input costs (as a proxy for materials, Panel D). Panels E and F adapt specification (1) to two measures of TFP. Panel E uses a measure of TFP resulting from OLS production function estimation, under the Cobb-Douglas functional form assumption. Panel F estimates TFP using the method proposed by Ackerberg, Caves, and Frazer (2015). The event is defined as a first-time sale to an MNC. θ_{-1}, the coefficient of the year prior to a first sale to an MNC, is normalized to zero. All regressions include firm and four-digit sector × province × calendar year fixed effects. The vertical lines reflect the 95% confidence intervals. The coefficients plotted correspond to Table I, columns (1)–(5) and (8), obtained from the full sample including 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.

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TABLE I

DOMESTIC FIRMS INCREASE THEIR SIZE AND TFP AFTER STARTING TO SUPPLY TO MNCS

	Firm size				TFP				
	Total sales (1)	Number workers (2)	Net assets (3)	Input costs (4)	CD OLS (5)	TL OLS (6)	LP (2003) (7)	ACF (2015) (8)	DL† (2013) (9)
4 years before event	0.044	0.009	−0.017	−0.004	0.016	0.015	0.020	0.016	−0.027**
	(0.028)	(0.023)	(0.052)	(0.047)	(0.017)	(0.016)	(0.018)	(0.017)	(0.014)
3 years before event	0.029	−0.004	−0.016	0.032	0.020*	0.019*	0.028**	0.023**	−0.016*
	(0.023)	(0.017)	(0.041)	(0.037)	(0.012)	(0.010)	(0.011)	(0.011)	(0.009)
2 years before event	0.026	0.005	0.006	0.025	0.015	0.007	0.011	0.008	−0.002
	(0.018)	(0.013)	(0.028)	(0.021)	(0.010)	(0.009)	(0.010)	(0.010)	(0.005)
Year of event	0.159***	0.063***	0.029	0.093***	0.059***	0.044***	0.061***	0.047***	0.004
	(0.019)	(0.022)	(0.020)	(0.024)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)
1 year after event	0.325***	0.242***	0.140***	0.227***	0.082***	0.057***	0.067***	0.058***	0.020***
	(0.028)	(0.028)	(0.031)	(0.029)	(0.012)	(0.011)	(0.011)	(0.010)	(0.007)
2 years after event	0.351***	0.272***	0.189***	0.237***	0.088***	0.067***	0.078***	0.066***	0.025***
	(0.032)	(0.033)	(0.038)	(0.041)	(0.012)	(0.012)	(0.010)	(0.010)	(0.007)
3 years after event	0.342***	0.272***	0.213***	0.214***	0.088***	0.064***	0.074***	0.061***	0.031***
	(0.035)	(0.035)	(0.037)	(0.050)	(0.016)	(0.014)	(0.012)	(0.012)	(0.010)
4 years after event	0.334***	0.256***	0.217***	0.234***	0.086***	0.066***	0.076***	0.064***	0.042***
	(0.037)	(0.036)	(0.048)	(0.058)	(0.015)	(0.015)	(0.013)	(0.012)	(0.011)

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TABLE I
CONTINUED

	Firm size				TFP				
	Total sales (1)	Number workers (2)	Net assets (3)	Input costs (4)	CD OLS (5)	TL OLS (6)	LP (2003) (7)	ACF (2015) (8)	DL† (2013) (9)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-4Dsect-prov FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Never suppliers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. var. (level)	0.85	13.2	2.93	0.78	1.12	1.12	−0.00	−0.00	1.51
Std. dev. dep. var. (level)	2.54	32.6	712.8	2.68	3.17	3.17	0.37	0.35	0.33
Adjusted R^2	0.77	0.74	0.81	0.83	0.95	0.97	0.63	0.62	0.87
No. observations	116,683	116,683	94,038	67,194	64,419	64,419	64,419	64,419	64,419
No. fixed effects	25,174	25,174	21,480	15,894	15,464	15,464	15,464	15,464	15,464
No. firms	18,035	18,035	14,804	10,834	10,492	10,492	10,492	10,492	10,492

Notes. Table I shows the results of running the event study specification (1), where the event is defined as a first-time sale to an MNC. The first four dependent variables are measures of firm size: log total sales (column (1)), log total number of workers (column (2)), log net assets (as a proxy for capital, column (3)), and log input costs (as a proxy for materials, column (4)). Columns (5)–(9) propose various proxies of TFP as an outcome variable. Column (5) uses a measure of TFP resulting from an OLS production function estimation that assumes 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. Column (6) differs from column (5) only in its 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. Column (7) shows the results of production function estimation following Levinsohn and Petrin (2003). Column (8) shows the results of production function estimation following Ackerberg, Caves, and Frazer (2015). †In column (9), we adapt the TFP estimation procedure from De Loecker (2013) such that the endogenous productivity process that is accommodated by this procedure is no longer learning by exporting, but learning from supplying to an MNC. θ_{-1}, the coefficient of the year prior to a first sale to an MNC, is normalized to zero. All columns 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. With the exception of the number of workers, means (in levels) are reported in millions of U.S. dollars (CPI-deflated to 2013 dollars). Clustering of standard errors is at the two-digit sector by province level. Robust standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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varying controls.[19] Because OLS does not account for the potential endogeneity of input choices, we also use the methods proposed by Levinsohn and Petrin (2003) and Ackerberg, Caves, and Frazer (2015). In cases without input and output price variations correlated with the event, these two methods provide credible estimates of true TFP.

Additionally, we adapt the TFP estimation procedure of De Loecker (2013) such that the endogenous TFP process that is accommodated by this procedure is no longer learning from exporting, but learning from supplying to an MNC. With this adapted method, we can explore the possibility that supplying to an MNC shapes a firm's future TFP while allowing other firm-level actions (e.g., investment decisions) to also affect future TFP. This method addresses the potential bias of ignoring a firm's MNC-supplying experience in the underlying TFP process (bias that might affect standard proxy estimators, such as Levinsohn and Petrin 2003).

Figure I, Panels E and F summarize the TFP results and Table I provides more 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 4% to 9% higher than in the year before the event (depending on the estimation procedure).

iii. Markup Effects (or Lack Thereof). The TFP estimates above might be upward biased if first-time suppliers to MNCs start charging higher markups—to the first MNC buyer alone or to other buyers as well. This can happen if supplying to MNCs leads to quality improvements, higher-quality goods carry higher markups (as in Atkin et al. 2015), and there are no countervailing forces that tend to compress markups (such as switching to buyers with greater bargaining power or markets with tougher competition, as in Mayer, Melitz, and Ottaviano 2014; Acemoglu and Tahbaz-Salehi 2020; Alviarez et al. 2020). We argue that while the first two conditions may be met, the third condition is unlikely to be met in our empirical setting.

Before proceeding with our evidence, an important caveat is in order. Lacking data on prices and quantities for domestic transactions makes it difficult to rule out definitively the possibility that

19. We use net instead of fixed assets because there are fewer missing or zero firm-year values for net assets. TFP estimates using fixed assets are virtually identical and are available on request.

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part of the estimated TFP gains reflects higher markups. That said, in what follows, we provide several pieces of evidence that strongly suggest that at least part of the estimated TFP effects capture an actual increase in productivity and/or quality.

First, in Online Appendix Table C1 we use the empirical models of De Loecker and Warzynski (2012) and Sampi, Jooste, and Vostroknutova (2021)[20] to show unchanged (or declining) average markups for first-time suppliers to MNCs. This evidence is in line with our surveys, which point to the strong bargaining power of MNCs and their ability to squeeze suppliers' margins.[21] Previous research reports similar findings (e.g., Javorcik 2008; Javorcik, Keller, and Tybout 2008).[22] Our surveys also suggest that even when the quality of the domestic firms' products increases after the first MNC linkage, these higher-quality products are sold at unchanged or falling prices (to both the first MNC buyer and other buyers). See Section VI for details.

Second, as we will see in the next section, starting to supply to MNCs improves the sales of domestic firms to other buyers. Suppose first-time suppliers learn from the first MNC buyer how to produce higher-quality products, and their other buyers also demand such products. One might be concerned that the increase in sales to others captures only higher markups on those higher-quality products. For plausible values of the demand elasticity (specifically, for values lower than -1), without a fall in marginal costs and/or an increase in the demand shifter (product quality or appeal) that are large enough to compensate for the higher markups, higher markups alone would lead to a fall in sales to others. Online Appendix E.3.3 contains

20. Sampi, Jooste, and Vostroknutova (2021) provide a work-around solution to the concerns raised by Bond et al. (2021) on the interpretation of markups estimated using the ratio of the output elasticity of a variable input to that input's cost share in revenue (such as in De Loecker and Warzynski 2012). Moreover, the Sampi, Jooste, and Vostroknutova (2021) method is appropriate in settings where measuring the change in markups (as opposed to their level) is enough.

21. MNCs have privileged access to imports (e.g., MNCs in free trade zones are exempted from customs duties) and leverage their corporate commodity managers to learn about suppliers abroad. Moreover, the leading international suppliers of MNCs tend to pursue their buyers as they open new affiliates (a practice called follow sourcing). The larger the MNC, the more likely it is to have these sourcing advantages. These factors combined leave little room for domestic suppliers to obtain higher markups from MNCs.

22. For instance, 40% of suppliers to MNCs in the Czech Republic had to lower prices by 1% to 30% (Javorcik 2008).

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the formal argument. Moreover, the tendency of higher markups on higher-quality goods may be offset by the greater bargaining power of the new buyers of first-time suppliers, who (as shown in the next section) are larger and more internationally exposed.

2. *Business with Other Buyers.* With the aid of the firm-to-firm transaction data, we explore the patterns of business of first-time suppliers with all buyers except the first MNC buyer. This exploration has two goals. First, it addresses the natural concern that the firm growth documented so far is owed primarily to the addition of the new MNC buyer. Second, we argue that what happens to the business of first-time suppliers in other markets (in this case, with all their other buyers in CR) is informative on the mechanisms behind the effects of a first linkage with an MNC and firm fundamentals more broadly (such as the marginal cost elasticity).

Let us first define a couple of objects of interest. The sales to others are equal to total sales minus the sales to the first MNC buyer, where the total sales come from the corporate income tax returns and the sales to the first MNC buyer come from the firm-to-firm transaction data. The corporate buyers of a firm in a given year are its buyers reported in the firm-to-firm transaction data, that is, firms in CR whose purchases of goods or services from that firm exceed US$4,200 that year. The total corporate sales are equal to the sum across the sales to all corporate buyers in the firm-to-firm transaction data. The corporate sales to others exclude the sales to the first MNC buyer. Aside from total corporate sales, total sales contain exports and sales to end consumers and to firms in CR whose purchases that year sum up to less than the reporting threshold. We call this difference noncorporate sales.

In addition to the pattern of total sales (sales to all buyers), Figure II shows the patterns of sales to all buyers except the first MNC buyer, all corporate buyers, and all corporate buyers except the first MNC buyer. Across the four types of buyers, we do not find 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 important, these increases are not mechanical because they survive the exclusion of the sales to the first MNC buyer. Four years after the event, sales to others increase by 20%, while corporate sales to others

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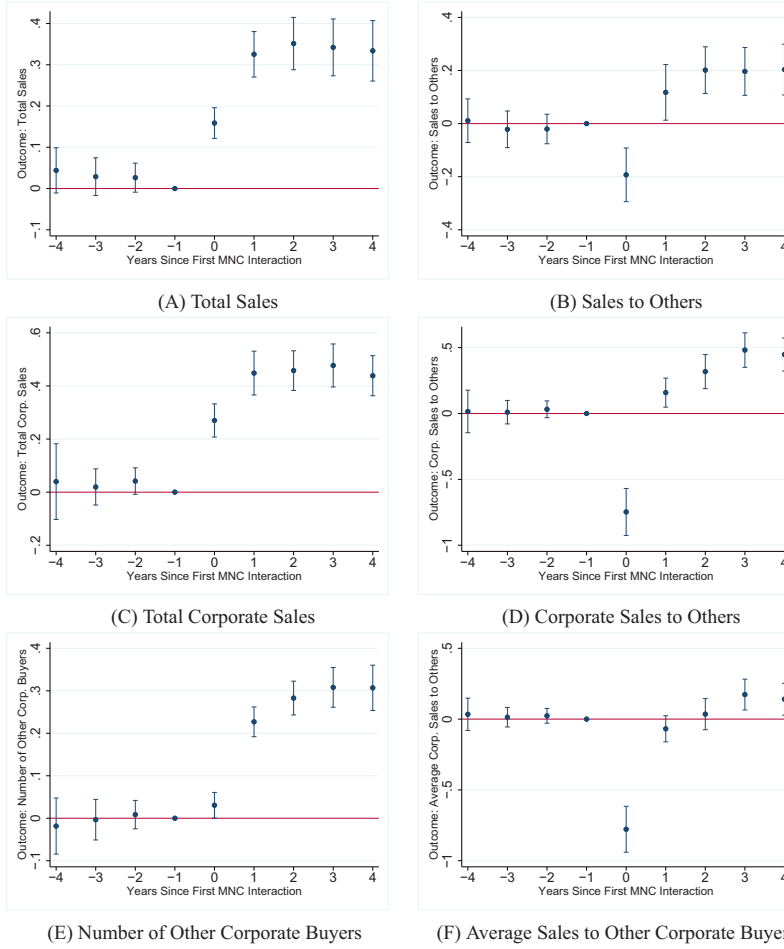


FIGURE II

Domestic Firms Improve Their Sales to Others after Starting to Supply to MNCs

Figure II plots the estimated θ_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 A), log sales to buyers other than the first MNC buyer (Panel B), log total sales to corporate buyers (Panel C), log sales to corporate buyers other than the first MNC buyer (Panel D), log number of other corporate buyers (Panel E), and log average value of sales to other corporate buyers (Panel F). The event is defined as a first-time sale to an MNC. θ_{-1}, the coefficient of the year prior to a first sale to an MNC, is normalized to zero. All regressions include firm and four-digit sector × province × calendar year fixed effects. The vertical lines reflect the 95% confidence intervals. The coefficients plotted correspond to Table II, columns (1), (2), and (5)–(8), obtained from the sample including 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.

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increase by 45%.[23] Table II provides details and robustness checks (e.g., showing that the baseline results are not driven by demand from buyers who are themselves new suppliers to MNCs).

i. Extensive- versus Intensive-Margin Responses. We ask whether these changes in sales to others materialize primarily along the extensive or the intensive margin. Figure II, Panel E depicts the extensive-margin response (i.e., the effect of the event on the log number of corporate buyers, except the first MNC buyer), while Panel F looks into the intensive-margin response (i.e., the effect on the average value of transactions across all other corporate buyers). Reassuringly, in the years before the first linkage with an MNC, we find no differential trends in either the number of corporate buyers or the average sales to others. After the event, however, both margins react. Four years later, first-time suppliers have 31% more corporate buyers and average transactions are 14% larger than in the year before the event. Hence, of the 45% increase in corporate sales to others, the intensive (extensive) margin accounts for one (two) third(s) of the increase.[24] Table II provides more details.

ii. Short- versus Medium-Run Adjustments. The focus on the effects four years after the event conceals striking short-run adjustments. Namely, in the year of the event, the sales to others decrease by 19%, corporate sales to others by 75%, and noncorporate sales to others by 9%. Most of the 75% drop in corporate sales to others occurs along the intensive margin. Specifically, the average sales to others drop by 78% in the year of the event, and the number of other buyers increases by a modest 3%. For details, see Table II.

These findings suggest that firms are capacity constrained in the short term. Although capacity constraints can encompass more factors than what is captured by our net assets variable

23. Naturally, the discrepancy between the increases in the sales to others and corporate sales to others is driven by the behavior of noncorporate sales. Four years after the event, noncorporate sales increased by 16%, making the share of noncorporate sales out of all sales to others fall by 7%. Hence, first-time suppliers have shifted their sales more toward corporate buyers, that is, toward firms with purchases above US$4,200 a year.

24. Our findings of increased sales to others suggest that these other buyers may have benefited as well from the upgrades of the first-time suppliers (as in Kee 2015). While potential gains to domestic buyers are relevant to any estimation of the aggregate effects of MNCs, they are beyond the scope of this article.

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TABLE II

DOMESTIC FIRMS IMPROVE THEIR BUSINESS WITH OTHERS AFTER STARTING TO SUPPLY TO MNCS

	Total sales (1)	Sales to others (2)	Sales to others robust 1 (3)	Sales to others robust 2 (4)	Total corp. sales (5)	Corp. sales to others (6)	Number other corp. buyers (7)	Average corp. sales to others (8)
4 years before event	0.044	0.011	0.014	0.028	0.040	0.016	− 0.018	0.034
	(0.028)	(0.042)	(0.042)	(0.040)	(0.073)	(0.082)	(0.034)	(0.058)
3 years before event	0.029	− 0.022	− 0.021	− 0.009	0.020	0.010	− 0.003	0.014
	(0.023)	(0.035)	(0.036)	(0.038)	(0.035)	(0.045)	(0.024)	(0.035)
2 years before event	0.026	− 0.020	− 0.021	− 0.029	0.042	0.032	0.009	0.023
	(0.018)	(0.028)	(0.029)	(0.035)	(0.025)	(0.033)	(0.017)	(0.027)
Year of event	0.159***	− 0.193***	− 0.189***	− 0.217***	0.270***	− 0.747***	0.031**	− 0.778***
	(0.019)	(0.052)	(0.051)	(0.052)	(0.032)	(0.091)	(0.015)	(0.083)
1 year after event	0.325***	0.118**	0.122**	0.115**	0.448***	0.159***	0.227***	− 0.068
	(0.028)	(0.053)	(0.052)	(0.052)	(0.042)	(0.056)	(0.018)	(0.047)
2 years after event	0.351***	0.201***	0.199***	0.212***	0.458***	0.318***	0.283***	0.035
	(0.032)	(0.045)	(0.049)	(0.050)	(0.038)	(0.066)	(0.020)	(0.056)
3 years after event	0.342***	0.196***	0.203***	0.219***	0.477***	0.481***	0.308***	0.173***
	(0.035)	(0.046)	(0.044)	(0.050)	(0.041)	(0.067)	(0.024)	(0.056)
4 years after event	0.334***	0.203***	0.204***	0.201***	0.438***	0.448***	0.307***	0.141**
	(0.037)	(0.049)	(0.048)	(0.056)	(0.039)	(0.064)	(0.027)	(0.057)

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TABLE II
CONTINUED

	Total sales (1)	Sales to others (2)	Sales to others robust 1 (3)	Sales to others robust 2 (4)	Total corp. sales (5)	Corp. sales to others (6)	Number other corp. buyers (7)	Average corp. sales to others (8)
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	Yes	Yes	Yes	Yes
Mean dep. var. (level)	0.85	0.84	0.84	0.81	0.39	0.37	12.8	0.038
Std. dev. dep. var. (level)	2.54	2.54	2.52	2.49	1.20	1.21	38.6	0.056
Adjusted R^2	0.77	0.70	0.69	0.65	0.75	0.63	0.84	0.57
No. observations	116,683	116,536	116,444	115,879	63,793	63,078	63,078	63,078
No. fixed effects	25,174	25,156	25,150	25,088	16,833	16,689	16,689	16,689
No. firms	18,035	18,024	18,019	17,977	10,985	10,895	10,895	10,895

Notes. Table II shows the results of running the event study specification (1) adapted to eight dependent variables: log total sales (across all buyers, including the first MNC buyer, column (1)), log sales to others (all buyers except the first MNC buyer, column (2)), log sales to others "robust 1" (across all buyers except the first MNC buyer and other first-time suppliers to MNCs, column (3)), log sales to others "robust 2" (across all buyers except the first MNC buyer and other buyers that supply at some point to MNCs themselves, column (4)), log total sales to corporate buyers (including the first MNC buyer, column (5)), log sales to other corporate buyers (all corporate buyers except the first MNC buyer, column (6)), log number of other corporate buyers + 1 (number of corporate buyers tracked by the firm-to-firm transaction data, except the first MNC buyer, + 1, column (7)), and log average sales to other corporate buyers (total sales to other corporate buyers, divided by the number of other corporate buyers, except the first MNC buyer, +1, column (8)). The event is defined as a first-time sale to an MNC. θ_{-1}, the coefficient of the year prior to a first sale to an MNC, is normalized to zero. All columns 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. All regressions include firm and four-digit sector × province × calendar year fixed effects. 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 are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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(say, managerial attention), the finding that the net assets react with a one-year lag is consistent with the idea that firms cannot adjust fixed inputs in real time. The short-term need to scale down the business with other buyers is one to which we will return in Section V.B.

iii. Changes in Buyers' Characteristics. Our data merge allows us to go beyond tracking responses in the business with others, where the "others" are left anonymous. Online Appendix Figure C1, breaks down the corporate sales of first-time suppliers to an MNC by whether a buyer is old or new and an MNC or not. We define an "old buyer" as a buyer to whom the first-time supplier sells by the event year. To provide a reference point, we also study never suppliers that are randomly assigned a fake event year between 2010 and 2015. Four years after the event, around 60% of the corporate sales of first-time suppliers go to new buyers acquired after the event. This percentage stands in contrast to slightly more than 50% for never suppliers. Hence, although the churning of old buyers is not a pattern limited to first-time suppliers, new buyers are clearly more important for them than for never suppliers. For legibility, the domestic buyers in Online Appendix Figure C1 bundle domestic firms, non-MNC but partially foreign-owned firms, and the government. While most corporate sales to new buyers are to new domestic buyers, first-time suppliers also acquire new MNC buyers.[25] Four years after the event, on average, 6% of the sales of first-time suppliers go to 1.2 new MNC buyers.[26]

25. Online Appendix Figure C1 has to focus on corporate sales, as it is only with the firm-to-firm transaction data that one can establish whether a buyer is old or new and an MNC or not. In Online Appendix Figure C2 we study total sales, which include the noncorporate sales (the sum of exports and the part of local sales not reported in the firm-to-firm transaction data). Online Appendix Figure C2 disaggregates the total sales of first-time suppliers into a more narrowly defined set of buyers: the government, domestic firms and consumers, non-MNC partially foreign-owned firms, MNCs, and exports. Here, the sales to domestic firms and consumers are computed as the residual from the total sales minus the sales to MNCs, sales to partially foreign-owned firms that are not MNCs, exports, and sales to the government. We find that most of the increase in total sales after the event stems from sales to domestic firms and consumers (this time, more narrowly defined). Other buyers also tend to increase their purchases, though more modestly.

26. Online Appendix Tables B4 and B5 provide more details on post-event relationships with MNCs. Moreover, Online Appendix Tables C2 and C3 expand our event study analysis to study the effects of subsequent MNC buyers. Namely, in these tables, a year with an event is any year in which a domestic firm starts

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Table III provides additional evidence that joining the supply chain of an MNC induces changes in the buyer characteristics of first-time suppliers. We first find that four years after acquiring a first MNC buyer, domestic firms sell to buyers in 18% (21%) more two-digit (four-digit) sectors. Meanwhile, first-time suppliers do not buy from more two-digit (four-digit) sectors. Next, we learn that the sales of first-time suppliers (four years after) are made to buyers with 49% more workers, 53% higher sales, 30% more suppliers, and 40% more buyers. First-time suppliers tend to sell to buyers who are slightly more internationally exposed, as proxied by their share of exports in total sales and imports in total inputs. Finally, first-time suppliers sell to buyers with more substantial relationships with all their suppliers, as measured by the 19% higher average value of transactions and 8% longer relationships.[27]

Overall, our evidence on the persistent boosts in performance with other buyers (in particular, on the improved ability to acquire new buyers), the changing composition of sales by buyer type (e.g., from old to new), and the better-performing new buyers (e.g., larger size or longer supplier relationships) of first-time suppliers to MNCs are consistent with improvements in productivity, product scope and quality, and reputation for first-time suppliers.

IV.B. Robustness Checks to the Baseline Results

1. *Results from Alternative Empirical Strategies.* Table IV presents the event study estimates obtained from the four alternative strategies described in Section III.B, namely, the Productive Linkages strategy and the three matching estimators applied to the economy-wide sample. Table IV focuses on three of our main outcomes: total sales, TFP residual from an OLS production function estimation under a Cobb-Douglas technology, and the

supplying to a new MNC buyer (the first MNC buyer or a subsequent one). Online Appendix Table C2 splits the baseline sample of first-time suppliers to MNCs based on their total number of years with events. The more years with events a first-time supplier has, the stronger its overall growth in size and TFP. Online Appendix Table C3 compares the pooled (before versus after) change in total sales and TFP after each new year with an event. After each additional year with an event, firms experience a slight increase (decrease) in the pooled change in sales (TFP). Although caution is warranted in drawing causal inferences, these findings are suggestive of the value of expanding one's portfolio of MNC buyers.

27. To avoid mechanical results, we exclude the first MNC buyer from all results in Table III. Changes in firm size also do not explain these results, as we have already controlled for the suppliers' contemporaneous total sales.

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TABLE III

FIRST-TIME SUPPLIERS TO MNCS START SELLING TO MORE BUYING SECTORS AND FIRST-TIME SUPPLIERS SHIFT THEIR SALES TOWARD BUYERS WITH BETTER PERFORMANCE

	Number of buying/supplying sectors				Average characteristics of the buyers (excluding the first MNC buyer)							
	No. 2D buying sectors	No. 2D supplying sectors	No. 4D buying sectors	No. 4D supplying sectors	Number workers	Total sales	Number suppliers	Number buyers	Export share	Import share	Trans / supplier	Length w/ suppliers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
4 years before event	−0.024	0.000	−0.018	−0.018	0.019	0.017	−0.012	−0.108	−0.007	−0.005	−0.018	0.015
	(0.026)	(0.021)	(0.029)	(0.026)	(0.075)	(0.078)	(0.052)	(0.084)	(0.005)	(0.006)	(0.038)	(0.034)
3 years before event	−0.003	−0.006	0.003	−0.009	−0.063	−0.108**	−0.056	−0.006	−0.005	0.002	−0.039	−0.028
	(0.018)	(0.016)	(0.021)	(0.016)	(0.055)	(0.050)	(0.043)	(0.050)	(0.004)	(0.006)	(0.029)	(0.030)
2 years before event	0.008	0.008	0.017	−0.002	−0.021	−0.036	−0.015	0.068	0.001	−0.001	−0.001	0.016
	(0.019)	(0.013)	(0.019)	(0.013)	(0.031)	(0.036)	(0.029)	(0.047)	(0.002)	(0.004)	(0.019)	(0.020)
Year of event	0.032***	−0.002	0.040***	−0.008	0.088*	0.085*	0.074**	0.076	−0.003	−0.008**	0.019	0.016
	(0.012)	(0.011)	(0.011)	(0.010)	(0.044)	(0.045)	(0.033)	(0.050)	(0.002)	(0.003)	(0.016)	(0.016)
1 year after event	0.125***	0.012	0.145***	0.010	0.362***	0.402***	0.241***	0.328***	0.011***	0.014***	0.081***	0.037**
	(0.014)	(0.013)	(0.013)	(0.014)	(0.050)	(0.051)	(0.038)	(0.053)	(0.003)	(0.004)	(0.019)	(0.017)
2 years after event	0.154***	0.023	0.182***	0.024	0.445***	0.498***	0.293***	0.415***	0.015***	0.015***	0.127***	0.062***
	(0.015)	(0.017)	(0.015)	(0.017)	(0.043)	(0.041)	(0.033)	(0.048)	(0.003)	(0.004)	(0.020)	(0.021)
3 years after event	0.175***	0.025	0.205***	0.026*	0.475***	0.541***	0.306***	0.468***	0.017***	0.017***	0.152***	0.079***
	(0.016)	(0.015)	(0.017)	(0.016)	(0.049)	(0.048)	(0.037)	(0.057)	(0.003)	(0.004)	(0.021)	(0.021)
4 years after event	0.175***	0.030	0.208***	0.030	0.487***	0.534***	0.301***	0.399***	0.012***	0.017***	0.190***	0.081***
	(0.020)	(0.019)	(0.021)	(0.020)	(0.054)	(0.055)	(0.043)	(0.051)	(0.004)	(0.006)	(0.020)	(0.024)

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TABLE III

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	Number of buying/supplying sectors				Average characteristics of the buyers (excluding the first MNC buyer)							
	No. 2D buying sectors	No. 2D supplying sectors	No. 4D buying sectors	No. 4D supplying sectors	Number workers	Total sales	Number suppliers	Number buyers	Export share	Import share	Trans / supplier	Length w/ suppliers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mean dep. var. (level)	3.67	4.56	4.52	6.04	456.0	74.0	172.4	428.8	0.049	0.10	0.036	3.69
Std. dev. dep. var. (level)	3.25	3.86	4.88	6.37	1,434.6	269.2	417.1	1,788.1	0.15	0.17	0.032	2.51
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-4Dsect-prov FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.78	0.83	0.81	0.86	0.73	0.74	0.74	0.74	0.77	0.70	0.64	0.72
No. observations	54,363	54,363	54,363	54,363	54,363	54,363	54,363	54,363	54,363	54,363	54,363	54,363
No. fixed effects	14,998	14,998	14,998	14,998	14,998	14,998	14,998	14,998	14,998	14,998	14,998	14,998
No. firms	9,652	9,652	9,652	9,652	9,652	9,652	9,652	9,652	9,652	9,652	9,652	9,652

Notes. This table shows the results of running the event study specification (1) for 12 outcomes. We define the event as a first-time sale to an MNC. Columns (1) and (3) (columns (2) and (4)) study the effect of the event on the log number of two-digit and four-digit buying sectors of (supplying sectors to) the first-time suppliers. For each domestic firm and regression, there is only one observation: the unweighted count of its number of buying (supplying) sectors in that event year. Columns (5)–(12) study the effect of the event on the characteristics of the buyers of first-time suppliers. We compute the variable in question for each buyer (e.g., its number of suppliers for column (9)). For each domestic firm, we compute a weighted average of the values of the variable across its buyers in that event year, where the weights reflect the importance of each buyer to the domestic firm that year (measured as a share of the value of transactions with that buyer out of the total value of the transactions of the domestic firm). The final outcome is the log weighted average. In order, columns (5) to (12) study the following buyer characteristics: the number of workers, total sales, number of suppliers, number of buyers, the share of exports in total sales, the share of imports in total input costs (imports plus local purchases), the average transaction value across all the suppliers of the buyer, the average length of the relationships of the buyer with all its suppliers (this last variable is the only one computed across all years; all other variables are in the event year). The MNC buyer triggering the event is always excluded from the set of buyers described in this table. All regressions control for the contemporaneous log total sales of the first-time supplier, in addition to firm and four-digit sector × province × calendar year fixed effects. All columns 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 during our entire firm-to-firm transaction data set. Clustering of standard errors is at the two-digit sector by province level. Robust standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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TABLE IV

BASELINE EVENT STUDY ESTIMATES ARE ROBUST TO FOUR ALTERNATIVE EMPIRICAL STRATEGIES

	Productive Linkages design			Predicted Procomer score			Propensity score matching			Nearest neighbors matching		
	Total sales (1)	TFP CD OLS (2)	Corp. sales to others (3)	Total sales (4)	TFP CD OLS (5)	Corp. sales to others (6)	Total Sales (7)	TFP CD OLS (8)	Corp. sales to others (9)	Total sales (10)	TFP CD OLS (11)	Corp. sales to others (12)
4 years before event	0.133	−0.004	−0.019	0.114***	0.017	0.045	0.135***	0.038**	0.090	−0.026	0.003	0.008
	(0.212)	(0.127)	(0.229)	(0.036)	(0.015)	(0.086)	(0.030)	(0.017)	(0.092)	[−0.098,0.107]	[−0.041,0.065]	[−0.181,0.279]
3 years before event	0.128	0.152	0.009	0.090***	0.026	0.065	0.092***	0.023	0.130**	−0.023	0.000	−0.017
	(0.172)	(0.139)	(0.251)	(0.032)	(0.018)	(0.058)	(0.025)	(0.013)	(0.061)	[−0.087,0.076]	[−0.035,0.041]	[−0.164,0.149]
2 years before event	0.019	0.112	−0.075	0.057**	0.019**	0.059	0.069***	0.028**	0.088**	−0.011	−0.003	−0.041
	(0.150)	(0.122)	(0.192)	(0.024)	(0.009)	(0.037)	(0.021)	(0.013)	(0.042)	[−0.046,0.056]	[−0.028,0.028]	[−0.134,0.067]
Year of event	0.182	0.131	0.008	0.153***	0.051***	−0.699***	0.095***	0.040***	−0.763***	0.165***	0.029***	−1.285***
	(0.167)	(0.140)	(0.193)	(0.019)	(0.010)	(0.067)	(0.023)	(0.012)	(0.064)	[0.111,0.218]	[0.013,0.064]	[−1.694, −1.091]
1 year after event	0.335**	0.279***	0.088	0.301***	0.077***	0.179***	0.184***	0.063***	0.085*	0.338***	0.055***	0.049
	(0.140)	(0.106)	(0.189)	(0.028)	(0.014)	(0.057)	(0.023)	(0.015)	(0.045)	[0.284,0.398]	[0.031,0.092]	[−0.199,0.177]
2 years after event	0.370**	0.218**	0.359**	0.362***	0.095***	0.345***	0.238***	0.069***	0.229***	0.392***	0.064***	0.227*
	(0.159)	(0.108)	(0.176)	(0.030)	(0.011)	(0.072)	(0.022)	(0.015)	(0.063)	[0.330,0.461]	[0.039,0.104]	[−0.031,0.351]
3 years after event	0.358**	0.203*	0.120	0.397***	0.099***	0.517***	0.256***	0.077***	0.413***	0.425***	0.067***	0.337***
	(0.153)	(0.116)	(0.191)	(0.036)	(0.011)	(0.078)	(0.026)	(0.016)	(0.080)	[0.351,0.503]	[0.035,0.109]	[0.120,0.472]
4 years after event	0.389**	0.225**	0.141	0.427***	0.100***	0.499***	0.293***	0.089***	0.385***	0.476***	0.063***	0.372***
	(0.165)	(0.114)	(0.201)	(0.041)	(0.016)	(0.061)	(0.029)	(0.018)	(0.065)	[0.395,0.557]	[0.026,0.113]	[0.126,0.540]

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TABLE IV

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	Productive Linkages design			Predicted Procomer score			Propensity score matching			Nearest neighbors matching		
	Total sales (1)	TFP CD OLS (2)	Corp. sales to others (3)	Total sales (4)	TFP CD OLS (5)	Corp. sales to others (6)	Total Sales (7)	TFP CD OLS (8)	Corp. sales to others (9)	Total sales (10)	TFP CD OLS (11)	Corp. sales to others (12)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	n/a	n/a	n/a
Year FE	Yes	Yes	Yes	No	No	No	No	No	No	n/a	n/a	n/a
Year-4Dsect-prov FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	n/a	n/a	n/a
Adjusted R^2	0.83	0.96	0.81	0.80	0.96	0.68	0.82	0.97	0.69	n/a	n/a	n/a
No. observations	1,111	1,087	1,072	107,135	55,208	71,083	98,393	53,693	70,903	91,382	46,883	71,776
No. fixed effects	123	123	123	15,470	10,026	12,540	14,888	9,720	12,275	n/a	n/a	n/a
No. treated	31	31	31	3,606	2,248	3,383	3,599	2,247	3,380	3,670	2,024	3,254
No. control	84	84	84	10,814	6,297	8,096	10,811	6,598	8,632	11,010	6,072	9,762

Notes. This table contains robustness checks to the baseline results reported in Tables I and II. These exercises use the four alternative empirical strategies described in Section III.B for three outcomes (all in logs): total sales, TFP residual from an OLS regression that assumes a Cobb-Douglas technology, and corporate sales to others. Columns (1) to (3) present the results from the Productive Linkages design, columns (4) to (6) those from the predicted Procomer scores matching, columns (7) to (9) those from the propensity score matching, and columns (10) to (12) those from the nearest neighbors matching. Due to missing values in the input costs (materials) variable for its small sample, the Productive Linkages OLS production function estimation considers only workers and net assets (as a proxy for capital) as inputs. The three matching variables also control for materials usage. Regressions in columns (1) to (3) include firm, deal, and year fixed effects. Regressions in columns (4) to (12) include firm and four-digit sector × province × calendar year fixed effects. For columns (1) to (9), robust standard errors are in parentheses. For the nearest neighbors matching, 95% confidence intervals, given in brackets, and statistical significance levels are constructed via subsampling. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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corporate sales to others.[28] We contrast the estimates for each alternative strategy and outcome with our baseline estimates summarized in Tables I and II.

Reassuringly, across methods and outcomes, we find either a lack of or sporadic pretrends. Moreover, all four sets of event study estimates display the same qualitative patterns as the baseline estimates (e.g., the extensive-margin response of new buyers is the leading driver of the rise in sales to other buyers). Although the point estimates tend to vary across empirical strategies, the confidence intervals overlap for most outcomes and event years. This is true despite these alternative approaches using control groups built on either more information than what is typically observed in administrative data (but captured in the Procomer score) or stronger predictors of supplying linkages than the sector and province of a firm. Overall, it is encouraging that these four alternative approaches support our baseline results.

2. *More Robustness Checks to the Baseline Economy-Wide Event Studies.* Our baseline economy-wide regressions allow in the sample of control firms the never suppliers, that is, domestic firms never observed as supplying to an MNC throughout 2008 to 2017. To assuage concerns over the similarity between first-time suppliers and never suppliers to MNCs, Online Appendix D.2 explores the implications of dropping from the control group all or part of the never suppliers. Online Appendix Table D4 shows that the baseline estimates hold up to dropping all the never suppliers. This suggests that the driver of our baseline results is the staggered timing of the event and not the contrast to never suppliers. In Online Appendix Table D5, we only exclude the never suppliers to an MNC that are also never suppliers to a large domestic firm throughout 2008 to 2017. This exercise therefore accepts in the control group only firms having sold to a large buyer. These new event study estimates remain similar to the baseline ones.

There is one important threat to identification that is not addressed by our analysis thus far: firms may experience unobservable firm-specific shocks that affect the timing of their first supplying relationship with an MNC and their subsequent performance. While not all such shocks need to be embodied in new employees, the hiring of new influential employees before the first

28. Online Appendix Table D1 reports the estimates for the number of workers, the number of other buyers, and the average sales to other buyers.

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sale to an MNC is among the most plausible confounding factors. Problematic influential employees would need to be able to establish the first contract with an MNC and improve firm performance. In Online Appendix D.3 we investigate this scenario using matched employer-employee data from the Costa Rican Social Security Fund.

We first consider the hiring of a new manager, as managers can affect overall firm performance. We define managers as the firm's top two earners. Alternatively, we take as managers workers whose occupation is categorized as managerial by ISCO-08. From the baseline sample of first-time suppliers, we drop those having hired a new manager in the year of their event or the year before. We also consider hiring workers straight from an MNC or a supplier to an MNC as another plausibly concerning event. Such workers may use their MNC contacts to generate a first MNC contract for their new employer and transfer knowledge acquired during their previous employment (improving the performance of their new employer). We exclude from the baseline sample of first-time suppliers those who have hired a new worker—in the year of their event or the year before—whose previous main employer was one of the 622 MNC affiliates in CR (or, in a separate exercise, was a supplier to one of these MNCs).[29] Our findings survive all four exclusions. Although it is impossible to fully dismiss the threat of firm-specific shocks with the problematic traits mentioned above, this evidence suggests that worker-embodied shocks are unlikely confounders.

Finally, we probe the sensitivity of our results to relaxing the restrictions imposed onto the main sample described in Section II.B. In Online Appendix D.4 we relax both one-at-a-time and simultaneously the size and sectoral restrictions set on either the domestic firms or MNCs in the baseline sample. Across variables and sample variants, our main takeaways from Tables I and II remain unaffected. Moreover, our key takeaways remain qualitatively similar across significant variations in fixed effects, including fixed effects that control for trends in more disaggregated geographic units (see Online Appendix D.5). Results also remain largely unchanged for a balanced sample in event time (see Online Appendix D.6). These alternative exercises corroborate the robustness of our baseline event study specification and sample.

29. We exclude all firms hiring one of these types of workers, irrespective of the occupation taken at the new firm.

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V. More Evidence from Administrative Data to Guide Interpretation

V.A. MNC Demand Shocks Differ from Those from Large Domestic Buyers

We carry out three placebo event studies where we define the event as a first sale to the government, a large domestic firm, or a domestic exporter, respectively. Thanks to the firm-to-firm transaction data, we observe 1,447 domestic firms that started supplying to one of 98 government entities, 1,944 that started supplying to one of 373 large domestic firms, and 1,432 that started supplying to one of 385 domestic exporters. These placebo event studies allow us to shed light on the remarkable effects of demand shocks from MNCs.

First, MNCs may differ from domestic firms not only in their potential for knowledge transfers but also in other traits that are attractive to suppliers (e.g., reliable payment or the potential for scaling the collaboration, as in Ferraz, Finan, and Szerman 2016). The placebo exercise with government demand shocks probes whether these features drive our results.

One might be concerned that the government is not a buyer who values high-quality inputs and therefore that its suppliers are negatively selected. Alternatively, even if the government appreciates such inputs, one might think that it does not know how to achieve or enforce high quality. Then our findings may be due to MNCs' taste for quality and ability to guide it and not to their MNC nature. The two placebo exercises with demand shocks from a large domestic buyer or a domestic exporter investigate these possibilities. For comparability with the baseline sample of MNCs, we take as large domestic firms all domestic firms whose median number of workers is more than 100 (across all years of activity in the country). Also, for comparability with MNCs (who tend to be consistently export-oriented), we take as domestic exporters those domestic firms that are observed as exporting in all years.

One option is to directly compare the estimates from these placebo exercises with those from the baseline exercise on the full sample of first-time suppliers to an MNC. One caveat is that, on average, the event of starting to supply to an MNC may differ from these three other types of events. Online Appendix Tables E2–E7 test for differences in characteristics of the first-time suppliers (e.g., supplier sector), the first buyers (e.g., average number of suppliers), and their first interaction

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(e.g., average duration). Because we do detect some statistically significant differences,[30] we use a matching procedure that limits the dissimilarity between the baseline and placebo events to only that between the buyers triggering the events.[31]

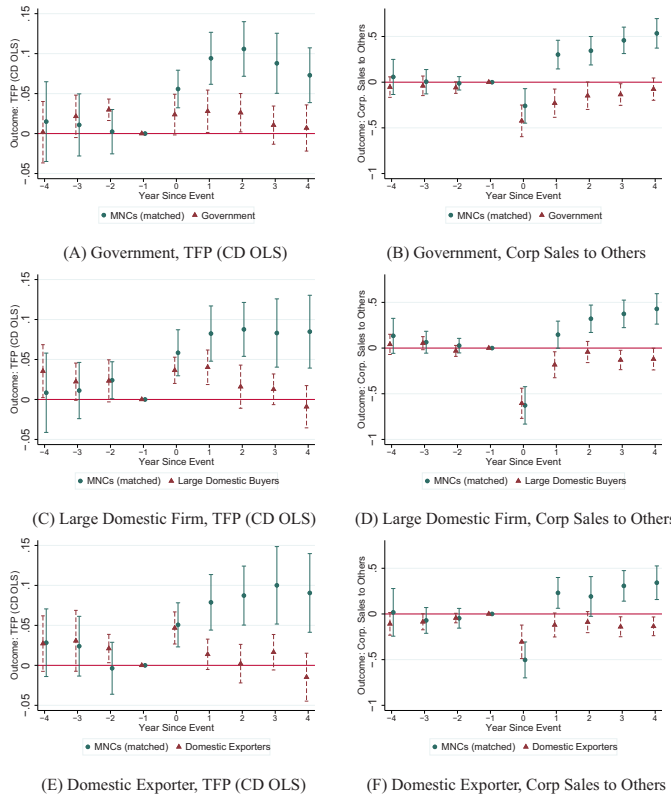
We implement all three placebo exercises with the same specification as in equation (1), altering only the definition of the event. Figure III plots the event study coefficients from these three placebo events on two outcomes: log TFP from an OLS production function estimation that assumes a Cobb-Douglas technology and log corporate sales to others. For reference, we also include in this figure the event study estimates for the matched sample of first-time suppliers to MNCs. Online Appendix Figures E1 and E2 also study total sales, the number of workers, number of other corporate buyers, and average sales to other corporate buyers.

Despite built-in similarities in the traits of the suppliers and their first relationship, we notice that after the event, the trends of the first-time suppliers to placebo buyers and the matched sample of first-time suppliers to MNCs diverge decisively. First-time suppliers to placebo buyers exhibit weaker and shorter-lived improvements in firm performance than first-time suppliers to an MNC. For instance, their TFP gains are smaller and statistically significant only in the first two years after the event. The sales to other buyers experience similar drops in the year of the event. However, in the following years first-time suppliers to MNCs see continued growth in their sales to others, and first-time suppliers to placebo buyers see their sales to others

30. For instance, first-time suppliers to the government or to a domestic exporter tend to be larger than those to an MNC, whereas first-time suppliers to a large domestic firm tend to be similar in size. First-time suppliers to all three types of placebo buyers tend to receive a smaller and shorter-lived demand shock than those to an MNC.

31. The matching is based on key characteristics of the first-time suppliers and their first relationship with the relevant buyer (see these characteristics in Online Appendix Tables E5–E7). We proceed in two steps. First, we restrict the candidates for matching in the sample of first-time suppliers to MNCs to being in the same sector and location as the firm (i.e., the first-time supplier to the placebo buyer) to be matched. For each leftover variable, we compute a z-score. We then construct a loss function, defined as the equally weighted sum (across all the leftover variables) of squares of differences between the z-score of the candidate match and that of the firm to be matched. The match for a given first-time supplier to a placebo buyer is the first-time supplier to MNCs in the same sector and location with the smallest value of the loss function.

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(A) Government, TFP (CD OLS)

(B) Government, Corp Sales to Others

(C) Large Domestic Firm, TFP (CD OLS)

(D) Large Domestic Firm, Corp Sales to Others

(E) Domestic Exporter, TFP (CD OLS)

(F) Domestic Exporter, Corp Sales to Others

FIGURE III

The Effects of Three Placebo Events—First Time Supplying to the Government, Large Domestic Buyer, or Domestic Exporter—versus the First Time Supplying to an MNC Event

Figure III compares the effects of the event of starting to supply to an MNC with those from three other placebo events, namely, starting to supply to (i) the Costa Rican government (Panels A and B); (ii) a large domestic firm (Panels C and D); and (iii) a domestic exporter (Panels E and F). We show these effects for two outcome variables: log TFP from an OLS production function estimation that assumes a Cobb-Douglas technology (left panels), and log corporate sales to others (right panels). The vertical lines reflect the 95% confidence intervals. For comparability, in each figure, we contrast the effects on the sample of first-time suppliers to the government, large domestic buyer, or domestic exporter to those on a matched subset from the baseline sample of first-time suppliers to MNCs. For example, to construct this subset for the government, we start from the sample of first-time suppliers to the government. Then, for each firm in that sample, we identify the best match in the baseline sample of first-time suppliers to MNCs (where the matching is based on the similarity in supplier characteristics and the demand shock received during the corresponding event). For details, see Section V.A and Online Appendix E.2.

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trend back to their pre-event level. To conclude, for these and other variables, by the third year after the event, first-time suppliers to the placebo buyers revert to their pre-event performance. In contrast, first-time suppliers to MNCs show persistent improvement.

V.B. *Short-Run Effects Suggest Steep Short-Run Marginal-Cost Curves*

Our event study evidence from Section IV.A shows that first-time suppliers to an MNC significantly scale back their sales to other buyers in the year of the event. One could think that this feature is specific to supplying to MNCs (e.g., due to potential exclusivity clauses). However, Figure III shows that firms experiencing other types of demand shocks also display similar patterns (even those supplying to the government—who does not impose exclusivity clauses). The pattern of interdependence between sales to one buyer and sales to all others is at odds with the standard Melitz (2003) framework and subsequent work in which firms are assumed to have a constant marginal cost. The constant marginal-cost assumption implies that demand shocks from one buyer do not affect the sales to other buyers.

One natural interpretation of the short-lasting drop in sales to others is the presence of a steep marginal-cost curve in the short run (due to fixed factors or capacity constraints) that becomes flatter in the medium run. To quantitatively explore this idea, we present a simple model that rationalizes our empirical findings. The model is an abridged adaptation of the one in Almunia et al. (2021) that still captures the main intuition of interdependence between sales to different buyers. In our model, firms are allowed to face an increasing marginal cost with respect to the quantity produced. This can be justified by a production function for the firm that aggregates fixed or predetermined inputs and flexible ones. When firms experience a positive demand shock, they increase the usage of flexible inputs (such as labor). All else equal, this demand shock leads to an increase in the short-run marginal cost. This increase in the marginal cost increases prices and results in a loss in competitiveness with other buyers, translating into a decrease in sales to these other buyers.

1. *A Stylized Model with Nonconstant Marginal Costs.* Consider a set of domestic supplier firms indexed by i selling a variety

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of a good to buyers indexed by j. We assume that supplier i faces an isoelastic demand from buyer j given by $q_{ij} = b_{ij} p_i^{-\sigma}$, where q_{ij} denotes the units of output that buyer j demands from supplier i, p_i is the price that supplier i charges, and $\sigma > 1$ is the elasticity of demand. $b_{ij} = (b_{ij}^*)^{\sigma-1}$ is a demand shifter that could be interpreted as an adjustment of the price for the quality or appeal of the good of supplier i, among others. The supplier produces a total quantity $Q_i = \sum_j q_{ij}$ with a total-cost function given by

$$TC(Q_i) = \kappa_i \left(\frac{Q_i}{\phi_i^*} \right)^{\gamma+1}, \tag{3}$$

where ϕ_i^* refers to physical efficiency and κ_i is a constant. Note that γ is the marginal-cost elasticity with respect to total output ($\gamma > -1$). As shown by Almunia et al. (2021), a cost function like the one in equation (3) can be derived in a model where the production function of the firm is a Cobb-Douglas aggregator of a fixed or predetermined input and a flexible input. We also show that when all inputs are flexible, the total cost function in equation (3) encompasses both Cobb-Douglas and general returns to scale CES production functions (see Online Appendix E.3.1). In such a case, $\frac{1}{\gamma+1}$ can be interpreted as the returns to scale of the firm. A value of $\gamma > 0$ ($\gamma < 0$) would imply decreasing (increasing) returns to scale.

Consider now an event where supplier i starts selling an amount $R_{i,M} \equiv p_i q_{i,M}$ to a given firm M. Define sales to firms other than M (sales to others) as $\tilde{R}_i \equiv p_i \tilde{Q}_i$, where $\tilde{Q}_i = \sum_{j \neq M} q_{ij}$. We solve for the optimal level of sales to others in Online Appendix E.3.2. Taking log differences of the optimal sales to others τ years after the event versus the year before the event, we find:

$$\Delta_\tau \ln(\tilde{R}_i) = \delta \Delta_\tau \ln(\tilde{R}_i + R_{i,M}) + (\sigma - 1)\Delta_\tau \ln(\phi_i), \tag{4}$$

where $\delta \equiv -\frac{(\sigma-1)\gamma}{\gamma+1}$ is our object of interest. This parameter governs the interdependence between changes in the total sales of firm i (due to the demand shock from firm M) and its sales to others. The $\phi_i \equiv \phi_i^* \tilde{B}_i^*$ term is the revenue productivity of firm i, incorporating its physical efficiency and demand adjustments for quality reflected in the demand shifter aggregator $\tilde{B}_i^* \equiv (\sum_{j \neq M} b_{ij}^{*\sigma-1})^{\frac{1}{\sigma-1}}$. This means that increases in physical productivity or product quality are isomorphic in terms of their effect on sales.

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If the marginal cost of production is constant ($\gamma = 0$) and there is no change in revenue productivity ($\Delta_\tau \ln(\phi_i) = 0$), then the demand shock $R_{i,M}$ does not affect the sales to others $\tilde{R}_i$. However, if the marginal cost is, say, increasing ($\gamma > 0$), then the demand shock decreases the sales to others even when ϕ_i stays constant. This is because the change in total production affects the marginal cost and thus the price of firm i. In general, the more elastic the demand, the more sensitive sales to others are to changes in the marginal cost induced by changes in total production. Also, the more distant γ is from zero, the more the marginal cost changes with total production, and thus, the more the sales to others are affected via price changes.

2. *Implications of Our Event Study Evidence for the Dynamics of the Marginal Cost.* We now exploit the staggered timing of the event and the different time horizons (indexed by τ) at which we can estimate the effects of the event to explore the dynamics of δ (and the marginal-cost elasticity γ). Taking expectations in equation (4) across all first-time suppliers i, we have:

$$\delta = \frac{\mathbb{E}[\Delta_\tau \ln(\tilde{R}_i)] - (\sigma - 1)\mathbb{E}[\Delta_\tau \ln(\phi_i)]}{\mathbb{E}[\Delta_\tau \ln(\tilde{R}_i + R_{i,M})]}. \tag{5}$$

To provide an estimate of δ we need estimates of the change in sales to others $\mathbb{E}[\Delta_\tau \ln(\tilde{R}_i)]$, the change in revenue productivity $\mathbb{E}[\Delta_\tau \ln(\phi_i)]$, the change in total sales $\mathbb{E}[\Delta_\tau \ln(\tilde{R}_i + R_{i,M})]$, and an estimate for the demand elasticity σ. For the baseline estimates of δ, we estimate the first three moments by leveraging our event study specification for the case of first-time suppliers to MNCs (i.e., we take firm M to be the first MNC buyer). We also set $\sigma = 5.03$ (which we infer from the average markup in the economy).[32] We provide estimates of δ at different event time horizons τ (from the year of the event to up to four years after the event). Moreover, we use the relationship between the marginal-cost elasticity γ and δ, namely, $\gamma = -\frac{\delta}{\delta+\sigma-1}$, to infer the value of γ from that of δ.

32. We estimate the average markup (μ) using the methodology of De Loecker and Warzynski (2012) (see Online Appendix Table E8). We infer σ from the fact that the isoelastic demand implies $\mu = \frac{\sigma}{\sigma-1}$. A value of $\sigma = 5.03$ is central in the range of estimates in the international trade literature (see Head and Mayer 2014).

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TABLE V

FIRST-TIME SUPPLIERS TO MNCS HAVE A STEEP (CLOSER TO FLAT) SHORT-RUN (MEDIUM-RUN) MARGINAL-COST CURVE

	Baseline Sales to others		Robustness check Transactions with others	
	δ (1)	$\gamma = \frac{\delta}{\delta+\sigma-1}$ (2)	δ (3)	$\gamma = \frac{\delta}{\delta+\sigma-1}$ (4)
Year of event	−2.702***	2.034	−3.553***	7.455
	(0.550)	(1.255)	(0.570)	(10.120)
1 year after event	−0.654***	0.194***	−0.419***	0.116**
	(0.158)	(0.056)	(0.153)	(0.047)
2 years after event	−0.435***	0.121***	−0.128	0.033
	(0.120)	(0.038)	(0.164)	(0.043)
3 years after event	−0.464***	0.130***	0.191	−0.045
	(0.156)	(0.049)	(0.165)	(0.037)
4 years after event	−0.433**	0.120**	0.159	−0.038
	(0.169)	(0.053)	(0.171)	(0.039)
No. observations	116,683	116,683	63,793	63,793

Notes. The table shows the estimates of δ (the parameter that governs the interdependence between the change in total sales of firm i and its change in sales to others) and the marginal-cost elasticity $\gamma = -\frac{\delta}{\delta+\sigma-1}$. Their estimation is based on equation (5). For these estimates, we set $\sigma = 5.03$, which we infer from the average markup in the economy using the methodology of De Loecker and Warzynski (2012). Columns (1) and (2) include the estimates of δ and γ when we use the total sales and sales to others constructed from the corporate income tax returns. The estimates in columns (1) and (2) are our preferred estimates. Columns (3) and (4) replace the total sales by the total corporate sales and the sales to others by the corporate sales to others (where "corporate" is used only for sales that are traced in the firm-to-firm transaction data). We obtain standard errors for our estimates of δ using a bootstrap procedure. Since γ is a function of δ, we then apply the delta method to obtain standard errors for our estimates of γ. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Finally, we obtain standard errors for these estimates of δ and γ using a bootstrap procedure.

Table V presents our baseline results. Columns (1) and (2) refer to the estimated δ and γ when we use the total sales and the sales to others constructed from the corporate income tax returns. Columns (3) and (4) replace the total sales by the total corporate sales and the sales to others by the corporate sales to others (where "corporate" is used only for sales that are traced in the firm-to-firm transaction data). Our preferred estimates are those from columns (1) and (2) since total sales (as opposed to total transactions) map directly to the model. However, both exercises paint a similar picture.

Column (1) shows estimates of δ that are large and negative in the short run, but that approach zero over time ($\delta = -2.70$ in the year of the event versus $\delta = -0.43$ four years after). Column (2) shows an estimate of the marginal-cost elasticity $\gamma = 2.03$ in

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the year of the event. This value points to a significant departure from the constant marginal-cost ($\gamma = 0$) assumption and implies weak short-run returns to scale of the flexible inputs (around 0.33). Similar to the estimates of δ, the estimates of γ decrease over time. In particular, four years after the event we find a value of $\gamma = 0.12$ (we still reject the null of $\gamma = 0$). A value of $\gamma = 0.12$ implies that when all inputs are flexible, the returns to scale are equal to $\frac{1}{1+\gamma} = 0.89$. This 0.89 value is close to the 0.92 value found when estimating the production function with standard methods (see Online Appendix Table E8). Thus, the simple model is consistent with our event study evidence and other moments of the data.

As mentioned already, the short-run decrease in sales to others in the year of the event is not unique to first-time suppliers to MNCs. To highlight the commonalities with other demand shocks, we provide alternative estimates of δ and γ based on event studies where the event is that of becoming a first-time supplier to the government, domestic exporters, or big domestic firms (see Online Appendix Table E9). All three cases remain consistent with a steep short-run marginal-cost curve in the year of the event ($\delta \in [-3.68, -1.69]$) and a less steep marginal-cost curve four years after ($\delta \in [-1.29, -0.97]$). Moreover, our estimates of δ are also compatible with those of Almunia et al. (2021), who study the export behavior of Spanish firms after a negative domestic demand shock around the 2008 crisis. Their preferred estimate of $\delta = -2.374$ is in the ballpark of our short-run estimates.

Overall, this exercise indicates that firms have upward-sloping marginal-cost curves in the short run—most likely because firms cannot immediately adjust fixed factors such as capital—and closer to flat marginal-cost curves in the medium run. We also show that the dynamics of the marginal cost are qualitatively similar across different types of demand shocks. This similarity suggests that the short-run adjustments uncovered by our event studies are not unique to supplying to MNCs, but they plausibly reflect general constraints faced by firms.

V.C. Results Do Not Simply Capture Changes in Tax Compliance

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

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opportunity to evaluate this concern. In theory, third-party reporting has self-enforcing properties. However, when tax authorities lack resources to pursue inconsistencies in 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 firms believe that MNCs are more prone to audits than domestic buyers, this may affect the accuracy of their D-151 reporting (similar to Pomeranz 2015).

Firms can improve their D-151 reporting by reducing gaps in reported values for transactions declared by both firms in a buyer-seller pair 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 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 underreporting of one's sales compared with 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 overreporting 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.

We find 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 opposite to that predicted by a reduction of tax-evasive behaviors (for details, see Online Appendix Table E10). Hence, we do not ascribe our results to changes in third-party reporting behavior.

Moreover, we resort to the matched employer-employee data (MEED), which records the employment of workers with social security contributions (i.e., formal employment). A working-age person who is not in MEED in a given year might either be nonemployed that year, work informally (i.e., without social security contributions), or be a foreign worker not yet integrated in the Costa Rican labor market. We ask whether the event of starting to supply to MNCs leads domestic firms to increase the share of new hires who come from outside the MEED. An increase in this share cannot by itself prove that first-time suppliers are formalizing incumbent informal workers, as firms might still be legitimately growing by hiring workers who were either nonemployed,

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working informally for a different firm, or were newly arrived foreign workers; however, it would at least raise suspicions of formalization. That said, the lack of significant effects of the event on this share (whether we include or exclude foreign workers) suggests that the growth in employment of the new suppliers is real and not a mere reporting response. This evidence is described in Online Appendix Table E11.

V.D. Not All First-Time Relationships with an MNC Are Created Equal

Here we characterize the heterogeneity of TFP gains by traits of the first-time supplier, first MNC buyer, or their first interaction. In Table VI, we split domestic firms based on either their sector or that of their first MNC buyer, where sectors fall into one of four groups: manufacturing, retail (including repair and maintenance), services, or agriculture. Domestic firms in manufacturing experience the largest TFP gains from supplying to MNCs, whereas those in services and retail attain only half of those gains. 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 or services see their TFP improve.

Second, in Table VII, we ask whether the TFP effects vary by the importance of the transaction to either the MNC or supplier. We measure its importance to the MNC by the I-O share of the purchases of the MNC sector from the supplier sector out of the total purchases of the MNC sector. We find that domestic firms whose inputs tend to be more important (core) to their first MNC buyer experience higher TFP gains. We then compute the median of the values of the first transaction with an MNC and split suppliers by whether their first transaction was below or above this median. All TFP gains are concentrated in the above-median sample.

Third, in Online Appendix Table C4, we examine whether the footprint of the MNC in CR matters for the TFP gain potential. We first split the first MNC buyers into below- and above-median groups of affiliate sizes in CR. Irrespective of whether we measure the affiliate size as the number of workers, total sales, or local purchases, smaller MNC buyers tend to generate stronger TFP gains for their first-time suppliers. One plausible reason is that larger MNC affiliates invest less in local suppliers because they have a stronger bargaining position or outside options (see note 21 for additional intuition).

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TABLE VI

TFP GAINS VARY BY THE SECTOR OF THE DOMESTIC FIRM OR THE FIRST MNC BUYER

	Sector of the domestic first-time supplier to an MNC								Sector of the first MNC buyer			
	Full sample				Restricted sample				Restricted sample			
	MFG (1)	RET (2)	SER (3)	AGR (4)	MFG (5)	RET (6)	SER (7)	AGR (8)	MFG (9)	RET (10)	SER (11)	AGR (12)
4 years before event	−0.03	0.02	−0.03	0.09	−0.01	−0.00	−0.11	0.08	0.00	−0.03	−0.05	0.14
	(0.04)	(0.02)	(0.04)	(0.06)	(0.07)	(0.03)	(0.08)	(0.13)	(0.04)	(0.07)	(0.06)	(0.10)
3 years before event	−0.02	0.02	−0.01	0.01	−0.00	0.00	−0.08	0.01	−0.05	0.02	−0.02	0.14*
	(0.03)	(0.01)	(0.03)	(0.05)	(0.04)	(0.02)	(0.06)	(0.09)	(0.03)	(0.05)	(0.04)	(0.07)
2 years before event	0.00	0.03**	−0.03	0.01	0.02	0.02	−0.05	−0.00	0.01	0.03	0.01	0.09*
	(0.03)	(0.01)	(0.03)	(0.05)	(0.03)	(0.01)	(0.04)	(0.06)	(0.02)	(0.03)	(0.02)	(0.05)
Year of event	0.07***	0.05***	0.06***	0.01	0.09***	0.06***	0.08**	0.01	0.09***	0.03	0.05**	0.02
	(0.02)	(0.01)	(0.02)	(0.04)	(0.03)	(0.01)	(0.03)	(0.05)	(0.02)	(0.03)	(0.02)	(0.05)
1 year after event	0.12***	0.06***	0.08***	−0.01	0.15***	0.07***	0.13***	0.01	0.12***	0.07	0.09***	−0.06
	(0.02)	(0.01)	(0.02)	(0.04)	(0.05)	(0.02)	(0.05)	(0.08)	(0.03)	(0.05)	(0.04)	(0.07)
2 years after event	0.11***	0.07***	0.08***	−0.01	0.13**	0.08***	0.16**	0.01	0.12***	0.09	0.12**	−0.08
	(0.02)	(0.01)	(0.02)	(0.04)	(0.06)	(0.03)	(0.07)	(0.12)	(0.04)	(0.06)	(0.05)	(0.09)
3 years after event	0.09***	0.06***	0.08***	−0.01	0.11	0.08**	0.19**	0.01	0.14***	0.09	0.12*	−0.12
	(0.02)	(0.01)	(0.02)	(0.05)	(0.08)	(0.04)	(0.09)	(0.15)	(0.05)	(0.08)	(0.06)	(0.11)
4 years after event	0.12***	0.06***	0.05**	0.05	0.14	0.08*	0.18*	0.03	0.14**	0.07	0.14*	−0.09
	(0.03)	(0.01)	(0.03)	(0.05)	(0.09)	(0.04)	(0.11)	(0.19)	(0.06)	(0.10)	(0.08)	(0.13)

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TABLE VI
CONTINUED

	Sector of the domestic first-time supplier to an MNC								Sector of the first MNC buyer			
	Full sample				Restricted sample				Restricted sample			
	MFG (1)	RET (2)	SER (3)	AGR (4)	MFG (5)	RET (6)	SER (7)	AGR (8)	MFG (9)	RET (10)	SER (11)	AGR (12)
Mean dep. var. (level)	1.12	1.30	0.80	1.05	2.15	2.10	1.52	1.96	1.76	1.75	1.68	3.66
Std. dev. dep. var. (level)	4.27	2.84	3.21	2.25	7.56	4.42	6.08	4.10	3.67	3.95	4.39	9.89
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-2Dsect-prov FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Never suppliers	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Adjusted R^2	0.96	0.97	0.92	0.91	0.97	0.97	0.94	0.95	0.96	0.96	0.96	0.98
No. observations	9,806	33,550	17,998	4,929	2,792	7,836	3,822	1,039	5,904	2,920	4,489	837
No. fixed effects	2,076	5,374	4,498	894	910	1,306	1,340	246	1,797	957	1,407	314
No. firms	1,424	5,164	3,389	788	396	1,099	722	161	923	451	716	120

Notes. The table presents the heterogeneity of TFP gains by the sector of either the first-time supplier or the sector of the first MNC buyer triggering the event. All columns report results from running the event study specification (1) adapted to the Cobb-Douglas OLS measure of TFP. Regressions differ in the sample over which the regression is run. Columns (1)–(8) separate firms based on the sector of the domestic firm. 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. Note that this latter separation can only be done in the restricted sample containing only first-time suppliers, as never suppliers do not have a first MNC buyer. 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. All regressions include firm and two-digit sector × province × calendar year fixed effects. Robust standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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TABLE VII

TFP GAINS VARY BY THE IMPORTANCE OF THE FIRST TRANSACTION

	Median I-O share		I-O share larger than			Median first trans.	
	Below (1)	Above (2)	1% (3)	5% (4)	10% (5)	Below (6)	Above (7)
4 years before event	0.01	−0.03	−0.03	−0.14	−0.21	0.02	−0.05
	(0.04)	(0.04)	(0.05)	(0.10)	(0.14)	(0.03)	(0.05)
3 years before event	0.02	−0.03	−0.04	−0.10	−0.12	0.01	−0.05
	(0.03)	(0.03)	(0.03)	(0.06)	(0.08)	(0.02)	(0.04)
2 years before event	0.02	0.01	0.01	−0.07*	−0.04	0.02	−0.02
	(0.02)	(0.02)	(0.02)	(0.04)	(0.05)	(0.01)	(0.03)
Year of event	0.06***	0.06***	0.07***	0.08**	0.09*	0.02	0.11***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.05)	(0.01)	(0.02)
1 year after event	0.08***	0.11***	0.12***	0.20***	0.17**	0.05**	0.15***
	(0.03)	(0.03)	(0.03)	(0.06)	(0.08)	(0.02)	(0.04)
2 years after event	0.07**	0.12***	0.13***	0.23***	0.24**	0.05*	0.16***
	(0.03)	(0.04)	(0.04)	(0.08)	(0.11)	(0.03)	(0.05)
3 years after event	0.08*	0.14***	0.15***	0.28***	0.28*	0.05	0.18***
	(0.04)	(0.05)	(0.05)	(0.11)	(0.15)	(0.04)	(0.06)
4 years after event	0.07	0.15**	0.17**	0.35***	0.37**	0.05	0.18**
	(0.05)	(0.06)	(0.07)	(0.13)	(0.18)	(0.05)	(0.08)

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TABLE VII
CONTINUED

	Median I-O share		I-O share larger than			Median first trans.	
	Below (1)	Above (2)	1% (3)	5% (4)	10% (5)	Below (6)	Above (7)
Mean dep. var. (level)	1.75	2.22	2.18	2.16	2.49	1.63	2.49
Std. dev. dep. var. (level)	5.44	5.68	5.48	3.19	3.63	4.47	6.73
Adjusted R^2	0.96	0.96	0.96	0.95	0.97	0.97	0.96
No. observations	7,810	7,189	6,733	2,188	1,030	8,692	6,173
No. fixed effects	2,319	1,861	1,761	662	326	2,231	1,946
No. firms	1,196	1,112	1,037	331	149	1,243	1,046

Notes. The table presents the heterogeneity of TFP gains by the importance of the first transaction to both the supplier and the buyer. All columns report results from running the event study specification (1) adapted to the Cobb-Douglas OLS measure of TFP. All columns start from the restricted sample of first-time suppliers. Columns differ in the subsample over which the regression is run. Columns (1)–(5) show the heterogeneity of the TFP gains based on how core the sector of the first-time supplier is to the sector of their first MNC buyer. We start from the firm-to-firm transaction data and aggregate the transactions up to the buying-sector by selling-sector pair. We then compute the I-O shares that each buying sector purchases from each selling sector out of the total purchases of the buying sector. Columns (1) and (2) separate first-time suppliers into those with an I-O share below or above the median I-O share (across all first-time suppliers). The higher the I-O share, the more the first-time supplier sells an input that is more "core" to the production of its first MNC buyer. Columns (3), (4), and (5) keep only the first-time suppliers whose sector sells more than 1%, 5%, and 10% (respectively) to the sector of the first MNC buyer. Columns (6) and (7) separate domestic firms based on the amount of their transaction with the MNC buyer that triggered their first-time supplying event. If a domestic firm supplies to more than one MNC in the year of its event, we assign the amount of the largest transaction with an MNC that year. We then compute the median (across all first-time suppliers) of the amount of the first transaction with an MNC and split suppliers by whether their first transaction was below or above this median. All regressions include firm and two-digit sector × province × calendar year fixed effects. Robust standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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Fourth, Online Appendix Table C5 asks whether the TFP gains differ by the headquarters (HQ) country of the first MNC buyer. The first split of HQ countries is by region. From this split, we learn that TFP gains are mostly driven by MNC buyers that are either U.S.- or Canada-owned. The second split of HQ countries is by their GDP per capita (PPP). MNC buyers with higher GDP per capita HQ countries bring larger TFP gains. Finally, we split HQ countries by their quality of management (as measured by the World Management Survey). MNC buyers from HQ countries with better management practices yield stronger TFP gains.

In sum, not all first-time relationships with an MNC are created equal. Domestic firms in manufacturing, who supply a core input to the MNC or have a stronger first interaction with the MNC are those who gain most from their event. Moreover, it is most beneficial to start supplying to MNCs in manufacturing and services, smaller MNC affiliates, or MNCs whose HQ country has a higher GDP per capita and better management practices.

VI. Additional Survey-Based Evidence to Guide Interpretation

We focus on the lessons from our surveys that directly address why and how domestic firms improve their performance after linkages with MNCs.[33] We first inquired on the expectations of MNCs and domestic suppliers ahead of a first linkage. When evaluating a potential supplier, MNCs pay particular attention to input quality, the willingness or ability of the supplier to adapt to the MNC's needs, the price, and organizational traits such as reliability or input traceability. 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).

33. Online Appendix F details the rest of our survey findings.

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When asked if they offer any explicit support to new suppliers, 69% of MNCs claimed to provide such support—mainly in the form of sharing of blueprints or details about the expected product or services, visits of the supplier to the MNC to learn about the use of the input, and visits of the MNC to the supplier to carry out audits and advise on upgrades. Moreover, 44% of domestic suppliers acknowledged receiving support consistent with what MNCs described. According to one domestic supplier, working with MNC buyers feels like having access to a "global catalog of best practices." MNCs are more likely to perceive their interactions as direct help than domestic suppliers for two reasons. First, MNCs are notoriously demanding with their suppliers and expect them to adapt fast. MNCs admitted that the pressure to adapt quickly was one of the largest disadvantages or risks for new suppliers.[34] Second, domestic suppliers declared that they alone bear most of the adaptation efforts.

Of the 69% of MNCs claiming to provide explicit help to their new domestic suppliers, about half expect, in return, prices that either remain unchanged or fall (for an improving or constant quality). Of the 44% of domestic firms that have supposedly received explicit help from their first MNC buyer, more than two-thirds said that the MNC expected either unchanged prices (for improving quality) or lower prices (for unchanged quality or even for better quality). Hence, even when deals with MNC lead to quality upgrades, both MNCs and domestic firms concur that MNCs expect prices to stay constant, if not decrease.

We asked domestic firms about their pricing practices for the same order (i.e., the same product, quality, and quantity) made by 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. Most firms stated that they had made deals at a loss, particularly among the

34. 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. We are willing to help [suppliers], and we do help them, but cannot be a charitable benefactor forever and ever." Interviews conducted by Alfaro and Rodríguez-Clare (2004) reveal similar patterns in which suppliers had improved their technologies because of the pressures exerted on them by MNCs.

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first MNC deals. To keep the MNC buyers content, suppliers are expected to absorb most of the unforeseen cost increases.

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

A systematic pattern emerging from the surveys is that domestic firms implemented various interrelated changes upon becoming suppliers to MNCs. This experience of one domestic supplier is illustrative: "The biggest change came with the expansion of the portfolio of goods and services we offered. . . . However, this change implied many others. One must be very agile in the organization of production, have inventories for very different inputs, improve financing, etc."[35]

Finally, we were interested in how joining the supply chain of an MNC affected the supplier's business with buyers other than their first MNC buyer. Of the 44% of the domestic suppliers that claim to have experienced changes in their business with domestic buyers, for most, the change involved selling more. The higher sales to domestic firms were first attributed to a combination of selling higher- or constant-quality products at constant or falling prices. The higher visibility and better reputation in the domestic market (that follow from supplying to MNCs) also played a decisive role in their larger sales to domestic firms. The better reputation might partly, explain why we find that sales to other buyers increased more on the extensive than on the intensive margin.

35. Based on four case studies of new exporting sectors in Argentina, Artopoulos, Friel, and Hallak (2013) find that to export differentiated products successfully, domestic firms need to continuously integrate knowledge about foreign taste and business practices into their production processes. This finding on the interrelated nature of the effects of exporting to developed countries echoes our findings on the effects of supplying to MNCs.

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When asked whether it was also easier to sell to more MNC buyers after the first such buyer, 78% of domestic firms responded positively. Of these, 86% stated that it became easier to gain the trust of new MNCs. That said, earning a reputation does not automatically imply that this reputation is positive and helpful in selling to new (MNC) buyers. Domestic firms were motivated to learn and adapt quickly to the expectations of their first MNC buyers to avoid being classified as bad suppliers.[36] Other key drivers of the better prospects with other MNC buyers included expansions in product scope that accommodated specific MNC needs, enhanced productivity (e.g., due to better managerial practices), and the higher-quality products sold at prices similar or lower than before the first MNC linkage.

Together with our regression-based findings, these survey-based findings suggest that disentangling the relative importance of the various effects of supplying to MNCs on domestic firms is not straightforward. First, such an endeavor would require data on rarely measured product and firm characteristics (such as quality and reputation). Second, these effects are interrelated enough that only a controlled empirical setting would allow one to estimate their separate contributions credibly. For instance, successful expansions in product scope (typically with higher-quality products) tend to go hand in hand with higher efficiency so that firms can switch seamlessly between products requiring different inputs and processes. Moreover, the clear improvement in the ability to acquire new and "better" buyers suggests that first-time suppliers got a boost in reputation in the local market. This reputation boost is linked to the product characteristics that these domestic firms are revealed to be capable of supplying. Therefore, isolating these interrelated effects remains outside of the scope of this article.

VII. Conclusion

We use rich administrative data and an event study design to show that first-time suppliers to an MNC experience strong

36. Not being known or trusted by MNCs was among the main reasons why suppliers struggled to get a first contract with MNCs. Moreover, MNCs believed that one of the biggest risks for suppliers was to be revealed as incapable of coping with their standards and for this to be shared with other potential clients, particularly other MNCs.

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and persistent gains in firm performance. Four years after joining the supply chain of an MNC, domestic firms employ 26% more workers and have a 4% to 9% higher TFP. We then exploit the fact that we observe all firm-to-firm sales of first-time suppliers, not just those to their first MNC buyer. In addition, we find persistent increases in sales to other (better-performing) buyers, explained mainly by an improved ability to acquire new buyers. Finally, we learn from our surveys that first-time suppliers benefit from wide-ranging improvements such as those to their managerial practices and reputation.

We highlight three directions for future research. First, as discussed at the end of the previous section, one of our main takeaways is that first-time suppliers to MNCs experience a series of interdependent improvements in efficiency, product scope, quality, and reputation. Estimating the magnitudes of these effects separately and their contributions to firm performance require even richer data than the one this project builds on and a controlled empirical environment (such as one provided by a randomized control trial).

Second, our evidence strongly suggests that markup increases do not explain our estimated TFP gains. However, without direct information on product characteristics, prices, and quantities, our evidence against markup increases is not definitive. Novel data sets that contain such information would open new possibilities to study what domestic firms sell and at which price upon joining the supply chain of an MNC.

Third, our placebo exercises show that the effects on the first-time suppliers to MNCs are not just demand effects; similarly sized demand shocks from large domestic firms or domestic exporters do not generate as strong and persistent effects. However, we cannot definitively settle the extent to which our estimated effects are entirely owed to the buyer's MNC nature. This is because MNCs and large domestic firms (domestic exporters) might still differ along dimensions other than MNC status and size (exporter status) for which we control, dimensions that could be relevant for the effects (e.g., management practices). Nonetheless, the placebo exercises shed light on the unique effects of demand shocks from MNCs—at least in developing countries where non-MNC firms that are strictly comparable to MNCs are hard to find. Disentangling the precise role of the MNC status of a buyer relative to other correlated characteristics is a fruitful avenue for future work.

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SUPPLEMENTARY MATERIAL

An Online Appendix for this article can be found at the *Quarterly Journal of Economics* online.

DATA AVAILABILITY

Code replicating the tables and figures in this article can be found in Alfaro-Ureña, Manelici, and Vasquez (2022) in the Harvard Dataverse, https://doi.org/10.7910/DVN/PAGZ9Y.

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