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

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Motivation and Research Question

- Most governments use generous incentives to attract MNCs

- MNCs expected to induce productivity catch-up throughout the economy

- Supplying linkages, as most likely conduits for performance upgrades

What happens to domestic firms upon becoming suppliers to MNCs?
Old Question, New Evidence

Challenges:

1. Unobservable economy-wide linkages
2. Research design to tease out direction of causality
3. Measurement of firm performance

This project:

1. Quasi-universe of firm-to-firm trans. between firms in Costa Rica (CR)

2. Event-study design. Event = first time a dom. firm supplies MNCs in CR
   ▶ Main: economy-wide unmediated events
   ▶ Alternative: government-mediated events. “Winners vs. losers" design

3. Firm-to-firm transactions + model w/ intensive and extensive margin effects
   ▶ Account for scale and extensive margin effects
   ▶ Estimate productivity residual bundling efficiency, quality, scope effects
   ▶ Surveys
First-time suppliers grow and improve their performance

- +22 to 33% in VA, π, Y, L
- + 6 to 11% in Y/L, VA/L, π/L, OLS CD/TL, prod index, LP2003, DLW2012, ACF2015
- Using sales to others, model-based estimate of change in productivity residual

Channels

- Suppliers learn from MNCs through blueprints and audits
- There is no unique channel of productivity improvement; first-time suppliers undergo wide-ranging changes
1. Data

2. Descriptive Statistics

3. Research Design and Causality

4. Firm Performance

5. Conclusion and Future Work
Administrative Data


- All yearly firm-to-firm sales or purchases cumulating to more than $4,400
- 90% of all trans. and 87% of value of all trans. are suitable for analysis
- Similar stylized facts CR’s production network to those from BE and JP

Corporate Tax Data (2005-2017, Ministry of Public Finance)

- Firm-level revenues, costs, profit. Plus 4-digit sector, corporate group


- Firm-level number of workers and total wage bill

Foreign ownership data

- Share and country of foreign ownership: four surveys (BCCR and CINDE)
- Orbis data on MNCs in Costa Rica (Bureau van Dijk)
Procomer data: “Winners vs. Losers”

- Procomer implements “Productive Linkages,” matching prog. to MNCs
- Full mappings of supplying sectors, evaluating firms open to join their records
- Procomer assesses product., mkt, R&D capacity, cooperation, quality
- MNCs approach Procomer with input need
- Procomer shares w/ MNCs ranking of top candidates
- Supplier chosen for the deal=“winner,” other candidates=“losers”

Data:

- Deals mediated by Procomer b/n MNC and local firms: 2001-2016
- Evaluations and scores by Procomer: 2004-2015
- Archived emails + rules to re-create ranking
Primary Data Collection

- Firms contacted: domestic suppliers + MNCs in main economy-wide event-study sample

- Objective: shed light on unobservable features of linkages between domestic firms and their first MNC buyers

- Typical respondent: founder of the domestic firm and supply chain or operations manager of the MNC

- 151 responses:
  - 96 domestic suppliers and 55 MNCs
  - Cover 11% of suppliers, 14% of MNCs, 27% of events
1. Data

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MNCs in Costa Rica and their First-time Domestic Suppliers

MNC affiliates in Costa Rica

- 444 first-time MNC buyers from domestic firms between 2010 and 2015
- 47% from U.S., the rest from LAC or W Europe
- 40% in manufacturing, 19% retail, 8% agriculture, 8% administrative and support services, 6% hospitality

First-time domestic suppliers to these MNC affiliates

- 3,697 first-time suppliers to MNCs between 2010 and 2015
- In 2009, mean (median) employment of 19.5 workers (7.8)
- 35% in retail, 16% hospitality, 9% manufacturing, 9% professional service, 8% agriculture, 7% administrative and support services, 6% transport and storage

(Alfaro Ureña, Manelici & Vásquez)
First-time Domestic Suppliers to MNCs

(Alfaro Ureña, Manelici & Vásquez)
The First Transaction with an MNC Buyer

**Event:** First sale of a domestic firm to an MNC buyer, observed in firm-to-firm transaction data

Features of the first transaction: mean (median)

- Amount: $56,770 ($11,940)
- Percentage of sales that year: 17% (6%)
- Length: 2.77 years (2 years)

Economy-wide events vs. those mediated by the government

- More than 99% of events in the economy are unmediated
- On observable features, events are comparable
- Survey: deals not different, “Productive Linkages” is an alternative source of business (53%) and lends credibility to supplier (40%)
1. Data

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Empirical Strategy

- **Main research design:**
  - Economy-wide matches between domestic firms and MNCs
  - Event study: differential timing of event across domestic firms

- **Alternative research designs/Robustness checks:**
  - Government-mediated matches between domestic firms and MNCs: Event study + “Winners vs Losers" à la GHM [2010]
  - Remaining potential threats to identification

**Performance**

1. **Classic approaches:** From basic measures of firm performance: \(Y/L, \pi/L\) to OLS, LP[2003], ACF[2015]

2. **Theory-based measure:** isolates scale/reputation from the residual performance, based on changes in *adjusted* sales to domestic clients
Economy-wide Event Study: General Specification

- Event: 1st-time a domestic firm supplies to an MNC

\[ y_{it} = \alpha_i + x_{it}'\beta + \lambda s(i) \times p(i) \times t + \sum_{k=C}^{C} \theta_k D_{it}^k + \varepsilon_{it}, \]

- **Coefficients of interest:** \( \theta_k \). \( D_{it}^k \) are event-time dummies

- Normalize \( k = -1 \) (year before event) coefficient to 0

- Two samples: full (first-time suppliers and never-suppliers) and restricted (only first-time suppliers)

- **Both samples:** tens of thous. of \( \lambda s(i) \times p(i) \times t \) FEs

- All regressions include firm fixed effects, \( \alpha_i \)
First-time Suppliers Get a Boost in Total Sales

\[
\log(\text{Total Sales}_{it}) = \alpha_i + \lambda_{4D\_Sector} \times t \times \text{Province} + \sum_{k=C}^{\bar{C}} \theta_k D_{it}^k + \varepsilon_{it}
\]
“Winners vs. Losers” Research Design

\[ y_{idt} = \alpha_i + x'_{it}\beta + \gamma_d(i) + \lambda_{s(i)\times t} + \sum_{k=C}^{\bar{C}} \theta^L_k D_{idt}^k + \sum_{k=C}^{\bar{C}} \theta^\text{Diff}_k \mathbb{1}\{\text{Winner}\}_{id} \times D_{idt}^k + \varepsilon_{it} \]

- Still event study, as diff. timing of 1st deal w/ MNC through Procomer
- With an extra within-deal “winner” vs. “losers” difference in outcomes

(Alfaro Ureña, Manelici & Vásquez) Effects of Joining MNCs Supply Chains Red CEMLA 13 / 28
“Winners vs. Losers” Research Design

\[
y_{idt} = \alpha_i + x_{it}'\beta + \gamma_{d(i)} + \lambda_{s(i)\times t} + \sum_{k=C}^{\overline{C}} \theta^L_k D_{idt}^k + \sum_{k=C}^{\overline{C}} \theta^\text{Diff}_k 1\{\text{Winner}\}_{id} \times D_{idt}^k + \varepsilon_{it}
\]

- Still event study, as diff. timing of 1st deal w/ MNC through Procomer
- With an extra within-deal “winner” vs. “losers” difference in outcomes
- Why not main research design?
  - 29 “winners” and 81 “losers”
  - Only 1% of matches MNCs - domestic firms through Procomer

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Winners Get Boost in Sales. Losers Unharmed

\( \theta_k^L \) (dashed) vs \( \theta_k^L + \theta_k^{Diff} \) (solid)

\[ \gamma = \alpha_i + \gamma \cdot \text{Diff} \]

\[ \text{Years Since First MNC Interaction Through Procomer} \]

Difference: winners - losers

95% conf.
Remaining Threat to Causal Inference

- Timing of first deal with an MNC buyer as main driver of results

- Remaining threat to causal inference?
  - Firm-specific time-varying unobservables that affect the timing of first deal
  - AND that influence firm performance after the deal, BUT NOT before the deal

- Shock driving both first deal with MNC and subsequent performance gains
  - Admin data: No evidence of contemporaneous change in management driving results
  - Survey: 95% of suppliers denied such shock had occurred, changes observed are seen as triggered by the deal itself
1. Data

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Performance Gains: If? How much? How?

Challenges for measurement:

- We lack firm-level data on $P$, $Q$, quality for inputs and outputs
- Simultaneity (input endog.) and omitted price ($P \times Q$ vs $Q$) biases

Two paths to measurement:

1. Classic approaches used in settings with similar data constraints
2. Using sales to others (all buyers except the first MNC buyer), model-based estimate of change in productivity residual

(extra insights from surveys on channels)
Path 1: Classic Approaches to Productivity Measurement

- Firm performance: $\pi$, $\pi/L$, $Y/L$, $VA/L$ etc.

- Production function estimation using OLS: Cobb-Douglas (CD) and Translog (TL)

- Control function methods: LP[2003], ACF[2015]

- Cost-share productivity index

- Markups estimation: DLW[2012].
**OLS prod. funct. est. (CD) + Cost-share prod. index (CD)**

\[
\text{Left} : Y_{it} = \alpha_i + \beta_L L_{it} + \beta_K K_{it} + \beta_M M_{it} + \lambda_{4D \text{ Sec}} \times t \times \text{Prov} + \sum_{k=C}^{\bar{C}} \theta_k D_{it}^k + \varepsilon_{it},
\]

\[
\text{Right} : \text{Prod}_{it} = \lambda_{4D \text{ Sec}} \times t \times \text{Prov} + \sum_{k=C}^{\bar{C}} \theta_k D_{it}^k + \varepsilon_{it},
\]

\[
\text{Prod}_{it} = \log \left( \frac{Y_{it}}{L_{it}^{\beta_L^{2D}} K_{it}^{\beta_K^{2D}} M_{it}^{\beta_M^{2D}}} \right), \quad \text{where } 2D = 2D \text{ Sec of } i
\]
Path 2: First-time Suppliers See Boost in Sales to Others

\[
\log(\text{sales to others}) = \alpha_i + \lambda_{4\text{-digit sector} \times t \times \text{province}} + \sum_{k=C}^{\overline{C}} \theta_k D_{it}^k + \varepsilon_{it}
\]
Model-Based Estimate of Performance Gains

Overview

1. Increase in *adjusted* sales to domestic buyers $\iff$ increase in $\varepsilon_A$
   - Adjustment takes into consideration demand and scale effects
   - 4 years after first sale to an MNC, from firm-to-firm transaction data 45% higher sales to others, 31% more buyers, 14% higher average sale

2. A model-based measure of productivity residual changes: General returns to scale *and* Extensive Margin

   $$\Delta \% (\phi) \approx \frac{1}{\delta + \sigma - 1} \Delta \% \left( \frac{p\tilde{Q}/(pQ)^\delta}{\tilde{N}} \right)$$

   - Implementation of this measure requires the price-elasticity of demand and the scale-elasticity of the marginal cost.
First-time Suppliers See Boost in Business w/ Other Buyers

\[ \log(\text{Trans\_to\_Other\_Buyers}_{it}) \quad \log(\text{Nr\_of\_Other\_Buyers}_{it}) \]

\[ \text{Outcome}_{it} = \alpha_i + \lambda_{4D \text{ Sector}} \times t \times \text{Province} + \sum_{k=C}^{\bar{C}} \theta_k D^k_{it} + \varepsilon_{it} \]
Summary of the Productivity Residual Results - General Returns to Scale, No Extensive Margin.

(Alfaro Ureña, Manelici & Vásquez)
Accounting for the Extensive Margin Halves the Gain in Productivity

Estimates of the productivity gain (4 years after) for plausible ranges of $\delta$ and $\sigma$ ignoring (left) or accounting for the extensive margin of buyers (right)

Preferred values $\delta = -0.22$ and $\sigma = 6$
Opening the Black Box of Performance Gains

Insights from our surveys to 96 first-time suppliers and 55 MNCs

1. How do MNCs interact with their first-time suppliers? Are these interactions perceived as helpful?

2. What is behind our measured performance gains? What (other) changes did the first-time suppliers undergo?
What Explains The Productivity Gains? No Unique Answer

According to survey answers, first MNC clients brought about several (related) changes:

- 50.0% of suppliers improved their management practices
- 37.5% acquired knowledge on new technologies

Changes in the product offer

- 61.5% of suppliers expanded their product scope
- 40.6% kept existing products, but quality/prices changed
- 5.2% fully replaced their product offer

Suppliers made changes in their workforce:

- 43.7% hired more high-skilled workers
- 27.1% had to have their existing workers work harder

- 38.5% changed their sourcing strategies
Quotes from Surveys with First-time Suppliers to MNCs

The most important help came in the form of “blueprints or sharing of best practices. As the multinational had encountered the same issue in other affiliates as well, they already had the experience of how the issue had been solved by those other affiliates.

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

(Alfaro Ureña, Manelici & Vásquez)
1. Data

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Conclusion and Future Research

This project:

- Study of economy-wide relationships b/n MNCs in CR and their domestic suppliers, both unmediated and mediated by the government

- Research design to measure the effects of starting to supply MNCs

- Focus on the gains in the productivity residual, plus inquiry into channels
  
  - Ignoring the extensive margin of buyers, estimates from our model-based formula are similar to those from classic methods: +6 to 9%, 4 years later
  
  - Accounting for the extensive margin of buyers halves the estimate. Remaining residual bundles efficiency, quality and product scope
  
  - Surveys corroborate with wide-ranging effects of supplying to MNCs
Conclusion and Future Research

Future research:

- Adding employer-employee data to study distributional effects of MNCs.
- Studying extent of MNC integration and implications on aggregate effects.