FDI and Superstar Spillovers:

Evidence from Firm-to-Firm Transactions

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Introduction

- Governments often encourage inward Foreign Direct Investment (FDI) by multinationals (although may be changing with de-globalization)

  - Multinationals (MNE) firms have well-known advantages of higher productivity, pay, technologies, management,.... `Example`

  - Also see this when looking at takeovers (with lag & much variance). Example: Bloom, Sadun & Van Reenen (2012, AER) on management & IT productivity

Introduction

- Policy rationale assumes multinationals also generate "spillover" benefits to local firms

- **Case studies often positive**: Iacovone, Javorcik, Keller & Tybout (2015) on Wal-Mex; Sutton (2004) on Toyota; Bloom, Van Reenen & Melvin (2013) on Gokaldas/Nike

Introduction

- **General Econometric studies mixed**: e.g. Aitken & Harrison (1999) find negative effects (horizontal FDI); Javorcik (2004) find positive effects (from downstream FDI)

    - Use industry level data on MNE exposure. But are benefits much greater from having a direct supply relationship with MNE (as case studies suggest)?

    - Alfaro-Urena, Manelici & Vasquez (2022) use firm-to-firm sales from Costa-Rica. Positive performance effects from selling to MNEs (event study).

- **Questions**:
    - Does this result generalize to richer countries?
    - Is it being a multinational or any "superstar firm" (e.g. exporter and/or very large domestic firms)?
    - If there is a causal effect, what are the mechanisms?

Summary of this paper (1/2)

- Use firm-to-firm panel data 2002-2014 on universe of Belgian firms.

    - Diff-In-Diff Event studies find positive TFP effects for firms who start selling to MNE (~8% after 3+ years). Also increase in sales to other firms (intensive & extensive margin), inputs (intermediates, labor, capital), international trade, etc.

- We **also** find similar performance effects when firms start to sell to intensive exporters and very large firms (even if these are not multinationals)

- Alternative identification strategies imply these are causal effects

    - No effect from starting to sell to a non-"superstar" firm (e.g. smaller firms)
    - New IV strategy based on proximity and "superstar shocks"
    - Control function based on Amiti & Weinstein (2018)

Summary of this paper(2/2)

- New formal model explains these results & also implies
  - Lower price-variable cost margins, but higher profits
  - Characteristics of winning suppliers (e.g. *ex ante* more productive and larger)

- Two Mechanisms:
  - **Tech transfer**: treatment effects particularly large when a superstar firm intensive in R&D, ICT or human capital
  - **Match Making :**Number of buyers increases, but particularly so to other firms in superstar firms' network.
    * This impact strongest for young firms and suggests MNE enhances "Relationship capability" (Bernard et al, 2021)

- **Higher productivity of multinationals**: Bloom et al. (2012); Helpman et al. (2004); Chaney (2014), Antràs and Chor (2013), Eaton et al. (2011), Antràs et al. (2017), Lim (2018)

- **Multinational spillovers**: Alfaro-Urena, Manelici & Vasquez (2022), Aitken & Harrison (1999); Javorcik (2004); Alvarez & Lopez (2008), Keller & Yeaple (2009), Setzler and Tintelnot (2021), Keller (2021)

- **Impact of large firm entry**: "Million Dollar Plants" – Greenstone, Hornbeck and Moretti (2010); Bloom et al (2019)

- **Production Networks**: Acemoglu et al. (2012, 2017); Conconi et al.

Outline

Data

- National Bank of Belgium (NBB) B2B Transaction dataset (Dhyne et al, 2015) – value of sales between all buyer-seller relationships ($>€250$) in Belgium from 2002 to 2014

- Company accounts from NBB Central Balance Sheet office (all incorporated firms) – sales (inc. exports & to final consumers), labor, intermediate inputs (goods & sevices), capital (tangible & intangibles)

- VAT declarations (total intermediate inputs of small firms, inc. imported intermediates)

- NBB Foreign Direct Investment (FDI) survey

- Intrastat trade survey (intra-EU) & customs trade data (extra EU)

- TFP measurement – Baseline is Wooldridge (2009) but compare with Gandhi et al (2020), Collard-Wexler & de Loecker (2020), ACF, OP, etc.

Sample and Cleaning   Summary Statistics by Treatment

Outline

Empirical Strategy

- Define Superstar firm j in three separate ways (& look at each)
  - Multinational (>10% inward FDI or >10% outward FDI).
  - Exporter (non-wholesalers with >10% of sales exported)
  - Large Firm (top 0.1% of the sales distribution)

- Examine a firm i who starts selling to superstar firm j at time t
  - Focus on "serious relationships": firm i must sell at least 10% of its sales to superstar j:

$$y_{i,t} = \sum_{t=-5}^{5} \beta_t I_{i,t} + \delta_i + \gamma_{s,t} + \epsilon_{i,t}$$

  - $I_{i,t} = 1$ when firm i starts selling to superstar, otherwise zero (so $t = 5$ indicates 4+ years after event); δ_i = firm FE; $\gamma_{s,t}$ = 4 digit NACE (648 industries) by year FE
  - $y_{i,t}$: TFP, sales to other firms (value & numbers), inputs, survival, trade, mark-ups, etc.
  - Compare our baseline TWFE with more recent DID, e.g. Sun and Abraham (2021)

Outline

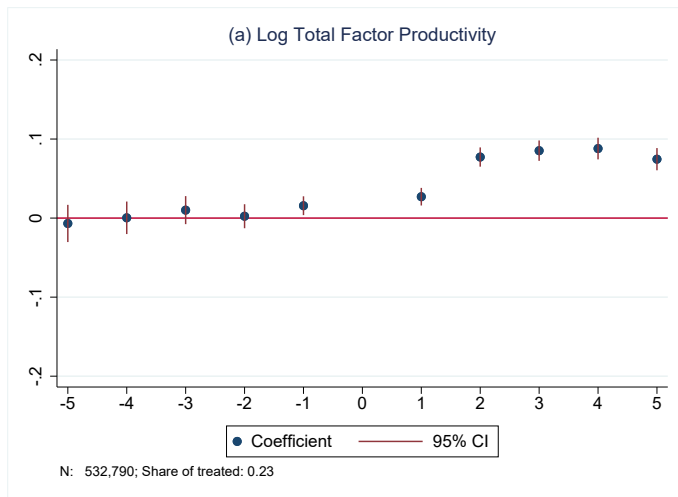# Selling to MNE firm increases TFP by ~8% after 4 years

(a) Log Total Factor Productivity

N: 532,790; Share of treated: 0.23

Notes: $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5 (i.e. 4+ years after event). Regressions include 4-digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method.

Selling to MNE firm also increases sales and inputs
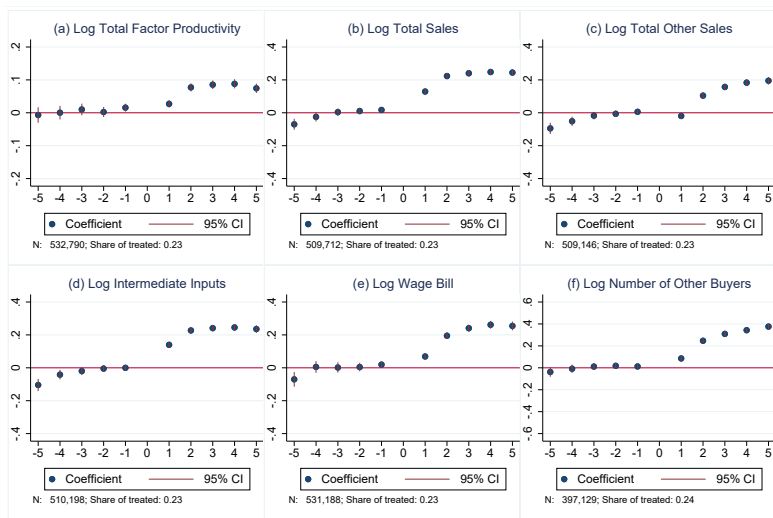
(a) Log Total Factor Productivity
N: 532,790; Share of treated: 0.23

(b) Log Total Sales
N: 509,712; Share of treated: 0.23
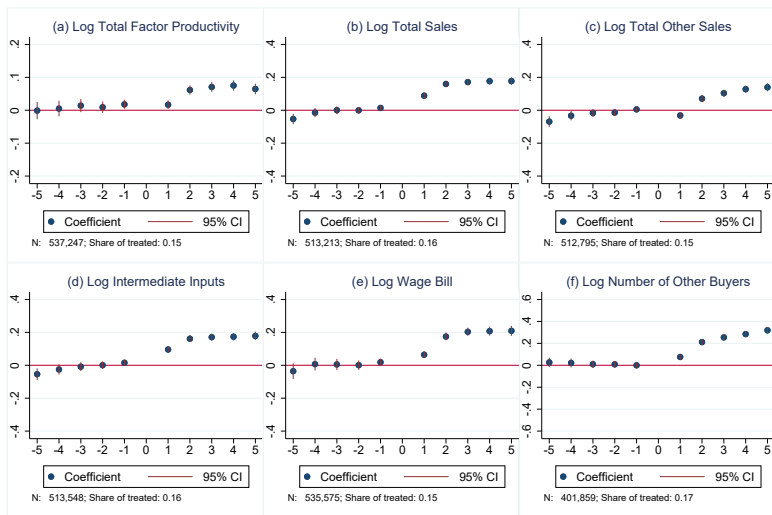
(c) Log Total Other Sales
N: 509,146; Share of treated: 0.23

(d) Log Intermediate Inputs
N: 510,198; Share of treated: 0.23

(e) Log Wage Bill
N: 531,188; Share of treated: 0.23

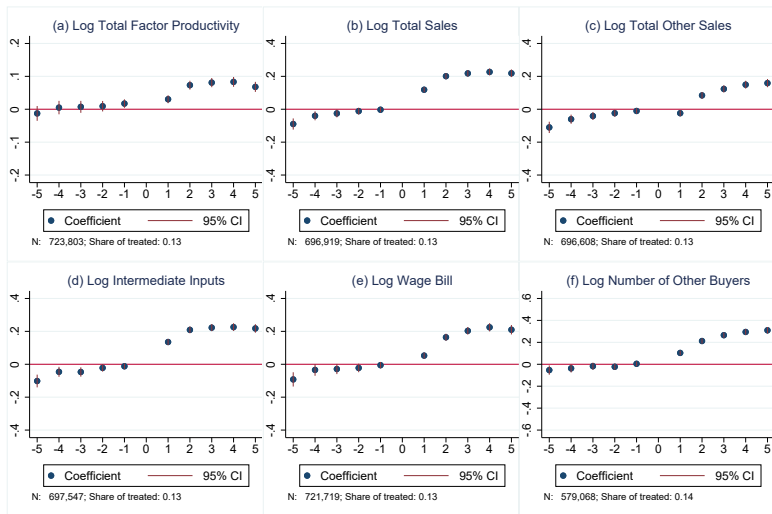(f) Log Number of Other Buyers
N: 397,129; Share of treated: 0.24

Notes: $t = 1$ first year of treatment. Regressions include 4 digit industry by year dummies and firm fixed effects. SE clustered by firm.

Table   Additional Outcomes   International Trade Outcomes

Selling to an <u>Exporter</u> also increases TFP, sales & inputs

(a) Log Total Factor Productivity — N: 537,247; Share of treated: 0.15
(b) Log Total Sales — N: 513,213; Share of treated: 0.16
(c) Log Total Other Sales — N: 512,795; Share of treated: 0.15
(d) Log Intermediate Inputs — N: 513,548; Share of treated: 0.16
(e) Log Wage Bill — N: 535,575; Share of treated: 0.15
(f) Log Number of Other Buyers — N: 401,859; Share of treated: 0.17
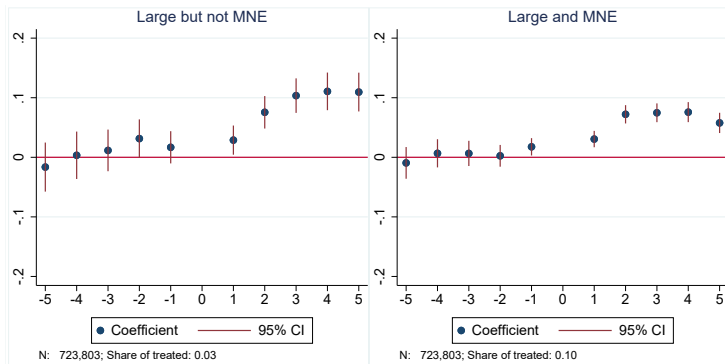
• Coefficient — 95% CI

Notes: $t = 1$ first year of treatment. Regressions include 4 digit industry by year dummies and firm fixed effects. Exporter is a (non-wholesale) firm with an export to sales ratio of 10% or more.

Table   Additional Outcomes   International Trade Outcomes

BUT also gains from selling to a <u>Very Large</u> Firm

Notes: Three quarters of large firms are also MNE and/or exporters. $t = 1$ first year of treatment. Regressions include 4 digit industry by year dummies and firm fixed effects. "Very large" is defined as being in the top 0.1% of the sales distribution (>€199m)

Table   Additional Outcomes   International Trade Outcomes

Large domestic firms give just as big a TFP pay-off as large MNEs.

Notes: $t = 1$ first year of treatment. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method.

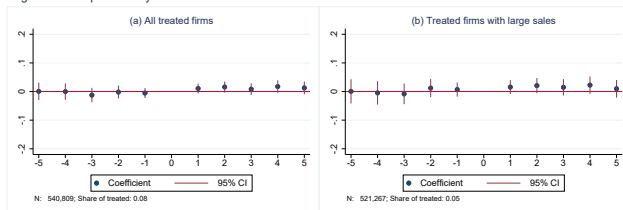Examples   Alternative large domestic definition

Outline

Placebo: No gains from starting to sell to non-Superstar/small Firms
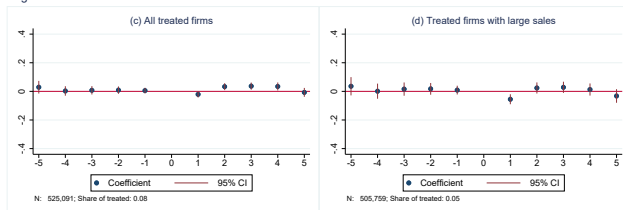
Notes: $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5. Small firm is defined as in the bottom quintile of sales distribution. Right panels restrict treatment to those that sell $>=3,000$ euros to small firms. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method.

Endogeneity of superstar relationships

- Consider the two-period case for $lnTFP$, $a_{i,t}$:

$$\triangle a_{i,t} = \beta \triangle I_{i,t} + \gamma_s + \triangle \epsilon_{i,t}$$

- If firm i TFP shocks, $\triangle \epsilon_{i,t}$, change chances of forming superstar relationship, OLS estimate $\hat{\beta}$ is biased
  - e.g. $\triangle \epsilon_{i,t} = \triangle c_{i,t} + \triangle e_{i,t}$ where $E[\triangle I_{i,t} | \triangle e_{i,t}, \gamma_s] = 0$, but $E[\triangle I_{i,t} | \triangle c_{i,t}, \gamma_s] \neq 0$

- Baseline approach differences out $\triangle c_{i,t}$ using control group and shows no pre-trends, but could still be an unobserved contemporaneous shock
  - Note that placebo on new relationships with SMEs helps alleviate this concern

- Consider 2 alternative approaches:
  - **New IV strategy:** instrument $\triangle I_{i,t}$ with $\triangle Z_{it}$
  - **Control function**: condition out using proxy for $\triangle c_{i,t}$ using Amiti and Weinstein (2018)

Endogeneity of superstar relationships?

1. **IV idea:** An expanding superstar is more to form relationship with a firms in closer proximity
   – Superstar j-year lagged change in sales ($\triangle lnQ_{j,t-l}$), weighted by "initial exposure" measure. Overlap of superstar j purchases and firm i sales in (i) industry or (ii) province:

   $$\triangle Z_{it} = \sum_{j \in J} EXPOSURE_{ij,0} \triangle lnQ_{jt-l}$$

   – Exposure is Jaffe (1986) cosine similarity in pre-sample period (initial 2 years) Exposure variable

2. **"Control function"**: Condition out proxy for $\triangle c_{i,t}$: Amiti-Weinstein methodology
   • Estimate Amiti & Weinstein (2018) on entire production network:
   $$(\triangle lnQ_{i,j,t})/lnQ_{i,j,t} = \mu_{it} + \pi_{jt} + u_{ijt}$$

Control function approach

Interpretation of treatment effects

- **Issues**

  – IV strategy identifies a LATE. Since this is from compliers who are more similar to superstars, their treatment effects are likely to be larger (*over*-estimating ATT, $\bar{\beta}$)

  – Control function absorbs any genuine treatment effects in initial event year, so likely *under*-estimates ATT, $\bar{\beta}$)

Instrumental Variables Results

Dependent variable: Δ log Total Factor Productivity	MNE		FX		FLS	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
t1: Year of event	0.073***	0.851***	0.065***	0.636**	0.071***	0.539**
	(0.007)	(0.275)	(0.007)	(0.309)	(0.007)	(0.213)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	230,629	230,629	251,181	251,181	357,864	357,864
Kleibergen-Paap F-stat.		54.440		62.763		146.624
Hansen J-stat.		0.355		0.050		6.602
Hansen J-stat. p-val.		0.551		0.823		0.010

First stage

	Dependent variable: t1: Year of event		
$Z_{it}^{industry}$	0.097***	0.068***	0.374***
	(0.013)	(0.008)	(0.038)
$Z_{it}^{province}$	0.020***	0.012***	0.071***
	(0.003)	(0.002)	(0.005)

Notes: The dependent variable is the 3 year log change in TFP, from t0 to t3. TFP is estimated using the Wooldridge methodology. The instruments are constructed as in the equation, where $\hat{\pi}_{it}$ is the one period log change in a superstar's sales, winsorized at the 1st and 99th percentiles. For $Z_{it}^{industry}$, the $EXPOSURE_{ij}$ is defined over the set of 4-digit NACE industries. For $Z_{it}^{province}$, the it is defined over the set of Belgian provinces. $Z_{it}^{industry}$ and $Z_{it}^{province}$ are winsorized at the 5th and 95th percentiles. Standard errors are clustered at the firm level.

Control Function Approach

- We recover firm i specific shock μ_{it} and construct control function $Control_{it} = \hat{\mu}_{it} Y_{it-1}$ and condition on $f(Control_{it})$ in main equation

Dep. var.: Log TFP	MNE			Exporters			Large		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1 or more years after event	0.075***	0.055***	0.040***	0.059***	0.055***	0.043***	0.069***	0.051***	0.035***
	(0.005)	(0.007)	(0.007)	(0.006)	(0.008)	(0.007)	(0.006)	(0.007)	(0.007)
Control			0.042***			0.042***			0.045***
			(0.001)			(0.001)			(0.001)
Observations	532,790	305,499	305,499	537,247	305,789	305,789	723,803	454,968	454,968
Adjusted R^2	0.645	0.669	0.673	0.644	0.668	0.672	0.648	0.670	0.674

Notes: TFP estimated using Wooldridge (2009) methodology. Regressions include 4-digit NACE industry-year and firm fixed effects. SEs clustered at firm level. All regressions include indicator for the year of the event (t1).

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Robustness

- **Greenfield Superstars** `Results`
  - Consider only "new" superstars (cf Greenstone et al, 2010).

- **Alternative TFP estimates** `Results`
  - OP, Gandhi et al (2020), LP, translog ACF and accounting for intangible capital

- **Alternative Treatment Definitions of Superstar** `Results`
  - Results are not sensitive to 10% cutoff for "serious" relationship or exact superstar definition.

- **Heterogeneous treatment effects/negative weights** `Results`
  - Sun and Abraham (2021) approach produce same results.
  - Advantage of our application: treatment is binary, staggered; large control group of "never treated"

- **Matched Controls: Nearest Neighbor** `Results`
  - matched on pre-treated average values of TFP, sales, inputs, and average wages. Each treated firm is matched to one control firm.

Outline

Superstar Firm Model

- We have found causal impact of forming a relationship with a superstar on local firm performance

    - Consider a simple model that can help rationalize the results

    - Also generates some testable auxiliary predictions

    - Upstream suppliers sell to downstream firms. Downstream market contains one superstar and many smaller firms.

        * Focus on upstream supplier that wins contract to supply superstar (and so benefits from productivity spillover)

Stages

- **Stage 1:** Upstream firms ($i = 1, ..., N$) enter & draw TFP from distribution, $\bar{F}(.)$ generates heterogeneous marginal costs, c_i

- **Stage 2:** A downstream SuperStar (SS) firm contracts with one preferred supplier. Model
  - Winning firm's marginal cost c_i is reduced to γc_i ($0 < \gamma < 1$) from this relationship
  - Model as a first price, sealed bid auction. Characterize optimal bidding strategies (Milgrom and Weber, 1982)

- **Stage 3:** Firm i's sell on spot market under CES monopolistic competition (so common markup to non-superstars)
  Model

Model Implications

1. After forming superstar contract, firm has:
   – TFP increases $\Rightarrow$ sales up to other firms on intensive & extensive margin $\Rightarrow$ inputs up

2. After forming superstar contract, firm also has:
   – Fall in overall price cost margin
     * Spot contract margin to other firms unchanged (CES), but margin on superstar contracts lower (due to auction)
     * So total margin falls
   – But **total profits** rise because higher output on spot market due to productivity spillover compensates for lower margins on SS contract
     * Compare de Loecker & Warzynski (2012) vs. Antras et al (2017) methods of estimating markup

   Markups and Profits

3. Firms who are selected for superstar relationships have higher prior TFP (as they benefit more from the cost reduction)

   Summary statistics Pre and Post

Outline

Mechanism I: Tech transfer – impact on TFP much larger for high tech/high skill superstar firms

Dependent variable:	Log TFP		
Indicator variable:	RD (1)	ICT (2)	Skill labor (3)
MNE			
1 or more years after event	0.068*** (0.006)	0.065*** (0.006)	0.062*** (0.006)
x indicator variable	0.026*** (0.009)	0.032*** (0.009)	0.050*** (0.009)
Observations	532,790	532,790	532,790
Adjusted R^2	0.645	0.645	0.645
Exporters			
1 or more years after event	0.056*** (0.006)	0.056*** (0.007)	0.060*** (0.008)
x indicator variable	0.022* (0.013)	0.010 (0.010)	-0.001 (0.010)
Observations	537,247	537,247	537,247
Adjusted R^2	0.644	0.644	0.644
Large			
1 or more years after event	0.060*** (0.006)	0.062*** (0.007)	0.059*** (0.006)
x indicator variable	0.065*** (0.012)	0.019** (0.009)	0.042*** (0.011)
Observations	723,803	723,803	723,803
Adjusted R^2	0.648	0.648	0.648

Notes: (1) top decile of R&D/Sales; (2) top quartile of ICT spend/Purchases, (3) top quartile of share of workers with college degree. All regressions include 4-digit industry-year and firm FE. All regressions include indicator for the year of the event (t1).

Mechanism II: Dating Agency – impact on buyers within the superstar's network is strong

Dependent variable:	Number of buyers in network (1)	Number of buyers outside network (2)
MNE		
1 or more years after event	1.231***	3.646***
	(0.211)	(0.371)
Observations	397,129	397,129
Adjusted R^2	0.927	0.829
Exporters		
1 or more years after event	0.325***	2.843***
	(0.046)	(0.199)
Observations	396,435	396,435
Adjusted R^2	0.896	0.854
Large		
1 or more years after event	2.213***	4.740***
	(0.593)	(0.639)
Observations	579,068	579,068
Adjusted R^2	0.807	0.877

Notes: Mean of Number of buyers in Superstar's network is 0.94 for MNE; 0.37 for Exporters; 0.74 for Large. Mean Number of buyers outside network 11.3 for MNE; 8.8 for exporters; and 15.2 for Large. Results imply that forming a relationship with an MNE means a greater likelihood of a new buyer from inside MNE's network of 1/3 compared to outside, compared to 1/500 if new buyer was random. All regressions include indicator for the year of the event (t1).

Larger Treatment effects for Young Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Total Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Buyers (6)	Log Number of Buyers In Network (7)	Log Number of Buyers Outside Network (8)
MNE								
1 or more years after event	0.065***	0.233***	0.168***	0.243***	0.225***	0.363***	0.115***	0.234***
	(0.006)	(0.009)	(0.010)	(0.010)	(0.011)	(0.011)	(0.006)	(0.009)
x Young	0.058***	0.020***	-0.011	0.019**	0.042***	-0.006	0.013**	-0.072***
	(0.006)	(0.007)	(0.009)	(0.008)	(0.010)	(0.008)	(0.006)	(0.008)
Observations	532,765	509,687	509,121	510,173	531,163	401,672	401,672	401,672
Adjusted R^2	0.645	0.851	0.835	0.869	0.804	0.836	0.881	0.847
Exporters								
1 or more years after event	0.053***	0.170***	0.121***	0.173***	0.189***	0.318***	0.062***	0.243***
	(0.006)	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)	(0.005)	(0.010)
x Young	0.043***	0.015*	-0.005	0.006	0.043***	-0.000	0.009	-0.039***
	(0.007)	(0.008)	(0.012)	(0.009)	(0.012)	(0.010)	(0.010)	(0.009)
Observations	537,206	513,172	512,754	513,507	535,534	404,507	404,507	404,507
Adjusted R^2	0.644	0.844	0.835	0.865	0.809	0.806	0.819	0.823
Large								
1 or more years after event	0.061***	0.226***	0.153***	0.236***	0.208***	0.335***	0.119***	0.227***
	(0.006)	(0.009)	(0.010)	(0.011)	(0.012)	(0.012)	(0.008)	(0.010)
x Young	0.056***	0.031***	-0.003	0.032***	0.062***	-0.003	0.022***	-0.065***
	(0.007)	(0.008)	(0.011)	(0.009)	(0.012)	(0.010)	(0.007)	(0.009)
Observations	723,763	696,879	696,568	697,507	721,679	581,693	581,693	581,693
Adjusted R^2	0.648	0.860	0.851	0.877	0.814	0.851	0.888	0.864

Notes: The Young indicator equals one if the age of the firm is less than or equal to five years. All regressions include indicator for the year of the event (t1).

Conclusions

- Forming a relationship with a superstar firm improves outcomes (TFP, outputs, inputs & survival)

    - Non-trivial magnitudes

    - Likely through both transfer of know-how (& match making)

- But does not have to be a MNE or globally engaged firm. Local superstars also bring benefits

- Does not rule out more general spillovers (these are absorbed by industry by year effects)

- Policy: barriers to firms to grow to become future superstar could be costly (misallocation). e.g. Aghion, Bergeaud & Van Reenen (2022) on regulations

- Next Steps: GE, quantification; modeling dating agency effect

DIRECT EFFECT: MULTINATIONALS SEEM TO TRANSPLANT BETTER MANAGEMENT PRACTICES WHEREVER THEY LOCATE
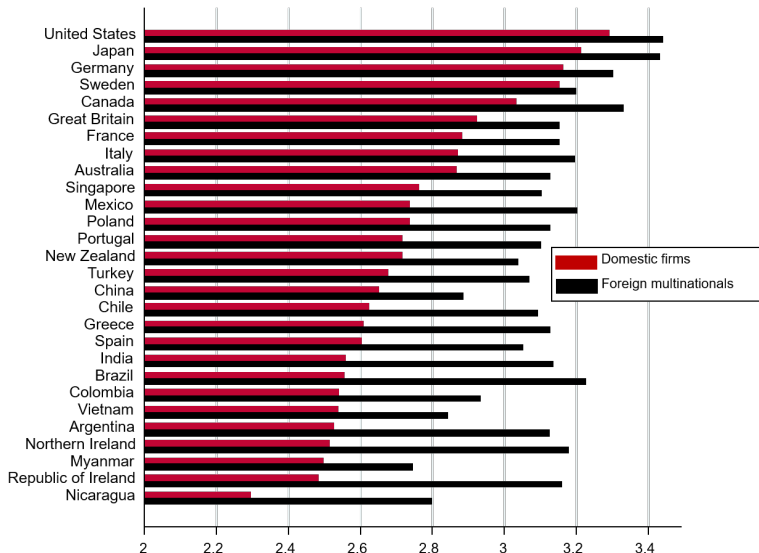
Source: Bloom, Sadun and Van Reenen (2017), World Management Survey

Management score

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Summary Statistics–Sample and Cleaning

Sample	Average annual		Share of sample dropped	
	N firms (thousands)	Employment (millions)	N firms	Employment
Full sample NBB	368.19	1.90		
Drop firms missing initial emp	364.50	1.90	1.0	
Drop observations with zero emp	160.35	1.90	56.0	
Drop firms not in B2B	139.33	1.83	13.1	3.5
Drop observations missing TFP	120.21	1.50	13.7	18.2

Summary statistics

Variable	P50	Mean	SD
$ln(TFP_{WR})$	-0.37	-0.40	0.67
$\Delta ln(TFP_{WR})$	0.03	0.02	0.44
Sales (millions euros)	0.35	1.07	17.71
Intermediate inputs (millions euros)	0.20	0.87	57.16
Wage bill (millions euros)	0.05	0.18	1.27
# buyers (hundreds)	0.05	0.16	0.60
Employment (FTE)	1.80	4.36	16.42
Total fixed assets (millions euros)	0.06	0.41	5.61
Export value (millions euros)	0.00	0.08	1.63
Export dummy	0.00	0.05	0.22
Export varieties	0.00	1.15	28.65
Import value (millions euros)	0.00	0.09	1.56
Import dummy	0.00	0.09	0.28
Import varieties	0.00	2.06	16.77
Firm survival	1.00	0.64	0.48
Intangible assets (millions euros)	0.00	0.05	2.23
Purchases (millions euros)	0.15	0.62	5.11
Operating profit (thousands euros)	13.95	40.39	113.25
Ratio of sales to inputs	1.59	2.12	1.89
Markup	1.18	1.24	0.39

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Summary Statistics by Treatment Type

Total N	491,155		
Treatment type	MNE	FX	Large
N	3,920	4,260	491
Share of firms	0.80	0.87	0.10
Share of employment	33.00	17.70	21.44
Average employment	182	90	944
MNE intensity	77.51		
Export intensity (average)		45.51	
Out of treated, share of:			
MNE		18.80	71.69
Large	8.98	3.71	
FX	20.43		32.18
MNE or FX			74.13
Large or FX	25.69		
Large or MNE		19.08	
High TFP (1 percentile)	13.72	4.20	46.03
RD top-10 percentile cutoff	0.323	1.394	0.924
ICT top-25 percentile cutoff	2.094	1.203	2.196
Skill labor top-25 percentile cutoff	66.667	26.376	68.205
Networks			
Median number of buyers	28	37	132
Mean number of buyers	441	115	1,588
Mean number in network as share of all potential buyers	0.019	0.008	0.139
Median sales (million euros)	0.108	0.042	0.384
Mean sales (million euros)	1.022	0.277	3.438

Links to MNE Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Total Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
t-5: 6 years before event	-0.007 (0.012)	-0.070*** (0.017)	-0.095*** (0.017)	-0.104*** (0.019)	-0.070*** (0.023)	-0.038* (0.023)
t-4: 5 years before event	0.000 (0.010)	-0.025* (0.014)	-0.051*** (0.014)	-0.042*** (0.015)	0.005 (0.018)	-0.009 (0.019)
t-3: 4 years before event	0.010 (0.009)	0.004 (0.011)	-0.017 (0.012)	-0.020 (0.012)	0.002 (0.016)	0.011 (0.016)
t-2: 3 years before event	0.002 (0.008)	0.011 (0.010)	-0.006 (0.010)	-0.005 (0.010)	0.005 (0.013)	0.018 (0.013)
t-1: 2 years before event	0.016*** (0.006)	0.017** (0.008)	0.006 (0.008)	-0.000 (0.008)	0.019** (0.009)	0.012 (0.010)
t1: Year of event	0.027*** (0.006)	0.129*** (0.008)	-0.019** (0.009)	0.140*** (0.009)	0.069*** (0.009)	0.085*** (0.010)
t2: 1 year after event	0.077*** (0.006)	0.223*** (0.009)	0.104*** (0.010)	0.227*** (0.010)	0.195*** (0.010)	0.247*** (0.011)
t3: 2 years after event	0.085*** (0.007)	0.240*** (0.009)	0.157*** (0.010)	0.241*** (0.010)	0.241*** (0.011)	0.309*** (0.012)
t4: 3 years after event	0.088*** (0.007)	0.248*** (0.010)	0.183*** (0.011)	0.245*** (0.011)	0.262*** (0.012)	0.343*** (0.013)
t5: 4 years after event	0.075*** (0.007)	0.245*** (0.011)	0.195*** (0.012)	0.236*** (0.012)	0.255*** (0.014)	0.376*** (0.013)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	532,790	509,712	509,146	510,198	531,188	397,129
Adjusted R^2	0.645	0.851	0.835	0.869	0.804	0.834

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Links to Exporting Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Total Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
t-5: 6 years before event	-0.001 (0.013)	-0.053*** (0.016)	-0.069*** (0.017)	-0.054*** (0.018)	-0.036 (0.024)	0.027 (0.022)
t-4: 5 years before event	0.005 (0.012)	-0.014 (0.014)	-0.033** (0.014)	-0.025 (0.016)	0.007 (0.020)	0.021 (0.021)
t-3: 4 years before event	0.014 (0.010)	0.001 (0.012)	-0.017 (0.012)	-0.008 (0.014)	0.005 (0.017)	0.010 (0.017)
t-2: 3 years before event	0.009 (0.009)	-0.000 (0.010)	-0.014 (0.010)	0.001 (0.011)	0.001 (0.015)	0.009 (0.015)
t-1: 2 years before event	0.018*** (0.007)	0.014* (0.008)	0.005 (0.008)	0.016* (0.009)	0.019* (0.011)	-0.000 (0.012)
t1: Year of event	0.017*** (0.007)	0.089*** (0.008)	-0.032*** (0.010)	0.096*** (0.009)	0.064*** (0.010)	0.076*** (0.012)
t2: 1 year after event	0.062*** (0.007)	0.160*** (0.009)	0.071*** (0.011)	0.162*** (0.010)	0.175*** (0.012)	0.212*** (0.012)
t3: 2 years after event	0.071*** (0.007)	0.171*** (0.010)	0.104*** (0.011)	0.171*** (0.011)	0.204*** (0.013)	0.255*** (0.013)
t4: 3 years after event	0.075*** (0.008)	0.177*** (0.010)	0.128*** (0.011)	0.174*** (0.012)	0.208*** (0.014)	0.284*** (0.014)
t5: 4 years after event	0.065*** (0.008)	0.178*** (0.012)	0.140*** (0.012)	0.179*** (0.013)	0.209*** (0.015)	0.319*** (0.015)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	537,247	513,213	512,795	513,548	535,575	401,859
Adjusted R^2	0.644	0.844	0.835	0.865	0.809	0.805

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Links to Large-Sales Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Total Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
t-5: 6 years before event	-0.013 (0.011)	-0.090*** (0.017)	-0.110*** (0.018)	-0.102*** (0.020)	-0.092*** (0.022)	-0.053** (0.022)
t-4: 5 years before event	0.005 (0.010)	-0.040*** (0.014)	-0.061*** (0.014)	-0.046*** (0.015)	-0.034* (0.018)	-0.037* (0.019)
t-3: 4 years before event	0.007 (0.009)	-0.025** (0.012)	-0.041*** (0.012)	-0.047*** (0.014)	-0.029* (0.016)	-0.017 (0.016)
t-2: 3 years before event	0.009 (0.008)	-0.011 (0.011)	-0.024** (0.011)	-0.022* (0.011)	-0.022* (0.013)	-0.023* (0.014)
t-1: 2 years before event	0.017*** (0.007)	-0.003 (0.008)	-0.010 (0.008)	-0.012 (0.009)	-0.005 (0.010)	0.004 (0.011)
t1: Year of event	0.030*** (0.006)	0.119*** (0.008)	-0.024*** (0.009)	0.135*** (0.009)	0.053*** (0.009)	0.104*** (0.011)
t2: 1 year after event	0.073*** (0.007)	0.201*** (0.009)	0.084*** (0.010)	0.209*** (0.010)	0.164*** (0.011)	0.212*** (0.012)
t3: 2 years after event	0.081*** (0.007)	0.218*** (0.010)	0.124*** (0.011)	0.223*** (0.011)	0.203*** (0.012)	0.265*** (0.013)
t4: 3 years after event	0.083*** (0.008)	0.227*** (0.011)	0.149*** (0.012)	0.226*** (0.012)	0.225*** (0.013)	0.295*** (0.014)
t5: 4 years after event	0.068*** (0.008)	0.219*** (0.012)	0.159*** (0.013)	0.218*** (0.013)	0.210*** (0.015)	0.310*** (0.015)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	723,803	696,919	696,608	697,547	721,719	579,068
Adjusted R^2	0.648	0.860	0.851	0.877	0.814	0.850

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Robustness Additional Outcomes (MNE)

	Firm survival	Log employment	Log tangible fixed assets	Log intangible assets	Log purchases	Profits	Log sales / to materials	Log markup
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MNE								
1 or more years after event	0.053^{***}	0.207^{***}	0.200^{***}	0.345^{***}	0.249^{***}	7.813^{***}	-0.031^{***}	-0.019^{***}
	(0.002)	(0.009)	(0.015)	(0.031)	(0.010)	(0.885)	(0.008)	(0.002)
Observations	999,051	527,874	531,492	523,019	523,019	532,790	415,681	402,843
Adjusted R^2	0.548	0.794	0.804	0.603	0.830	0.634	0.799	0.815

Notes: These specifications are the same as in the baseline results except with a different outcome variable as the dependent variable. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. The mean of the firm exit variable is 0.88. All regressions include indicator for the year of the event (t1).

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Robustness Additional Outcomes

	Firm survival	Log employment	Log tangible fixed assets	Log intangible assets	Log purchases	Log markup	Log sales / to materials	Profits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MNE								
1 or more years after event	0.053***	0.207***	0.200***	0.345***	0.249***	-0.019***	-0.031***	7.813***
	(0.002)	(0.009)	(0.015)	(0.031)	(0.010)	(0.002)	(0.008)	(0.885)
Observations	999,051	527,874	531,492	523,019	523,019	402,843	415,681	532,790
Adjusted R^2	0.548	0.794	0.804	0.603	0.830	0.815	0.799	0.634
Exporters								
1 or more years after event	0.061***	0.162***	0.175***	0.265***	0.167***	-0.010***	-0.017*	6.491***
	(0.003)	(0.011)	(0.017)	(0.036)	(0.011)	(0.002)	(0.009)	(0.936)
Observations	995,190	532,138	536,034	526,845	526,845	409,354	413,660	537,247
Adjusted R^2	0.550	0.801	0.805	0.613	0.828	0.813	0.798	0.635
Large								
1 or more years after event	0.051***	0.190***	0.197***	0.299***	0.243***	-0.019***	-0.038***	8.532***
	(0.003)	(0.010)	(0.016)	(0.033)	(0.011)	(0.002)	(0.009)	(1.205)
Observations	1,315,233	717,452	722,150	712,544	712,544	560,041	576,211	723,803
Adjusted R^2	0.549	0.806	0.803	0.610	0.841	0.813	0.800	0.634

Notes: These specifications are the same as in the baseline results except with a different outcome variable as the dependent variable. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1).

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International Trade Outcomes (MNE)

	Export value (1)	Export dummy (2)	Export varieties (3)	Import value (4)	Import dummy (5)	Import varieties (6)
MNE						
1 or more years after event	0.049***	0.012***	0.277***	0.040***	0.022***	0.306**
	(0.009)	(0.002)	(0.088)	(0.011)	(0.002)	(0.154)
Observations	532,790	532,790	532,790	532,790	532,790	532,790
Adjusted R^2	0.907	0.668	0.851	0.803	0.630	0.748

Notes: These specifications are the same as in the baseline results except with a different outcome variable as the dependent variable. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1).

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International Trade Outcomes

	Export value (1)	Export dummy (2)	Export varieties (3)	Import value (4)	Import dummy (5)	Import varieties (6)
MNE						
1 or more years after event	0.049***	0.012***	0.277***	0.040***	0.022***	0.306**
	(0.009)	(0.002)	(0.088)	(0.011)	(0.002)	(0.154)
Observations	532,790	532,790	532,790	532,790	532,790	532,790
Adjusted R^2	0.907	0.668	0.851	0.803	0.630	0.748
Exporters						
1 or more years after event	0.005	0.005***	-0.442	0.016**	0.013***	0.334***
	(0.004)	(0.002)	(0.580)	(0.006)	(0.002)	(0.122)
Observations	537,247	537,247	537,247	537,247	537,247	537,247
Adjusted R^2	0.627	0.515	0.319	0.729	0.536	0.738
Large						
1 or more years after event	0.117***	0.014***	0.464**	0.118***	0.024***	0.678***
	(0.022)	(0.002)	(0.191)	(0.023)	(0.003)	(0.171)
Observations	723,803	723,803	723,803	723,803	723,803	723,803
Adjusted R^2	0.826	0.684	0.752	0.784	0.663	0.767

Notes: These specifications are the same as in the baseline results except with a different outcome variable as the dependent variable. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1).

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Examples of Large Domestic Firms

Examples of Large Domestic Firms

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Examples of Large Domestic Firms

Examples of Large Domestic Firms

Examples of Large Domestic Firms

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Alternative Large Domestic Definition

Dependent Variable: Log Total Factor Productivity	Exclude the following firms from large domestic definition:			
	MNE (1)	& exporters (2)	& indirect MNE (3)	& govt. (4)
Large domestic, 1 or more years after event	0.092***	0.092***	0.097***	0.081***
	(0.012)	(0.012)	(0.015)	(0.025)
Percentage of treated large domestic	2.79	2.73	1.68	0.66
Observations	723,803	723,803	723,803	723,803
Adjusted R^2	0.648	0.648	0.648	0.648

Notes: TFP is estimated using the Wooldridge (2009) methodology. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1).

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Amiti-Weinstein (2018) methodology

- Write sales growth between firm i and j:

$$\triangle Y_{i,j,t} / Y_{i,j,t} = \mu_{it} + \pi_{jt} + u_{ijt}$$

- Amiti-Weinstein (2018) methodology incorporates new relationships, estimating supply and demand shocks that match change in aggregate sales

- Moment conditions:

$$D_{it} \equiv \frac{\sum_{j} Y_{ijt} - \sum_{j} Y_{ij,t-1}}{\sum_{j} Y_{ij,t-1}} = \mu_{it} + \sum_{j} \phi_{ij,t-1} \pi_{jt}, \text{with } \phi_{ij,t-1} \equiv \frac{Y_{ij,t-1}}{\sum_{j} Y_{ij,t-1}}$$

and

$$D_{jt} \equiv \frac{\sum_{i} Y_{ijt} - \sum_{i} Y_{ij,t-1}}{\sum_{i} Y_{ij,t-1}} = \pi_{jt} + \sum_{i} \theta_{ij,t-1} \mu_{it}, \text{with } \theta_{ij,t-1} \equiv \frac{Y_{ij,t-1}}{\sum_{i} Y_{ij,t-1}}$$

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"Exposure" measure

- Use well-known Jaffe (1986) measure of firm overlap:

$$EXPOSURE_{ij} = \frac{F_i F_j'}{(F_i F_i')^{1/2}(F_j F_j')^{1/2}}$$

  – $1 \times K$ vector $F_i = (F_{i1}, ..., F_{iK})$, where K is the set of 4-digit NACE industries (Belgian provinces) and F_{ik} is the share of firm i sales to industry (province) k in the first two years that firm i is in the sample

  – $1 \times K$ vector $F_j = (F_{j1}, ..., F_{jK})$, where F_{jk} is the share of firm j purchases from industry (province) k in the first two years that firm j is in the sample

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Greenfield Superstars

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Total Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
MNE						
1 or more years after event	0.068***	0.221***	0.172***	0.210***	0.238***	0.274***
	(0.016)	(0.027)	(0.030)	(0.028)	(0.033)	(0.030)
Observations	422,619	402,302	402,241	400,710	399,476	304,571
Adjusted R^2	0.644	0.847	0.845	0.875	0.794	0.845
Inward FDI						
1 or more years after event	0.062***	0.214***	0.173***	0.202***	0.247***	0.255***
	(0.017)	(0.028)	(0.030)	(0.028)	(0.035)	(0.031)
Observations	421,673	401,391	401,335	399,804	398,572	303,757
Adjusted R^2	0.644	0.847	0.846	0.875	0.794	0.845
Exporters						
1 or more years after event	0.061***	0.138***	-0.022	0.125***	0.194***	0.151***
	(0.020)	(0.027)	(0.045)	(0.030)	(0.041)	(0.032)
Observations	463,073	440,255	440,201	438,503	437,121	336,589
Adjusted R^2	0.644	0.842	0.839	0.871	0.804	0.813

Notes: TFP estimated using Wooldridge (2009) methodology. Regressions include 4-digit NACE industry-year and firm fixed effects. SEs clustered at firm level. All regressions include indicator for the year of the event (t1).

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Alternative TFP measures

	WR (1)	WR with wagebill (2)	ACF (3)	ACF with translog (4)	GNR (5)	OP (6)	CWDL (7)	OLS (8)	WR with intangibles (9)
MNE									
1 or more years after event	0.075^{***}	0.098^{***}	0.041^{***}	0.182^{***}	0.054^{***}	0.057^{***}	0.061^{***}	0.034^{***}	0.069^{***}
	(0.005)	(0.005)	(0.006)	(0.007)	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)
Observations	532,790	532,786	532,790	532,790	508,177	532,790	532,646	532,790	519,251
Adjusted R^2	0.646	0.674	0.609	0.812	0.777	0.612	0.622	0.553	0.655
Exporters									
1 or more years after event	0.059^{***}	0.073^{***}	0.031^{***}	0.147^{***}	0.039^{***}	0.043^{***}	0.045^{***}	0.024^{***}	0.054^{***}
	(0.006)	(0.006)	(0.006)	(0.008)	(0.004)	(0.006)	(0.007)	(0.006)	(0.006)
Observations	537,247	537,244	537,247	537,247	511,548	537,247	537,155	537,247	523,279
Adjusted R^2	0.645	0.679	0.606	0.819	0.718	0.607	0.618	0.542	0.656
Large									
1 or more years after event	0.069^{***}	0.089^{***}	0.038^{***}	0.165^{***}	0.057^{***}	0.053^{***}	0.053^{***}	0.031^{***}	0.059^{***}
	(0.006)	(0.006)	(0.006)	(0.008)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	723,803	723,794	723,803	723,803	695,295	723,803	723,596	723,803	707,682
Adjusted R^2	0.649	0.681	0.609	0.819	0.774	0.613	0.625	0.554	0.659

Notes: WR = Wooldrige (2009). ACF = Ackerberg, Caves, and Frazer (2015). GNR = Gandhi, Navarro, and Rivers (2020). OP = Olley and Pakes (1996). CWDL = Collard-Wexler and De Loecker (2020). All regressions include indicator for the year of the event (t1).

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Alternative Treatment Definition

	Alternative cutoffs for serious relationship					
	> 0% (1)	> 1% (2)	> 5% (3)	> 15% (4)	> 20% (5)	> 50% (6)
MNE						
2 or more years before event	-0.014***	-0.007	0.006	0.002	0.004	0.001
	(0.003)	(0.004)	(0.005)	(0.007)	(0.007)	(0.010)
1 or more years after event	0.061***	0.068***	0.079***	0.076***	0.080***	0.071***
	(0.004)	(0.004)	(0.005)	(0.007)	(0.007)	(0.010)
Observations	727,485	652,422	571,540	511,284	496,958	455,895
Adjusted R-squared	0.653	0.648	0.647	0.645	0.645	0.644
Exporters						
2 or more years before event	-0.014***	-0.004	0.012**	0.006	0.004	0.006
	(0.004)	(0.004)	(0.006)	(0.008)	(0.008)	(0.012)
1 or more years after event	0.053***	0.063***	0.070***	0.064***	0.063***	0.062***
	(0.004)	(0.004)	(0.006)	(0.008)	(0.008)	(0.012)
Observations	720,511	646,670	569,642	520,248	509,517	482,116
Adjusted R-squared	0.654	0.648	0.645	0.645	0.644	0.645
Large						
2 or more years before event	-0.014***	-0.006	0.007	0.003	0.003	0.016
	(0.003)	(0.004)	(0.005)	(0.007)	(0.007)	(0.011)
1 or more years after event	0.050***	0.061***	0.072***	0.073***	0.074***	0.078***
	(0.003)	(0.004)	(0.005)	(0.007)	(0.008)	(0.011)
Observations	940,257	841,212	759,294	705,447	692,888	660,276
Adjusted R-squared	0.660	0.652	0.649	0.648	0.648	0.647

Notes: All regressions include indicator for the year of the event (t1).

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Alternative Superstar Definition: MNE

	Dependent variable: Log Total Factor Productivity				
	Inward FDI (1)	Outward FDI (2)	FDI > 50% (3)	Include indirect FDI (4)	By source/destination (5)
1 or more years after event	0.077*** (0.006)	0.077*** (0.005)	0.076*** (0.006)	0.076*** (0.005)	
EU, 1 or more years after event					0.072*** (0.006)
US, 1 or more years after event					0.094*** (0.011)
Other developed, 1 or more years after event					0.084*** (0.022)
Less developed, 1 or more years after event					0.052*** (0.016)
Observations	611,742	610,123	516,471	529,892	532,790
Adjusted R-squared	0.647	0.649	0.646	0.645	0.645
Share of treated	0.17	0.18	0.20	0.23	0.23

Notes: TFP is estimated using the Wooldridge (2009) methodology. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1). Back

| | Exporters | | | | | Large | |
| | | Alternative thresholds for FX | | | | | |
	Include wholesalers (1)	> 0% (2)	> 20% (3)	> 50% (4)	By destination (5)	Top 0.2 percentile sales (6)	Top 0.2 percentile TFP (7)
1 or more years after event	0.057*** (0.005)	0.071*** (0.006)	0.060*** (0.007)	0.060*** (0.009)		0.075*** (0.005)	0.053*** (0.007)
EU, 1 or more years after event					0.053*** (0.009)		
US, 1 or more years after event					0.070*** (0.010)		
Other developed, 1 or more years after event					0.134*** (0.029)		
Less developed, 1 or more years after event					0.063*** (0.010)		
Observations	457,986	456,730	521,806	493,513	537,247	613,084	915,927
Adjusted R-squared	0.646	0.646	0.645	0.645	0.644	0.646	0.655
Share of treated	0.24	0.23	0.13	0.08	0.15	0.18	0.07

Notes: Dependent variable is TFP estimated using the Wooldridge (2009) methodology. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1). Back

Alternative Samples

	Dependent variable: Log Total Factor Productivity							
	Drop firms with low employment			Put dropped treated in untreated	Min 1 year of pre and post treatment	Include non-B2B firms in untreated	Drop wholesalers	Balanced panel
	≤ 1	≤ 5	≤ 10					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MNE								
1 or more years after event	0.069***	0.078***	0.052***	0.080***	0.072***	0.074***	0.074***	0.043***
	(0.006)	(0.012)	(0.018)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)
Observations	249,703	54,223	19,092	1,332,512	574,921	681,663	492,407	293,605
Adjusted R-squared	0.681	0.726	0.753	0.693	0.648	0.661	0.644	0.660
Exporters								
1 or more years after event	0.059***	0.082***	0.094***	0.064***	0.057***	0.059***	0.059***	0.043***
	(0.007)	(0.014)	(0.022)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Observations	257,896	60,136	23,239	1,069,331	562,567	684,876	537,247	299,711
Adjusted R-squared	0.681	0.726	0.740	0.691	0.646	0.660	0.644	0.662
Large								
1 or more years after event	0.066***	0.065***	0.067***	0.072***	0.066***	0.069***	0.070***	0.041***
	(0.007)	(0.011)	(0.015)	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)
Observations	362,970	93,439	36,940	1,333,869	755,001	872,950	661,286	421,691
Adjusted R-squared	0.684	0.725	0.742	0.698	0.651	0.660	0.647	0.664

Notes: TFP is estimated using the Wooldridge (2009) methodology. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1). Back

Heterogeneous Treatment Effects

- Much recent work on these Event Study Diff-in-Diffs

    - Examples: Sun and Abraham (2021); Callaway and Sant'Anna (2020); de Chaisemartin and D'Haultfoeuille (2020, 2021); Borusyak, Jaravel and Spiess (2021)

    - Concern that with heterogeneous treatment effects, our baseline approach can be misleading (e.g. negative weights)

- Advantages of our application - treatment is:

    - Binary

    - Staggered

    - Large control group of "never treated"

- Check robustness to these various estimators

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Heterogeneous Treatment Effects (Sun and Abraham, 2021): MNE Treatment
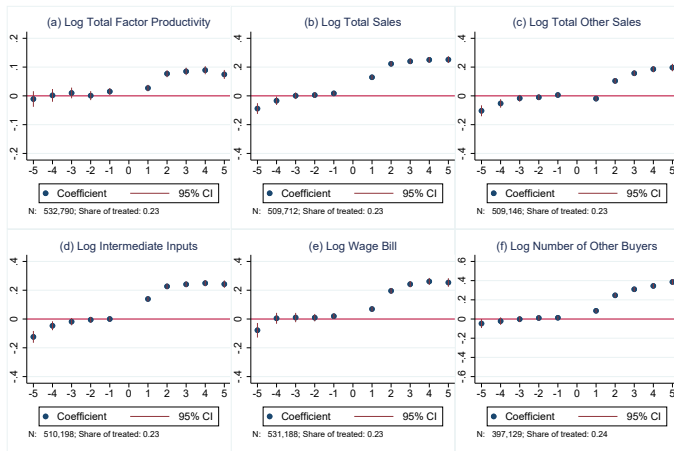
Notes: $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method. Estimation using Sun and Abraham (2021) method.

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Heterogeneous Treatment Effects (Sun and Abraham, 2021): Exporters Treatment
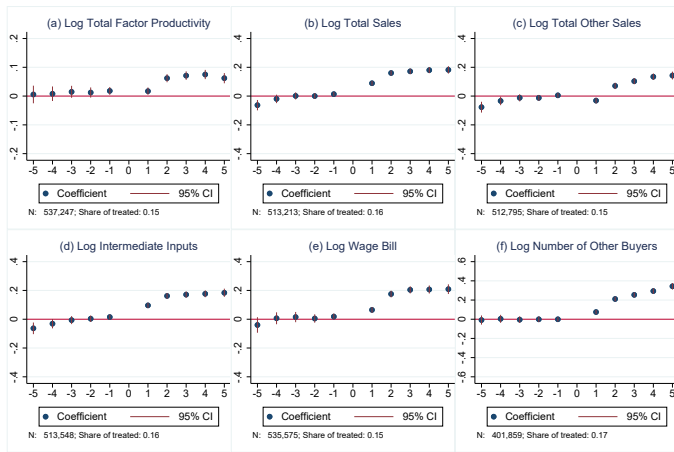
Notes: $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method. Estimation using Sun and Abraham (2021) method. Serious exporter is a (non-wholesale) firm with an export to sales ratio of 10% or more.

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Heterogeneous Treatment Effects (Sun and Abraham, 2021): Large Treatment

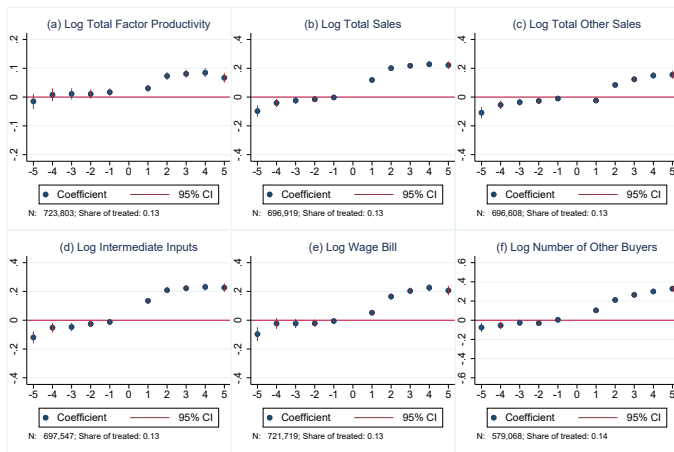**Notes**: Two-thirds of large firms are also FDI and/or serious exporters. $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method. Estimation using Sun and Abraham (2021) method. "Very large" is defined as being in the top 0.1% of the sales distribution ($> €199m$).

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Matching: Nearest Neighbor

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Total Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
MNE						
1 or more years after event	0.071***	0.231***	0.155***	0.237***	0.261***	0.286***
	(0.006)	(0.010)	(0.010)	(0.011)	(0.012)	(0.012)
Observations	147,207	143,337	143,142	143,429	146,810	108,310
Adjusted R^2	0.651	0.851	0.829	0.862	0.820	0.768
Exporters						
1 or more years after event	0.059***	0.167***	0.108***	0.175***	0.214***	0.238***
	(0.007)	(0.010)	(0.011)	(0.011)	(0.014)	(0.013)
Observations	103,373	101,585	101,476	101,640	103,103	78,921
Adjusted R^2	0.637	0.847	0.824	0.860	0.812	0.738
Large						
1 or more years after event	0.064***	0.216***	0.129***	0.229***	0.239***	0.258***
	(0.007)	(0.010)	(0.011)	(0.012)	(0.013)	(0.013)
Observations	123,456	120,605	120,482	120,653	123,178	98,334
Adjusted R^2	0.657	0.874	0.857	0.876	0.840	0.810

Notes: We match on the basis of the pre-treated average values of TFP, sales, inputs and average wages. Each treated firm is matched to exactly one control firm. All regressions include indicator for the year of the event (t1).

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Superstar Relationship (Stage 2)

- First price sealed bid auction. $\bar{q}^{SS}=$ SS contract; $I = \#$Bidders; Revenue from winning the auction is Z_i.

- Opportunity costs, $\sigma(\phi_i) = \pi_{0i}^{SS} - \pi_{1i}^{SS}$ profit difference in spot market of *not* having a SS relationship (π_{0i}^{SS}) vs. having one (π_{1i}^{SS})

- Bid solves (usual trade-off):

$$\max_{Z_i}(Z_i - \sigma_i)Pr(D_i = 1|Z_i) \tag{1}$$

- A firm with productivity ϕ_i bids s_i (Milgrom and Weber, 1982):

$$s_i = \sigma_i \delta_i; \text{ where } \delta_i = 1 + \frac{\int_{\sigma_i}^{\bar{\sigma}}[1 - F(\bar{\sigma})]^{I-1}d\bar{\sigma}}{\sigma_i[1 - F(\sigma_i)]^{I-1}} \tag{2}$$

- $\delta_i \geq 1$ is **markup over op. cost**, decreases with $\#$Bidders (I):
- This defines unique symmetric equilibrium. Winner:

$$D_i = 1\{s(\phi_i) < s(\phi_{i'})\}, \forall i' \neq i \text{ such that } i, i' \in \mathcal{H}$$

- Supplies SS and obtains lower costs, γc_i

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Output market (Stage 3)

- Price cost markup

$$\frac{p_i - c_i}{p_i} = \frac{1}{\eta} \tag{3}$$

$\eta, \eta > 1,$ = elasticity of consumer demand; p_i = firm's product price.

- Profits

$$\pi_i = \widetilde{\eta} \left(\frac{1}{c_i} \right)^{\eta - 1} \tag{4}$$

$\widetilde{\eta} = \eta^{-\eta} (\eta - 1)^{\eta - 1} > 0.$

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Markups and Profits

	Log markup (1)	Log sales / to materials (2)	Profits (3)
MNE			
1 or more years after event	-0.019***	-0.031***	7.813***
	(0.002)	(0.008)	(0.885)
Observations	402,843	415,681	532,790
Adjusted R^2	0.815	0.799	0.634
Exporters			
1 or more years after event	-0.010***	-0.017*	6.491***
	(0.002)	(0.009)	(0.936)
Observations	409,354	413,660	537,247
Adjusted R^2	0.813	0.798	0.635
Large			
1 or more years after event	-0.019***	-0.038***	8.532***
	(0.002)	(0.009)	(1.205)
Observations	560,041	576,211	723,803
Adjusted R^2	0.813	0.800	0.634

Notes: These specifications are the same as in the baseline results except with a different outcome variable as the dependent variable. All regressions include 4-digit NACE industry-year and firm fixed effects. SEs are clustered at the firm level. All regressions include indicator for the year of the event (t1).

Summary Statistics Pre- and Post-Treatment

Variable	MNE			Exporters			Large		
	Pre	Post	Control	Pre	Post	Control	Pre	Post	Control
$ln(TFP_{WR})$	0.087	0.128	-0.034	0.051	0.111	-0.016	0.110	0.146	-0.020
	(0.672)	(0.666)	(0.672)	(0.645)	(0.646)	(0.671)	(0.671)	(0.666)	(0.663)
ln(Sales)	0.172	0.453	-0.111	0.148	0.375	-0.056	0.262	0.569	-0.070
	(1.216)	(1.274)	(1.196)	(1.094)	(1.148)	(1.202)	(1.316)	(1.351)	(1.210)
ln(Intermediate inputs)	0.240	0.538	-0.134	0.215	0.437	-0.067	0.342	0.674	-0.085
	(1.346)	(1.413)	(1.361)	(1.229)	(1.288)	(1.345)	(1.460)	(1.491)	(1.381)
ln(Wage bill)	0.071	0.417	-0.092	0.019	0.341	-0.042	0.147	0.500	-0.057
	(1.460)	(1.535)	(1.364)	(1.410)	(1.491)	(1.426)	(1.551)	(1.597)	(1.413)
ln(# buyers)	-0.151	0.379	-0.085	-0.092	0.386	-0.052	-0.162	0.342	-0.032
	(0.994)	(1.294)	(1.241)	(0.937)	(1.172)	(1.141)	(1.122)	(1.348)	(1.318)
ln(Total fixed assets)	0.149	0.237	-0.061	0.156	0.359	-0.052	0.262	0.328	-0.045
	(1.788)	(1.944)	(1.903)	(1.727)	(1.887)	(1.906)	(1.843)	(1.981)	(1.875)
ln(Employment)	0.089	0.364	-0.083	0.056	0.300	-0.040	0.159	0.436	-0.051
	(1.278)	(1.339)	(1.188)	(1.238)	(1.299)	(1.240)	(1.365)	(1.398)	(1.228)
Average N	32,615	85,870	403,590	24,240	55,756	445,929	28,647	63,373	619,177

Notes: The Pre columns report the demeaned value of each variable for treated firms for all years before treatment and the Post columns for the years of treatment i.e. $t1$ to $t5$. The Control column reports the average over the sample period for untreated firms. The SEs are reported in parentheses. The average N is the average number of observations across the different variables.

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