FDI and Superstar Spillovers:

Evidence from Firm-to-Firm Transactions

MARY AMITI
Federal Reserve Bank of New York

CEDRIC DUPREZ
National Belgium Bank

JOZEF KONINGS
Nazarbayev University and KU Leuven

JOHN VAN REENEN
LSE and MIT

Introduction

- Do superstar (SS) firms generate positive spillovers?
  - Increasing dominance of large firms in developed countries (Autor et al (2020))
  - Mostly focus on potential costs (Philippon (2019))

- Despite fears, governments often encourage one particular type of SS firms - MNEs
  - Multinationals (MNE) firms have well-known advantages of higher productivity, pay, technologies, management,...

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

Introduction

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

- **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**:
  - Do SS firms generate spillovers?
  - Is it being a multinational or any "superstar firm" (e.g. exporter and/or very large domestic firms)?
    * need data on developed country to answer this question
  - What are the mechanisms driving the spillovers?

Summary of this paper

- 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 SS firms (~8% after 3+ years).
    * Also increase in sales to other firms (intensive & extensive margin), inputs (intermediates, labor, capital), international trade, etc.
    * Similar magnitudes for all 3 types of SS firms: large domestic firms, MNEs, and exporters

- 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)

- Mechanisms
  - **Tech transfer**: treatment effects particularly large when a superstar firm intensive in R&D, ICT or human capital
  - **Relationship Capability (Bernard et al, 2022)**: SS have higher customer acquisitions skills and can pass this on to suppliers
  - **Dating Agency**: Number of buyers increases, but particularly so to other firms in the superstar firm's network.

Some Existing Literature

- **Growth of Superstar firms**: Furman and Orszag (2018); Autor et al. (2020); Bajar et al. (2018); Philippon (2019); de Loecker et al. (2020); White House (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)

- **Production Networks**: Dhyne, Kikkawa & Margaman (2022); Acemoglu et al. (2012, 2017); Conconi et al. (2022); Liu (2019); Acemoglu & Azar (2020); Atalay et al. (2011); Iyoha (2021); Dhyne et al. (2021, 2023); Bernard and Moxnes (2018); Bernard et al. (2019, 2021); Macchiavello (2022); Bianchi & Giorcelli (2022)

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

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:

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

    - $l_{i,t} = 1$ when firm i starts selling to superstar, otherwise zero (so $t = 1$ indicates year of 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
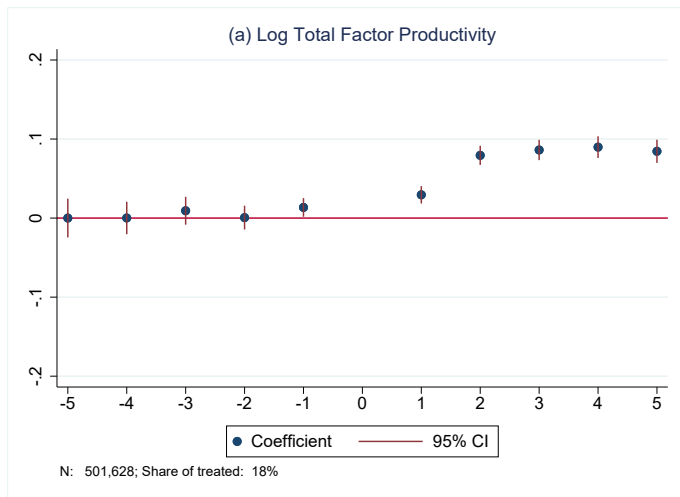
(a) Log Total Factor Productivity

N: 501,628; Share of treated: 18%

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.

Selling to MNE firm also increases sales and inputs
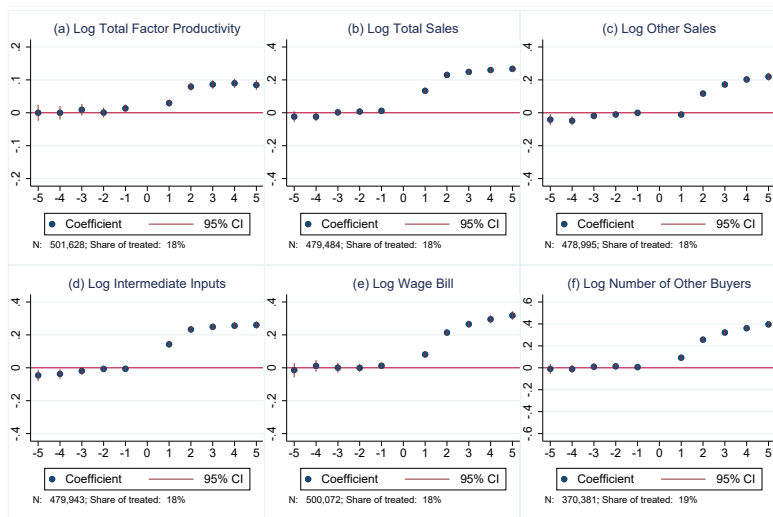
Notes: $t = 1$ first year of treatment. Regressions include 4 digit industry by year dummies and firm fixed effects. SE clustered by firm.

Table   Additional Outcomes   International Trade Outcomes

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

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

(a) Log Total Factor Productivity — N: 700,161; Share of treated: 10%
(b) Log Total Sales — N: 673,950; Share of treated: 10%
(c) Log Other Sales — N: 673,684; Share of treated: 10%
(d) Log Intermediate Inputs — N: 674,562; Share of treated: 10%
(e) Log Wage Bill — N: 698,115; Share of treated: 10%
(f) Log Number of Other Buyers — N: 558,277; Share of treated: 10%

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.

Log Total Factor Productivity

Large but not MNE — Large and MNE

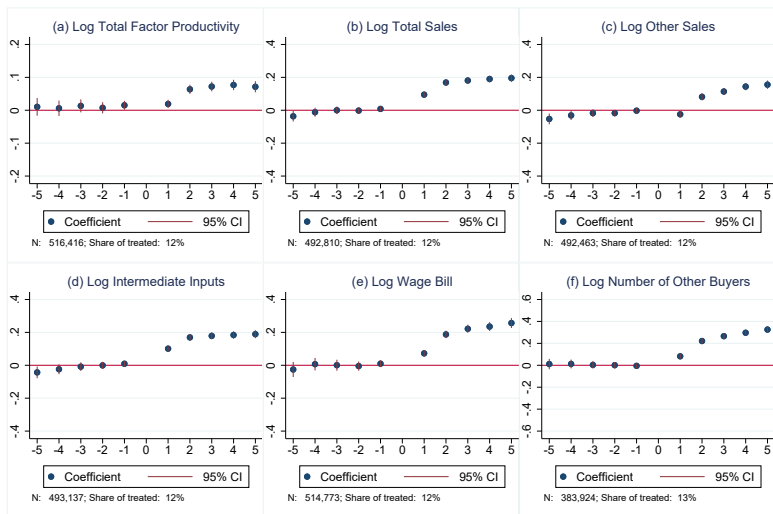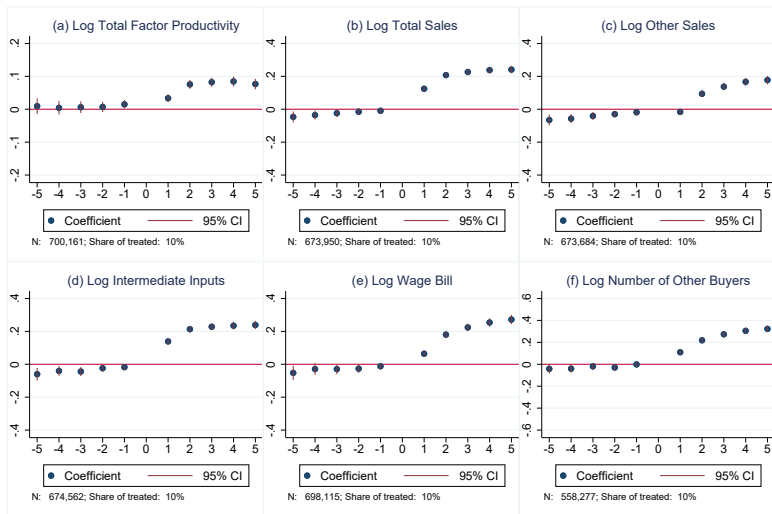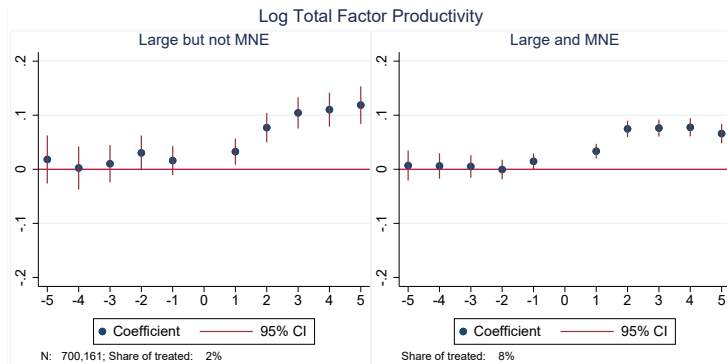N: 700,161; Share of treated: 2% — Share of treated: 8%

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

Log total factor productivity

(a) All treated firms

N: 530,550; Share of treated: 6%

(b) Treated firms with large sales

N: 515,664; Share of treated: 3%

Log other sales

(c) All treated firms

N: 515,016; Share of treated: 6%

(d) Treated firms with large sales

N: 500,269; Share of treated: 4%
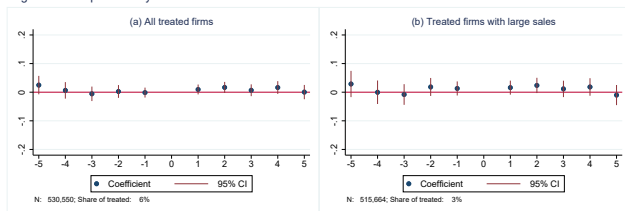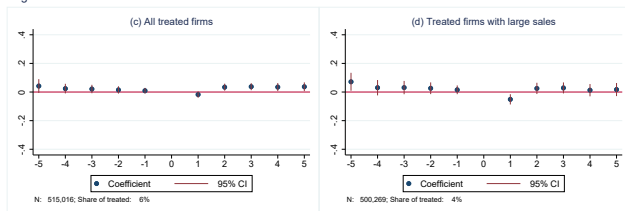
Notes: $t = 1$ first year of treatment. Small firm is defined as in the bottom quintile of sales distribution. Right panels restrict treatment to those that sell $>=3,000$ euros to small firms. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method.

Outline

Mechanism I: Tech transfer and relationship capability

Dependent variable:	Log TFP				Log Other Buyers			
	Indicator Variable				Indicator Variable			
	R&D (1)	ICT (2)	Skill labor (3)	RC (4)	R&D (5)	ICT (6)	Skill labor (7)	RC (8)
MNE								
1 or more years after event	0.068*** (0.006)	0.065*** (0.006)	0.062*** (0.006)	0.070*** (0.008)	0.287*** (0.011)	0.276*** (0.012)	0.277*** (0.011)	0.260*** (0.014)
x indicator variable	0.043*** (0.010)	0.032*** (0.009)	0.050*** (0.009)	0.008 (0.009)	0.133*** (0.023)	0.106*** (0.017)	0.132*** (0.019)	0.075*** (0.016)
Observations	532,790	532,790	532,790	532,790	397,129	397,129	397,129	397,129
Adjusted R^2	0.645	0.645	0.645	0.645	0.834	0.834	0.834	0.834
Exporters								
1 or more years after event	0.056*** (0.006)	0.056*** (0.007)	0.060*** (0.008)	0.056*** (0.008)	0.242*** (0.012)	0.247*** (0.013)	0.228*** (0.014)	0.228*** (0.014)
x indicator variable	0.022* (0.013)	0.010 (0.010)	-0.001 (0.010)	0.006 (0.010)	0.137*** (0.027)	0.045** (0.019)	0.073*** (0.018)	0.068*** (0.018)
Observations	537,247	537,247	537,247	537,247	401,859	401,859	401,859	401,859
Adjusted R^2	0.644	0.644	0.644	0.644	0.805	0.805	0.805	0.805
Large								
1 or more years after event	0.060*** (0.006)	0.062*** (0.007)	0.059*** (0.006)	0.075*** (0.008)	0.260*** (0.012)	0.261*** (0.014)	0.250*** (0.013)	0.249*** (0.015)
x indicator variable	0.065*** (0.012)	0.019** (0.009)	0.042*** (0.011)	-0.010 (0.009)	0.147*** (0.028)	0.052*** (0.019)	0.131*** (0.023)	0.055*** (0.018)
Observations	723,803	723,803	723,803	723,803	579,068	579,068	579,068	579,068
Adjusted R^2	0.648	0.648	0.648	0.648	0.850	0.850	0.850	0.850

Notes: For each SS type: (1) top decile of R&D/Sales, (2) top quartile of ICT spend/Purchases, (3) top quartile of share of workers with college degree, (4) top quartile of Relationship Capability as measured by number of buyers. All regressions include 4-digit industry-year and firm FE. All regressions include indicator for the year of the event (t1).

Model

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

Superstar Treatment:	MNE		Exporters		Large	
Number of other buyers:	in network (1)	out of network (2)	in network (3)	out of network (4)	in network (5)	out of network (6)
Mean of dependent variable	0.937	11.3	0.199	9.0	0.739	15.2
Year of event	0.496** (0.214)	-0.459* (0.236)	0.010 (0.034)	-0.345** (0.162)	1.627** (0.643)	0.296 (0.362)
1 or more years after event	1.231*** (0.211)	3.646*** (0.371)	0.352*** (0.066)	2.654*** (0.191)	2.213*** (0.593)	4.740*** (0.639)
Observations	397,129	397,129	401,859	401,859	579,068	579,068
Adjusted R^2	0.927	0.829	0.820	0.861	0.807	0.877
Expected number of buyers in network	0.248		0.085		0.649	
Odds Ratio	4.96:1		4.16:1		3.39:1	

- Number of buyers increases, but particularly so to other firms in the superstar firm's network.

Outline

Robustness

- **IV / Control Function** `IV` `Control`

- **Superstar Entry** `Results`
  - Consider only "new" superstars.

- **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.

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 exporter. Local superstars also bring benefits

- Policy Implications: (i) Why favor foreign superstars? (ii) barriers to firms to grow to become future superstar could be costly. e.g. Aghion, Bergeaud & Van Reenen (2022) on regulations

Summary Statistics–Sample and Cleaning

Sample cleaning

Sample	Average annual		Share of sample dropped	
	N firms (thousands)	Employment (millions)	N firms	Employment
Full sample NBB	368.19	1.90		
Sample after drop due to:				
firms missing initial emp	364.50	1.90	1.0	
observations with zero emp	160.35	1.90	55.4	
firms not in B2B	139.33	1.83	5.7	3.7
observations missing TFP	120.21	1.50	5.2	17.4

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
Markup (accounting estimate): ratio of sales to materials	1.59	2.12	1.89
Markup (de Loecker and Warzynski (2012))	1.18	1.24	0.39

Back

Summary Statistics by Treatment Type

Total N		491,155	
Treatment type K:	MNE	FX	Large
N	3,928	4,260	491
Share of firms	0.80	0.87	0.10
Share of employment	33.01	17.70	21.44
Average employment	182	90	944
MNE intensity	77.37		
Export intensity (average)			
Out of treatment type K, share of:			
MNE		18.80	71.69
Large	8.96	3.71	
FX	20.39		32.18
MNE or FX			74.13
Large or FX	25.64		
Large or MNE		19.08	
High TFP (1 percentile)	13.72	4.20	46.03
Technology			
RD top-10 percentile cutoff	0.328	1.394	0.924
ICT top-25 percentile cutoff	2.099	1.203	2.196
Skill labor top-25 percentile cutoff	66.667	26.376	68.205
Networks			
Median number of buyers	27	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)	0.109	0.042	0.384
Mean sales (million euros)	1.021	0.277	3.438
Relationship capital top-25 percentile cutoff	112.625	100.397	701.769

Back

Links to MNE Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
t-5: 6 years before event	0.000 (0.013)	-0.023 (0.016)	-0.041** (0.017)	-0.046*** (0.018)	-0.014 (0.022)	-0.010 (0.024)
t-4: 5 years before event	0.000 (0.010)	-0.024* (0.014)	-0.048*** (0.014)	-0.037** (0.015)	0.012 (0.018)	-0.011 (0.019)
t-3: 4 years before event	0.009 (0.009)	0.003 (0.011)	-0.019* (0.011)	-0.019 (0.012)	0.001 (0.016)	0.010 (0.016)
t-2: 3 years before event	0.001 (0.008)	0.007 (0.009)	-0.010 (0.010)	-0.007 (0.010)	-0.000 (0.013)	0.014 (0.013)
t-1: 2 years before event	0.013** (0.006)	0.012 (0.007)	-0.000 (0.008)	-0.006 (0.008)	0.012 (0.009)	0.006 (0.010)
t1: Year of event	0.029*** (0.006)	0.134*** (0.008)	-0.011 (0.009)	0.143*** (0.008)	0.081*** (0.009)	0.092*** (0.010)
t2: 1 year after event	0.079*** (0.006)	0.230*** (0.008)	0.117*** (0.010)	0.233*** (0.009)	0.214*** (0.010)	0.256*** (0.011)
t3: 2 years after event	0.086*** (0.007)	0.249*** (0.009)	0.172*** (0.010)	0.249*** (0.010)	0.265*** (0.011)	0.322*** (0.012)
t4: 3 years after event	0.090*** (0.007)	0.260*** (0.010)	0.202*** (0.011)	0.256*** (0.011)	0.295*** (0.012)	0.361*** (0.012)
t5: 4 years after event	0.085*** (0.007)	0.267*** (0.011)	0.219*** (0.012)	0.260*** (0.011)	0.318*** (0.013)	0.396*** (0.013)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	501,628	479,484	478,995	479,943	500,072	370,381
Adjusted R^2	0.645	0.849	0.838	0.869	0.802	0.835

Back

Links to Exporting Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
t-5: 6 years before event	0.010 (0.014)	-0.036** (0.016)	-0.053*** (0.017)	-0.043** (0.018)	-0.025 (0.023)	0.011 (0.024)
t-4: 5 years before event	0.006 (0.012)	-0.012 (0.014)	-0.031** (0.014)	-0.024 (0.015)	0.007 (0.019)	0.012 (0.020)
t-3: 4 years before event	0.013 (0.010)	0.000 (0.012)	-0.017 (0.012)	-0.008 (0.013)	0.001 (0.017)	0.004 (0.017)
t-2: 3 years before event	0.007 (0.009)	-0.002 (0.010)	-0.017* (0.010)	-0.000 (0.011)	-0.005 (0.014)	0.001 (0.014)
t-1: 2 years before event	0.015** (0.007)	0.008 (0.008)	-0.002 (0.008)	0.009 (0.009)	0.010 (0.010)	-0.005 (0.012)
t1: Year of event	0.019*** (0.006)	0.095*** (0.008)	-0.025** (0.010)	0.101*** (0.009)	0.073*** (0.010)	0.082*** (0.012)
t2: 1 year after event	0.064*** (0.007)	0.169*** (0.009)	0.082*** (0.011)	0.170*** (0.010)	0.188*** (0.012)	0.221*** (0.012)
t3: 2 years after event	0.072*** (0.007)	0.181*** (0.009)	0.114*** (0.011)	0.179*** (0.011)	0.222*** (0.012)	0.266*** (0.013)
t4: 3 years after event	0.077*** (0.008)	0.190*** (0.010)	0.144*** (0.011)	0.184*** (0.012)	0.235*** (0.014)	0.297*** (0.014)
t5: 4 years after event	0.071*** (0.009)	0.196*** (0.011)	0.156*** (0.013)	0.189*** (0.012)	0.257*** (0.015)	0.326*** (0.015)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	516,416	492,810	492,463	493,137	514,773	383,924
Adjusted R^2	0.645	0.843	0.837	0.865	0.808	0.805

Back

Links to Large-Sales Firms

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
t-5: 6 years before event	0.009 (0.012)	-0.047*** (0.017)	-0.065*** (0.017)	-0.060*** (0.019)	-0.052** (0.022)	-0.042* (0.022)
t-4: 5 years before event	0.004 (0.010)	-0.035** (0.014)	-0.057*** (0.014)	-0.040*** (0.015)	-0.029 (0.018)	-0.040** (0.019)
t-3: 4 years before event	0.006 (0.009)	-0.024** (0.012)	-0.041*** (0.012)	-0.044*** (0.014)	-0.030* (0.015)	-0.019 (0.016)
t-2: 3 years before event	0.007 (0.008)	-0.015 (0.010)	-0.030*** (0.010)	-0.024** (0.011)	-0.027** (0.013)	-0.029** (0.013)
t-1: 2 years before event	0.015** (0.006)	-0.009 (0.008)	-0.018** (0.008)	-0.017** (0.009)	-0.012 (0.010)	-0.001 (0.010)
t1: Year of event	0.034*** (0.006)	0.125*** (0.008)	-0.016* (0.009)	0.139*** (0.009)	0.064*** (0.009)	0.110*** (0.011)
t2: 1 year after event	0.076*** (0.007)	0.208*** (0.009)	0.094*** (0.010)	0.213*** (0.010)	0.180*** (0.011)	0.219*** (0.012)
t3: 2 years after event	0.082*** (0.007)	0.226*** (0.009)	0.137*** (0.011)	0.228*** (0.011)	0.224*** (0.012)	0.274*** (0.013)
t4: 3 years after event	0.085*** (0.008)	0.238*** (0.010)	0.167*** (0.012)	0.234*** (0.012)	0.254*** (0.013)	0.305*** (0.014)
t5: 4 years after event	0.077*** (0.008)	0.241*** (0.011)	0.177*** (0.013)	0.239*** (0.013)	0.272*** (0.014)	0.322*** (0.014)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	700,161	673,950	673,684	674,562	698,115	558,277
Adjusted R^2	0.648	0.860	0.854	0.877	0.813	0.852

Back

Robustness Additional Outcomes (MNE)

	Firm survival	Log employment	Log tangible fixed assets	Log intangible assets	Log markup	Log sales / to materials	Profits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MNE							
t1: Year of event	0.049***	0.071***	0.119***	0.305***	-0.011***	-0.036***	0.523
	(0.002)	(0.008)	(0.012)	(0.030)	(0.001)	(0.008)	(0.827)
1 or more years after event	0.053***	0.207***	0.200***	0.345***	-0.015***	-0.031***	7.813***
	(0.002)	(0.009)	(0.015)	(0.031)	(0.001)	(0.008)	(0.885)
Observations	999,051	527,874	531,492	523,019	402,843	415,681	532,790
Adjusted R^2	0.548	0.794	0.804	0.603	0.814	0.799	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. The mean of the firm survival variable is 0.886. All regressions include indicator for the year of the event (t1).

Back

Robustness Additional Outcomes

	Firm survival	Log employment	Log tangible fixed assets	Log intangible assets	Log markup	Log sales / to materials	Profits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MNE							
t1: Year of event	0.049***	0.071***	0.119***	0.305***	-0.011***	-0.036***	0.523
	(0.002)	(0.008)	(0.012)	(0.030)	(0.001)	(0.008)	(0.827)
1 or more years after event	0.053***	0.207***	0.200***	0.345***	-0.015***	-0.031***	7.813***
	(0.002)	(0.009)	(0.015)	(0.031)	(0.001)	(0.008)	(0.885)
Observations	999,051	527,874	531,492	523,019	402,843	415,681	532,790
Adjusted R^2	0.548	0.794	0.804	0.603	0.814	0.799	0.634
Exporters							
t1: Year of event	0.048***	0.055***	0.120***	0.225***	-0.006***	-0.035***	-1.291
	(0.002)	(0.010)	(0.014)	(0.036)	(0.001)	(0.009)	(0.915)
1 or more years after event	0.061***	0.162***	0.175***	0.265***	-0.010***	-0.017*	6.491***
	(0.003)	(0.011)	(0.017)	(0.036)	(0.002)	(0.009)	(0.936)
Observations	995,190	532,138	536,034	526,845	409,354	413,660	537,247
Adjusted R^2	0.550	0.801	0.805	0.613	0.815	0.798	0.635
Large							
t1: Year of event	0.046***	0.071***	0.131***	0.281***	-0.011***	-0.051***	0.514
	(0.002)	(0.009)	(0.013)	(0.032)	(0.001)	(0.009)	(1.160)
1 or more years after event	0.051***	0.190***	0.197***	0.299***	-0.013***	-0.038***	8.532***
	(0.003)	(0.010)	(0.016)	(0.033)	(0.001)	(0.009)	(1.205)
Observations	1,315,233	717,452	722,150	712,544	560,041	576,211	723,803
Adjusted R^2	0.549	0.806	0.803	0.610	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).

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).
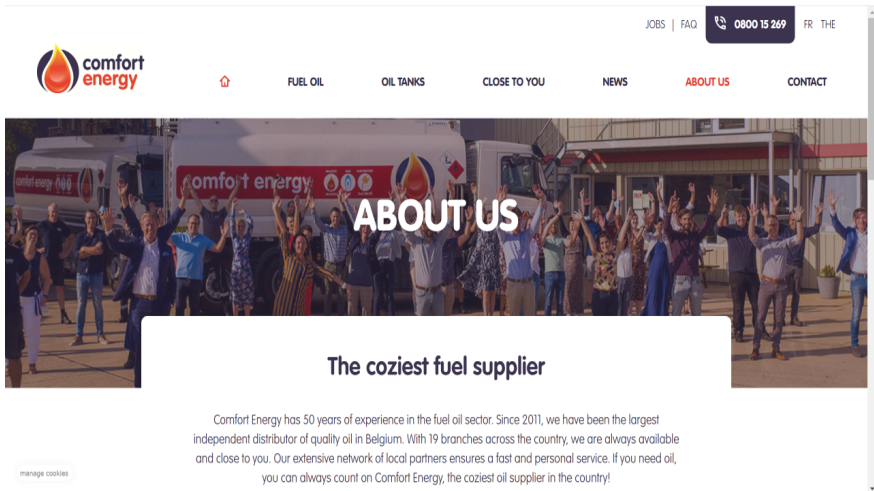
Back

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).

Back

Examples of Large Domestic Firms

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*** (0.012)	0.092*** (0.012)	0.097*** (0.015)	0.081*** (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).

Back

Endogeneity of superstar relationships

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

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

- 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 $E[\triangle l_{i,t} | \triangle e_{i,t}, \gamma_s] = 0$, but $E[\triangle l_{i,t} | \triangle c_{i,t}, \gamma_s] \neq 0$

- 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 $\triangle l_{i,t}$ 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)

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

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.

Back

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).

Back

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:

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

and

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

"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

Greenfield Superstars

	Log Total Factor Productivity (1)	Log Total Sales (2)	Log Other Sales (3)	Log Intermediate Inputs (4)	Log Wage Bill (5)	Log Number of Other Buyers (6)
MNE						
1 or more years after event	0.061***	0.235***	0.175***	0.221***	0.226***	0.276***
	(0.020)	(0.032)	(0.037)	(0.032)	(0.038)	(0.035)
Observations	419,259	399,148	399,100	397,581	396,351	301,967
Adjusted R^2	0.644	0.847	0.845	0.875	0.794	0.846
Inward FDI						
1 or more years after event	0.053**	0.225***	0.177***	0.212***	0.234***	0.244***
	(0.021)	(0.033)	(0.039)	(0.033)	(0.041)	(0.037)
Observations	418,252	398,180	398,137	396,618	395,390	301,104
Adjusted R^2	0.644	0.847	0.846	0.875	0.793	0.846
Exporters						
1 or more years after event	0.057**	0.124***	-0.061	0.086***	0.183***	0.151***
	(0.022)	(0.031)	(0.055)	(0.033)	(0.046)	(0.036)
Observations	461,409	438,610	438,565	436,867	435,492	335,192
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).

Back

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).

Back

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)	(0.008)	(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).

Back

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	17%	18%	20%	23%	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 implications-1

Alternative Superstar Definition: Exporters and Large

	Exporters					Large	
	Include wholesalers (1)	Alternative thresholds for FX			By destination (5)	Top 0.2 percentile sales (6)	Top 0.2 percentile TFP (7)
		> 0% (2)	> 20% (3)	> 50% (4)			
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	24%	23%	13%	8%	15%	18%	7%

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							
	≤ 1	≤ 5	≤ 10	Put dropped treated in untreated	Min 1 year of pre and post treatment	Include non-B2B firms in untreated	Drop wholesalers	Balanced panel
	(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

Back

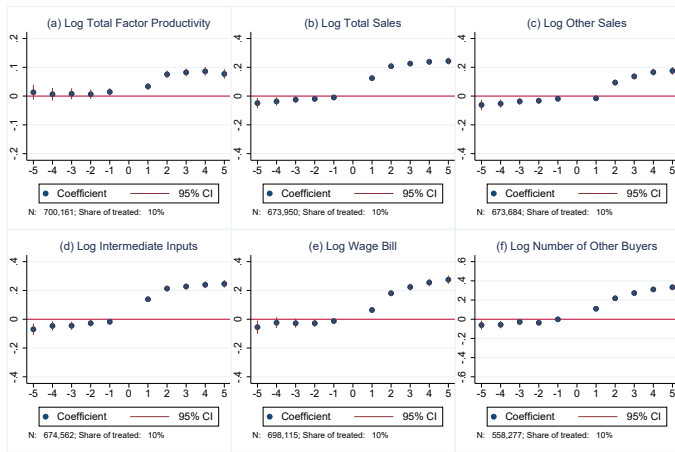# Heterogeneous Treatment Effects (Sun and Abraham, 2021): MNE Treatment
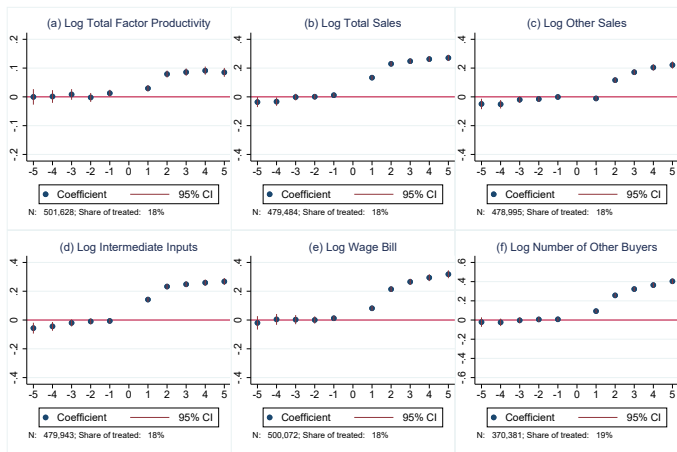
Notes: $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method. Estimation using Sun and Abraham (2021) method.

Back

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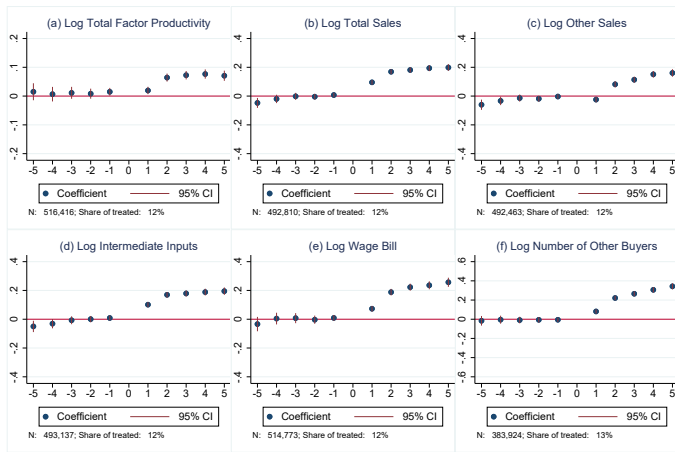
Notes: $t = 1$ first year of treatment; $t = 5$ is all years ≥ 5. Regressions include 4 digit industry by year dummies and firm fixed effects. TFP estimated by Wooldridge (2009) method. Estimation using Sun and Abraham (2021) method. Serious exporter is a (non-wholesale) firm with an export to sales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

Back

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).

Back

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).

Back

Markups and Profits

	Log markup (5)	Log sales / to materials (6)	Profits (7)
MNE			
t1: Year of event	-0.011***	-0.036***	0.523
	(0.001)	(0.008)	(0.827)
1 or more years after event	-0.015***	-0.031***	7.813***
	(0.001)	(0.008)	(0.885)
Observations	402,843	415,681	532,790
Adjusted R^2	0.814	0.799	0.634
Exporters			
t1: Year of event	-0.006***	-0.035***	-1.291
	(0.001)	(0.009)	(0.915)
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	0.815	0.798	0.635
Large			
t1: Year of event	-0.011***	-0.051***	0.514
	(0.001)	(0.009)	(1.160)
1 or more years after event	-0.013***	-0.038***	8.532***
	(0.001)	(0.009)	(1.205)

Summary Statistics Pre- and Post-Treatment

Variable	MNE			Exporters			Large		
	Pre	Post	Control	Pre	Post	Control	Pre	Post	Control
$ln(TFP_{WR})$	-0.444	-0.266	-0.477	-0.449	-0.264	-0.436	-0.382	-0.219	-0.434
	(0.673)	(0.670)	(0.678)	(0.646)	(0.650)	(0.677)	(0.673)	(0.671)	(0.669)
Sales (millions euros)	0.832	1.854	0.610	0.820	1.328	0.678	1.345	2.337	0.766
	(4.048)	(50.774)	(3.023)	(9.163)	(10.134)	(6.562)	(5.640)	(9.776)	(2.845)
Intermediate inputs (millions euros)	0.637	1.335	0.492	0.617	1.843	0.510	1.052	1.853	0.590
	(3.355)	(9.759)	(30.743)	(8.834)	(201.429)	(29.473)	(4.688)	(9.142)	(24.879)
Wage bill (millions euros)	0.148	0.266	0.103	0.135	0.243	0.145	0.238	0.392	0.134
	(1.127)	(1.182)	(0.312)	(0.853)	(1.222)	(1.367)	(1.595)	(2.235)	(0.445)
# buyers (thousands)	0.006	0.020	0.011	0.005	0.014	0.009	0.009	0.027	0.015
	(0.010)	(0.091)	(0.023)	(0.007)	(0.033)	(0.019)	(0.016)	(0.157)	(0.031)
Total fixed assets (millions euros)	0.383	0.577	0.298	0.292	0.525	0.405	0.527	0.966	0.303
	(3.533)	(6.259)	(3.026)	(2.565)	(5.427)	(4.700)	(4.838)	(15.388)	(2.797)
Employment	4.144	6.021	2.920	3.782	5.519	3.596	5.934	8.051	3.553
	(23.264)	(19.950)	(7.775)	(17.852)	(19.532)	(14.130)	(30.556)	(32.189)	(9.503)
Age of firm	10.630	11.920	12.419	10.873	12.546	12.336	11.252	12.820	12.991
	(10.089)	(9.944)	(10.444)	(9.379)	(9.813)	(10.606)	(10.210)	(10.382)	(10.751)
Average N	33,038	86,306	405,277	24,616	56,015	447,709	29,060	63,666	623,069

Notes: The Pre columns report the 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.

Back

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)

    Back

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.
    - 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)

  Back

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

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

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):

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

- $\delta_i \geq 1$ is **markup over op. cost**, decreases with $\#$Bidders (I):

- This defines unique symmetric equilibrium. Winner:

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

- Supplies SS and obtains lower costs, γc_i

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

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

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

Back