

# Adjustments of Multinational's Production Activities in Response to the US-Sino Trade War

—EVIDENCE FROM JAPANESE AFFILIATE-LEVEL DATA—

---

Presenter: Liang Licheng

Nov. 16, 2022

@ Seminar: International trade, Keio University

# Table of Contents

1. Introduction
2. Previous Studies
3. Methodology and Data
4. Analysis
5. Conclusion

# Introduction



# Introduction

- **Research question:** How do multinational enterprises (MNEs) respond to an unexpected negative trade shock? Would they adjust the production network when a part of which is negatively affected by such shock?
- Trade war between the US and China starting from July of 2018<sup>1</sup> can serve as a quasi-natural experiment for examining MNEs' reaction to shocks.
- From the perspective of potential production reallocation, this study investigates the impact on production activities of Japanese multinational companies in the ASEAN countries.

---

<sup>1</sup> Around 22 March 2018, the first announcement of tariff proposing by the Trump administration was made (Huang et al., 2019)

## What's new in this version

- Comment 1: Why use pre-war characteristics of parent firms for matching at the first step, while estimate how trade war affects affiliates' production activities via DID at the second step.
  - use affiliate-level characteristics in both matching and DID analysis.
- Comment 2: The choice of VFDI or HFDI can be endogenously determined, the original matching process might not be enough to mitigate the bias.
  - matching are separately conducted for the following cases: VFDI Chinese siblings vs. No Chinese siblings, HFDI Chinese siblings vs. No Chinese siblings
- Comment 3: The matching should be restricted to the observations in the same sector
  - matching is conducted sector by sector
- Comment 4: In relation to country-level verification, interactions between four terms can be difficult to interpret, then why not use sub-samples to run the regression?
  - use sub-samples to show the heterogeneity
- Comment 5: The simplified definition of VFDI is not appropriate
  - use information provided by the I-O table to identify the input relationship between subsidiaries and parent owners

# Background

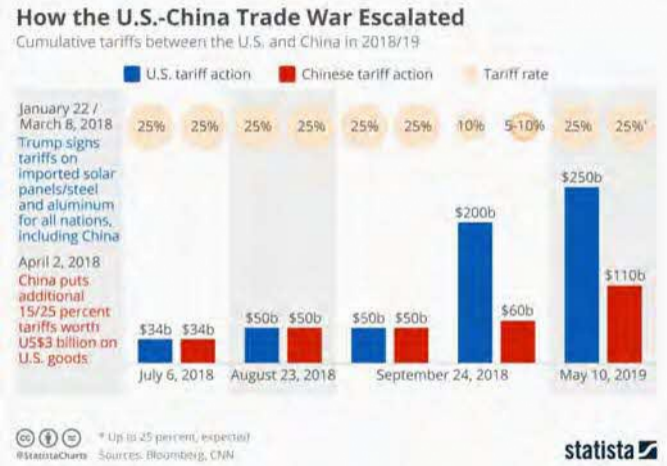
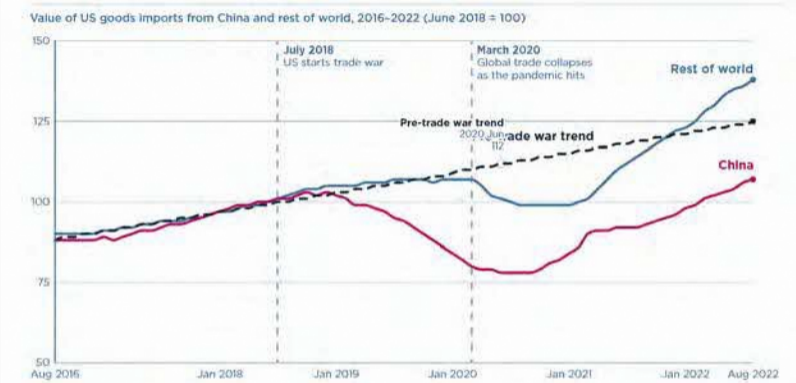


Figure 1: Timetable of the Trade war <sup>2</sup>

<sup>2</sup>Source: Statista

# Background (continued)



**Figure 2:** Value of US goods imports from China and rest of world, 2016–2022 (June 2018 = 100) <sup>3</sup>

<sup>3</sup>Created by the Chad P. Bown, Peterson Institute for International Economics, retrieved from <https://www.piie.com/blogs/realtime-economics/four-years-trade-war-are-us-and-china-decoupling>

# Background (continued)

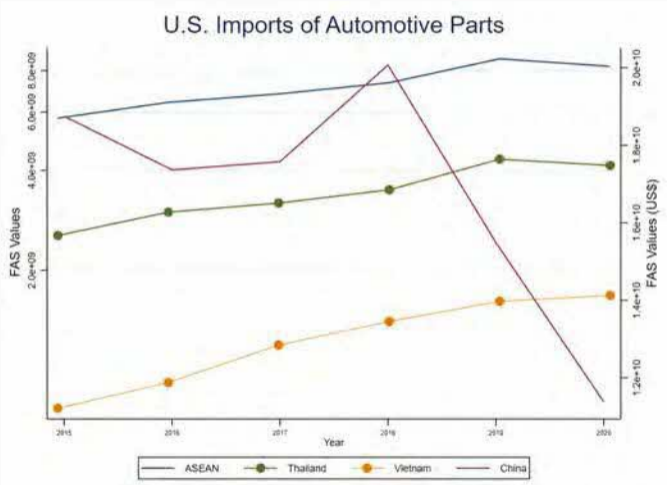


Figure 3: U.S. Imports of Automotive Parts<sup>4</sup>

<sup>4</sup>Data source: International Trade Administration, U.S. Department of Commerce

## Previous Studies



## Previous studies

- Firm performance
  - Amiti et al. (2020), Huang et al. (2019), Sun et al. (2019), Ding et al. (2022), Benguria et al. (2022)
- International trade flows
  - Benguria (2019), Sun et al. (2019), Fajgelbaum et al. (2021), Ito, T. (2022)
- Substitution of employment and production
  - Muendler and Becker (2010), Flaaen et al. (2020), Todo et al. (2015), Hayakawa et al. (2015)

## The Case of Japanese MNEs

- According to a survey by the Japan External Trade Organization (JETRO)<sup>5</sup>, a bunch of Japanese manufacturing MNEs who have invested in China tend to move a part or whole production lines to other countries, including Thailand, Vietnam and other ASEAN states.
  - Among 293 interviewed MNEs, 9.2% will move or have been moving
  - 42.3% MNEs moved 10% to 30% of production outward China
  - 30.8% MNEs prefer a proportion ranged from 30% to 100%

---

<sup>5</sup> Related information and data can be found at <https://www.jetro.go.jp/biz/areareports/special/2019/1201/b9bc9720fbf660d4.html>

## The Case of Japanese MNEs (continued)

**Table 1:** Examples of production relocation from China to third countries<sup>6</sup>

Company Name	Product	From where	To where	Overview
Toshiba Machine (now known as Shibaura Machine)	Injection Molding Machines	China	Japan, Thailand	Transferred in October 2018 due to the application of additional U.S. tariffs on Chinese products.
Mitsubishi Electric	machine tool	China	Japan	Production of machine tools for the U.S. market, subject to tariffs, was transferred from China to Japan. Conversely, products not destined for the U.S. were moved from Japan to China.
Ricoh	multi-function printer	China	Thailand	In May 2019, following the announcement by the U.S. that the fourth round of sanctions against China would extend tariff increases to almost all Chinese imported products, the company decided to transfer production of its main MFPs for the U.S. market from China to Thailand.
Iris Ohyama	Part of circulator (ventilator)	China	South Korea	In preparation for a situation in which exports from China to the U.S. would become more difficult, the company planned to diversify risk by switching some of the ventilators produced at two plants in China to South Korean production in 2020.
Kyocera	multi-function printer	China	Vietnam	In response to President Trump's announcement of his plan to impose the fourth round of tariffs against China, its executives expressed their intention to transfer the production of MFPs for the U.S. market from China to Vietnam.
Sharp	Automotive LCD display	China	Vietnam	Changed the plan to produce automotive LCDs for the U.S. market in Vietnam, which were originally planned to be made in China.

<sup>6</sup>Source: JETRO report, 2020, see <https://www.jetro.go.jp/biz/areareports/special/2019/1201/b9bc9720fbf660d4.html>

## Purpose and Contribution

- Multinationals (Japanese manufacturing MNEs in this case) get the motive to relocate part of production chains to unaffected destinations.
  - to avoid rising labor costs (Donaubauer & Dreger, 2018)
  - to avoid tariff risks
  - affiliates in the ASEAN may react actively to this trade war shock.
- Provide new and more direct empirical evidence of adjustment of production network within multinationals
  - add to the literature on indirect impact of the US-China trade shock from a third-country view and propagation effects through value chains.

# Conceptual Framework

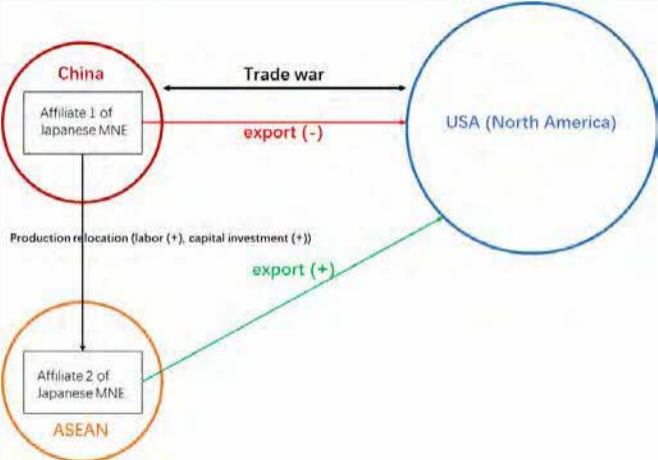


Figure 4: Concept of with-MNE production relocation

## What We Do

- Taking advantage of factual Japanese MNEs' affiliate-level data, we analyze the impact of the trade war on the production activities of the ASEAN-located affiliates.
- Utilize a DID setting with propensity score matching approaches to specify the causal effect of the trade war on adjustment within MNEs' overseas production network.
  - address potential concern of selection bias

## Result Preview

- The trade war leads to an increase on production activities (total sales, employment and local sourcing) for ASEAN-located affiliates with vertically integrated Chinese siblings<sup>7</sup> within the same MNE.
- A 29-32 pp up in the exports to North America for those affiliates with VFDI Chinese siblings
- Heterogeneous effects across host countries and industries

---

<sup>7</sup> Chinese siblings are the affiliates operating in China that belong to the same parent firm as our sample firms.

## Methodology and Data

---

## Treatment and Control Groups

- Define treatment and control groups
  - Treatment group 1: affiliates in the ASEAN with VFDI Chinese siblings
  - Treatment group 2: affiliates in the ASEAN with HFDI or other typed Chinese siblings
  - Control group: affiliates in the ASEAN<sup>8</sup> without Chinese sibling affiliates.
- Distinguish FDI types for Chinese affiliates according to differences in industry affiliation (Alfaro and Charlton, 2009)
  - HFDI sibling: a plant in the same sector code as the foreign owner parent
  - VFDI sibling: a plant that produces in sectors that are inputs to the foreign parent's product
  - use the I-O table (2015 Input-Output Tables for Japan) to determine connections between industries via an input relationship
  - set a threshold of 0.01 for the “total requirements” coefficient in the baseline estimation
  - enables us to more precisely identify the heterogeneous impact of trade shocks on MNEs' production networks.

---

<sup>8</sup>including all member states, Singapore, Malaysia, Thailand, Indonesia, the Philippines, Cambodia, Brunei, Lao PDR, Vietnam and Myanmar

## Empirical Strategy

- Average effect of Treatment on the Treated:

$$ATT = E[y_{1,i,t'} | D_i = 1, X_{i,t}] - E[y_{0,i,t'} | D_i = 1, X_{i,t}]$$

- $D_i$  takes 1 if an ASEAN affiliate  $i$  has VFDI/HFDI Chinese siblings (receiving treatment 1/ treatment 2), 0 if such affiliate has no Chinese siblings (being controlled) .
  - $X_{i,t}$  is a vector of pre-trade war pre-treatment affiliate-level characteristics.
- DID with matching:

$$PSM - DID = \frac{1}{n_i} \sum_{i \in I_1} [\Delta y_{1,i,t'} - \sum_{j \in I_0} w(ps_i, ps_j) \Delta y_{0,j,t'}]$$

- affected affiliates are unlikely random samples from the population.
- $I_1$  is the set for the treatment groups ( $I_1 = \{i : D = treated1/treated2\}$ ), and  $I_0$  is the set for the control group ( $I_0 = \{j : D = controlled\}$ ).
- $y_1$  and  $y_0$  denote the potential outcomes in the two counterfactual situations of treatment and the control.  $\Delta y_{1,i,t'} = y_{i,t'} - y_{i,t}$  and  $\Delta y_{0,j,t'} = y_{j,t'} - y_{j,t}$ , indicating that the difference in outcome  $y$  before and after the trade war for the treated and controlled affiliates, respectively.
- $w(\cdot)$  denotes the weight for the matching between samples  $i$  and  $j$ ;  $ps_i$  and  $ps_j$  are respective propensity scores for the treatment and control group.

## Empirical Strategy (continued)

- DID setting:

$$y_{a,c,t} = \beta_1 \cdot \text{ChinaSib}_a \cdot \text{Post}_t \cdot \text{VFDI}_{chnsib} + \beta_2 \cdot \text{ChinaSib}_a \cdot \text{Post}_t \cdot \text{OtherFDI}_{chnsib} \\ + u_a + \gamma_{s,t} + v_c + \epsilon_{a,s,c,t}$$

Variables	Definition
$y_{a,c,t}$	outcomes (e.g., export to North America, import to North America, local procurement, total sales, investment in capital and number of regular employees) for the affiliate $a$ in ASEAN country $c$ at year $t$ .
$\text{ChinaSib}_a$	affiliates in China that belong to the same parent company are called Chinese siblings. It takes the value of 1 if there exist such an affiliate in China and 0 otherwise.
$\text{Post}_t$	a dummy variable indicating the time period after the occurrence of trade war ( $t=2018$ in this case);.
$\text{VFDI}_{chnsib}$	indicator variable taking 1 if Chinese siblings are classified as pure vertical FDI, 0 otherwise.
$\text{OtherFDI}_{chnsib}$	correspond to 1 if the Chinese siblings fall into the category of horizontal or others types of FDI.
$u_a$	affiliate-level fixed effects
$\gamma_{s,t}$	industry-year fixed effect
$v_c$	country fixed effects
$\epsilon_{a,s,c,t}$	error term

# Data

- Annual data of all Japanese overseas affiliates, 2017-2019
  - the Basic Survey on Overseas Business Activities (BSOBA), compiled by ministry of economy, trade and industry (METI)<sup>9</sup>
  - only manufacturing firms
  - affiliate-level characteristics
  - include decomposed sales and procurement in terms of shipment destinations and procurement origins
  - annual affiliate-level data before 2017 is not available
- Annual data of Japanese owner MNEs, 2017-2019
  - the survey form for parent companies of the BSOBA
  - profile and features of owner parents
- Input-Output Tables for Japan, 2015
  - construct the total requirements coefficients matrix or direct requirement matrix at four-digit BSOBA industry level
  - the matrix provide a vector of coefficients that enable us to identify the input relationship

<sup>9</sup> Provided by the Joint Usage and Research Center Programs under Hitotsubashi University  
(<https://www.ier.hit-u.ac.jp/kyodo-riyou/English/index.html>)

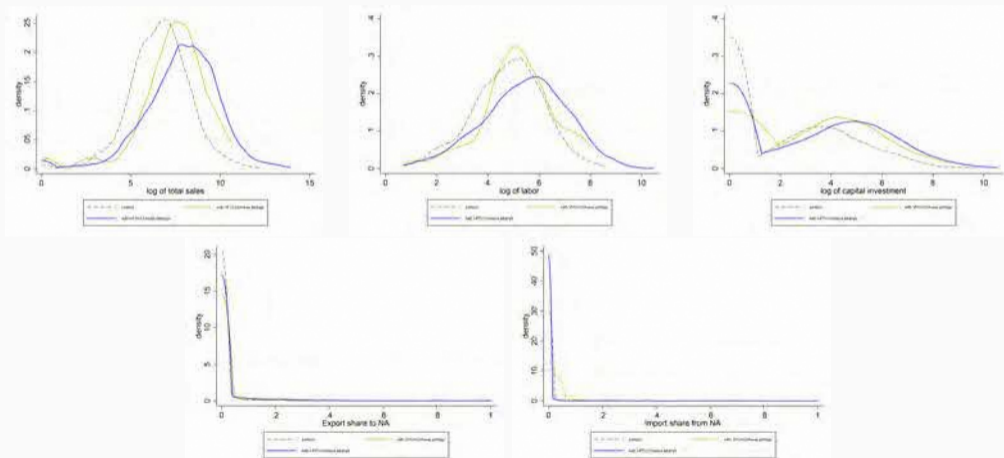
## Summary of Statistics

**Table 2:** Summary statistics

VARIABLES	No Chinese Siblings (# of affiliates: 1554)			VFDI Chinese Siblings (# of affiliates: 155)			Other Chinese Siblings (# of affiliates: 1838)		
	Obs	Mean	Sd	Obs	Mean	Sd	Obs	Mean	Sd
Export to NA/Total sales	3672	0.014	0.077	371	0.019	0.075	4891	0.018	0.089
log (Export to NA)	3672	0.424	1.465	371	0.917	2.189	4891	0.809	2.098
Import from NA/Total purchases	3672	0.005	0.052	371	0.024	0.113	4891	0.004	0.041
log (Import from NA)	3672	0.424	1.465	371	0.917	2.189	4891	0.809	2.098
Import from Asia/Total purchases	3672	0.050	0.154	371	0.073	0.189	4891	0.094	0.217
Local purchases/Total purchases	3672	0.423	0.419	371	0.307	0.375	4891	0.309	0.384
log (Local purchases)	3672	0.309	0.295	371	0.230	0.269	4891	0.230	0.275
log (Employees)	2997	4.706	1.396	289	5.204	1.473	4240	5.441	1.647
log (Investment)	3672	2.005	2.297	371	3.072	2.599	4891	3.055	2.754
log (Total sales)	2977	6.556	1.730	286	7.512	1.947	4269	7.862	2.125

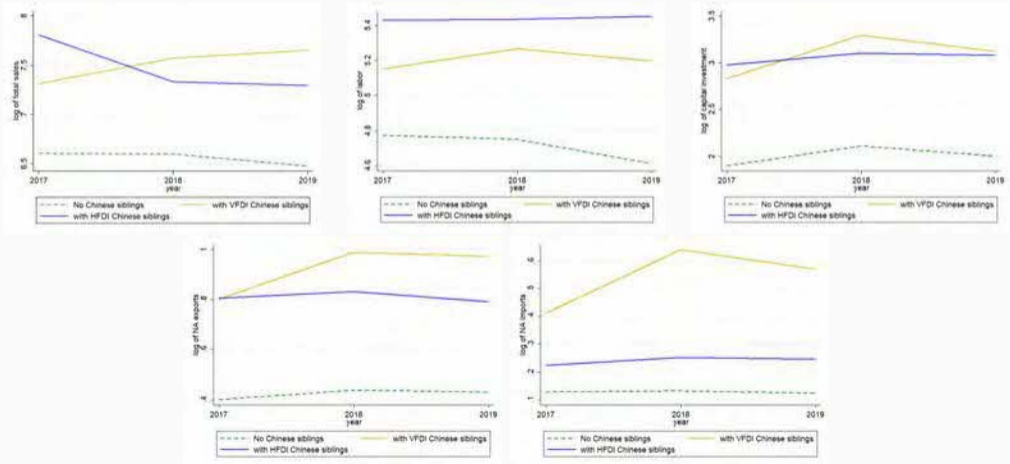
# Summary of Statistics (continued)

Figure 5: Distribution of selected outcome variables



# Visualization of Time Trends

Figure 7: Production activities before and after the trade war



# Analysis



## Procedures of Matching

- Attempt to find affiliates in the control group that has similar pre-treatment characteristics as those in the treatment groups.
  - (1) use the pre-war characteristics of ASEAN-located affiliates to estimate the determinants of having a VFDI or HFDI Chinese siblings respectively
  - (2) based on the propensity score from the logit estimation, the matching is restricted to affiliates within the same sector
  - (3) matching methods: caliper matching, kernel matching
  - (4) compute the PSM-DID estimator with matched groups that pass the balancing test

## Results: Baseline

**Table 3:** Impact of trade war on production activities of ASEAN affiliates (caliper matching)

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.000156	(0.00989)	963	0.901	-0.00147	(0.00224)	4,804	0.901
log (Export to NA)	<b>0.315**</b>	(0.154)	963	0.926	0.00810	(0.0536)	4,804	0.897
Import Share (NA)	0.00720	(0.00782)	963	0.857	0.00127	(0.00137)	4,804	0.827
log (Import NA)	0.185	(0.195)	963	0.693	0.0266	(0.0359)	4,804	0.853
Import Share (Asia)	<b>-0.0206*</b>	(0.0123)	963	0.895	<b>-0.0134**</b>	(0.00684)	4,804	0.846
Local share	<b>0.0902**</b>	(0.0428)	963	0.860	0.00236	(0.0122)	4,804	0.864
log (Local sourcing)	<b>0.0630**</b>	(0.0306)	963	0.855	0.00312	(0.00861)	4,804	0.862
log (Labor)	<b>0.0812**</b>	(0.0370)	910	0.988	0.0162	(0.0148)	4,589	0.986
log (Investment)	-0.0528	(0.298)	963	0.788	0.101	(0.0914)	4,804	0.828
log (Total sales)	<b>0.0899**</b>	(0.0430)	924	0.987	0.0269	(0.0218)	4,630	0.974

Clustered robust standard errors at the affiliate level in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## Results: Baseline

**Table 4:** Impact of trade war on production activities of ASEAN affiliates (simple DID)

	1.Post#1.ChinaSib#1.VFDI		1.Post#1.ChinaSib#1.OtherFDI		Observations	R <sup>2</sup>
	coef.	sd	coef.	sd		
Export Share (NA)	0.000745	(0.00654)	0.000165	(0.00218)	8,321	0.850
log (Export to NA)	<b>0.172*</b>	(0.0956)	0.0282	(0.0442)	8,321	0.889
Import Share (NA)	0.0111	(0.00865)	0.00102	(0.00162)	8,321	0.758
log (Import NA)	0.177	(0.119)	0.00324	(0.0279)	8,321	0.840
Import Share (Asia)	-0.00343	(0.00812)	<b>-0.0152***</b>	(0.00526)	8,321	0.837
Local share	0.0166	(0.0261)	-0.0149	(0.0110)	8,321	0.854
log (Local sourcing)	0.0117	(0.0186)	-0.0106	(0.00778)	8,321	0.855
log (Labor)	-0.00693	(0.0314)	0.0108	(0.0164)	6,892	0.985
log (Investment)	-0.224	(0.165)	-0.0948	(0.0738)	8,321	0.849
log (Total sales)	<b>0.189*</b>	(0.104)	0.0291	(0.0248)	6,910	0.970

## Results: Baseline

**Table 5:** Impact of trade war on production activities of ASEAN affiliates (kernel matching)

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	-0.000465	(0.00967)	988	0.901	-0.00139	(0.00224)	4,815	0.906
log (Export to NA)	<b>0.288*</b>	(0.151)	988	0.929	0.00954	(0.0537)	4,815	0.899
Import Share (NA)	0.00774	(0.00769)	988	0.857	0.00129	(0.00137)	4,815	0.827
log (Import NA)	0.187	(0.192)	988	0.723	0.0274	(0.0361)	4,815	0.852
Import Share (Asia)	<b>-0.0251**</b>	(0.0125)	988	0.886	<b>-0.0136**</b>	(0.00681)	4,815	0.846
Local share	<b>0.0926**</b>	(0.0421)	988	0.857	0.00265	(0.0122)	4,815	0.864
log (Local sourcing)	<b>0.0651**</b>	(0.0300)	988	0.852	0.00332	(0.00860)	4,815	0.862
log (Labor)	<b>0.0715**</b>	(0.0339)	935	0.988	0.0157	(0.0147)	4,600	0.986
log (Investment)	-0.0388	(0.289)	988	0.794	0.102	(0.0913)	4,815	0.829
log (Total sales)	<b>0.0781*</b>	(0.0416)	949	0.987	0.0268	(0.0217)	4,641	0.974

## Interpretation

- The baseline PSM-DID results show an economically and significantly significant (31.5 pp) increase in export to NA for the ASEAN-located affiliates with VFDI Chinese siblings relative to the pre-war period compared to affiliates without Chinese siblings.
- After the trade war, an increase in total sales and employment can also be seen for the same group of affiliates.
  - potential relocation of production through the intensive margin of MNEs
- No robust and significant impact on imports from NA
  - the corresponding coefficients are positive but not significant
- ASEAN-affiliates tend to reduce imports from Asia (mainly China), while those with VFDI Chinese siblings are likely to increase their local procurement share.
  - increase FDI spillovers and GVC participation

## Industry-level Heterogeneity

**Table 6:** Industries of electrical machinery, ICT device & Transportation equipment

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	-0.00518	(0.0213)	476	0.849	-0.00567	(0.00421)	1,975	0.866
log (Export to NA)	<b>0.421*</b>	(0.252)	476	0.914	0.00481	(0.0941)	1,975	0.885
Import Share (NA)	0.0166	(0.0166)	476	0.664	0.00101	(0.000823)	1,975	0.960
log (Import NA)	0.443	(0.409)	476	0.561	0.0416	(0.0510)	1,975	0.876
Import Share (Asia)	-0.00763	(0.0162)	476	0.884	-0.0146	(0.0109)	1,975	0.878
Local share	0.101	(0.0662)	476	0.848	0.0195	(0.0202)	1,975	0.879
log (Local sourcing)	0.0735	(0.0483)	476	0.840	0.0148	(0.0143)	1,975	0.877
log (Labor)	<b>0.0999**</b>	(0.0398)	456	0.990	-0.00732	(0.0242)	1,911	0.982
log (Investment)	-0.172	(0.390)	476	0.749	0.164	(0.153)	1,975	0.832
log (Total sales)	0.126	(0.0764)	458	0.984	-0.0322	(0.0353)	1,923	0.962

## Industry-level Heterogeneity

**Table 7:** Industries of chemicals, Iron, steel and non-ferrous metal

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.00299	(0.00188)	144	0.992	-0.00238	(0.00347)	676	0.966
log (Export to NA)	0.235	(0.208)	144	0.949	-0.00217	(0.137)	676	0.917
Import Share (NA)	0.00321	(0.00453)	144	0.633	0.00612	(0.00393)	676	0.881
log (Import NA)	0.0316	(0.182)	144	0.716	0.0409	(0.123)	676	0.829
Import Share (Asia)	-0.00765	(0.0132)	144	0.956	<b>-0.0535***</b>	(0.0154)	676	0.818
Local share	0.0297	(0.0714)	144	0.898	0.0177	(0.0269)	676	0.883
log (Local sourcing)	0.0181	(0.0483)	144	0.903	0.0112	(0.0190)	676	0.880
log (Labor)	-0.0134	(0.0288)	137	0.997	-0.0326	(0.0248)	661	0.993
log (Investment)	-0.210	(0.570)	144	0.859	-0.172	(0.238)	676	0.804
log (Total sales)	-0.0215	(0.0561)	139	0.989	-0.0193	(0.0316)	662	0.991

## Industry-level Heterogeneity

**Table 8:** Industries of miscellaneous manufacturing

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.0125	(0.0116)	200	0.761	-0.00511	(0.00490)	737	0.963
log (Export to NA)	0.499	(0.644)	200	0.869	-0.155	(0.127)	737	0.946
Import Share (NA)	-0.00699	(0.00787)	200	0.867	-0.000814	(0.00412)	737	0.883
log (Import NA)	-0.0228	(0.129)	200	0.708	0.111	(0.0839)	737	0.882
Import Share (Asia)	-0.0462	(0.0297)	200	0.891	-0.0167	(0.0149)	737	0.841
Local share	0.0659	(0.0565)	200	0.902	-0.0120	(0.0292)	737	0.865
log (Local sourcing)	0.0362	(0.0368)	200	0.898	-0.00889	(0.0207)	737	0.863
log (Labor)	0.00628	(0.0483)	181	0.984	0.0480	(0.0356)	670	0.980
log (Investment)	0.247	(1.058)	200	0.771	0.115	(0.223)	737	0.799
log (Total sales)	0.0669	(0.0800)	191	0.990	<b>0.123*</b>	(0.0691)	684	0.965

## Country-level Heterogeneity

**Table 9:** Impact of the trade war on affiliates in ASEAN-6 <sup>10</sup>

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.000253	(0.0123)	790	0.883	-0.00129	(0.00233)	4,014	0.906
log (Export to NA)	<b>0.361*</b>	(0.185)	790	0.917	0.0177	(0.0589)	4,014	0.892
Import Share (NA)	0.00862	(0.00991)	790	0.864	0.000747	(0.00155)	4,014	0.861
log (Import NA)	0.217	(0.245)	790	0.704	0.0374	(0.0394)	4,014	0.852
Import Share (Asia)	-0.0139	(0.0118)	790	0.903	-0.0108	(0.00715)	4,014	0.853
Local share	0.0592	(0.0487)	790	0.870	-0.000856	(0.0136)	4,014	0.867
log (Local sourcing)	0.0427	(0.0348)	790	0.865	0.000893	(0.00955)	4,014	0.865
log (Labor)	<b>0.108**</b>	(0.0453)	744	0.988	0.0193	(0.0169)	3,830	0.986
log (Investment)	0.0670	(0.311)	790	0.792	0.0413	(0.0982)	4,014	0.832
log (Total sales)	<b>0.104**</b>	(0.0510)	753	0.989	0.0216	(0.0243)	3,861	0.971

<sup>10</sup>They are Thailand, Malaysia, Indonesia, Singapore, The Philippines, Vietnam.

## Country-level Heterogeneity

**Table 10:** Impact of the trade war on affiliates in Singapore and Thailand

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.0223	(0.0222)	387	0.925	0.00216	(0.00250)	2,115	0.931
log (Export to NA)	<b>0.613*</b>	(0.348)	387	0.906	0.0601	(0.0843)	2,115	0.895
Import Share (NA)	0.00146	(0.00375)	387	0.964	-0.000258	(0.00256)	2,115	0.935
log (Import NA)	0.220	(0.238)	387	0.695	0.0586	(0.0629)	2,115	0.852
Import Share (Asia)	-0.00214	(0.0125)	387	0.929	<b>-0.0219***</b>	(0.00847)	2,115	0.877
Local share	-0.0902	(0.0918)	387	0.837	-0.0176	(0.0202)	2,115	0.858
log (Local sourcing)	-0.0605	(0.0649)	387	0.827	-0.0109	(0.0141)	2,115	0.856
log (Labor)	0.0416	(0.0515)	361	0.994	0.0130	(0.0166)	2,016	0.992
log (Investment)	-0.526	(0.610)	387	0.820	0.0519	(0.136)	2,115	0.839
log (Total sales)	<b>0.103*</b>	(0.0577)	364	0.994	0.0328	(0.0305)	2,026	0.982

## Country-level Heterogeneity

**Table 11:** Impact of the trade war on affiliates in Indonesia Malaysia & the Phillipines

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	-0.0197	(0.0177)	368	0.776	-0.00602	(0.00443)	1,875	0.888
log (Export to NA)	0.225	(0.283)	368	0.932	-0.0316	(0.0910)	1,875	0.894
Import Share (NA)	0.0163	(0.0202)	368	0.635	0.00185	(0.00194)	1,875	0.681
log (Import NA)	0.318	(0.484)	368	0.745	0.0166	(0.0447)	1,875	0.853
Import Share (Asia)	-0.00894	(0.0199)	368	0.892	0.00326	(0.0121)	1,875	0.846
Local share	<b>0.158**</b>	(0.0623)	368	0.911	0.0219	(0.0182)	1,875	0.882
log (Local sourcing)	<b>0.111**</b>	(0.0446)	368	0.910	0.0173	(0.0129)	1,875	0.881
log (Labor)	<b>0.133*</b>	(0.0725)	349	0.981	0.0281	(0.0331)	1,788	0.978
log (Investment)	0.471	(0.467)	368	0.764	0.0121	(0.157)	1,875	0.830
log (Total sales)	0.135	(0.0912)	355	0.986	0.00906	(0.0397)	1,809	0.961

## Country-level Heterogeneity

**Table 12:** Impact of the trade war on affiliates in CLMV <sup>11</sup>

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	-0.0156	(0.0203)	124	0.948	-0.00256	(0.00736)	726	0.884
log (Export to NA)	0.0591	(0.276)	124	0.961	-0.0304	(0.131)	726	0.929
Import Share (NA)	1.48e-05	(2.07e-05)	124	0.480	0.00284	(0.00227)	726	0.742
log (Import NA)	0.0414	(0.0582)	124	0.542	-0.0253	(0.0892)	726	0.890
Import Share (Asia)	-0.0581	(0.0362)	124	0.858	-0.0361	(0.0233)	726	0.831
Local share	<b>0.171**</b>	(0.0764)	124	0.855	0.00759	(0.0312)	726	0.856
log (Local sourcing)	<b>0.113**</b>	(0.0527)	124	0.855	0.00714	(0.0225)	726	0.853
log (Labor)	0.00530	(0.0890)	114	0.993	-0.000176	(0.0283)	694	0.990
log (Investment)	0.155	(0.540)	124	0.799	0.625**	(0.248)	726	0.836
log (Total sales)	-0.0304	(0.156)	121	0.982	0.0685	(0.0453)	702	0.989

<sup>11</sup>They are Cambodia, Laos PDR, Myanmar and Vietnam.

## Interpretation

- The trade war mainly makes positive impact on NA exports from affiliates producing in industries of electrical machinery and transportation equipment.
- Not find significant effect on heavy industries that immediate relocation of production is unlikely to undertaken (e.g., steel industries)
  - impacts of the trade war are heterogeneous across industries
- Affiliates located in bystander countries may benefit from the trade war by substituting China's exports to NA.
  - the case of Singapore and Thailand
  - impacts of the trade war are heterogeneous across host countries as well

# Robustness

- The impact on outcome variables may depend on matching methods
  - apply alternative matching methods
- The impact on outcome variables may depend on the way of how we split the treatment group
  - ⇒ redefine the measure of VFDI
    - use the “direct requirements” coefficients as an alternative input-output coefficients to identify the type of subsidiaries

## Robustness: Reclassification of VFDI

**Table 13:** Impact of the trade war on production activities of ASEAN affiliates: redefined FDI by direct requirements coefficient (caliper matching)

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.00181	(0.0123)	823	0.895	-0.00147	(0.00224)	4,804	0.901
log (Export to NA)	<b>0.364*</b>	(0.191)	823	0.926	0.00810	(0.0536)	4,804	0.897
Import Share (NA)	0.00832	(0.00937)	823	0.610	0.00127	(0.00137)	4,804	0.827
log (Import NA)	0.205	(0.233)	823	0.663	0.0266	(0.0359)	4,804	0.853
Import Share (Asia)	<b>-0.0251*</b>	(0.0147)	823	0.891	<b>-0.0134**</b>	(0.00684)	4,804	0.846
Local share	<b>0.0892*</b>	(0.0487)	823	0.854	0.00236	(0.0122)	4,804	0.864
log (Local sourcing)	<b>0.0618*</b>	(0.0349)	823	0.851	0.00312	(0.00861)	4,804	0.862
log (Labor)	<b>0.0756***</b>	(0.0253)	787	0.993	0.0162	(0.0148)	4,589	0.986
log (Investment)	-0.212	(0.346)	823	0.786	0.101	(0.0914)	4,804	0.828
log (Total sales)	0.0525	(0.0472)	794	0.987	0.0269	(0.0218)	4,630	0.974

## Robustness: Reclassification of VFDI

**Table 14:** Impact of the trade war on production activities of ASEAN affiliates: redefined FDI by direct requirements coefficient (simple DID)

	1.Post#1.ChinaSib#1.VFDI		1.Post#1.ChinaSib#1.OtherFDI		Observations	R <sup>2</sup>
	coef.	sd	coef.	sd		
Export Share (NA)	0.00139	(0.00800)	0.000160	(0.00219)	8,250	0.850
log (Export to NA)	<b>0.199*</b>	(0.112)	0.0285	(0.0442)	8,250	0.888
Import Share (NA)	0.0124	(0.0105)	0.00103	(0.00162)	8,250	0.746
log (Import NA)	0.181	(0.145)	0.00352	(0.0279)	8,250	0.832
Import Share (Asia)	-0.00385	(0.00927)	<b>-0.0151***</b>	(0.00526)	8,250	0.836
Local share	0.0228	(0.0309)	-0.0149	(0.0110)	8,250	0.853
log (Local sourcing)	0.0157	(0.0220)	-0.0105	(0.00779)	8,250	0.854
log (Labor)	-0.00973	(0.0408)	0.0108	(0.0164)	6,835	0.985
log (Investment)	-0.297	(0.194)	-0.0947	(0.0739)	8,250	0.849
log (Total sales)	<b>0.237*</b>	(0.128)	0.0293	(0.0248)	6,853	0.970

## Robustness: Reclassification of VFDI

**Table 15:** Impact of the trade war on production activities of ASEAN affiliates: redefined FDI by direct requirements coefficient (kernel matching)

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.00163	(0.0121)	844	0.895	-0.00139	(0.00224)	4,815	0.906
log (Export to NA)	<b>0.353*</b>	(0.186)	844	0.926	0.00954	(0.0537)	4,815	0.899
Import Share (NA)	0.00814	(0.00932)	844	0.610	0.00129	(0.00137)	4,815	0.827
log (Import NA)	0.196	(0.231)	844	0.669	0.0274	(0.0361)	4,815	0.852
Import Share (Asia)	-0.0222	(0.0146)	844	0.901	<b>-0.0136**</b>	(0.00681)	4,815	0.846
Local share	<b>0.0834*</b>	(0.0478)	844	0.853	0.00265	(0.0122)	4,815	0.864
log (Local sourcing)	0.0578*	(0.0342)	844	0.850	0.00332	(0.00860)	4,815	0.862
log (Labor)	<b>0.0817***</b>	(0.0251)	807	0.993	0.0157	(0.0147)	4,600	0.986
log (Investment)	-0.262	(0.341)	844	0.780	0.102	(0.0913)	4,815	0.829
log (Total sales)	0.0603	(0.0462)	815	0.987	0.0268	(0.0217)	4,641	0.974

## Conclusion

---

## Conclusion

- Due to the trade war, ASEAN-located affiliates with Chinese siblings that vertically integrated in the value chains of the same Japanese MNE tend to increase their export to the North America market.  
→ Production relocation to third countries as export platforms (Flaaen, Hortaçsu & Tintelnot, 2020)
- They increase the production activities: total sales and labor.
- They are also more likely to increase both the share and value of local procurement, while reduce the procurement from other Asian area (including China).
- The impact is heterogeneous among different host countries and industries.
- Within-MNE adjustment behavior of Japanese firms in response to economic shocks is documented.

# References i



Alfaro, L., and Charlton, A. (2009).  
**Intra-industry foreign direct investment.**  
*American Economic Review.*, 99(5):2096–2119.



Amiti, M., Kong, S. H., and Weinstein, D (2020)  
**The effect of the US-China trade war on US investment.**  
*National Bureau of Economic Research Working Paper.*



Benguria, F.,(2019)  
**The Global Impact of the US-China Trade War: Firm-Level Evidence.**  
*Working Paper. Available at SSRN 3413229.*



Ding, H., Koedijk, K. G., Qi, T., and Shen, Y. (2022).  
**US–China trade war and corporate reallocation: Evidence from Chinese listed companies.**  
*The World Economy.*,00:1–26.







Donaubauer , J., and Dreger, C. (2018).  
**The end of cheap labor: Are foreign investors leaving china?**  
*Asian Economic Papers.*,17(2):94–107.



Fajgelbaum, P., Goldberg, P. K., Kennedy, P. J., Khandelwal, A., and Taglioni, D. (2021)  
**The US-china trade war and global reallocations.**  
*Technical report, National Bureau of Economic Research.*

## References ii

-  Flaaen, A., Hortaçsu, A., & Tintelnot, F.,(2020)  
**The production relocation and price effects of US trade policy: the case of washing machines.**  
*American Economic Review.*, 110(7), 2103-27.
-  Hayakawa, K., Matsuura, T., & Okubo, F.,(2015)  
**Firm-level impacts of natural disasters on production networks: Evidence from a flood in Thailand.**  
*Journal of the Japanese and International Economies.*,38, 244-259.
-  Huang, Y., Lin, C., Liu, S., and Tang, H. (2019).  
**Trade networks and firm value: Evidence from the us-china trade war.**  
*Available at SSRN 3504602.*
-  Muendler, M.-A. and Becker, S. O. (2010).  
**Margins of multinational labor substitution.**  
*American Economic Review.*, 100(5):1999–2030
-  Sun, C., Tao, Z., Yuan, H., & Zhang, H.,(2019)  
**The Impact of the US-China Trade War on Japanese Multinational Corporations.**  
*RIETI Working Paper.*
-  Todo, Y., Nakajima, K., & Matous, P.,(2015)  
**How do supply chain networks affect the resilience of firms to natural disasters? Evidence from the Great East Japan Earthquake.**  
*Journal of Regional Science.*,55(2), 209-229.

## Appendix: What Affiliates Have VFDI/Other FDI Chinese Siblings?

VARIABLES	VFDI Chinese Siblings	Other Chinese Siblings
log(Age)	-0.221 (0.219)	-0.376*** (0.0946)
log (Labor cost)	-0.0308 (0.157)	0.160** (0.0628)
Size	0.451** (0.175)	0.295*** (0.0682)
Parent_sourcing	-0.421 (0.457)	-0.270 (0.180)
R&D ratio	-7.783 (14.18)	1.500 (3.307)
c_labor_productivity	0.0909 (0.163)	0.504*** (0.0619)
Constant	-4.747*** (0.796)	0.642 (0.942)
Observations	794	1,788
Pseudo R2	0.156	0.108
Log Likelihood	-236.959	-1083.305

## Appendix: Balancing Test for Matching

	<u>VFDI Chinese Siblings</u>		<u>Other Chinese Siblings</u>	
	Before matching	After matching	Before matching	After matching
<i>log (Age)</i>				
Mean treated	2.786	2.801	2.738	2.741
Mean control	2.596	2.779	2.738	2.670
t-test (p-value)	0.010	0.861	0.005	0.023
<i>log (Labor cost)</i>				
Mean treated	5.014	4.916	5.303	5.272
Mean control	4.467	4.923	4.484	5.167
t-test (p-value)	0.000	0.978	0.000	0.110
<i>Size</i>				
Mean treated	5.225	5.217	5.398	5.394
Mean control	4.750	5.266	4.802	5.290
t-test (p-value)	0.002	0.855	0.000	0.124
<i>Parent_sourcing</i>				
Mean treated	0.180	0.196	0.192	0.196
Mean control	0.220	0.192	0.225	0.199
t-test (p-value)	0.229	0.936	0.020	0.788
<i>R&amp;D ratio</i>				
Mean treated	0.002	0.001	0.002	0.002
Mean control	0.001	0.001	0.001	0.001
t-test (p-value)	0.090	0.921	0.226	0.693
<i>c_labor_productivity</i>				
Mean treated	0.052	0.131	0.153	0.100
Mean control	-0.014	0.114	-0.275	0.052
t-test (p-value)	0.495	0.909	0.000	0.280

## Appendix: Multinomial Logit Estimation for Matching

**Table 16:** PSM-DID results using multiple propensity scores based on multinomial logit estimation (caliper matching)

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.0152	(0.00933)	1,036	0.873	-0.00169	(0.00256)	3,915	0.902
log (Export to NA)	<b>0.296*</b>	(0.157)	1,036	0.928	-0.0218	(0.0601)	3,915	0.900
Import Share (NA)	0.0149	(0.00936)	1,036	0.840	0.00135	(0.00158)	3,915	0.823
log (Import NA)	<b>0.224*</b>	(0.120)	1,036	0.800	0.0207	(0.0376)	3,915	0.858
Import Share (Asia)	-0.0223	(0.0140)	1,036	0.895	<b>-0.0141*</b>	(0.00737)	3,915	0.834
Local share	0.0546	(0.0422)	1,036	0.853	0.00423	(0.0137)	3,915	0.864
log (Local sourcing)	0.0368	(0.0300)	1,036	0.847	0.00436	(0.00967)	3,915	0.861
log (Labor)	<b>0.0504*</b>	(0.0301)	978	0.987	0.0156	(0.0159)	3,746	0.988
log (Investment)	0.0703	(0.285)	1,036	0.783	0.164	(0.101)	3,915	0.827
log (Total sales)	0.0390	(0.0387)	989	0.986	0.0221	(0.0238)	3,772	0.979

## Appendix: Multinomial Logit Estimation for Matching

**Table 17:** PSM-DID results using multiple propensity scores based on multinomial logit estimation (kernel matching)

	1.Post#1.ChinaSib#1.VFDI				1.Post#1.ChinaSib#1.OtherFDI			
	coef.	sd	obs	R <sup>2</sup>	coef.	sd	obs	R <sup>2</sup>
Export Share (NA)	0.0152	(0.00930)	1,041	0.873	-0.00170	(0.00256)	3,923	0.902
log (Export to NA)	<b>0.295*</b>	(0.157)	1,041	0.928	-0.0235	(0.0601)	3,923	0.900
Import Share (NA)	0.0148	(0.00932)	1,041	0.840	0.00134	(0.00158)	3,923	0.823
log (Import NA)	<b>0.224*</b>	(0.119)	1,041	0.800	0.0206	(0.0376)	3,923	0.858
Import Share (Asia)	-0.0228	(0.0140)	1,041	0.895	<b>-0.0143*</b>	(0.00736)	3,923	0.834
Local share	0.0496	(0.0426)	1,041	0.852	0.00433	(0.0137)	3,923	0.864
log (Local sourcing)	0.0332	(0.0302)	1,041	0.846	0.00442	(0.00965)	3,923	0.862
log (Labor)	<b>0.0517*</b>	(0.0300)	981	0.987	0.0158	(0.0159)	3,754	0.988
log (Investment)	0.0829	(0.285)	1,041	0.784	0.165	(0.101)	3,923	0.828
log (Total sales)	0.0392	(0.0386)	992	0.986	0.0232	(0.0237)	3,780	0.979

## Appendix:

**Table 18:** Impact of the trade war on affiliates located in China (simple DID)

	1.Post#1.China coef.	sd	Observations	R <sup>2</sup>
Export Share (NA)	-0.00190**	(0.000846)	32,643	0.889
log (Export to NA)	-0.0426**	(0.0207)	32,643	0.897
Import Share (NA)	-0.000625	(0.000683)	32,643	0.770
log (Import NA)	-0.0236**	(0.0120)	32,643	0.877
log (Export to Asia)	-0.0487*	(0.0285)	32,643	0.902
Local share	-0.00703	(0.00530)	32,643	0.860
log (Local sourcing)	-0.00514	(0.00373)	32,643	0.861
log (Labor)	-0.0628***	(0.00877)	26,046	0.983
log (Investment)	0.0582*	(0.0340)	32,643	0.857
log (Total sales)	-0.0155	(0.0154)	26,514	0.963