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# The Effect of COVID-19 on Firms' Behaviour: The Case of Japan

**Yuting CHEN<sup>‡</sup>***School of Economics, Yokohama National University***Bin NI<sup>§</sup>***Department of Economics, Hosei University*

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**Abstract:** *Since the onset of the coronavirus disease (COVID-19) pandemic, social distancing practices and government-mandated lockdowns have become the norm. These have cut off interaction amongst people, firms, and society, triggering an even larger decline in economic activity. In this study, we apply annual Japanese foreign affiliate data to quantify how COVID-19 has affected firms' behaviour in various aspects. The estimation results show that both the revenue and purchasing behaviour of Japanese foreign affiliates were affected during COVID-19. This negative impact is mainly through the channel of stringent regulations imposed by host countries where affiliates are located. The general result we can derive from these findings is that COVID-19 negatively affects Japanese firms engaged in overseas activities. This leaves us with the question of when external shocks such as COVID-19 stand in the way of firms' overseas activities, and what role the government should play to achieve a balance between safety and economic revival.*

**Keywords:** COVID-19, parent-affiliate data, lockdown, firm performance

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<sup>‡</sup> Email: [chen-yuting-bh@ynu.ac.jp](mailto:chen-yuting-bh@ynu.ac.jp)

<sup>§</sup> Email: [bin@hosei.ac.jp](mailto:bin@hosei.ac.jp)

## **1. Introduction**

### **1.1. Motivation and Hypothesis**

The coronavirus disease (COVID-19) shock quickly spilled over to the global economy, triggering a dramatic decline in economic activity, due to both social distancing practices and government-mandated lockdowns and other mobility restrictions. In describing the consequences of the pandemic crisis, the media have frequently used the word ‘unprecedented’. An example of such commentary is the proposition that the world economy may be entering a period of de-globalisation. Additionally, the first half of 2020 witnessed the largest decline in world trade and output since World War II (Antràs, 2020). The restrictions invoked under COVID-19 distorted economic activity by disorganising work (supply side) and limiting people’s ability to consume (demand side), or through additional frictions in the functioning of transportation and distribution networks.

Moreover, as firms are increasingly engaged in overseas activities, it is important to assess the effect of the pandemic on firms of various types. In this regard, our hypothesis is that firms engaging in multinational activities are more likely to be negatively affected by COVID-19 (either the disease itself or the relevant lockdown policies). We would like to examine how the foreign affiliates’ activities are affected by COVID-19. We hypothesise that affiliates relying more on the host country’s local markets for sales and production are more negatively affected during COVID-19. We also seek to investigate how the intra-firm trade is affected during COVID-19 and by what types of restriction regulations in the host country.

### **1.2. What We Do in This Paper**

To conduct a thorough evaluation of the impact of COVID-19 on Japanese firms’ behaviour, we apply annual Japanese foreign affiliate firm data. These data are used to investigate how COVID-19 may have caused chaos in the activities of multinational enterprises (MNEs). To investigate the mechanism through which multinational activities negatively affect firms’ performance during COVID-19, we conduct reduced-form empirical analysis. In this paper, we identify that lockdown measures may have a negative effect on multinational activities during the COVID-19 pandemic. School closures, restrictions on gatherings, and work-from-home orders have a negative impact on both affiliates’ local revenues and purchases. We do not find a consistently significant effect from other lockdown measures. In this regard, we identify that lockdown measures can transmit this effect across borders creating a negative effect on other

countries through foreign firms' affiliates. This finding could have implications for international coordination in disease control measures.

The policy implication of these findings could be twofold: COVID-19 has a negative impact on the sourcing and sales activities of Japanese firms' foreign affiliates. When firms' overseas activities are sabotaged by unexpected external shocks, such as COVID-19, local government officials should consider how to support these firms, especially those that are most vulnerable to such shocks. Meanwhile, different lockdown regulations in host countries have heterogeneous impacts on the decision-making of Japanese foreign affiliates, which may spill over to their parent firms. Nevertheless, we cannot conclude whether such an impact is temporary or long-term without further analysis.

The rest of this paper is structured as follows: Section 2 discusses the existing literature and how we position the current study. Section 3 introduces the data and methodology used for the analysis, and section 4 presents the estimation results and robustness checks. The final section concludes.

## **2. Existing Literature**

This paper is related to two strands of research: the effect of pandemics and the impact of natural disasters on economic activities.

The first related literature is on pandemics and their effect on the economy. Research regarding the effect of pandemics on trade and economic development started before COVID-19. Huang (2021) used the 2003 severe acute respiratory syndrome (SARS) epidemic as a natural experiment to examine the resilience of Chinese manufacturing importers. The paper found that firm imports fell by 7.9% on average when the trade route was hit by SARS. The epidemic reduced total Chinese manufacturing outputs by about 0.7% at its peak. Previous research also identified the detrimental effect of the 2014 Ebola outbreak in Africa, which led to a decrease in the provision of agricultural products and malnutrition in Africa (Alpha and Figuié, 2016). Since the COVID-19 pandemic, various studies regarding its effect on trade and the economy have been published. For example, Hayakawa and Mukunoki (2020) discovered negative effects on durable and essential products and found that workplace closures had significantly negative effects on trade. In assessing the effects of the lockdown, Chen et al. (2022) used high-frequency, city-to-city truck flow data to estimate the economic cost of the lockdown in China. The model in that paper implied that a full lockdown in major cities reduces real gross domestic product (GDP) by 4%. In this paper, we aim to investigate how different lockdown methods in one country can affect the overseas activities of MNEs differently, and in what aspects.

This paper also intends to contribute to the robust literature evaluating the impact of natural disasters on economic activity. For example, the 2011 Tōhoku earthquake in Japan caused severe disruptions to affiliates of Japanese multinationals in the United States (Boehm, Flaaen, and Pandalai-Nayar, 2019). Related to that, Carvalho et al. (2020) quantified the role of input–output linkages as a mechanism for the propagation and amplification of shocks. In that paper, disruption caused by the disaster propagated upstream and downstream along supply chains, affecting the direct and indirect suppliers and customers of disaster-stricken firms. However, different from the prior studies, we consider MNEs’ input–output relations across multiple countries.

### **3. Data, Empirical Approach, and Robustness Checks**

#### **3.1. Data**

##### **3.1.1. Firm-Level Japanese Foreign Affiliates**

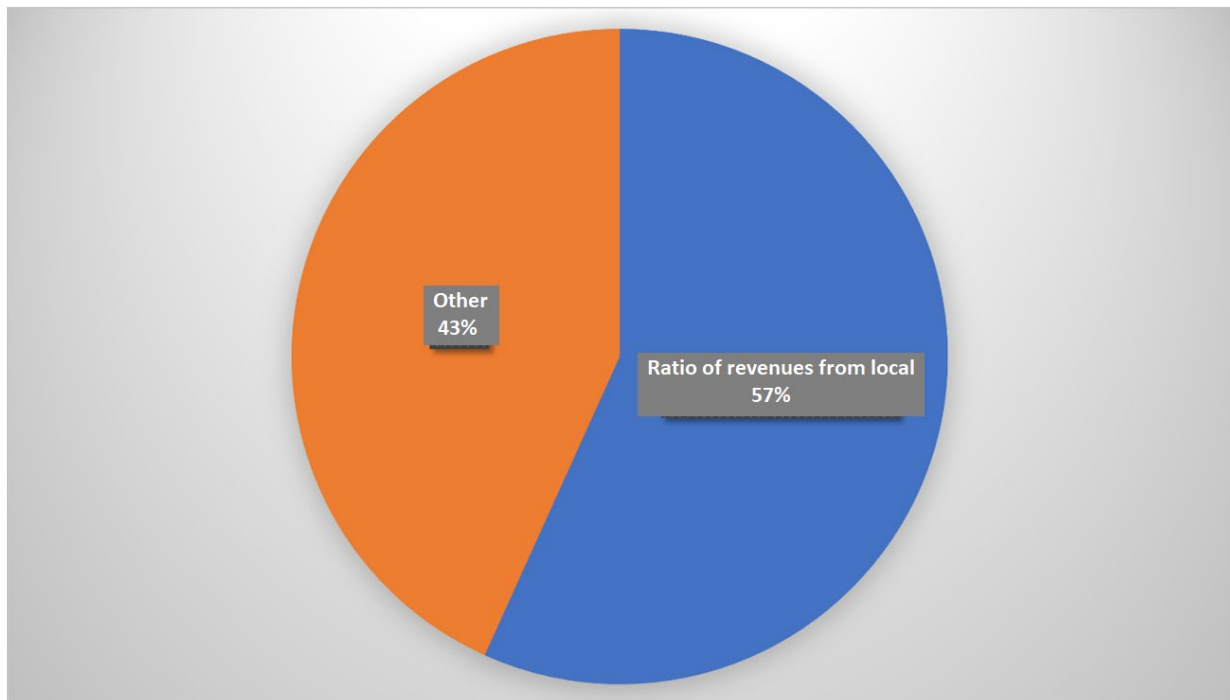
Our data include extensive firm-level information on Japan’s foreign affiliates from the Survey on Overseas Business and Activities prepared by the Research and Statistics Department of the Japanese Ministry of Economy, Trade and Industry (METI). The yearly survey is conducted by METI using a questionnaire and covers all Japanese firms that have at least one business enterprise in a foreign country. We mainly focus on the information provided by the foreign affiliates, and our sample period covers 2018–2020. The survey includes both manufacturing and non-manufacturing sectors but excludes firms in the finance, insurance, and real estate sectors. The survey questions cover a very broad range of economic issues, including the establishment year, number of employees, assets, sales and purchases by destination country, and some intellectual property indicators. The intra-firm trade information is also included, such as exports to and imports from Japanese parent firms. While the basic questions are constant across years, a subset of questions has some annual variations. The trend has been for the survey to be simplified in recent years. The sector classifications used in the survey do not correspond to international standards (e.g. United Nations Industrial Development Organization or Organisation for Economic Co-operation and Development classifications), and they changed slightly in 2002 and 2008. We thus use the concordance table provided by Japan’s Research Institute of Economy, Trade and Industry and aggregate them into 30 sectors.

First, we investigate affiliate revenues and purchases across different parent firms. On average, in 2018, 57% of the total revenues earned by an overseas affiliate were from sales in the local market (Figure 1). Amongst the local sales, on average 51% of the revenues come from sales to local Japanese firms, while 45% of the revenues are from sales to local firms (Figure 2).

Lastly, in terms of sourcing, on average, 49% of the sourcing by affiliates is from the local market (Figure 3). Amongst purchasing from the local market, 65% comes from purchases from local firms (Figure 4).

In this paper, we are mainly interested in the performance of MNEs' overseas activities during COVID-19. For that purpose, we use the Japan's foreign affiliates data ranging from 2018 to the end of 2020 since the most recent data available are up to 2020. To address endogeneity concerns, we incorporate firm-level control variables from 2018.

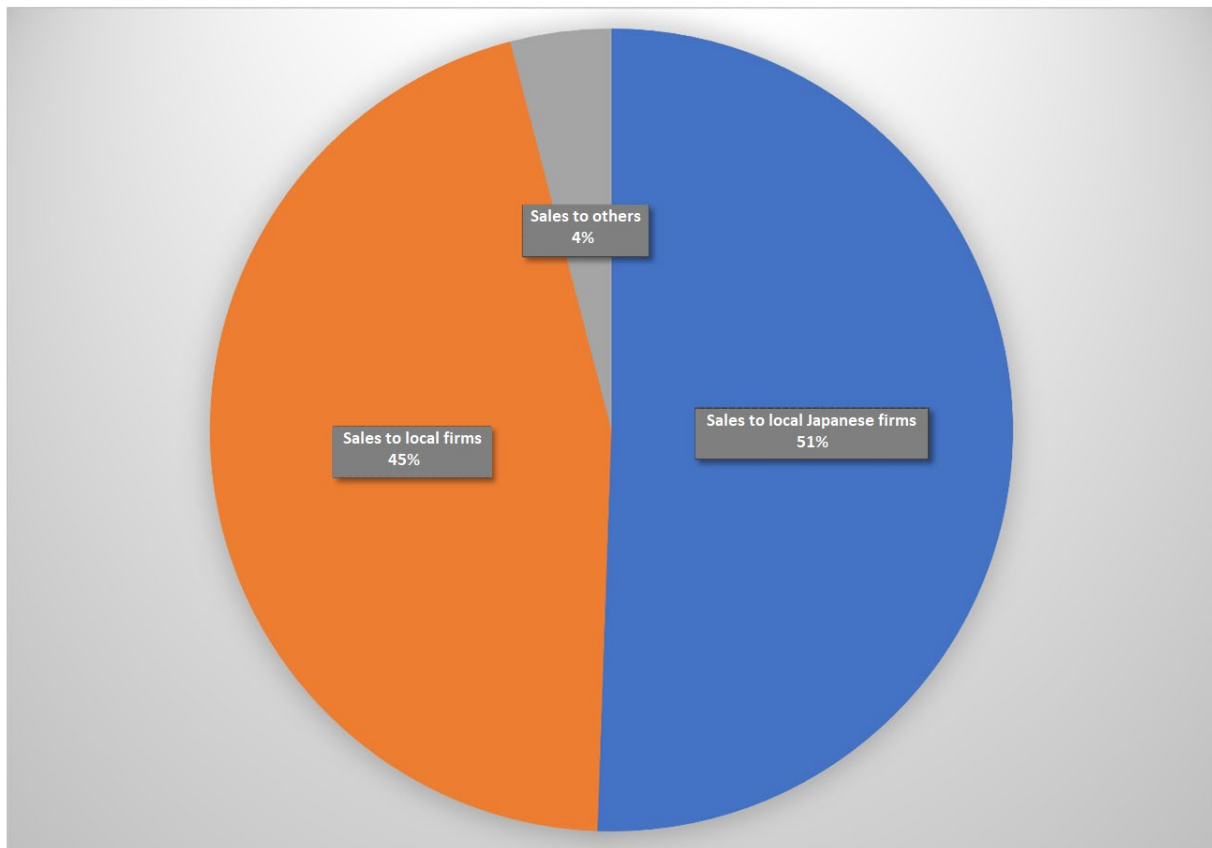
**Figure 1: Revenue Sources Ratios – Local vs Other**



Note: "Revenues from local" is defined as the revenues owned by the affiliate firm from the local host country market where the affiliate is located.

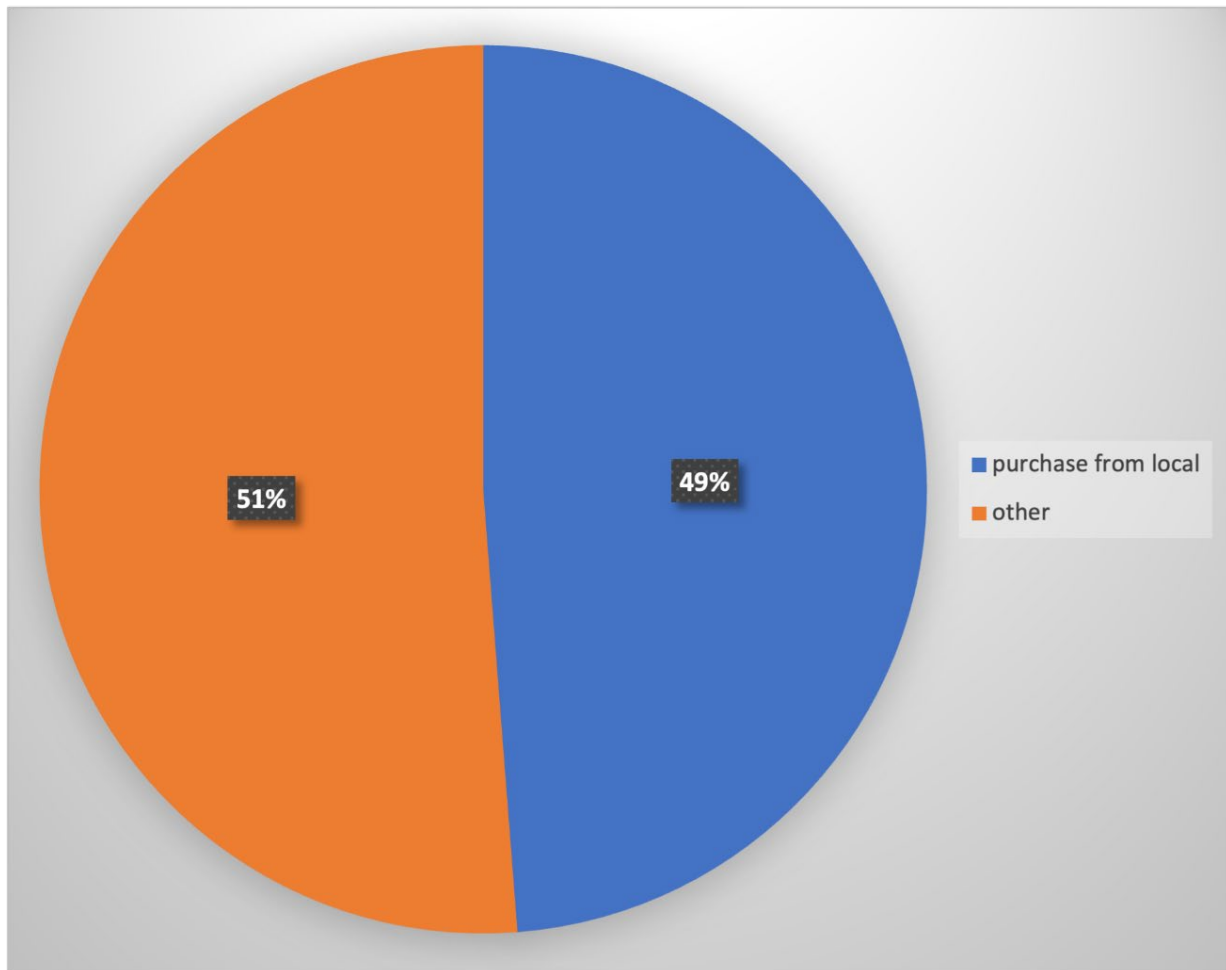
Sources: Survey on Overseas Business and Activities of the Ministry of Economy, Trade and Industry (METI) and authors' own calculations.

**Figure 2: Different Sources of Local Revenue**



Source: Survey on Overseas Business and Activities of the Ministry of Economy, Trade and Industry (METI) and authors' own calculations.

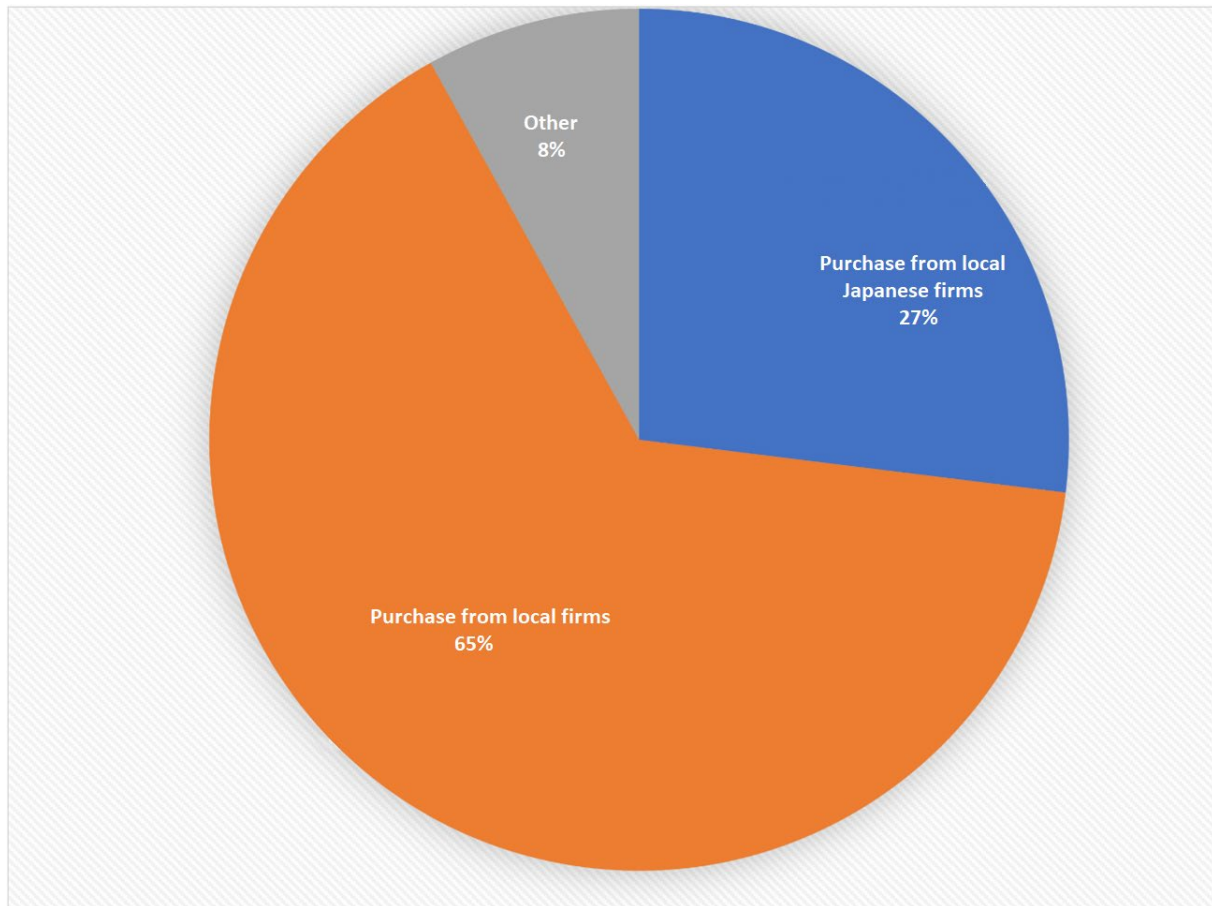
**Figure 3: Different Sources of Purchase**



Note: 'Purchase from Local' refers to purchase from local suppliers.

Source: Survey on Overseas Business and Activities of the Ministry of Economy, Trade and Industry (METI) and authors' own calculations.

**Figure 4: Sources of Purchases from Local Market**



Source: Survey on Overseas Business and Activities of the Ministry of Economy, Trade and Industry (METI) and authors' own calculations.

### **3.1.2. Country-level COVID-19 Restrictions**

Indicators representing the damage caused by COVID-19 were collected using the Oxford COVID-19 Government Response Tracker (Hale et al., 2021). Recent studies such as Hayakawa and Mukunoki (2021) have also applied this data set. The Oxford COVID-19 Government Response Tracker collected publicly available information on 21 indicators of government response. This information was collected by a team of over 200 volunteers from the Oxford community and was updated continuously. We used eight of the policy indicators (C1–C8) recording information on containment and closure policies because we assume these indicators are the most likely to affect firms' decision-making.<sup>3</sup> For example, C2 Workplace closure includes 1 – recommend closure (or recommend work from home), 2 – require closure (or work

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<sup>3</sup> E1–E4 record economic policies such as income support to citizens or the provision of foreign aid. H1–H8 record health system policies such as the COVID-19 testing regime or emergency investments in healthcare. Three indicators (V1–V3) record vaccination policies. These measures are assumed to affect individuals more.



from home) for some sectors or categories of workers, and 3 – require closure (or work from home) for all but essential workplaces (e.g. grocery stores, hospitals). Thus, a larger magnitude of the answer to question C2 responds to a more severe restriction caused by COVID-19.

Other indicators include C1 School-closing, C3 Cancel-public-events, C4 Restrictions-on-gatherings, C5 Close-public-transport, C6 Stay-at-home requirements, C7 Internal-move, and C8 International-trip. All take the categorical answers as in C2 above. A more detailed description is provided in Hale et al. (2021).

We merge the affiliate-level data with the country-level restriction data using the three-digit ISO country codes across time. Apart from the sourcing and sales behaviour of Japanese foreign affiliates in local markets, we would like to see how within-firm interaction is affected by the heterogeneous COVID-19 restrictions.

## 3.2. Empirical Strategy

### 3.2.1. Effect of Lockdown

Our empirical specifications explore the heterogeneous impacts of COVID-19 as well as lockdown policies in each destination country. To be specific, we use different indicators as a proxy for the heterogeneous policies in each country. Take stringency of workplace closure, for instance. As shown in Figure 5, workplace closure is less severe in Europe and Africa, while it is stringent in Russia, India, Australia, etc. We then include the country-level stringency indicators as our variable of interest and check how it affects the revenue of the Japanese affiliates located in that country. As an alternative, we test on the indicator of stay-at-home requirements, which is in Figure 6. As a robustness check, we use restrictions on international travel, public transport closure, and school closure in the destination countries, respectively, to account for the impact of COVID-19.

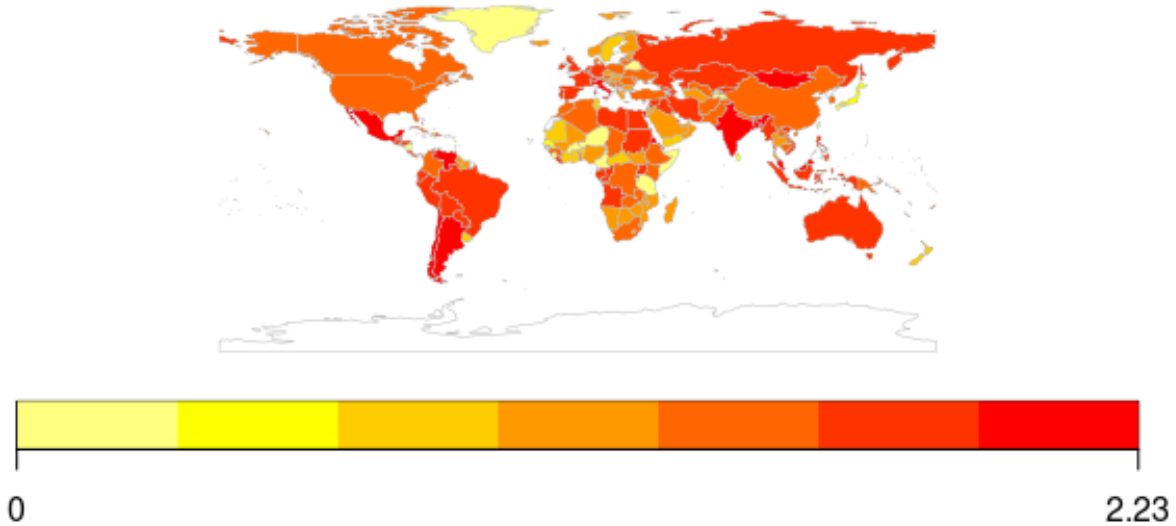
We examine the differential effect of the pandemic on MNEs and domestic firms by looking at how they respond differently to COVID-19 both before and after it occurs. The baseline estimation takes a continuous difference-in-difference form:

$$Y_{fct} = \alpha_0 + Stringency_{ct} \times Post\_Covid_t + X_{fct} + FE_t + \varepsilon_{fct} \quad (1)$$

$Y_{fct}$  is the yearly performance of the foreign affiliate  $f$  located in country  $c$  at time  $t$ . In practice, we include the revenue or the sourcing values of the affiliate, as well as the intra-firm trade measures between the parent and affiliate firms. The stringency term is a country-level

continuous variable, proxied by the different measurements introduced above.  $Post\_Covid_t$  is a dummy that equals 1 if  $t = 2020$ , otherwise 0.  $X_f$  is the vector of firm-level covariates.

**Figure 5: Workplace Closures in the Destination Country**

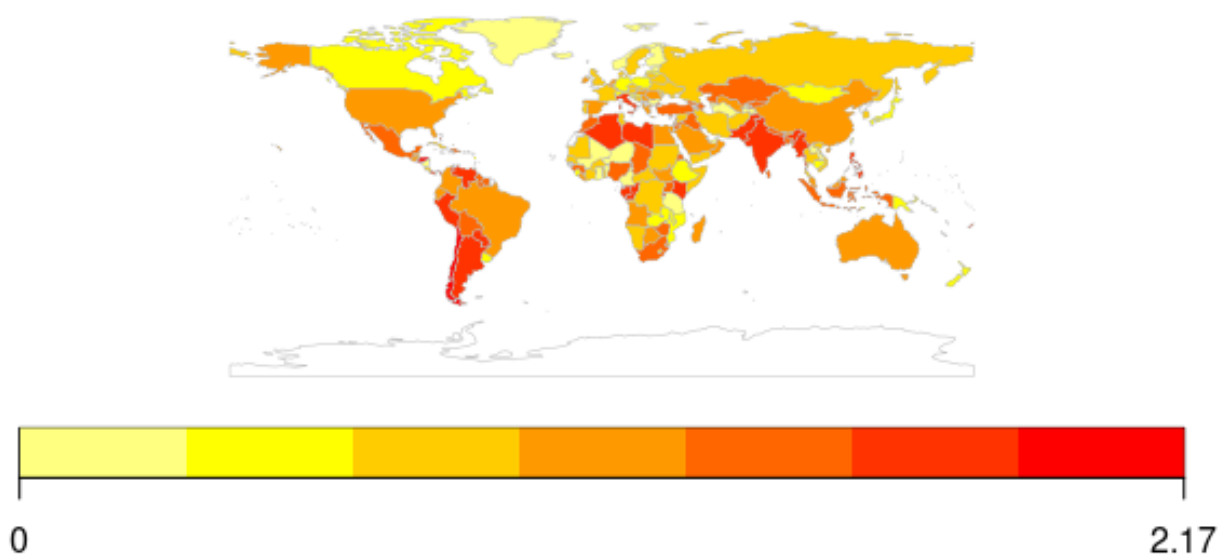


COVID-19 = coronavirus disease.

Note: The unit of measurement is based on an ordinal scale: 0 – no measures; 1 – recommend closing (or recommend work from home) or all businesses open with alterations, resulting in significant differences compared to non-COVID-19 operation; 2 – require closing (or work from home) for some sectors or categories of workers; 3 – require closing (or work from home) for all-but-essential workplaces (e.g. grocery stores, doctors). The score of each country is the average of the scale over 1 year.

Sources: Oxford COVID-19 Government Response Tracker (Hale et al., 2021) and authors' own calculations.

**Figure 6: Stay-at-Home in the Destination Countries**



COVID-19 = coronavirus disease.

Note: The unit of measurement is based on an ordinal scale: 0 – no measures; 1 – recommend closing (or recommend work from home) or all businesses open with alterations, resulting in significant differences compared to non-COVID-19 operation; 2 – require closing (or work from home) for some sectors or categories of workers; 3 – require closing (or work from home) for all-but-essential workplaces (e.g. grocery stores, doctors). The score of each country is the average of the scale over 1 year.

Sources: Oxford COVID-19 Government Response Tracker (Hale et al., 2021) and authors' own calculations.

## **4. Estimation Results**

### **4.1. Baseline Results**

The estimation results for Equation (1) are summarised in Table 1 and Table 2. When we focus on the total local purchases and total local revenues of the affiliate – irrespective of whether we use the indicator for school closures, stay-at-home requirements, or restrictions on gatherings for the stringency proxy – the average treatment effect on the treated is always negative and significant. The significance remains regardless of whether we make use of the samples in manufacturing industries only or all industries. This shows that when we keep other conditions constant, a higher level of stringency on COVID-19 regulation in the destination country, the more damage it will cause to the Japanese affiliates located in that country. Out of the eight stringency indicators, the three personal communication-related ones are the most likely to have a negative impact on firms' decision-making. This suggests that when employees are restrained from face-to-face interactions, or distracted from work by taking care of children (school closures may lead to parents spending more time with children), it might have a negative impact on firms' performance.

**Table 1: Results on Affiliate Revenue Sources**

Affiliate-level Revenues from Host Country Market									
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions	
	-0.131***	-0.0429	-0.0507	-0.0689***	-0.0631	-0.0870**	-0.0279	0.0478	
	(0.0294)	(0.0329)	(0.0425)	(0.0198)	(0.0396)	(0.0369)	(0.0404)	(0.0308)	
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
R-Squared	0.953	0.953	0.953	0.953	0.953	0.953	0.953	0.953	
Obs	9,971	9,971	9,971	9,971	9,971	9,971	9,971	9,971	
Affiliate-level Revenues from Local Firms in the Host Country									
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions	
	-0.116**	-0.00599	0.0122	-0.0281	-0.0120	-0.0562	-0.0279	0.0944	
	(0.0587)	(0.0544)	(0.0667)	(0.0311)	(0.0702)	(0.0662)	(0.0679)	(0.0625)	
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
R-Squared	0.926	0.926	0.926	0.926	0.926	0.926	0.926	0.926	
Obs	5,446	5,446	5,446	5,446	5,446	5,446	5,446	5,446	
Affiliate-level Revenues from Japanese Firms in the Host Country									
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions	
	-0.160***	-0.0592	-0.114**	-0.114***	-0.0411	-0.106**	-0.0111	0.0720	
	(0.0432)	(0.0383)	(0.0510)	(0.0277)	(0.0580)	(0.0497)	(0.0515)	(0.0448)	
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
R-Squared	0.945	0.945	0.945	0.945	0.945	0.945	0.945	0.945	
Obs	5,558	5,558	5,558	5,558	5,558	5,558	5,558	5,558	

COVID-19 = coronavirus disease, Obs = observations.

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* stand for a significance level of 1%, 5%, and 10%, respectively.

Source: Authors' own calculation.

**Table 2: Results on Affiliate Exports**

Affiliate-level Exports to Japan								
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions
	-0.0504	0.0405	-0.00500	0.00173	-0.0439	-0.0363	0.0348	0.0487
	(0.0476)	(0.0379)	(0.0479)	(0.0236)	(0.0538)	(0.0514)	(0.0526)	(0.0511)
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.932	0.932	0.932	0.932	0.932	0.932	0.932	0.932
Obs	6,926	6,926	6,926	6,926	6,926	6,926	6,926	6,926
Affiliate level Exports to Headquarter								
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions
	-0.0622	0.0256	-0.0172	-0.00687	-0.0455	-0.0736	0.0206	0.0653
	(0.0515)	(0.0411)	(0.0516)	(0.0257)	(0.0587)	(0.0553)	(0.0555)	(0.0598)
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931
Obs	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
Affiliate-level Export to Other Countries								
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions
	-0.0404	-0.00260	-0.00953	-0.0442	-0.0296	-0.0319	0.00837	-0.0341
	(0.0527)	(0.0500)	(0.0605)	(0.0290)	(0.0618)	(0.0559)	(0.0590)	(0.0517)
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931
Obs	6,085	6,085	6,085	6,085	6,085	6,085	6,085	6,085

COVID-19 = coronavirus disease, Obs = observations.

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* stand for a significance level of 1%, 5%, and 10%, respectively.

Source: Authors' own calculation.

Another interesting finding is how the COVID-19 stringency indicators affect affiliates' purchase and sourcing behaviour from overseas. As shown in Table 3 and Table 4, the restrictions negatively affect affiliates' purchases from Japan, purchases from the third country, and purchases from the Japanese parent firm. In contrast, we do not observe the impact of restrictions on affiliates' revenue in terms of the above three categories (revenue to Japan, revenue to the third country, and revenue to the Japanese parent firm). This shows that the COVID-19 regulations in the destination countries have a more severe impact on the affiliates' cross-border sourcing patterns than on their sales abroad. A possible explanation might be that the personnel working in the purchasing departments of the firms are more affected by the COVID-19 restrictions than their counterparts working in the sales-related departments. More detailed information is necessary to verify such a phenomenon.

Combined with the results above, we can infer that Japanese MNEs' overseas affiliates are negatively affected by COVID-19 – both their local sales and sourcing activities – and such an impact is mainly through the channel of stringent regulations imposed by the destination countries where the foreign affiliates are located. The affiliates' sourcing activities outside the destination countries are also affected, but their sales pattern remains unchanged. This provides evidence that Japanese overseas affiliates can be sensitive to external shocks in their destination environment, such as COVID-19.

**Table 3: Affiliate Purchases**

Affiliate-level Purchase from Host Country								
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions
	-0.129*** (0.0408)	-0.0152 (0.0354)	-0.0484 (0.0468)	-0.0714*** (0.0234)	-0.0108 (0.0550)	-0.0900* (0.0465)	-0.0747* (0.0433)	0.123*** (0.0439)
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.943	0.943	0.943	0.943	0.943	0.943	0.943	0.943
Obs	8,275	8,275	8,275	8,275	8,275	8,275	8,275	8,275
Affiliate-level Purchase from Local Firms in the Host Country								
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions
	-0.147*** (0.0558)	-0.0254 (0.0453)	-0.0632 (0.0611)	-0.0719** (0.0299)	0.00971 (0.0756)	-0.0896 (0.0604)	-0.0591 (0.0563)	0.195*** (0.0559)
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930
Obs	6,155	6,155	6,155	6,155	6,155	6,155	6,155	6,155
Affiliate-level Purchase from Japanese Firms in the Host Country								
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions
	-0.0896 (0.0668)	0.0789 (0.0768)	0.00671 (0.102)	-0.0678 (0.0495)	0.0619 (0.0906)	0.00275 (0.0806)	0.120 (0.114)	0.0567 (0.0867)
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931
Obs	3,817	3,817	3,817	3,817	3,817	3,817	3,817	3,817

COVID-19 = coronavirus disease, Obs = observations.

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* stand for a significance level of 1%, 5%, and 10%, respectively.

Source: Authors' own calculation.

**Table 4: Results on Affiliate Imports**

Affiliate-level Imports from Japan									
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions	
	-0.149***	-0.0190	-0.0659	-0.0538**	-0.0203	-0.0686	0.00765	0.0799*	
	(0.0443)	(0.0391)	(0.0490)	(0.0242)	(0.0563)	(0.0507)	(0.0508)	(0.0478)	
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
R-Squared	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	
Obs	6,934	6,934	6,934	6,934	6,934	6,934	6,934	6,934	
Affiliate-level Imports from Headquarter									
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions	
	-0.154***	-0.0193	-0.0565	-0.0536**	-0.0137	-0.0657	-0.0109	0.105**	
	(0.0466)	(0.0408)	(0.0514)	(0.0255)	(0.0597)	(0.0533)	(0.0521)	(0.0482)	
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
R-Squared	0.935	0.935	0.935	0.935	0.935	0.935	0.935	0.935	
Obs	6,560	6,560	6,560	6,560	6,560	6,560	6,560	6,560	
Affiliate-level Imports from Other Firms in Japan									
COVID Restrictions	School Closure	Workplace Closure	Cancellation of Public Events	Restrictions on Gathering	Public Transport Closure	Stay at Home Requirements	Internal Movements Restrictions	International Trip Restrictions	
	-0.153	-0.0687	-0.158	-0.0970*	-0.169	-0.230**	-0.0501	-0.0299	
	(0.104)	(0.0803)	(0.101)	(0.0538)	(0.140)	(0.116)	(0.105)	(0.133)	
Affiliate Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	
R-Squared	0.902	0.902	0.902	0.902	0.902	0.902	0.902	0.902	
Obs	2,027	2,027	2,027	2,027	2,027	2,027	2,027	2,027	

COVID-19 = coronavirus disease, Obs = observations.

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* stand for a significance level of 1%, 5%, and 10%, respectively.

Source: Authors' own calculation.



## 4.2. Robustness Checks

In the baseline estimations, we use the samples in the manufacturing industries. However, it could be argued that firms in these industries respond to COVID-19 differently from firms in other industries, such as service industries. Thus, we go a step further and perform two exercises. The first is to expand our sample to all industries. The second is to choose samples that have both headquarters and foreign affiliates in the manufacturing industries. The results (available upon request) are consistent with the baseline results. Compared with the baseline estimations using the limited sample, the signs do not change. The magnitude is larger in absolute terms when both the headquarters and foreign affiliates are in the manufacturing industries. This means that firms in the manufacturing industries are more affected by the propagation of COVID-19 through the interaction between the Japanese headquarters and their foreign affiliates.

## 5. Conclusions

When the world is faced with economic uncertainty, e.g. COVID-19, how will firms respond? When the government implements precautionary measures, such as lockdown policies, how do firms respond? To answer these questions, we have applied annual Japanese foreign affiliate data to quantify how COVID-19 affects firms' behaviour from various perspectives through the lens of firms' overseas activities. The reduced form estimation results show that Japanese foreign affiliates are negatively affected by the COVID-19 restrictions implemented in destination countries. To be more specific, we examine details of how the sales and sourcing patterns, as well as their intra-firm trade, are affected by different COVID-19 preventive regulations such as school closures and stay-at-home policies. We find that the magnitude of such a negative impact is larger for firms whose headquarters and foreign affiliates are both in the manufacturing industries. Combined with the baseline results, we draw the conclusion that Japanese MNEs are negatively affected by COVID-19 through the channel of stringent regulations imposed by destination countries. This provides solid evidence that the pandemic in both domestic and overseas markets, together with lockdown policies, can cause serious problems for MNEs intensely involved in overseas activities.

Without further analysis, we cannot make a more accurate prediction as to how far-reaching the impact of COVID-19 will be on firms. For example, the period for the parent–affiliate analysis is only until the end of 2020. When available, more recent data could be applied to verify if the impact is long-lasting. Furthermore, the influence of COVID-19 on firms may be heterogeneous across regions. More detailed investigation of the geographical dimension could be conducted to ascertain this. To investigate how different waves of lockdown policies might

affect firms' performance, more disaggregated data will be necessary. Moreover, there is still room to evaluate COVID-19's impact from the viewpoint of welfare gains or losses. We will leave these issues for our future study.

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