

Global Supply Chain Disruptions*

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Abstract

We examine how firms are impacted by disruptions to their supply chain caused by the COVID-19 pandemic. Using a compilation of novel data sources, we document that sales decline for firms around the world with Chinese suppliers (relative to control firms) in the first quarter of 2020, due to the production shock in China. Stockholders of U.S. and international firms with Chinese suppliers suffered combined risk-adjusted market value losses of about \$438 billion relative to control firms in 2020q1, with no additional effects afterwards. Bondholders of U.S. firms also suffered sizable market value losses. U.S. firms exposed to this shock increased debt significantly in 2020, keeping investment at par with control firms, but cutting first and then increasing R&D spending. EU and Asian firms also increased debt, but more modestly, and generally experienced a decline in investment. To our best knowledge, our paper is the first to document the importance of international production network disruptions in the propagation of shocks using granular supply chain relationship data.

Keywords: Production network disruptions, supply chain relationships, propagation effects, sales, COVID-19.

JEL Classification: G12; G14; G31; G32; G33; L1; L2; L5.

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1 Introduction

Motivated by the seminal work of Coase (1937), finance theory has long recognized the importance of finance for product market relationships, identifying financial stability as a vehicle to encourage relationship specific investments (Titman, 1984; Maksimovic and Titman, 1991).¹ The importance of finance for product market relationships has also been documented empirically (MacKay and Phillips, 2005; Kale and Shahrur, 2007; Banerjee, Dasgupta and Kim, 2008; Moon and Phillips, 2021). Empirical studies have further shown that stronger product market relationships are associated with better corporate performance (e.g., Allen and Phillips, 2000; Brandt et al., 2017; Chu, Tian and Wang, 2019; Dai, Liang and Ng, 2020).

This study focuses on the costs that related firms incur when product market relationships are disrupted by shocks. Theoretically, Long and Plosser (1983) are the first to study how production network shocks affect related firms. They show that a production shock affecting firms in a certain industry will propagate to the customers of these firms, and potentially propagate further downstream.² The transmission of production shocks is caused by the existence of search costs preventing firms from easily adjust their sourcing networks, especially for product market relationships characterized by a higher degree of relationship specific investments (Antràs, Fort and Tintelnot, 2017; Bernard, Moxnes and Saito, 2019). Firm-level evidence for the U.S. and other major international firms has been scarce because of limited data availability.³ Given the role of the U.S. in the international trade landscape, it is clearly important to quantify the consequences of production network shocks affecting U.S. and other international firms.

We examine public and private worldwide suppliers of goods and services of international firms during the COVID-19 shock, as well as the worldwide customers of these firms using granular import-level transaction data. In 2020q1, COVID-19 was an “exogenous” shock that “halted” production in China, the largest import trading partner of the U.S., the European Union (EU), and many Asian countries. As Figure 1 shows, China’s industrial production dropped by 13.5% year-

¹Other studies include, Chemla and Faure-Grimaud (2001), Hennessy and Livdan (2009), and Chu (2012).

²Carvalho et al. (2021) and Baqaee and Farhi (2019) extend the Long and Plosser model and show that production shocks can additionally propagate upstream to the suppliers of the affected firms.

³One exception is Barrot and Sauvagnat (2016), who find significant short-lived downstream negative propagation effects for publicly traded U.S. firms whose significant U.S. suppliers are affected by natural disasters. However their data is limited to large suppliers that represent 10% or greater of firm sales) of U.S. publicly traded firms

on-year in January/February 2020, and an additional 1.1% in March 2020, before starting to grow again in April 2020 (Source: Organization for Economic Cooperation and Development (OECD)). Container traffic from China’s top eight ports dropped by 19.8% year-on-year in February 2020, and another 5.6% in March 2020 (Source: China Ports and Harbors Association – China Ministry of Transport).⁴ As discussed in more detail later, U.S. imports from China dropped significantly in 2020q1, while imports from other main U.S. trading partners started to be sizable in 2020q2. We find very similar, albeit smaller, import patterns for the EU and Asia during the first half of 2020.

In our empirical strategy, we exploit the “staggered” effect of the COVID-19 production shock. Using a difference-in-difference (DiD) setting, we assess the extent to which the COVID-19 production shock affected U.S., EU, and Asian firms with Chinese suppliers in 2020q1 relative to firms in the same region without Chinese suppliers. Starting from 2020q2, all U.S. and global firms, with and without Chinese suppliers, were affected by the COVID-19 production shock through their domestic and/or foreign suppliers (other than Chinese), and we expect not to find any differential effects between treated and control firms using our empirical DiD setting.

We design our empirical tests to ensure that we measure how the Chinese supply disruption propagated downstream to U.S., EU, and Asian customers controlling for other potential contaminating effects. To this end, in addition to firm fixed effects, all our estimations include industry-quarter-year fixed effects. Our empirical strategy ensures that we compare effects for treated firms (U.S., EU, and Asian firms with Chinese suppliers at the onset of the pandemic) and control firms (U.S., EU, and Asian firms without Chinese suppliers at the onset of the pandemic) within the same industry, therefore mitigating possible concerns that our results capture changes in demand of different products sold by treated and control firms during the pandemic. Additional tests, discussed later, further mitigate the concern that industry could drive our results.

Second, we also need to ensure that the COVID-19 pandemic affected treated firms only through its disruptive effects on Chinese suppliers and not through demand. For example, this assumption could be violated if firms with Chinese suppliers also have Chinese customers. In this case, any potential downstream propagation effect detected in our estimations could be driven by the affected firms having customers in China as opposed to the supply chain disruption. Our empirical design

⁴The China Ports and Harbors Association suspended the release of container traffic statistics for the month of January 2020.

mitigates the concern.

We find that U.S. firms with Chinese suppliers prior to the COVID-19 shock lost about 4% of these suppliers in 2020q1. By 2020q2, the loss of Chinese suppliers increased to about 10%, without any further change for the rest of 2020. By comparison, the number of Chinese suppliers decreased by 7.3% and 2.4% in 2020q2 for EU and Asian firms, respectively, but no change was documented in 2020q1. The decrease in the number of Chinese suppliers reached about 9% and 5% in 2020q4 for EU and Asian firms, respectively. In a difference-in-difference setting, we find no change in the number of U.S. and foreign (other than Chinese) suppliers for U.S. firms with Chinese suppliers (treated group) relative to U.S. firms without Chinese suppliers (control group) in 2020q1. By comparison, the number of foreign (other than Chinese) suppliers increased by about 6% for both EU and Asian firms with Chinese suppliers by 2020q4, indicating that these firms might have replaced some of their lost Chinese suppliers.

For the U.S. firms, we are also able to study import activities. Importantly, using 900k+ import-level transactions extracted from bills of lading for the U.S. firms, we are able to pin down the reduction in imports from Chinese suppliers as the channel through which the COVID-19 production network disruptions affected U.S. firms with Chinese suppliers. Our analysis using 900k+ import-level transactions extracted from bills of lading and matched with our sample of U.S. firms reveal that weight (kg/ton) and volume (TEU) imports from China decreased by 11.2% and 5.3%, respectively, in 2020q1. We do not find any change in imports from other countries for treated U.S. firms relative to control firms in 2020q1. Combined these findings help validate the logic of our empirical strategy that the COVID-19 shock halted production in China in 2020q1 before affecting other U.S. trading partners, leading to a corresponding decrease in U.S. imports from China during the same quarter.⁵

Next, we analyze how the production network disruptions affected sales of U.S., EU, and Asian firms with Chinese suppliers. We find that sales decreased by 3.7% for both U.S. and EU firms with Chinese suppliers relative to their domestic counterparties without Chinese suppliers in 2020q1, compared with the pre-COVID-19 period. For the Asian firms with Chinese suppliers, the decrease in sales in 2020q1 was 5.5%. We do not find any additional drop in sales for 2020q2, 2020q3, and

⁵This is an important departure from previous studies, which have used a more reduced-form approach focusing exclusively on the indirect effect of production network disruptions on the sales of the customers of the affected firms, without providing any direct evidence on the channel leading to the reduction in sales.

2020q4, when both treated and control firms are affected by the COVID-19 shock. In line with our empirical strategy that COVID-19 was a China production shock in 2020q1, we do not find any reduction in sales for U.S., EU, and Asian firms with Chinese customers compared with firms without Chinese customers in 2020q1. Although U.S. and global firms with Chinese suppliers were affected more severely during the COVID-19 pandemic than their domestic firm counterparties without Chinese suppliers, our analysis reveals that these firms benefited in terms of higher sales and operating performance in the ten-year period leading to the pandemic.

In support of the validity of our empirical strategy, we do not find that the reduction in sales for the affected firms can be explained by potential pre-COVID-19-trends. Relatedly, we find no evidence of any patterns in sales for U.S., EU, and Asian firms with Chinese suppliers for each “placebo” two-year period from 2016q1 to 2019q4. Further contributing to validate our empirical strategy, our tests reveal no change in sales in 2020q1 for Chinese firms with U.S., EU, and Asian (other than Chinese) suppliers.

Did firms with Chinese suppliers benefit from the different measures put in place by their countries’ monetary authorities to facilitate access to credit? We find that U.S. firms with Chinese suppliers tapped the short-term debt market and “drew down” from their cash reserves in 2020q1. During the same quarter, capital expenditures increased modestly for these firms, but R&D decreased by a sizable 8.2%. We also find that long-term debt increased by 1.8 and 1.7 percentage points (pp) for U.S. firms with Chinese suppliers in 2020q2 and 2020q3, respectively, which is more than twice as much the average change in long-term debt for these firms. This might explain why capital expenditures did not decrease for the affected U.S. firms during 2020q2-2020q4, although R&D decreased by an additional 11.8% in 2020q3, before increasing by a sizable 27.9% in 2020q4. We generally find that debt levels increased also for EU and Asian firms with Chinese suppliers, although more modestly, which might help explain why affected firms in these countries experienced a reduction in capital expenditures.

We next estimate the wealth effects associated with the sales drop following the COVID-19 supply chain network disruptions. We find that buy-and-hold stockholders of U.S. firms with Chinese suppliers experienced risk-adjusted abnormal returns of -2.8% in 2020q1, with the effect remaining unchanged throughout the entire 2020. We find a very similar pattern for the buy-and-

hold bondholders of U.S. firms with Chinese suppliers. A simple back-of-the-envelope calculation suggests that the stockholders and bondholders of U.S. firms with Chinese suppliers suffered market value losses of about \$197 billion and \$5 billion, respectively, relative to control firms. We do not find any abnormal returns for U.S. firms with Chinese customers. Similarly, we find that the buy-and-hold stockholders of EU and Asian (other than Chinese) firms with Chinese suppliers suffered risk-adjusted market value losses of \$197 billion and \$100 billion in 2020q1, respectively. Bond data is not available for EU and Asian firms. Overall, the wealth effect results suggest that COVID-19 was a sizable production shock, and further contribute to validate the logic of our identification strategy that the production shock affected Chinese suppliers in 2020q1 before affecting production in other countries.

Our paper adds to the literature on supply chains (mostly, theoretical) and the role of multi-sourcing as a strategy to manage supply chain disruption risk (e.g., Babich et al., 2012; Tang, Gurnani and Gupta, 2014; Ang, Iancu and Swinney, 2017; and Bimpikis, Fearing and Tahbaz-Salehi, 2018; Bimpikis, Candogan and Ehsani, 2019) and other forms of supplier risk (e.g., Tomlin and Wang, 2005; Babich, Burnetas and Ritchken, 2007; Kouvelis and Tang, 2011; Honhon, Gaur and Seshadri, 2012; Li, Sethi and Zhang, 2017). We complement this literature with evidence on the potential costs that firms incur when product market relationships are interrupted by a “real shock.”

Overall, our novel data and empirical design provide a unique opportunity to estimate the overall cost of the COVID-19 shock for product market related firms. To the best of our knowledge, our paper is the first to provide such a comprehensive analysis on the propagation of shocks with a focus on a sample of global firms located in the world largest importing countries.

Our findings can offer useful insights to decision makers around the world involved in trade discussions amid the pandemic. There is mounting pressure from political analysts, policymakers, and the public to decouple the U.S. supply chain from China.⁶ Our findings suggest that U.S. firms with Chinese suppliers incurred significant losses because of the COVID-19 supply chain network disruptions. However, because of relationship specific investments that firms make over time (see, e.g., Grossman and Hart, 1986; Aghion and Tirole, 1994), redesigning production networks might

⁶For example, Senator Tom Cotton and Congressman Mike Gallagher introduced a bill on March 19, 2020, called “Protecting our Pharmaceutical Supply Chain from China Act”, to end U.S. dependence on China for pharmaceutical manufacturing.

be costly. The takeaway for policymakers worldwide is that escalating trade tensions could end up inflicting additional damage to all interested parties.

The rest of the paper is organized as follows. Section 2 discusses data sources and descriptive statistics. Section 3 presents our main results, as well as validity and robustness tests. Section 4 concludes. An Appendix provides additional details about our data.

2 Data Sources and Descriptive Statistics

We obtain granular supply chain relationship data from the FactSet Revere Supply Chain Relationships database. The dataset contains up-to-date information of material intercompany relationships obtained from supply contracts, purchase obligations, SEC 10-K filings, investor presentations, press releases, and other public sources. The focus on material supply chain relationships indicates that our sample firms might also have relationships with suppliers that are too small to be included in the FactSet database. Using FactSet, we extract information on Chinese suppliers, as well as U.S., European Union (EU), and Asian (other than Chinese) suppliers, customers, and competitors of U.S., EU, and Asia publicly listed firms on December 31, 2019, the onset of the COVID-19 pandemic.

For the U.S. sample, import-level transaction weights (kg/ton) and volumes (twenty-foot equivalent unit containers, TEU) data is obtained from ocean freight bills of lading, extracted using the Panjiva Supply Chain Intelligence platform. The data comes in the form of massive text files that need to be carefully cleaned and matched with our treated and control firms.

We combine the supply chain relationship data with U.S. firms' fundamentals from COMPUSTAT North America Fundamentals quarterly using 8-digit CUSIPs. The import-level data is combined with COMPUSTAT North America Fundamentals quarterly by first linking the PanjivaID to S&P Capital IQ company identifiers, and then linking the latter with COMPUSTAT GVKEYs. We obtain additional information for the U.S. firms from the following sources: daily stock returns are from CRSP, Fama-French factors from Kenneth French's website (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html), U.S. bond transaction prices from the Trade Reporting and Compliance Engine (TRACE) Enhanced database, bond characteristics from the Mergent Fixed Income Securities Database (FISD), and analysts earnings

conference call transcripts from the BAMSec database. Daily stock returns for the EU, Asian, and other international firms are from COMPUSTAT Global Security Daily, while fundamentals are from COMPUSTAT Global Fundamentals quarterly. We adjust stock prices for dividends and splits using the daily adjustment factor and total return factor provided in the COMPUSTAT Global Security Daily database. Our EU and Asian samples include firms from 26 out of the 27 EU countries and 9 out of the 17 East Asian countries with data in both FactSet and COMPUSTAT.⁷

Media coverage of the COVID-19 pandemic is obtained from LexisNexis and Factiva. Trade data for the U.S., EU, and Asia are from the U.S. Census Bureau, AA, and BB, respectively. Macroeconomic data on China’s GDP growth, production, and container traffic is from the World Bank, the OECD, and the China Ports and Harbors Association – China Ministry of Transport, respectively.

Table 1 reports basic descriptive statistics for the U.S., EU, and Asian firms in the FactSet Revere Supply Chain Relationships database, except financial firms (SICs 6000-6999), for the period 2019q1-2020q4. While we allow firms to enter and exit the sample during our sample period, we note that nearly 92%, 90%, and 88% of the U.S., EU, and Asian firms, respectively, are in our sample for at least two quarters in 2019 and two quarters in 2020, and 61%, 75%, and 73% of the U.S., EU, and Asian firms, respectively, are in the sample for all eight quarters. Our results are robust if we focus only on firms with data available for the entire sample period, and if we replace missing sales information for firms exiting the sample with the latest information available before exiting the sample. This latter test allows us to assess any potential downward bias in our estimations due to more affected firms exiting the sample. Table A.1 in the Appendix provides detailed definitions for all the variables used in the paper.

Table 1 shows that 16.3% and 16.6% of the U.S. firms in our sample have at least one Chinese supplier or customer, respectively, on December 31, 2019. On average, U.S. firms have 0.6 Chinese suppliers and 0.3 Chinese customers. They also have 8.8 (6.8) and 8.3 (7.8) U.S. (foreign, other than Chinese) suppliers and customers, respectively. On average, firms with Chinese suppliers import

⁷The 26 EU countries includes Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden. Slovakia is the only EU countries not part of our sample. The 9 East Asia countries include Hong Kong, Indonesia, South Korea, Malaysia, Philippines, Singapore, Thailand, Taiwan, Vietnam. The list of excluded East Asia countries includes Brunei, Cambodia, Laos, Macao, Mongolia, Myanmar, North Korea, Japan. With the exception of Japan, which does not require firms to file quarterly reports, the excluded list includes small countries

12.8 kg/tons and 2.3 TEU containers from China, respectively. For the average firm in our sample, imports from all other countries are 11.8 kg/tons and 1.6 TEU containers, respectively. For the median U.S. firm, quarterly sales and book assets are \$0.3 billion and \$1.7 billion, respectively.

Similar to U.S. firms, 16.6% and 17.8% of EU firms have at least one Chinese supplier or customer, respectively. On average these firms have 4.7 (7.3) and 5.2 (7.9) EU (foreign, other than Chinese) suppliers and customers, respectively. For the median EU firm, quarterly sales and book assets are \$0.2 billion and \$0.9 billion, respectively. Asian (other than Chinese) firms are similar to both U.S. and EU firms in terms of percentage of firms with at least one Chinese supplier or customer, but they are significantly smaller with quarterly sales of \$0.07 billion and \$0.4 billion, respectively. Figure A.2 in the Appendix reports the top 15 U.S., EU, and Asian firms with Chinese supplier by 2019q4 sales.

[Table 1]

Table A.2 in the Appendix reports descriptive statistics separately for U.S. (EU, Asian) firms with and without Chinese supplier, respectively. As it can be noticed by a visual inspection of Table A.2, U.S. firms with Chinese suppliers are significantly larger than U.S. firms without Chinese suppliers. For the two groups, book assets are \$34.6 billion and \$5.3 billion, respectively. Similarly, book assets are \$27.1 (\$11.2) billion and \$4.5 (\$1.5) billion for EU (Asian) firms without Chinese suppliers, respectively. In our main regressions, we control for the pre-event natural logarithm of book assets interacted with quarter-year fixed effects to mitigate the concern that pre-COVID-19 differences in size between firms with and without Chinese suppliers could be driving our results. In robustness tests, we further match on pre-event assets and industry, and we find that our main results are stronger, both economically and statistically, in the matched sample.

3 Results

3.1 Sourcing Activities During the COVID-19 Pandemic

Over the last 30 years, China grew to become one of the most important production hubs of the world.⁸ As discussed in the Introduction, this important production hub unexpectedly stopped

⁸China's GDP grew at the formidable rate of 9.3% per year on average over the 30-year period from 1989 to 2018 (Source: World Bank). Studies have attributed this growth to the impressive increase in productivity of

operating because of the COVID-19 pandemic (Figure 1). Figure 2 , Panel A, shows that U.S. imports from China dropped by 19.8% (from \$41.5 billion to \$33.3 billion), 31.3%, 36.5%, and 10.4% year-on-year in January, February, March, and April 2020, respectively, continued to drop, but more moderately, in May and June, before stabilizing and eventually starting to increase in the last part of 2020 (Source: U.S. Census Bureau). Panel B shows that EU imports from China grew by 2.9% in year-on-year January 2020, but declined by 8.8% and 12.0% in February and March, respectively (Source: Eurostat - European Commission). Similarly, Panel C shows that Asian (other than Chinese) countries imports from China, which unfortunately are only available for South Korea, Thailand, Taiwan, and Vietnam,⁹ declined year-on-year by 9.5% and 6.4% in January and February 2020, respectively, but started to increase in March 2020.

[Figure 1]

[Figure 2]

By comparison, U.S. exports to China, which are significantly smaller than imports (e.g., \$7.2 vs. \$33.3 billion in January 2020), dropped year-on-year in February and March 2020, but grew for the rest of 2020 (Figure 2, Panel D). Similarly, Panels E and F show no significant changes in exports to China from the EU and Asia, respectively, in the first quarter of 2020. Notably, U.S. imports from Mexico, Canada, Japan, and Germany, the second to fifth import trading partners of the U.S., respectively, only started to drop significantly in 2020q2 (Figure 3, Panels A - D). Similarly, Figure 3, Panels E - H, shows that EU imports from the U.S., Russia, Turkey, and Japan (some of the main trading partners of the EU), respectively, started to decrease significantly in 2020q2. Figure 3, Panels I - L, generally confirms that imports for the four Asian countries with available data from some of their main trading partners, including the U.S., Japan, Singapore, and India, also started to increase significantly in 2020q2. In our empirical design, we exploit the

China's manufacturing sector associated to global trade liberalization and the accession of China to the World Trade Organization at the end of 2001 (e.g., Brandt, Van Biesebroeck and Zhang, 2012; Khandelwal, Schott and Wei, 2013; Yu, 2015; Brandt et al., 2017). These productivity benefits can help explain why it became common practice for firms worldwide to adopt a China-centric supply chain, as China grew to be known as the 'factory' of the world.

⁹Data sources: South Korea, Trade Statistics - Korea Customs Service; Thailand, Thailand Central Bank, and Thai Customs; Taiwan, Bureau of Foreign Trade, Ministry of Economic Affairs; Vietnam, General Department of Customs, Ministry of Finance.

“staggered” effect of the COVID-19 shock, which halted production in China in 2020q1, before affecting production also in other countries.

[Figure 3]

We start by analyzing U.S. and international firms sourcing activities from Chinese suppliers during the COVID-19 pandemic. We do so by estimating the following regression model:

$$\begin{aligned} \text{Log of Chinese Suppliers}_{i,q} = \\ \beta_1 2020q1 + \beta_2 2020q2 + \beta_3 2020q3 + \beta_4 2020q4 + \gamma \text{Log Assets}_{i,q} + y_i + \varepsilon_{i,q}, \end{aligned} \quad (1)$$

Log of Chinese Suppliers is the natural logarithm of the number of Chinese suppliers of U.S. (EU, Asian) firm i in quarter q . We estimate Eq. (1) for the 2019q4 – 2020q4 quarters, with 2019q4 being the omitted case. In these regressions, we consider firms with Chinese suppliers on December 31, 2019. These are the firms with Chinese suppliers at the onset of the COVID-19 pandemic, which we use in the analysis in the rest of the paper. Our regressions also include Log Asset, the natural logarithm of book assets, and firm fixed effects, y_i . Standard errors are clustered at the firm level.

As Table 2, column 1, shows that the number of Chinese suppliers for U.S. firms decreased by 3.8% in 2020q1 relative to 2019q4. The loss of Chinese suppliers reached 10.3% by 2020q2 and stabilized after that. For EU and Asian firms, columns 4 and 7 show that the number of Chinese suppliers decreased by 7.3% and 2.4% in 2020q2, reaching 8.9% and 5.2% in 2020q4, respectively. In line with the logic of our empirical strategy that the COVID-19 shock was mainly a China’s production shock in 2020q1 that quickly affected the U.S. as China’s largest importer, the evidence in Table 2 indicates that U.S. firms lost a significant number of Chinese suppliers as early as 2020q1, while the effect on EU and Asian firms was slower but sizable starting from 2020q2. As we discuss in the Appendix and related Table A.3 and Figure A.1, it is improbable that the decrease in the number of Chinese suppliers for U.S. firms can be explained by the ongoing trade war between the U.S. and China.

If it is the case that U.S. and international firms lost Chinese suppliers in early 2020 because the COVID-19 shock first halted production in China, we should not find decrease in early 2020 in

the number of U.S. (EU, Asian) and foreign (other than Chinese) suppliers for U.S. (EU, Asian) firms with Chinese suppliers on December 31, 2019 (treated firms), relative to U.S. (EU, Asian) firms without Chinese suppliers. For this analysis, we rely on the following difference-in-difference model:

$$\begin{aligned}
& \text{Log of Suppliers}_{i,q} = \\
& \beta_1(\text{Chinese Suppliers} \geq 1_{i,Pre-event} \times 2020q4) + \beta_2(\text{Chinese Suppliers} \geq 1_{i,Pre-event} \times 2020q3) + \\
& \beta_3(\text{Chinese Suppliers} \geq 1_{i,Pre-event} \times 2020q2) + \beta_4(\text{Chinese Suppliers} \geq 1_{i,Pre-event} \times 2020q1) + \\
& \gamma_1(\text{Chinese Customers} \geq 1_{i,Pre-event} \times 2020q4) + \gamma_2(\text{Chinese Customers} \geq 1_{i,Pre-event} \times 2020q3) + \\
& \gamma_3(\text{Chinese Customers} \geq 1_{i,Pre-event} \times 2020q2) + \gamma_4(\text{Chinese Customers} \geq 1_{i,Pre-event} \times 2020q1) + \\
& \text{Pre-event Log Assets}_i \times z_q + i_i \times z_q + y_i + \varepsilon_{i,q}, \tag{2}
\end{aligned}$$

where Log of Suppliers is the natural logarithm of the number of either U.S. (EU, Asian) or foreign (other than Chinese suppliers) suppliers of firm i in quarter q . $\text{Chinese Suppliers} \geq 1$ and $\text{Chinese Customers} \geq 1$ are indicators for firms with at least one Chinese supplier or customer, respectively, on December 31, 2019, while 2020q1-2020q4 are quarter-year indicators. This design allows us to estimate the effect of having Chinese suppliers on the outcome variable of interest accounting for the potential effects associated with having Chinese customers, exclusion restriction.

Further, to control for differences between firms with and without Chinese suppliers, and customers, all our regressions include Pre-event Log Asset, the natural logarithm of book assets in 2019q4, interacted with quarter-year fixed effects, z_q , 2-digit SIC industry indicators, i_i , interacted with quarter-year fixed effects, and firm fixed effects, y_i . Standard errors are clustered at the firm level. Our analysis focuses on the sample period 2019q1–2020q4: an eight-quarter time window centered on 2019q4.

The focus of our analysis is the interaction terms in Eq. (2), our difference-in-difference estimators, which measure the change in the number of suppliers for U.S. (EU, Asian) firms exposed to Chinese suppliers (treated firms) relative to U.S. (EU, Asian) firms without exposure to Chinese suppliers (control firms) in 2020q1–2020q4, relative to 2019q1–2019q4.

Table 2, columns 2-3, 4-5, and 8-9 report results from these estimations for the U.S., EU,

and Asian sample, respectively. The insignificant coefficient for the interaction term between the Chinese suppliers' indicator and the 2020q1 dummy across all estimations indicates no changes in the number of U.S. (EU, Asian) and foreign suppliers for the treated firms relative to the control firms in 2020q1. These findings are in line with our empirical strategy that the COVID-19 production shock affected only Chinese suppliers in 2020q1. We note, however, that the number of foreign suppliers increased by 6.1% and 5.7% for the EU and Asian firm with Chinese suppliers, respectively, suggesting that these firms might have replaced some of their lost Chinese suppliers. The number of EU suppliers increased by 5% for EU firms with Chinese suppliers in 2020q2, but was back to pre-COVID-19 levels by the end of 2020.

[Table 2]

To pin down the reduction in imports from Chinese suppliers as the channel through which the COVID-19 production network disruptions affected U.S. firms with Chinese suppliers, we match import-level transactions extracted from bills of lading with our sample of U.S. firms. Unfortunately, import data is not available for EU and Asian firms. Table 3 presents results from these estimations. We find that weight (kg/ton) and volume (TEU) imports from China decreased by 11.2% and 5.3%, respectively, in 2020q1, and an additional 4.7% and 3.5%, respectively, in 2020q2 (Table 3, columns 1 and 2). Notably, Table 3, columns 3 and 4, do not show any decrease in weight and volume imports, respectively, from foreign countries (other than China) for the U.S. firms with Chinese suppliers relative to the control group. Combined, the evidence in Tables 2 and 3 helps validate the logic of our empirical strategy that the COVID-19 shock halted production in China in 2020q1 before affecting other U.S. import trading partners, leading to a corresponding decrease in the number of Chinese suppliers and imports from China for affected U.S. firms during the same quarter.

[Table 3]

3.2 Sales for Affected U.S., EU, and Asian Firms

We next analyze how the COVID-19 production shock affected sales of U.S., EU, and Asian firms with Chinese suppliers relative to U.S., EU, and Asian firms without Chinese suppliers. To this end, we estimate Eq. (2) using the natural logarithm of quarterly sales as dependent variable. Table

4 reports results from this estimation. Focus on columns 2, 4, and 6, specifications with Chinese customers, the significantly negative coefficient on the Chinese supplier indicator interacted with the 2020q1 indicator suggests that sales decreased by 3.7% (3.7% and 5.5%), statistically significant at the 5% level (5% and 1% level), for U.S. (EU, Asian) firms with Chinese suppliers compared with U.S. (EU, Asian) firms without Chinese suppliers in 2020q1 relative to the pre-COVID-19 period.

Because in this estimation we control for whether treated firms have Chinese customers at the onset of the pandemic, this mitigates the concern that the sales results for U.S. (EU, Asian) firms with Chinese suppliers could be driven by these firms having customers in China. We do not find any additional drop in sales for the treated firm in 2020q2, 2020q3, and 2020q4. In line with our empirical strategy, these findings suggest that following the shock that halted production in China in 2020q1, imports from China dropped for U.S. and international firms with Chinese suppliers, and this resulted in a corresponding decrease in sales in 2020q1 for the affected firms. Starting in 2020q2 our experiment “switches off” because, by then, COVID-19 became a global pandemic that affected all suppliers (U.S., EU, Asian, and other foreign), probably leading to lower sales for all U.S. and international firms independently from whether they had Chinese suppliers.

Table A.4 in the Appendix shows a similar decreasing pattern in sales for firms located in some of the main Chinese trading partners, namely, Germany, the Netherlands, Italy, France, and Spain for the EU, and Hong Kong, Taiwan, South Korea, Thailand, and Indonesia for East Asia. We note, however, that there is heterogeneity in terms of how firms in these countries are impacted. For the EU group, the reduction in sales in 2020q1 ranges from 3.2% for Spanish firms, to 14.4% for Dutch firms. For the Asian group, the decrease in sales in 2020q1 ranges from 3.4% for Taiwanese firms, to 18% for Thailand firms.

[Table 4]

Did affected firms underestimate the risks of a China-based supply chain, or did they accept the risks because of the economic benefits associated with a China-based sourcing strategy? To investigate this issue, we analyze sales and operating performance of firms with Chinese suppliers relative to firms without Chinese suppliers in the ten-year period leading to the COVID-19 pandemic. Table 5 shows that, before the pandemic, firms with Chinese suppliers experienced higher

sales compared to firms without Chinese suppliers, ranging from 4.6% for Asian firms to 7.7% for U.S. firms. Similarly, higher operating performance for firms with Chinese suppliers ranged from 2.4% for U.S. firms, to 4.6% for Asian firms.

[Table 5]

One could also be concerned that in Table 4 we are picking up trends in sales that started to affect U.S. (EU, Asian) firms with Chinese suppliers prior to the COVID-19 production network disruptions. For the U.S., for example, it could be that our results in Tables 4 are influenced by the ongoing trade war between the U.S. and China. To consider this possibility, we re-estimate the model in Table 4, columns 1, 3, 5, adding interactions of the indicators for firms with Chinese suppliers with three pre-COVID-19 quarter indicators, 2019q2-2019q4, with 2019q1 as the omitted case. Table 6, columns 1, 2, and 3, shows that none of the pre-COVID-19 interactions are statistically significant for the U.S., EU, and Asian samples. Instead, the interaction of the Chinese supplier indicator with the 2020q1 dummy remains significantly negative for all three samples. Figure 4, Panels A, B, and C, plots the coefficients on the interaction term of interest from columns 1, 2, and 3, respectively. Overall, this evidence mitigates the concern that our findings could be driven by a trend specific to U.S. and international firms with Chinese suppliers that initiated prior to the COVID-19 pandemic.

[Table 6]

[Figure 4]

3.3 Financing and Real Effects for Firms with Chinese Suppliers

In response to the COVID-19 pandemic, the Fed and other central banks around the world put in place massive Quantitative Easing (QE) measures to facilitate access to credit and mitigate the effects of the health crisis on the real economy. In this section, we analyze access to credit and real effects of firms with Chinese suppliers relative to firms without Chinese suppliers during the pandemic.

As Table 7, Panel A, shows, change in short-term debt increased by 1.2 percentage points (pp) in 2020q1 for firms with Chinese suppliers relative to firms without Chinese suppliers, or about

three times as much the average of 0.3 for the firms with Chinese suppliers presented in Table A.2. In 2020q1, affected U.S. firms also “drew down” from their cash reserves. Capital expenditures went up modestly, but R&D spending decreased by a sizable 8.2%. Notably, change in long-term debt increased by 1.8 and 1.7 percentage points (pp) in 2020q2 and q3, respectively, for affected U.S. firms, or more than twice as much the sample average of 1.5 in Table A.2. This might help explain why capital expenditures did not decrease for the affected U.S. firms during 2020q2-2020q4, although R&D decreased by an additional 11.8% in 2020q3, before increasing by a sizable 27.9% in 2020q4.

[Table 7]

For EU firms, Table 7, Panel B, shows a decrease in cash holdings in 2020q1, and significant increases (albeit smaller compared with the U.S. sample) in total debt change (mainly driven by long-term debt), in 2020q2 and q3. Overall, this might help explain why capital expenditures only decreased in 2020q1, but not afterwards. In general, increase in debt was much more modest for the Asian firms with Chinese suppliers, Table 7, Panel C, and only started in 2020q3, which could explain why capital expenditures decreased for these firms both in 2020q2 and 2020q3. Overall, the more limited access to credit for the EU and Asian firms is possibly a consequence of the smaller and delayed responses put in place by the monetary authorities in these regions.

3.4 Validation and Robustness Tests

In our empirical strategy, in 2020q1 sales decreased for U.S. firms with Chinese suppliers because these suppliers stopped production in that quarter. Therefore, we should not find any patterns in sales for U.S. firms with Chinese suppliers if we estimate our difference-in-difference model outside of the COVID-19 sample period. As Table 8, columns 1 to 9, shows, the Chinese supplier interactions are never statistically significant for the U.S., EU, and Asian samples in any of the two-year “placebo” periods from 2016q1 to 2019q4.

[Table 8]

In our empirical strategy, the COVID-19 shock affected production in China in early 2020 and propagated to U.S. and other international firms with Chinese suppliers by affecting their imports

from China. Because the shock did not originate in the U.S. (EU, Asia), we should not find any effect on the sales of the Chinese firms with U.S., EU, and Asian suppliers. To test this prediction, we estimate a regression like Eq. (2) for a sample of Chinese firms from COMPUSTAT Global with the log of quarterly sales as dependent variable. Table 9 reports results from this estimation. Notably, the U.S., EU, and Asian supplier indicators interacted with the post-COVID-19 quarter-year indicators are all statistically insignificant, in line with the logic of our empirical strategy that COVID-19 was mainly a Chinese production shock in 2020q1.

[Table 9]

If treated and control firms operate in different industries, then one could be worried that demand forces, as opposed to the COVID-19 production shock that first affected Chinese suppliers, could be the reason for the decline in sales of U.S. firms with Chinese suppliers in 2020q1. To mitigate this concern, all our sales regressions include industry-quarter-year fixed effects.

To further address this issue, we perform the following tests. As Figure 5 shows, treated and firms in the U.S., EU, and Asian samples have a very similar industry distribution on December 31, 2019. Yet, while there are control firms in all the 2-digit SIC industries, a few of the industries are not populated by treated firms. To deal with this issue, in 2019q4, we exact-match each treated firm to its closest control based on industry and one-hundred book asset categories. We use these one hundred asset categories instead of the continuous book asset to ensure that each treated firm is matched with a control firm, but our results are very similar for all three samples if we match on the continuous book assets, although in this case we lose some of the treated firms. As Table 10, column 1, shows, for the U.S. sample, the coefficient on the interaction term of interest is now statistically significant at the 1% level, and economically larger (in absolute value) compared with the base specification in Table 4, column 3: -4.8% vs. -3.7%. Similarly, Table 10, columns 5 and 7, for the EU and Asian samples, respectively, shows, a larger decrease in sales for affected firms in the matched samples compared with base specifications in Table 4: -4.4% vs. -3.7%. and -6.7% vs. -5.5% for the EU and Asian samples, respectively.

[Table 10]

In our next test, we take advantage of newly available data in the FactSet database to identify the U.S. competitors of our treated firms without Chinese suppliers. We do the same for the EU

and Asian samples. We then estimate our difference-in-difference sales regressions for a sample that includes U.S. (EU, Asian) firms with Chinese suppliers (treated firms) and U.S. (EU, Asian) competitors of the treated firms without Chinese suppliers (control firms). As Table 10, columns 2, 6, and 8, for the U.S. EU, and Asian samples, respectively, shows, our interaction term of interest remains significantly negative in all three estimations. In a related test, for the U.S. sample only, we identify the top-1 and top-5 rivals of our treated firms without Chinese suppliers using the Text-based Network Industry Classifications of Hoberg and Phillips (2010, 2016). We then estimate our sales regressions for a sample that includes only the treated firms and its U.S. rivals without Chinese suppliers. Our results are stronger in these additional estimations (Table 10, columns 3 and 4) compared to baseline estimation in Table 4, column 2. Altogether, the evidence in Table 10 is reassuring that our sales results are not driven by a demand channel affecting treated and control firms differently because of the different industries in which they operate.

Our main sample is based on treated and control firms with supply chain relationship data available in the FactSet database. This ensures that there are similarities between treated and control firms that make them both traceable by the FactSet data collection team. However, the FactSet database includes, in principle, all material suppliers and customers. This suggests that the firms not covered by the FactSet database have either no Chinese suppliers or customers, or these suppliers and customers are not material, which suggests that these firms could potentially serve as viable control firms for our analysis. For this reason, we estimate our main Table 4, using an extended sample that includes firms not covered by FactSet. As Table 11 shows, we find very similar results when we use this extended sample for the U.S., EU, and Asian samples.

[Table 11]

In our main analysis, we use an indicator to identify firms exposed to Chinese suppliers at the onset of the pandemic. For the U.S. sample, we can also use the extent to which firms are exposed to Chinese suppliers using import-level data from Panjiva. We build two measures of Chinese imports to total imports based on kg/ton and volume/TEU. We then interact these continuous variable with the quarter dummy indicators. In line with the main results in Table 4, Table 12 shows a significant decrease in sales for U.S. firms with higher imports from China only for the first quarter of 2020.

[Table 12]

In our next robustness test, we consider the entire sample of international firms in both FactSet and COMPUSTAT Global. As Table 13 shows, all our main results hold for these extended international sample. First of all, we find that sales decreased for the international firms with Chinese suppliers relative to firms without Chinese suppliers in the 2020q1, but not afterwards. We also find that change in total debt increased throughout 2020, which can explain why capital expenditures did not decrease for the affected firms with the exception of 2020q2. As for all our tests, cash holdings decreased for the affected firms but only in 2020q1.

[Table 13]

3.5 Wealth Effects of Affected Firms

We next estimate the stock market value losses associated with the sales drops following the COVID-19 supply chain network disruptions. For this analysis, we obtain buy-and-hold abnormal returns (BHARs) for all the U.S., EU, and Asian firms in our samples over different time windows from January 2, 2020 (the first trading day in 2020)¹⁰ to December 31, 2020, based on a standard Carhart 4-factor model (Carhart, 1997) with the market portfolio proxied by the NYSE-AMEX-NASDAQ value-weighted index returns. We also obtain BHARs for the bondholders of the U.S. firms in our sample.¹¹ If the COVID-19 production network disruptions lead to a higher risk of default for the U.S. firms with Chinese suppliers, we should also expect this higher risk of default to be reflected into the bond prices of the affected firms. Bond returns are not available in Mergent-FISD for the EU and Asian samples.

We use these BHARs as dependent variables in regressions including our indicators for whether U.S. (EU, Asian) firms have Chinese suppliers and customers pre-COVID-19, pre-event log assets,

¹⁰Figure 6 presents a timeline of major events concerning the COVID-19 pandemic. To the best of our knowledge, Fox News was the first media outlet in the U.S. to discuss a mysterious respiratory illness in China on Friday, January 3, 2020 (“Mysterious Respiratory Illness Linked to China Food Market Sickens At Least 44, Officials Say”). On January 6, 2020, the news was covered by Bloomberg, CNN, New York Times, and Wall Street Journal. From January 7, 2020 to January 11, 2020, the pandemic was covered by most of the major media outlets, including Bloomberg (January 8), CNN (January 9), Fox Business News (January 8), NBC News (January 9 and 11), New York Times (January 8 and 10), Wall Street Journal (January 8, 10, and 11), and Washington Post (January 9).

¹¹We only keep bonds that trade on January 2, 2020. For bonds that do not trade at the end of our event window, we consider up to 7 trading days before and after the event window and drop bonds that do not trade during that time window. We calculate a bond market factor as the value-weighted return of all bonds in our sample, $r_{mkt,\tau ev}$.

and industry fixed effects. We cluster standard errors at the industry level. Table 14, Panel A, reports these estimations for stockholders (columns 1 to 3) and bondholders (columns 4 to 6) of U.S. for three different time windows.

Column 1 shows that by the end of the 30th trading day of 2020, buy-and-hold stockholders of U.S. firms with Chinese suppliers experienced risk-adjusted abnormal returns of -3.2%, with the effect remaining similar by the end of the 61st trading day of 2020 (i.e., end of 2020q1) and throughout the rest of 2020. The size of the abnormal return grew (in absolute value) from -0.4% at the end of the 30th trading day to -1.0% at the end of 2020q1 and remained practically unchanged for the rest of 2020. We find a very similar pattern for the buy-and-hold bondholders of U.S. firms with Chinese suppliers. Similar to the U.S. sample, the stockholders of EU and Asian firms experienced BHARs of -2.7% and -2.9%, respectively, with the effect remaining practically unchanged for the remaining part of 2020. We do not find any abnormal returns for U.S. firms with Chinese customers. These patterns are in line with our sales results and the logic of our empirical strategy that COVID-19 was a production shock that affected Chinese suppliers in 2020q1 before affecting production in other countries.

[Table 14]

A simple back-of-the-envelope calculation suggests that the stockholders and bondholders of U.S. firms with Chinese suppliers suffered market value losses of about \$195 billion and \$5 billion, respectively, relative to control firms. The market value losses for the stockholders of EU and Asian firms are \$128 billion and \$110 billion, respectively. The relatively large size of the market value losses suggests that the market anticipates that U.S. (EU, Asian) firms with Chinese suppliers will probably need to make structural changes to their sourcing strategy to avoid that similar disruptions can affect them again in the future.

4 Conclusions

This paper studies the role of production networks in the propagation of shocks worldwide. In our empirical strategy, we exploit the “staggered” effect of the COVID-19 shock, which halted production in China, a major import partner of the U.S., the EU, and Asia, in 2020q1 before

affecting also other U.S. (EU, Asia) trading partners starting in 2020q2, when our identification “switches off.”

We document the magnitude of how firms around the world were impacted. In 2020, firms in the U.S., the EU, and China lost approximately 10%, 9%, and 5% of their Chinese suppliers, respectively. The U.S. firms lost about 4% of their Chinese suppliers as early as 2020q1. Sales declines in 2020q1 were 4% - 5% more for firms with Chinese suppliers than those with other suppliers.

We examine over 900k+ import-level transactions extracted from bills of lading and show that weight (kg/ton) and volume (TEU) imports from China decreased by 11.2% and 5.3%, respectively, in 2020q1. By comparison, we find no change in imports from other countries for U.S. firms with Chinese suppliers (treated group) relative to U.S. firms without Chinese suppliers (control group).

These findings cannot be explained by potential pre-COVID-19-trends, confounding events, having Chinese customers, or the industries in which treated firms and control firms operate. Further, tests reveal no change in sales for U.S., EU, and Asian firms with Chinese suppliers during placebo periods, or for Chinese firms with U.S., EU, and Asian (other than Chinese) suppliers.

We also find that affected firms tapped the debt market throughout the world. For U.S. firms, capital expenditures did not decrease for these firms, but R&D spending decreased significantly in 2020q1 and 2020q3, before increasing robustly in 2020q4. EU and Asian firms also increased debt, but more modestly than the U.S. firms, and generally experienced a reduction in capital expenditures. The more modest increase in debt for the EU and Asian firms is possibly a consequence of the smaller and delayed responses to the COVID-19 put in place by the monetary authorities in these regions.

We also show that the stockholders and bondholders of U.S., EU, and Asian firms with Chinese suppliers suffered combined risk-adjusted market value losses of about \$438 billion relative to control firms because of the production shock. To our best knowledge, our paper is the first to document the importance of production network disruptions in the propagation of shocks using granular supply chain relationship data for the U.S. and international firms.

Our findings can offer useful insights to decision makers around the world involved in trade discussions amid the pandemic. There is mounting pressure from political analysts, policymak-

ers, and the public to decouple the U.S. supply chain from China. For example, Senator Tom Cotton and Congressman Mike Gallagher introduced a bill on March 19, 2020, called “Protecting our Pharmaceutical Supply Chain from China Act”, to end U.S. dependence on China for pharmaceutical manufacturing. Our findings suggest that U.S. firms with Chinese suppliers incurred significant sales and market value losses because of the COVID-19 supply chain disruption. However, redesigning supply chain production networks might be costly for firms, for instance, because of relationship specific investment made over time (see, e.g., Grossman and Hart, 1986; Aghion and Tirole, 1994). The takeaway for policymakers worldwide is that escalating trade tensions could end up inflicting additional damage to firms and consumers.

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Table 1: Descriptive Statistics

This table reports descriptive statistics for the firms in our sample for period 2019q1 – 2020q4. The sample in Panel A includes all U.S. firms in both FactSet and COMPUSTAT. The samples in Panels B and C include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global. We exclude financial firms (SICs 6000-6999). Chinese Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one Chinese supplier (customer) as of December 31, 2019. U.S. Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one U.S. supplier (customer) on December 31, 2019. EU Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one EU supplier (customer) on December 31, 2019. Asian Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one Asian supplier (customer) on December 31, 2019. The EU sample includes firms from 26 out of the 27 European Union countries with data available in both FactSet and COMPUSTAT. The Asian sample includes firms from 9 out of 17 East Asia countries with data available in both FactSet and COMPUSTAT. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Weight (kg/ton) and volume (TEU) import data is from the S&P Global Panjiva Supply Chain Intelligence database. Refer to Table A.1 for detailed variable definitions.

Panel A: U.S. Firms						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	1.656	6.316	0.067	0.293	1.020	15,389
Chinese Suppliers ≥ 1	0.163	0.369	0.000	0.000	0.000	15,389
Chinese Imports (kg/ton)	12.751	21.363	4.132	7.552	13.510	87,917
Chinese Imports (volume/TEU)	2.325	4.693	0.500	2.000	2.000	87,733
Other Imports (kg/ton)	11.774	29.676	0.508	3.810	11.460	833,890
Other Imports (volume/TEU)	1.646	2.983	0.110	0.690	2.000	821,327
Number of Chinese Suppliers	0.587	3.401	0.000	0.000	0.000	15,389
U.S. Suppliers ≥ 1	0.889	0.314	1.000	1.000	1.000	15,389
Number of U.S. Suppliers	8.769	17.801	1.000	3.000	9.000	15,389
Number of Foreign Suppliers	6.808	19.513	1.000	2.000	5.000	15,389
Chinese Customers ≥ 1	0.166	0.372	0.000	0.000	0.000	15,389
Number of Chinese Customers	0.235	1.194	0.000	0.000	0.000	15,389
U.S. Customers ≥ 1	0.767	0.423	1.000	1.000	1.000	15,389
Number of U.S. Customers	8.315	18.012	1.000	3.000	9.000	15,389
Number of Foreign Customers	7.812	23.708	0.000	2.000	7.000	15,389
Assets (Billions \$)	10.019	35.113	0.412	1.730	5.953	15,389
Panel B: EU Firms						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	1.222	3.730	0.036	0.170	0.759	10,456
Chinese Suppliers ≥ 1	0.166	0.372	0.000	0.000	0.000	10,456
Number of Chinese Suppliers	0.741	4.410	0.000	0.000	0.000	10,456
EU Suppliers ≥ 1	0.783	0.412	1.000	1.000	1.000	10,456
Number of EU Suppliers	4.664	9.647	1.000	2.000	4.000	10,456
Number of Foreign Suppliers	7.338	19.347	1.000	2.000	6.000	10,456
Chinese Customers ≥ 1	0.178	0.382	0.000	0.000	0.000	10,456
Number of Chinese Customers	0.478	1.796	0.000	0.000	0.000	10,456
EU Customers ≥ 1	0.632	0.482	0.000	1.000	1.000	10,456
Number of EU Customers	5.166	10.649	0.000	1.000	6.000	10,456
Number of Foreign Customers	7.939	16.937	0.000	2.000	8.000	10,456
Assets (Billions \$)	8.267	29.192	0.195	0.916	4.451	10,456
Panel C: Asian Firms						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	0.451	2.082	0.023	0.068	0.234	17,649
Chinese Suppliers ≥ 1	0.170	0.376	0.000	0.000	0.000	17,649
Number of Chinese Suppliers	0.449	2.697	0.000	0.000	0.000	17,649
Asian Suppliers ≥ 1	0.789	0.408	1.000	1.000	1.000	17,649
Number of Asian Suppliers	4.028	8.688	1.000	2.000	4.000	17,649
Number of Foreign Suppliers	3.679	9.460	0.000	1.000	4.000	17,649
Chinese Customers ≥ 1	0.122	0.327	0.000	0.000	0.000	17,649
Number of Chinese Customers	0.247	0.966	0.000	0.000	0.000	17,649
Asian Customers ≥ 1	0.645	0.479	0.000	1.000	1.000	17,649
Number of Asian Customers	3.402	6.030	0.000	1.000	4.000	17,649
Number of Foreign Customers	2.486	6.627	0.000	0.000	2.000	17,649
Assets (Billions \$)	3.143	26.436	0.148	0.386	1.205	17,649

Table 2: Number of Suppliers During the COVID-19 Pandemic

This table presents estimations from supplier regressions. The sample in column (1) includes all U.S. firms in both FactSet and COMPUSTAT, with at least one Chinese supplier in FactSet on December 31, 2019, for the period 2019q4 – 2020q4. The samples in columns (2) – (3) include all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999) for the period 2019q1 – 2020q4. The dependent variable in column (1) is the Log of Chinese Suppliers, the natural logarithm of the number of Chinese suppliers. The dependent variable in column (2) is Log of U.S. Suppliers, the natural logarithm of the number of U.S. suppliers, while the dependent variable in column (3) is Log of Foreign Suppliers, the natural logarithm of the number of foreign suppliers excluding Chinese. The samples in column (4) and (7) include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, with at least one Chinese supplier in FactSet on December 31, 2019, for the period 2019q4 – 2020q4. The samples in columns (5) – (6) and (8) – (9) include all EU firms and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999) for the period 2019q1 – 2020q4. Chinese Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one Chinese supplier (customer) on December 31, 2019. As control variables, in columns (1), (4) and (7) we include the natural logarithm of book assets, and in columns in columns (2) – (3), (5) – (6), and (8) – (9) the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	U.S. Firms			EU Firms			Asian Firms		
	Log of Chinese Suppliers (1)	Log of U.S. Suppliers (2)	Log of Foreign Suppliers (3)	Log of Chinese Suppliers (4)	Log of EU Suppliers (5)	Log of Foreign Suppliers (6)	Log of Chinese Suppliers (7)	Log of Asian Suppliers (8)	Log of Foreign Suppliers (9)
2020q1	-0.038*** (0.010)			-0.028 (0.026)			0.021 (0.013)		
2020q2	-0.103*** (0.014)			-0.073*** (0.026)			-0.024* (0.014)		
2020q3	-0.100*** (0.014)			-0.091*** (0.026)			-0.063*** (0.013)		
2020q4	-0.100*** (0.015)			-0.089*** (0.027)			-0.052*** (0.014)		
Chinese Suppliers $\geq 1 \times 2020q1$		-0.018 (0.024)	-0.017 (0.023)		0.029 (0.026)	0.036 (0.026)		-0.008 (0.024)	0.029 (0.025)
Chinese Suppliers $\geq 1 \times 2020q2$		-0.029 (0.024)	-0.021 (0.025)		0.050* (0.028)	0.046 (0.032)		0.008 (0.025)	0.032 (0.025)
Chinese Suppliers $\geq 1 \times 2020q3$		-0.029 (0.024)	-0.021 (0.025)		0.045 (0.031)	0.058* (0.032)		-0.001 (0.029)	0.056** (0.027)
Chinese Suppliers $\geq 1 \times 2020q4$		-0.009 (0.015)	-0.022 (0.017)		0.049 (0.031)	0.061* (0.032)		-0.001 (0.027)	0.057** (0.026)
Chinese Customers $\geq 1 \times 2020q1$		0.014 (0.021)	0.020 (0.021)		0.011 (0.022)	0.028 (0.025)		-0.015 (0.024)	0.014 (0.024)
Chinese Customers $\geq 1 \times 2020q2$		0.015 (0.021)	0.021 (0.023)		0.008 (0.024)	0.026 (0.029)		0.001 (0.025)	0.009 (0.025)
Chinese Customers $\geq 1 \times 2020q3$		0.014 (0.021)	0.021 (0.023)		0.003 (0.027)	0.011 (0.030)		0.007 (0.026)	-0.009 (0.027)
Chinese Customers $\geq 1 \times 2020q4$		-0.001 (0.014)	0.009 (0.016)		0.006 (0.027)	0.011 (0.030)		0.007 (0.025)	-0.006 (0.027)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,564	15,427	15,427	1,099	10,859	10,859	1,706	18,308	18,308
R2 (within)	0.125	0.016	0.001	0.091	0.005	0.007	0.060	0.007	0.004
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	No	No	No	Yes	Yes	No	Yes	Yes

Table 3: Imports During the COVID-19 Pandemic

This table presents estimations from import-level regressions. The dependent variables in columns (1) and (3) and (2) and (4) are the natural logarithm of import-level transaction weights (kg/ton) and volumes (twenty-foot equivalent unit containers, TEU). The sample includes U.S. firms in FactSet and COMPUSTAT with import data available in Panjiva, except financial firms (SICs 6000-6999), for the period 2019q1 -- 2020q4. Chinese Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one Chinese supplier (customer) on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables, we include the natural logarithm of book assets in columns (1) and (2) and the natural logarithm of pre-event book assets interacted with quarter-year fixed effects in columns (3) and (4), respectively. Imports data is from the S&P Global Panjiva Supply Chain Intelligence database. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Sample: Dep. Variable:	U.S. Firms with Chinese Suppliers		All U.S. Firms	
	Chinese Imports		Other Imports	
	Log of Weight (kg/ton)	Log of Volume (TEU)	Log of Weight (kg/ton)	Log of Volume (TEU)
	(1)	(2)	(3)	(4)
2020q1	-0.112*** (0.035)	-0.053** (0.026)		
2020q2	-0.047* (0.028)	-0.035* (0.019)		
2020q3	0.015 (0.088)	-0.003 (0.059)		
2020q4	0.034 (0.085)	0.047 (0.055)		
Chinese Suppliers $\geq 1 \times 2020q1$			-0.042 (0.062)	-0.029 (0.030)
Chinese Suppliers $\geq 1 \times 2020q2$			-0.048 (0.080)	-0.045 (0.032)
Chinese Suppliers $\geq 1 \times 2020q3$			-0.054 (0.057)	-0.046 (0.034)
Chinese Suppliers $\geq 1 \times 2020q4$			-0.042 (0.042)	-0.013 (0.025)
Chinese Customers $\geq 1 \times 2020q1$	0.200 (0.122)	0.003 (0.062)	-0.076 (0.080)	-0.007 (0.029)
Chinese Customers $\geq 1 \times 2020q2$	0.154 (0.125)	0.005 (0.052)	0.051 (0.098)	0.037 (0.035)
Chinese Customers $\geq 1 \times 2020q3$	0.052 (0.108)	-0.043 (0.049)	-0.002 (0.070)	0.040 (0.025)
Chinese Customers $\geq 1 \times 2020q4$	0.071 (0.132)	-0.027 (0.057)	-0.041 (0.049)	0.013 (0.022)
Controls	Yes	Yes	Yes	Yes
Obs.	87,917	87,733	833,890	821,327
R2 (within)	0.006	0.004	0.001	0.00
Firm Fixed Effects	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	No	No	Yes	Yes

Table 4: Sales During the COVID-19 Pandemic

This table reports estimations from difference-in-difference sales regressions. The dependent variable is the natural logarithm of sales. The sample in columns (1) and (2) includes all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. The samples in columns (3) and (4) and (5) and (6) include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. Chinese Suppliers ≥ 1 (Customers ≥ 1) is an indicator for firms with at least one Chinese supplier (customer) on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales					
	U.S. Firms		EU Firms		Asian Firms	
	(1)	(2)	(3)	(4)	(5)	(6)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.033** (0.015)	-0.037** (0.015)	-0.043** (0.020)	-0.037** (0.016)	-0.055*** (0.019)	-0.055*** (0.020)
Chinese Suppliers $\geq 1 \times 2020q2$	-0.028 (0.024)	-0.036 (0.025)	-0.037 (0.027)	-0.030 (0.025)	-0.012 (0.022)	-0.014 (0.022)
Chinese Suppliers $\geq 1 \times 2020q3$	0.008 (0.025)	0.001 (0.027)	-0.022 (0.023)	-0.015 (0.023)	0.007 (0.022)	0.002 (0.023)
Chinese Suppliers $\geq 1 \times 2020q4$	-0.004 (0.022)	-0.013 (0.022)	-0.007 (0.028)	-0.008 (0.023)	-0.045 (0.041)	-0.045 (0.042)
Chinese Customers $\geq 1 \times 2020q1$		0.017 (0.016)		-0.020 (0.021)		-0.007 (0.019)
Chinese Customers $\geq 1 \times 2020q2$		0.036 (0.028)		-0.037 (0.023)		0.020 (0.028)
Chinese Customers $\geq 1 \times 2020q3$		0.030 (0.032)		-0.019 (0.021)		0.043 (0.034)
Chinese Customers $\geq 1 \times 2020q4$		0.042 (0.026)		0.011 (0.019)		0.004 (0.039)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	15,389	15,389	10,456	10,456	17,649	17,649
R2 (within)	0.002	0.002	0.001	0.002	0.002	0.002
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	No	Yes	Yes	Yes	Yes

Table 5: Sales and Operating Performance Before the COVID-19 Pandemic

This table reports estimations from several sales and operating performance regressions. The dependent variables are the natural logarithm of sales (COMPUSTAT item saleq), columns (1), (3) and (5), and the natural logarithm of operating income (COMPUSTAT item oibdpq), columns (2), (4) and (6). The sample in columns (1) – (2) includes all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999), for the period 2010q1 – 2019q4. The samples in columns (3) and (4) and (5) and (6) include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999), for the period 2010q1 – 2019q4. Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier on the first day of each quarter in the sample. As control variable we include the natural logarithm of book assets. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	U.S. Firms		EU Firms		Asian Firms	
	Log of Sales	Log of Operating Income	Log of Sales	Log of Operating Income	Log of Sales	Log of Operating Income
	(1)	(2)	(3)	(4)	(5)	(6)
Chinese Suppliers ≥ 1	0.077*** (0.021)	0.024** (0.011)	0.042** (0.020)	0.061** (0.030)	0.046** (0.023)	0.039** (0.016)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	67,351	55,839	25,819	22,996	39,877	35,031
R2 (within)	0.337	0.123	0.358	0.094	0.277	0.175
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	No	Yes	Yes	Yes	Yes

Table 6: Sales During the COVID-19 Pandemic: Testing for Parallel Trends

This table reports estimations from difference-in-difference sales regressions with pre-COVID-19 interactions to test for the parallel trend assumption. The dependent variable is the natural logarithm of sales. The sample in column (1) includes all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. The samples in columns (2) and (3) include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier on December 31, 2019. 2019q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Reverse Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales		
	U.S. Firms	EU Firms	Asian Firms
	(1)	(2)	(3)
Chinese Suppliers ≥ 1 \times 2020q4	-0.012 (0.023)	-0.005 (0.027)	-0.055 (0.045)
Chinese Suppliers ≥ 1 \times 2020q3	0.002 (0.026)	-0.019 (0.029)	-0.003 (0.026)
Chinese Suppliers ≥ 1 \times 2020q2	-0.027 (0.025)	-0.035 (0.030)	-0.023 (0.026)
Chinese Suppliers ≥ 1 \times 2020q1	-0.031** (0.015)	-0.040** (0.020)	-0.066*** (0.023)
Chinese Suppliers ≥ 1 \times 2019q4	0.011 (0.020)	0.014 (0.021)	-0.030 (0.020)
Chinese Suppliers ≥ 1 \times 2019q3	0.002 (0.017)	-0.011 (0.020)	0.004 (0.015)
Chinese Suppliers ≥ 1 \times 2019q2	0.008 (0.017)	0.006 (0.023)	-0.015 (0.014)
Controls	Yes	Yes	Yes
Obs.	15,389	10,456	17,649
R2 (within)	0.011	0.002	0.002
Firm Fixed Effects	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	Yes	Yes

Table 7: Debt, Cash, and Capital Expenditures During the COVID-19 Pandemic

This table reports estimations from several difference-in-difference regressions. The dependent variables are the ratio of change in total debt to lagged assets (COMPUSTAT item dlqtt+dlcq/atq), column (1), the ratio of change in long-term debt to lagged assets (COMPUSTAT item dlqtt), column (2), the ratio of change in short-term debt to lagged assets (COMPUSTAT item dlcq), column (3), the ratio of cash to assets (COMPUSTAT item cheq), column (4), the ratio of capital expenditures to lagged assets (COMPUSTAT item capxy), column (5), and the natural logarithm of R&D expenses (COMPUSTAT item xrdq), column (6). The sample in Panel A includes all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999). The samples in Panels B and C include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999). Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Panel A: U.S. Firms						
Dep. Variable:	Δ Total Debt	Δ Long-Term Debt	Δ Short-Term Debt	Cash	Capital Expenditures	Log of R&D
	(1)	(2)	(3)	(4)	(5)	(6)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.002 (0.006)	-0.009 (0.006)	0.012** (0.005)	-0.006* (0.004)	0.001* (0.001)	-0.082** (0.033)
Chinese Suppliers $\geq 1 \times 2020q2$	0.013* (0.007)	0.018*** (0.006)	-0.010 (0.010)	-0.001 (0.005)	0.002 (0.002)	-0.057 (0.042)
Chinese Suppliers $\geq 1 \times 2020q3$	0.016*** (0.005)	0.017*** (0.005)	-0.005* (0.003)	-0.001 (0.005)	-0.002 (0.002)	-0.118*** (0.044)
Chinese Suppliers $\geq 1 \times 2020q4$	0.005 (0.005)	0.004 (0.004)	-0.002 (0.003)	-0.001 (0.006)	-0.001 (0.001)	0.279*** (0.089)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	15,005	15,344	15,040	15,379	15,227	15,227
R2 (within)	0.002	0.003	0.002	0.003	0.003	0.031
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	No	No	No	No	No
Panel B: EU Firms						
Dep. Variable:	Δ Total Debt	Δ Long-Term Debt	Δ Short-Term Debt	Cash	Capital Expenditures	
	(1)	(2)	(3)	(4)	(5)	
Chinese Suppliers $\geq 1 \times 2020q1$	-0.006 (0.005)	-0.003 (0.004)	-0.001 (0.003)	-0.005* (0.003)	-0.002* (0.001)	
Chinese Suppliers $\geq 1 \times 2020q2$	0.008* (0.004)	0.010** (0.004)	0.003 (0.003)	-0.000 (0.006)	-0.001 (0.001)	
Chinese Suppliers $\geq 1 \times 2020q3$	0.010** (0.004)	0.007 (0.005)	0.005 (0.004)	-0.000 (0.005)	-0.001 (0.001)	
Chinese Suppliers $\geq 1 \times 2020q4$	0.007 (0.005)	0.005 (0.005)	0.004 (0.004)	0.001 (0.006)	-0.001 (0.002)	
Controls	Yes	Yes	Yes	Yes	Yes	
Obs.	9,320	9,845	9,502	10,579	9,579	
R2 (within)	0.005	0.004	0.002	0.002	0.002	
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	
Country \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	
Panel C: Asian Firms						
Dep. Variable:	Δ Total Debt	Δ Long-Term Debt	Δ Short-Term Debt	Cash	Capital Expenditures	
	(1)	(2)	(3)	(4)	(5)	
Chinese Suppliers $\geq 1 \times 2020q1$	-0.002 (0.003)	0.001 (0.003)	-0.003 (0.003)	-0.001* (0.001)	-0.001 (0.001)	
Chinese Suppliers $\geq 1 \times 2020q2$	-0.001 (0.003)	0.001 (0.002)	-0.002 (0.003)	0.001 (0.003)	-0.002** (0.001)	
Chinese Suppliers $\geq 1 \times 2020q3$	0.004** (0.002)	0.002 (0.002)	0.002 (0.003)	0.002 (0.003)	-0.002** (0.001)	
Chinese Suppliers $\geq 1 \times 2020q4$	0.002 (0.003)	0.003** (0.001)	-0.003 (0.003)	0.003 (0.004)	-0.001 (0.001)	
Controls	Yes	Yes	Yes	Yes	Yes	
Obs.	15,795	15,938	16,860	18,888	17,348	
R2 (within)	0.005	0.002	0.002	0.001	0.004	
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	
Country \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	

Table 8: Sales During Placebo Periods

This table reports estimations from difference-in-difference sales regressions, for the following two-year “placebo” periods: 2016q1–2017q4; 2017q1–2018q4; 2018q1–2019q4. The dependent variable is the natural logarithm of sales. The sample in columns (1) – (3) includes all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999). The samples in columns (4) – (6) and (7) – (9) include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999). Chinese Suppliers ≥ 1 in columns (1), (4), and (7), (2), (5), and (8), and (3), (6), and (9) are indicators for firms with at least one Chinese supplier on December 31 of 2016, 2017 or 2018, respectively. Year-q4 – Year-q1 are quarter-year dummies for the years of 2017, 2018 or 2019, respectively. As control variables we include the natural logarithm of pre-placebo-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales								
	U.S. Firms			EU Firms			Asian Firms		
	2016q1-2017q4	2017q1-2018q4	2018q1-2019q4	2016q1-2017q4	2017q1-2018q4	2018q1-2019q4	2016q1-2017q4	2017q1-2018q4	2018q1-2019q4
Sample Period:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Chinese Suppliers $\geq 1 \times$ Year-q1	-0.016 (0.013)	-0.017 (0.016)	-0.012 (0.012)	0.025 (0.027)	-0.030 (0.022)	0.005 (0.022)	0.001 (0.021)	0.009 (0.029)	-0.014 (0.019)
Chinese Suppliers $\geq 1 \times$ Year-q2	-0.021 (0.014)	-0.022 (0.014)	-0.017 (0.014)	-0.016 (0.016)	-0.006 (0.017)	-0.030 (0.021)	0.021 (0.020)	0.024 (0.026)	0.001 (0.018)
Chinese Suppliers $\geq 1 \times$ Year-q3	-0.019 (0.014)	-0.014 (0.015)	-0.012 (0.013)	-0.029 (0.021)	-0.006 (0.015)	-0.040 (0.025)	0.003 (0.016)	0.015 (0.024)	-0.015 (0.017)
Chinese Suppliers $\geq 1 \times$ Year-q4	-0.013 (0.017)	-0.011 (0.020)	-0.023 (0.017)	-0.018 (0.020)	0.011 (0.017)	-0.030 (0.019)	0.004 (0.015)	0.020 (0.022)	0.006 (0.017)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	15,166	15,271	15,328	7,988	9,190	9,948	13,014	15,116	16,378
R2 (within)	0.002	0.002	0.002	0.002	0.004	0.005	0.002	0.003	0.004
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Sales of Chinese Firms During the COVID-19 Pandemic

This table reports estimations from difference-in-difference sales regressions. The dependent variable is the natural logarithm of sales. The sample includes all Chinese firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. U.S. Suppliers ≥ 1 is an indicator for firms with at least one U.S. supplier on December 31, 2019. EU Suppliers ≥ 1 is an indicator for firms with at least one EU supplier on December 31, 2019. Asian Suppliers ≥ 1 is an indicator for firms with at least one Asian (other than Chinese) supplier on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT Global. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales			
	(1)	(2)	(3)	(4)
U.S. Suppliers $\geq 1 \times 2020q1$	0.022 (0.039)			0.021 (0.040)
U.S. Suppliers $\geq 1 \times 2020q2$	-0.010 (0.033)			-0.005 (0.033)
U.S. Suppliers $\geq 1 \times 2020q3$	-0.035 (0.044)			-0.032 (0.046)
U.S. Suppliers $\geq 1 \times 2020q4$	-0.008 (0.038)			0.001 (0.040)
EU Suppliers $\geq 1 \times 2020q1$		0.039 (0.036)		0.006 (0.037)
EU Suppliers $\geq 1 \times 2020q2$		0.028 (0.034)		-0.009 (0.033)
EU Suppliers $\geq 1 \times 2020q3$		0.017 (0.037)		0.007 (0.036)
EU Suppliers $\geq 1 \times 2020q4$		-0.037 (0.047)		-0.025 (0.050)
Asian Suppliers $\geq 1 \times 2020q1$			-0.025 (0.038)	-0.001 (0.032)
Asian Suppliers $\geq 1 \times 2020q2$			-0.048 (0.033)	-0.010 (0.027)
Asian Suppliers $\geq 1 \times 2020q3$			-0.039 (0.035)	-0.017 (0.035)
Asian Suppliers $\geq 1 \times 2020q4$			-0.025 (0.042)	-0.007 (0.042)
Controls	Yes	Yes	Yes	Yes
Obs.	11,792	11,792	11,792	11,792
R2 (within)	0.007	0.007	0.007	0.007
Firm Fixed Effects	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes

Table 10: Sales During the COVID-19 Pandemic: Controlling for Industry Effects

This table reports estimations from difference-in-difference sales regressions. The dependent variable is the natural logarithm of sales. The sample in columns (1) – (4) includes all U.S. firms in both FactSet and COMPUSTAT, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. The samples in columns (5) – (6) and in columns (7) – (8) include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999). Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. In columns (1), (5), and (7), the control groups include U.S., EU, and Asian firms without Chinese suppliers, respectively, identified as the closest exact-match based on industry and log of asset categories. In columns (2), (6), and (8), the control groups include FactSet competitors without Chinese suppliers. In columns (3) and (4), the control groups include the top 1 and top 5 rivals of our treated firms without Chinese suppliers, respectively, identified using the Text-based Network Industry Classifications of Hoberg and Phillips (2010, 2016). Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales							
	U.S. Firms				EU Firms		Asian Firms	
Sample:	Matching on 2-digit SIC and Log of Assets Categories	FactSet Competitors	Top 1 TNIC Rivals	Top 5 TNIC Rivals	Matching on 2-digit SIC and Log of Assets Categories	FactSet Competitors	Matching on 2-digit SIC and Log of Assets Categories	FactSet Competitors
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.048*** (0.018)	-0.040** (0.017)	-0.044** (0.022)	-0.047*** (0.018)	-0.043** (0.021)	-0.030** (0.016)	-0.067*** (0.024)	-0.035** (0.014)
Chinese Suppliers $\geq 1 \times 2020q2$	-0.043 (0.030)	-0.039 (0.026)	-0.034 (0.030)	-0.031 (0.025)	-0.023 (0.026)	-0.028 (0.049)	-0.041 (0.028)	-0.030 (0.029)
Chinese Suppliers $\geq 1 \times 2020q3$	-0.005 (0.029)	0.002 (0.028)	-0.009 (0.036)	-0.003 (0.029)	-0.002 (0.023)	-0.058 (0.051)	-0.041 (0.028)	0.022 (0.014)
Chinese Suppliers $\geq 1 \times 2020q4$	0.004 (0.025)	0.007 (0.023)	-0.023 (0.035)	-0.005 (0.026)	-0.001 (0.030)	-0.004 (0.053)	-0.049 (0.041)	-0.023 (0.018)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	5,065	5,963	4,265	7,957	3,385	2,715	5,997	4,617
R2 (within)	0.004	0.004	0.004	0.003	0.012	0.011	0.004	0.002
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes

Table 11: Sales During the COVID-19 Pandemic: Extended Sample

This table reports estimations from difference-in-difference sales regressions. The dependent variable is the natural logarithm of sales. The sample in columns (1) includes all U.S. firms in either FactSet or COMPUSTAT, except financial firms (SICs 6000- 6999), for the period 2019q1 – 2020q4. The samples in columns (2) and (3) include all EU and Asian firms, respectively, in either FactSet or COMPUSTAT Global, except financial firms (SICs 6000-6999). Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales		
	U.S. Firms	EU Firms	Asian Firms
	(1)	(2)	(3)
Chinese Suppliers ≥ 1 \times 2020q1	-0.035** (0.015)	-0.053** (0.024)	-0.048** (0.021)
Chinese Suppliers ≥ 1 \times 2020q2	-0.022 (0.023)	-0.042 (0.030)	-0.001 (0.021)
Chinese Suppliers ≥ 1 \times 2020q3	0.007 (0.024)	-0.026 (0.026)	0.010 (0.023)
Chinese Suppliers ≥ 1 \times 2020q4	-0.011 (0.021)	0.011 (0.031)	-0.050 (0.037)
Controls	Yes	Yes	Yes
Obs.	22,370	24,608	49,452
R2 (within)	0.002	0.002	0.001
Firm Fixed Effects	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	No	Yes	Yes

Table 12: Sales During the COVID-19 Pandemic: Chinese Import Exposure

This table reports estimations from difference-in-difference sales regressions. The dependent variable is the natural logarithm of sales. The sample includes all U.S. firms in both FactSet and COMPUSTAT with import data available in Panjiva, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. Chinese Imports/Total Imports (kg/ton) is the ratio of Chinese imports to total imports in 2019. We measure imports based on both kg/ton and volume/TEU. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Imports data is from the S&P Global Panjiva Supply Chain Intelligence Database. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable: Imports' Measure	Log of Sales	
	(kg/ton)	(TEU)
	(1)	(2)
Chinese Imports/Total Imports × 2020q1	-0.039** (0.017)	-0.037** (0.013)
Chinese Imports/Total Imports × 2020q2	0.013 (0.015)	0.018 (0.016)
Chinese Imports/Total Imports × 2020q3	0.011 (0.014)	0.021 (0.013)
Chinese Imports/Total Imports × 2020q4	0.021 (0.014)	0.020 (0.014)
Controls	Yes	Yes
Obs.	14,275	14,234
R2 (within)	0.011	0.012
Firm Fixed Effects	Yes	Yes
Industry×Quarter-Year Fixed Effects	Yes	Yes

Table 13: Sales, Debt and Cash During the COVID-19 Pandemic: Overall Global Sample

This table reports estimations from several difference-in-difference regressions. The dependent variables are the natural logarithm of sales (COMPUSTAT item saleq), column (1), the ratio of change in total debt to lagged assets (COMPUSTAT item dlttp+dlcq/atq), column (2), the ratio of change in long-term debt to lagged assets (COMPUSTAT item dlttp), column (3), the ratio of change in short-term debt to lagged assets (COMPUSTAT item dlcq), column (4), the ratio of cash to assets (COMPUSTAT item cheq), column (5), and the ratio of capital expenditures to lagged assets (COMPUSTAT item capxy), column (6). The sample includes all firms in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier on December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT Global. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:	Log of Sales	Δ Total Debt	Δ Long-Term Debt	Δ Short-Term Debt	Cash	Capital Expenditures
	(1)	(2)	(3)	(4)	(5)	(6)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.030** (0.012)	0.003* (0.002)	0.001 (0.002)	0.003 (0.002)	-0.002** (0.001)	0.001 (0.001)
Chinese Suppliers $\geq 1 \times 2020q2$	-0.017 (0.014)	-0.000 (0.002)	0.003** (0.001)	-0.002 (0.002)	-0.001 (0.002)	-0.002* (0.001)
Chinese Suppliers $\geq 1 \times 2020q3$	-0.009 (0.014)	0.004** (0.002)	0.002 (0.002)	0.002 (0.001)	-0.001 (0.002)	-0.001 (0.001)
Chinese Suppliers $\geq 1 \times 2020q4$	-0.014 (0.015)	0.004* (0.002)	0.003 (0.002)	0.001 (0.001)	0.002 (0.003)	0.001 (0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	56,877	48,077	49,645	52,189	58,926	54,300
R2 (within)	0.001	0.003	0.001	0.001	0.001	0.002
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 14: Wealth Effects During the COVID-19 Pandemic

This table presents estimations from cross-sectional Buy-and-Hold Abnormal Return (BHAR) regressions. The dependent variables in Panel A, columns (1) – (3) and columns (4) – (6), are the stock VW C-4 BHARs and the market-adjusted bond BHARs, respectively. The sample in Panel A includes all U.S. firms in FactSet, COMPUSTAT North America, and CRSP. Bond returns for U.S. firms are from TRACE and Mergent FISD. The dependent variables in Panel B, columns (1) – (6) are the stock VW C-4 BHARs. The samples in Panel B includes all EU and Asian firms in FactSet, COMPUSTAT Global, and COMPUSTAT Global Security Daily, respectively. We calculate BHARs over the following daily event windows: [0,+30]; [0, +61 (March 31)]; [0, +252 (Dec. 31)], where day 0 is January 2, 2020. VW C-4 BHARs are estimated using the Carhart 4-factor (Carhart, 1997), and the market portfolio proxied by the NYSE-AMEX-NASDAQ value-weighted index returns. Market-adjusted bond BHARs are estimated using a value-weighted return of all bonds as a proxy for the bond market. Chinese Suppliers ≥ 1 (Customers ≥ 1) is an indicator for U.S. (EU, Asian) firms with at least one Chinese supplier (customer) on December 31, 2019. As control variables we include the natural logarithm of pre-event book assets. We exclude financial firms (SICs 6000-6999). Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the industry level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Panel A: U.S. Firms						
Dep. Variable:	Value-Weighted			Market-adjusted		
	4-Factor Stock BHARs			Bond BHARs		
	(1)	(2)	(3)	(4)	(5)	(6)
	[0,+30]	[0,+61]	[0,+252]	[0,+30]	[0,+61]	[0,+252]
Chinese Suppliers ≥ 1	-0.032**	-0.028**	-0.029**	-0.004**	-0.010**	-0.012**
	(0.014)	(0.013)	(0.014)	(0.002)	(0.004)	(0.006)
Chinese Customers ≥ 1	-0.016	-0.028	-0.077	0.001	0.003	0.014
	(0.019)	(0.043)	(0.101)	(0.003)	(0.013)	(0.017)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,793	1,790	1,719	2,908	2,760	2,340
Adjusted-R2	0.041	0.093	0.029	0.036	0.053	0.006
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: EU and Asian Firms						
Dep. Variable:	EU Firms			Asian Firms		
	Value-Weighted			Value-Weighted		
	4-Factor Stock BHARs			4-Factor Stock BHARs		
	(1)	(2)	(3)	(4)	(5)	(6)
	[0,+30]	[0,+61]	[0,+252]	[0,+30]	[0,+61]	[0,+252]
Chinese Suppliers ≥ 1	-0.033**	-0.027**	-0.026**	-0.024**	-0.029**	-0.030**
	(0.017)	(0.012)	(0.012)	(0.011)	(0.014)	(0.015)
Chinese Customers ≥ 1	0.014	-0.007	-0.017	-0.011	-0.018	0.027
	(0.026)	(0.017)	(0.050)	(0.010)	(0.021)	(0.026)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,292	1,291	1,264	2,206	2,205	2,196
Adjusted-R2	0.063	0.123	0.121	0.049	0.038	0.080
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Figure 1: China Industrial Production Index

This figure plots China Industrial Production Index (excl. construction) for the periods from Jan./Feb. 2018 to Dec. 2018, dark blue bars, from Jan./Feb. 2019 to Dec. 2019, light blue bars, and from Jan./Feb. 2020 to Dec. 2020, red-stripped bars. Index for the same month in the previous year is normalized to 100. Data is from the OECD.

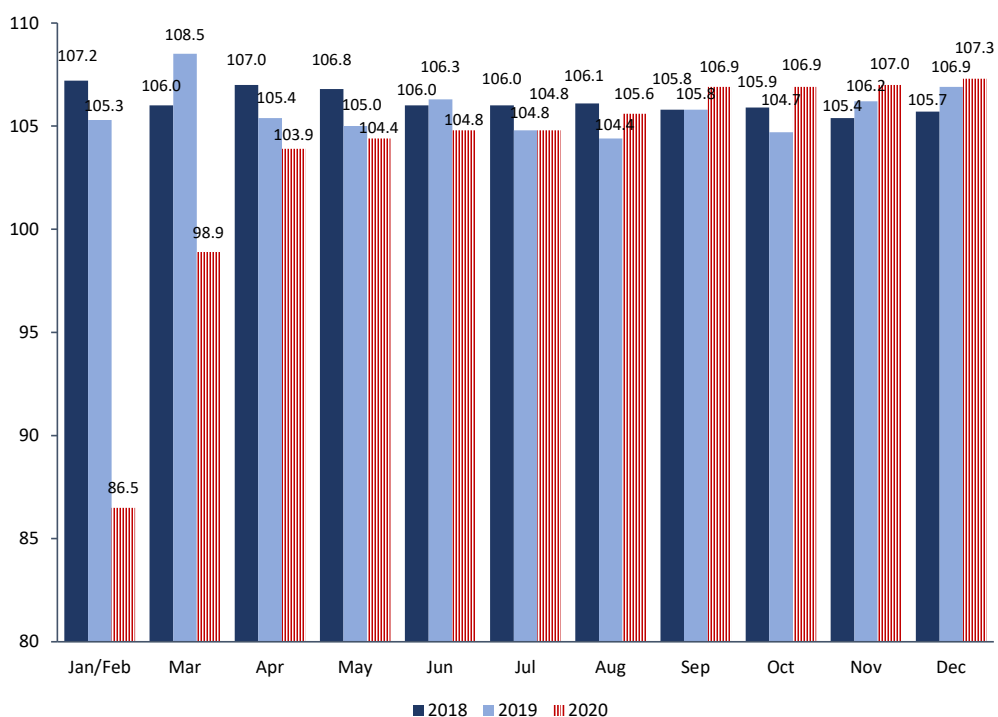


Figure 2: U.S., EU, and Asia Monthly Trade Activities with China

This figure plots U.S., EU, and Asia monthly imports (exports) from China, Panels A - C (Panels D - F), respectively, for the periods from Jan. 2018 to Dec. 2018, dark blue bars, from Jan. 2019 to Dec. 2019, light blue bars, and from Jan. 2020 to Dec. 2020, red-stripped bars, in \$ billion. Data is from the U.S. Census Bureau, the Eurostat - European Commission, and several data sources discussed in the text for Asia.

(a)

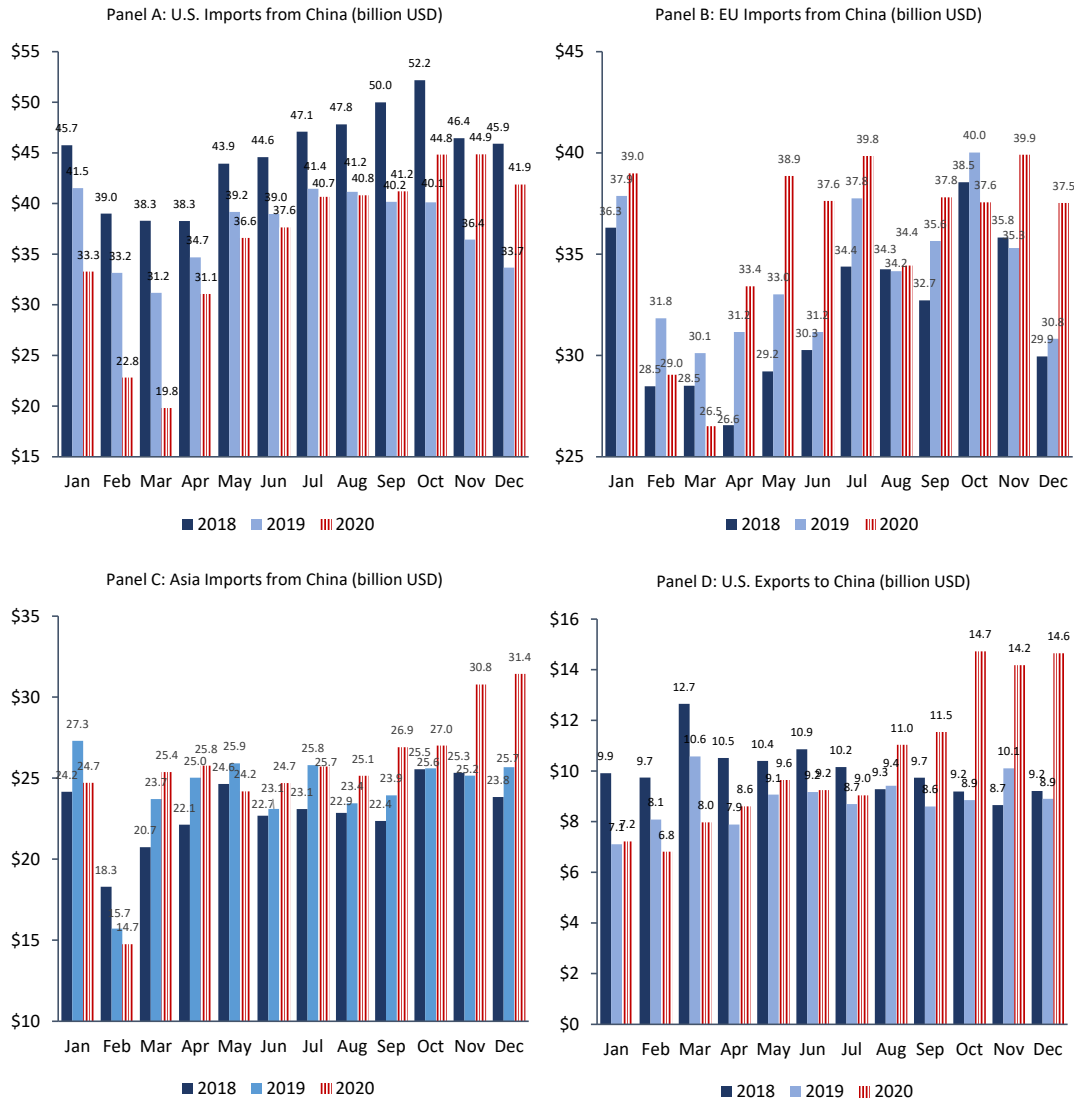


Figure 2: U.S., EU, and Asia Monthly Trade Activities with China (cont.)

(b)

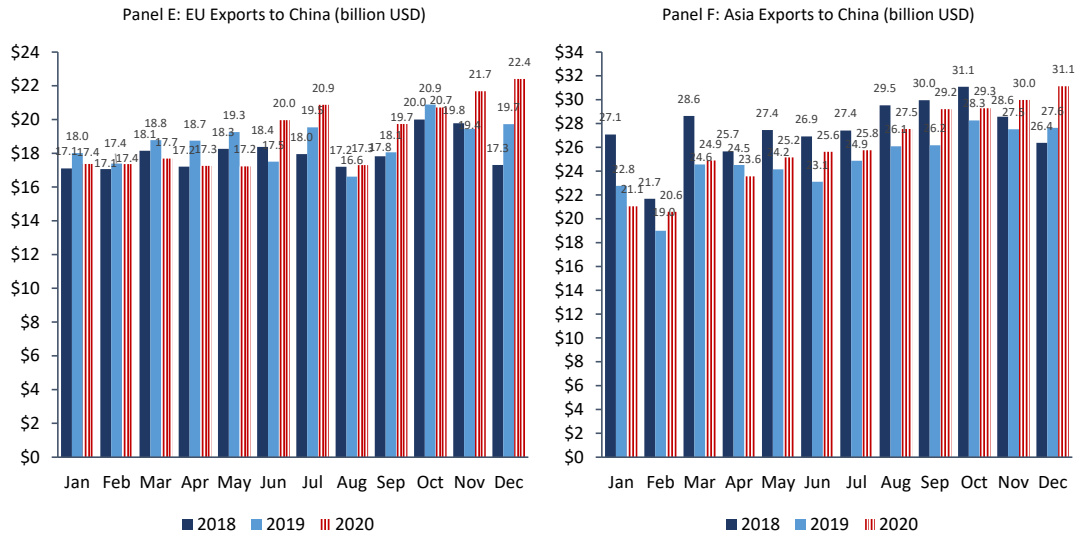


Figure 3: U.S., EU and Asia Monthly Imports from Top Trading Partners Other than China

This figure plots U.S. monthly imports from Mexico, Canada, Japan, and Germany (Panels A - D), EU monthly imports from U.S., Russia, Turkey, and Japan (Panels E - H), and Asia monthly imports from U.S., Japan, Singapore, and India (Panels I - L), respectively, for the periods from Jan. 2018 to Dec. 2018, dark blue bars, from Jan. 2019 to Dec. 2019, light blue bars, and from Jan. 2020 to Dec. 2020, red-stripped bars, in \$ billion. Data is from the U.S. Census Bureau, the Eurostat - European Commission, and several data sources discussed in the text for Asia.

(a)

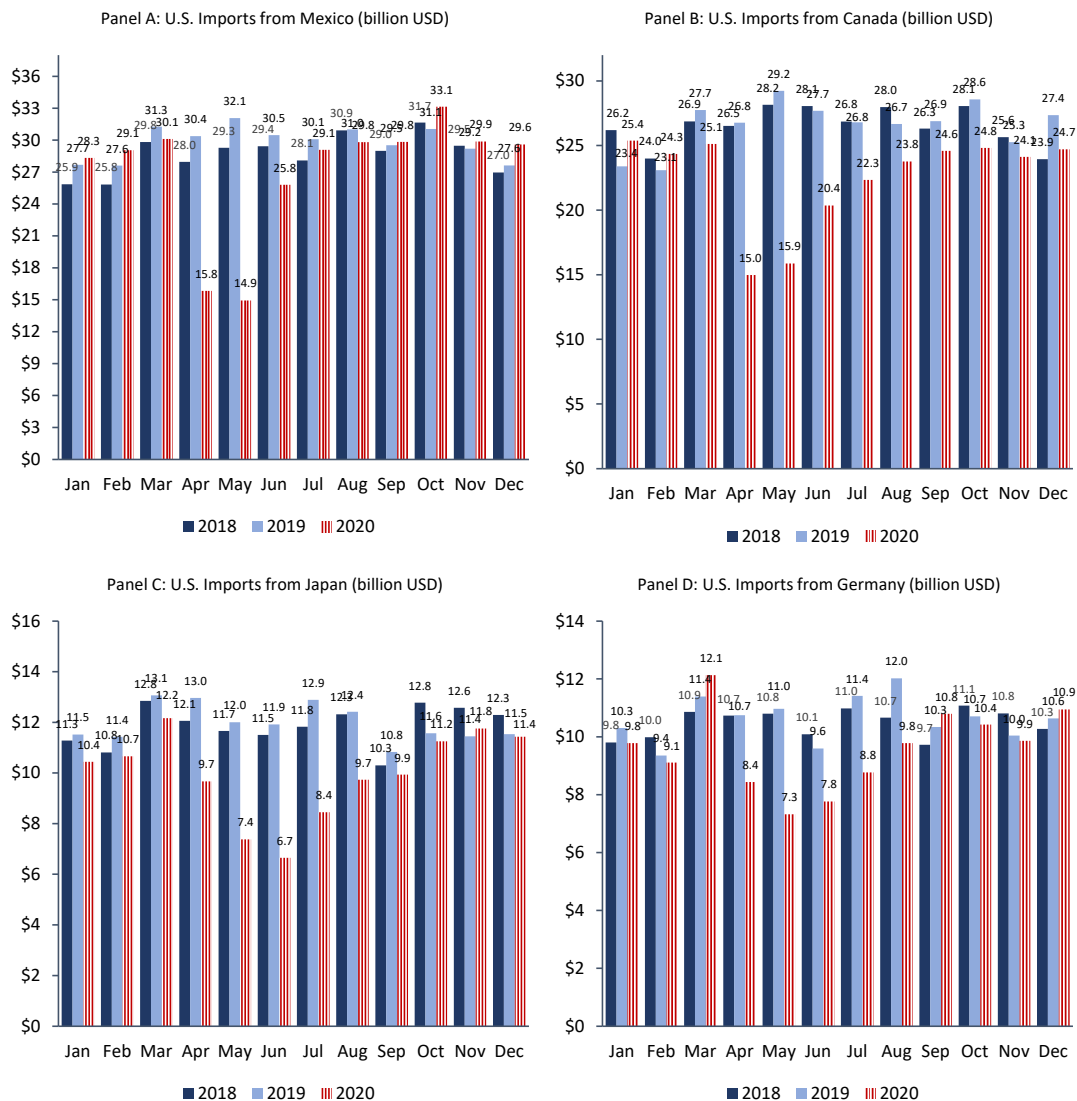


Figure 3: U.S., EU and Asia Monthly Imports from Top Trading Partners Other than China (cont.)

(b)

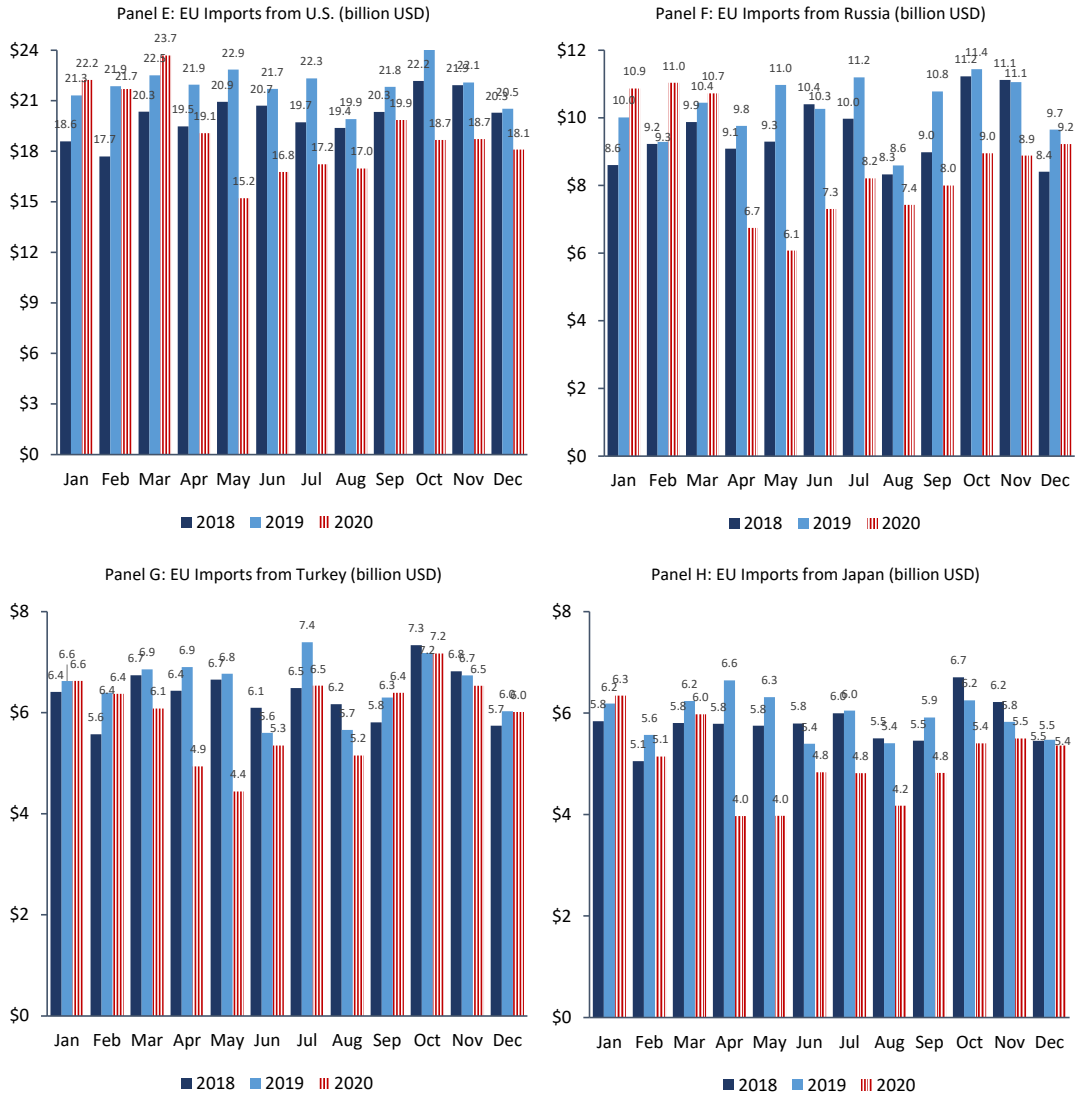


Figure 3: U.S., EU and Asia Monthly Imports from Top Trading Partners Other than China (cont.)

(c)

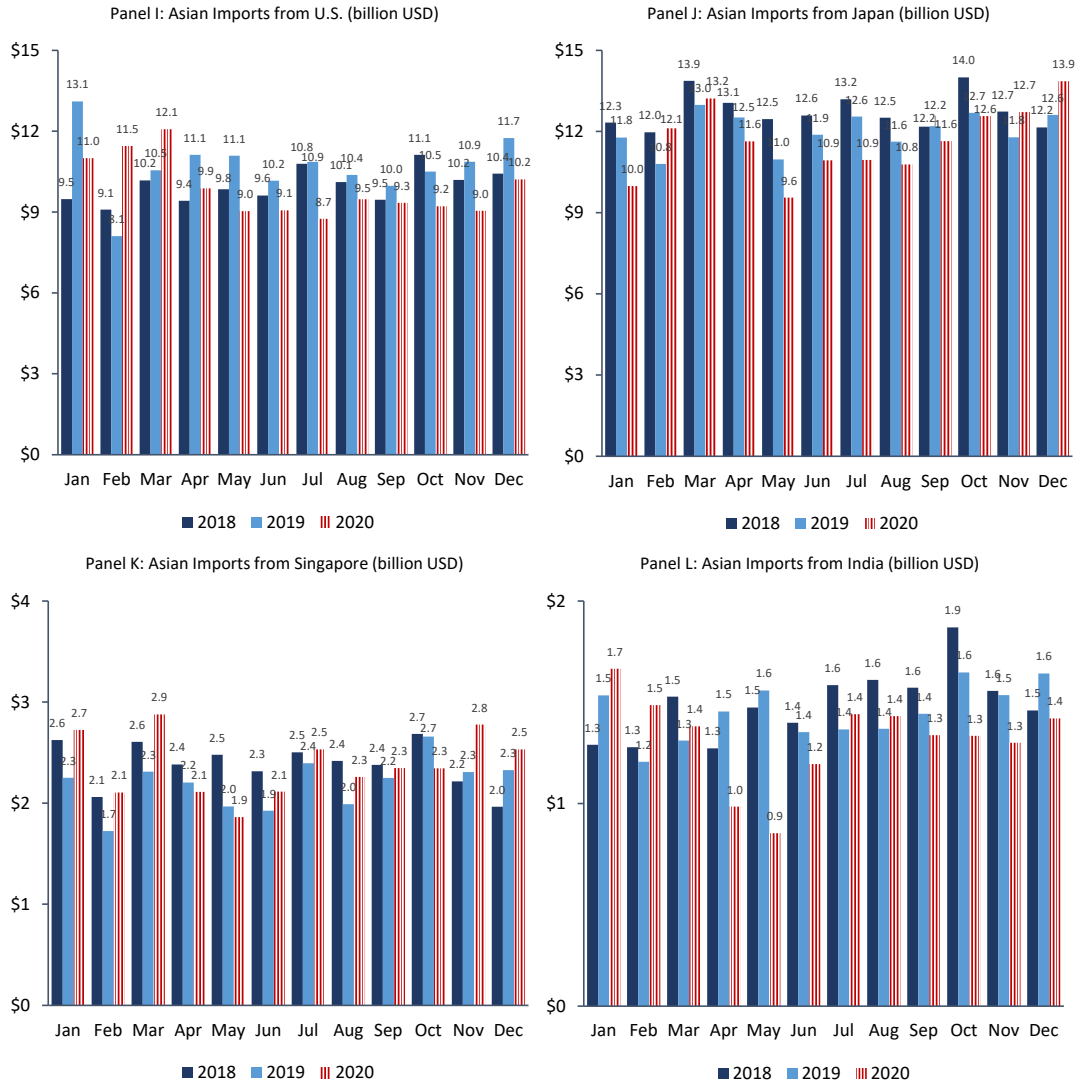


Figure 4: Sales in the Period around the COVID-19 Pandemic: Firms with Chinese Suppliers vs. Firms without Chinese Suppliers

This figure plots the coefficients on the interactions of the Chinese Suppliers ≥ 1 indicator with quarter dummies from sales regressions. Ninety-five percent confidence intervals are also plotted. The dependent variable is the natural logarithm of sales. The estimates in Panels A, B, and C are from Table 6, columns (1) — (3), respectively, for the period 2019q1 – 2020q4, with 2019q1 as the omitted case. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Refer to Table A.1 for detailed variable definitions.

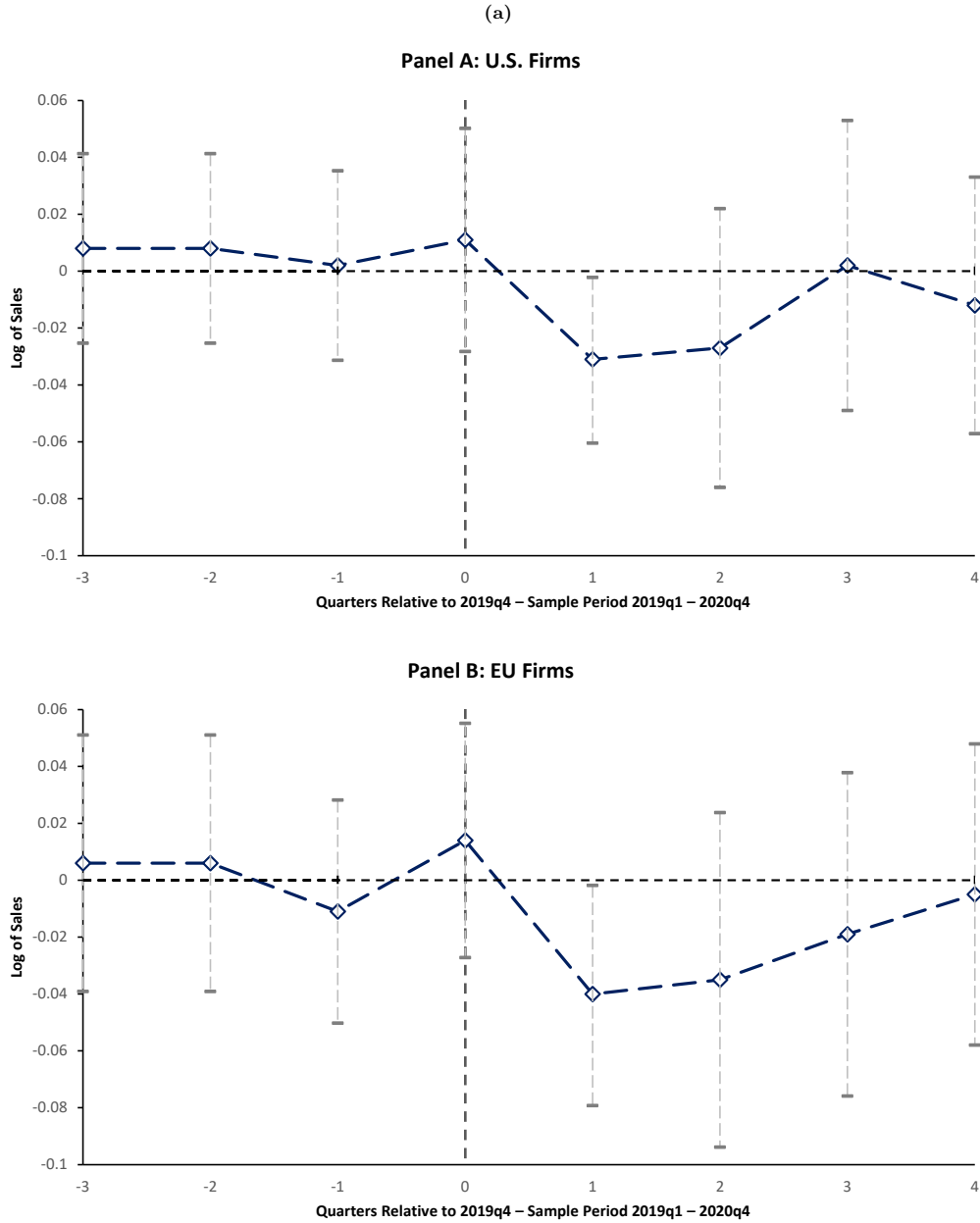


Figure 4: Sales in the Period around the COVID-19 Pandemic: Firms with Chinese Suppliers vs. Firms without Chinese Suppliers (cont.)

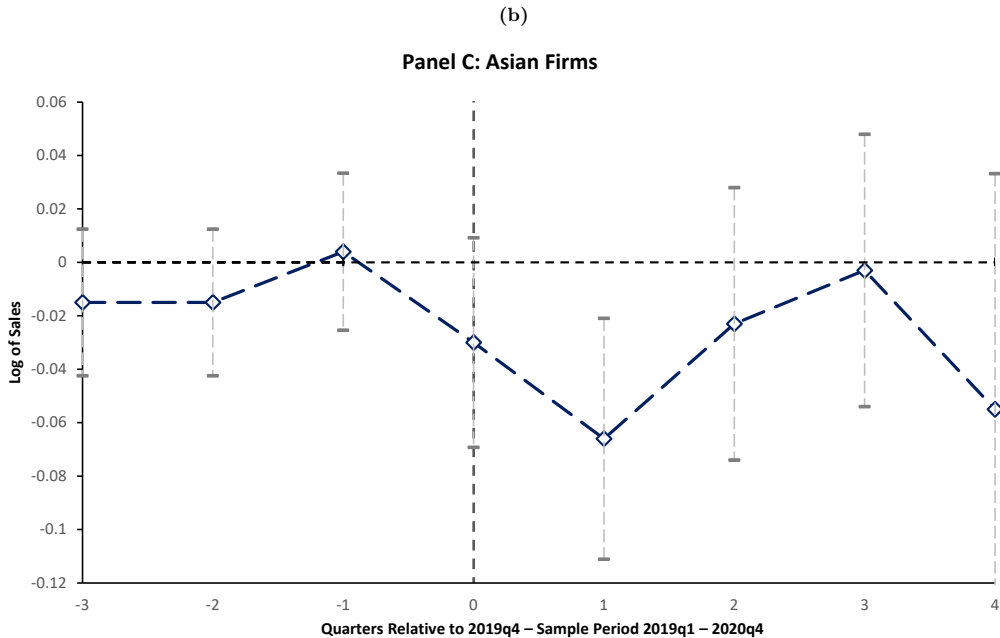


Figure 5: Industry Distribution of U.S., EU, and Asian Firms with and without Chinese Suppliers

This figure plots the industry (2-digit SIC) distribution of U.S. (Panel A), EU (Panel B), and Asian (Panel C) firms with and without Chinese suppliers as a percentage of the total number of firms in each industry group. We identify whether U.S. (EU, Asian) firms have Chinese suppliers on December 31, 2019. Supply chain relationship data is from the FactSet Reverse Supply Chain Relationships database.

(a) Panel A: U.S. Firms

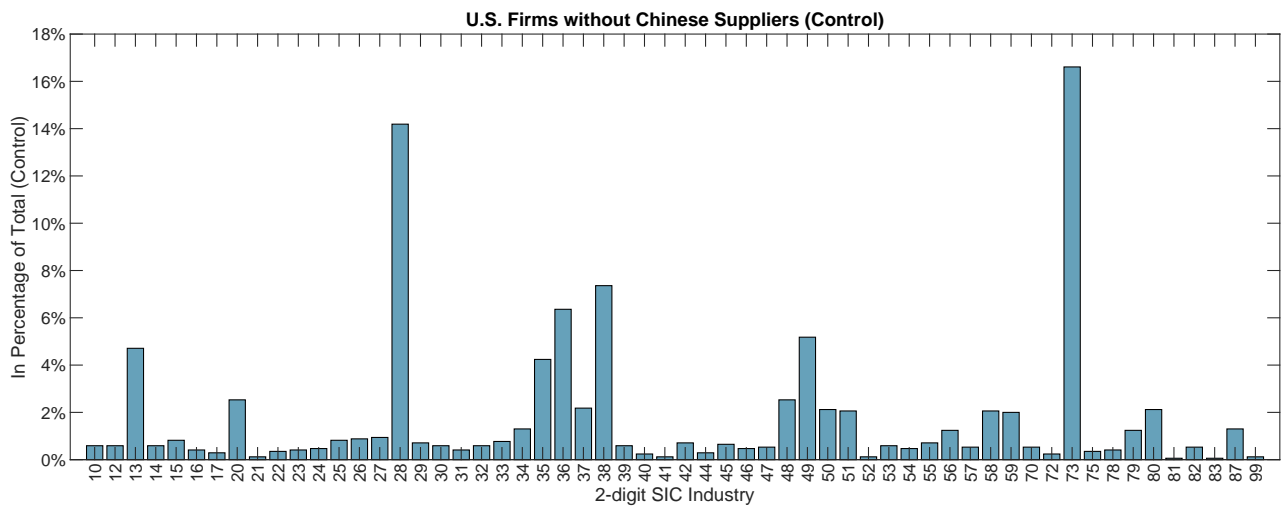
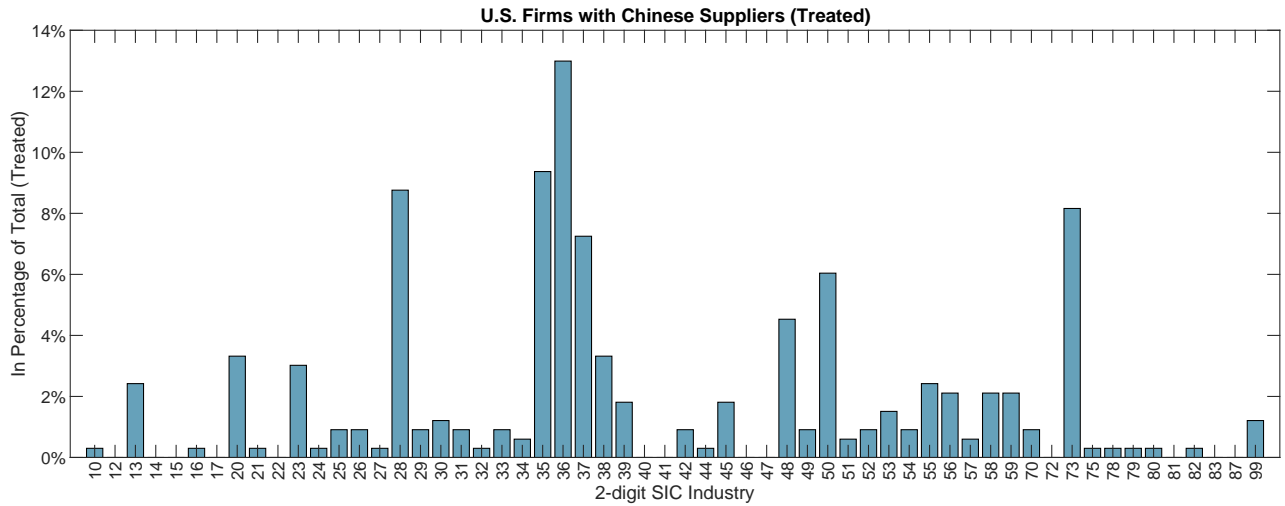


Figure 5: Industry Distribution of U.S., EU, and Asian Firms with and without Chinese Suppliers (cont.)

(b) Panel B: EU Firms

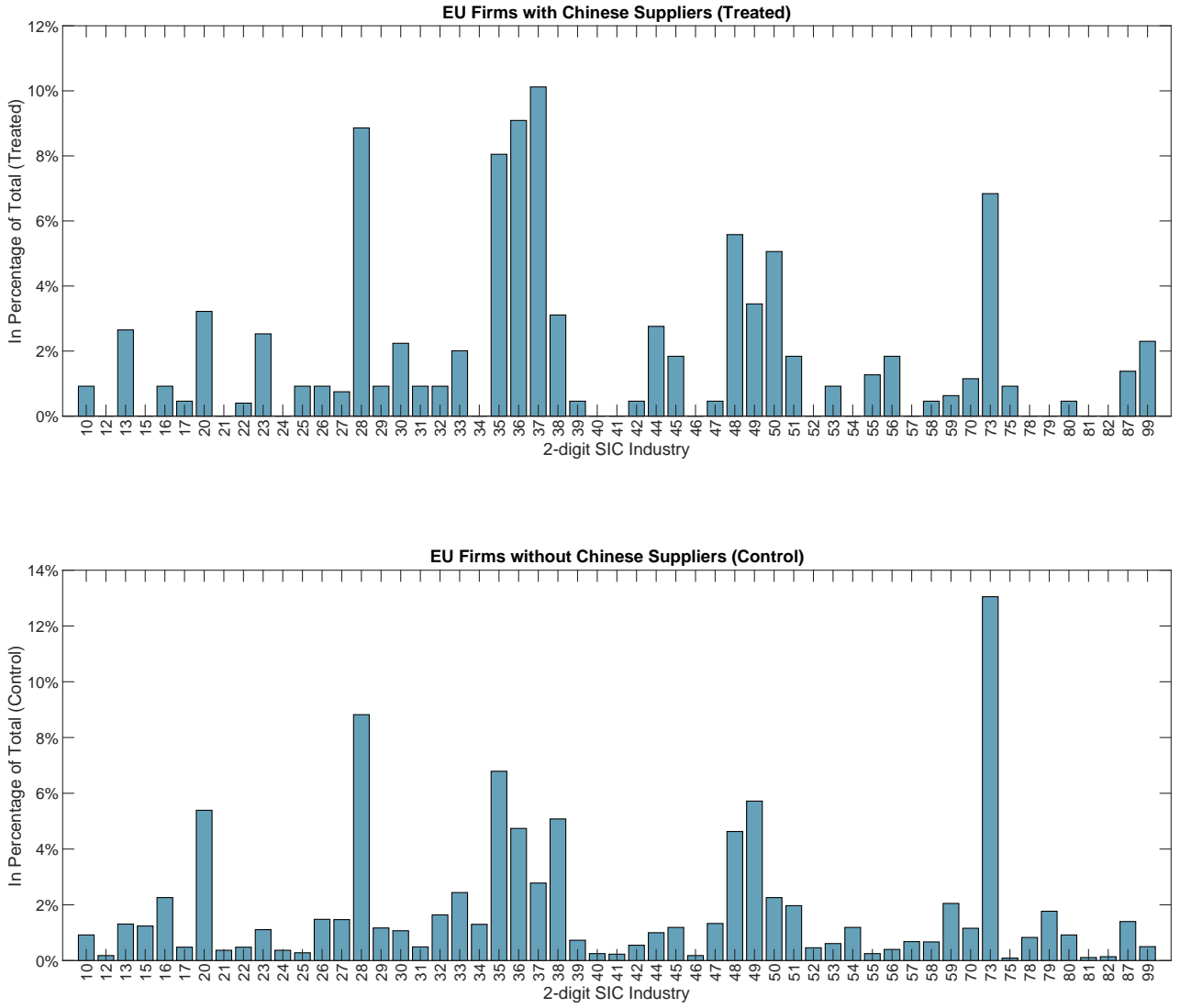


Figure 5: Industry Distribution of U.S., EU, and Asian Firms with and without Chinese Suppliers (cont.)

(c) Panel C: Asian Firms

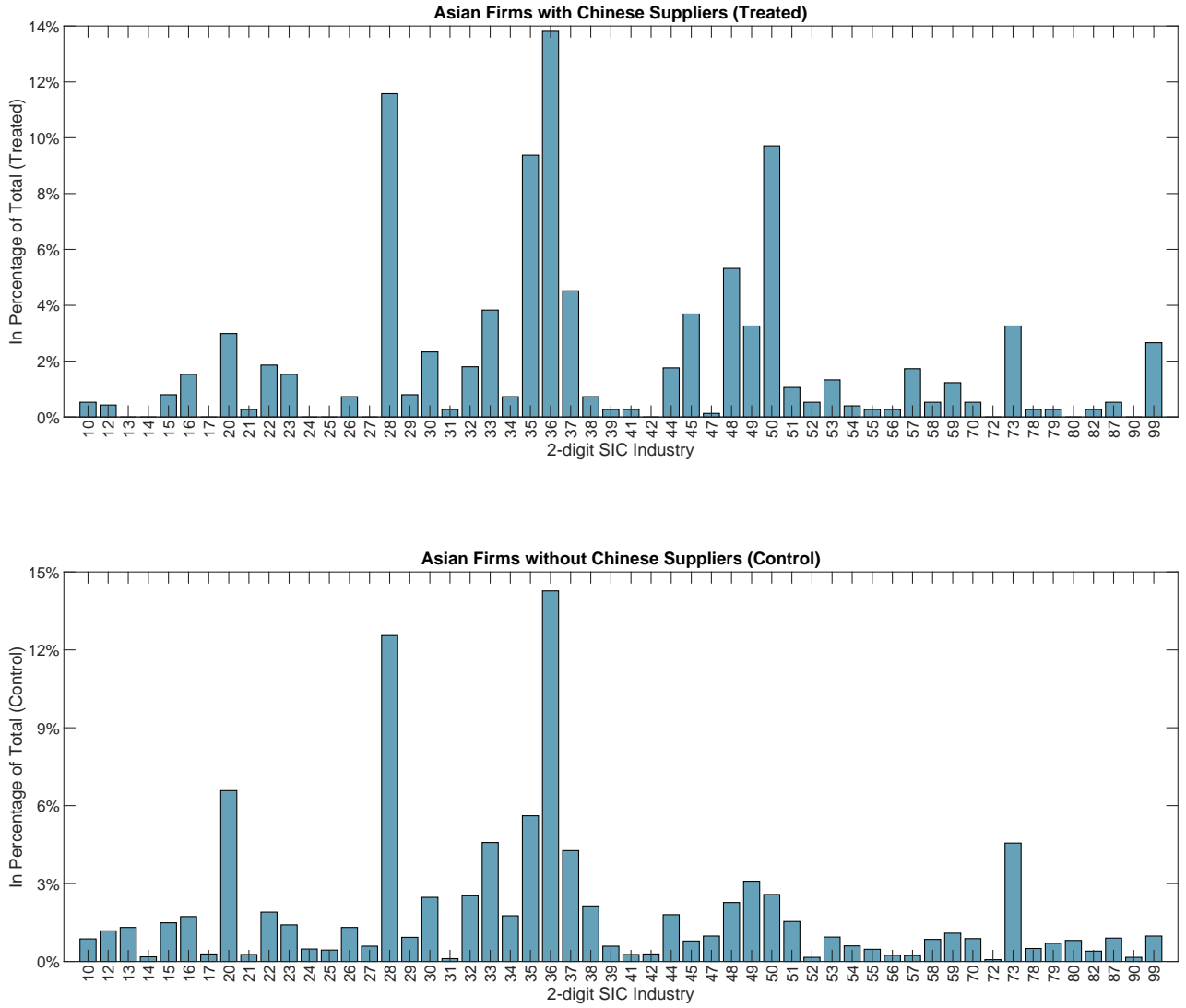
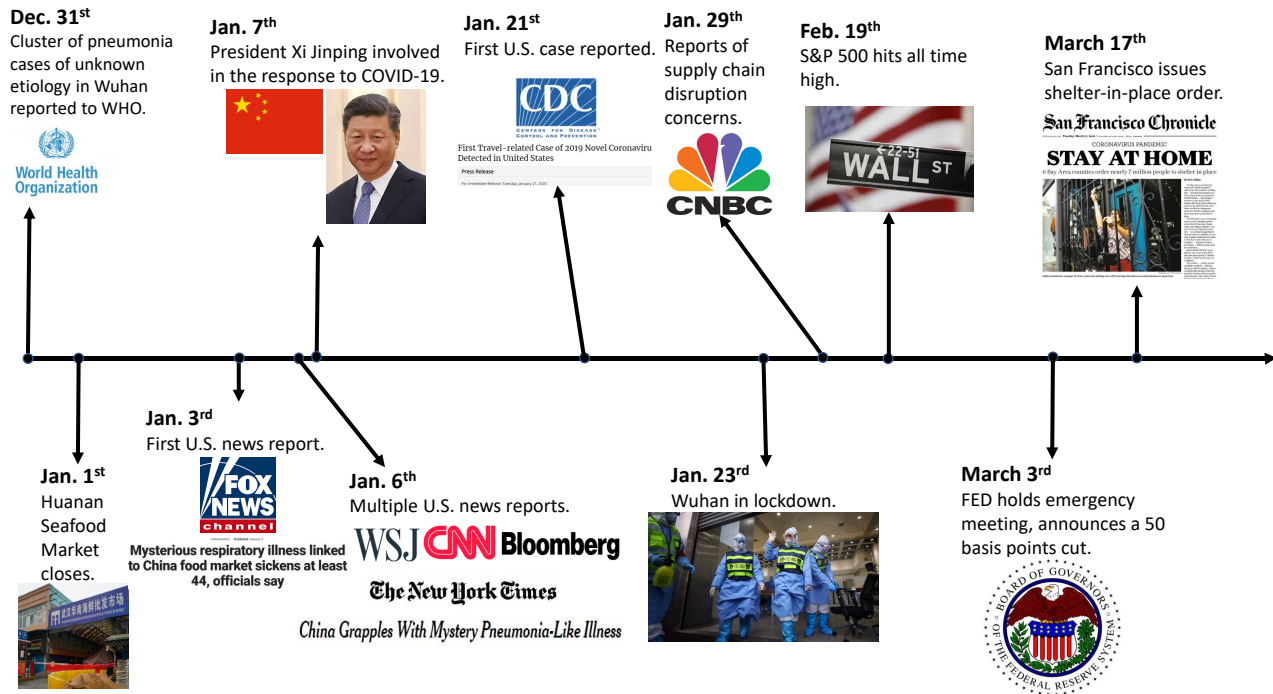


Figure 6: Timeline of the COVID-19 Pandemic

This figure presents a timeline of major events of the COVID-19 pandemic from December 31, 2019 when the first pneumonia cases in Wuhan were reported to the World Health Organization (WHO) until the first U.S. shelter-in-place order was issued in San Francisco on March 17, 2020.



A Appendix

A.1 Trade War

One could be concerned that the decrease in the number of Chinese suppliers for U.S. firm is a consequence of the ongoing trade war between the two countries. To address this concern, we estimate a version of Eq. (1) for the sample period from January 1, 2018 to December 31, 2020. This allows us to assess how the trade war affected the sourcing strategies of U.S. firms from Chinese suppliers in the nearly 26 months that preceded the pandemic outbreak. We consider March 8, 2018, the day when President Trump ordered 25% tariffs on steel imports and 10% tariffs on aluminum imports, as the beginning of the ‘trade war’ between the U.S. and China. Trade tensions started to ease during the weeks that preceded the announcement on December 13, 2019 that new tariffs to be mutually imposed on December 15 would not be implemented, and a follow-up agreement signed on January 15, 2020.

Our sample includes one pre-trade war quarter, the period from January 1, 2018, to March 7, 2018, 2018q1. We also include all quarters after the beginning of the trade war on March 8, 2018, 2018q2, till December 31, 2020, 2020q4. We build indicators for each of these quarters, 2018q1 to 2020q4, with 2018q1 being the omitted case. In these regressions, we consider U.S. firms with Chinese suppliers as of March 7, 2018. Therefore, the coefficients on the quarter indicators measure the percentage change in the number of Chinese suppliers for these firms relative to 2018q1, which we treat as the pre-trade war quarter.

Table A.3 reports results from these estimations. Column 1 shows no change in the number of Chinese suppliers in 2018q2, a 4.7% increase in 2018q3, before the number of suppliers started to decrease in 2019q1 relative to 2018q1. The number of Chinese suppliers decreased further to 5.7% in 2019q2. After 2019q2, the effect of the trade war seems to have leveled off, as suggested by the coefficients of -0.058, statistically significant at the 5% level, for the 2019q3 indicator, and the coefficient of -0.003, statistically insignificant, for the 2019q4 indicator, suggesting that by the end of 2019 U.S. firms had a number of Chinese suppliers equal to the pre-trade war level in 2018q1. This is further confirmed by the evidence in Table A.3, column 2, showing that the changes in the coefficients for the 2019q1 to 2019q4 indicators relative to the coefficients for their respective

previous quarter indicators are all economically very close to zero and statistically insignificant, except for the last one, which is significantly positive.

However, importantly, the coefficient of -0.073 , statistically significant at the 5% level, for the 2020q1 indicator in Table A.3, column 1, suggests that by 2020q1 U.S. firms had lost 7.3% of their Chinese suppliers relative to 2018q1, the pre-trade war quarter. If compared with the coefficient of -0.003 for the 2019q4 indicator, the coefficient of -0.073 for the 2020q1 indicator suggests that, in the first quarter of the COVID-19 pandemic, U.S. firms lost 7% more of their Chinese suppliers than can be explained by the ongoing trade war between the U.S. and China. As Table A.3, column 2 shows the -0.070 change in the coefficient for the 2020q1 indicator relative to the 2019q4 indicator is statistically significant at the 1% level. The coefficient on the 2020q2 indicator suggests that by 2020q2 U.S. firms had lost 12.2% of their Chinese supplies with no further changes after that. Refer also to Figure A.1, Panels A and B, which plot the coefficients on the quarters and difference in quarter indicators from columns 1 and 2, respectively.

[Table A.3]

[Figure A.1]

Table A.1: Variable Definitions

This table provides the definitions of the main variables used in this paper.

Main Firm-Level Variables:	Definition:
Sales	Quarterly sales (COMPUSTAT item saleq). We exclude financial firms (SICs 6000-6999). Firm-level data for the U.S. firms is from COMPUSTAT North America. Firm-level data for the EU and Asian firms are from COMPUSTAT Global.
Chinese Suppliers (Customers) ≥ 1	Indicator for U.S. (EU, Asian) firms with at least one Chinese supplier (customer) on December 31, 2019. Data on suppliers (customers) is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Chinese Imports	U.S. firms import-level transaction weights (kg/ton) and volumes (twenty-foot equivalent unit containers, TEU) from China. Import data is from the S&P Global Panjiva Supply Chain Intelligence database. We exclude financial firms (SICs 6000-6999).
Other Imports	U.S. firms import-level transaction weights (kg/ton) and volumes (twenty-foot equivalent unit containers, TEU) from countries other than China. Import data is from the S&P Global Panjiva Supply Chain Intelligence database. We exclude financial firms (SICs 6000-6999).
Number Chinese Suppliers	Number of Chinese suppliers of U.S. (EU, Asian) firms on December 31, 2019. Data on suppliers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
U.S. Suppliers (Customers) ≥ 1	Indicator for U.S. (Chinese) firms with at least one U.S. supplier (customer) on December 31, 2019. Data on suppliers (customers) is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number U.S. Suppliers	Number of U.S. suppliers of U.S. firms on December 31, 2019. Data on suppliers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number Foreign Suppliers	Number of foreign suppliers (excl. Chinese) of U.S. (EU, Asian) firms on December 31, 2019. Data on suppliers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number Chinese Customers	Number of Chinese customers of U.S. (EU, Asian) firms on December 31, 2019. Data on customers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number U.S. Customers	Number of U.S. customers of U.S. firms on December 31, 2019. Data on customers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number Foreign Customers	Number of foreign customers (excl. Chinese) of U.S. (EU, Asian) firms on December 31, 2019. Data on customers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).

(Table continues on next page.)

Main Firm-Level Variables:	Definition:
Assets	Book assets (COMPUSTAT item atq). We exclude financial firms (SICs 6000-6999). Firm-level data for the U.S. firms are from COMPUSTAT North America. Firm-level data for the EU and Asian firms are from COMPUSTAT Global.
EU Suppliers (Customers) ≥ 1	Indicator for EU (Chinese) firms with at least one EU supplier (customer) on December 31, 2019. Data on suppliers (customers) is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number EU Suppliers	Number of EU suppliers for EU firms on December 31, 2019. Data on suppliers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number EU Customers	Number of EU customers for EU firms on December 31, 2019. Data on customers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Asian Suppliers (Customers) ≥ 1	Indicator for Asian (Chinese) firms with at least one Asian supplier (customer) on December 31, 2019. Data on suppliers (customers) is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number Asian Suppliers	Number of Asian suppliers for Asian firms on December 31, 2019. Data on suppliers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).
Number Asian Customers	Number of Asian customers for Asian firms on December 31, 2019. Data on customers is from the FactSet Revere Supply Chain Relationships database. We exclude financial firms (SICs 6000-6999).

Table A.2: Descriptive Statistics Subsamples

This table reports descriptive statistics for the firms in our sample for the period 2019q1 – 2020q4. The samples in Panels A and B include all U.S. firms in both FactSet and COMPUSTAT, with and without Chinese suppliers on December 31, 2019, respectively. The samples in Panels C and D and E and F include all EU and Asian firms, respectively, in both FactSet and COMPUSTAT Global. We exclude financial firms (SICs 6000-6999). Supply chain relationship data is from the FactSet Reverse Supply Chain Relationships database. Firm-level data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU or Asian firms, respectively. Weight (kg/ton) and volume (TEU) import data is from the S&P Global Panjiva Supply Chain Intelligence database. Refer to Table A.1 for detailed variable definitions.

Panel A: U.S. Firms with Chinese Suppliers						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	5.946	13.592	0.447	1.512	5.012	2,540
Other Imports (kg/ton)	21.627	51.454	1.147	6.000	16.438	104,725
Other Imports (volume/TEU)	1.911	2.851	0.210	1.330	2.000	98,105
Number of Chinese Suppliers	3.484	7.805	1.000	1.000	3.000	2,540
U.S. Suppliers ≥ 1	0.950	0.218	1.000	1.000	1.000	2,540
Number of U.S. Suppliers	24.528	35.514	4.000	12.000	28.000	2,540
Number of Foreign Suppliers	26.157	41.287	4.000	12.000	29.000	2,540
Chinese Customers ≥ 1	0.406	0.491	0.000	0.000	1.000	2,540
Number of Chinese Customers	0.953	2.584	0.000	0.000	1.000	2,540
U.S. Customers ≥ 1	0.850	0.357	1.000	1.000	1.000	2,540
Number of U.S. Customers	14.476	28.956	2.000	6.000	16.000	2,540
Number of Foreign Customers	22.496	50.894	1.000	7.000	22.000	2,540
Assets (Billions \$)	34.571	77.043	2.185	7.359	30.113	2,540
Δ Total Debt/Assets $_{t-1}$	0.016	0.086	-0.009	0.000	0.020	2,456
Δ Long-Term Debt/Assets $_{t-1}$	0.014	0.071	-0.006	0.000	0.015	2,525
Δ Short-Term Debt/Assets $_{t-1}$	0.002	0.050	-0.004	0.000	0.007	2,461
Cash/Assets	0.021	0.025	0.006	0.014	0.027	2,522
Capital Expenditures/Assets $_{t-1}$	0.150	0.153	0.045	0.101	0.200	2,537
Log of R&D	2.015	2.607	0.000	0.000	4.016	2,540

Panel B: U.S. Firms without Chinese Suppliers						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	0.829	2.739	0.058	0.230	0.725	12,849
Other Imports (kg/ton)	10.358	24.717	0.460	3.564	10.658	729,165
Other Imports (volume/TEU)	1.611	3.000	0.100	0.630	2.000	723,222
Number of Chinese Suppliers	0.023	0.199	0.000	0.000	0.000	12,849
U.S. Suppliers ≥ 1	0.881	0.324	1.000	1.000	1.000	12,849
Number of U.S. Suppliers	5.754	8.768	1.000	3.000	7.000	12,849
Number of Foreign Suppliers	3.079	6.114	0.000	1.000	3.000	12,849
Chinese Customers ≥ 1	0.118	0.323	0.000	0.000	0.000	12,849
Number of Chinese Customers	0.096	0.537	0.000	0.000	0.000	12,849
U.S. Customers ≥ 1	0.754	0.431	1.000	1.000	1.000	12,849
Number of U.S. Customers	7.128	14.728	0.000	2.000	8.000	12,849
Number of Foreign Customers	4.965	10.902	0.000	1.000	5.000	12,849
Assets (Billions \$)	5.308	13.462	0.353	1.400	4.381	12,849
Δ Total Debt/Assets $_{t-1}$	0.020	0.108	-0.007	0.000	0.020	12,549
Δ Long-Term Debt/Assets $_{t-1}$	0.015	0.081	-0.006	0.000	0.015	12,819
Δ Short-Term Debt/Assets $_{t-1}$	0.004	0.053	-0.001	0.000	0.004	12,579
Cash/Assets	0.024	0.032	0.006	0.013	0.029	12,857
Capital Expenditures/Assets $_{t-1}$	0.199	0.228	0.033	0.105	0.279	12,690
Log of R&D	1.169	1.645	0.000	0.000	2.458	12,687

(Table continues on next page.)

Panel C: EU Firms with Chinese Suppliers						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	3.870	7.056	0.320	1.311	4.766	1,739
Number of Chinese Suppliers	4.340	10.066	1.000	1.000	3.000	1,739
EU Suppliers ≥ 1	0.948	0.222	1.000	1.000	1.000	1,739
Number of EU Suppliers	13.848	18.522	2.000	7.000	18.000	1,739
Number of Foreign Suppliers	26.413	39.348	4.000	11.000	29.000	1,739
Chinese Customers ≥ 1	0.396	0.489	0.000	0.000	1.000	1,739
Number of Chinese Customers	1.684	3.577	0.000	0.000	2.000	1,739
EU Customers ≥ 1	0.785	0.411	1.000	1.000	1.000	1,739
Number of EU Customers	8.109	12.506	1.000	3.000	11.000	1,739
Number of Foreign Customers	19.097	30.139	1.000	7.000	25.000	1,739
Assets (Billions \$)	27.072	58.545	1.467	7.836	26.455	1,739
Δ Total Debt/Assets $_{t-1}$	0.011	0.052	-0.007	0.000	0.018	1,738
Δ Long-Term Debt/Assets $_{t-1}$	0.010	0.049	-0.004	0.000	0.012	1,725
Δ Short-Term Debt/Assets $_{t-1}$	0.002	0.037	-0.006	0.000	0.009	1,717
Cash/Assets	0.123	0.095	0.057	0.099	0.162	1,789
Capital Expenditures/Assets $_{t-1}$	0.023	0.027	0.007	0.015	0.030	1,739

Panel D: EU Firms without Chinese Suppliers						
	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	0.694	2.255	0.028	0.125	0.482	8,717
Number of Chinese Suppliers	0.023	0.169	0.000	0.000	0.000	8,717
EU Suppliers ≥ 1	0.750	0.433	1.000	1.000	1.000	8,717
Number of EU Suppliers	2.831	4.800	1.000	1.000	3.000	8,717
Number of Foreign Suppliers	3.532	7.293	0.000	1.000	4.000	8,717
Chinese Customers ≥ 1	0.134	0.341	0.000	0.000	0.000	8,717
Number of Chinese Customers	0.238	0.984	0.000	0.000	0.000	8,717
EU Customers ≥ 1	0.601	0.490	0.000	1.000	1.000	8,717
Number of EU Customers	4.579	10.137	0.000	1.000	5.000	8,717
Number of Foreign Customers	5.713	11.540	0.000	1.000	6.000	8,717
Assets (Billions \$)	4.539	16.061	0.170	0.644	2.817	8,717
Δ Total Debt/Assets $_{t-1}$	0.011	0.055	-0.008	0.000	0.017	7,582
Δ Long-Term Debt/Assets $_{t-1}$	0.010	0.053	-0.005	0.000	0.011	8,120
Δ Short-Term Debt/Assets $_{t-1}$	0.002	0.039	-0.004	0.000	0.008	7,785
Cash/Assets	0.138	0.141	0.046	0.095	0.176	8,790
Capital Expenditures/Assets $_{t-1}$	0.023	0.028	0.006	0.014	0.030	7,840

(Table continues on next page.)

Panel E: Asian Firms with Chinese Suppliers

	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	1.497	4.641	0.044	0.188	0.838	3,006
Number of Chinese Suppliers	2.480	6.122	1.000	1.000	2.000	3,006
Asian Suppliers ≥ 1	0.862	0.345	1.000	1.000	1.000	3,006
Number of Asian Suppliers	9.973	18.038	2.000	6.000	12.000	3,006
Number of Foreign Suppliers	10.612	19.911	2.000	5.000	12.000	3,006
Chinese Customers ≥ 1	0.260	0.439	0.000	0.000	1.000	3,006
Number of Chinese Customers	0.620	1.712	0.000	0.000	1.000	3,006
Asian Customers ≥ 1	0.725	0.447	0.000	1.000	1.000	3,006
Number of Asian Customers	4.988	8.600	0.000	2.000	6.000	3,006
Number of Foreign Customers	4.066	11.526	0.000	1.000	4.000	3,006
Assets (Billions \$)	11.226	62.723	0.257	0.827	5.546	3,006
Δ Total Debt/Assets $_{t-1}$	0.005	0.041	-0.012	0.000	0.016	2798
Δ Long-Term Debt/Assets $_{t-1}$	0.004	0.033	-0.005	0.000	0.007	2,822
Δ Short-Term Debt/Assets $_{t-1}$	0.001	0.038	-0.012	0.000	0.013	2,960
Cash/Assets	0.161	0.123	0.071	0.132	0.215	3,088
Capital Expenditures/Assets $_{t-1}$	0.023	0.030	0.004	0.012	0.029	3,012

Panel F: Asian Firms without Chinese Suppliers

	Mean	Std. Dev.	25th Prc.	Median	75th Prc.	Obs.
Sales (Billions \$)	0.236	0.732	0.021	0.059	0.183	14,643
Number of Chinese Suppliers	0.032	0.232	0.000	0.000	0.000	14,643
Asian Suppliers ≥ 1	0.774	0.418	1.000	1.000	1.000	14,643
Number of Asian Suppliers	2.807	3.930	1.000	1.000	3.000	14,643
Number of Foreign Suppliers	2.255	3.821	0.000	1.000	3.000	14,643
Chinese Customers ≥ 1	0.094	0.292	0.000	0.000	0.000	14,643
Number of Chinese Customers	0.171	0.700	0.000	0.000	0.000	14,643
Asian Customers ≥ 1	0.629	0.483	0.000	1.000	1.000	14,643
Number of Asian Customers	3.077	5.294	0.000	1.000	4.000	14,643
Number of Foreign Customers	2.162	5.006	0.000	0.000	2.000	14,643
Assets (Billions \$)	1.491	4.654	0.137	0.344	0.939	14,643
Δ Total Debt/Assets $_{t-1}$	0.005	0.044	-0.011	0.000	0.016	12,997
Δ Long-Term Debt/Assets $_{t-1}$	0.003	0.034	-0.005	0.000	0.006	13,116
Δ Short-Term Debt/Assets $_{t-1}$	0.001	0.041	-0.010	0.000	0.012	13,900
Cash/Assets	0.171	0.145	0.063	0.130	0.238	15,800
Capital Expenditures/Assets $_{t-1}$	0.024	0.032	0.004	0.013	0.031	14,336

Table A.3: Number of Chinese Suppliers Before and During the COVID-19 Pandemic

This table presents estimations from supplier regressions. The sample includes all U.S. firms in both FactSet and COMPUSTAT, with at least one Chinese supplier in FactSet on March 7, 2018, for the period 2018q1 – 2020q4. We exclude financial firms (SICs 6000-6999). The dependent variable is Log of Chinese Suppliers, the natural logarithm of the number of Chinese suppliers. 2018q2 to 2020q4 are quarter dummies. Column (2) reports the differences in coefficients for the quarter dummies between two consecutive quarters. As control variables we include the natural logarithm of book assets. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Dep. Variable:		Log of Chinese Suppliers	
Sample:		U.S. Firms with Chinese Suppliers	
		2018q1–	2020q4
		(1)	(2)
Pre COVID-19	2018q2	0.005 (0.005)	
	2018q3	0.047*** (0.011)	
	2018q4	-0.025 (0.019)	
	2019q1	-0.043** (0.022)	
	2019q2	-0.057** (0.023)	
	2019q3	-0.058** (0.024)	
	2019q4	-0.003 (0.027)	
	2020q1	-0.073** (0.029)	
COVID-19	2020q2	-0.122*** (0.031)	
	2020q3	-0.118*** (0.031)	
	2020q4	-0.117*** (0.033)	
	2018q2–2018q1		0.005 (0.005)
Pre COVID-19	2018q3–2018q2		0.042*** (0.011)
	2018q4–2018q3		-0.072*** (0.015)
	2019q1–2018q4		-0.018 (0.016)
	2019q2–2019q1		-0.014 (0.009)
	2019q3–2019q2		-0.001 (0.019)
	2019q4–2019q3		0.055*** (0.013)
	2020q1–2019q4		-0.070*** (0.016)
	2020q2–2020q1		-0.049*** (0.011)
COVID-19	2020q3–2020q2		0.004 (0.003)
	2020q4–2020q3		0.001 (0.003)
	2020q2–2019q4		-0.119*** (0.019)
	2020q3–2019q4		-0.115*** (0.019)
	2020q4–2019q4		-0.114*** (0.021)
	Controls	Yes	Yes
Obs.	3,292	3,292	
Num. of Firms	289	289	
R2 (within)	0.053	0.053	
Firm Fixed Effects	Yes	Yes	

Table A.4: Sales During the COVID-19 Pandemic for EU and Asian Firms Located in Main Trading Partners of China

This table reports estimations from difference-in-difference sales regressions for EU and Asian firms located in some of the main trading partners of China. The dependent variable is the natural logarithm of sales. The sample includes all firms in both FactSet and COMPUSTAT Global, except financial firms (SICs 6000-6999), for the period 2019q1 – 2020q4. Chinese Suppliers ≥ 1 is an indicator for firms with at least one Chinese supplier as of December 31, 2019. 2020q1 to 2020q4 are quarter dummies. As control variables we include the natural logarithm of pre-event book assets interacted with quarter-year fixed effects. Supply chain relationship data is from the FactSet Revere Supply Chain Relationships database. Other firm-level data is from COMPUSTAT Global. Refer to Table A.1 for detailed variable definitions. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tailed) test levels, respectively.

Panel A: EU Firms					
Dep. Variable:	Log of Sales				
Sample:	German Firms	Dutch Firms	Italian Firms	French Firms	Spanish Firms
	(1)	(2)	(3)	(4)	(5)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.047** (0.023)	-0.144** (0.072)	-0.116** (0.054)	-0.062* (0.034)	-0.032* (0.017)
Chinese Suppliers $\geq 1 \times 2020q2$	0.086 (0.090)	-0.063 (0.117)	0.109 (0.077)	-0.034 (0.050)	-0.072 (0.099)
Chinese Suppliers $\geq 1 \times 2020q3$	0.045 (0.061)	0.008 (0.085)	-0.005 (0.072)	-0.033 (0.047)	0.119 (0.124)
Chinese Suppliers $\geq 1 \times 2020q4$	-0.003 (0.053)	-0.058 (0.125)	0.093 (0.102)	-0.023 (0.064)	0.242 (0.161)
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	1,415	410	751	1,448	414
R2 (within)	0.013	0.027	0.023	0.005	0.047
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Panel B: Asian Firms					
Dep. Variable:	Log of Sales				
Sample:	Hong Kong Firms	Taiwan Firms	South Korea Firms	Thailand Firms	Indonesia Firms
	(1)	(2)	(3)	(4)	(5)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.052** (0.021)	-0.049*** (0.016)	-0.034* (0.020)	-0.180** (0.087)	-0.114** (0.051)
Chinese Suppliers $\geq 1 \times 2020q2$	-0.015 (0.023)	-0.005 (0.021)	0.004 (0.029)	-0.071 (0.069)	-0.047 (0.037)
Chinese Suppliers $\geq 1 \times 2020q3$	0.080 (0.044)	0.025 (0.027)	0.020 (0.031)	-0.038 (0.052)	-0.076 (0.079)
Chinese Suppliers $\geq 1 \times 2020q4$	0.048 (0.042)	-0.009 (0.030)	0.007 (0.030)	-0.028 (0.081)	0.041 (0.070)
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	445	4,259	6,049	1,930	1,388
R2 (within)	0.058	0.005	0.004	0.009	0.014
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry \times Quarter-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Figure A.1: Number of Chinese Suppliers Before and During the COVID-19 Pandemic

This figure (Panel A) plots the coefficient estimates (%) from the supplier regressions in Table A.3, columns (1) – (2), respectively. Panel B reports the differences in coefficients in percentage for the quarter dummies between two consecutive quarters. The sample includes all U.S. firms in FactSet with at least one Chinese supplier on March 7, 2018, for the period 2018q1 – 2020q4. We exclude financial firms (SICs 6000-6999). Supply chain relationship data is from the FactSet Reverse Supply Chain Relationships database. Other firm-level data is from COMPUSTAT North America. Refer to Table A.1 for detailed variable definitions. 95% confidence interval bands are based on standard errors clustered at the firm level.

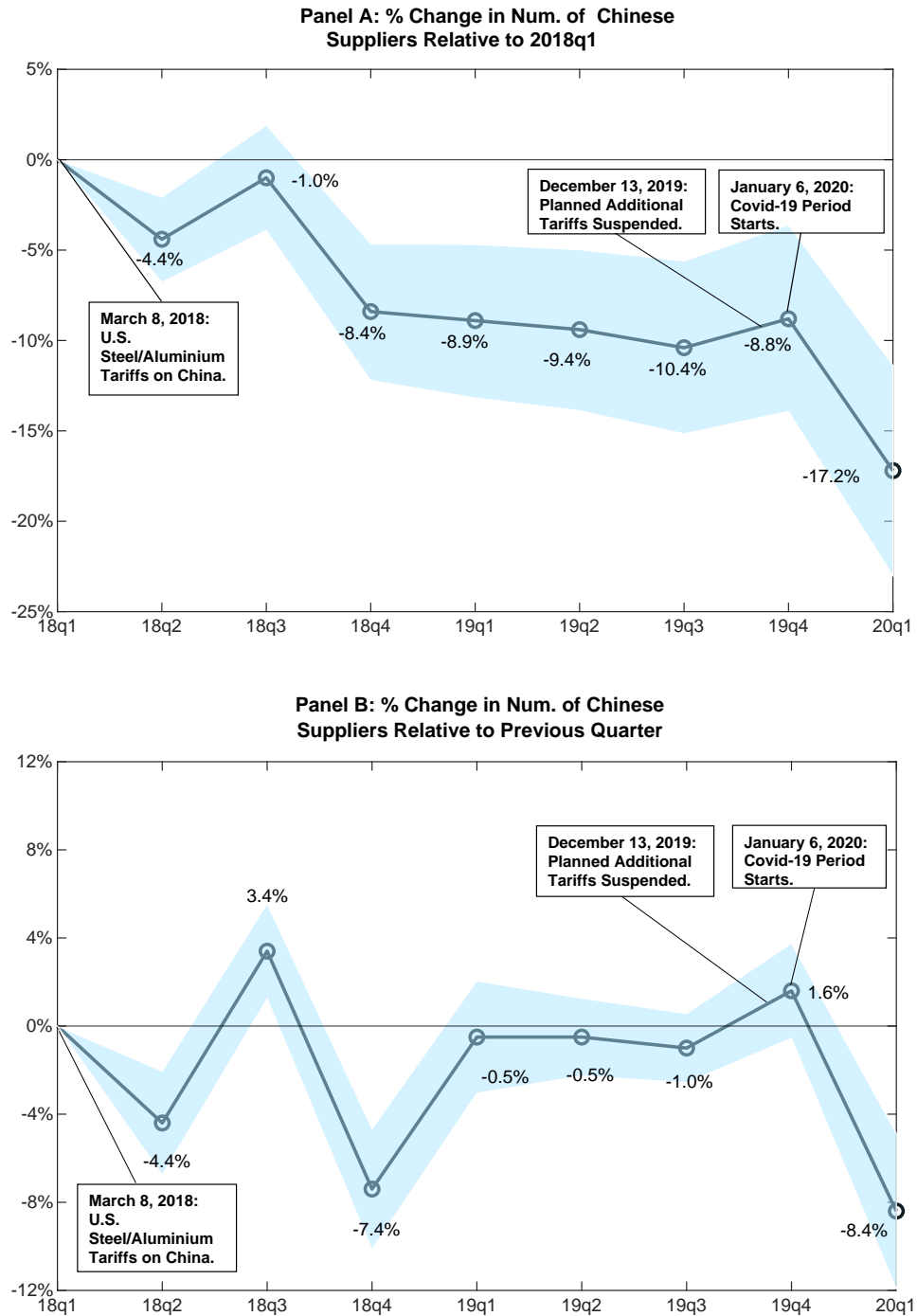
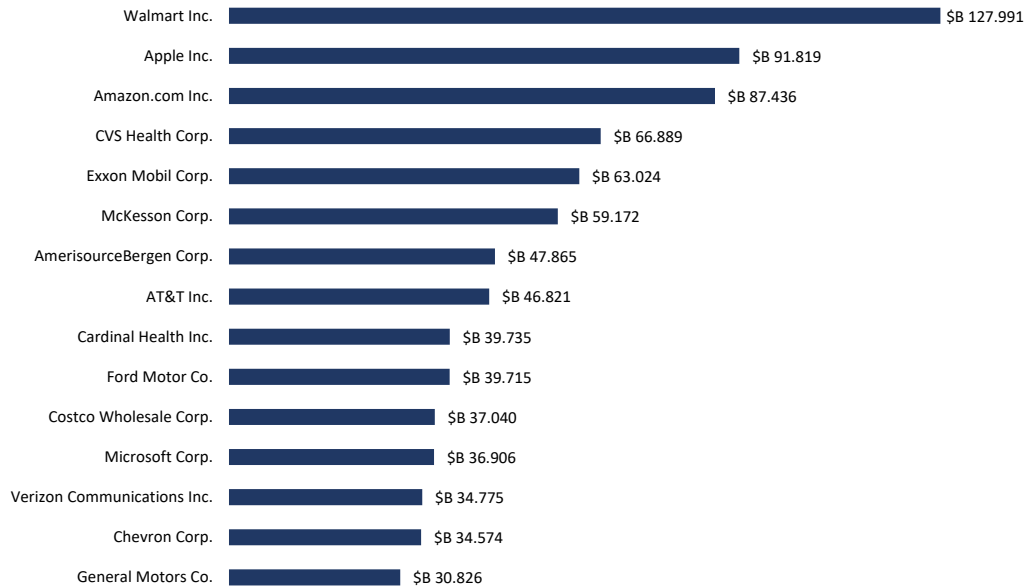


Figure A.2: Largest U.S., EU, and Asian Firms with Chinese Suppliers

This graph presents the top 15 U.S. (Panel A), EU (Panel B), and Asian (Panel C) firms by 2019q4 sales, respectively, with at least one Chinese supplier on December 31, 2019. Supply chain relationship data is from FactSet Revere Supply Chain Relationships. Sales data is from COMPUSTAT North America for U.S. firms and COMPUSTAT Global for EU and Asian firms, respectively. Refer to Table A.1 for detailed variable definitions.

(a)

Panel A: Top 15 U.S. Firms with Chinese Suppliers by Sales in 2019q4



Panel B: Top 15 EU Firms with Chinese Suppliers by Sales in 2019q4

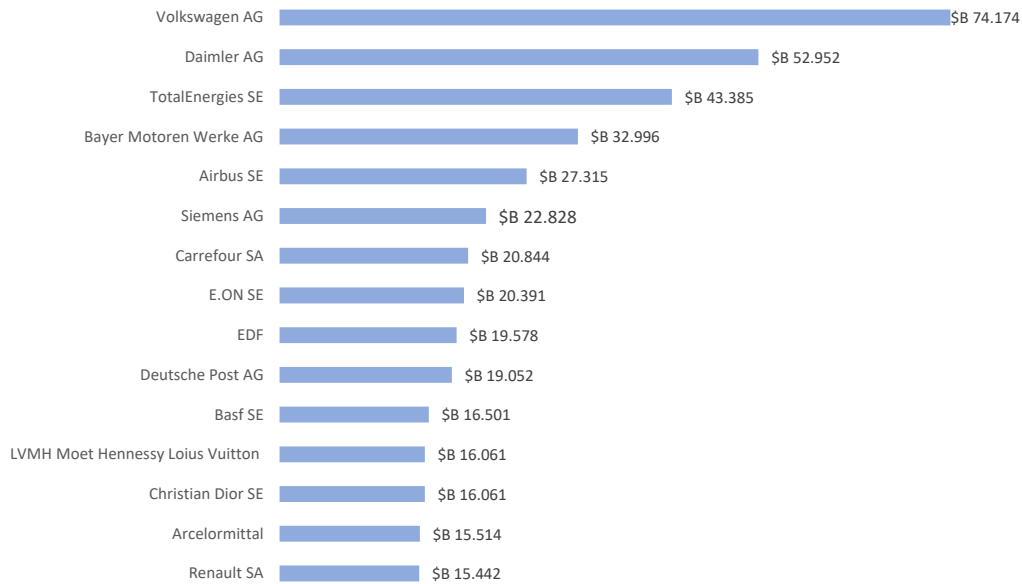


Figure A.2: Largest Firms with Chinese Suppliers (cont.)

(b)

Panel C: Top 15 Asian Firms with Chinese Suppliers by Sales in 2019q4

