Geopolitical Risk and Decoupling: Evidence from U.S. Export Controls*

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Abstract

Amid the current U.S.-China technological race, the U.S. has imposed export controls to deny China access to strategic technologies. We document that these measures prompted a broad-based decoupling of U.S. and Chinese supply chains. Once their Chinese customers are subject to export controls, U.S. suppliers are more likely to terminate relations with Chinese customers, including those not targeted by export controls. However, we find no evidence of reshoring or friend-shoring. As a result of these disruptions, affected suppliers experience negative abnormal stock returns, wiping out $130 billion in market capitalization, as well as a drop in profitability and employment.

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1 Introduction

In the midst of the current geopolitical race for technological leadership, the U.S. is using export controls to deny rival countries access to domestic cutting-edge technologies. However, these controls could also impose collateral damage to the domestic firms that produce and export such technologies. With many commentators and policymakers pointing at an inevitable decoupling between the U.S. and China, it is important to understand the costs and benefits of the strategies currently used in this geopolitical race. While export controls may seem useful because they deny cutting-edge technologies to rival countries, they do so by forbidding domestic firms from exporting to selected foreign entities. Therefore, export controls may potentially inflict collateral damage on the same domestic firms that are creating valuable domestic technologies.

In an effort to stop the transfer of cutting-edge technologies to China, the Bureau of Industry and Security (BIS) under the Department of Commerce forbids U.S. companies from exporting goods and services to a list of Chinese firms deemed to be a risk to U.S. national security and foreign policy interests. Most of these Chinese targets included in the BIS export control lists are involved in strategic sectors, such as semiconductors, telecommunications, aviation, artificial intelligence, and military technologies.

In this paper, we study the supply chain reconfiguration and associated financial and real effects following the imposition of export controls by the U.S. government. We focus on the effects on the U.S. firms that supply goods and services to the Chinese targets i.e., the affected suppliers. We find that export controls prompt a broad-based decoupling from Chinese firms.

Specifically, following the inclusion of Chinese targets in the BIS lists, affected suppliers are more likely to terminate relations with Chinese customers—both those that are directly targeted by export controls and those that are not. Moreover, affected suppliers are also less likely to form new relations with other Chinese customers. This broad-based decoupling from China is consistent with concerns by affected U.S. suppliers that other Chinese firms may either re-export their sensitive technology to the targeted Chinese firms—a violation of export controls—or may be added to the BIS export control lists.

Despite export controls achieving their main purpose of terminating transfers of U.S. goods and technology to Chinese targets, we do not observe new supply chain relations formed by U.S. firms with alternative customers located outside of China, nor specifically with domestic ones. In other words, we do not find any evidence of friend-shoring nor reshoring following export controls. The inability of affected suppliers to quickly find alternative customers may therefore harm the very same affected suppliers whose technology U.S. export controls are trying to protect.

We indeed find that affected U.S. suppliers experience negative cumulative abnormal returns (CAR) once the targets are added to the BIS export control lists. This negative stock market reaction occurs immediately after the export control announcement and is economically significant, representing a 2.5% abnormal decline in stock prices. Our estimates suggest that export controls cost the average affected U.S. supplier $857 million in lost market capitalization, with total losses across all the suppliers of $130 billion. The expected benefits of export controls ought to be carefully weighed against the costs we estimate.

Finally, we also find that the affected suppliers experience negative real outcomes

following the export controls. Relative to similar firms, affected suppliers display a decline in profitability and operating income, which represents real collateral damage from export controls. In addition, we estimate a significant decline in employment among the affected U.S. suppliers, while the effect on capital expenditures is not statistically significant. The last result is consistent with export controls do not considerably changing the long-term investment opportunities of firms, but with the decline in profitability requiring a cut to some parts of the labor force.

Our results are unlikely to be driven by the 2018-2019 trade war between the U.S. and China that saw a few waves of U.S. tariffs on Chinese imports followed by Chinese retaliatory tariffs on U.S. exports. While those tariffs were broad-based and not targeting specific companies (Fajgelbaum et al., 2020; Amiti, Redding and Weinstein, 2019), our estimates rely on the identification of U.S. companies that are not allowed to export to *specific* Chinese entities. The use of granular fixed effects allows us to exploit variation within industry, size quartile among firms that export to China, and are thus unlikely to be affected by broad-based tariffs. Similarly, our results also unlikely to be driven by the August 2022 CHIPS Act which provided subsidies to chip makers with operations in the U.S. and the August 2023 executive order which limited U.S. investments to China in some sensitive sectors. Indeed, these policies apply to a broad set of firms and not just to our set of affected suppliers.

The use of economic linkages and dependencies as a weapon has many historical precedents, including Britain and France imposing blockades on Germany during World War I and Germany retaliating by endangering transatlantic commerce with the use of U-boats (Mulder, 2022). Another example is the U.S. embargo on Cuba. President Eisenhower cut

off U.S. exports to Cuba, except for medicine and some foods, in October 1960, after Fidel Castro's nationalization of hundreds of businesses, including several local subsidiaries of U.S. corporations. The embargo was made permanent by President Kennedy in 1962.

Even though we have many precedents for the use of economic linkages as weapons in geopolitical conflicts, we still lack a clear framework to assess the desirability of economic tools and interventions such as export controls. If national security is a public good and the transfer of technology to rival countries is an externality, economic theory suggests that firms should internalize such externality. In this case, export controls may seem desirable. However, they impose collateral damage on the very same domestic firms that produce cutting-edge technologies. Alternatively, if the government is using export controls to retaliate against the theft of intellectual property by foreign actors or to slow down foreign technological progress, imposing collateral damage on its own domestic firms also appears sub-optimal. Under both scenarios, incentivizing the reshoring of supply chains by supporting internal demand for the technologies affected by export controls seems advisable.

Our paper is related to the recent literature on geopolitical risk in economics and finance. Some studies have documented the labor and trade costs of U.S.-China trade wars (e.g., Benguria and Saffie, 2023, 2020; Flaaen, Hortaçsu and Tintelnot, 2020; Fajgelbaum et al., 2020). Cen, Fos and Jiang (2022) study the effect of Chinese Five-Year Plans on U.S. firms, while Bian and Meier (2023) consider the effect of CEO incentives on technological transfers to China. Clayton, Maggiori and Schreger (2023) provide a theoretical framework for the use of economic leverage in a geopolitical conflict. In their framework, taxes on exporters can be used to counter the economic coercion exerted by a rival country. These measures are

analogous to export controls, which are indeed used by the U.S. administration to counter China's technological transfer and development. More closely related to our analysis, Han, Jiang and Mei (2023) describe the effect of Chinese industrial policy and U.S. export controls on the innovation output of Chinese firms.

Our paper is also connected to the economic literature on sanctions (e.g., Efing, Goldbach and Nitsch, 2023; Ahn and Ludema, 2020; Felbermayr et al., 2020; Crozet et al., 2021; Besedeš, Goldbach and Nitsch, 2021). While tariffs increase trading costs and are often used to protect domestic nascent industries and raising government revenues, sanctions instead prohibit some or all trade and capital flows with a specific country. Historically, sanctions have been used to influence another country's behavior without resorting to military interventions (Kaempfer and Lowenberg, 2007), and range from broad trade restrictions to more targeted "small yard, high fence" interventions. Examples of broad sanctions include the U.S. embargo on Cuba, while more targeted sanction include those on Russian oligarchs in the aftermath of the annexation of Crimea and invasion of Ukraine. Since sanctions are usually applied to either small countries or a selected group of individuals connected to a specific administration, they tend to have limited negative effects on U.S. firms. On the other hand, export controls against Chinese firms are different. Indeed, due to the interconnectedness of domestic and Chinese firms, forbidding the export of high-tech products to large Chinese multinationals can have a pronounced negative impact on the profitability of domestic firms.

Finally, we contribute to the supply chain literature by exploring emerging risks to global supply chains. While most of the literature has explored the propagation of financial shocks (Alfaro, García-Santana and Moral-Benito, 2021; Cortes, Silva and Van Doornik, 2019;

Costello, 2020), natural disasters (Boehm, Flaaen and Pandalai-Nayar, 2019; Barrot and Sauvagnat, 2016; Carvalho et al., 2021), and cyberattacks (Crosignani, Macchiavelli and Silva, 2023; Garg, 2020), we explore how export control shocks propagate through the supply chain and how supply chains themselves are reconfigured following the imposition of export controls. As such, our paper also complements Alfaro and Chor (2023), which documents recent shifts in U.S. imports away from China and towards alternative locations, such as Vietnam and Mexico. Relatedly, we also contribute to the supply chain literature that studies the dynamic evolution of supply chains following shocks (Elliott, Golub and Leduc, 2022; Pankratz and Schiller, 2023) by documenting the decoupling process initiated by export controls.

2 Background

In this section we provide some background on the regulations and policies surrounding export controls and then describe a few case studies of export controls to highlight the main motivations for such measures.

2.1 Export Administration Regulations

Title 15 of the United States Code contains regulations related to trade and commerce. In particular, Chapter VII introduces Export Administration Regulations (EAR). These are issued by the Bureau of Industry and Security, BIS, of the Department of Commerce to control certain export activities. Part 774, Supplement No. 4, also known as the "Entity List", contains names of foreign persons, including businesses, institutes, and universities,

that are subject to license requirements for the export, re-export, and in-country transfer of certain items. In other words, U.S. firms that intend to export, re-export, and transfer goods and services to foreign firms included in the Entity List must first obtain a license from the Commerce Department. In addition to U.S. firms, BIS export controls also apply to foreign firms that use U.S.-origin components, manufacturing equipment, technology, and software.[1] The BIS license review policy indicates that, for the most part, there is a presumption of license denial.

An item requires an export license from the Commerce Department if it belongs to the Commerce Control List (CCL), which includes nuclear material, toxins, electronics, computers, telecommunications, information security, navigation, sensors, lasers, aerospace and propulsion systems. Any other item is designated as EAR99, including low-tech consumer goods, and requires a license only if it is exported to embargoed countries or end-users of concern. The latter consists persons, institutes, universities, and corporations included in the Entity List or other similar lists described below. A license can thus be required not only for CCL items but also EAR99 items that are intended to be exported to parties included in the Entity List. The specific license requirement details are provided in Part 744, Supplement No. 4, for each company included in the Entity List.

The first Entity List was published in 1997 and was meant to limit exports to entities engaging in the production of weapons of mass destruction (WMDs). Since then, reasons for inclusion in the Entity List have expanded to limit "activities contrary to the national

[1] See Part 734.9 Foreign-Direct Product Rules for more details.

security or foreign policy interests of the United States". In particular, items subject to EAR export controls include purely civilian items, items with both civil and military use (dual-use), terrorism or potential WMD-related applications, and items that are exclusively used for military applications. Other offices in the State and Treasury Departments have jurisdiction over EAR export controls, including the Department of Treasury's Office of Foreign Assets Control (OFAC) and the Department of State's International Traffic in Arms Regulations (ITAR). Decisions regarding the Entity List are made by the End-User Review Committee, which is composed of representatives of the Departments of Commerce, State, Defense, Energy and, where appropriate, the Treasury. An entry to the Entity List requires a majority vote while unanimity is required for removal or modification.

On December 23, 2022, the BIS introduced an additional list, the Military End User (MEU) list, published in Part 774, Supplement No. 7. Entities are added to the MEU list if they represent "unacceptable risk of use in or diversion to a 'military end use' or 'military end user' in China, Russia, or Venezuela." In other words, entities are added to the MEU list if they are considered producers or intermediaries of military technologies ultimately used by China, Russia, or Venezuela. Any exporter of military items (listed in Part 744, Supplement No. 2) to entities included in the MEU list must receive prior license.

Finally, the BIS also publishes the Unverified List (UVL) in Part 774, Supplement No. 6. Inclusion in the UVL generally occurs if the BIS cannot verify the legitimacy of the end-use and end-user of items subject to export controls. The BIS removes an entity from the UVL when it can verify the legitimacy of the listed person as an end-user through the completion of a pre-license check or a post-shipment verification. To export items in the CCL to entities

in the UVL, a license is required. On the other hand, to export EAR99 items, the end-user must provide a statement with an agreement to comply with EAR and a declaration about the end-use for the item.[2]

From the point of view of a U.S. firm trying to export goods and services to foreign companies, the inclusion of such foreign companies in either the Entity List or the MEU list is therefore more restrictive than inclusion in the Unverified List.

In addition to export controls, the U.S. government deploys other tools towards selected Chinese companies. Chiefly among them, the Treasury Department's OFAC forbids U.S. persons from buying or selling securities issued by a list of Chinese companies belonging to the Chinese military-industrial complex. The list is spelled out in Executive Orders 13959 of November 12, 2020 and 14032 of June 3, 2021. The purpose of such actions is to deny access to U.S. capital markets to Chinese companies that "enable the development and modernization of its military, [...] which continues to allow the [People's Republic of China] to directly threaten the United States homeland".

2.2 Entity List Case Studies

Next, we provide some examples of Chinese firms included in the Entity List to highlight the different motivations for export controls. Huawei is a Chinese company specialized in telecom-

[2]In October 2022, the BIS announced a new two-step policy to address foreign government interference with end-use checks. If end-use checks are not completed within 60 days, the BIS will initiate the regulatory process to add the foreign party to the UVL. If the addition to the UVL is due to the interference of the foreign government, a second 60-day clock starts after the listing. If the BIS is unable to complete an end-use check within the second 60-day clock, it will start a process to move the foreign party from the UVL to the Entity List.

munications equipment and consumer electronics. It became the largest telecommunications equipment manufacturer in 2012 and the largest smart-phones manufacturer in June 2020. Regarding the development of 5G networks, some countries voiced concerns that Huawei's equipment could be used as a backdoor for espionage by the Chinese military and intelligence services, citing the 2014 Counter-Espionage Law and the 2017 National Intelligence Law of the People's Republic of China that require Chinese companies to cooperate on intelligence gathering. Indeed, western intelligence agencies have alleged that Huawei's equipment was used for hacking into several telecommunication companies in U.S., Canada, and Australia, such as Nortel, Cysco, and Optus.

Moreover, in January 2019 the U.S. Department of Justice (DOJ) unsealed an indictment alleging that Huawei circumvented U.S. sanctions on Iran and was involved in the theft of trade secrets from telecommunications companies around the world, including T-Mobile. Shortly after, in May 2019, the BIS added Huawei and its subsidiaries to the Entity List on the grounds that it violated U.S. sanctions on Iran by causing the export of goods, technology, and services from the U.S. to Iran without obtaining a license from OFAC. Several additions of Huawei's affiliates to the Entity List occurred up to April 2022.

Semiconductor Manufacturing International Corporation Incorporated (SMIC) is the largest semiconductor manufacturer in China. SMIC was added to the Entity List as a result of its activities with the Chinese military industrial complex. "The Entity List designation limits SMIC's ability to acquire certain U.S. technology by requiring exporters, reexporters, and in-country transferors of such technology to apply for a license to sell to the company. Items uniquely required to produce semiconductors at advanced technology nodes 10 nanometers

or below will be subject to a presumption of denial to prevent such key enabling technology from supporting China's military modernization efforts."

Another motivation to include Chinese companies in the Entity List has to do with intellectual property (IP) theft. A clear case of IP theft-driven inclusion involves Fujian Jinhua Integrated Circuit Company (Jinhua). On October 30, 2018, Jinhua was included in the Entity List for being "involved in activities that could have a negative impact on the national security interests of the United States." On November 1, 2018, the Department of Justice issues an indictment charging Jinhua with crimes related to economic espionage and theft of intellectual property from Micron, a semiconductor company specialized in memory storage devices, including dynamic random-access memory.

3 Data

We use four different data sources. Information on export controls comes from the Bureau of Industry and Security, part of the U.S. Department of Commerce, and can be obtained online via the Federal Register (federalregister.gov) and the Code of Federal Regulations (ecfr.gov). We hand-collect additions and removals of Chinese companies from the Entity List (Part 774, Supplement No. 4), the Military End Use list (Part 774, Supplement No. 7) and the Unverified List (Part 774, Supplement No. 6). For each entity, we collect the many aliases that are often provided, the dates in which the notices of addition and removal are announced, the dates in which they become effective (usually 5 calendar days after the announcement), and the physical addresses of the entities and their aliases. For consistency, we only focus on

Chinese entities, since they are the vast majority of the targets of export controls that can be matched with our supply chain data.

Excluding aliases from the 1,120 total Chinese entries, we have 732 unique Chinese entities. Out of them, 497 are corporations, and 235 are universities and institutions. Moreover, 425 are from the Entity List, 58 from the MEU list, and 253 from the UVL. The total across lists is greater than the total number of Chinese entities since some are listed in multiple lists at different points in time. For instance, some could be listed in both Entity and MEU lists, while others initially included in the UVL end up permanently in the Entity List. The Entity List starts in 1997 and most of the Chinese entities are added after 2014. The MEU list currently contains Chinese companies added on December 23, 2020 and January 14, 2021. The Unverified List starts in 2002, with most of the Chinese entities included after 2019.

Information on supply chain relationships comes from FactSet Revere, which is arguably the most comprehensive source of supply chain data available.[3] Each supply chain relationship contains names and identifiers of the customer and the supplier, as well as the start and end dates of the relationship. The information is collected via public filings, investor presentations, websites, corporate actions, press releases, and news reports. We follow Gofman, Segal and Wu (2020) and drop relationships with start and end dates included within a longer relationship between the same two entities, and combine multiple relationships with time gaps shorter than 6 months into a continuous relationship. Using International Securities Identification Numbers (ISINs) as well as manual name matching, we are able to identify 92 Chinese entities

[3]For instance, Bloomberg and Capital IQ do not report at sufficiently high frequency the start and end dates of a supply chain relationship, while the Compustat Segments data report only the largest customers of a given supplier at the annual frequency.

subject to export controls (target firms), which have supply chain relations with a total of 357 affected suppliers. Out of these, 175 have supply chain relations overlapping with the export control event dates.[4]

Finally, we obtain daily stock price data from the Center for Research in Security Prices (CRSP daily stock file) and firm-level balance sheet data from Compustat (North America, fundamentals annual). To match firm identifiers among CRSP, Compustat, and Factset data, we use the firm's CUSIP. The final daily stock price sample has a total of 250 events arising from 156 affected suppliers spanning from 2010 to 2022. The number of events is higher than that of affected suppliers because some Chinese target firms are included in BIS lists multiple times, often because some previously neglected subsidiaries are added later on.[5] On the other hand, the firm-level annual panel goes from 2007 to 2022 and has a total of 692 firms, of which 125 are affected suppliers. We focus on firms that export to China, and remove firms with less than $5 million in total assets. Figure 1 Panel A shows the number of affected U.S. suppliers over time as BIS includes Chinese customers on the entity list. Most target Chinese firms belong to the telecommunication, transportation, and electronic equipment sectors, while most affected suppliers are in the electronics and industrial machinery equipment sectors (Figure 1 Panel B).

Summary statistics on supply chain and balance sheet variables are presented in Tables 1 and 2, respectively. In the supply chain analysis, treated firms (affected suppliers) are those that export to Chinese entities in the BIS list, control firms are restricted to those that export

[4]We allow one year buffer between the event date and supply chain relationship end year.

[5]For each affected supplier, we consider events that happen at least 6 months apart when estimating the pre-treated betas and cumulative abnormal returns.

to Chinese firms not included in the BIS lists. Affected suppliers tend to have more total customers than control firms, and thus also terminate and form more customer relations relative to control firms. However, treated and control firms have a more similar geographical distribution of their customers. The average share of Chinese customers is 9.4% for treated and 5.3% for control firms, the European share is 19.1% for treated and 18.8% for control firms, and finally the domestic share is 40.5% for treated and 53% for control firms.

Affected suppliers, being exporters to Chinese conglomerates, tend to be larger in size than unaffected firms. They also tend to be more profitable (greater cash flow and return on assets), due to both higher operating income and lower interest payments over total assets. Once we split the sample by industry-specific size quartiles and focus on the sample of exporters to China, treated and control firms are more comparable, other than for the bottom size quartile (see Table 3).

Across all size quartiles, capital expenditure, interest expenses, and the number of employees are very similar between treated and control firms. Since size quartiles are computed within each industry (2-digit SIC code), it is still possible that treated firms are larger than control ones within each size quartile if treated firms are concentrated in industries with larger firms on average. However, this is not a concern in our empirical analysis since we compare each treated firm to control units within the same industry and the same industry-specific size quartile.

4 Empirical Strategy and Results

We use different methodologies when estimating the effect of export controls on abnormal stock return and real outcomes (including supply chain and balance sheet variables). For ease of exposition, we first discuss the event study approach to estimate cumulative abnormal returns.

To study the stock market reaction to export controls, we estimate abnormal stock returns of affected suppliers around the announcement dates of their Chinese customers being added to the relevant BIS lists: Entity List, UVL, and MEU list. Affected suppliers are the U.S. firms that export to the Chinese entities included in the BIS lists. The same affected supplier can participate to multiple events if it exports to more than one target company or if the same target company enters the BIS lists more than once. The latter can happen when different subsidiaries of the same company are added at different times. For those reasons we have 250 events and 156 unique affected suppliers. The main specifications estimate cumulative abnormal returns in a [-10, 20] day window around the event date, using either the Fama-French 3-factor model (Fama and French, 1993) or the Fama-French 5-factor model (Fama and French, 2015).[6]

We also study the effect of export controls on the real outcomes of affected suppliers, including supply chain and balance sheet variables. The BIS has been including Chinese entities in the various export control lists since the early 2000s in a staggered fashion. Due to

[6]We follow standard event study method to use [-150, -50] day window to estimate betas and then estimate the out-of-sample abnormal returns during the event window [-10, 20].

staggered nature of the shock (i.e., a Chinese customer is included in a BIS list), a standard differences-in-differences model may produce biased estimates of the treatment effects.[7] Therefore, we employ the stacked regression estimator methodology developed by Gormley and Matsa (2011) and described in Andrew C Baker, David F Larcker and Charles CY Wang (2022). Specifically, we stack observations from multiple cohorts, where a cohort includes treated and control firms in a [-3, 3] year window centered around an event. We restrict the control group to firms that are either never treated or not yet treated. An event is the first time that a Chinese firm is included in a BIS export control list, while treatment refers to the first time that a firm's customer is included in the BIS lists. We then estimate the following stacked regression specification:

$$y_{ict} = \sum_{j=-3}^{j=3} \beta_j \mathbb{1}(J_{ict} = j) + \mu_{ic} + \mu_{ckt} + \varepsilon_{ict} \tag{1}$$

where c indicates a specific cohort, i a firm, and t a year. y_{ict} is the outcome variable for firm i in cohort c and year t, including cash flow (operating income before depreciation minus interest and taxes, divided by lagged assets) and CAPEX (capital expenditures divided by lagged assets). When we analyze supply chain data and use count or count-like outcome variables, such as the number of terminated relations with China or the number of new relations with other Chinese customers, we follow Cohn, Liu and Wardlaw (2022) and estimate Poisson regressions using the maximum likelihood approach of Correia, Guimarães and Zylkin (2020). $\mathbb{1}(J_{ict} = j)$ is an indicator variable equal to one if an export control c on a Chinese customer

[7] See Jonathan Roth, Pedro H.C. Sant'Anna, Alyssa Bilinski and John Poe (2023), for instance, for a detailed review of the recent literature on staggered differences-in-differences designs.

of firm i occurred j years apart from the event year. Each cohort includes observations from 3 years before to 3 years after the event. The interaction term for the year prior to treatment is excluded and thus constitutes the omitted group. Each cohort c includes treated, never treated, and not yet treated units. To make sure that each treated unit is compared to units within the same cohort that are similar in terms of industry and size, we include cohort-industry-size quartile-year fixed effects, μ_{ckt}. As customary in stacked regressions, we also include firm-cohort fixed effects, μ_{ic}. Standard errors are double-clustered at the firm and year levels.

Sometimes different subsidiaries of the same Chinese parent company are added sequentially to the BIS lists. This happens because the Department of Commerce later finds out that additional subsidiaries may acquire controlled technology for the same target parent company. Often, further subsidiaries are included just a few months later. For a specific U.S. firm, we include events that are at least six months apart to avoid contamination on the CAR estimates. While each of these additions is treated as a separate event in the CAR study, multiple treatments are more cumbersome to deal with in a panel setting with yearly data. To only capture the specific Chinese entity with which U.S. firms conduct a meaningful amount of business, in our main yearly panel regressions (Eq. 1) we define treatment as the first time that a parent company of a Chinese customer enters the BIS lists, conditional on the U.S. supplier having a sizable CAR response to such event.[8] To select the more stringent

[8]Specifically, if a Chinese customer of U.S. firm i is added multiple times under different aliases or subsidiary names to the BIS lists, we require that the first one of such events is also the one with the most negative CAR response for firm i. This requirement excludes 16 out of the 145 treatments. Using the full sample that includes the first time that parent company enters a BIS list (without CAR response restrictions), results are qualitatively unchanged, albeit a bit more noisy due to the inclusion of firms that are only marginally affected by export controls.

among all export controls, in some specifications we further restrict the sample to Chinese firms belonging to the Entity List and the MEU list ("Restrictive Sample"), thus excluding the less restrictive and often temporary inclusions in the Unverified List.

In robustness tests, we also estimate the more standard (albeit potentially biased) two-way fixed effects (TWFE) model, as follows:

$$y_{it} = \sum_{j=-3}^{j=3} \beta_j \mathbb{1}(J_{it} = j) + \mu_i + \mu_{kt} + \varepsilon_{it} \tag{2}$$

where y_{it} and is an outcome of firm i in year t and $\mathbb{1}(J_{it} = j)$ is an indicator variable equal to one if an export control on a Chinese customer of firm i occurred j years from the event year. We consider a window of 3 years around the incident date ($-3 \leq j \leq 3$). The interaction term for the year prior to treatment is excluded and is thus part of the omitted group. We include firm and industry-size quartile-year fixed effects, namely μ_i and μ_{kt}, respectively. The latter fixed effects are included to make sure that the control group consists of firms in the same industry and of comparable size as the treated firms. Since treated firms are by definition exporting to China, we require control firms to also be exporting to China (but not to the BIS-targeted entities), in addition to belonging to the same industry as the treated firms. Standard errors are double-clustered at the firm and year levels.

Our main results using the stacked regression approach of Eq. (1) are qualitatively similar to those employing the TWFE model of Eq. (2). This is consistent with the fact that the TWFE bias is less likely to be a problem when the number of ever-treated units is small relative to the full sample (Baker, Larcker and Wang, 2022), as it is the case in out setting.

4.1 Decoupling and Supply Chain Dynamics

First, we study how supply chain relations endogenously respond to export controls. By definition, affected suppliers are required to stop exporting certain critical goods to their Chinese customers in the BIS lists. To make sure that control firms are comparable to the treated ones, we require control firms in each cohort to be exporting to China in the pre-treatment period.

We explore various ways in which export controls may lead to a U.S.-China decoupling. Specifically, we study the effect of export controls on both termination and creation of relations with Chinese customers. Since the affected suppliers are required to terminate relations only with the Chinese firms targeted by export controls, we explore whether affected suppliers selectively terminate relations only with the targeted Chinese customers or more broadly with any of their Chinese customers. Terminating relations with Chinese customers not directly targeted by export controls would indicate a broader decoupling above and beyond what is strictly required by regulation.

Notice that we cannot directly estimate whether affected suppliers are more likely to terminate relations with Chinese targets following export controls, because control firms by definition do not have relations with those firms. As a result, we estimate the effect of export controls on the number of terminated relations with any Chinese customer and compare it to the effect on terminated relations excluding the Chinese targets of export controls. If affected suppliers terminate relations only with the directly targeted firms, we would estimate a significant effect only on total terminations and not on terminations excluding Chinese targets. If, on the other hand, affected suppliers terminate relations with both groups, we

should estimate significant effects on terminations with any Chinese customer and excluding Chinese targets, albeit with the latter effect being smaller in magnitude.

Lastly, we study whether affected suppliers are also less likely to form new relations with other Chinese customers following export controls. Studying both the termination of existing relations and the creation of new ones gives us a full picture of the dynamic supply chain reconfiguration following the imposition of export controls. The supply chain variables, summarized in Table 1, are the total number of terminated or new relations. We use Poisson regressions on these count variables, as suggested by Cohn, Liu and Wardlaw (2022).

Table 4 presents the regression results using the preferred stacked regression approach of Eq. (1) and displays the main coefficient of interest, Affected·Post. The dependent variables are the number of terminated relations with Chinese customers in columns (1) to (3), with Chinese customers excluding the targeted ones in columns (4) to (6), and the number of new relations with Chinese customers in columns (7) to (9). The quartile of the lagged number of total customers is introduced as an additional fixed effect to control for supply chain relationship differences between treated and control groups. As a result, we compare firms with a similar number of customers. The positive and significant coefficients of interest (Affected·Post) in columns (1) to (3), indicate that export controls lead to more relations with Chinese customers being terminated. Once we exclude the Chinese customers directly targeted by export controls, the coefficients in columns (4) to (6) show that affected suppliers are more likely to terminate relations even with Chinese firms that are not directly targeted by export controls. Comparing the coefficients in columns (3) and (6) indicates that affected suppliers are more likely to terminate relations not only with Chinese customers targeted by

export controls, but also with other Chinese customers that are not directly targeted. Lastly, columns (7) to (9) explore the formation of new relations with Chinese customers. We find that, after one of their customers is targeted by export controls, affected suppliers form fewer relations with new Chinese customers.

In addition to affected suppliers terminating more existing relations with Chinese firms (both targeted and not), new relations are also less likely to be formed, pointing to a long-lasting decoupling from China for the affected suppliers. Thus, export controls induce a broader degree of decoupling than strictly required by export control laws. This broad decoupling is consistent with a wake-up call whereby affected suppliers become more aware of geopolitical risk and the possibility of future controls. It is also consistent with fear that intermediate Chinese firms may purchase the sensitive goods and sell them back to the targeted firms, which too is a violation of export control laws. The decoupling effects are not only statistically but also economically significant. Export controls lead to an increase in terminations with Chinese customers by 50%-75% (column 5-6), and a decline in the establishment of new Chinese customer relations by 60% -68% (column 8-9).[9]

Next, we explore whether affected suppliers reconfigure their supply chains and form new relations away from China to offset the drop in Chinese customers following export controls. The results are displayed in Table 5. The dependent variables are the total number of customers in columns (1) and (2) and total number of domestic (U.S.) customers in columns (3) and (4). The negative and significant coefficients of Affected·Post in columns (1) and (2)

[9]These economic magnitudes are obtained by taking the exponential of the estimated coefficients and then subtracting one.

indicate that affected suppliers experience a reduction in the overall number of customers. They are therefore not able to significantly offset the reduction in Chinese customers due to the imposition of export controls by finding alternative ones in the following 3 years. We also find no evidence of reshoring by affected customers. Indeed, the insignificant coefficients in columns (3) and (4) suggest that affected suppliers do not significantly change the number of domestic customers following export controls.

We further examine the effect of export controls on the customer shares of U.S. suppliers by regions. The results are displayed in Table 6. In Panel A, the dependent variables are the share of customers from the U.S. and China, respectively. The positive and significant coefficient of Affected·Post in columns (1) to (2) shows that affected suppliers are more reliant on domestic customers as they reduce the reliance on Chinese customers (column 3 to 4). In Panel B, we examine customer shares of U.S. suppliers from other regions in Asia and Europe. The dependent variables are the share of customers from Asia (excluding China), Asia allies (South Korea, Japan, Taiwan, and Australia), and Europe in columns (1) to (6). If U.S. suppliers reroute their customer base to politically friendly regions, we expect to see an increase in customer shares from those regions. We observe negative coefficients of Affected·Post in columns (1) to (6), suggesting that firms are not friend-shoring and in general are less reliant on other international customers.

Our results are not driven by pre-trends, as we discuss next. Figure 2 displays the coefficient plots for total terminations, terminations excluding targeted Chinese firms, and new relationships with Chinese firms using the preferred stacked regression approach of Eq. (1) (Panels A, C and E) and the TWFE model of Eq. (2) (Panel B, D and F). The dynamic

plots show no pre-trends before treatment. In addition, there is a significant increase in the total number of terminations with Chinese customers, whether or not we include the targeted Chinese firms. At the same time, there is a significant decrease in the number of new relationships formed with Chinese customers. The results are qualitatively similar between the stacked regression approach and the TWFE method. Next, Figure 3 corroborates that our results in shares (shown in Table 6) are also not driven by pre-trends.

The supply chain results of Tables 4, 5 and 6 suggest that affected suppliers cannot find new customers to make up for the decline in Chinese customers following the imposition of export controls. The lack of any meaningful short-run adjustment in supply chains is consistent with the findings in Boehm, Flaaen and Pandalai-Nayar (2019) that the "short-run elasticity of substitution between different inputs is near 0".

4.2 Chinese Firm Supply Chain Reconfiguration

Next, we examine how Chinese firms respond to U.S. export controls. In line with our previous results we expect a decoupling from U.S. suppliers, but it is unclear whether they are able to find alternative suppliers and, if so, from which country. Appendix Table B.1 reports the summary statistics for Chinese supply chain variables.

We first examine whether Chinese firms that are directly targeted by U.S. export controls decouple from the U.S. and whether they reshore by finding alternative suppliers domestically. Table 7 displays the results. The dependent variables are the total terminations with U.S. suppliers in columns (1) to (2), new relationships formed with Chinese suppliers in columns (3) to (4), and new relationships formed with U.S. suppliers in columns (5) to (6). The positive

and significant coefficients of Affected·Post in columns (1) and (2) indicate that Chinese firms' relationships with U.S. suppliers were terminated after the export controls. We also find that affected Chinese firms increase new relationships with domestic Chinese suppliers in columns (3) to (4). Although the number of new relationships with U.S. suppliers does not change in a statistically significant manner after the export controls, the size of the coefficient is negative, as displayed in columns (5) to (6).

We further examine the total number of suppliers and the change in supplier shares in Table 8. The dependent variables are the total number of suppliers in columns (1) to (2), the share of Chinese suppliers in columns (3) to (4), and the share of U.S. suppliers in columns (5) to (6). The total number of suppliers of the affected Chinese firms does not change significantly after the export controls, indicating a strong substitution of new Chinese suppliers for the terminated U.S. suppliers. The share of Chinese suppliers increases significantly in columns (3) to (4), while the share of U.S. suppliers decreases significantly in columns (5) to (6). The results indicate that Chinese firms that are directly targeted by U.S. export controls can quickly adjust their supply chain by forming new relationships with domestic Chinese suppliers, suggesting that decoupling is accompanied by reshoring for the Chinese firms targeted by U.S. export controls. It is possible that Chinese firms reshore faster and more effectively than U.S. firms hit by export controls because large state-owned Chinese firms enjoy a stronger degree of coordination.

Taken together, the results point to a significant decoupling between U.S. and Chinese firms following the introduction of U.S. export controls. Moreover, U.S. suppliers seem unable to find alternative customers once the Chinese ones become targets of export controls. As

a result, export controls may inflict some collateral damage on the same U.S. firms whose technology they are trying to protect. Assessing the potential negative consequences of export controls on U.S. firms is the subject of the following analysis.

4.3 Export Controls and Negative Abnormal Returns

Next, we show evidence of the negative stock market reaction to news about export controls. Panels A and B of Figure 5 display the cumulative abnormal returns relative to the Fama-French 3-factor and 5-factor models, respectively. Upon announcement that Chinese entities are added to the BIS lists (the event), the U.S. suppliers of these targeted entities experience negative abnormal returns.

While there is no evidence of abnormal returns in the 10 days preceding the event, the market seem to quickly incorporate the negative news for the affected suppliers once the inclusion of the targeted entities in the BIS lists is announced.[10] Most of the decline in CAR following the event is indeed concentrated within the first few days and persists for at least the next 20 days. The negative stock market reaction is an indication that export control may create some collateral damage. To deny key Chinese firms access to U.S. technologies, export controls impose immediate valuation losses on the affected U.S. suppliers. On average, U.S. suppliers experience a negative 2.5% cumulative abnormal return in the 20 days following the export controls. This estimate implies that the average U.S. firm affected by export

[10]The significant negative CAR happens at the post-announcement period. Five-factor CAR[-10, -1] is -0.6% with 95% confidence interval being [-0.015, 0.003]. The five-factor CAR[-10, 2] is -2.7% with the confidence interval being [-0.038, -0.015]. In the 3-factor model, the first day with significantly negative CAR is day -1, while in the 5-factor model it is day zero.

controls loses $857 million in market capitalization. Across all the firms in our sample, this translates to a total loss of $130 billion, which is economically significant.[11] The CAR results are quantitatively unchanged if we focus on the more restrictive export control events, namely those in the Entity and Military End Use lists (hence excluding events from the Unverified List), as shown in Appendix Figure B.1.

4.4 Real Collateral Damage

Finally, we document the real effects of export controls on the affected suppliers. By restricting exports to selected Chinese customers, export controls may lead to an economic loss for U.S. firms that export goods and services to the selected group of Chinese firms included in the BIS lists. This is especially likely given our previous findings that, at least in the short term, affected suppliers do not form new customer relations to offset the loss of business from the Chinese targets. While there may be some indirect benefits to the U.S. economy from restricting exports of cutting-edge technologies to strategic rivals, the affected suppliers are likely to face a direct and immediate business loss, a sort of collateral damage. We investigate these potentially detrimental effects next.

Figure 6 displays the dynamic effects of export controls on firms' cash flow, operating income, capex, and the number of employees. The parallel trends assumption seems to be validated by the lack of pre-trends in all specifications. In addition, there is a significant drop in cash flow, operating income, and number of employees after the inclusion of a Chinese

[11]The aggregate loss is estimated by multiplying the loss for the average affected supplier by the number of affected suppliers, 156.

customer in the export control lists.

Table 9 displays the real effect of export controls on affected suppliers. The dependent variables are cash flow in columns (1) to (2), operating income in columns (3) to (4), capex in columns (5) to (6) and number of employees in columns (7) to (8). For each dependent variable, we include stringent fixed effects, representing progressively tighter definitions of the control group. Panel A uses the main sample, while Panel B uses only the more restrictive export controls. Of note, the coefficients are stable regardless of the degree of fixed effects saturation. The collateral damage of export controls on U.S. suppliers is both statistically and economically significant. The coefficient of column (5) in Panel A indeed suggests that export controls lead to a decline in cash flow that is equal to 20% of its average value for treated firms. Affected suppliers seem to adjust to the negative consequences of export controls by reducing employment but not investment, as shown in columns (5) to (8). The effect on employment is both statistically and economically significant, representing a 6.4% decline in the total number of employees. The asymmetric effect on investment and employment is consistent with the fact that export controls do not significantly change the long-term investment opportunities of the affected firms, but may require a short-term adjustment to the labor force.

The reader may be concerned that our results are driven by reverse causality. In a few instances discussed in Section 2, a Chinese company is added to the Entity List because it is charged with stealing intellectual property from a U.S. supplier. In those cases, the inclusion in the BIS list is concurrent with the DOJ indictment. Therefore, the stock price and the cash flow of those U.S. suppliers may be negatively affected not because of the export controls,

but because of the theft of trade secrets that caused the inclusion in the BIS list. However, we make sure to exclude the victims of IP theft from the group of affected suppliers in our sample.[12] It is therefore unlikely that our results are driven by reverse causality.

Our results are also unlikely to be driven by the 2018-2019 trade wars in which U.S. and China engaged in retaliatory tariffs (Fajgelbaum et al., 2020; Amiti, Redding and Weinstein, 2019; Benguria and Saffie, 2023). Indeed, the broad-based tariffs did not apply to a single company but to various products and sectors. Since our estimates rely on variation within the same industry, size quartile, export status (whether or not a firm exports to China), and year, they are unlikely to be affected by broad-based tariffs. Similarly, our results also unlikely to be driven by the August 2022 CHIPS Act which provided subsidies to chip makers with U.S. operations. Indeed, the reform applies to a broad set of firms and not just to our set of affected suppliers.

5 Conclusion

By forbidding U.S. firms to export to a selected list of Chinese firms for national security reasons, export controls aim to generate a selective decoupling of U.S. firms from China. We indeed show that they prompt a supply chain reconfiguration away from Chinese customers, both those targeted by export controls and those that are not. This broad-based decoupling

[12]The U.S. victims of intellectual property theft that could also be in our treatment group are Micron, based on the inclusion of Jinhua in the Entity List, and Avago and Skyworks, based on the inclusion of ROFS Microsystems and Tianjin Micro Nano Manufacturing. We obtain this information by reading the motivations for inclusion in the Entity List and checking the DOJ website for indictments of Chinese companies regarding the theft of intellectual property.

from China is not offset by the creation of new supply chain relations in other countries. Indeed, the total number of customers declines, potentially inflicting collateral damage upon the same U.S. firms whose technology export controls are trying to protect.

We indeed find that export controls impose significant collateral damage on the affected U.S. firms. We estimate a negative cumulative abnormal return of 2.5% and a decline in profitability following the introduction of Chinese customers in the export control lists. These costs ought to be weighed against the expected benefits of such measures.

We lack a comprehensive framework to assess the optimality of these geopolitical tools. If national security is a public good, are these export controls a way to make firms internalize their negative externalities? Is it actually beneficial to penalize the same domestic firms that produce cutting-edge technologies? Some may argue that if the government forbids U.S. firms from exporting to certain foreign customers, it should indemnify those U.S. firms. This could be achieved by boosting domestic demand for the restricted goods, in what may look like an industrial plan to reshore or friend-shore high-tech supply chains. More research, both theoretical and empirical, is needed to better understand the costs and benefits of using economic linkages in the geopolitical arena.

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Figure 1: Number of Affected U.S. Suppliers Figure 1 Panel A displays the number of affected U.S. suppliers over time as BIS includes Chinese customers on the entity list. The histogram represents the number of affected U.S. suppliers in a specific year. The blue line represents the cumulative number of affected U.S. suppliers over time. Symbolic Chinese firms that are included in the entity list are highlighted with orange text. Panel B displays the top 10 most affected industries based on the total number of affected U.S. suppliers in each industry. The industry classification is based on the 2-digit SIC code.

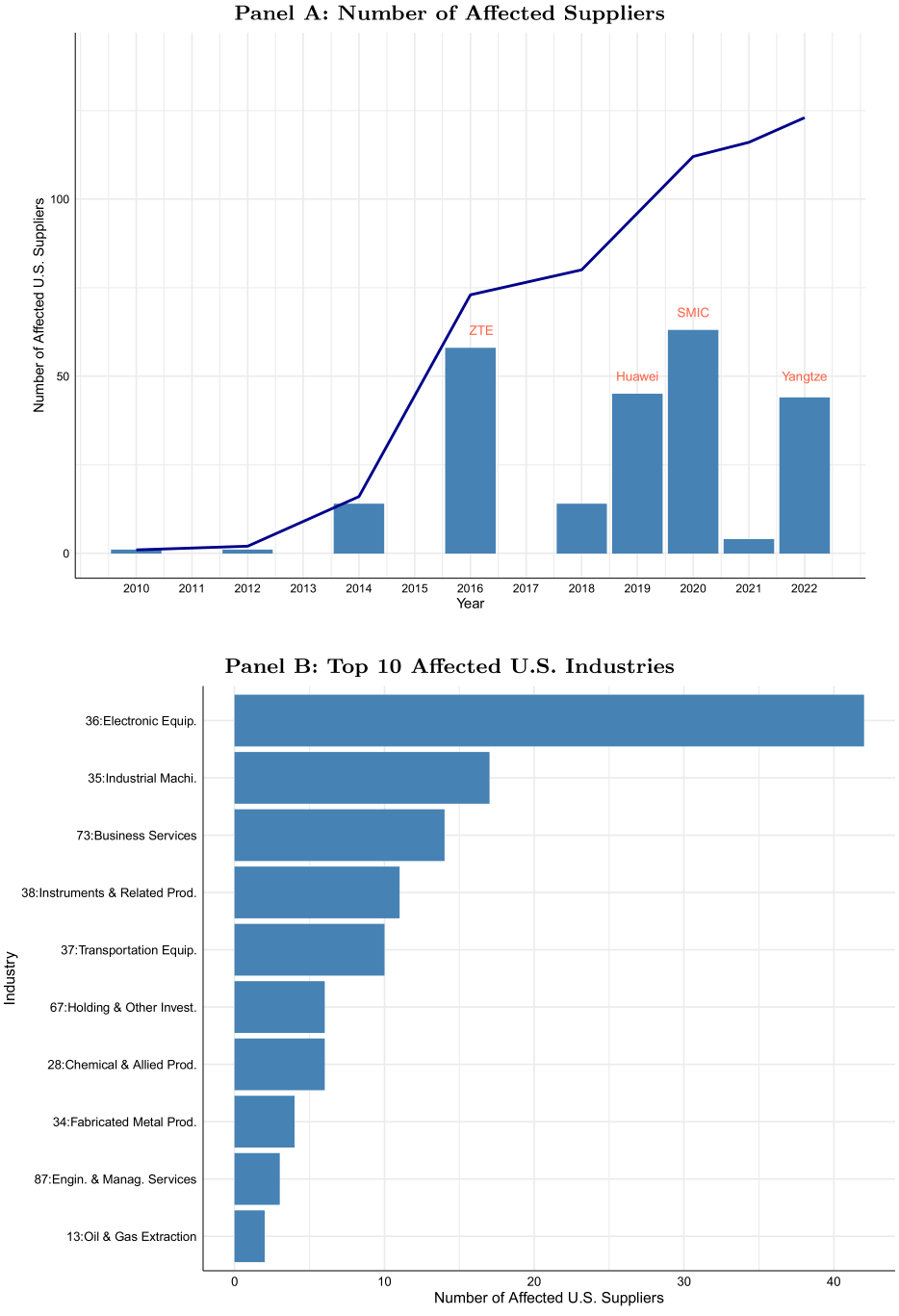


Figure 2: Decoupling from Chinese Customers. Figure 2 displays the dynamic effects of export controls on the number of terminated Chinese customers in affected suppliers. Panels A, C and E show the coefficient plots for the number of terminated Chinese customers using the Poisson Maximum likelihood regression (PPML) on the stacked regression of Eq. (1) while Panels B, D and F employ the TWFE model of Eq. (2). Panels A and B display the results on the total terminations with Chinese customers. Panels C and D show terminations with Chinese customers, excluding the targeted ones. Panels E and F display the results on the new relationship with Chinese customers. Regressions include firm and industry-size quartile-lagged customer number quartile-year fixed effects. In the stacked regressions, the fixed effects are further interacted with the cohort indicator variable. The blue bars indicate 95% confidence intervals around the estimated dynamic coefficient (blue dot).

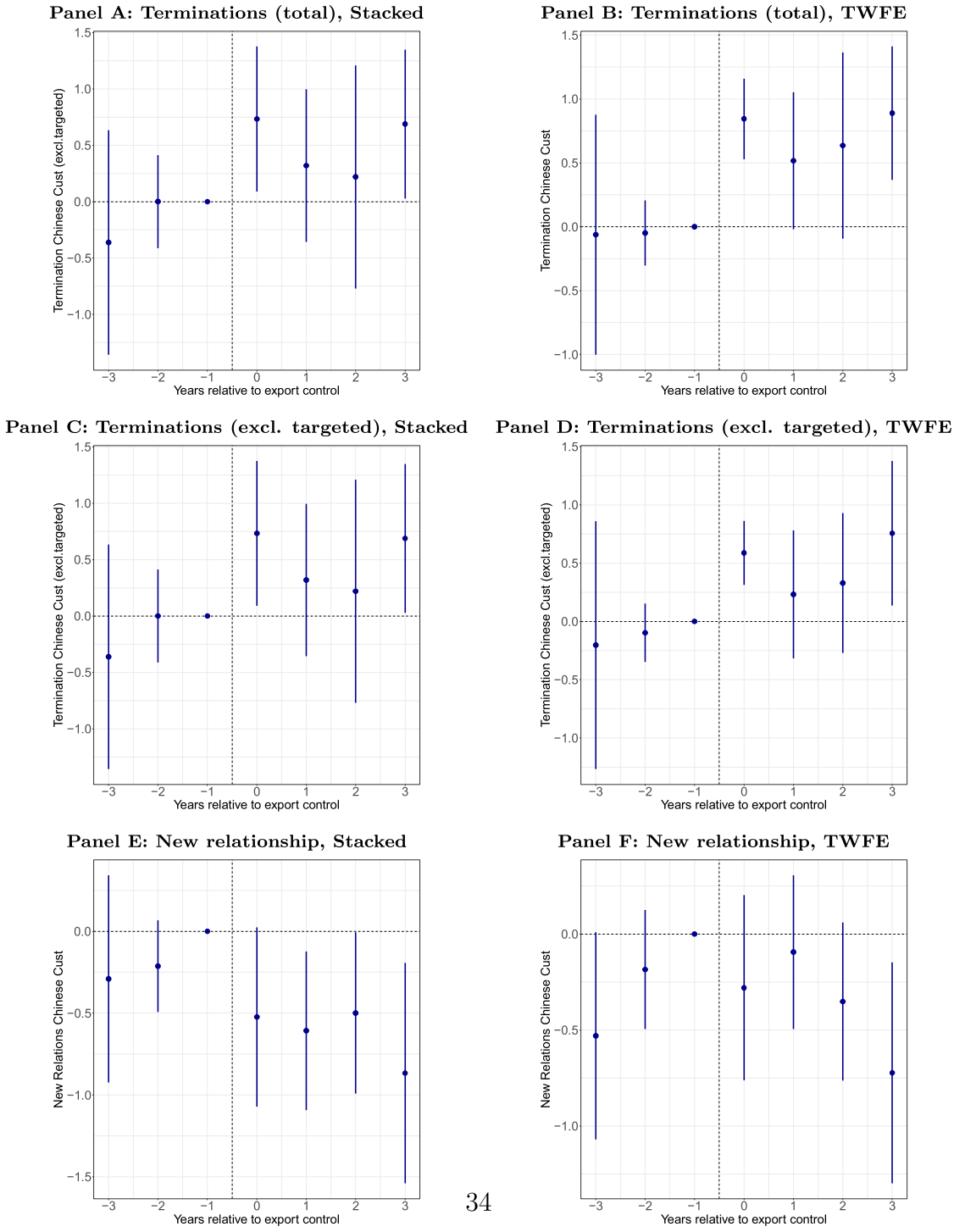


Figure 3: Decoupling in Shares. Figure 3 displays the dynamic effects of export controls on shares of customers in affected suppliers. Panels A shows the coefficient plots for the domestic share using the Poisson Maximum likelihood regression (PPML) on the stacked regression of Eq. (1) while Panels B, C, D, and E display the results on the share of Chinese customers, Asian (excluding Chinese) customers, Asian friend (South Korea, Japan, Taiwan and Australia) customers, and European customers. Regressions include cohort-firm and cohort-industry-size quartile-lagged customer number quartile-year fixed effects. The blue bars indicate 95% confidence intervals around the estimated dynamic coefficient (blue dot).

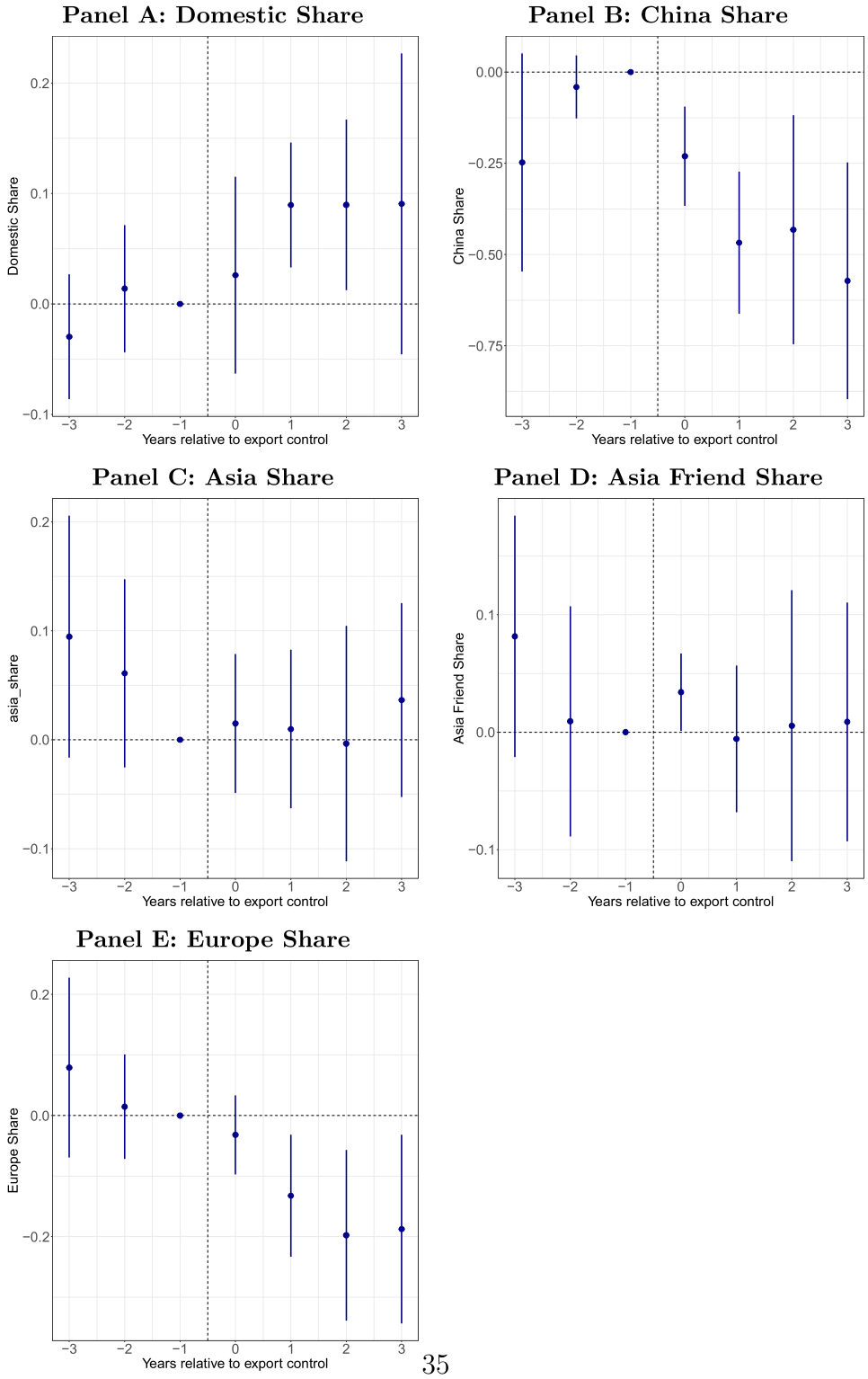


Figure 4: Chinese Firms' Supply Chain Reconfiguration. Figure 4 displays the dynamic effects of export controls on the number of terminated Chinese customers in affected suppliers. Panels A shows the coefficient plots for the terminations with U.S. suppliers using the Poisson Maximum likelihood regression (PPML) on the stacked regression of Eq. (1) while Panels B, C, and D display the results on the new relationships with Chinese suppliers, share of Chinese suppliers, and share of U.S. suppliers. Regressions include cohort-firm and cohort-lagged customer number quartile-year fixed effects. The blue bars indicate 95% confidence intervals around the estimated dynamic coefficient (blue dot).

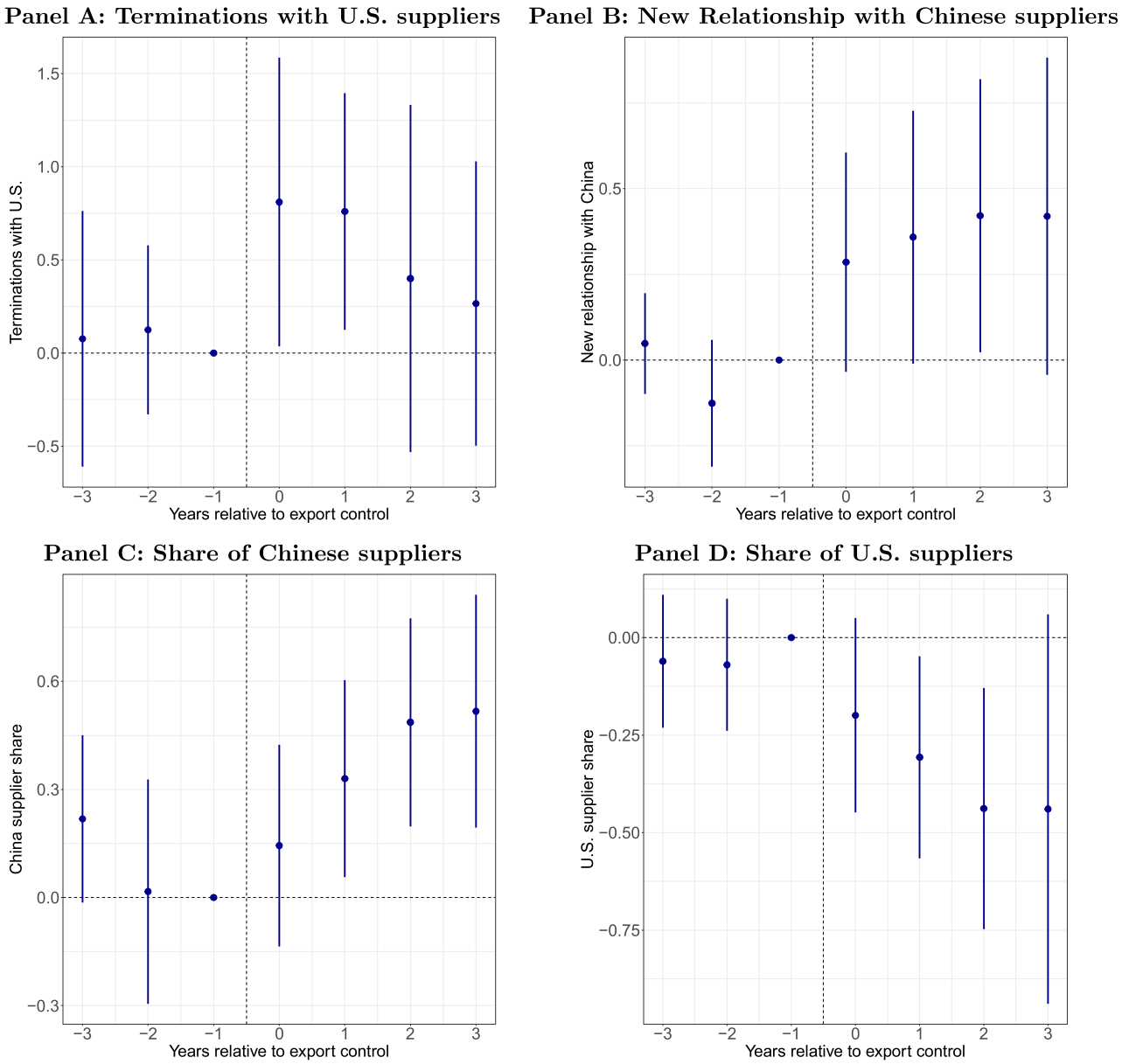


Figure 5: Cumulative Abnormal Returns around Announcement Dates. Figure 5 displays the cumulative abnormal returns (CAR) of affected suppliers in a [-10, 20] day window around the announcement date of the inclusion of a target entity in the BIS lists. Panel A shows CARs using the Fama-French 3-factor model (Fama and French, 1993) while Panel B uses the Fama-French 5-factor model (Fama and French, 2015). On the vertical axis are the cumulative abnormal returns in percentages and on the horizontal axis the days relative to the announcement dates. The dashed vertical line represents the announcement date. The solid red line represents the average CARs and the dot-dash blue line the 95% confidence intervals.

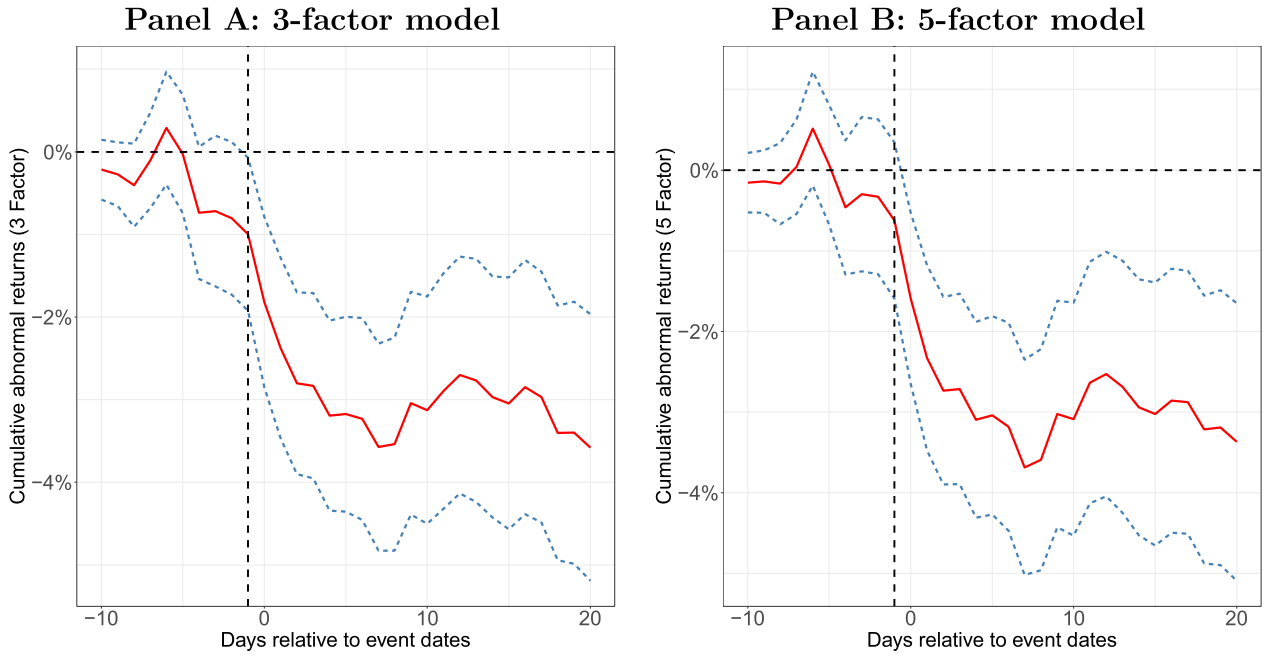


Figure 6: Firm variables for Affected Suppliers. Figure 6 displays dynamic effects of export controls on the firm variables of affected suppliers with the full sample of export control events. Panels A shows the coefficient plots for cash flow using the stacked regression approach of Eq. (1), while Panels B, C, and D display the results on operating income, capex, and the logarithm of one plus number of employees. Regressions include cohort-firm, cohort-industry-size quartile-year. The blue bars indicate 95% confidence intervals around the estimated dynamic coefficient (blue dot).

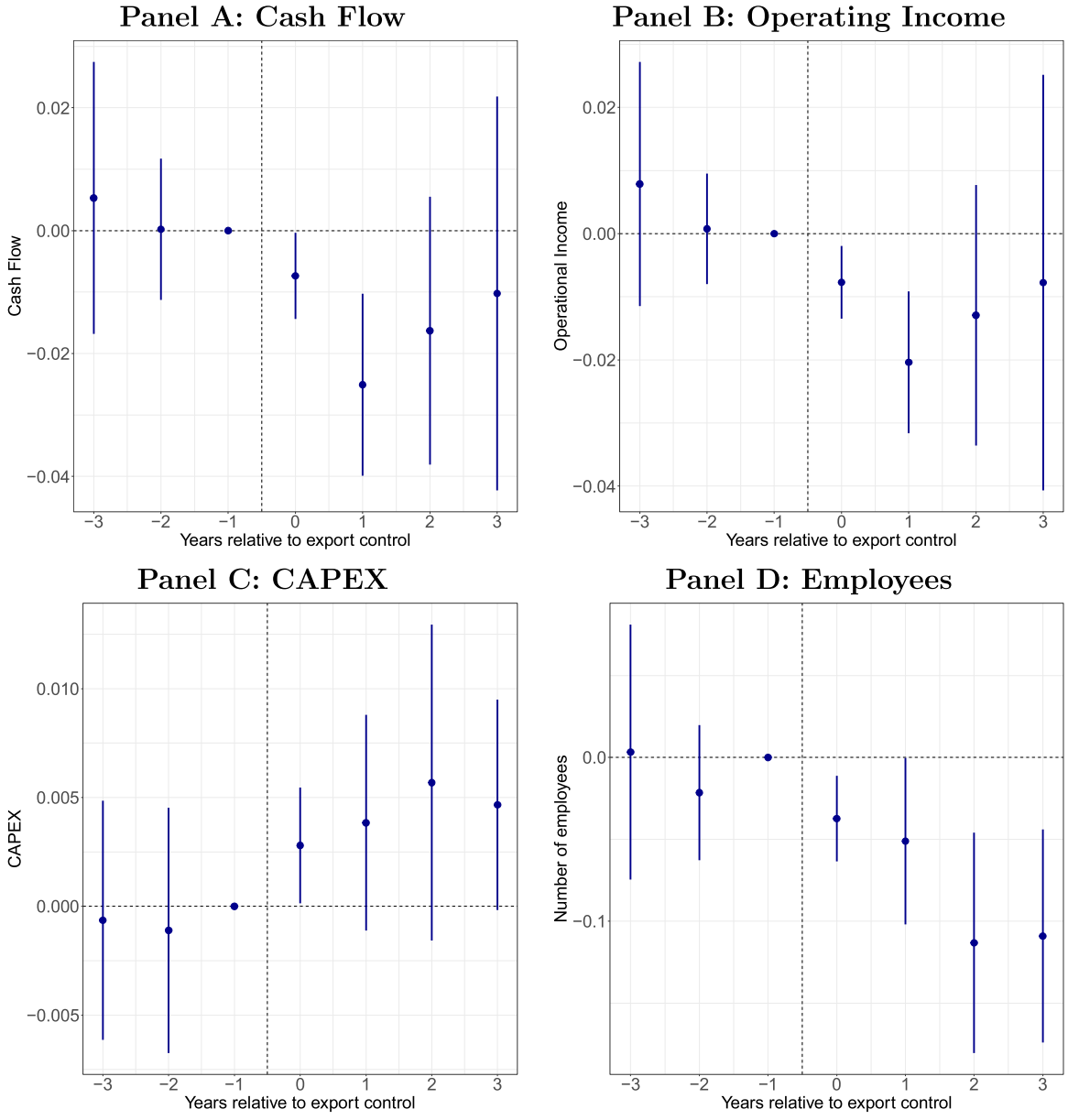


Table 1: Summary Statistics of Supply Chain Reconfigurations. Table 1 presents summary statistics for firms' supply chain relationships based on their treatment status (treated if they supply to Chinese entities in the BIS lists; control if they exported to Chinese entities not in the BIS lists). Termination Chinese Cust is the total number of terminated relations with Chinese customers. Termination Chinese Cust (excl. targeted) is the total number of terminated relations with Chinese customers, excluding those targeted by the BIS lists. New Relations Chinese Cust is the number of new Chinese customers. Total Cust is the total number of customers. Domestic Cust is the number of domestic (U.S.) customers. Domestic Share is the ratio of the total number of domestic US customers to the contemporaneous number of total customers. China share is the ratio of the total number of Chinese customers to the contemporaneous number of total customers. Asia share is the ratio of the total number of customers from Asian countries other than China to the contemporaneous number of total customers. Asia Friend Share is the ratio of the total number of customers from South Korea, Japan, Australia, and Taiwan to the contemporaneous number of total customers. Europe share is the ratio of the total number of customers from European countries to the contemporaneous number of total customers. SD refers to standard deviation, Obs to the number of observations and p(25), p(50), and p(75) to the 25^{th}, 50^{th}, and 75^{th} percentiles, respectively.

	Mean	SD	Obs	p(25)	p(50)	p(75)
Termination Chinese Cust	0.191	0.7	5,972	0	0	0
Treated	0.597	1.42	737	0	0	1
Control	0.134	0.5	5,235	0	0	0
Termination Chinese Cust (excl. targeted)	0.18	0.665	5,972	0	0	0
Treated	0.502	1.301	737	0	0	0
Control	0.134	0.5	5,235	0	0	0
New Relations Chinese Cust	0.41	1.237	5,972	0	0	0
Treated	1.221	2.476	737	0	0	2
Control	0.296	0.883	5,235	0	0	0
Total Cust	31.679	58.086	5,972	7	19	38
Treated	62.248	120.915	737	17	34	60
Control	27.375	40.534	5,235	7	17	35
Domestic Cust	15.133	23.839	5,972	3	9	18
Treated	24.654	44.382	737	6	14	23
Control	13.792	18.888	5,235	3	8	18
Domestic Share	0.515	0.249	5,857	0.333	0.5	0.676
Treated	0.405	0.174	733	0.3	0.395	0.5
Control	0.53	0.255	5,124	0.349	0.515	0.703
China Share	0.058	0.128	5,857	0	0	0.065
Treated	0.094	0.111	733	0.027	0.065	0.122
Control	0.053	0.129	5,124	0	0	0.053
Asia Share	0.195	0.195	5,857	0.026	0.154	0.296
Treated	0.26	0.168	733	0.143	0.246	0.35
Control	0.185	0.196	5,124	0	0.139	0.279
Asia Friend Share	0.148	0.178	5,857	0	0.091	0.217
Treated	0.202	0.168	733	0.077	0.167	0.295
Control	0.14	0.178	5,124	0	0.082	0.2
Europe Share	0.189	0.157	5,857	0.075	0.176	0.272
Treated	0.191	0.118	733	0.111	0.19	0.264
Control	0.188	0.161	5,124	0.067	0.174	0.273

Table 2: Summary Statistics. Table 2 presents summary statistics for firms' balance sheet characteristics based on their treatment status (treated if they supply to Chinese entities in the BIS lists; control otherwise) and for the cumulative abnormal returns of Treated suppliers before and after the announcement of export controls. SD refers to standard deviation, Obs to the number of observations and p(25), p(50), and p(75) to the 25^{th}, 50^{th}, and 75^{th} percentiles, respectively. Cash Flow equals operating income before depreciation minus interest and taxes, divided by lagged assets, ROA is return on assets, CAPEX is capital expenditures divided by lagged assets, Income equals operating income before depreciation divided by lagged assets, Interest is interest expenses divided by lagged assets, Employees is the logarithm of one plus the total number of employees.

	Mean	SD	Obs	p(25)	p(50)	p(75)
Balance Sheet Characteristics						
Assets, $m	10,878	45,837	5,972	199	910	4,090
Treated	15,488	43,377	737	442	1,935	8,030
Control	10,229	46,140	5,235	179	816	3,609
Cash Flow	0.019	0.253	5,944	0.002	0.076	0.124
Treated	0.084	0.128	734	0.052	0.098	0.135
Control	0.010	0.265	5,210	-0.014	0.072	0.122
ROA	-0.031	0.261	5,971	-0.062	0.031	0.083
Treated	0.032	0.142	737	0.002	0.048	0.093
Control	-0.040	0.272	5,234	-0.080	0.027	0.081
CAPEX	0.035	0.040	5,941	0.012	0.024	0.042
Treated	0.037	0.044	734	0.013	0.024	0.041
Control	0.035	0.039	5,207	0.012	0.023	0.042
Income	0.045	0.251	5,944	0.016	0.100	0.156
Treated	0.108	0.132	734	0.074	0.122	0.165
Control	0.037	0.262	5,210	0.002	0.096	0.154
Interest	0.013	0.026	5,313	0.001	0.008	0.017
Treated	0.010	0.010	675	0.004	0.008	0.013
Control	0.014	0.028	4,638	0.001	0.007	0.017
Employees	7.665	2.025	5,908	6.225	7.759	9.105
Treated	8.289	2.05	733	6.935	8.525	9.863
Control	7.576	2.006	5175	6.136	7.649	9.012
Cumulative Abnormal Returns						
3-factor CAR						
[-10, -1]	-0.011	0.082	250	-0.053	-0.009	0.024
[0, 20]	-0.025	0.103	250	-0.081	-0.029	0.024
5-factor CAR						
[-10, -1]	-0.007	0.085	250	-0.047	-0.007	0.027
[0, 20]	-0.027	0.11	250	-0.086	-0.025	0.023

Table 3: Summary Statistics for China Exporters by Size Quartiles. Table 3 presents summary statistics for balance sheet characteristics of firms that export to China, broken down by size quartiles and treatment status (whether or not they were ever treated, namely suppliers of Chinese entities included in the BIS lists). SD refers to the standard deviation. Cash Flow equals operating income before depreciation minus interest and taxes, divided by lagged assets, ROA equals earnings before extraordinary items divided by lagged assets, CAPEX is capital expenditures divided by lagged assets, Operating Income equals operating income before depreciation divided by lagged assets, Interests to asset equals interest expense divided by lagged assets, and Employees equals the log of one plus the total number of employees.

		Full	Size Q1		Size Q2		Size Q3		Size Q4	
	Stat.	Sample	Treated	Control	Treated	Control	Treated	Control	Treated	Control
No. Obs.	Tot.	5,972	32	279	134	984	195	1,670	373	2,274
Assets, $m	Mean	10,878	1,116	130	2,690	623	1,404	1,101	28,649	22,264
	Median	910	120	20	166	93	767	446	6,753	3,705
	SD	45,837	1,753	432	10,027	3,218	1,670	1,732	57,545	67,800
Cash Flow	Mean	0.019	-0.013	-0.266	-0.01	-0.059	0.086	0.009	0.125	0.074
	Median	0.076	0.068	-0.071	0.028	0.027	0.088	0.068	0.115	0.088
	SD	0.253	0.29	0.621	0.183	0.318	0.074	0.216	0.069	0.142
ROA	Mean	-0.031	-0.082	-0.295	-0.048	-0.115	0.024	-0.044	0.075	0.027
	Median	0.031	0.013	-0.295	-0.003	-0.115	0.036	-0.044	0.069	0.027
	SD	0.261	0.367	0.586	0.195	0.35	0.087	0.227	0.074	0.151
CAPEX	Mean	0.035	0.062	0.032	0.035	0.038	0.037	0.038	0.035	0.031
	Median	0.024	0.026	0.018	0.024	0.024	0.026	0.027	0.023	0.022
	SD	0.04	0.105	0.049	0.04	0.046	0.044	0.041	0.035	0.033
Income	Mean	0.045	0.008	-0.241	0.004	-0.037	0.106	0.036	0.154	0.103
	Median	0.1	0.082	-0.062	0.037	0.041	0.108	0.093	0.146	0.117
	SD	0.251	0.28	0.582	0.183	0.314	0.079	0.216	0.074	0.15
Interest	Mean	0.013	0.012	0.023	0.009	0.016	0.009	0.013	0.01	0.013
	Median	0.008	0.009	0.005	0.003	0.004	0.008	0.006	0.01	0.009
	SD	0.026	0.017	0.069	0.017	0.035	0.009	0.025	0.007	0.016
Employees	Mean	7.665	6.83	4.551	6.157	6.016	7.656	7.167	9.508	8.88
	Median	7.759	6.075	4.376	6.077	5.861	7.647	7.046	9.596	8.896
	SD	2.025	1.699	1.559	2.103	1.609	1.373	1.425	1.398	1.539

Table 4: Decoupling from China. This table presents the Poisson Pseudo Maximum Likelihood (PPML) regression results of the effect of export controls on supply chain configurations. Termination Chinese Cust is the total number of terminated relations with Chinese customers. Termination Chinese Cust (excl. targeted) is the total number of terminated relations with Chinese customers, excluding those targeted by the BIS lists. New Relations Chinese Cust is the number of new Chinese customers. Affected equals one for firms that within the previous year had a customer included in the BIS lists (Entity List, UVL, and MEU list) and Post equals one after the inclusion of such customer in the BIS lists. For each cohort, the control group includes never treated and not yet treated firms. SIC refers to the 2-digit standard industrial classification (SIC) code. Size refers to the industry-specific size quartile of each firm. Custom refers to the lagged total number of customers quartile of each firm in the treatment group. We require all firms to be exporting to China in the pre-treatment period. We double cluster the standard errors at the firm and year level. *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	Termination Chinese Cust			Termination Chinese Cust (excl.targeted)			New Relations Chinese Cust		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Affected · Post	0.571***	0.587**	0.698***	0.371*	0.408*	0.558**	-0.480***	-0.523***	-0.472**
	(0.210)	(0.234)	(0.266)	(0.224)	(0.242)	(0.267)	(0.139)	(0.153)	(0.120)
Fixed Effects:									
Cohort-Firm	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cohort-SIC-Year	✓			✓			✓		
Cohort-SIC-Size-Year		✓			✓			✓	
Cohort-SIC-Size-Custom-Year			✓			✓			✓
Observations	18,375	16,034	11,337	18,266	15,960	11,267	25,294	23,221	19,000
Pseudo R^2	0.294	0.314	0.365	0.291	0.312	0.362	0.401	0.425	0.472

Table 5: Supply Chain Reconfiguration – Number of customers. This table presents the Poisson Pseudo Maximum Likelihood (PPML) regression results of the effect of export controls on supply chain configurations. Total Cust is the total number of customers. Domestic Cust is the number of domestic customers. Affected equals one for firms that within the previous year had a customer included in the BIS lists (Entity List, UVL, and MEU list) and Post equals one after the inclusion of such customer in the BIS lists. For each cohort, the control group includes never treated and not yet treated firms. SIC refers to the 2-digit standard industrial classification (SIC) code, and Size to the industry-specific size quartile of each firm. We require all firms to be exporting to China in the pre-treatment period. We double cluster the standard errors at the firm and year level. *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	Total Cust		Domestic Cust	
	(1)	(2)	(3)	(4)
Affected · Post	-0.144**	-0.138**	-0.117	-0.098
	(0.065)	(0.070)	(0.076)	(0.084)
Fixed Effects:				
Cohort-Firm	✓	✓	✓	✓
Cohort-SIC-Year	✓		✓	
Cohort-SIC-Size-Year		✓		✓
Observations	32,294	32,159	31,803	31,639
Pseudo R^2	0.848	0.861	0.771	0.787

Table 6: Supply Chain Reconfigurations – Customer Share. This table presents the Poisson Pseudo Maximum Likelihood (PPML) regression results of the effect of export controls on supply chain reconfigurations. Domestic Share is the ratio of the total number of domestic US customers to the contemporaneous number of total customers. China Share is the ratio of the total number of Chinese customers to the contemporaneous number of total customers. Asia Share is the ratio of the total number of customers from Asia, excluding China, to the contemporaneous number of total customers. Asia Friend Share is the ratio of the total number of customers from South Korea, Japan, Taiwan, and Australia to the contemporaneous number of total customers. Europe Share is the ratio of the total number of customers from Europe to the contemporaneous number of total customers. Affected equals one for firms that within the previous year had a customer included in the BIS lists (Entity List, UVL, and MEU list), and Post equals one after the inclusion of such customer in the BIS lists. For each cohort, the control group includes never treated and not yet treated firms. SIC refers to the 2-digit standard industrial classification (SIC) code. Size refers to the industry-specific size quartile of each firm. Custom refers to the lagged total number of customers quartile of each firm in the treatment group. We require firms to export to China in the pre-treatment period. We double-cluster the standard errors at the firm and year level. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Domestic Share and China Share

	Domestic Share		China Share	
	(1)	(2)	(3)	(4)
Affected · Post	0.081***	0.074**	-0.332***	-0.318***
	(0.030)	(0.032)	(0.075)	(0.104)
Fixed Effects:				
Cohort-Firm	✓	✓	✓	✓
Cohort-SIC-Size-Year	✓		✓	
Cohort-SIC-Size-Custom-Year		✓		✓
Observations	31,443	31,355	27,897	26,414
Pseudo R^2	0.060	0.063	0.226	0.232

Panel B: Other Customer Share

	Asia Share		Asia Friend Share		Europe Share	
	(1)	(2)	(3)	(4)	(5)	(6)
Affected · Post	-0.049	-0.035	-0.038	-0.015	-0.111**	-0.149***
	(0.047)	(0.047)	(0.049)	(0.042)	(0.05)	(0.035)
Fixed Effects:						
Cohort-Firm	✓	✓	✓	✓	✓	✓
Cohort-SIC-Size-Year	✓		✓		✓	
Cohort-SIC-Size-Custom-Year		✓		✓		✓
Observations	29,446	29,148	28,209	27,722	29,469	29,130
Pseudo R^2	0.103	0.107	0.129	0.132	0.069	0.073

Table 7: Decoupling from the US: The Chinese Perspective. This table presents the Poisson Pseudo Maximum Likelihood (PPML) regression results of the effect of export controls on Chinese firms' supply chain reconfigurations. Termination US Supp is the total number of terminated relations with the US suppliers. New Relations Chinese Supp is the number of new Chinese suppliers. New Relations US Supp is the number of new US suppliers. Affected equals one for Chinese firms that within the previous year are included in the BIS lists (Entity List, UVL, and MEU list) and Post equals one after the inclusion of such firms in the BIS lists. For each cohort, the control group includes never treated and not yet treated firms. Custom refers to the lagged total number of customers quartile of each firm of the targeted Chinese firm group. We require all firms to be importing from US suppliers in the pre-treatment period. We double cluster the standard errors at the firm and year level. *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	Terminations US Supp		New Relations Chinese Supp		New Relations US Supp	
	(1)	(2)	(3)	(4)	(5)	(6)
Affected · Post	0.567**	0.533*	0.4702***	0.399**	-0.206	-0.255
	(0.288)	(0.298)	(0.1798)	(0.189)	(0.174)	(0.187)
Fixed Effects:						
Cohort-Firm	✓	✓	✓	✓	✓	✓
Cohort-Year	✓		✓		✓	
Cohort-Custom-Year		✓		✓		✓
Observations	164,404	163,292	191,616	190,181	181,496	180,782
Pseudo R^2	0.1460	0.153	0.462	0.466	0.225	0.232

Table 8: Decoupling from the US – Customer Shares. This table presents the Poisson Pseudo Maximum Likelihood (PPML) regression results of the effect of export controls on Chinese firms' supply chain configurations. Total Suppliers is the total number of suppliers. China Supplier Share is the ratio of the total number of Chinese suppliers to the contemporaneous number of total suppliers. US Supplier Share is the ratio of the total number of US suppliers to the contemporaneous number of total suppliers. Affected equals one for Chinese firms that within the previous year are included in the BIS lists (Entity List, UVL, and MEU list) and Post equals one after the inclusion of such Chinese firms in the BIS lists. For each cohort, the control group includes never treated and not yet treated firms. Custom refers to the lagged total number of customers quartile of each firm in the treatment group. We require all control firms to be importing from US in the pre-treatment period. We double cluster the standard errors at the firm and year level. *** p<0.01, ** p<0.05, * p<0.1.

Dependent Variables:	Total Suppliers		China Supplier Share		US Supplier Share	
	(1)	(2)	(3)	(4)	(5)	(6)
Affected · Post	0.064	0.002	0.302***	0.295***	-0.327**	-0.282**
	(0.122)	(0.107)	(0.114)	(0.108)	(0.135)	(0.125)
Fixed Effects:						
Cohort-Firm	✓	✓	✓	✓	✓	✓
Cohort-Year	✓		✓		✓	
Cohort-Custom-Year		✓		✓		✓
Observations	250,368	250,368	180,707	180,647	191,090	191,090
Pseudo R^2	0.712	0.715	0.089	0.089	0.208	0.209

Table 9: Real Effects of Export Controls. This table presents the stacked regression results of the effect of export controls on cash flow, operating income, capital expenditure and employment. Cash Flow equals operating income before depreciation minus interest and taxes, divided by lagged total assets. Income equals operating income before depreciation divided by lagged assets; CAPEX is capital expenditures divided by lagged assets; and Employees is the logarithm of one plus the number of employees. Affected equals one for firms that within the previous year had a customer included in the BIS lists (Entity List, UVL, and MEU list). Post equals one after the inclusion of such customer in the BIS lists. For each cohort, the control group includes never treated and not yet treated firms. SIC refers to the 2-digit standard industrial classification (SIC) code, Size to the industry-specific size quartile of each firm, and China equals one if a firm exports to China. We require all firms to be exporting to China in the pre-treatment period. We double cluster the standard errors at the firm and year level. *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	Cash Flow		Income		CAPEX		Employees	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Full Sample				
Affected · Post	-0.021**	-0.017**	-0.018**	-0.015*	0.006*	0.005	-0.081**	-0.066**
	(0.007)	(0.007)	(0.007)	(0.008)	(0.003)	(0.003)	(0.032)	(0.027)
Observations	32,190	32,190	32,190	32,190	32,147	32,147	32,069	32,069
				Panel B: Restrictive Sample				
Affected · Post	-0.022**	-0.017**	-0.019**	-0.015*	0.006*	0.004	-0.079**	-0.066**
	(0.008)	(0.007)	(0.008)	(0.007)	(0.003)	(0.003)	(0.033)	(0.027)
Observations	26,837	26,837	26,837	26,837	26,803	26,803	26,743	26,743
Fixed Effects:								
Cohort-Firm	✓	✓	✓	✓	✓	✓	✓	✓
Cohort-SIC-Year	✓		✓		✓		✓	
Cohort-SIC-Size-Year		✓		✓		✓		✓

Online Appendix: Not For Publication

This appendix includes several sections of supplemental information. Appendix A contains definitions for the variables used in the paper and Appendix B includes additional results.

A Variable Definitions

Variable Name	Description
Terminations Chinese Cust	Total number of terminated relations with Chinese customers *Source:* Factset Revere.
Terminations Chinese Cust (excl.targeted)	Total number of terminated relations with Chinese customers, excluding those targeted by the BIS lists. *Source:* Factset Revere.
New Relations Chinese Cust	The number of new Chinese customers *Source:* Factset Revere.
Total Cust	Total number of customers. *Source:* Factset Revere.
Domestic Cust	Total number of domestic customers. *Source:* Factset Revere.
Domestic Share	Ratio of the total number of domestic US customers to the contemporaneous number of total customers. *Source:* Factset Revere.
China Share	Ratio of the total number of Chinese customers to the contemporaneous number of total customers. *Source:* Factset Revere.
Asia Share	Ratio of the total number of customers from Asia, excluding China, to the contemporaneous number of total customers. *Source:* Factset Revere.
Asia Friend Share	Ratio of the total number of customers from South Korea, Japan, Taiwan, and Australia to the contemporaneous number of total customers. *Source:* Factset Revere.
Europe Share	Ratio of the total number of customers from Europe to the contemporaneous number of total customers. *Source:* Factset Revere.
Termination US Supp	Total Number of terminated relations with the US suppliers. *Source:* Factset Revere.
New Relations Chinese Supp	Number of new Chinese suppliers. *Source:* Factset Revere.
New Relations US Supp	Number of new US suppliers. *Source:* Factset Revere.
Total Suppliers	Total number of suppliers. *Source:* Factset Revere.
China Supplier Share	Ratio of the total number of Chinese suppliers to the contemporaneous number of total suppliers. *Source:* Factset Revere.

Continued on next page

Table A.1 – *Continued from previous page*

Variable	**Description**
US Supplier Share	Ratio of the total number of US suppliers to the contemporaneous number of total suppliers. *Source:* Factset Revere.
Assets	Total assets in $ million (at). *Source:* Compustat.
Cash Flow	Operating income before depreciation (oibd) minus interest (xint) and taxes (txt), divided by lagged assets. *Source:* Compustat.
ROA	Earnings before extraordinary items (ib) divided by lagged assets. *Source:* Compustat.
CAPEX	Capital expenditures (capx) divided by lagged assets. *Source:* Compustat.
Income	Operating Income before depreciation (oibdp) divided by lagged assets. *Source:* Compustat.
Interest	Interest expense (xint) divided by lagged assets. *Source:* Compustat.
Employees	Logarithm of one plus the number of employees in thousands (emp). *Source:* Compustat.
Affected	Firm that supplied goods and services to a Chinese entity within one year of its inclusion in a BIS export control list. *Source:* FactSet Revere.

B Additional Results

Table B.1: Summary Statistics of Chinese firms' Supply Chain Reconfigurations. Table B.1 presents summary statistics for Chinese firms' supply chain relationships based on their treatment status (treated if they are included the BIS lists; control if they are not in the BIS lists). Termination US Supp is the total number of terminated relations with US suppliers. New Relations Chinese Supp is the number of new Chinese suppliers. New Relations US Supp is the number of new US suppliers. Total Suppliers is the total number of suppliers. China share is the ratio of the total number of Chinese suppliers to the contemporaneous number of total suppliers. US share is the ratio of the total number of US suppliers to the contemporaneous number of total suppliers. SD refers to standard deviation, Obs to the number of observations and p(25), p(50), and p(75) to the 25^{th}, 50^{th}, and 75^{th} percentiles, respectively.

	Mean	SD	Obs	p(25)	p(50)	p(75)
Termination US Supp.	0.202	0.498	271,345	0	0	0
Treated	0.507	0.765	211	0	0	1
Control	0.201	0.498	271,134	0	0	0
New Relations Chinese Supp.	1.253	2.576	271,345	0	0	1
Treated	2.839	3.951	211	0	1	4
Control	1.252	2.574	271,134	0	0	1
New Relations US Supp.	0.303	0.686	271,345	0	0	0
Treated	0.668	1.03	211	0	0	1
Control	0.303	0.686	271,134	0	0	0
Total Suppliers	6.824	11.265	271,345	1	2	7
Treated	14.739	16.411	211	2	7	21.5
Control	6.818	11.258	271,134	1	2	7
China Share	0.476	0.369	214,378	0	0.5	0.8
Treated	0.433	0.305	198	0.167	0.5	0.647
Control	0.476	0.369	214,180	0	0.5	0.8
US Share	0.295	0.351	214,378	0	0.157	0.5
Treated	0.352	0.305	198	0.113	0.25	0.5
Control	0.295	0.351	214,180	0	0.157	0.5

Figure B.1: Cumulative Abnormal Returns and Tighter Export Controls. Figure B.1 displays the cumulative abnormal returns (CAR) of affected suppliers in a [-10, 20] day window around the announcement date of the inclusion of a target entity in the most stringent BIS lists, the Entity and MEU lists. Panel A shows CARs using the Fama-French 3-factor model (Fama and French, 1993) while Panel B uses the Fama-French 5-factor model (Fama and French, 2015). On the vertical axis are the cumulative abnormal returns in percentages and on the horizontal axis the days relative to the announcement dates. The dashed vertical line represents the announcement date. The solid red line represents the average CARs and the dot-dash blue line the 95% confidence intervals.

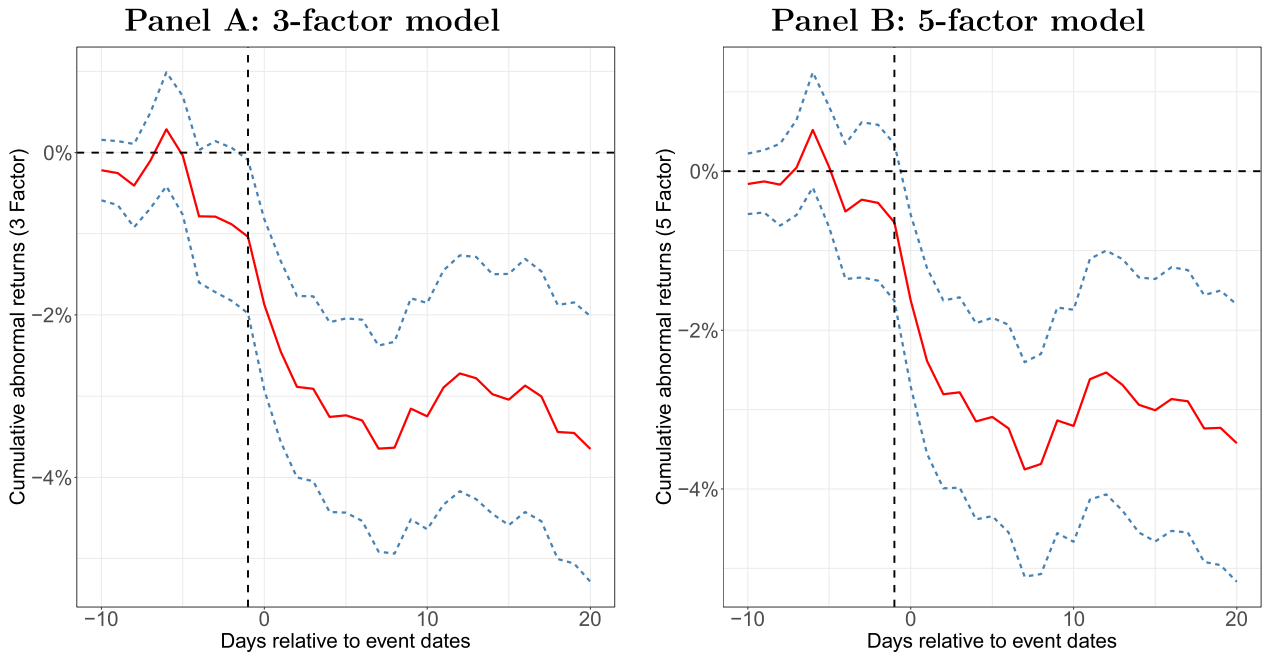
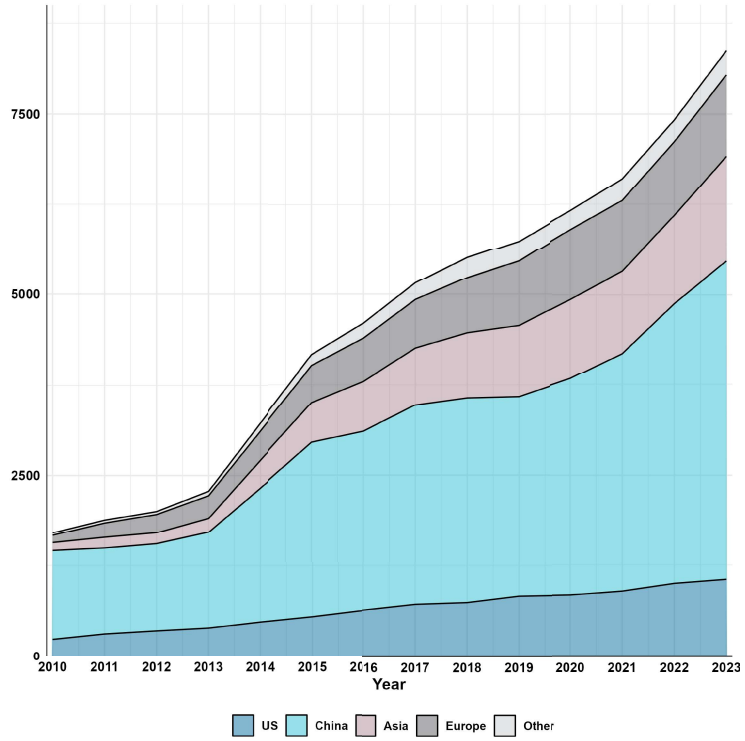


Figure B.2: Global suppliers to Chinese firms. Figure B.2 displays the number of suppliers to Chinese firms and the share of suppliers to Chinese firms by regions.

Panel A: Number of suppliers to Chinese firms by regions



Panel B: Share of suppliers to Chinese firms by regions