

Global Supply Chain Disruptions and Product Market Competition

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The Effects of New Geopolitical Risks on Financial Markets and Firms

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We study the effect of supply chain interruptions on corporate performance in competitive and non-competitive industries.

Finance and Product Market Relationships:

- Motivated by Coase (1937), finance theory has long recognized the importance of finance for product market relationships (Titman, 1984; Maksimovic and Titman, 1991).
- The importance of finance for competition has also been documented empirically (Phillips, 1995; MacKay and Phillips, 2005; Kale and Shahrur, 2007; Banerjee, Dasgupta and Kim, 2008; Moon and Phillips, 2021; Giambona, Kumar, and Phillips, 2023).
- Empirical studies have also documented that product market relationships are associated with corporate performance (e.g., Allen and Phillips, 2000; Chu, Tian and Wang, 2019; Dai, Liang and Ng, 2020).

Product Market Relationships and the Propagation of Production Shocks

- Theoretically, Long and Plosser (1983) are the first to study how production network shocks affect related firms.
 - Shocks can propagate through production networks.
 - A production shock affecting firms in industry j will propagate to the customers of these firms.
 - Shocks can potentially further propagate downstream to the customers of the customers.
- Shocks can further propagate upstream to the suppliers (Carvalho et al., 2020; Baqaee and Farhi, 2018).
- Search costs can limit firms' ability to adjust their sourcing strategy following a shock, leading to the propagation (Antràs, Fort, and Tintelnot, 2017; Bernard, Moxnes, and Saito, 2019).
- Our discussant (Ersahin, Huang, Giannetti, 2023) has a paper that shows the impact of supply chain risk during the Covid-19 crisis on vertical integration and changes in supply chain composition.

Competition and the Propagation of Production Shocks

How do production shocks affect corporate performance in competitive and non-competitive industries?

- Conceptually, it could be that firms in more competitive industries are able to cope more effectively with production shocks because only more efficient firms operate in such industries.
- Alternatively, it could be that firms in non-competitive industries can respond better to supply chain shocks because they are cash rich and can attract alternative suppliers by paying higher price:

The aim of this paper is to study this question empirically:

- Prior studies have not considered the role of product market competition in the propagation of shocks.

Competition and Productivity: Our Contribution

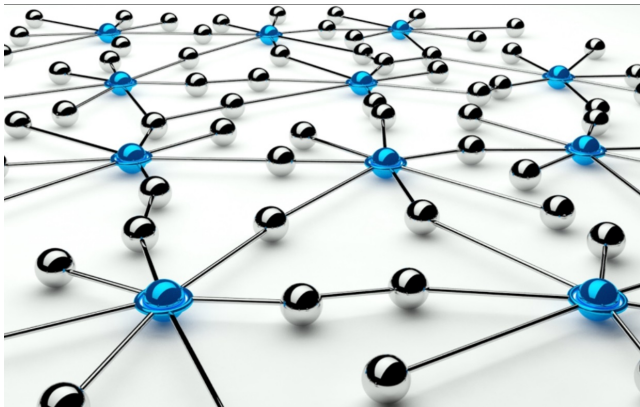
- Our contribution: We show the impact of product market competition on the impact of disruptions to supply chains.
- Starting with Nickell (1996), several studies have documented that greater industry competition leads to faster productivity growth (e.g., Blundell, Griffith and van Reenen, 1999; Aghion et al., 2004, 2009; Schmitz Jr, 2005).
- This productivity growth occurs because competition:
 - Facilitates the displacement of less efficient firms by their rivals (Disney, Haskel and Heden, 2003; Harris and Li, 2006).
 - Incentivizes managers to work hard (Koke and Renneboog, 2005).
 - Reduces agency costs (Giroud and Mueller, 2010) as managers are less likely to enjoy the “quiet life.”

Measuring Competition: Analyze Textual Data!



Use scalable NLP to create a generalized concept of industry, identify competitors and measure competition. Useful in many economics and management questions.

New data & methods enable *Network representation* of industries



- * Industry is the most core part of market structure.
- * Modeling which firms are in the same industries is essentially “network design”. We can measure localized competition and find related firm that are important in corporate finance and asset pricing.

Competitor and Industry Identification: Use Text and NLP

- Text-based Network Industry Classification (TNIC) data:
 - [Hoberg and Phillips \(2010 RFS\)](#): “Product Market Synergies and Competition in Mergers and Acquisitions: A Text-Based Analysis.”
 - [Hoberg and Phillips \(2016 JPE\)](#): “Text-Based Network Industries and Endogenous Product Differentiation.”
- Many new “Big Data and NLP” papers in finance and economics.
 - New NLP methods applied to understand firm scope and industry concentration. [Hoberg and Phillips \(2022, wp\)](#): “Scope, Scale and Concentration: The 21st Century Firm”
 - New research using machine learning of patent text from over 600,000 patents to understand innovation competition. [Acikalin, Caskurlu, Hoberg and Phillips \(2022, wp\)](#): “Intellectual Property Protection Lost and Competition: An Examination Using Large Language Models.”

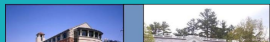
TNIC data available on the web: 1989-2019



The Hoberg and Phillips Text Based Industry Classifications have a spatial representation. All firms have a location in a product market space shaped as a unit sphere. Competitive product markets are areas of the sphere where many firms are located. Concentrated areas are sparsely populated.

Some regions of the product space have no firms residing there, as some text descriptions of products would describe products with no demand, such as the word combination: "eggs", "paint" and "gardening".

The best way to tap the full research power of this product market grid is to use the Text-based Network Industry Classifications (TNIC), which is a network way of identifying competitors to each firm. Competitors are firms residing in close proximity in product space to each firm based on a continuous measure of similarity. Another key benefit of TNIC industries is that industry composition is updated annually, and our own research indicates that the product market space itself thus dynamically changes over time. As a result, static fixed-location FIC classifications miss out on much of the picture.



Welcome to the Hoberg-Phillips Data Library

<< **NEW: Data extended to 2019 AND back-extended to 1989 (9 more years)! >>**

<< **Also: new paper on industry scope using extended data [download here] >>**

Data provided by [Gerard Hoberg \(USC\)](#) and [Gordon Phillips \(Dartmouth\)](#)

[Text-based Network Industry Classifications \(TNIC\) data](#) **[click here]**

* These new industry classifications are based on firm pairwise similarity scores from text analysis of firm 10K product descriptions. Competitors are firm centric with each firm having its own distinct set of competitors - analogous to networks or a "Facebook" circle of friends. These new industry classifications are updated annually and offer more research flexibility, and are also more informative, than FIC (fixed industry) classifications such as SIC, NAICS, and the 10-K based FIC classifications below. Our research shows they sharply improve upon SIC and NAICS codes in explaining many different firm specific decisions, including firm profitability, Tobins Q and dividends. These benefits are outlined in Hoberg and Phillips (2010, 2016), with references available by clicking on above link.

[Industry Concentration and Total Similarity Data](#) **[click here]**

* HHI Concentration metrics and Total Similarity data is available based on TNIC Industries.

[Product Market Fluidity Data](#) **[click here]**

* Product Market Fluidity data assesses the degree of competitive threat and product market change surrounding a firm, and is based on Hoberg, Phillips and Prabhala (2014).

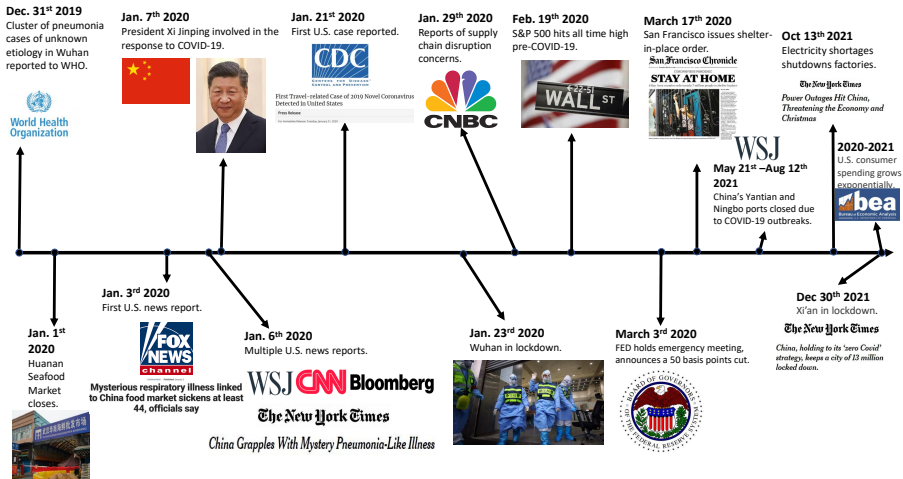
[Vertical TNIC Data \(VTNIC\)](#) **[click here]**

* Vertical TNIC data is comprised of two key databases, and is based on Fresard, Hoberg, and Phillips (2019 forthcoming). The first is a firm-year panel indicating the extent to which firms are vertically integrated. The second is a firm-pair-year database indicating the potential for vertical relatedness for every pair of firms in every year.

Now at: <http://hobergphillips.tuck.dartmouth.edu/>. Over 75,000 downloads of data by academics and industry.

Timeline of the Coronavirus Pandemic

- U.S. media coverage of the pandemic started in early January 2020.
- On January 29, 2020, CNBC reported a list of 27 firms, including Apple, 3M, United Technologies, Crane & Co., reporting shipment delays from China.



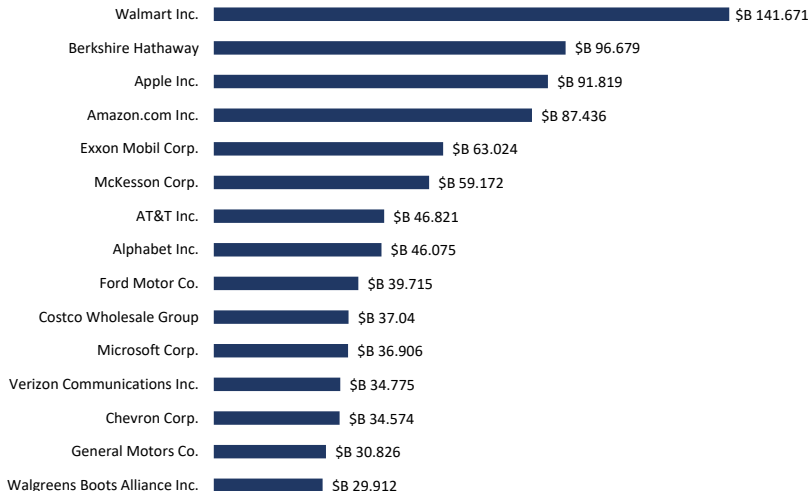
FactSet Supply-Chain Statistics

- Use micro-level FactSet Revere Supply chain relationships database (millions of observations). Almost 1 million firm-quarter relationships for just public firms.
- 15.8% and 16.3% of U.S. firms have at least one material Chinese supplier and customer, respectively, on December 31, 2019:
 - On average, U.S. firms have 0.7/0.3 Chinese suppliers/customers.
 - They also have 9.1 (6.9) and 6.0 (5.5) U.S. (foreign) suppliers/customers.
- On average, firms with Chinese suppliers import 13.2 kg/tons and 2.4 TEU (20-foot container Equivalent Units) containers from China, respectively.
- Other foreign imports are 14.6 kg/tons and 1.8 TEU containers, respectively.

==> We link in Compustat, CRSP Stock and Trace Bond Prices.

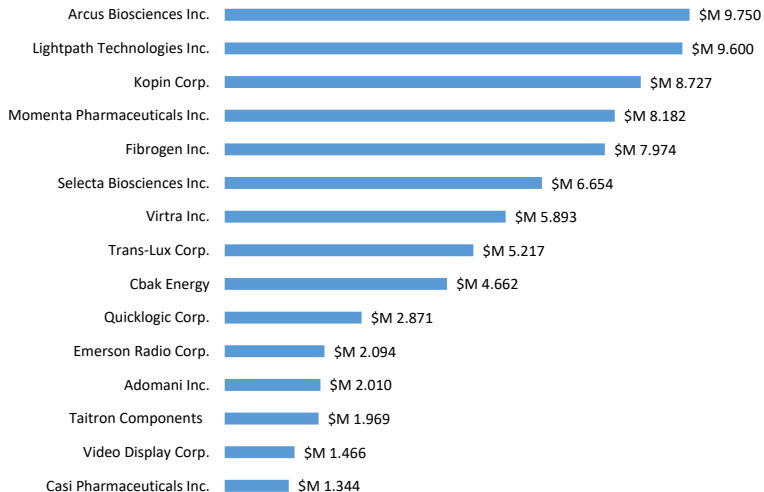
Top 15 US Firms with Chinese Suppliers

- Top 15 US firms with Chinese suppliers by sales in 2019q4.



Bottom 15 US Firms with Chinese Suppliers

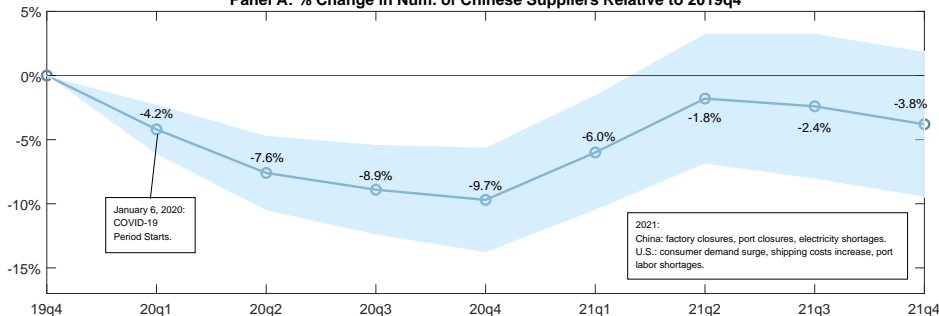
- Bottom 15 US firms with Chinese suppliers by sales in 2019q4.



Number of Chinese Suppliers During the Pandemic

- U.S. firms with Chinese suppliers on December 31, 2019, lost a significant percentage of these suppliers by 2020q4.
- But the number was nearly at pre-pandemic levels at the end of 2021.

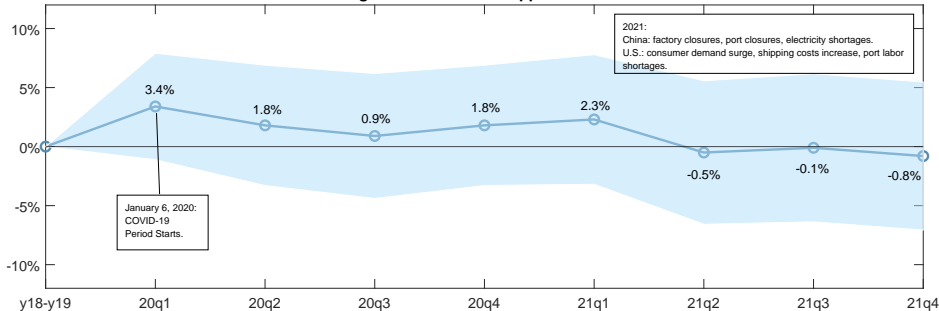
Panel A: % Change in Num. of Chinese Suppliers Relative to 2019q4



Number of US Suppliers During the Pandemic

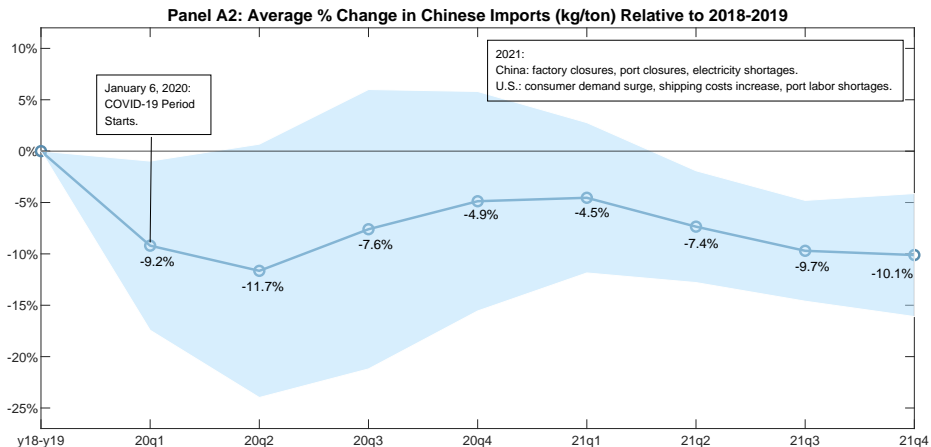
- Firms with Chinese suppliers did not resort to US suppliers relatively more than US firms without Chinese suppliers in 2020q1-2021q4.

Panel B: % Change in Num. of U.S. Suppliers Relative to 2018-2019



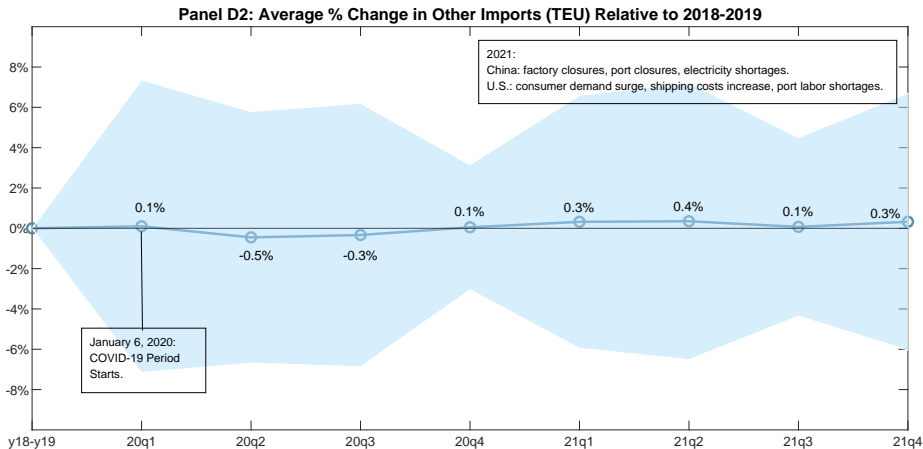
Imports from China During the Pandemic

- On average, weight (kg/ton) imports from China for firms with Chinese suppliers decreased by 10.1% during the pandemic compared with 2018-2019.



Imports (TEU) from Other Countries During the Pandemic

- Volume imports from other countries did not change relatively more for firms with Chinese suppliers relative to firms without Chinese suppliers during the pandemic.



Empirical Design

We use a DiD set-up to analyze the effects of the supply chain shock on firms with Chinese suppliers.

We compare effects in 2021q4-2020q1 with 2019q4-2018q1.

$$\begin{aligned} \text{Log of Sales}_{i,q} = & \sum_{k=2020q1}^{2021q4} \beta_k (\text{Chinese Suppliers} \geq 1_{i,Pre-event} \times k) + \\ & \sum_{k=2020q1}^{2021q4} \gamma_k (\text{Chinese Customers} \geq 1_{i,Pre-event} \times k) + \\ & 1 / \text{Assets}_{i,q-1} + i_i \times z_q + y_i + \varepsilon_{i,q}, \end{aligned} \quad (1)$$

Log of Sales_{i,q}: natural log of sales of firm *i* in quarter *q*.

Chinese Suppliers $\geq 1_{i,Pre-event}$: indicator for firms with Chinese suppliers on December 31, 2019.

Chinese customers indicator defined similarly.

2020q1: indicator for 2020 quarter 1.

$i_i \times z_q$: industry-year-quarter fixed effects. y_i : firm fixed effects.

Industry Distribution: Treated Firms vs. Control Firms

- Is it possible that firms w/ Chinese suppliers are in industries more affected by lower demand during pandemic (as opposed to supply shock)s?
- We control for industry in all regressions.
- In addition, the industry distribution is comparable for treated and control firms.

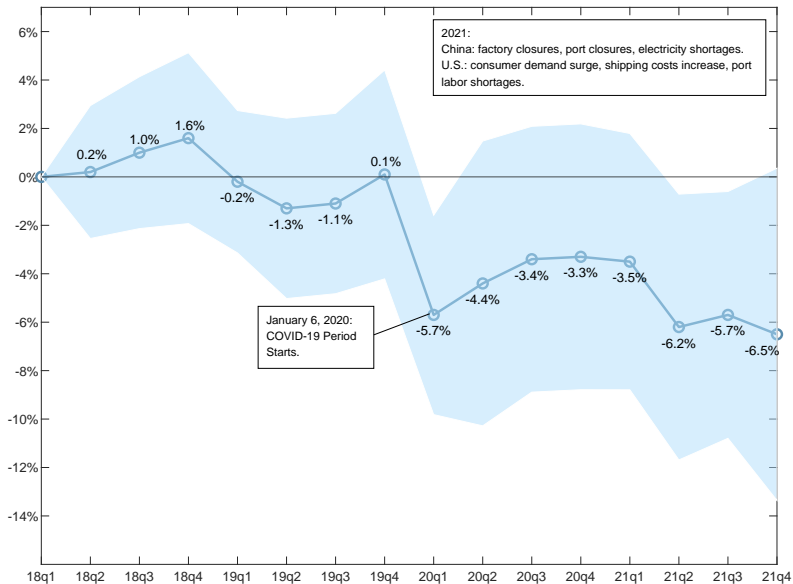
Sales During the Pandemic: By Sourcing Strategy

- Sales declined sizably for firms with Chinese suppliers relative to firms w/out Chinese suppliers during 2020q1-2021q1.
- Similar sales declines if firms w/out Chinese suppliers are identified using industry matching, FactSet competitors, top 5 TNIC rivals.

Sample:	Dep. Variable: Log of Sales			
	All Firms	Matching on 2-digit SIC and Log of Assets Categories	FactSet Competitors	Top 5 TNIC Rivals
	(1)	(2)	(3)	(4)
Chinese Suppliers ≥ 1 \times 2020q1	-0.057*** (0.016)	-0.086*** (0.019)	-0.069*** (0.018)	-0.047** (0.018)
Chinese Suppliers ≥ 1 \times 2020q2	-0.045* (0.026)	-0.070** (0.033)	-0.048* (0.029)	-0.021 (0.029)
Chinese Suppliers ≥ 1 \times 2020q3	-0.034 (0.023)	-0.054* (0.028)	-0.045* (0.026)	-0.023 (0.026)
Chinese Suppliers ≥ 1 \times 2020q4	-0.033 (0.023)	-0.030 (0.029)	-0.022 (0.027)	-0.012 (0.026)
Chinese Suppliers ≥ 1 \times 2021q1	-0.036 (0.022)	-0.048* (0.029)	-0.025 (0.026)	-0.002 (0.026)
Chinese Suppliers ≥ 1 \times 2021q2	-0.062** (0.024)	-0.059* (0.031)	-0.053** (0.027)	-0.055** (0.028)

Sales Around the Pandemic: By Sourcing Strategy

■ No pre trends.



Sales for Affected EU, Asian, and Global Firms

- Sales only declined for EU and Asian firms with Chinese suppliers in 2020q1.
- No effect on sales of other global firms.

	Dep. Variable: Log of Sales		
	EU Firms	Asian Firms	Global Firms
	(1)	(2)	(3)
Chinese Suppliers $\geq 1 \times 2020q1$	-0.060** (0.024)	-0.065*** (0.021)	0.011 (0.022)
Chinese Suppliers $\geq 1 \times 2020q2$	-0.035 (0.028)	-0.027 (0.024)	0.021 (0.024)
Chinese Suppliers $\geq 1 \times 2020q3$	-0.027 (0.027)	-0.002 (0.024)	0.016 (0.027)
Chinese Suppliers $\geq 1 \times 2020q4$	-0.003 (0.028)	-0.053 (0.043)	0.023 (0.026)
Chinese Suppliers $\geq 1 \times 2021q1$	0.014 (0.030)	-0.055 (0.042)	0.022 (0.028)
Chinese Suppliers $\geq 1 \times 2021q2$	-0.020 (0.031)	-0.067 (0.042)	0.012 (0.029)
Chinese Suppliers $\geq 1 \times 2021q3$	-0.024 (0.027)	-0.062 (0.044)	-0.029 (0.031)
Chinese Suppliers $\geq 1 \times 2021q4$	-0.021 (0.028)	-0.044 (0.044)	-0.032 (0.032)
Controls	Yes	Yes	Yes
Obs	20,498	36,497	46,799

Sales During the Pandemic: By Sourcing Strategy and Product Market Competition

- Sales declined sizably for firms with Chinese suppliers in low entry threat and low competition industries.

	Dep. Variable: Log of Sales	
	Entry Threat: Low vs. High	Competition: Low vs. High
	(1)	(2)
Chinese Suppliers $\geq 1 \times$ Low \times 2020q1	-0.087*** (0.018)	-0.072*** (0.018)
Chinese Suppliers $\geq 1 \times$ Low \times 2020q2	-0.072** (0.035)	-0.049 (0.033)
Chinese Suppliers $\geq 1 \times$ Low \times 2020q3	-0.042* (0.023)	-0.041* (0.024)
Chinese Suppliers $\geq 1 \times$ Low \times 2020q4	-0.032 (0.026)	-0.038 (0.027)
Chinese Suppliers $\geq 1 \times$ Low \times 2021q1	-0.051* (0.027)	-0.041 (0.029)
Chinese Suppliers $\geq 1 \times$ Low \times 2021q2	-0.085*** (0.030)	-0.069*** (0.026)
Chinese Suppliers $\geq 1 \times$ Low \times 2021q3	-0.090*** (0.022)	-0.078*** (0.025)
Chinese Suppliers $\geq 1 \times$ Low \times 2021q4	-0.088*** (0.027)	-0.085*** (0.031)

Sales During the Pandemic: By Sourcing Strategy and Product Market Competition

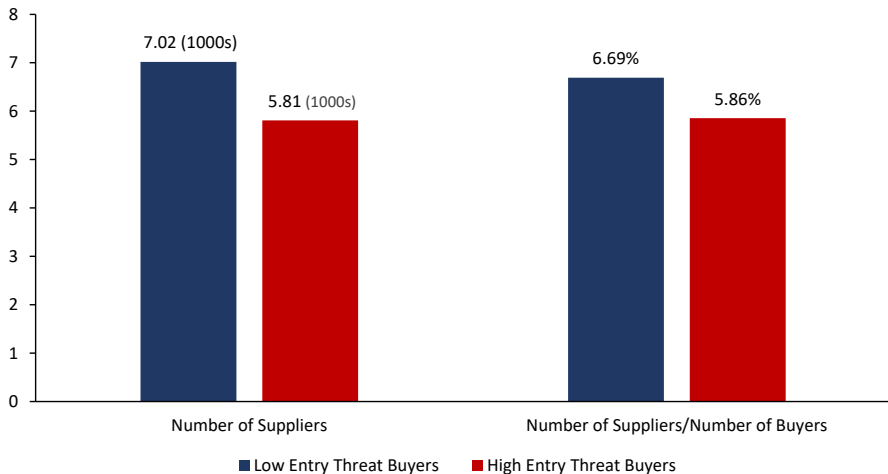
- No significant sales declines for firms with Chinese suppliers in high entry threat and high competition industries.

	Dep. Variable: Log of Sales	
	Entry Threat: Low vs. High	Competition: Low vs. High
	(1)	(2)
Chinese Suppliers $\geq 1 \times$ High \times 2020q1	-0.011 (0.026)	-0.036 (0.025)
Chinese Suppliers $\geq 1 \times$ High \times 2020q2	0.002 (0.036)	-0.037 (0.038)
Chinese Suppliers $\geq 1 \times$ High \times 2020q3	-0.008 (0.044)	-0.015 (0.039)
Chinese Suppliers $\geq 1 \times$ High \times 2020q4	-0.016 (0.041)	-0.014 (0.036)
Chinese Suppliers $\geq 1 \times$ High \times 2021q1	0.005 (0.036)	-0.014 (0.031)
Chinese Suppliers $\geq 1 \times$ High \times 2021q2	-0.010 (0.037)	-0.040 (0.041)
Chinese Suppliers $\geq 1 \times$ High \times 2021q3	0.016 (0.040)	-0.009 (0.033)
Chinese Suppliers $\geq 1 \times$ High \times 2021q4	-0.016 (0.070)	-0.026 (0.060)

Number of Unique Suppliers: By Entry Threat

- Supply chain structure is similar in low/high entry threat industries.

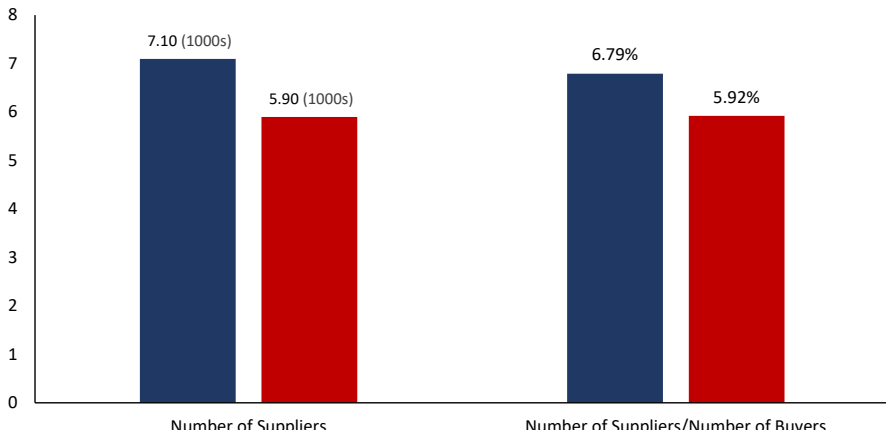
Panel A: Number of Unique Suppliers by Buyer Entry Threat



Number of Unique Suppliers: By Competition

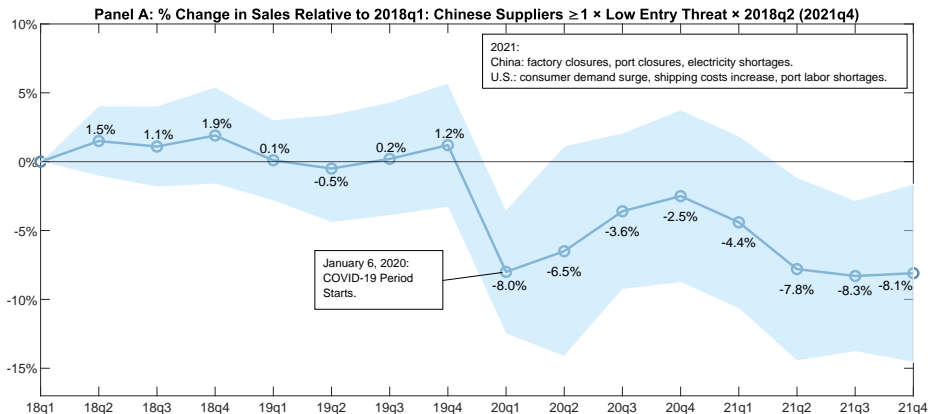
- Supply chain structure is similar in low/high competition industries.
- Findings suggest that the insulation of firms in less competitive industries is probably responsible for the differential impact of the shock.

Panel B: Number of Unique Suppliers by Buyer Competition



Sales Around the Pandemic: Treated Firms in Low Entry Threat Industries

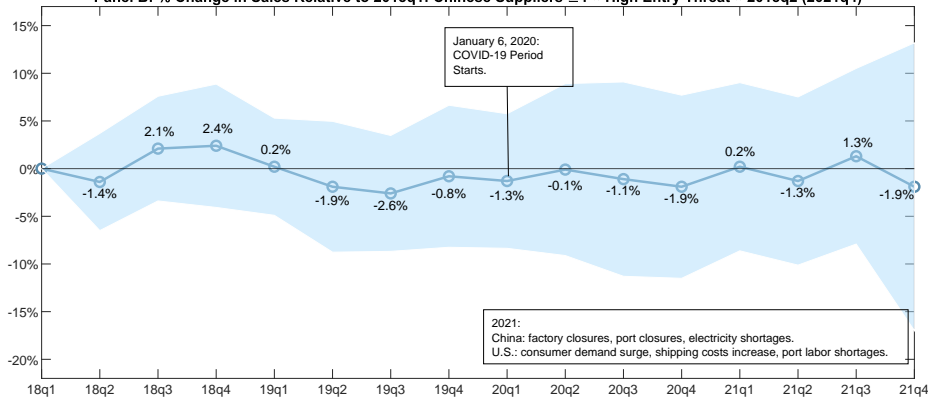
- No evidence of pre-trends before the shock.



Sales Around the Pandemic: Treated Firms in High Entry Threat Industries

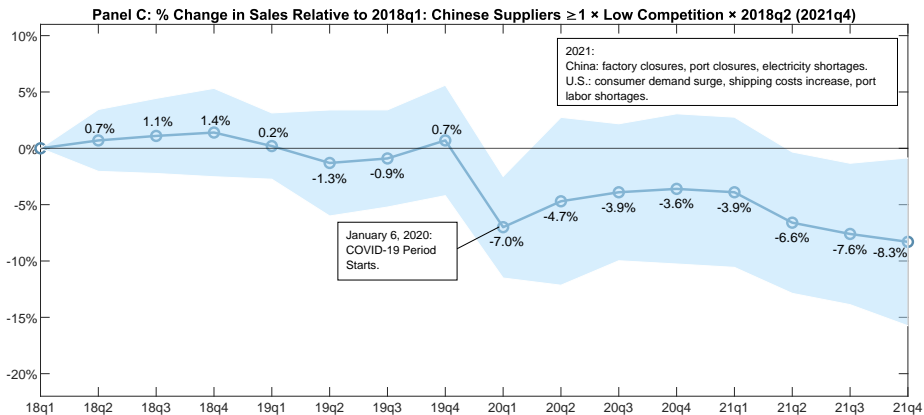
- No differential effects on sales before or during the pandemic.

Panel B: % Change in Sales Relative to 2018q1: Chinese Suppliers $\geq 1 \times$ High Entry Threat \times 2018q2 (2021q4)



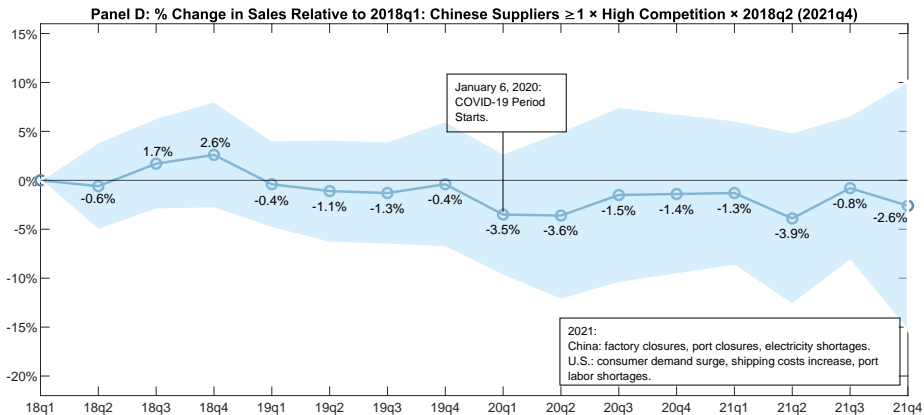
Sales Around the Pandemic: Treated Firms in Low Competition Industries

- No evidence of pre-trends before the shock.



Sales Around the Pandemic: Treated Firms in High Competition Industries

- No differential effects on sales before or during the pandemic.



Sales During Placebo Periods

- No differential effects on sales by treatment/competition during placebo periods.

Sample Period:	Dep. Variable: Log of Sales				
	Entry Threat: Low vs. High			Competition: Low vs. High	
	14q1-17q4	15q1-18q4	16q1-19q4	14q1-17q4	15q1-18q4
	(1)	(2)	(3)	(4)	(5)
Chinese Suppliers $\geq 1 \times$ Low \times Year-q1	-0.016 (0.021)	-0.022 (0.023)	-0.004 (0.023)	-0.014 (0.021)	-0.001 (0.024)
Chinese Suppliers $\geq 1 \times$ Low \times Year-q2	-0.025 (0.029)	-0.028 (0.030)	0.007 (0.023)	0.001 (0.021)	0.003 (0.024)
Chinese Suppliers $\geq 1 \times$ Low \times Year-q3	-0.015 (0.029)	-0.025 (0.031)	-0.020 (0.029)	0.018 (0.021)	0.019 (0.023)
Chinese Suppliers $\geq 1 \times$ Low \times Year-q4	0.017 (0.030)	-0.006 (0.032)	-0.004 (0.029)	-0.002 (0.027)	0.006 (0.027)
Chinese Suppliers $\geq 1 \times$ Low \times Year(+1)-q1	-0.016 (0.035)	-0.012 (0.037)	-0.004 (0.034)	0.005 (0.027)	0.017 (0.030)
Chinese Suppliers $\geq 1 \times$ Low \times Year(+1)-q2	0.020 (0.036)	0.007 (0.037)	0.016 (0.034)	0.013 (0.025)	0.018 (0.029)
Chinese Suppliers $\geq 1 \times$ Low \times Year(+1)-q3	0.040 (0.035)	0.013 (0.036)	0.039 (0.032)	0.003 (0.026)	0.012 (0.030)
Chinese Suppliers $\geq 1 \times$ Low \times Year(+1)-q4	0.037 (0.042)	0.008 (0.039)	0.015 (0.039)	-0.006 (0.039)	-0.001 (0.042)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	26,441	26,565	26,565	27,888	28,010
R2 (within)	0.013	0.013	0.013	0.010	0.010

Wealth Effects for Affected U.S. Firms: By Sourcing Strategy

- Buy-and-hold stockholders of U.S. firms with Chinese suppliers experienced abnormal returns of -4.9% from Jan 2, 2020, to Dec 31, 2021.
- Also, in line with sales, no BHARs for U.S. firms with Chinese customers.
- Similar patterns for bondholders.

	Dep. Variable: Value-Weighted 4-Factor Stock BHARs		Dep. Variable: Market-adjusted Bond BHARs	
	(1)	(2)	(3)	(4)
	[0,+61]	[0,+504]	[0,+61]	[0,+504]
Chinese Suppliers ≥ 1	-0.039** (0.019)	-0.049** (0.021)	-0.013** (0.006)	-0.021** (0.010)
Chinese Customers ≥ 1	0.008 (0.024)	0.000 (0.036)	-0.007 (0.005)	-0.006 (0.007)
Controls	Yes	Yes	Yes	Yes
Obs.	1,778	1,625	2,910	2,822
Adjusted-R2	0.002	0.004	0.012	0.025
Industry Fixed Effects	Yes	Yes	Yes	Yes

Wealth Effects by Sourcing and Competition

- In line with sales results, we find sizable market value losses only for firms with Chinese suppliers in less competitive industries.
- By the end of 2021, the stockholders and bondholders of U.S. firms with Chinese suppliers in low entry threat and low competition industries experienced losses of \$522 billion and \$15 billion and \$452 billion and \$13 billion, respectively.
- Also, in line with sales, no BHARs for U.S. firms with Chinese customers.

	Dep. Variable: Value-Weighted 4-Factor Stock BHARs				Dep. Variable: Market-adjusted Bond BHARs		
	Entry Threat: Low vs. High		Competition: Low vs. High		Entry Threat: Low vs. High		Competition: Low vs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	[0,+61]	[0,+504]	[0,+61]	[0,+504]	[0,+61]	[0,+504]	[0,+61]
Chinese Suppliers $\geq 1 \times$ Low	-0.066*** (0.022)	-0.085*** (0.029)	-0.044** (0.022)	-0.066** (0.028)	-0.022*** (0.006)	-0.042*** (0.014)	-0.024*** (0.005)
Chinese Suppliers $\geq 1 \times$ High	0.005 (0.030)	0.014 (0.029)	-0.032 (0.031)	-0.022 (0.032)	-0.008 (0.007)	0.003 (0.012)	-0.007 (0.007)
Chinese Customers ≥ 1	0.008 (0.025)	-0.002 (0.035)	0.010 (0.026)	-0.001 (0.036)	-0.005 (0.005)	-0.005 (0.007)	-0.004 (0.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,753	1,603	1,753	1,603	2,819	2,731	2,819

Sales During the Pandemic: Robustness tests

- In all our regression, we have industry-year-quarter fixed effects to mitigate the concern that a demand channel could be driving our results.
- Results are robust if firms without Chinese suppliers are identified using industry matching, FactSet competitors, top 5 TNIC rivals.
- Results are robust to using Chinese imports as a measure of exposure to China supply chain.
- Treated firms have either Chinese suppliers on Dec 31, 2019 or Chinese imports at some point during 2019. We have 663 (664) treated firms in this case compared with 332 (333) in main table.

Conclusions

- Sales declined sharply for U.S. firms with Chinese suppliers in the first half of 2020 and then again for most of 2021, as production was impacted in China with the coronavirus outbreak.
- Risk-adjusted stock market and bond market values also declined.
- Notably, these sales and market-value losses occurred among firms operating in less competitive industries.
- Our findings point to limited competition as an important channel through which supply chain disruptions lead to sustained sales losses.
- There is mounting pressure to decouple the U.S. supply chain from China:
 - For example, “Protecting our Pharmaceutical Supply Chain from China Act of 2020” and “ONSHORE Manufacturing Act of 2023.”
 - The takeaway for policymakers worldwide is that escalating trade tensions could inflict additional damage for all.