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RESEARCH ARTICLE

The Impact of the COVID-19 Pandemic on Global Sourcing of Medical Supplies

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ABSTRACT

We provide evidence that the COVID-19 pandemic has incentivized U.S. firms to rebalance the trade-off between manufacturing cost efficiency and supply chain resilience in their sourcing decisions. Over the past few decades, companies have been outsourcing production to low-cost countries such as China in pursuit of cost-efficiency. However, the risk of supply chain disruptions has been receiving heightened attention recently, as countries strive to prioritize scarce resources for domestic needs during the global pandemic. Our research shows that while China's supply chain has proved resilient, U.S. companies have increased their access to medical supplies through domestic production. As a result, COVID-19 has highlighted the importance of local capacity and changed the traditional perception of outsourcing from a purely economic efficiency focus to one emphasizing the need to balance risks in global exposures.

1. Traditional paradigm in global manufacturing: outsourcing for efficiency gains

Global sourcing is traditionally considered a tool to acquire operational efficiency by leveraging the comparative advantages of a focal firm and its suppliers in global competition [1, 2]. With its low labor costs and substantial workforce, China has become one of the world's most popular and vital sourcing destinations. A survey conducted by PwC showed that German companies achieve an average of 20% in cost benefits by sourcing in China compared to local procurement [3]. According to Figure 1 in the Q2 2022 QIMA barometer report, China suppliers made up 60% of US and EU sourcing markets in the pre-pandemic era and still accounted for approximately 50% under the impacts of lockdowns in response to COVID-19 [4].

In the US, the term outsourcing dates to the 1970s and was first brought to prominence in the fiercely competitive and performance-driven environment of the 1990s. According to a survey of attendees at The 2004 Outsourcing World Summit, nearly half of the companies reported outsourcing for cost reduction, and another 17% said they outsource to improve the organization's business focus [5]. While US companies increasingly shifted their business process and finished products to lower-cost countries such as China and Mexico in pursuit of efficiency gains, a major function of outsourcing also tended to become design and distribution instead of production. As Sony Corp. chairman and co-founder Akio Morita said, "The result is a hollowing of American industry. The US is abandoning its status as an industrial power." [6]

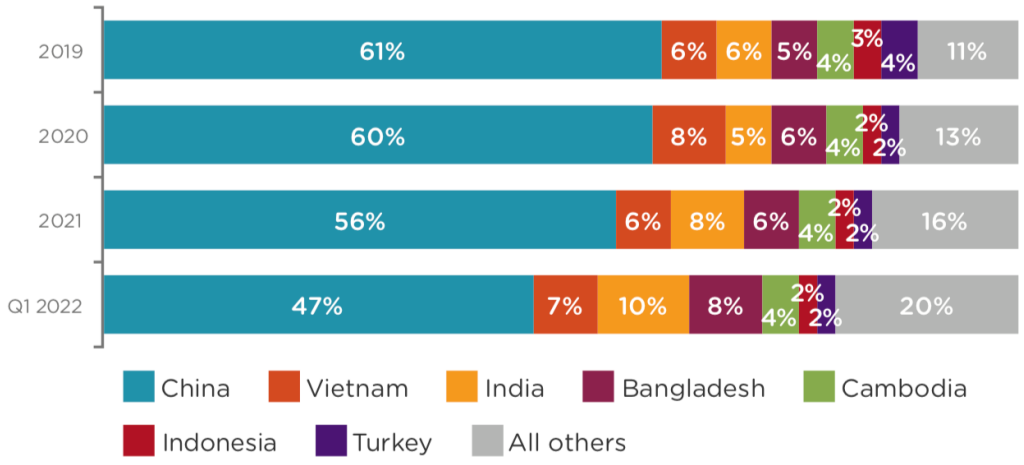


Figure 1: US and EU buyers' top sourcing markets by share; Source: The QIMA barometer for Q2 2022

2. Rising concern: systematic supply risk under the pandemic

The outbreak of the COVID-19 pandemic has highlighted the "hollow corporations" problem. Under such systematic supply risk, the production base determines which country gets priority supplies: governments do their best to direct production to meet domestic demand in response to stresses such as the pandemic. According to the estimation of the International Trade Centre's Market Access Map shown in Figure 2, 98 countries had restricted medical exports up to June 30, 2022. During the first quarter of 2020, when China was suffering from the peak of the COVID-19 outbreak, the Ministry of Commerce of China issued Notice No. 5 of 2020 that put new restrictions on the quality control of medical exports [7]. However, the US objected, indicating that the measures were intended to "hold up supplies" and asked China to revise them. Besides export control, China also utilized its massive production capacity to alleviate face mask shortages. The companies that turned to face mask production included a number of US manufacturers such as GM and 3M [8, 9, 10].

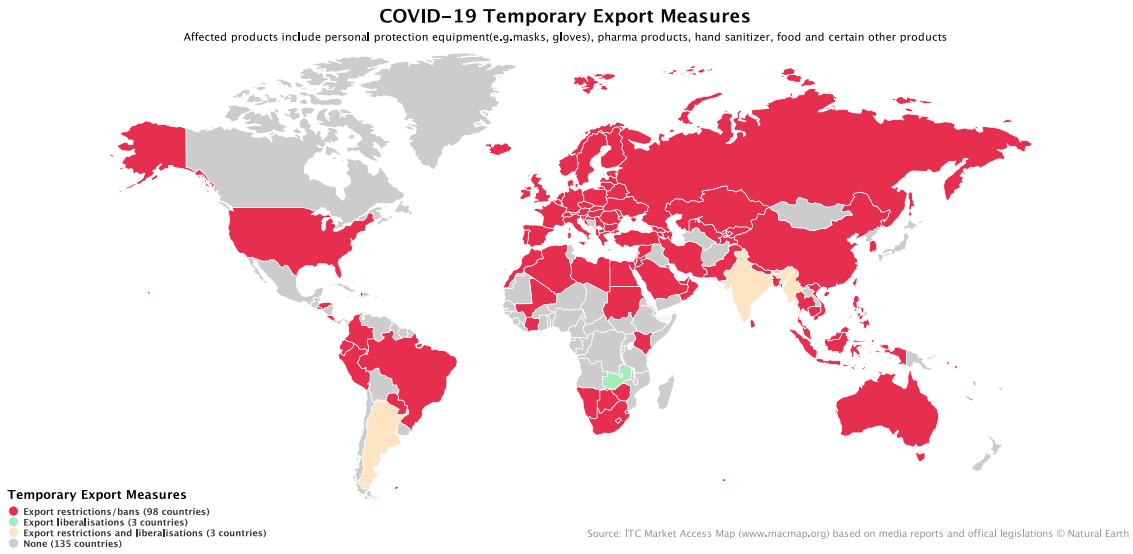


Figure 2 Global map of COVID-19 temporary trade measures (June 30, 2022); Source: ITC Market Access Map(www.macmap.org) based on media reports and official legislations

The shortage of critical medical supplies during the crisis raised concerns about the risk of high import dependencies due to manufacturing sourcing. The implication of optimal sourcing strategies became no longer just efficiency improvement but a trade-off between efficiency and risk concentration. Theoretically, companies could gain resilience in supply chains by diversifying sourcing countries against a certain country's adverse events, but such diversification may have limited efficacy in a global public health crisis. Therefore, both manufacturers and policy makers have developed a growing awareness of the necessity of domestic supplies, especially in certain industries that are essential to public health and national security [11]. Responding to this need is exactly what the US is doing.

3. US is building domestic production capacity

As mentioned above, China is a critical base for procurement, and the US suffered a supply shock of material because the pandemic disrupted product flow from China. The US firms were harmed in various ways: the adverse credit shock was propagated through supply chains [12], the increased policy uncertainty hurt market value [13], and the disruption limited access to cross-border financing [2]. Nonetheless, China's supply chain is highly resilient [14]. Figure 3 shows daily new confirmed cases from January 2020 to June 2022. China's confirmed cases first peaked during the first two months of 2020, but strict Zero-Covid control measures quickly slowed the spread of the virus. In March 2020, the number of cases in China dropped sharply, while the number of cases in the United States began to surge and rose steadily through the end of the year.

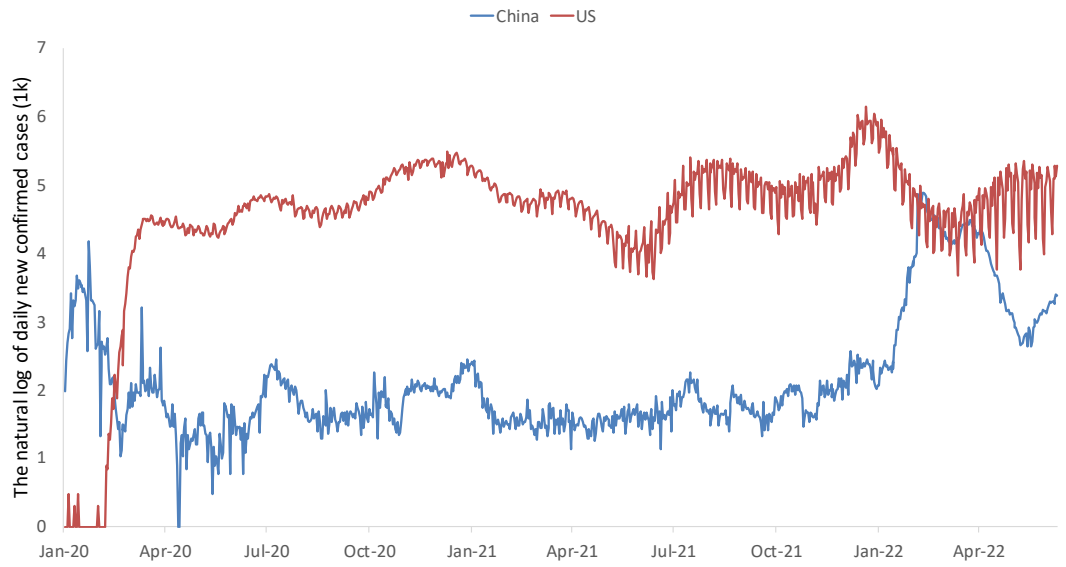


Figure 3 The natural log of daily new confirmed cases of US (left axis) and China (right axis); Source: Center for Systems Science and Engineering, Johns Hopkins University

Meanwhile, as shown in Figure 4, China's total exports to the US declined to their lowest levels in early 2020 while China was integrating resources in fighting the first wave of the pandemic. However, from April 2020 on, China's exports to the US dramatically rebounded and stayed above the previous year's level for the following eight months. This shows that once China had kept Covid-19 cases at bay, it was able to rapidly restore production and supply, a sign of supply chain resilience.

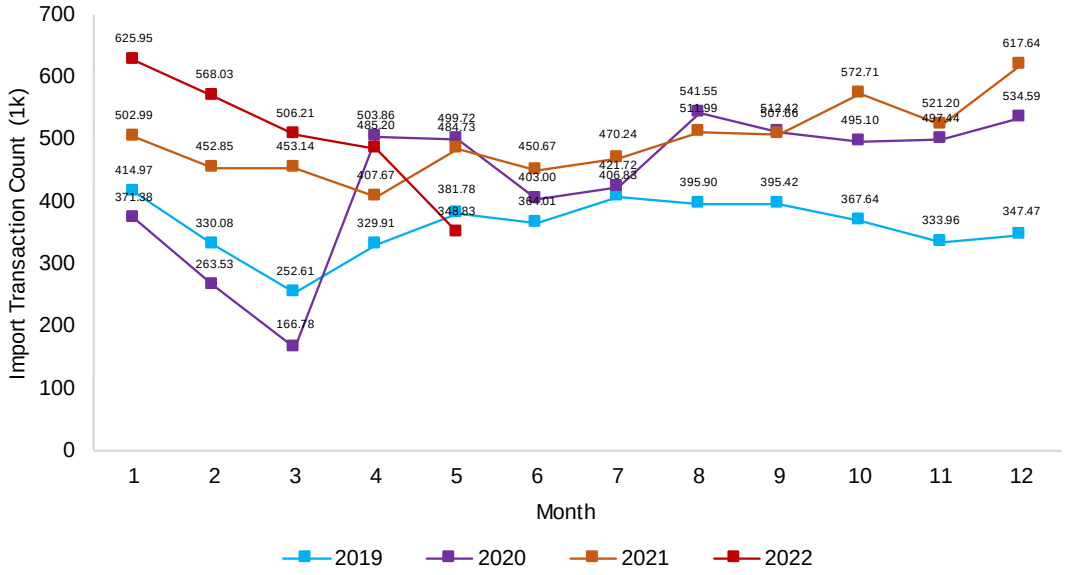


Figure 4 US Import from China of All Goods: Transaction Count; Source: Panjiva

China's strong supply chain resilience is also reflected in credit risk measured by the Credit Default Swap (CDS) spread [14], which is the premium for insurance against the default on its debt of a borrowing organization. Figure 5 shows the "abnormal CDS spread" (CDS spread adjusted for implied credit rating category and industry to extract the individual risk of each borrower) for firms with and without Chinese suppliers and customers over the beginning pandemic period in 2020. For US firms with Chinese suppliers, the abnormal

CDS spread went up initially due to the supply disruption caused by the business shutdown, and was about 25 basis points (0.25%) higher than that of firms without Chinese suppliers, representing a significant shift in risk. However, as China resumed production and the US economy shut down in March, the abnormal CDS spread of US companies with Chinese suppliers declined sharply compared to the increasing trend of companies without Chinese suppliers. The gap between the two groups was approximately 40 basis points. In other words, Chinese suppliers considerably reduced a US firm's default risk soon after China resumed production, suggesting both China's manufacturing resilience and its influence on US firms.

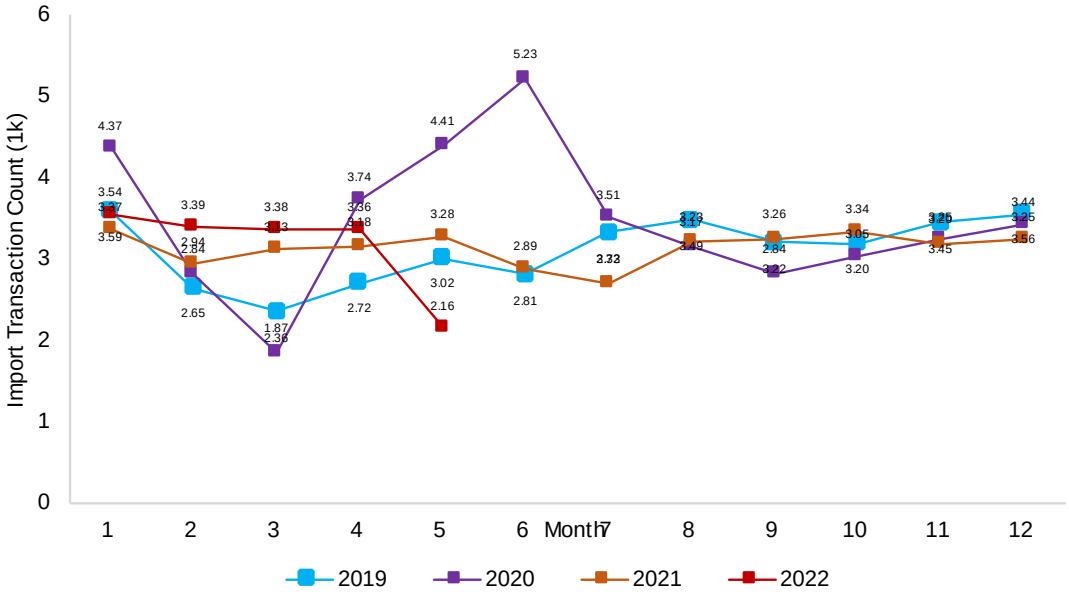
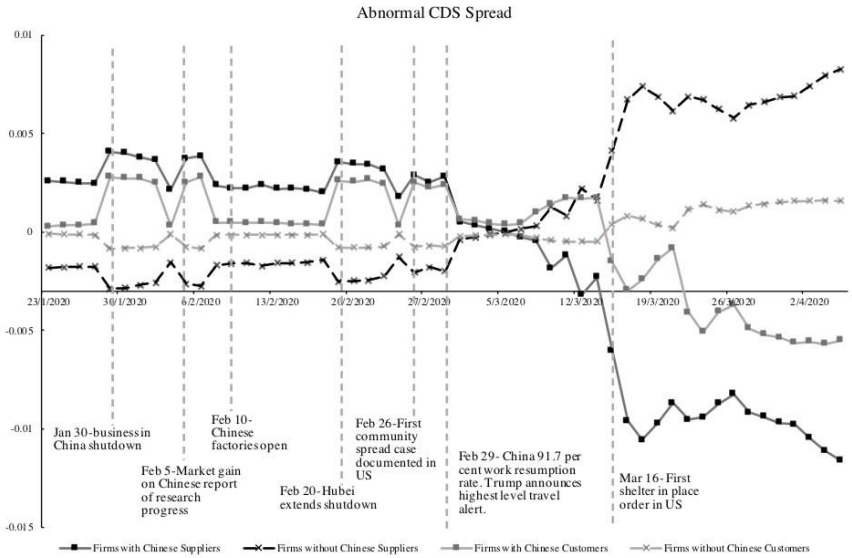


Figure 5 Abnormal CDS spread and major events; Source: [14]



Note: This figure plots the equal-weighted abnormal CDS spreads (AS) for firms with Chinese suppliers, firms without Chinese suppliers, firms with Chinese customers, and firms without Chinese customers, as well as the important COVID-19 events along the timeline.

Figure 6 US Import from China of Medical Supplies: Transaction Count; Source: Panjiva

In spite of China's remarkable economic resumption speed, US companies still sought to further ensure supply chain resilience by building domestic production capacity. Many experts argued that supply chains should be re-nationalized and that the government should restrict companies' sourcing activities [15]. In August 2020, US President Trump signed an executive order to boost the production of US medical supplies, which included a provision mandating government purchase of essential medicines and medical equipment [11]. Medical device providers such as Johnson & Johnson and ApiJect Systems invested substantial funds to expand domestic manufacturing [16]. Furthermore, following the example of automakers in China, such as BYD, the automakers pivoted their factories and workers to produce the protective gear in short supply [17, 18, 19].

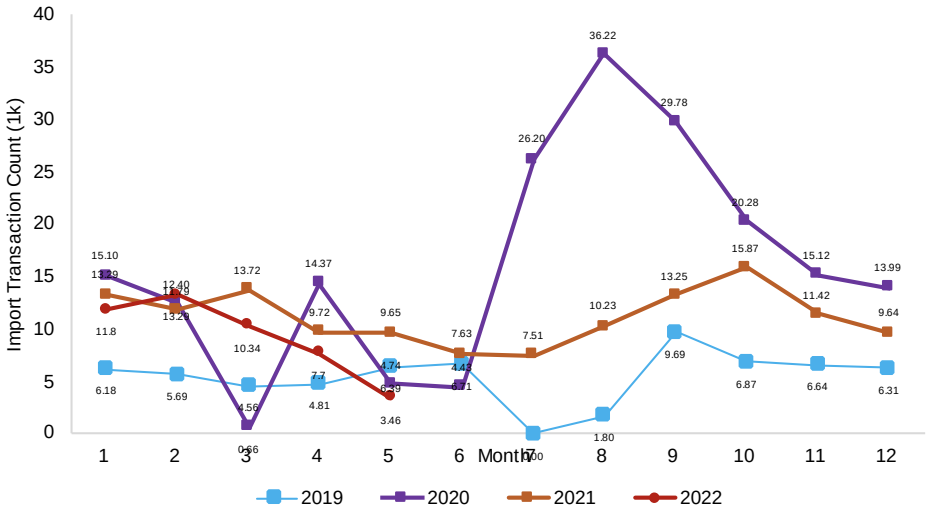


Figure 7 US Import from China of Mask Products: Transaction Count; Source: Panjiva

From a data perspective, we use the customs shipping data to provide evidence of this domestic production trend. Figure 6, Figure 7 and Figure 8 show the transaction counts of US imports from China of medical supplies, masks, and respiratory devices, respectively. Overall those three plots suggest that (1) US medical imports first surged during the 2nd quarter of 2020, right after China resumed production. During the remaining months of that year, the imports gradually declined and stabilized at a level close to 2019 while Covid-19 was still escalating in the US (as shown by Figure 3). Similar patterns are observed for importing essential respiratory protective equipment such as masks and respiratory devices. For respiratory devices, whose production was supported by automakers' manufacturing expertise, its imports even declined over the years, suggesting a decreasing reliance on sourcing due to domestic production. We note that the surge in medical imports (including masks and respiratory devices) did not appear at the beginning of 2022 when the US confirmed cases reached an all-time peak. These patterns indicate that the US, with the increasing awareness of supply chain resilience, was rebuilding domestic supply chains to reduce its dependency on China for critical medical supplies.

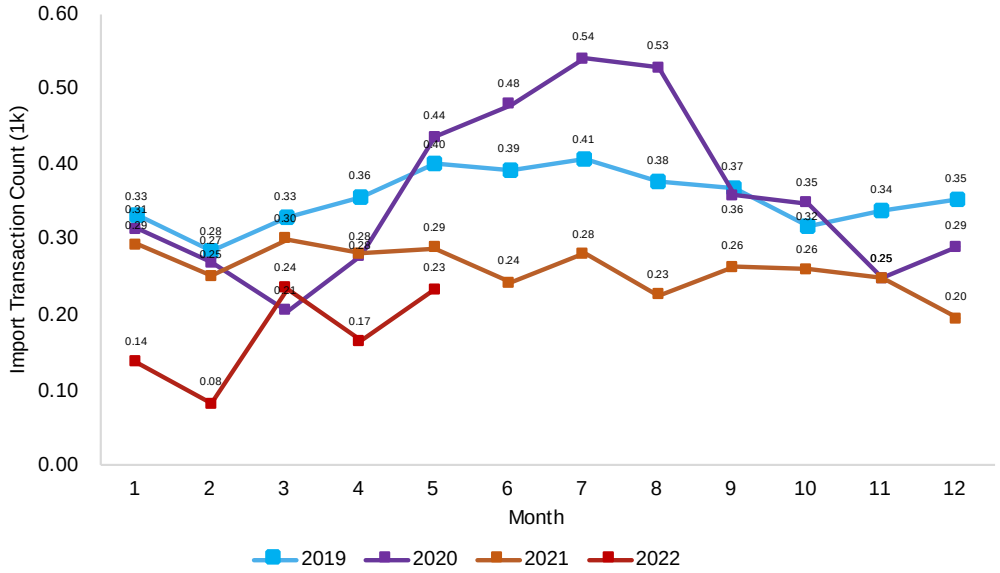


Figure 8 US Import from China of Respiratory Devices: Transaction Count; Source: Panjiva

4. Conclusion

For decades global sourcing has expanded as companies driven by productivity gains choose low-cost countries such as China as their manufacturing base. However, as the outbreak of the Covid-19 pandemic highlights the risk of extreme import reliance, companies are reconsidering the trade-off between resilience and efficiency when developing sourcing strategies. While the implicit optimization function of a company's traditional production decision is only a tradeoff between cost efficiency and concentration risk, now such an optimization function would further consider or even magnify tail (i.e., rare and extreme) risks, even if it means sacrificing cost efficiency. Even though China's supply bounced back from disruption with remarkable speed, US companies have already started the localization of supply chains for essential industries such as medical and healthcare. If we look at other manufacturing hubs around the world, apart from Wuhan, China, COVID-19 effects targeted all major global manufacturing hubs, e.g., Daegu in South Korea, Bavaria in Germany, Milan in Italy, and Detroit in the United States. These areas were all severely affected by the pandemic.

Overall, the pandemic has revealed the vulnerability of offshoring under a global crisis and has spotlighted the significance of domestic production capacity, creating a new implication for companies' optimal sourcing strategies. From a policy perspective, we believe that governments around the world will continue to realize the importance of locally sourced manufacturing capacity and the integrity of the industrial system after years of globalization of production outsourcing. In turn, implemented policies such as subsidies to encourage local production or trade tariffs to discourage strong reliance on global sourcing will also likely affect the production decision-making parameters faced by companies in the future. To sum up, we expect that the production and supply chains of important medical products will follow the trend of localization and regionalization. Finally, while we do not focus on the political factors that affect measures on COVID-19, factors from the political economy play a potentially important role in supply chain research which deserves further attention and, in particular, for the global health care industry.

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