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Mask wars: Sourcing a critical medical product from China in times of COVID-19

Andreas Fuchs [a,b], Lennart Kaplan [a,b,c], Krisztina Kis-Katos [a], Sebastian Leue [a,d,e], Felix Turbanisch [a], Feicheng Wang [f,*]

[a] Faculty of Business and Economics, University of Göttingen, Germany
[b] Kiel Institute for the World Economy, Germany
[c] German Institute of Development and Sustainability (IDOS), Germany
[d] Hamburg Institute of International Economics, Germany
[e] Faculty of Economics and Social Sciences, Helmut Schmidt University Hamburg, Germany
[f] Faculty of Economics and Business, University of Groningen, The Netherlands

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ABSTRACT

The COVID-19 pandemic dramatically heightened global demand for critical medical goods, with China being a key supplier. This paper examines the political factors that eased global access to face masks, a vital product during the initial phase of the pandemic. Employing a triple difference-in-differences event study framework, we compare the export dynamics of face masks with those of similar products. Our findings indicate that face mask prices surged after the outbreak of the pandemic, and China's exports increased in response. Amid global shortages, political alignment at the national and subnational levels, particularly through political ties with Chinese provinces, played a significant role in driving the increase in China's face mask exports to partner countries. These political connections contributed to export growth at both the extensive and intensive margins. Moreover, sister city relationships appear to have assisted in mitigating the early price increases.

> *"America first" will not help us to cope with this crisis. [...] The protective materials available here are currently only sufficient for a few days. [...] I therefore ask the People's Republic of China for support.*
>
> Stephan Pusch, Administrator of Heinsberg District, Germany, in an open letter to China's President Xi Jinping, March 23, 2020 (own translation)

* Corresponding author.
E-mail addresses: afuchs@uni-goettingen.de (A. Fuchs), lennart.kaplan@wiwi.uni-goettingen.de (L. Kaplan), krisztina.kis-katos@uni-goettingen.de (K. Kis-Katos), leue@hwwi.org (S. Leue), felix.turbanisch@uni-goettingen.de (F. Turbanisch), f.wang@rug.nl (F. Wang).

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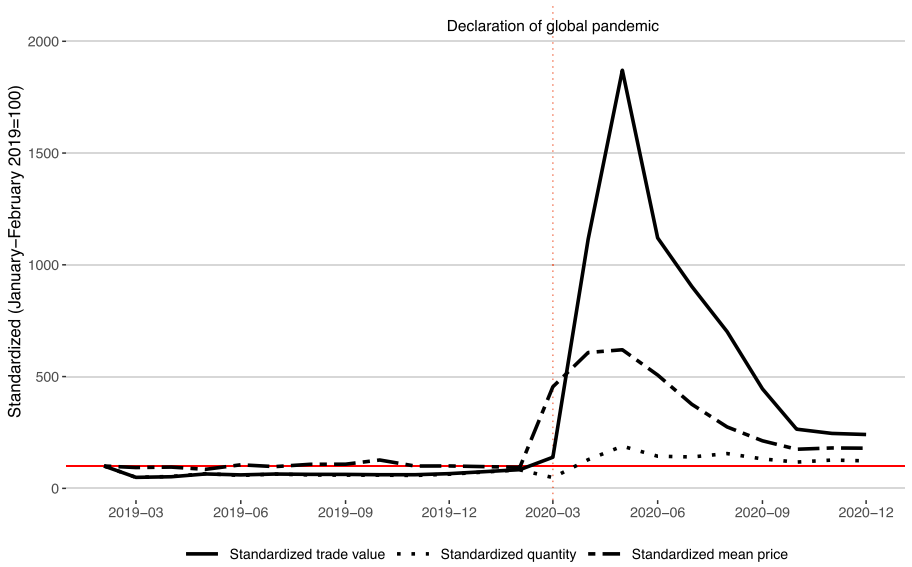

Fig. 1. Trade value, quantity, and price of China's face mask exports between January–February 2019 and December 2020 (January–February 2019=100).
Notes: The figure shows monthly trade value, quantity, and mean price of China's exports of face masks between January 2019 and December 2020. All three series are standardized to 100 at their January–February 2019 level. As the China Customs statistics database reports export data in January and February 2020 together, we sum up exports in January and February 2019 to keep consistency. The dashed vertical line indicates the declaration of the global pandemic by the WHO in March 2020. Data on export value and price (in US$) and quantity (in kg) are obtained from the China Customs statistics database (GACC, 2020b).

1. Introduction

The global demand for critical medical equipment soared beyond supply capabilities with the outbreak of the coronavirus (COVID-19) pandemic in March 2020. Essential healthcare products, such as face masks, became scarce commodities.[1] Consequently, countries, provinces, companies, hospitals, and individuals entered into intense competition for these life-saving items, occasionally employing questionable methods. For instance, on April 4th, 2020, reports emerged that masks bound for Berlin were "confiscated" at Suvarnabhumi Airport in Bangkok, Thailand, and redirected to the United States. This situation prompted Berlin's Senator for Interior to label it an "act of modern piracy" and insist that "even in times of global crisis there should be no wild west methods" (The Guardian, 2020a). This was anything but an isolated incident. The Guardian (2020b) reported on April 3rd, 2020, that "US buyers waving wads of cash [had] managed to wrest control of a consignment of masks as it was about to be dispatched from China to one of the worst-hit coronavirus areas of France." Tensions also escalated within countries. For example, the French Interior Minister Christophe Castaner referred to the situation within France as a *guerre de masques* – a mask war between the local authorities and the state (Le Monde, 2020).

China played a critical role in these "mask wars" as the world's leading supplier of vital medical supplies. Pre-pandemic statistics from 2019 show that China was responsible for 47% of the world's face mask exports (UN Comtrade, 2020). In contrast, the next largest exporters, Germany (7%) and the United States (6%), played comparatively smaller roles. However, as global demand for face masks from China surged with the onset of the pandemic in March 2020, China's own supply was severely impacted by the economic shutdown caused by the pandemic. In February 2020, when the virus was primarily contained within China, the country found itself short of medical equipment and was reliant on imports. By this point, China's daily production of face masks had been cut in half to ten million per day.[2] This scarcity prompted the European Commission to limit its medical equipment exports in mid-March 2020, which was seen as a response to uncertainty about Europe's access to medical supplies from China (Bown, 2020). This restriction resulted in fierce international competition for Chinese medical goods (Evenett, 2020).

The substantial increase in demand alongside a restricted supply led to a strong price increase for masks in April and May 2020, as depicted in Fig. 1. This price surge reflects extreme shortages experienced in the early months of the global pandemic and corroborates previous evidence on large profit margins for producers during pandemic situations (Harrington and Hsu, 2010).

In this paper, we propose that close political relations helped countries procure face masks from China. While the basic gravity model of international trade suggests that China should export more goods to economically larger and geographically closer

[1] Face masks have been shown to mitigate the spread of COVID-19 (Mitze et al., 2020; Chernozhukov et al., 2021). In the week beginning on March 15th, 2020, the global search interest in the topic "masks" outnumbered the interest in otherwise popular topics like "food" and "soccer," according to Google Trends (own query for the past five years on https://trends.google.com on October 24, 2022).

[2] A spokeswoman from China's Ministry of Foreign Affairs summarized the situation as: "What China urgently needs at present are medical masks, protective suits, and safety goggles" (BBC, 2020). Official Chinese sources use "face masks" and "medical masks" interchangeably, a practice we adopt in this paper.

countries, it is not necessarily evident that these factors would primarily drive the expansion of trade links when global demand surges rapidly. Differences in the early severity of the coronavirus outbreak across countries should also have led to differences in demand for face masks and willingness to pay for them in those countries. Alongside this, we expect that political connections at national and subnational levels aided in reducing costs associated with finding new suppliers or expanding existing supplies, thus simplifying the sourcing of essential medical items like face masks.

On the one hand, we anticipate that the state of international political relations at the national level influences China's export patterns of critical products and has facilitated the expansion of exports. Beijing has a history of leveraging trade to advance its foreign policy goals (Fuchs and Klann, 2013; Du et al., 2017; Didier, 2018). Therefore, we analyze to what extent the expansion of China's face mask exports is linked to measures of national-level political relations with its trading partners. On the other hand, previous efforts towards decentralization (e.g., Jin et al., 2005) lead us to believe that subnational political ties also considerably impact trade. Following China's gradual opening up post-1978, local governments have become key participants in China's multi-layered foreign policy (Jian et al., 2010). While local governments must conform to the policy directives of the respective national ministries, they take on significant roles in lower-level politics in this process of "localizing foreign policy" (Hocking, 1993). To this end, provinces have established various mechanisms, including city events, sister city relationships, aid donations, provincial trade delegations, and the hosting of foreign diplomatic missions (Jian et al., 2010).

To investigate whether political relationships foster trade expansion in critical situations, we analyze China's export pattern of face masks using monthly dyadic trade data from the General Administration of Customs of the People's Republic of China (GACC, 2020b), issued at the level of pairs of Chinese provinces and partner countries. Our empirical strategy relies on a difference-in-differences (DiD) approach that contrasts the fluctuation in the value, quantity, and mean price of monthly face mask exports (measured at the 8-digit level of the Harmonized System (HS)) with those of two different types of control products (other made-up textile products and non-critical medical products) before and after the outbreak of the pandemic. Dynamic estimates of monthly treatment effects from 2019 to 2020 help substantiate that the exports of face masks and their control products followed parallel trends before the pandemic outbreak; therefore, our DiD results are likely to indicate a causal relationship. In our subsequent analyses, we implement a triple-difference strategy to test whether political ties, represented by voting alignment within the General Assembly of the United Nations (UN), local diplomatic missions, and sister linkages at the provincial level and below, facilitated the sourcing of face masks, as reflected in China's export pattern.

Our results indicate a substantial increase in the value of face mask exports from China during the global pandemic outbreak, which arose due to extreme price increases and the expanded quantities of exports compared to control products. Our triple-difference models confirm our hypotheses: close bilateral political ties at both national and subnational levels facilitated the growth in the quantity of face masks exported. The presence of a country's diplomatic representation within a province and sister relationships between subnational entities contributed to trade creation at both the extensive and intensive margins of trade. Sister linkages between lower-level administrative entities, like cities, even contributed to reducing face mask prices shortly after the pandemic outbreak, which reflects the influence of interpersonal relationships. In general, political ties played a more significant role in trade creation than linkages through past trade or foreign direct investment (FDI), preferential trade agreements, or traditional determinants within a gravity framework. Scenario analyses demonstrate that strong political ties were especially beneficial for low-income countries, which might have been less able to afford the spike in market prices and trade costs. These findings suggest that political ties shifted the allocation of face masks towards resource-constrained countries during this time of crisis.

Our paper expands on previous research in economics and political science that explores how political relations can impact international trade (Hirschman, 1945; Baldwin, 1985; Berger et al., 2013; Rose, 2019; Crozet and Hinz, 2020). In a seminal contribution, Pollins (1989) develops a public-choice model in which importers reward political allies with increased trade and penalize adversaries with reduced trade. Further research corroborates that diplomatic relations, characterized by factors such as embassies and state visits, can stimulate bilateral trade (Nitsch, 2007a,b; Rose, 2007).[3] While interlinked supply chains and bilateral and multilateral trade agreements might deter governments from politicizing trade due to sunk costs (Davis and Meunier, 2011), the persistent government control over economic activities could explain why Chinese trade still "follows the flag" (Davis et al., 2019). Notably, in emerging economies like China, where the "government is still regarded as a natural partner in the economy" (Moons and van Bergeijk, 2017), and many business decisions require government approval, economic diplomacy facilitates trade. Another mechanism through which politics influences commerce involves consumer reactions to the state of bilateral relationships (Pandya and Venkatesan, 2016).

Empirical evidence indeed suggests that Chinese trade remains politicized following bilateral tensions (Du et al., 2017). Political strains caused by governments receiving the Dalai Lama led to reductions in their countries' exports to China (Fuchs and Klann, 2013), a phenomenon that appears to primarily operate through State-Owned Enterprises (SOEs) (Lin et al., 2019). These firms are not only obliged to adhere to government objectives by definition, but they are also financially dependent on the government and demonstrate a large overlap in terms of leadership staffing (Davis et al., 2019). Various episodes of Sino-Japanese tensions have also led to significant reductions in Chinese imports from Japan (Fisman et al., 2014; Heilmann, 2016). We extend the literature by examining the relationship between international politics and trade in the realm of global health.

Our paper is the first quantitative study that examines the role of politics in Chinese exports of critical medical goods during the COVID-19 pandemic. Against the backdrop of an emerging body of literature highlighting the importance of subnational decision-makers in Chinese domestic politics (Zhang and Van Witteloostuijn, 2004; Chen and Kung, 2019; Ye, 2021), we extend prior analyses

[3] See Moons and van Bergeijk (2017) for a meta-analysis on the trade effects of economic diplomacy.

of the politics-trade nexus by considering provincial-level ties. Thus, we also contribute to the broader literature on the politics-trade nexus as we investigate the impacts of current international political relations on trade at the *subnational* level. While Che et al. (2015) also analyze political factors in Chinese trade at the provincial level, their focus is on political tensions that are rooted in history. They find that Chinese provinces exhibiting more casualties during the Japanese invasion from 1937 to 1945 traded less with Japan in 2001. In contrast, our paper focuses on contemporary political connections and explores friendly relations, such as diplomatic representation and sister linkages, at the subnational level.

We proceed as follows. Section 2 discusses how political relations can facilitate the sourcing of a commodity that suddenly became critical medical equipment during a pandemic. In Section 3, we introduce our measurements for trade flows and bilateral political ties. Section 4 documents an event study on the impact of COVID-19 on Chinese exports of face masks. In Section 5, we estimate the causal effects of political relations on face mask exports, both in an event study and using a triple-difference framework. Section 6 concludes.

2. The potential role of political relationships in trade

What factors contribute to trade creation amidst a sudden global demand shock? The classical economic gravity framework (Anderson and Van Wincoop, 2003; Arkolakis et al., 2012; Head and Mayer, 2014) postulates that international trade grows with the economic size of trading partners and a range of factors that reduce trade costs. In this context, trade costs are not only positively associated with physical distance, but they also decrease with common language (Melitz and Toubal, 2014), cultural similarity (Guiso et al., 2009), institutional quality (Anderson and Marcouiller, 2002), existing preferential trade agreements (Baier and Bergstrand, 2007; Egger et al., 2011), and other cross-country connections which reduce information barriers (Volpe Martincus et al., 2010). While these factors are vital in explaining trade generally, it is not immediately clear if such gravity-related explanatory factors will also play a dominant role during a sudden surge in global demand. In this case study, we propose that in a setting where trade is heavily politicized and the government holds significant influence over bilateral trade relationships, political ties play a crucial role in trade creation.

In general, national politics plays a pivotal role in China's foreign economic relations. China has a history of reducing imports to penalize unwanted diplomatic behavior and in response to broader political tensions (Fuchs and Klann, 2013; Heilmann, 2016; Du et al., 2017; Lin et al., 2019). Owing to the tight integration of the state (and party) with the economy, China's national government has more means to steer China's economic behavior abroad compared to most other countries (Davis et al., 2019). In fact, SOEs contributed to the rapid increase in face mask production during the pandemic, for example, through the repurposing of their established assembly lines (López-Gómez et al., 2020). Therefore, we expect that national-level political ties were particularly significant during the pandemic, a period in which China was reported to have directed masks towards countries supporting Beijing. For instance, a report published by the U.S. Congress claims that trading partners which were more politically aligned with China received a prioritized supply of critical medical equipment from China (CRS, 2020).

Our paper contrasts the relative importance of national political ties with the role of subnational ties in trade creation during a surge in excess demand. Unlike the central government, local governments in China do not have an official role in international diplomatic relations but are encouraged to establish foreign relationships to reinforce national foreign policy (Liu and Song, 2020). They promote cultural and economic exchanges, establish sister ties, sign non-treaty agreements, and take part in national delegations (Liu and Song, 2020; Mierzejewski, 2020). Through forming sister bonds with individuals abroad, they are tasked to "tell China's story well and show the world a real China, a three-dimensional China, a comprehensive China" (Xi, 2014). However, their actions do not always align with national policy, as they often operate with "little understanding of or regard for China's wider foreign policy objectives or the diplomatic context" (Jones and Hameiri, 2021, 32). Thus, local governments in China are frequently characterized as "semi-independent actors in China's foreign relations" (Li, 2014, 292).

To capture subnational ties, we examine two dimensions of political connections between Chinese provinces and countries abroad: the presence of diplomatic representations and the number of sister linkages. Regarding how diplomatic representations facilitate trade, in a cross-country setting, Rose (2007) shows that each additional consulate in a partner country boosts exports by 6 to 10 percent. Empirical literature broadly confirms a positive correlation between additional consulates and trade (van Bergeijk et al., 2011; Plouffe and van der Sterren, 2016; Moons and van Bergeijk, 2017). During the global surge in demand for face masks, we expect that diplomatic representations could have fostered face mask exports by reducing transaction costs and connecting potential trading partners. Accordingly, we expect countries that maintain a diplomatic mission in a given Chinese province to have been more successful at acquiring face masks from that province. We anticipate this to have extended beyond the trade creation happening in Beijing under the central government's direction. For instance, the Uruguay consulate in Chongqing was perceived as instrumental in procuring aid goods from China during the COVID-19 pandemic following its establishment in 2019 (Telias and Urdinez, 2022).

Less formal connections, such as sister city relationships, may also facilitate trade. China's president Xi Jinping specifically underlined the importance of sister city ties for economic policy by invoking the term "city diplomacy" (*chengshi waijiao*) (Xi, 2014). Higher-level associations between Chinese provinces and foreign governments are expected to be more closely aligned with national political interests. In contrast, lower-level links with cities and counties usually rest on more decentralized, often personal, relationships. Many sister relations have evolved from other areas, like education and culture, towards trade (Mascitelli and Chung, 2008; Liu and Hu, 2018). Thus, they represent bilateral relations in a broader sense than diplomatic missions, extending to personal bonds and communication channels between firms and through liaison offices. These linkages may also help establish new trade ties when required.

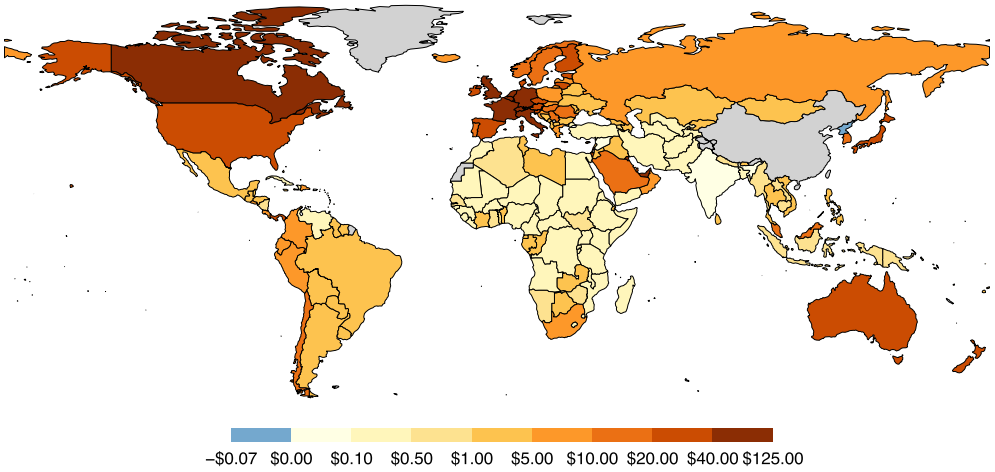

Fig. 2. Change in per capita face mask exports between 2019 and 2020 by partner country.
Notes: The map shows the absolute *per capita* change in US$ of Chinese face masks exports by trade partner country for 2020 compared to 2019. Face masks are identified by the HS 8-digit China Customs code 63079000.
Source: Data are taken from GACC (2020b).

Anecdotal evidence suggests that sister relationships were indeed useful in sourcing medical equipment from China during the COVID-19 pandemic. Many Chinese provinces donated face masks to their sister entities, such as Fujian province to the US state of Oregon and Hunan province to Lincolnshire county in the UK (People's Daily, 2020; The Lincolnite, 2020). In April 2020, the small town of Rinteln in Northern Germany reached out for help to its sister district, Tongnan. The Tongnan municipal government promptly facilitated the procurement of face masks directly from Chinese manufacturers, allowing Rinteln to purchase 100,000 face masks at a price considerably lower than the prevailing German market price at the time (Gokl, 2020). Similarly, the German town of Eutin leveraged personal ties with Xinchang County to import masks from China: "The fact that the city was able to order masks in China at all was based on the personal relationships established in October 2018 during a visit to Xinchang by a delegation of representatives from Eutin politics and administration" (Benthien, 2020).

3. Data and measurement

3.1. Exports of face masks and comparison products

To study how Chinese bilateral exports reacted to the global shortage of essential medical products, we focus on face masks, which became the most symbolic and coveted medical product during the first months of the global COVID-19 pandemic. Our analysis relies on official monthly dyadic export data for pairs of Chinese provinces and trade partner countries during the years 2019 and 2020, which are provided at the level of 8-digit codes by China Customs (GACC, 2020b) (based on the 2017 revision of the Harmonized System). Specifically, we use the 8-digit code 63079000 ("Made up articles (incl. dress patterns), n.e.s."), which includes face masks.[4] An 8-digit code specifically associated with face masks was only introduced after China Customs implemented a new edition of the HS in 2022. Consequently, our measure for medical masks is not perfect. First, it obscures the proportion of face masks in relation to the other unspecific made-up articles. Second, it restricts our ability to differentiate between simple surgical masks and more sophisticated FFP (filtering face piece) masks, also known as respirators. Despite these limitations, this is the best measure currently available. Relying on it, we find that the export value of China's face masks (broadly defined, including "made-up articles, not elsewhere specified") increased by about 20-fold in 2020 compared to 2019. Notably, this increase was due to substantial increases in prices and – with some delay – in quantities (see Fig. 1).

Fig. 2 demonstrates that the value of face mask exports from China to all its trading partners increased between the two years, with the exception of North Korea. The leading importers were major economies, such as the United States, Germany, and Japan, which led in terms of total trade values and quantities (see Appendix Table C.1). High-income countries were also among the most severely impacted during the early phase of the pandemic. The average price of imported face masks rose substantially compared to 2019 for all countries, although the magnitude of the increase differed from one country to another. Among the top-20 importers, Italy, which was severely affected in the early stages of the pandemic, purchased face masks at a price 13 times greater in 2020

[4] In April 2020, China Customs implemented quality control measures for 11 different medical goods identified by their 10-digit codes, including medical masks (code 6307900010) (GACC, 2020a). As China Customs does not publish export data at the 10-digit level, we revert to the 8-digit level code 63079000, which includes face masks. According to https://www.i5a6.com/hstree (accessed May 2020), this category comprises two 10-digit codes: 6307900010 denoting "medical masks" and 6307900090 indicating "other made-up articles, not elsewhere specified."

compared to the previous year. In contrast, the United States experienced a four-fold increase, while in Malaysia, the price only doubled.

In terms of export origins, all Chinese provinces exported at least some face masks both before and after the outbreak of the pandemic. However, Beijing and the coastal regions in the Southeast dominated the market as exporters. The leading exporter in 2020 was Guangdong Province (27.4%). Compared to the previous year, nine provinces increased their face mask exports by more than US$ 1 billion (see also Appendix Figure B.1)). Notably, this growth was the most substantial among the coastal provinces, which are also recognized as China's economic powerhouses. Concurrently, the sourcing of medical equipment became more geographically diverse compared to the previous year, presumably driven by subsidies and the repurposing of state-owned enterprises (López-Gómez et al., 2020). Appendix Table C.2 lists the top 20 source–destination (province-country) pairs for face mask exports in 2019 and 2020. The majority of face mask exports were from eastern coastal provinces, such as Guangdong, Zhejiang, and Jiangsu, to major economies including the United States, Germany, and France. Of the 5,952 province-country pairs, 1,126 did not record exports of face masks in 2019 but did so in 2020. These findings suggest that the pandemic induced the formation of a substantial number of new trade links.

Our empirical analyses compare the export dynamics of face masks with two control product groups that were not equally impacted by the global pandemic outbreak. The first control group includes products similar to face masks in terms of production material and, consequently, production technology. This group comprises the additional two textile product categories under the same HS 4-digit subchapter 6307 (''other made-up articles, including dress patterns''). These items are ''floor-cloths, dish-cloths, dusters and similar cleaning cloths'' (63071000) and ''life-jackets and life-belts'' (63072000). Since these items can be produced employing analogous technologies, their export patterns prior to the pandemic should resemble those of face masks. However, their global demand remained unaffected by the pandemic outbreak, making them a valid comparison group. Yet, focusing on a control group containing comparatively close production substitutes may also introduce certain drawbacks. If companies responded to the heightened global demand for face masks by switching products, shifting from manufacturing and selling control products to face masks, the outbreak would not only have triggered an increase in face mask production and exports but also a decrease in the production (and exports) of closely substitutable products. This would result in an overestimation of the pandemic's effect on mask exports. Even assuming this to be the case, it is unlikely that this would bias our main, *triple*-difference specification that we describe below, as these substitution effects would need to vary across province-country pairs with differing levels of political alignment. However, we also perform all analyses with an alternative control group.

Our second, alternative control group comprises a wider range of medical products that are related to face masks in terms of use, rather than production technology. We take a list of 310 medical products collected by Helble (2012) and measured at the HS 6-digit level, but exclude all products that have been categorized as "critical" by either the Chinese government or the World Customs Organization (WCO) and the World Health Organization (WHO) during the initial phases of the COVID-19 pandemic.[5] This results in a control group composed of 214 non-critical medical products, such as vitamins, dental instruments, and malaria diagnostic test kits. For a comprehensive list of control products, see Appendix Table E.1. This alternative control group addresses concerns regarding potential product switching and simultaneously ensures that the demand for these control products was not significantly impacted by the outbreak of COVID-19.

3.2. Political linkages and further controls

In order to evaluate the influence of close national and subnational political relations on the sourcing of face masks during global shortages, we compute three measures of political linkages. At the national level, we measure the state of political relations using data on voting alignment in the UN General Assembly (Bailey et al., 2017). UN voting alignment is a widely acknowledged measure of country-level political linkages in both economic and political science literature, often employed as a determinant of trade relationships (Alesina and Dollar, 2000; Dreher et al., 2008; Berger et al., 2013). Numerous studies highlight the correlation between China's trade patterns and its UN voting alignment with other countries (see, e.g., Flores-Macías and Kreps, 2013; Davis et al., 2019). Our principal measure of voting alignment is the variable *UN voting agree*, defined as the share of votes in the UN General Assembly where another country's votes align with China's, i.e., both countries vote ''yes'', ''no,'' or opt to abstain.[6] According to this measure, China unsurprisingly aligns least with the United States (evidenced by a score of 0.244), Israel (0.267), and Micronesia (0.444). Meanwhile, it has the closest voting alignment with Dominica (0.914), Syria (0.900), and Zimbabwe (0.894) (see also Appendix Table C.1).

We utilize two variables that vary at the province-country pair level to assess subnational political ties.[7] The first measure, *Diplomatic representation*, is a binary variable indicating whether a partner country has at least one diplomatic mission, such as an embassy or consulate, within a given Chinese province. Other than geographical and ideological distance, the political relevance

[5] The Chinese government designated face masks and ten additional products as essential for the control and treatment of COVID-19, including disinfectants, ventilators, surgical caps, and thermometers (GACC, 2020a). The list by WCO/WHO comprises 80 products, defined at the HS 6-digit level, for instance, COVID-19 test kits, medical oxygen, and ultrasound machines (see WCO/WHO, 2020).

[6] Abstention is considered half-agreement with yes or no votes (Bailey et al., 2017). To minimize potential bias arising from outliers, we average voting agreement from the three years preceding the pandemic, 2017–2019. During this period, China was eligible to vote on 315 resolutions, six of which it did not vote on at all. From the remaining 309 votes, it agreed/rejected/abstained on 238/29/42 resolutions, respectively. In pairing this with the voting behavior of partner countries, we derive a measure that exhibits considerable variation (see Appendix Table C.3).

[7] Appendix Figures B.2, B.3, B.4, B.5, and B.6 illustrate the variation across countries and provinces for national and subnational political connections.

of partner nations – in terms of economic and military strength – is one of the primary factors influencing the establishment of diplomatic representations at the country level (Neumayer, 2008). Among China's largest trading partners, Thailand (9), South Korea (8), and Cambodia (8) have the highest number of diplomatic missions in the country. While all embassies are located in Beijing, consulates are distributed throughout China, with their placements reflecting the relative diplomatic significance of each province-country relationship. For example, 76 countries have a consulate in Shanghai, while 65 have a consulate in Guangdong. Our second measure of subnational political ties, called *Number of sister linkages*, tracks the total number of sister relationships for each province-country pair. This includes relationships at both provincial and sub-provincial administrative levels (Liu and Hu, 2018). Over half (51%) of all countries in our sample have at least one sister relationship with a Chinese province. The United States has the highest number of sister linkages (258), followed closely by Japan (252).[8]

In addition to political ties, we consider the intensity of excess demand for face masks, which varied based on the pandemic's severity in importing countries during the first months after its outbreak. We utilize the variable *COVID-19 infections*, accounting for the number of coronavirus infections per 10 million inhabitants in the importing country by the end of April 2020 (Wahltinez, 2020). For analyzing alternative mechanisms, we rely on a series of additional controls, measuring the strength of past dyadic economic relationships (*Past exports*, *Past imports*, *Past inward FDI*) and past aid linkages (*Past donations*), accompanied by typical gravity controls. Throughout the paper, all monetary values are measured in US dollars. The precise definitions for all utilized variables can be found in Appendix A.

4. Event study: Face mask exports during the pandemic

4.1. Empirical strategy

Our empirical strategy is based on product-level regressions, where we compare the monthly dynamics of bilateral exports of face masks – our treatment group – with those of similar products over time. This dynamic DiD approach may offer causal evidence on the impacts of the coronavirus pandemic outbreak on face mask exports, under the condition that the parallel trends and no anticipation assumptions are met. The parallel trends assumption stipulates that, had the pandemic not occurred, the exports of treatment and control products would have followed parallel trends over time. Meanwhile, the no anticipation assumption rules out any differential adjustment of mask exports prior to the pandemic. Albeit ultimately untestable, examining the pre-trends in the treatment and comparison groups before the pandemic can assist us in evaluating the likelihood of both assumptions being met.

The pandemic outbreak triggered an abrupt and sharp increase in the global demand for face masks in 2020. As a result, all bilateral pairs were treated simultaneously, making it unnecessary to weight treatment effects (Roth et al., 2023). To reinforce the credibility of our estimation strategy, we contrast the exports of face masks with two separate control groups. Both groups comprise products that are comparable to face masks yet remained unaffected by the COVID-19 pandemic (see Section 3.1). By comparing face masks not only with similarly composed textile products but also to a broader category of non-critical medical goods, we ensure that our estimates are not influenced by a direct production shift from technologically similar control products to face masks. Appendix Table C.3 offers descriptive statistics for all variables that we include in our empirical models.

We run the following event-study regression to examine the dynamics of face mask exports before and after the onset of the COVID-19 pandemic, using control products as a comparison:

$$X_{ijkt} = \exp\left[\psi_{ijt} + \delta_{ijk} + \sum_{m=-2}^{9} \beta_m \times Mask_{k,m}\right] \epsilon_{ijkt}. \tag{1}$$

X_{ijkt} represents the outcome variables, which consist of export value, quantity, or unit price of product k from Chinese province i going to partner country j in month t. The dynamic treatment indicators, $Mask_{k,m}$, equal one for face masks in month $t = m$, and zero otherwise. We use December 2019 as the baseline period $m = 0$. During this month, neither China nor the partner countries were substantially impacted by the coronavirus outbreak. Since trade data for January and February 2020 were reported jointly by China Customs, we combined these two months for both years, resulting in 11 observations per year. For easier graphical representation, we group all months from January to October 2019 into one indicator, $Mask_{k,m\leq -2}$, and the months from October through December 2020 into another indicator, $Mask_{k,m\geq 9}$. We plot 11 coefficients on our mask indicators $Mask_{k,m}$, comparing them to the baseline month, December 2019.

Our regressions rely on a strict set of fixed effects. The province-country-time fixed effects, ψ_{ijt}, account for all macro-level shocks impacting all exports from a given Chinese province to a partner country in a specific month. These fixed effects do not only capture province-year factors such as the differential exposure of Chinese provinces to the pandemic (including shutdown measures) – for example, during the early outbreak in Hubei province – at various points in time. They also capture fluctuating demand patterns in the partner countries over time, such as those resulting from lockdowns. These fixed effects also account for disruptions in bilateral

[8] Please see Appendix Table C.2 for additional statistics concerning these two measures of subnational political ties for the top 20 province-country pairs for face mask exports. Out of these 20 pairs, 12 are linked by a diplomatic mission, a number considerably greater than the full sample's 6% average. They have an average of 10.5 sister linkages, substantially surpassing the sample's average of 0.4. Note that all countries in this top 20 list have a below-average *UN voting agree* score. The stark contrast between national and subnational political linkages highlights the complementary role of subnational connections when national links are weak.

trade flows due to factors such as border controls, which impact the exports of all comparable products between a dyadic pair.[9] Additionally, we control for the overall trade relationship strength between a Chinese province and its partner country with bilateral product fixed effects, δ_{ijk}, which fully account for differences in past bilateral trade linkages related to particular products.

For trade quantities and their total values, we build on the gravity literature (e.g., Anderson and Van Wincoop, 2003; Arkolakis et al., 2012; Head and Mayer, 2014) and estimate Eq. (1) with the Poisson Pseudo-Maximum Likelihood (PPML) estimator. This allows us to account for zero trade flows and the heteroskedastic nature of trade data (Santos Silva and Tenreyro, 2006). For prices, however, since they are not defined when exports are zero, we take the natural logarithm of Eq. (1) and estimate it by ordinary least squares (OLS), with log prices regressed on the dynamic treatment indicators. In our main specifications, we cluster error terms at the province-country-product level, which allows for serial correlation.[10] We also test the robustness of our results to other clustering choices, which accommodate correlated errors across province-country pairs or products due to the common shock of the outbreak of COVID-19.

In further results, we aggregate the dynamic treatment effects into an average static treatment effect by substituting the indicators for treatment timing in Eq. (1) by a post indicator:

$$X_{ijkt} = \exp\left[\psi_{ijt} + \delta_{ijk} + \beta Post_t \times Mask_k\right] \epsilon_{ijkt}, \tag{2}$$

where $Mask_k$ designates the treatment product, $Post_t$ marks the time periods after the pandemic outbreak, and the coefficient β averages the monthly treatment dynamics, represented as β_m, from Eq. (1) over time.

It is important to note that our measure for face mask exports may be subject to measurement error. This is because the HS code (63079000) for face masks includes other residual products, as detailed in Section 3.1. This data limitation is likely to lead to an underestimation of changes in quantity as we have no reason to expect that exports of other unspecified textile products rose as significantly as those of face masks. Additionally, since prices are calculated as unit values, any changes could also mirror composition effects – should there be a shift in exports towards more valuable (or less valuable) products within the HS code. Thus, our price estimates should be understood as the joint effect of price changes and potential changes in within-category product composition.

4.2. Results

Fig. 3 plots our estimated monthly coefficients, β_m, relative to the baseline period of December 2019. The event study graphs reveal that prior to March 2020, the export patterns for masks and their control products (other made-up textile products within the same HS 4-digit subchapter) followed a precisely estimated parallel trend in terms of their values, quantities, and prices. With the onset of the pandemic in March 2020, the total value of mask exports skyrocketed, showing an almost 20-fold increase in the value of exported masks in May 2020, as illustrated in the left panel.[11] This dramatic surge is attributed to two key factors: a nearly three-fold increase in the quantity of exports and an almost seven-fold increase in prices, as shown in the panel on the right. After having reached its peak in May 2020, mask prices began a gradual decline, stabilizing at a significantly increased level compared to pre-pandemic prices. As previously discussed, this sustained price increase is likely due to a genuine surge in global demand. To a lesser extent, it might also reflect a shift towards higher-quality products within the HS category (e.g., due to demand shifting to FFP masks instead of surgical masks). The increase in mask export quantities lagged slightly behind the rise in values, with a noticeable acceleration beginning in April 2020. This surge quickly stabilized at a level significantly higher than before the pandemic. The quicker adjustment of prices compared to quantities at the onset of the pandemic could potentially be explained by early production bottlenecks, especially when one considers the strict nationwide lockdown imposed in China from January through March 2020. Moreover, establishing new trade links could have taken time, possibly constraining the initial quantity increase. With the lifting of protective measures in April, the Chinese economy recovered swiftly (Al-Haschimi et al., 2020), with some manufacturing firms shifting their production lines to critical medical products, including face masks (López-Gómez et al., 2020), leading to an immediate supply increase. From June 2020 onwards, the export quantities of face masks remained relatively stable at an increased level. Conversely, prices, attaining their peak in May, began to decrease as the rapid expansion of global production capacities started to ease global supply shortages.[12]

Our estimated dynamics remain robust when we constrain samples, use the alternative control group, vary fixed effects, or change the clustering of standard errors. First, as prices cannot be measured for zero quantities, the price regressions inherently capture only the intensive margin of trade and use a smaller sample. In contrast, volume and quantity regressions include zero values and thus rely on a larger sample. To improve their comparability, we repeat the volume and quantity regressions relying on the reduced sample with positive values (intensive margin only). Appendix Figure B.7 shows that the dynamics of export volumes and quantities

[9] Nitsch (2022) demonstrates that changes in transportation modes for New Zealand's exports during the pandemic were brought about by supply-side frictions. Such supply-side differences in trade costs are also captured by province-country-time fixed effects.

[10] We cluster our standard errors at the level of treatment that is the main building block of our triple-difference setting as shown in Eq. (3) in the next section (see, e.g., Cameron and Miller, 2015; MacKinnon et al., 2023).

[11] The coefficient for export values in May 2020 is 3.02, for export quantities 0.95, and for prices 1.90. When looking at export values, this yields an effect size of $exp(3.02) - 1 = 19.49$, or an increase by about 1,949%, that is, about a 20-fold increase.

[12] By June 2020, the European Union planned a 20-fold increase in face mask production by November, reaching a monthly output of 1.5 billion (EDANA, 2020). In comparison, the United States produced 180 million N95 masks (a type of FFP mask) during winter 2020, a four-fold increase from only 45 million in January 2020 (Statista, 2024).

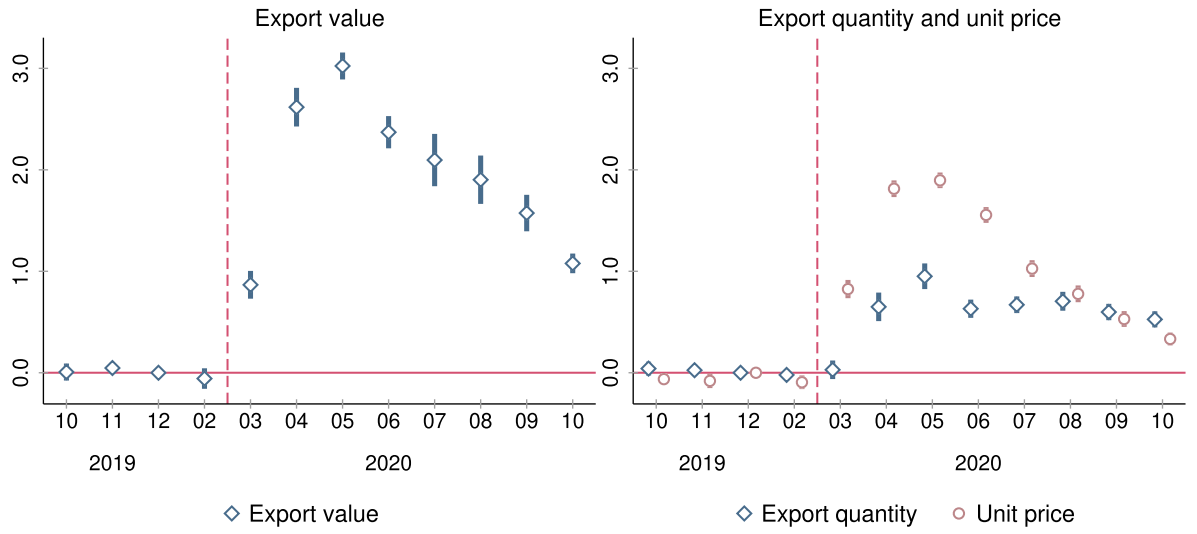

Fig. 3. Event study estimates of face mask exports between January 2019 and December 2020.
Notes: This figure plots the monthly coefficient estimates and their corresponding 90% confidence intervals for dyadic face mask exports, in comparison to two control products from the same HS 4-digit subchapter (made-up textiles) as specified in Eq. (1). Coefficient estimates for export values and quantities rely on PPML, while prices are estimated by OLS. The reference month is December 2019. The first coefficient pools the months January 2019 to October 2019, whereas the last coefficient combines October through December 2020. February 2020 in the figure indicates the combined data for January and February, as the raw customs data reports these two months together. We combine data from January and February 2019 to maintain consistency across years.

Table 1
Face mask exports before and after the COVID-19 outbreak: Difference-in-differences estimates.

Control group	Other made-up textile products			Non-critical medical products		
	Value PPML (1)	Quantity PPML (2)	Price OLS (3)	Value PPML (4)	Quantity PPML (5)	Price OLS (6)
Masks×Post	2.009***	0.584***	0.996***	2.303***	0.794***	1.131***
	(0.107)	(0.062)	(0.019)	(0.057)	(0.044)	(0.016)
Country-province-product FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-province-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,387	89,249	37,262	1,327,900	1,291,536	337,402

Notes: The dependent variables measure the value, quantity, or the natural logarithm of the unit price of face mask exports from each Chinese province to each partner country. The estimation sample includes HS 8-digit product-level data from January 2019 through December 2020. The treatment group consists of face masks, the control group in columns 1–3 includes two other types of made-up textiles (within the same HS 4-digit subchapter), and the control group in columns 4–6 includes 214 non-critical medical products. The post-treatment period begins in March 2020. Columns 1, 2, 4, and 5 are estimated using PPML and columns 3 and 6 using OLS. Standard errors clustered at the country-province-product level are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

based on the restricted sample exhibit almost the same pattern as those based on the full sample, indicating a limited contribution of extensive margin adjustments.

Second, the dynamic estimates remain very similar when we use non-critical medical products as a comparison group, rather than made-up textile articles, as shown in Appendix Figure B.8. In comparison to Fig. 3, the values, quantities, and prices of face mask exports developed similarly relative to this larger control group and are even more precisely estimated. Importantly, the alternative control group also results in fully parallel pre-trend estimates.

Third, nearly identical patterns emerge when we employ less strict fixed effects (Appendix Figure B.9). Specifically, we compare results where we employ (i) only province-country-product fixed effects and (ii) province-country-product fixed effects, province-time fixed effects, and country-time fixed effects with our baseline.

Fourth, a switch to a two-way clustering that additionally accommodates the presence of correlated shocks within the same product-month pair or within the same trade partner and month combination does not affect the significance of our findings (Appendix Figure B.10).

In Table 1, we show the dynamic estimates from Fig. 3 consolidated into static estimates, as per Eq. (2). These estimates compare changes in the export flow of face masks before and after the pandemic outbreak (March 2020) to our two groups of control products. After the outbreak, we observe a substantial and highly statistically significant average surge in the value of mask exports, which increased more than seven-fold relative to other textile products across the entire time period (column 1). Furthermore, a significant

increase was also observed in both the traded quantities (79.3% increase) and prices (99.6% increase) of mask exports (columns 2 and 3). We come to the same qualitative conclusions when we change the control group: the export values, quantities, and prices of face masks increased even more strongly when compared to non-critical medical products (columns 4 through 6).

5. The role of political relations for sourcing face masks

5.1. Empirical strategy

To evaluate whether political relations facilitated access to face masks from China immediately after the pandemic outbreak, we extend our event study estimates from Section 4 by interacting the pandemic treatment with a set of moderating variables in the following way:

$$X_{ijkt} = exp\left[\psi_{ijt} + \delta_{ijk} + \sum_{m=-2}^{9} \tilde{\beta}_m \times Mask_{k,m} + \sum_{m=-2}^{9} \zeta_m \times UN_j \times Mask_{k,m} + \sum_{m=-2}^{9} \rho_m \times P_{ij} \times Mask_{k,m} + \sum_{m=-2}^{9} \gamma_m \times Covid_j \times Mask_{k,m}\right] \epsilon_{ijkt}, \tag{3}$$

where our treatment variable $Mask_{k,m}$ is interacted with variables measuring the strength of the national and subnational political relations as well as COVID-19 affectedness. For national-level political relations, we use UN_j, an index reflecting past voting agreement of country j with China during votes in the UN General Assembly, as introduced above. The vector P_{ij} captures the strength of subnational relationships, indicative of pair-specific links between Chinese province i and country j. We distinguish between a country's diplomatic representation in a specific province and the total number of sister linkages between provinces and countries. Finally, $Covid_j$ captures the demand-side factors by focusing on differences in early exposure to the COVID-19 pandemic based on the number of infections in country j.

The coefficient $\tilde{\beta}_m$ measures the differential dynamics between face masks and control products for a hypothetical country with zero voting agreement with China in the UN General Assembly,[13] zero COVID-19 infections, and a province-country pair without any diplomatic and sister links, providing a baseline for comparison. The coefficients ζ_m, ρ_m, and γ_m capture the differential role played by political factors and early pandemic affectedness after the outbreak. The values for the coefficients during pre-periods, $m < 0$, allow us to assess how likely it is that the parallel trends assumption is fulfilled not only in general but also in this specific triple-difference setting.

In parallel to our strategy from Section 4, we aggregate the dynamic triple-difference estimates between Chinese provinces and their trade partners, as described in Eq. (3), which computes average post-treatment coefficients for each interacted variable. This simplifies the estimating equation to:

$$X_{ijkt} = exp\left[\psi_{ijt} + \delta_{ijk} + \tilde{\beta}\, Mask_k \times Post_t + \zeta\, UN_j \times Mask_k \times Post_t + \rho\, P_{ij} \times Mask_k \times Post_t + \gamma\, Covid_j \times Mask_k \times Post_t\right] \epsilon_{ijkt}, \tag{4}$$

which closely parallels the dynamic Eq. (3), but only estimates one average post-treatment coefficient for the baseline, $\tilde{\beta}$, and average treatment interactions for the pandemic period with regard to political alignment, ζ and ρ, as well as COVID infections, γ.

5.2. Results

Fig. 4 displays five event study graphs, plotting the baseline coefficients $\tilde{\beta}_m$ and all interactions, as outlined in Eq. (3). Neither of the event study graphs indicates a violation of the parallel trends assumption before the pandemic outbreak, with some notable divergent patterns arising afterwards.[14] The baseline plot for the dynamic $\tilde{\beta}_m$ coefficients in the top-left panel corresponds to the hypothetical country. For this purely hypothetical, wholly unaligned, and COVID-free country, we witness a sharp decline in the import quantity of face masks, which is accompanied by a considerable price surge that takes several months to ease off. These baseline results suggest that the exported quantities of face masks were impacted by significant rationing in the spring and summer of 2020.

The interaction terms on national-level political alignment, ζ_m, are displayed in the top-right panel. They illustrate that national political ties facilitated access to face masks following the pandemic outbreak. This resulted in statistically significant differential increases in quantities. Complete political alignment with China on a national level, i.e. a UN voting agreement of 100%, is fully offsetting the challenges in sourcing face masks from China as indicated by the decrease in the baseline exported quantities. However, better national political relations did not cushion against an increase in the price of the product.

The patterns associated with subnational connections are captured by the estimated ρ_m coefficients displayed in the two middle panels. Starting from April 2020, countries with a diplomatic representation in a particular province were capable of sourcing significantly more face masks than countries lacking such a link, as shown in the middle-left panel. This pattern clearly demonstrates

[13] The actual minimum is 0.244, reported for the United States.

[14] Appendix Figure B.11 demonstrates similar dynamics when comparing face masks with non-critical medical products instead of fabricated textile articles. This alternative control group results in more precise estimates for a number of the interactions.

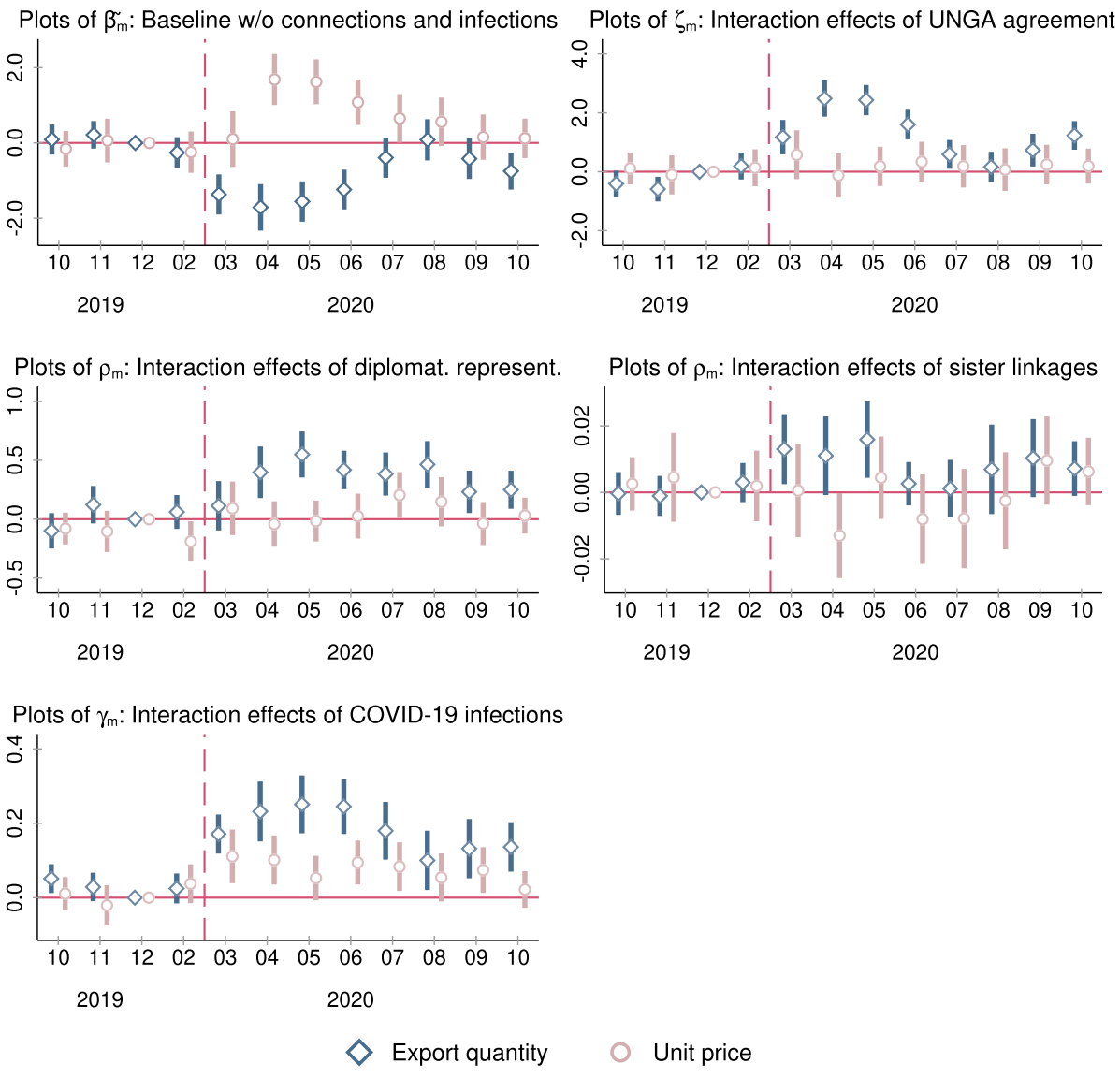

Fig. 4. Event study estimates of face mask exports between January 2019 and December 2020: Political and needs-based heterogeneities.
Notes: This figure plots monthly coefficient estimates and the corresponding 90% confidence intervals of dyadic exports of face masks as compared to two control products within the same HS 4-digit subchapter (made-up textiles), as shown in Eq. (3). Coefficient estimates for quantities rely on PPML and for log prices on OLS. The reference month is December 2019; the first coefficient pools the months January 2019 to October 2019, whereas the last coefficient combines October through December 2020. February 2020 in the figure represents January and February as the raw customs data report these two months together. We combine data of January and February of 2019 to ensure consistency across years. The different panels plot the event study coefficients for the baseline ($\tilde{\beta}_m$) and interactions as specified in Eq. (3).

the trade-facilitating impact of diplomatic representations during times of high demand. However, these diplomatic representations do not seem to have caused a reduction in the price of face masks. We observe similar trends with respect to sister linkages, as shown in the middle-right panel. One additional sister link led to roughly a 1 to 2 percent increase in exported face mask quantities immediately following the pandemic outbreak. While these differences might seem trivial, our model predicts substantial quantity effects for some country-province pairs with strong ties. For example, Jiangsu province maintains 35 sister linkages each to the United States and Japan, whereas Shandong province has 23 sister linkages with South Korea. Additionally, there is a slight indication that countries could source face masks at a lower cost from provinces they had sister relations with at the early stages of the pandemic (in April 2020). These initial price differences appear more significant when estimated with the alternative control group (see Appendix Figure B.11). This indicates a broader range of opportunities for decentralized cooperation between local

Table 2
The role of national vs. local politics: Triple-difference estimates.

Control group	Other made-up textile products			Non-critical medical products		
	Value PPML (1)	Quantity PPML (2)	Price OLS (3)	Value PPML (4)	Quantity PPML (5)	Price OLS (6)
Masks×Post	−1.006***	−0.988***	0.767***	−0.717**	−0.882***	0.863***
	(0.386)	(0.233)	(0.153)	(0.288)	(0.255)	(0.131)
UN voting agree×Masks×Post	2.646***	1.677***	0.099	2.697***	1.829***	0.208
	(0.411)	(0.237)	(0.171)	(0.293)	(0.249)	(0.146)
Dip. representation×Masks×Post	0.698***	0.426***	0.128***	0.673***	0.271***	0.133***
	(0.168)	(0.089)	(0.047)	(0.095)	(0.094)	(0.040)
No. of sister linkages×Masks×Post	0.007	0.009	−0.002	0.003	0.010**	−0.005
	(0.010)	(0.006)	(0.004)	(0.006)	(0.004)	(0.003)
asinh COVID-19 infect.×Masks×Post	0.376***	0.139***	0.052***	0.363***	0.140***	0.039***
	(0.052)	(0.033)	(0.015)	(0.035)	(0.034)	(0.012)
Country-province-product FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-province-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,387	89,249	37,262	1,327,900	1,291,536	337,402

Notes: The dependent variables measure the value, quantity, or the natural logarithm of the unit price of face mask exports from each Chinese province to each partner country. The estimation sample includes HS 8-digit product-level data from January 2019 through December 2020. The treatment group consists of face masks, the control group in columns 1–3 includes two other types of made-up textiles (within the same HS 4-digit subchapter), and the control group in columns 4–6 includes 214 non-critical medical products. The post-treatment period begins in March 2020. Columns 1, 2, 4, and 5 are estimated using PPML and columns 3 and 6 using OLS. Standard errors clustered at the country-province-product level are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

government bodies and firms. However, these instances of "friendship pricing" vanished already after one month.[15] Lastly, the bottom panel of Fig. 4 depicts dynamic γ_m coefficients, illustrating that countries with an early surge in COVID-19 infections were procuring more masks and at an increased unit price following the pandemic outbreak.

Table 2 again contrasts the dynamic triple-difference estimates with average post-treatment coefficients for each interacted variable, following the empirical specification in Eq. (4). The baseline average treatment coefficients remain highly significant for both control groups, indicating substantially less face mask exports to hypothetically unconnected and non-COVID-affected countries, as well as significant average price hikes in the period following the outbreak of the pandemic. The aggregate influence of national political alignment also remains significant: A nation with a one standard deviation (0.11) closer voting alignment with China at the UN General Assembly, comparable to the difference between China's voting alignment with Portugal (0.66) and Brazil (0.77), imported a 20 to 22% larger quantity of face masks after the pandemic started (depending on the comparison group). However, these political ties did not translate into price reductions; both "allies" and "adversaries" had to pay the extremely increased market price. These results on national political ties are robust to measurement.[16] When focusing on subnational political ties, it becomes apparent that diplomatic representations facilitated the pandemic mask trade as well. A country that has a diplomatic representation within a selected province increased the quantity of face mask imports from that province by 31 to 53%, depending on the comparison group. Furthermore, we observe significantly higher unit costs during the pandemic for province-country pairs that have diplomatic representation. The results for sister linkages dissipate when we look at the aggregated post period. This is in contrast to the observed short-run effects of sister linkages portrayed in Fig. 4. While we do not see statistically significant effects of sister linkages when comparing face masks to closely related textile products, each additional sister tie increases the quantity of face mask exports by around 1% on average when compared to other non-critical medical products. This is still close to the dynamic estimates measured in the early months of the pandemic (see Fig. 4).[17]

In Appendix D.1, we further decompose subnational political relations into upper- and lower-level ties by distinguishing between embassies and consulates for diplomatic missions and between upper- and lower-level sister ties. We find that the trade-facilitating effects of subnational political relations are mainly from upper-level connections through embassies and upper-level sister ties while the impacts of lower-level connections are considerably smaller (see Appendix Figure D.1). In contrast, lower-level sister linkages, which mainly build on personal relationships, seem to have contributed to reducing the extreme price markups in April and May

[15] We cannot entirely dismiss an alternative explanation where the observed price reductions represent a shift in composition towards lower-quality, cheaper masks. Nonetheless, we view this as unlikely in the scenario of sister connections, often politically portrayed as bonds of friendship between the populations of the two countries.

[16] Replacing UN voting alignment with the United States (rather than China) or with the ideal point distance between China and the respective trade partner country yields the expected results, with opposite signs (see Appendix Table C.4).

[17] The interaction coefficient has a very similar magnitude for the first control group but is less precisely estimated. Among further robustness checks, the effects of sister linkages appear to be less robust. However, we see that sister linkages significantly increased both mask export values and quantities when we factor out possible effects of past economic links (see below in Table 3). Decomposing sister linkages into upper-level and lower-level ties indicates that upper-level sister ties more strongly predict face mask exports, while lower-level sister ties do not appear to be linked to export value or quantity. However, they contribute to lower prices shortly after the pandemic outbreak (Appendix D.1).

2020. However, this effect disappeared afterwards, leading to an overall insignificant result in the static average effects for the first control group. The negative price effect remains significant at 10% level when comparing masks with non-critical medical products (see Appendix Table D.1). Further results reveal that in provinces with stronger central government control, as measured by the presence of centrally controlled SOEs, the positive effects of diplomatic missions are significantly weaker (Appendix Table D.2). This indicates that diplomatic missions promote trade through private-sector firms. In addition, it appears that SOE presence drives the price-reducing effects of sister linkages, implying that SOEs might have played a crucial role in "friendship pricing."

Returning to Table 2, we observe that countries with high infection rates at the onset of the coronavirus outbreak raised their imports of face masks in both values and quantities. In conjunction with this trend, they also paid on average higher prices for these items. Our elasticity estimates show that a doubling of documented COVID-19 infections by April 2020 resulted in about a 15% rise in face masks imported from China. Simultaneously, a doubling of early pandemic infection rates in an importing country resulted in an increase in prices by around 3.9 to 5.2%, reflecting the effects of heightened product demand.

To assess for which countries political ties mattered the most for sourcing face masks, we predict the quantity of face masks exported to each country in the post-COVID period based on Eq. (4) (see Appendix D.2 for a more detailed presentation of this scenario analysis). We find that countries with earlier exposure to COVID-19, as well as higher-income countries, imported substantially more face masks from an average Chinese province, indicating both a needs- and income-based gradient in mask imports. In contrast, the effects of both national and subnational political ties are comparatively smaller, but more pronounced in low-income countries. This highlights that political ties contributed to the allocation of masks towards resource-constrained nations during the pandemic.

Our results pose the question regarding the relative significance of political factors versus classical determinants of bilateral trade within a gravity model framework. To explore this issue, we incorporate additional triple interactions for a set of classical gravity controls into our model (see Appendix Table C.5). Our indicators of political ties are not only robust to the inclusion of such gravity-linked trade determinants but also strongly dominate them in relevance. For example, face mask exports to countries that have generally lower trading costs with China, as indicated by geographical distance, or possess a larger market, as captured by their GDP, did not see larger increases. We even observe significantly smaller increases in face mask exports following the pandemic outbreak in countries that either participate in a regional trade agreement (RTA) with China or are China's direct neighbors. These findings do not undermine the significance of gravity variables in general but show that in situations of demand surges, like the shortages around the pandemic outbreak, the exports of a highly sought-after product were more responsive to political factors than to usual trade flow determinants.

5.3. Robustness checks

A primary concern regarding our results is that the estimated effects of political ties might be merely reflecting the historical economic relations that played a part in establishing trade networks (Liu et al., 2001; Chaney, 2014; Morgan and Zheng, 2019). For example, these political ties could have promoted the creation of economic connections in the past, facilitating the expansion of trade in face masks during the pandemic. To investigate this alternative explanation, we expand our static triple-difference specification in Eq. (4) by interacting the treatment with past trade, investment, and aid linkages. We quantify past trade linkages through the value of *Past exports* and *Past imports*, representing the average yearly value of trade for each Chinese province with its trade partner country in 2017 and 2018. We measure investment linkages as the average annual value of *Past inward FDI* flows from partner countries to Chinese provinces over the 2015–2017 period (MOFCOM, 2019). We measure past aid linkages with *Past donations*, which capture the value of aid exports from partner countries to each Chinese province at the first peak of the coronavirus epidemic in China between January and March 2020.[18] Such donations may have been strategically reciprocated by the Chinese government via diplomatic gestures.[19]

Upon incorporating additional triple interactions presented in Table 3, the results concerning our political variables remain qualitatively identical. We find no evidence that the expansion of mask exports would have followed past trade or FDI ties. Instead, the relative increase in mask exports was significantly lower for province-country pairs that originated from higher levels of past exports. This emphasizes the unique circumstances during the pandemic outbreak when a plethora of countries with limited commercial province-country linkages succeeded in procuring face masks from China.[20] Unexpectedly, we also do not observe any clear signs of political reciprocity, as subsequent face mask exports did not correspond to the size of donations received by each province during the early stages of the coronavirus outbreak in China. In sum, these findings clearly indicate that the influence of political relations extended beyond that mediated through past trade, FDI, and aid relationships.

[18] During the first quarter of 2020, the most generous aid donor to China was the United States (US$ 36.8 million), followed by South Korea (US$ 23.8 million) and Japan (US$ 21.2 million). Overall, 120 countries donated goods to China, including many instances of South-South cooperation. Most of the donations consisted of medical equipment (accounting for 93% of total donation imports). However, our measure also includes other donations, like that of 30,000 sheep by Mongolia (Damdinsuren and Namjildorj, 2020). See Fuchs et al. (2022) for an overview of how to measure aid flows using China Customs data.

[19] For instance, the New York Times (2020) cites an official from Beijing's Ministry of Commerce saying: "In the previous stage of prevention and control, many countries have offered to help us, and we are willing to offer affected countries our share of help while we can."

[20] For example, we find that Afghanistan did not trade at all with Tianjin before the pandemic. After the outbreak, this country-province pair is in the top quintile for face mask exports. Other similar trade pairs include the Czech Republic and Inner Mongolia, Hungary and Guizhou, as well as the Netherlands and Hainan.

Table 3
Mechanisms: The role of past trade, investment, and aid linkages.

Control group	Other made-up textile products			Non-critical medical products		
	Value PPML (1)	Quantity PPML (2)	Price OLS (3)	Value PPML (4)	Quantity PPML (5)	Price OLS (6)
Masks×Post	4.471***	3.007***	0.491	6.554***	3.852***	1.574***
	(1.275)	(0.899)	(0.369)	(0.831)	(0.804)	(0.283)
UN voting agree×Masks×Post	1.918***	1.155***	0.079	1.747***	1.233***	0.220
	(0.409)	(0.281)	(0.171)	(0.293)	(0.278)	(0.146)
Dip. representation×Masks×Post	0.854***	0.537***	0.110**	0.862***	0.417***	0.170***
	(0.172)	(0.091)	(0.050)	(0.101)	(0.104)	(0.043)
No. of sister linkages×Masks×Post	0.023*	0.020***	−0.004	0.027***	0.025***	0.003
	(0.012)	(0.008)	(0.004)	(0.007)	(0.005)	(0.004)
asinh COVID-19 infect.×Masks×Post	0.370***	0.140***	0.049***	0.350***	0.134***	0.040***
	(0.050)	(0.034)	(0.015)	(0.031)	(0.031)	(0.013)
asinh Past exports×Masks×Post	−0.213***	−0.150***	0.007	−0.343***	−0.233***	−0.037**
	(0.065)	(0.046)	(0.020)	(0.044)	(0.043)	(0.015)
asinh Past imports×Masks×Post	−0.009	−0.011	0.008	0.043*	0.039	0.003
	(0.037)	(0.025)	(0.010)	(0.024)	(0.025)	(0.008)
asinh Past inward FDI×Masks×Post	−0.019	−0.014	0.003	−0.004	−0.010	−0.004
	(0.029)	(0.014)	(0.006)	(0.015)	(0.015)	(0.005)
asinh Past donations×Masks×Post	0.016	0.009	−0.004	0.010	0.011	0.000
	(0.013)	(0.009)	(0.004)	(0.008)	(0.007)	(0.003)
Country-province-product FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-province-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	90,387	89,249	37,262	1,327,900	1,291,536	337,402

Notes: Specifications closely follow those in Table 2. Past trade measures the average yearly value of a province's exports and imports with its trade partners in 2017 and 2018. Past FDI measures the average yearly FDI inflows to Chinese provinces from 2015 to 2017. Past donations measure donations from countries to Chinese provinces from January to March 2020. All economic link measures are transformed by the inverse hyperbolic sine function. Columns 1, 2, 4, and 5 are estimated using PPML and columns 3 and 6 using OLS. Standard errors clustered at the country-province-product level are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We also need to consider if our political variables truly reflect *political* connections, as they could have originally been established with the explicit intention to promote trade. Economic diplomacy is an essential part of China's diplomatic activities. To ensure our results do not solely portray the effects of recent – and, therefore, potentially economically motivated – connections, we re-estimate our model using only historical links. Regarding national political alignment, we consider UN voting alignment between 1971, when the People's Republic of China succeeded the Republic of China (Taiwan) in the UN, and 1991. In terms of our subnational measures, we restrict our dyadic measurements of diplomatic representations and sister affiliations to those connections initiated before 1992.[21] Since our outcomes largely hold true with historical political connections as well (see Appendix Table C.6), this further increases our confidence in our interpretation that politics, rather than economic motives, indeed influence our key findings.[22]

Our dataset on mask trade predominantly comprises commercial exports but also includes aid exports. Arguably, the role of political ties in China's exports is likely to be stronger for aid exports than commercial trade. Previous research indicates that countries with a close voting alignment with China in the UN receive significantly more aid, while countries that recognize the government in Taipei rather than the one in Beijing are excluded from such aid (Dreher and Fuchs, 2015; Dreher et al., 2018). Moreover, Beijing has incorporated its pandemic response as part of its broader strategy to emerge as a key player in global development and health (Fuchs et al., 2022). To ensure our findings are not influenced by politically motivated aid exports, we conduct robustness checks that eliminate donation exports and focus on commercial exports. We obtain results that closely align with our main findings as seen in Table 2, confirming that our findings reflect the expansion of commercial exports (see Appendix Table C.7).

Further robustness checks confirm that our results are not biased by outliers. For example, we find that our findings remain stable after excluding the United States from our sample. This is to account for potential confounding effects brought on by the US-China trade war (see Appendix Table C.8). Our results are robust to the exclusion of trade through Beijing, the seat of the central government, which is expected to reflect central government policies rather than "localized foreign policy" (panel A of Appendix Table C.9). Results also hold when we exclude Hubei instead, the province where the novel COVID-19 virus was first reported (panel B of Appendix Table C.9). Excluding countries, provinces, or country-province pairs with no or minimal political links confirms that our results persist when focusing only on politically important places (as described in Appendix D.3 and shown in Appendix Figure D.2). Lastly, similar to our findings in Section 4.2, we confirm that relaxing fixed effects and employing two-way clustered standard

[21] We use 1992 as a cutoff point because it marks the end of the Cold War, with the dissolution of the Soviet Union in December 1991 and Deng Xiaoping's Southern Tour in Spring 1992. The latter is a major milestone in China's "Reform and Opening Up" program. By gauging the strength of links formed prior to China's economic opening, we can ensure that they solely reflect historical political alignment.

[22] The trade-inducing effects of historical sister linkages become substantially more pronounced in these specifications.

errors, which additionally account for potential correlations within country-province pairs or products at any time point, do not change our results much (Appendix Tables C.10 and C.11).

5.4. Adjustments at the intensive vs. extensive margins

We have made use of all available trade data to estimate changes in export values and quantities, combining both the extensive and intensive margins of adjustment. When focusing on unit prices, we concentrated solely on the intensive margin, as prices are only observed when trade occurs. To evaluate the extent to which the quantity adjustment is influenced by changes along the extensive and intensive margins, we now decompose the total quantity adjustment along these two dimensions by re-estimating two variants of Eq. (3). We examine the adjustments along the intensive margin by retaining only product-country-province-pair-month combinations with positive trade flows when we estimate this model. We measure adjustments on the extensive margin by utilizing a dependent variable that, in a given month, takes the value of one if any trade of a product occurs between a province-country pair, and zero in all other cases. By concentrating on the extensive margin, we gain insights into the impact of politics on the establishment of new trade connections. Setting up a new trade link requires gathering information about potential buyers and sellers, a process that can be time-consuming. Political ties can help create these informational connections and build the trust required to finalize a transaction (see Section 2).

Fig. 5 illustrates that the majority of our quantity adjustment estimates are driven by changes at the intensive margin of trade, as indicated by the close alignment of the intensive margin coefficients with the baseline coefficients. Both national and subnational political relationships contribute to trade creation by increasing exported quantities along the intensive margin. However, we observe some patterns along the extensive margin of trade as well. First of all, baseline coefficients are consistently positive, implying that even for a hypothetical country with no political connections and no early coronavirus exposure, trade links continue to be created. Among all political factors, diplomatic representations have the most direct association with the development of new trade ties. Particularly in the early stages of the pandemic, the diplomatic representations facilitated trade by both establishing new ties and intensifying existing trade links. Conversely, sister linkages do not appear to operate through the extensive margin of trade in this context.[23] National links played a second-order role in establishing new trade links as we find only a significant effect of UN voting alignment in May and June.

6. Conclusion

The initial weeks of the COVID-19 pandemic underscored many economies' reliance on essential goods imported from China, with countries battling to procure face masks to contain the virus's spread. This article explores the factors contributing to the rapid growth of face mask exports, distinguishing between traded quantities, average product prices, and the overall trade value. To do so, we assembled data on monthly exports of face masks from China's provinces to trading partner countries at the HS 8-digit level. We implemented a difference-in-differences strategy, comparing the monthly dynamics of face mask exports before and after the pandemic outbreak with two control groups, namely made-up textile products and non-critical medical products. Estimates of monthly dynamic treatment effects confirmed that face mask exports and their control products were on a fully parallel trend before the pandemic outbreak, suggesting our estimates are causal. Both the short-run dynamics and the medium-run aggregate treatment effects reveal a dramatic surge in the value of exported face masks following the pandemic outbreak. This increase was triggered by steep price increases in response to the sudden surge in global demand for face masks. Starting from April 2020, the exported quantity of face masks also expanded rapidly, due to increased exports between existing trade partners and the formation of new trade links between China's provinces and countries worldwide.

We examined the drivers of this rapid expansion in trade, specifically focusing on the role of national and subnational political relationships, while comparing them to the impact of past economic ties. We employed a triple-difference strategy at the dyadic province-country pair level, conditional on country-province-time and country-province-product fixed effects. Our findings indicate that both national political alignment (captured by voting agreement with China in the UN General Assembly) and subnational linkages (measured by the presence of diplomatic representations within the province and sister ties) contributed to the surge in exported quantities. Furthermore, sister relations and particularly connections between lower-level administrative units resulted in a somewhat lower price for face masks during the initial months of the pandemic. This serves as evidence for temporary "special treatment" to partners with subnational links in commercial relationships.

These findings suggest that it would be wise for countries to diversify their sources of strategic goods. They also indicate that fostering political relations, both at the national and subnational level, could be beneficial as it aids in facilitating trade, speeding up both the formation of new trade connections and trade expansion. Future research might probe further into the role of migrant networks in advancing trade when dyadic diaspora data at the level of Chinese provinces become available. Considering anecdotal evidence of "subpar quality" mask and ventilator exports, future analyses of China's medical equipment exports should take into account quality differences. Lastly, researchers may want to examine patterns in China's trade with critical goods other than face masks, such as rare earths critical for semiconductors, and the influence of political ties on the resulting global trade patterns.

[23] One possible explanation for this pattern could be that province-country pairs with strong connections through subnational ties were less likely to start with no trade links for masks. For province-country pairs with at least one sister linkage in 2019, 44% of all monthly observations reported no mask exports in that year. In contrast, this percentage was 83% for province-country pairs lacking sister linkages.

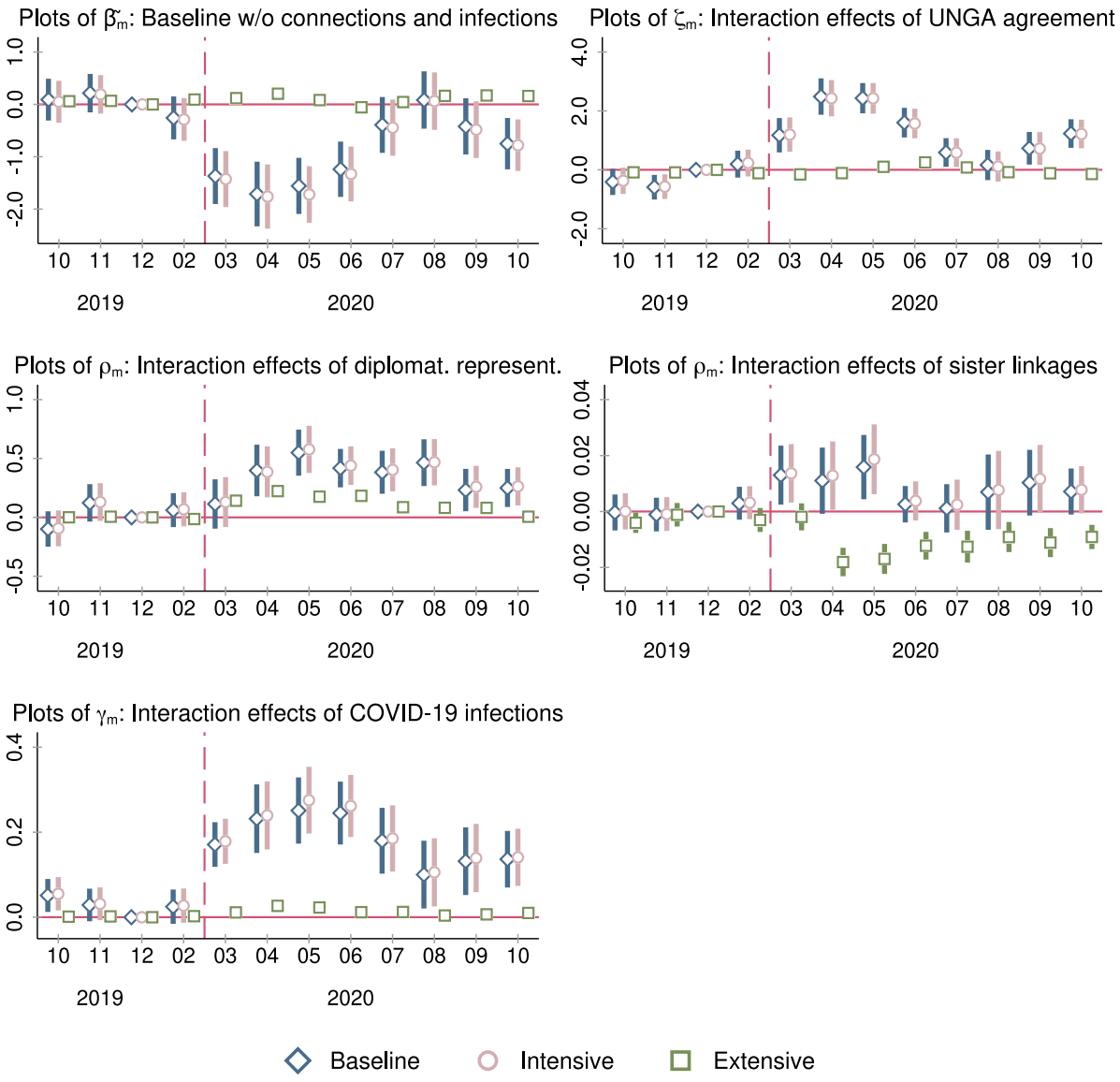

Fig. 5. Quantity adjustments along the extensive and intensive margins.
Notes: The figure plots monthly coefficient estimates and the corresponding 90% confidence intervals of dyadic exports of the quantity of face masks as compared to two control products within the same HS 4-digit subchapter (made-up textiles). Intensive-margin estimates are based on the sample of positive export quantities. Both baseline and intensive-margin coefficients are estimated using PPML. Extensive-margin coefficients are estimated in a linear probability model where the outcome variable is a dummy variable indicating whether a country-province pair has a positive trade value in a specific month. The reference month is December 2019; the first coefficient pools the months January 2019 to October 2019, whereas the last coefficient combines October through December 2020. February 2020 in the figure represents January and February as the raw customs data report these two months together. We combine data of January and February of 2019 to ensure consistency across years. The different panels plot the event study coefficients for the baseline and interactions as specified in Eq. (3).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to improve language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jinteco.2025.104068.

Data availability

Replication Files for Fuchs, Kaplan, Kis-Katos, Leue, Turbanisch, and Wang, "Mask Wars: Sourcing a Critical Medical Product from China in Times of COVID-19" (Original data) (Mendeley Data).

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