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## Mask Wars: China's Exports of Medical Goods in Times of COVID-19

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## Abstract

The COVID-19 outbreak has cut China's supply of and raised the world's demand for face masks, disinfectants, ventilators, and other critical medical goods. This article studies the political and economic factors that facilitated access to Chinese medical equipment during the first two months of the global pandemic. Regression results show that both political and economic ties with Chinese provinces increased Chinese exports of critical medical goods to partner countries. Friendly political relations, such as local diplomatic missions and sister linkages, appear to work as a substitute for pre-existing economic ties at the provincial level. These findings imply that countries are well advised to diversify their sources or develop closer relations with China's provinces to secure better medical equipment access in crises.

***Keywords:*** *COVID-19, health crisis management, medical equipment, face masks, strategic exports, diplomatic relations, emergency aid*

***JEL:*** *F14, F59, H12, H77, H84, I18, P33*

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> "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)*

# 1 Introduction

With the outbreak of the coronavirus disease (COVID-19) hitting the worldwide scale in March 2020, the demand for critical medical equipment has skyrocketed and outstripped the global supply of these goods by far. The global health crisis has transformed simple medical products, such as face masks, gowns, and disinfectants, into scarce goods.[1] Countries, companies, hospitals, and individuals started competing for these goods—with sometimes questionable means. For example, newspapers reported on April 4th that the United States had "confiscated" masks intended for the German capital Berlin at Bangkok Airport and diverted them to the United States. In response to these events, the Interior Minister of Berlin, Andreas Geisel, spoke of an "act of modern piracy" and demanded that "even in times of global crisis there should be no wild west methods" (The Guardian 2020a). This was everything but an isolated incident. The Guardian (2020b) reported on April 3rd 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 mounted within countries. Tellingly, the French Interior Minister Christophe Castaner called the situation within France a *guerre de masques*—a mask war between the local authorities and the state (Le Monde 2020).

China played the central role in these "mask wars." This comes without surprise since the emerging economy is the world's largest supplier of such medical equipment. According to UN Comtrade (2020) statistics, 47% of the world's exports of face masks originated from China in 2019, whereas the next largest exporters, Germany (7%) and the United States (6%), play a comparatively minor role. However, while global demand for vital medical equipment from China surged during the pandemic outbreak in March 2020, their supply was low due to the shutdown of the Chinese economy. In fact, China itself ran short of medical equipment and was dependent on imports in February 2020, when the virus was still

[1] In the week of March 15th, the global search interest in the topic "masks" outnumbered the interest in otherwise popular topics like "food" and "soccer," according to Google Trends.

mainly within Chinese borders.[2] The European Commission limited its own exports of medical gear in mid-March, which was interpreted as a reaction to uncertainty about Europe's access to medical supplies from China (Bown 2020). This all resulted in fierce competition between countries over Chinese medical goods (Evenett 2020).

The strong increases in demand combined with constrained supply resulted in a steep increase in prices as demonstrated for surgical masks in Figure 1. This is indicative of extreme shortages during the first months of the global pandemic and confirms previous evidence on the large profit margins for producers during pandemics (Harrington and Hsu 2010).

Anecdotal evidence suggests that political relations have been helpful to attract Chinese medical equipment in this competitive environment: Many Chinese provinces sent masks or other medical equipment to their respective sister entity, such as Fujian province to the US state Oregon, or Hunan province to the UK county of Lincolnshire (People's Daily 2020, The Lincolnite 2020).

Our paper is the first quantitative study of the role of politics in Chinese exports of critical medical goods in the COVID-19 pandemic. We also contribute to the broader literature on the politics-trade nexus as we analyze the effects of contemporaneous international political relations on trade at the *subnational* level. We focus on March and April 2020, which are the first two months in which the COVID-19 outbreak was considered a "global pandemic," and thus global competition over Chinese medical supplies was particularly fierce.[3] The basic gravity model of international trade suggests that China should sell more to economically larger and geographically closer countries. Moreover, the willingness to pay should depend on the severity of the coronavirus outbreak in a given country. Controlling for these demand factors through country fixed effects and accounting for supply factors with province fixed effects, we isolate the role of bilateral political and economic ties between China's provinces and its trade partner countries.

We test two hypotheses. First, we expect that international political relations shape China's export pattern of critical medical goods. Beijing has a track record of using trade to pursue its foreign-policy goals (Du et al. 2017, Didier 2018, Fuchs 2018). Therefore, we analyze the extent to which China's exports of such vital goods are linked to measures of political relations with its trade partner countries.

The role of political ties in China's exports is likely to be stronger for aid donations than for commercial exports. Previous research shows, for example, that countries that have a close voting alignment with China in the United Nations receive significantly more aid, while countries that recognize the government in Taipei, rather than the one in Beijing, are largely excluded from any aid receipt (Dreher and Fuchs 2015, Dreher et al. 2018). Concerns loom large that Chinese aid spurs corruption and promotes authoritarian norms (Isaksson and Kotsadam 2018, Gehring et al. 2019). As an aid donor and as an aid

[2]China's production of face masks had been cut by half to ten million per day in early February 2020. A spokeswoman from China's Ministry of Foreign Affairs summarized the situation as follows: "What China urgently needs at present are medical masks, protective suits[,] and safety goggles" (BBC 2020).

[3]The World Health Organization declared a global pandemic on March 11, 2020. We observe significant price increases in March and April but not in the following months (see again Figure 1).

recipient, China's ambiguous role has been particularly prominent during the COVID-19 crisis. While asking for discretion from donors such as the European Union when medical supplies were sent to Hubei Province in January 2020, China turned its own aid-giving in March into a media campaign (Popescu 2020).[4] Thus, Beijing has incorporated the pandemic response into its strategy to become a leading actor in global development and health (Grépin et al. 2014, Tang et al. 2017).

Second, given the Chinese economy's reliance on trade, we expect that exports of crucial goods build on pre-existing economic ties, with new trade ties showing a network character (Chaney 2014). In the Chinese context, Liu et al. (2001) observe a "virtuous circle" between trade and foreign direct investment (FDI) in the sense that economic ties in one of the two trigger links in the other. Similarly, Morgan and Zheng (2019) find that past Chinese aid promotes FDI today. We expect a similar effect of pre-existing economic ties in obtaining China's medical equipment during the pandemic.

To test our predictions, we analyze China's export pattern of critical medical goods using monthly dyadic trade data from the General Administration of Customs of the People's Republic of China (GACC 2020b), published at the level of pairs of Chinese provinces and partner countries. Specifically, we test whether previous economic linkages through trade and investment, as well as political relations (including diplomatic missions, sister linkages, and donations to China in the early phases of the health crisis), are associated with the export pattern. Analyzing China's bilateral exports at the provincial rather than national level comes with the advantage that country fixed effects fully capture demand factors, such as the degree of affectedness by the COVID-19 pandemic. Province fixed effects fully capture factors affecting local export supply, such as the medical industry's production capacities in Chinese provinces. This allows us to move closer to a causal interpretation of our results.

Our results show significant positive effects of bilateral political ties on the value of exported medical equipment at the province-country level. We observe that countries can source more than nine times the amount of donations from provinces in which they maintain a diplomatic representation and receive almost one-and-a-half times as much donations for each additional sister link per province as they would obtain otherwise. Moreover, China reciprocates past aid receipts through significantly larger exports of medical equipment. Likewise, past economic ties matter. Countries source more critical medical goods from Chinese provinces from which they have sourced such goods in the past and which are important host regions of their outward direct investments. Interaction effects with economic linkages suggest that friendly political relations can compensate for a lack of past economic ties. Further analyses show that our qualitative results hold when we focus on surgical masks exclusively. Finally, we provide evidence that the facilitation of new trade links is a mechanism that links political ties with China's mask exports.

Our paper builds on previous research in economics and political science that discusses the extent to which political relations matter for international commerce (Hirschman 1945, Baldwin 1985, Berger

[4]Empirical results for the pre-COVID-19 era provide a mixed picture of whether China can successfully translate its aid and economic engagement into soft power gains (Blair et al. 2019, Wellner et al. 2021, Eichenauer et al. (forthcoming)).

et al. 2013, Rose 2019). In a seminal contribution, Pollins (1989) develops a public-choice model in which importers reward political friends through trade increases and punish adversaries through trade reductions. A subsequent stream of research documents that diplomatic relations, as operationalized by embassies and state visits, can foster bilateral trade (Nitsch 2007a,b, Rose 2007).[5] While interlinked supply chains, bilateral, and multilateral trade agreements could prevent governments from politicizing trade due to sunk costs (Davis and Meunier 2011), the persistent government control over economic activities may explain why Chinese trade still follows the flag (Davis et al. 2019). Notably, economic diplomacy facilitates trade 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 need government approval. Consumer reactions to the state of bilateral relations are another mechanism through which politics affects commerce (Pandya and Venkatesan 2016).

Recent empirical evidence indeed suggests that Chinese trade has remained politicized in the aftermath of bilateral tensions. Political tensions caused by governments receiving the Dalai Lama lead to reductions of their countries' exports to China (Fuchs and Klann 2013), which appear to mainly operate through state-owned enterprises (Lin et al. 2019). These companies not only have to follow government objectives by their very definition, but they are also financially dependent on the government and show a large overlap in terms of the staffing of their leadership (Davis et al. 2019). Various episodes of Sino-Japanese tensions also led to substantial declines in Chinese imports from Japan (Fisman et al. 2014, Heilmann 2016). We contribute to the literature as we study the relationship between international politics and trade in the realm of global health.

This paper distinguishes itself from the bulk of the literature in that it studies the role of politics in *export* decisions in the face of an unprecedented global surge in demand for medical goods.[6] There are reasons to expect that exports would be less likely to be politicized than imports, as export restrictions are considered costlier from the sender's perspective (Martin and Glauber 2020). Nevertheless, given the extent to which the Chinese state controls medical equipment production, we expect to observe a politicization of its export decisions.[7] Tellingly, China's state-owned enterprises, including PetroChina and Sinopec, entered the mask business only in February 2020 and jointly produced up to an impressive 38.5 metric tons of mask components per day (Lo 2020).

In light of emerging literature that highlights the importance of subnational decision-makers for Chinese domestic politics (Zhang and Van Witteloostuijn 2004, Chen and Kung 2019), we advance previous analyses of the trade-politics nexus by considering province-level ties. Previous decentralization efforts (e.g., Jin et al. 2005) strengthen the expectation that subnational political and economic ties play

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

[6] In comparison to the vast literature on the politicization of import decisions, relatively few studies exist that study political influences on export decisions. Exceptions include work on weapon embargoes and export restrictions on strategic technologies (e.g., DellaVigna and La Ferrara 2010, Crozet and Hinz 2020).

[7] The SOE asset share in the manufacture of medicines reported by the National Bureau of Statistics of China is 27.9% (own calculation with data from NBS (2020a,b,c).

a substantial role in trade. While Che et al. (2015) also analyze political factors in Chinese trade at the provincial level, they focus on political tensions rooted in history. They find that Chinese provinces that suffered more casualties during the Japanese Invasion from 1937 to 1945 trade less with Japan "today" (in 2001). In contrast, our paper focuses on contemporaneous political ties and investigates friendly relations, such as donations and sister linkages at the provincial level. The dyadic province-level analysis allows us to fully capture general demand and supply factors with country and province fixed effects and zoom in on the importance of bilateral regional political and economic ties. Finally, the rich data from Chinese Customs enable us to analyze the role of international political ties for export prices, thereby contributing to the literature on the pricing of medical goods (Ganslandt and Maskus 2004, Harrington and Hsu 2010, Bucciol et al. 2020).

We proceed as follows. In Section 2, we present our measures of trade flows and bilateral linkages and describe the main econometric models. Section 3 presents and discusses the results. We conclude in Section 4.

# 2 Data and empirical strategy

## 2.1 Bilateral exports of critical medical goods

To study bilateral export flows of medical equipment between Chinese provinces and the world during the first months of the global COVID-19 pandemic, we rely on official monthly dyadic export data for pairs of Chinese provinces and trade partner countries (GACC 2020b). We identify a list of 11 medical products that were deemed essential by the Chinese government for COVID-19 treatment and control (GACC 2020a). These products are measured at the 8-digit level of the Harmonized System (HS8) and seem particularly suitable as they are considered essential by the government of the exporting country.[8]

Table 1 lists the 11 essential medical export goods together with their aggregate value, quantity, average price, the three most important exporting provinces, and the top three destination countries in per capita terms. Surgical masks top the list of essential medical equipment in terms of total export value, followed by surgical shoe covers and surgical gowns. Among the 11 essential products, ventilators are by far the most expensive (with average unit prices of about US$ 2,500), reflecting their relatively larger complexity. For all products, the United States was the most important importer, typically followed by Germany or Japan. However, in per capita terms smaller states dominate among China's export destinations, with Luxembourg, Singapore, and Monaco leading the list of per capita mask exports from China.

Our main dependent variable measures the US dollar value of *Total medical exports* from China

[8]For further robustness checks, we consider 80 medical commodities (at the coarser HS6-digit level) that were classified as "critical" by the World Customs Organization and the World Health Organisation in regards to the pandemic (WCO/WHO 2020). See Online Appendix A for more detailed information on all variables used as well as coding procedures and data sources.

during March and April 2020 (aggregated over all 11 HS8 products). We further decompose these trade flows into *Commercial medical exports* and *Donation medical exports*. Among total medical exports, commercial trade constitutes the major bulk (with 99%), whereas donations (with 1%) are of minor economic importance but of much larger symbolic value. Furthermore, we contrast aggregate exports of key medical equipment with exports of surgical masks only (also measured at HS8 level). Surgical masks received special and widespread global attention, and their predominance among the key supplies and the strong government interference led to frequent references to a new "mask diplomacy" (Hornung 2020).

As a result of the COVID-19 pandemic, the value of China's exports of key medical goods nearly doubled from March and April 2019 to March and April 2020, whereas those of disinfectants and masks increased by even more than 1,000% (see also Figure C.1 in the Online Appendix). Donations of medical products in March and April 2020 increased by more than 400% relative to the same period in 2019, while commercial exports of medical products nearly doubled in the same reference period.

The two world maps in Figure 2 show that there was virtually no country that did not import critical medical goods from China in March and April of 2020.[9] On aggregate, the top commercial importers include the largest economies and are strongly dominated by the United States, followed by Japan and Germany. By contrast, the list of countries that received the greatest amount of medical donations is led by Ethiopia, Italy, the United States, Hungary, South Korea, and Luxembourg and thus includes smaller and/or economically less advanced countries. Some countries on the list of top aid beneficiaries were significantly affected by an earlier outbreak (like Italy or Luxembourg). For other top beneficiaries (like Ethiopia or Hungary), this new "mask diplomacy" must have followed other political and economic motives that go beyond a simple targeting of the largest humanitarian needs (Hornung 2020). We explore this cross-country dimension descriptively in the Online Appendix B. Our main empirical strategy, however, will factor out this type of variation and analyze instead the sourcing of exports within China, emphasizing the role of province-country linkages.

Figure 3 shows the geographical distribution of the regional sourcing of medical exports within China, again split into commercial exports and donation exports. As can be seen, the production of medical equipment is widely spread across China. While Beijing and the coastal regions in the Southeast dominate as exporters of medical equipment, all Chinese provinces export at least some medical equipment, including commercial trade and donation exports. The largest commercial exporter in March and April 2020 was Guangdong Province (20%), whereas Beijing provided the largest share of donations (34%). At the beginning of the crisis, the regional sourcing of medical equipment became more widely spread than one year before. The Herfindahl-Hirschman Index of exporter market concentration across Chinese provinces in March/April 2020 went down from 0.16 to 0.12 in the case of masks and from 0.31 to 0.16 in

[9] The only two countries that did not import any medical equipment from China were the small island states Tuvalu and Vanuatu.

the case of ventilators. This suggests that the pandemic led to a significant creation of new trade links, which we will also investigate below more formally.

## 2.2 Measuring bilateral linkages at the provincial level

Focusing on the localization of medical export sources within China allows us to investigate the importance of bilateral political and economic ties between partner countries and Chinese provinces. We measure these ties by a series of proxies that vary at the province-country pair level. Our first measure of political ties, *Diplomatic representation*, is an indicator variable that records whether a partner country has a diplomatic mission (i.e., embassy or consulate) in the respective Chinese province. Besides geographical and ideological distance, the political relevance (in terms of economic and military power) of the partner countries is among the most important determinants for the establishment of diplomatic representations at the country level (Neumayer 2008). Among China's largest trading partners, South Korea (9) and Japan (7) maintain the most diplomatic missions in China (see also Table D.1 in the Online Appendix). Whereas all embassies are located in Beijing, consulates are usually spread across China, with their location reflecting the relative diplomatic importance of a province-country partnership. We expect countries to source more critical medical equipment from provinces where they maintain a diplomatic mission. In a cross-country setting, Rose (2007) shows that each additional consulate in a partner country increases exports between 6 to 10 percent and the empirical literature at large confirms a positive effect of additional consulates on trade (van Bergeijk et al. 2011, Plouffe and van der Sterren 2016, Moons and van Bergeijk 2017). With respect to the coronavirus pandemic, Telias and Urdinez (2020) highlight the role that consulates play in attracting Chinese aid and refer to aid to Uruguay from Chongqing, where a consulate opened up in 2019, as an example.

Our second measure of political ties is the *Number of sister linkages*, which records the total number of sister relationships for each province-country pair, counting both linkages at the provincial and lower administrative levels (Liu and Hu 2018). More than half of all countries (51%) have at least one sister relationship with a Chinese region. The United States tops the list with 258 such relationships, followed closely by Japan with 252 sister linkages (see also Table D.1 in the Online Appendix). These sister relations have evolved from other issue areas, like education, towards trade (Mascitelli and Chung 2008, Liu and Hu 2018). They measure bilateral relations in a broader sense than diplomatic missions, extending to personal bonds and communication channels between firms and through liaison offices. Anecdotal evidence indeed suggests that sister relations have been helpful to attract Chinese medical equipment during the COVID-19 pandemic: Many Chinese provinces sent masks or other medical equipment to their respective sister entity, such as Fujian province to the US state Oregon, or Hunan province to the UK county of Lincolnshire (People's Daily 2020, The Lincolnite 2020).

As a further proxy of the quality of bilateral diplomatic ties, *Donations to provinces in Jan.-Feb.* of 2020 capture the value of donations made by partner countries to each of the Chinese provinces at the

peak of the Chinese health crisis. Within the first two months of 2020, the United States had exported the most aid to China (US$ 19.3 million), followed by South Korea and Japan (see also Table D.1 in the Online Appendix). Altogether 112 countries donated goods to China, including many instances of South-South cooperation. Countries donated mostly medical equipment (96% of total donation imports), but our measure also includes other donations, like that of 30,000 sheep by Mongolia (Damdinsuren and Namjildorj 2020). We expect that such donations may have been systematically followed up by reciprocal diplomatic gestures. For instance, the New York Times (2020) cites an official from the Ministry of Commerce in Beijing stating: "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."

Finally, we capture the importance of past economic ties for the sourcing of medical equipment by controlling for past trade and investment linkages. We measure investment linkages by the average annual value of *Inward FDI* flows from partner countries to Chinese provinces from 2015 to 2017 (MOFCOM 2019). We expect inward FDI to positively affect mask exports, given previous evidence on the complementarity of Chinese FDI and trade (Liu et al. 2001). Anecdotal evidence during the pandemic supports this expectation. For example, the US-based 3M imported 10 million face masks from its Chinese plant during the pandemic's first peak (The Wall Street Journal 2020).

Moreover, as new trade ties follow a network character (Chaney 2014), we expect that previous commercial ties determine the exports of crucial medical goods. We measure past trade in medical exports, decomposed into commercial exports and donations during the same months of the previous year (March and April 2019). While *Commercial medical exports 2019* capture the existence of direct trade linkages within the same sector, *Donation medical exports 2019* account for more specific path-dependencies in foreign aid. Focusing on the same months of the year helps to deal with seasonality-induced variations in trade flows.

## 2.3 Econometric models

We investigate the sourcing of medical equipment exports within China by estimating the following dyadic trade model:

$$Y_{ij} = \beta_1 P_{ij} + \beta_2 E_{ij} + \theta_i + \rho_j + \epsilon_{ij}, \tag{1}$$

where $Y_{ij}$ denotes the inverse hyperbolic sine of the value of medical equipment exported from Chinese province $i$ to partner country $j$, $P_{ij}$ and $E_{ij}$ denote dyadic explanatory variables, and $\theta_i$ and $\rho_j$ are fixed effects for Chinese provinces and trade partner countries, respectively.[10] Table 2 provides descriptive

[10] All monetary values are measured in US dollars. We compute all log transformations by applying an inverse hyperbolic sine transformation, which is defined as $\sinh^{-1}(x) = \ln(x + \sqrt{x^2+1})$, is continuous through zero, and is well approximated for larger values by a log transformation. As suggested by Bellemare and Wichman (2020), we estimate elasticities at the sample mean of all other variables as $\lim_{c\to\infty} \frac{\sinh(c+\hat{\beta}s_1)}{\sinh(c+\hat{\beta}s_0)}$ .

statistics for all variables used in the empirical analysis.

This model's major advantage over a cross-country regression typically applied in the literature is that it controls for unobserved province-of-origin and destination-country factors. Province fixed effects, $\theta_i$, account for the average differences across Chinese provinces in their supply of medical equipment to the rest of the world and their average trade openness. They thus absorb cross-province variation in the location of medical industries within China and general market access. They also capture variation in the extent to which Chinese provinces were affected by the pandemic themselves, which may have also reduced their ability or willingness to export critical medical goods. Country fixed effects, $\rho_j$, capture variation in the total level of medical equipment bought from China by each partner country $j$. They thus fully capture differences in demand across China's trade partners, as well as all other political and economic determinants that drive aggregate trade relations between China and each country (e.g., geographic distance and trade agreements). This specification allows us to focus on the within-country sourcing of critical medical goods by partner countries.

Our vectors of measures of bilateral political ties, $P_{ij}$, and economic relations, $E_{ij}$, contain several political and economic variables, described above, that vary across province-country pairs. We capture bilateral political ties between province $i$ and country $j$, $P_{ij}$, by measuring the presence of a formal diplomatic representation in the province, the number of sister linkages, as well as the inverse hyperbolic sine of past donations to Chinese provinces during the first two months of the global pandemic. In line with our earlier reasoning, we expect that diplomatic representation, together with sister linkages, capture a wide range of formal and informal dyadic ties built in the past, and both could ease the sourcing of medical equipment from the respective provinces. We expect foreign donations in the recent past to trigger reciprocal behavior more directly and especially to be relevant in the face of the short-term capacity constraints.

We measure bilateral economic ties, $E_{ij}$, by the inverse hyperbolic sine of the average annual value of FDI inflows over the years 2015 to 2017, originating from partner country $j$ and targeting province $i$. As a further proxy for economic linkages between trading partners and Chinese provinces, we measure the inverse hyperbolic sine of past medical export values (distinguishing between commercial and donation exports) during the same months (March and April) of the previous year, from China's province $i$ to country $j$. We expect all these economic linkages to ease the sourcing of critical medical products during the crisis.

To investigate whether political and economic ties can also act as substitutes when sourcing medical supplies from Chinese provinces, we extend our bilateral trade model from equation (1) to include interactions of past political and economic linkages $P_{ij} \times E_{ij}$:

$$Y_{ij} \quad = \quad \gamma_1 P_{ij} + \gamma_2 E_{ij} + \gamma_3 P_{ij} \times E_{ij} + \theta_i + \rho_j + \epsilon_{ij}. \tag{2}$$

As before, our political measures, $P_{ij}$, capture diplomatic representations in Chinese provinces, bilateral sister linkages between countries and provinces, and prior medical donations to provinces. In each specification, we include only one selected measure of past economic ties, $E_{ij}$, which captures either past medical or surgical mask exports or inward FDI. Additionally, we interact our dyadic measures of political ties with the respective economic link. This estimation strategy allows us to investigate whether political factors enhance or mitigate the importance of past economic linkages.

Throughout all models, our empirical strategy focuses on the variation across province-country pairs. This allows us to isolate the effects of past bilateral linkages on the regional sourcing of China's medical exports and, as a consequence, to move closer to a causal interpretation of our coefficients. While we are confident that our analysis identifies the effect of province-country linkages on trade, our selected measures of these linkages do not allow for a clear distinction between different types of political and economic ties.

# 3 Results

Table 3 reports results from dyadic regressions of medical exports from Chinese provinces to trade partner countries.[11] The results show that political ties play a crucial role in the sourcing of medical exports within China. First, provinces that host a consulate (or embassy) of a certain country exported substantially more commercial medical equipment to that country in the first months of the global pandemic. Evaluated at the sample mean of all other variables, commercial medical exports were almost double as high (increased by 98.7%) in the presence of such a link, whereas commercial exports of surgical masks more than tripled (increased by 206.9%). At the same time, the presence of diplomatic missions increased total medical donations, and the donations of surgical masks by more than eight-fold at the sample mean, respectively. This very large effect is due to the large concentration of medical donations in Beijing (see again Figure 3), potentially representing decisions by the central government. As one aim of our province-level regressions is to disentangle central and provincial policy making, we also exclude Beijing in a robustness test in Table D.3 in the Online Appendix. While this reduces the magnitude of the effect of diplomatic missions as expected, we still observe sizable positive effects of diplomatic representation on medical donations in the rest of China.

Second, medical equipment donations are also significantly larger to countries that maintain more sister relations with Chinese provinces. Quantitatively, the financial value of donations is 46.3% larger (when evaluated at the mean of all other variables) for countries connected to the exporting province through one more sister relationship. If we analyze the first month of the global pandemic only, the sister-province effect extends to commercial exports in addition to aid and donations (see Tables D.4 and D.5 in the Online Appendix for monthly results).

[11] Table D.2 in the Online Appendix reruns the same regressions based on a much broader HS6 product list that are classified as medical products by the WHO, with qualitatively comparable results.

Third, Chinese provinces tend to reciprocate donations that they received just two months before, although with relatively low elasticities. A one-percent larger receipt of donations by a province increases commercial medical exports by 0.04 and donation exports of medical equipment from this province by 0.07 percent. The estimated elasticity for total surgical mask exports is in a similar range. Overall, we conclude that political ties with Chinese provinces improve access to critical medical goods during the pandemic.

Our measures of past economic linkages are also significantly related to exports of medical equipment. Provinces that received FDI in the past from a given country engage more in commercial and donation exports of medical equipment to that country. Estimated elasticities are the highest (of about 0.2) in the case of commercial exports of surgical masks, giving support to anecdotal evidence of foreign subsidiaries entering the mask trade during the first wave of the global pandemic. Past commercial ties in the form of bilateral exports in the previous year are relatively closely linked to commercial exports of both critical medical equipment in general and masks in particular (with an elasticity of 0.3 to 0.4), indicating that established commercial ties also matter in crises. Their importance for current donations is negligible in comparison. In a similar vein, donations during the pandemic are significantly building on past donation linkages, whereas past medical donations by Chinese provinces were also linked to more surgical mask exports in total.[12]

Results in Table 4 show that, while political linkages matter in general, they can be compensated with economic ties (and vice versa). As described in equation (2), we rely on a set of interactions by varying the measure of past economic ties (using bilateral medical exports in March and April of 2019 as well as past dyadic inward FDI) and interacting these economic linkages with dyadic political factors (diplomatic representation, sister linkages, and past donations). Each dimension of bilateral diplomatic relations results in significantly more medical exports in the following two months, but at the same time, they also reduce the relevance of the previous strength of economic linkages in both specifications. Thus, countries are able to compensate for the weakness of their past economic ties with certain provinces with stronger political ties and vice versa, showing that political and economic ties are imperfect substitutes.[13]

One mechanism through which political and economic ties could foster medical equipment exports during the pandemic is the creation of new trade linkages. To test this potential mechanism, we examine the extensive margin of trade in Table 5. To do so, we restrict our sample to province-country pairs with no previous medical (or product) trade in March and April 2019 and regress a binary indicator of

[12]While zero trade observations are less of an issue due to the inverse hyperbolic sine transformation, we nevertheless check for the robustness of our estimation approach by applying a Poisson Pseudo-Maximum-Likelihood (PPML) approach. Most of the results of the main model persist when we apply the PPML model (Silva and Tenreyro 2006) (see Table D.6 in the Online Appendix). The PPML results confirm that commercial exports respond to both political and past economic ties. The most notable difference to our least-squares regressions is that our reciprocity variable, *Donat. to prov. in Jan.-Feb.*, while still positive, loses statistical significance at conventional levels in the donation regressions.

[13]Table D.7 in the Online Appendix examines the robustness of these findings by using total medical exports aggregated across all HS6 products listed by the WHO as the dependent variable, and the results are qualitatively similar.

new medical trade linkages in March and April 2020 on the same covariates as in equation (1).[14] Within this subsample, 16% of province-country pairs formed a new medical trade link at the beginning of the pandemic.

The results support the notion that both political and economic linkages (in the form of inward FDI) help establish new trade relations in crises. In terms of magnitudes, although diplomatic representations play the strongest role in generating new trade linkages in medical or mask exports, sister linkages matter as well. Moreover, as sister linkages are much more widely spread and easier to establish, their actual relevance for trade creation in crises appears to be substantial.[15] With coefficients on diplomatic representation being only four to five times as large as the coefficient on sister links, sister linkages matter more for trade creation in relative terms. Diplomatic reciprocity considerations, captured by past donations to Chinese provinces, also result in new trade link creation. Although they are not significantly linked to total medical exports, they increase the exports of surgical masks (and donation exports both in the aggregate and of masks specifically). The significant results of inward FDI show that in addition to political linkages, economic linkages also help facilitate the establishment of new trade ties during the early pandemic outbreak.

Next, we run simple cross-country regressions to analyze whether we observe similar patterns at the national level. As we outline in detail in the Online Appendix B, these regressions include our measures of political and economic linkages aggregated to the country-China level, the typical gravity determinants (such as GDP and geographic distance), and proxies for demand factors (such as COVID-19 infection rates) as explanatory variables. Results confirm that, on aggregate, political relations with China (in the form of diplomatic representation and sister linkages) are strong predictors of medical product donations—but not for commercial exports. On aggregate, China appears to be following its commercial interests and exporting medical equipment to "friends" and "foes" alike. Another interesting result emerges. Countries that experienced higher COVID-19 infection rates at the beginning of the pandemic received more commercial medical exports from China, but not donations. It is remarkable that Chinese donations of medical equipment do not appear to respond to the pandemic's severity. Political calculus appears to dominate here, which is problematic for low-income countries if donations are the only option to access medical products in sufficient amounts (Kavanagh et al. 2020).

Finally, the rich data from Chinese Customs (GACC 2020b) also allow us to disentangle total export volumes into changes in export prices and quantities. As prices surged very strongly due to the excess demand and global shortages in the first two months of the pandemic (see again Figure 1), past political or economic ties may have enabled partner countries to secure substantially better deals. While the available price and quantity data contain many missing values, they are suitable for exploratory analysis of increasing export prices and quantities. Table 6 reruns our dyadic regressions from equation (1) with

[14] Note that we need to exclude past commercial and donation exports as they are always zero in this setting.

[15] On average, there are 0.4 sister linkages between each province-country pair, whereas the likelihood that a province hosts a diplomatic representation for a given country is only about 6% (see also Table 2).

average prices and quantities of commercial exports as new dependent variables. We focus on commercial exports only as donation prices contain more missing values and are difficult to interpret as they do not reflect market prices.[16] To account for our new dependent variables, we replace *Comm. med. exports 2019* and *Donation med. exports 2019* by the 2019 export price or 2019 quantity, respectively, and include province-product and country-product fixed effects throughout columns 1 to 3. The results suggest that our main findings on export volumes are largely driven by quantities rather than prices. Political and economic linkages do not help reduce the average price of sourced products at times of supply shortages on aggregate. For surgical masks, we observe marginally significant reductions in prices by 1.3% for each additional sister linkage. Local diplomatic missions, past donations, and investments do not appear to trigger further price decreases. Nonetheless, most of our former results are well mirrored in variations in physical quantities (see Table D.8), showing that political and economic ties to Chinese provinces provide access to larger quantities of critical goods and thus help to relieve supply shortages.

# 4 Conclusion

The first weeks of the COVID-19 pandemic revealed the dependence of many economies on vital goods imported from China. Countries entered a race to source Chinese medical equipment to secure a sufficient amount of face masks, protective equipment, and ventilators. This article investigated the factors that explain the resulting trade pattern. To do so, we collected data on trade in critical medical equipment between China's provinces and trade partner countries and carried out dyadic regressions to explain flows of medical exports between province-country pairs at the start of the pandemic. Country fixed effects fully capture demand factors, such as the degree of affectedness by the COVID-19 pandemic. Province fixed effects capture supply factors, such as the production capacities of the medical industry in Chinese provinces. In this conservative setting, countries were shown to receive more than nine times the amount of donations from provinces in which they maintained a diplomatic representation and almost one-and-a-half times as much donations per additional sister link with China's provinces. Moreover, China reciprocated recent aid receipts through significantly larger exports of medical equipment. The results for commercial exports were driven by adjustments in physical quantities, not prices. Interactions with economic linkages further suggested that political ties can work as substitutes for economic ties.

These findings imply that countries are well-advised to diversify their sources of strategic goods or develop closer relations with China's provinces to secure access to Chinese medical equipment in crises. Future research could delve deeper into the role of migrant networks as a facilitator of trade once dyadic diaspora data at the level of Chinese provinces are available. Moreover, rather than exploring the drivers of China's trade in medical equipment, scholars may want to study its effects on attitudes towards China in its trade partner countries. In light of anecdotal evidence on "poor quality" mask and ventilator

[16] Table D.8 in the Online Appendix reports results for physical quantities of total and donation exports for completeness.

exports, future analyses of China's medical equipment exports could account for quality differences. Finally, as COVID-19 vaccines have become available but remain extremely scarce goods for the months to come, researchers might want to delve into the analysis of "vaccine wars" and the role that political and economic ties play in the resulting global trade patterns.

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# Figures

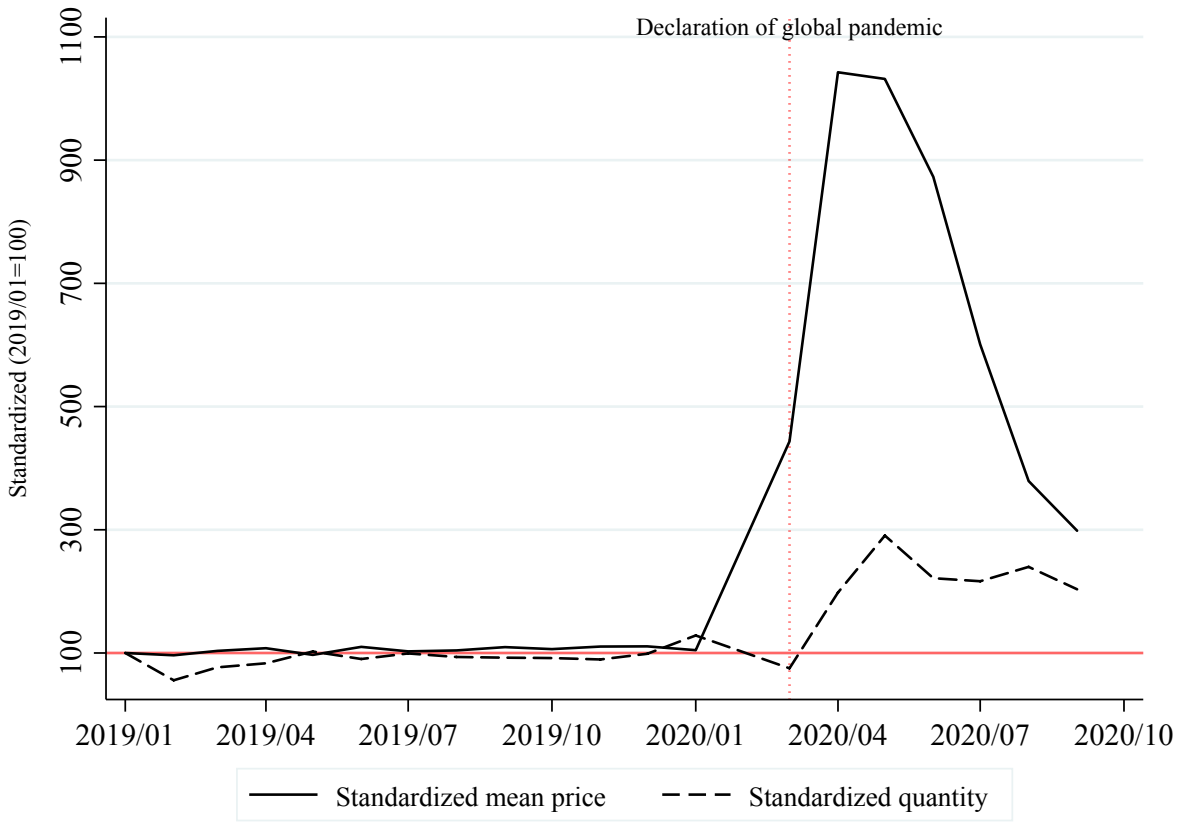
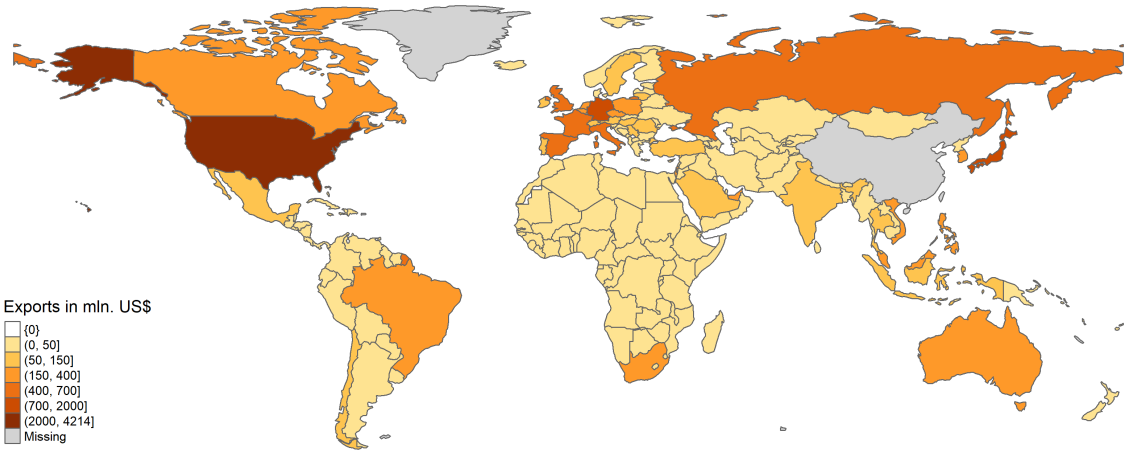
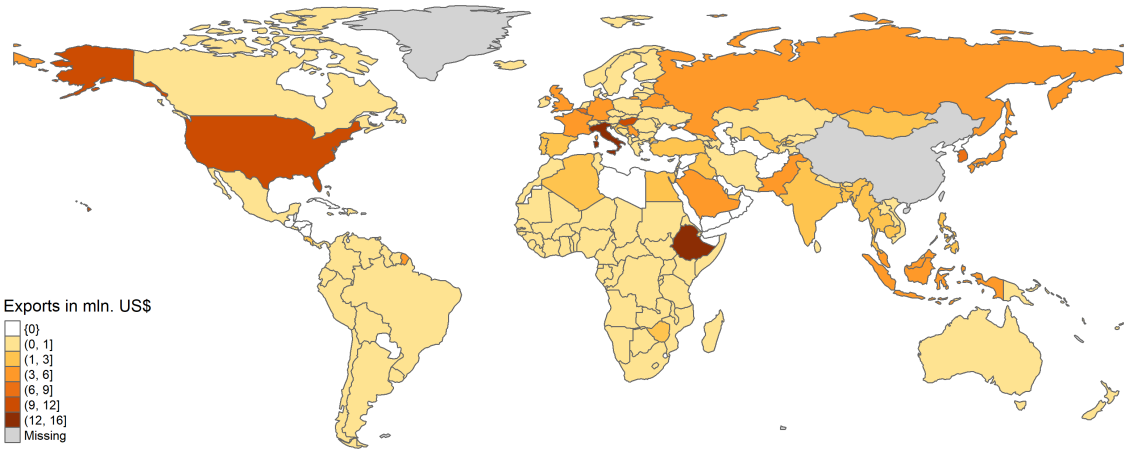



**Figure 1** – Prices and quantities of China's surgical mask exports across time (January 2019=100)

*Notes*: This figure shows monthly price (solid line) and total quantity (dashed line) of China's exports of surgical masks between January 2019 and September 2020. Both prices and quantities are standardized to 100 at their January 2019 level. Data on export price (in US$) and quantity (in kg) are obtained from the China Customs statistics database (GACC 2020b).



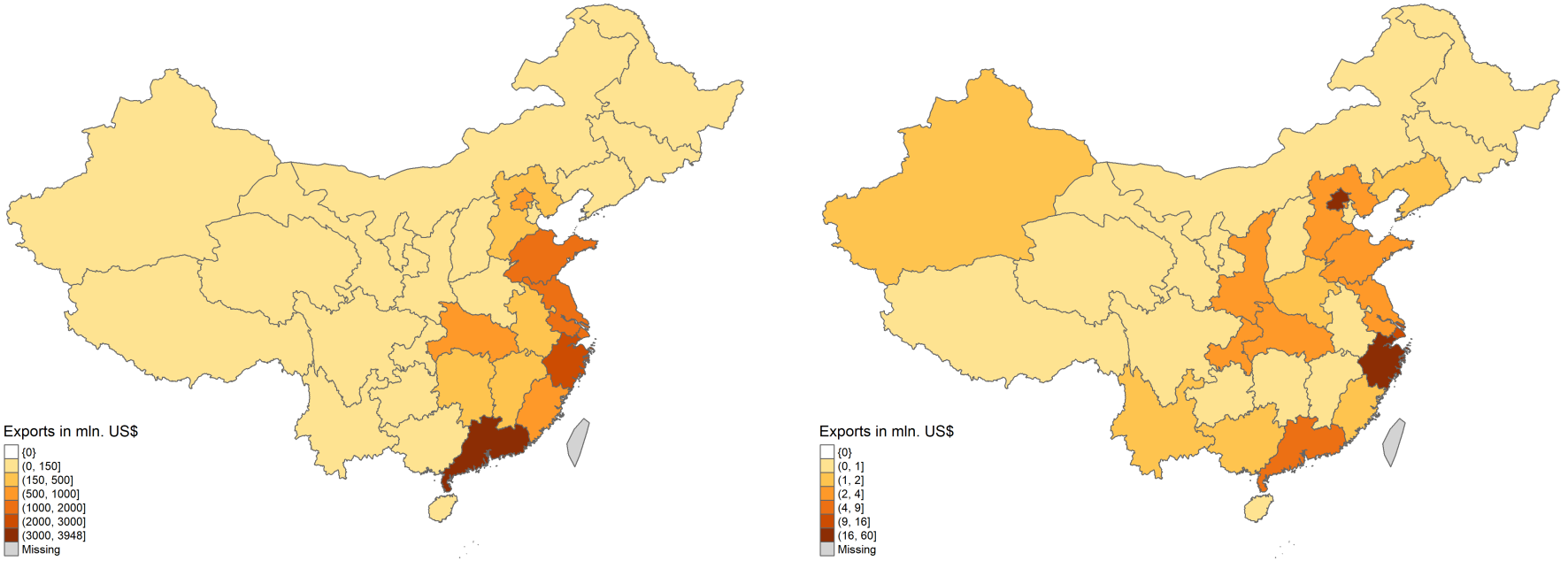

**(a)** Commercial exports of medical equipment




**(b)** Donation exports of medical equipment

**Figure 2** – Exports of medical equipment from China by partner country, March and April 2020

*Note:* The two maps display China's (a) commercial and (b) donation exports of medical products to each country in March and April 2020. Identification of medical products follows the list by the General Administration of Customs of China, including 11 medical products (17 HS-8 digit codes). Data on exports are obtained from the China Customs statistics database (GACC 2020b).




**(a)** Commercial exports of medical equipment

**(b)** Donation exports of medical equipment

**Figure 3** – Exports of medical equipment from Chinese provinces to all partner countries, March and April 2020

*Note:* The two maps display (a) commercial and (b) donation exports of medical products by each Chinese province in March and April 2020. Identification of medical products follows the list by the General Administration of Customs of China, including 11 medical products (17 HS-8 digit codes). Data on exports are obtained from the China Customs statistics database (GACC 2020b).

# Tables

**Table 1** – Essential medical equipment exports from China, March and April 2020

| Product | Value | Quantity | Av. Price | Top three export sources | Top three export destinations (p.c.) |
|---|---|---|---|---|---|
| Surgical masks | 9,431 | 227 | 72 | Zhejiang, Guangdong, Jiangsu | Luxembourg, Singapore, Monaco |
| Shoe covers | 2,319 | 411 | 17 | Guangdong, Zhejiang, Jiangsu | Singapore, Malta, Kuwait |
| Surgical gowns | 1,031 | 54 | 33 | Zhejiang, Beijing, Shanghai | Luxembourg, Monaco, Lithuania |
| Surgical gloves | 419 | 105 | 12 | Shandong, Jiangsu, Hebei | Mauritius, UAE, Ireland |
| Infrared thermometer | 353 | 56 | 95 | Guangdong, Zhejiang, Jiangsu | Singapore, UAE, Israel |
| Ventilators | 343 | 142 | 2,590 | Guangdong, Beijing, Jiangsu | Luxembourg, Slovenia, Hungary |
| Surgical goggles | 242 | 11 | 38 | Zhejiang, Guangdong, Jiangsu | Ireland, Lithuania, Czech Republic |
| Disinfectants | 218 | 62 | 13 | Guangdong, Zhejiang, Jiangsu | Singapore, Australia, Antigua and Barbuda |
| Surgical caps | 213 | 392 | 2 | Jiangsu, Shandong, Zhejiang | S. Korea, Netherlands, Australia |
| Disinfectant wipes | 145 | 23 | 22 | Jiangsu, Zhejiang, Guangdong | Qatar, Netherlands, Lithuania |
| Patient monitors | 145 | 6 | 581 | Guangdong, Shanghai, Jiangsu | Netherlands, Lithuania, Singapore |

*Notes:* This table shows export value, quantity, average price, top three exporting Chinese provinces, and top three export destinations (in terms of per capita) of 11 medical products designated as essential for COVID-19 treatment and controlled by Chinese authorities. The selected medical products are from a list released by the General Administration of Customs of China in early April 2020 and require statutory quality inspections before their shipment to other countries. Export values are measured in millions of U.S. Dollar, and export prices in U.S. Dollar. Export quantities are measured in million units for infrared thermometers, ventilators, surgical caps, and patient monitors, and million kilograms for all others.

**Table 2** – Descriptive statistics of key variables at the province level

| | (1) Mean | (2) S.D. | (3) Min. | (4) Max. |
|---|---|---|---|---|
| *asinh* Total med. exports 2020 | 6.487 | 6.675 | 0.000 | 21.098 |
| *asinh* Comm. med. exports 2020 | 6.337 | 6.667 | 0.000 | 21.098 |
| *asinh* Donat. med. exports 2020 | 1.113 | 3.418 | 0.000 | 17.193 |
| *asinh* Total exports of surgical masks 2020 | 5.084 | 6.413 | 0.000 | 20.513 |
| *asinh* Comm. exports of surgical masks 2020 | 4.902 | 6.393 | 0.000 | 20.513 |
| *asinh* Donat. exports of surgical masks 2020 | 0.985 | 3.138 | 0.000 | 16.410 |
| *asinh* Comm. med. exports 2019 | 5.425 | 6.061 | 0.000 | 20.349 |
| *asinh* Donat. med. exports 2019 | 0.039 | 0.576 | 0.000 | 12.962 |
| *asinh* Comm. exports of surgical masks 2019 | 2.689 | 4.761 | 0.000 | 18.842 |
| *asinh* Donat. exports of surgical masks 2019 | 0.008 | 0.274 | 0.000 | 11.832 |
| Dipl. representation (=1) | 0.062 | 0.242 | 0.000 | 1.000 |
| No. of sister linkages | 0.381 | 1.593 | 0.000 | 35.000 |
| *asinh* Donat. to prov. in Jan.-Feb. | 1.340 | 3.708 | 0.000 | 16.298 |
| *asinh* Inward FDI | 1.654 | 3.414 | 0.000 | 15.117 |

*Note:* The number of observations is 6,045.

**Table 3** – Determinants of medical exports between province-country pairs (March–April 2020)

| Exports by type (*asinh*): | 11 medical products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 0.499** | 0.686*** | 2.079*** | 1.037*** | 1.121*** | 2.067*** |
| | (0.204) | (0.222) | (0.410) | (0.295) | (0.291) | (0.373) |
| No. of sister linkages | 0.038 | 0.032 | 0.325*** | 0.083 | 0.069 | 0.304*** |
| | (0.042) | (0.039) | (0.044) | (0.061) | (0.058) | (0.044) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.026 | 0.038** | 0.067*** | 0.066*** | 0.081*** | 0.063*** |
| | (0.016) | (0.016) | (0.019) | (0.022) | (0.021) | (0.018) |
| *asinh* Inward FDI | 0.086*** | 0.095*** | 0.091*** | 0.172*** | 0.176*** | 0.074*** |
| | (0.020) | (0.020) | (0.021) | (0.027) | (0.028) | (0.018) |
| *asinh* Comm. med. exports 2019 | 0.410*** | 0.434*** | 0.006 | 0.331*** | 0.363*** | 0.026** |
| | (0.021) | (0.022) | (0.010) | (0.023) | (0.025) | (0.012) |
| *asinh* Donat. med. exports 2019 | 0.086 | 0.042 | 0.317*** | 0.336*** | 0.147 | 0.128* |
| | (0.074) | (0.068) | (0.092) | (0.067) | (0.232) | (0.077) |
| Observations | 6,045 | 6,045 | 6,045 | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.771 | 0.771 | 0.461 | 0.710 | 0.706 | 0.448 |

*Note:* Dependent variables measure the value of exports from each Chinese province to each partner country in March and April 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all transformed by *asinh*. Identification of medical products is based on HS 8-digit product classifications. All regressions control for province and country fixed effects. Controls for 2019 medical exports (commercial and donations) refer to all medical products in columns 1 to 3 and surgical masks in columns 4 to 6. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table 4** – Interactions between political and economic relations in dyadic medical exports (March–April 2020)

| Measures of economic link (*asinh*): | Total med. exp. | Total mask exp. | Inward FDI |
|---|---|---|---|
| | (1) | (2) | (3) |
| *Link* | 0.432*** | 0.409*** | 0.255*** |
| | (0.022) | (0.025) | (0.031) |
| *Link* × Dipl. representation (=1) | -0.329*** | -0.260*** | -0.238*** |
| | (0.046) | (0.037) | (0.042) |
| *Link* × No. of sister linkages | -0.039*** | -0.042*** | -0.056*** |
| | (0.009) | (0.007) | (0.008) |
| *Link* × *asinh* Donat. to prov. in Jan.-Feb. | -0.007** | -0.007** | -0.018*** |
| | (0.003) | (0.003) | (0.003) |
| Dipl. representation (=1) | 4.935*** | 3.463*** | 2.913*** |
| | (0.645) | (0.517) | (0.403) |
| No. of sister linkages | 0.763*** | 0.754*** | 0.782*** |
| | (0.152) | (0.122) | (0.096) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.139*** | 0.158*** | 0.165*** |
| | (0.048) | (0.036) | (0.021) |
| Observations | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.774 | 0.713 | 0.739 |

*Note:* Dependent variables measure the value of medical exports from each Chinese province to each partner country in March and April 2020, transformed by *asinh*. Column titles refer to the interacted variables that are used to capture economic linkages. Total medical exports (column 1) refer to the value of medical exports from each Chinese province to each partner country in March and April 2019; total mask exports (column 2) refer to the value of surgical mask exports from each Chinese province to each partner country in March and April 2019; inward FDI (column 3) refers to the average annual value of inward FDI into each Chinese province from each partner country between 2015 and 2017. All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

**Table 5** – Determinants of new trade linkages between province-country pairs

| New trade linkages (=1): | 11 med. products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 0.340*** | 0.135 | 0.153*** | 0.178*** | 0.140** | 0.157*** |
| | (0.103) | (0.120) | (0.036) | (0.063) | (0.064) | (0.035) |
| No. of sister linkages | 0.083*** | 0.076*** | 0.027*** | 0.049*** | 0.036*** | 0.027*** |
| | (0.028) | (0.028) | (0.004) | (0.012) | (0.012) | (0.004) |
| *asinh* Donat. to prov. | 0.009 | 0.006 | 0.005*** | 0.011*** | 0.010*** | 0.005*** |
| in Jan.-Feb. | (0.007) | (0.008) | (0.002) | (0.004) | (0.004) | (0.002) |
| *asinh* Inward FDI | 0.017*** | 0.013** | 0.008*** | 0.021*** | 0.021*** | 0.007*** |
| | (0.006) | (0.006) | (0.002) | (0.004) | (0.004) | (0.002) |
| Observations | 3,158 | 3,166 | 6,015 | 4,463 | 4,466 | 6,039 |
| $R^2$ | 0.350 | 0.319 | 0.420 | 0.425 | 0.396 | 0.421 |

*Note:* The sample is restricted to province-country pairs that had no export linkages within the given category in 2019. The dependent variable is a binary variable that equals one for province-country pairs exporting any medical product in 2020, but not in 2019, and is zero for those without export linkages in both 2019 and 2020. All regressions control for province and country fixed effects. Standard errors clustered at the country level are in parentheses. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

**Table 6** – Determinants of prices and quantities of Chinese medical exports across country-province pairs (March–April 2020)

| Export by type (*asinh*): | 11 med. products | | Surgical masks | |
|---|---|---|---|---|
| | (1) Price | (2) Quant. | (3) Price | (4) Quant. |
| Dipl. representation (=1) | -0.028 | 0.900*** | -0.053 | 0.932*** |
| | (0.044) | (0.109) | (0.077) | (0.188) |
| No. sister linkages | -0.004 | 0.125*** | -0.013* | 0.094** |
| | (0.003) | (0.015) | (0.007) | (0.040) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.004 | 0.081*** | 0.004 | 0.082*** |
| | (0.003) | (0.007) | (0.005) | (0.015) |
| *asinh* Inward FDI | -0.001 | 0.100*** | -0.003 | 0.135*** |
| | (0.004) | (0.010) | (0.006) | (0.020) |
| *asinh* Export price/quant. 2019 | 0.239*** | 0.462*** | 0.054** | 0.361*** |
| | (0.024) | (0.014) | (0.026) | (0.021) |
| Observations | 8,326 | 66,495 | 1,373 | 6,045 |
| $R^2$ | 0.720 | 0.695 | 0.429 | 0.744 |

*Note:* This table reports the results of the determinants of prices and quantities of Chinese *commercial* medical exports. Estimations of prices are based on the sample of product-province-country cells with a positive export value. Dependent variables measure each medical product's average price from each Chinese province to each partner country in March and April 2020, transformed by *asihn*. Columns 1 and 2 control for province-product and country-product fixed effects, and columns 3 and 4 control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

# ONLINE APPENDIX

## A Data generation and description of variables

**Estimation sample** Our dyadic results are based on bilateral linkages between 195 partner countries and 31 Chinese provinces, which results in a total of 6,045 province-country pairs. We exclude the Chinese territories Hong Kong, Macao, and Taiwan for obvious reasons. Cross-country results in the Appendix are based on 187 trading partners of China. In addition to Hong Kong, Macao, and Taiwan, we exclude eight countries and territories (Democratic People's Republic of Korea, Holy See, Liechtenstein, Monaco, Palestine, San Marino, South Sudan, and Western Sahara) due to missing political or gravity controls.

**Classifying medical exports** We identify medical exports primarily by relying on a list of 11 essential medical products (GACC 2020a), which was announced in early April 2020 by the General Administration of Customs of China as a response to mounting quality complaints with respect to Chinese medical exports. The 11 medical products cover 19 Harmonized System (HS) 10-digit codes, which we concord to 17 HS 8-digit codes, for which export data are available. Products on the list require statutory quality inspections before being exported.

Alternatively, for robustness checks, we rely on a list of 80 medical commodities, jointly established by the World Customs Organization (WCO) and the World Health Organisation (WHO) within the *HS Classification Reference for Covid-19 Medical Supplies*. It relies on the 6-digit level classification according to the HS, and its purpose is to provide a guideline to countries in order to facilitate trade in medical equipment.

Source: For the official announcement on the 11-product list (HS8), see `http://www.customs.gov.cn/customs/302249/302266/302267/2961602/index.html` (accessed June 18, 2020); for the 80-product list (HS6), see WCO/WHO (2020).

**Distinguishing between commercial exports and donation exports** We rely on the custom reporting system by the official monthly China Custom Statistics to distinguish between commercial exports and donations. Donations refer to exports under the custom regimes "Aid or Donation between Governments and International Organizations" (code 11) and "Other Donations" (code 12). Commercial exports cover all other custom regimes, including, among others, ordinary trade and processing trade.

Source: China Customs Statistics (GACC 2020b).

**Generating current and past exports variables** Our dependent variables measure the total US$ value of exports (total exports, commercial exports, and donation exports of medical products, as well as the corresponding breakdowns of those export measures for surgical masks) over the

first two months of the pandemic, March and April 2020. We sum up export values over these two months but re-run regressions by month in robustness checks. We transform all export values using an inverse hyperbolic sine transformation.

To control for trade links, we compute past medical exports during the same two months of the previous year (March and April 2019). We decompose past medical exports into the mutually exclusive categories of *Commercial medical exports 2019* and *Donation medical exports 2019*. In regressions that predominantly focus on exports of surgical masks, we include commercial exports and donation exports of surgical masks in March and April 2019 as controls for past trade links. In bilateral dyadic regressions, exports refer to province-country pairs, and in cross-country regressions (in the Online Appendix), they are aggregated for each partner country.

Source: Official Monthly China Customs Statistics (GACC 2020b).

**Diplomatic representation** In dyadic regressions, the indicator variable equals one if a partner country has a consulate or embassy in the respective Chinese province. Note that all embassies are located in Beijing. The variable is coded according to the list of foreign consulates and embassies on the Chinese Ministry of Foreign Affairs homepage as of November 2020. In cross-country regressions in the Online Appendix, the indicator variable equals one if a partner country has a consulate or embassy in China.

Source: MFA (2020a,b)

**Number of sister linkages** This variable is based on a dataset of 2,310 sister relationships on the provincial and sub-provincial levels (including prefectures and counties) from China International Friendship Cities Association (CIFCA). For our analyses, we build on a continuous indicator of the number of sister relationships of various administrative units within a country established with administrative units in China (at the provincial or lower administrative level). We measure ties that existed by the end of 2015. In the dyadic regressions, sister linkages refer to province-country pairs. In the cross-country regressions in the Online Appendix, they are aggregated by country.

Source: Liu and Hu (2018).

**Donations to province in Jan.-Feb.** In dyadic regressions, asinh *Donations to province in Jan.-Feb.* records the inverse hyperbolic sine of the US$ value of total aid and donation imports to each Chinese province from each partner country.

In cross-country regressions in the Online Appendix, asinh *Donations to China in Jan.-Feb.* measures the inverse hyperbolic sine of the US$ value of total aid and donation imports to China by each partner country between January and February of 2020.

Source: Official Monthly China Customs Statistics (GACC 2020b).

**Inward FDI** In dyadic regressions, the variable measures the average annual value of inward foreign direct investment inflows into each province originating from each of the partner countries from

2015 to 2017, measured in US$. In cross-country regressions in the Online Appendix, the variable measures the average annual value of inward foreign direct investment inflows into China originating from each of the partner countries from 2015 to 2017, measured in US$. Both measures are transformed via an inverse hyperbolic sine transformation.

Source: China's Ministry of Commerce (MOFCOM 2019).

**Ideal-point distance** In cross-country regressions in the Online Appendix, the variable records the ideal-point distance between China and each partner country. Ideal-point distance measures disagreement among country pairs during voting sessions in the United Nations General Assembly, weighting each roll call according to the relative importance of any given topic for a reference country. In order to flatten out yearly variation, we rely on a sum of all sessions from 2017 to 2019 in the ideal-point distance, which ranges from 0.04 (Seychelles) to 3.12 (United States), as depicted in the descriptive statistics in Table D.9.

Source: Bailey et al. (2017).

**Government effectiveness** In cross-country regressions in the Online Appendix, this variable is captured by an index that measures the quality of public services, the capacity of the civil service and its independence from political pressures, and the quality of policy formulation. The index is provided on an annual basis, and we average it over the years 2014 to 2016. In our sample, its values range from -2.3 to 2.2.

Source: Worldwide Governance Indicators (Kaufmann et al. 2011).

**COVID-19 infection rates** In cross-country regressions in the Online Appendix, *COVID-19 infection rates* are calculated as infected cases per 10 million people and are transformed by an inverse hyperbolic sine transformation. They provide us a proxy for the early spread of the pandemic in each importing country. By the end of April, San Marino showed the largest infection rate, followed by Andorra and Luxembourg. Throughout the paper, we use rates recorded by the end of April 2020 and only deviate for the regressions considering only March exports by using rates from March (in Table D.4).

Source: Open COVID-19 Dataset (Wahltinez 2020).

**Gravity controls** Cross-country regressions in the Online Appendix also include a set of gravity controls. Partner-country GDP in constant US$ as well as population size have been accessed via *wbopendata* (Azevedo 2011) and always refer to the latest available year. The partner country's geographic distance is measured from China's most populous city, Shanghai. *Contiguity* is a binary variable for a common border with China. GDP and distance are all converted by the inverse hyperbolic sine transformation.

Source: World Bank (2020) for GDP and CEPII (Mayer and Zignago 2011) for distance and contiguity.

# B Descriptive cross-country analysis

For a descriptive analysis of cross-country patterns of Chinese medical exports at the beginning of the pandemic, we run simple regression models at the cross-country level. We estimate the following regression equation:

$$Y_j = \alpha + \beta X_j + \epsilon_j, \tag{3}$$

where $Y_j$ denotes the inverse hyperbolic sine of the value of Chinese medical exports (also by type) to partner country $j$ in March and April 2020, $X_j$ is a vector of explanatory variables introduced below, and $\epsilon_j$ is an error term. The vector $X_j$ includes four sets of explanatory variables, capturing bilateral political and economic ties and extending them by other proxies for country-specific demand for medical equipment and typical gravity controls. We expect that both past political and economic ties make it more likely that medical equipment is sourced from China.

We measure four dimensions of political ties at the country level. *Ideal-point distance* is the only measure that is only available at the country level: it captures past political (mis-)alignment between partner countries and China (Bailey et al. 2017). It exploits differences in voting behavior between China and its trade partners within the United Nations General Assembly (UNGA) between 2017 and 2019 and has been widely used to capture bilateral political relationships (see e.g., Allen et al. 2020, Rommel and Schaudt 2020). The other three variables aggregate province-country linkages. The indicator of *Diplomatic representation* captures the presence of diplomatic links between China and any partner country. It takes only zero for countries that have no official diplomatic relationships with China and recognize Taiwan instead. The variable *Number of sister linkages* sums all sister relationships that administrative units in a country maintain to any Chinese province or lower administrative unit (Liu and Hu 2018). *Donations to China in Jan.-Feb.* of 2020 sum up all donations made by partner countries at the peak of the Chinese health crisis, capturing a reciprocity motive.

We measure economic ties by the average annual value of *Inward FDI* flows by partner countries in China from 2015 to 2017 (MOFCOM 2019), and by past trade flows in the form of medical exports (decomposed into commercial exports and donations) during the same months of the previous year (March and April 2019). We add two other proxies capturing demand factors to the cross-country analysis. We control for *Government effectiveness* as it may have also affected early demand for medical products by determining the extent to which governments could take early response measures in the face of a global health crisis (Kaufmann et al. 2011). *COVID-19 infection rates* control for the urgent need of medical equipment by measuring the spread of the pandemic in each importing country by the end of April 2020 (Wahltinez 2020). We recognize, however, that this variable is likely to suffer from substantial measurement error as testing and reporting practices vary greatly across countries (Bommer and Vollmer 2020, Stock 2020). Finally, we control for the typical variables that enter a gravity model

of trade, such as logged partner-country GDP and population size (Azevedo 2011, World Bank 2020), as well as geographic distance and contiguity (Mayer and Zignago 2011). Descriptive statistics are provided in Table D.9.

Table D.10 in this Online Appendix reports the cross-country regression results. Column 1 refers to all medical exports in March and April of 2020, whereas columns 2 and 3 split total exports into commercial exports and donations. Columns 4 to 6 repeat the same regressions for surgical masks only. Results show that political variables do not seem relevant for explaining where total or commercial medical exports go on aggregate. China appears to be exporting medical equipment to "friends" and "foes" alike. By contrast, political factors matter crucially for donations. Countries with no diplomatic linkages to China do not receive donations, resulting in extremely large coefficients in columns 3 and 6. Countries with sister linkages to Chinese administrative entities receive substantially more medical equipment donations in total and surgical masks in particular. Among the other political variables, neither prior donations nor ideal-point distance in UNGA voting are significantly linked to Chinese donations after the pandemic outbreak.

Results generally confirm that past economic ties matter for sourcing medical equipment in the face of the pandemic. Commercial exports seem to build only on past ties of medical (or surgical mask) exports. Donations follow a somewhat different logic (see column 3). Instead of following past commercial ties, they build on past donation trade links, which points towards a more sustained foreign aid relationship from China. This relationship is only significant when looking at all products jointly but not for surgical masks. Our alternative measure of economic linkages, past FDI flows to China, is not consistently related to medical exports at the cross-country level.

Turning to demand factors, we observe that more Chinese medical equipment exports go into countries with higher COVID-19 infection rates. Despite the substantial scope for measurement error in infection rates, the estimated coefficient is positive and statistically significant at the one-percent level for total, commercial, and total mask trade. It is remarkable that Chinese medical equipment donations do not appear to respond to the severity of the early pandemic outbreak. Political calculus appears to dominate here. Finally, trading partners' government effectiveness is not linked to overall Chinese medical exports, but more effective governments have been sourcing more masks over March and April 2020 from China.

In sum, we find that past trade ties are associated with larger commercial exports of critical medical goods during the pandemic's early months. Political ties appear to play a role for donations only.

# C Figure

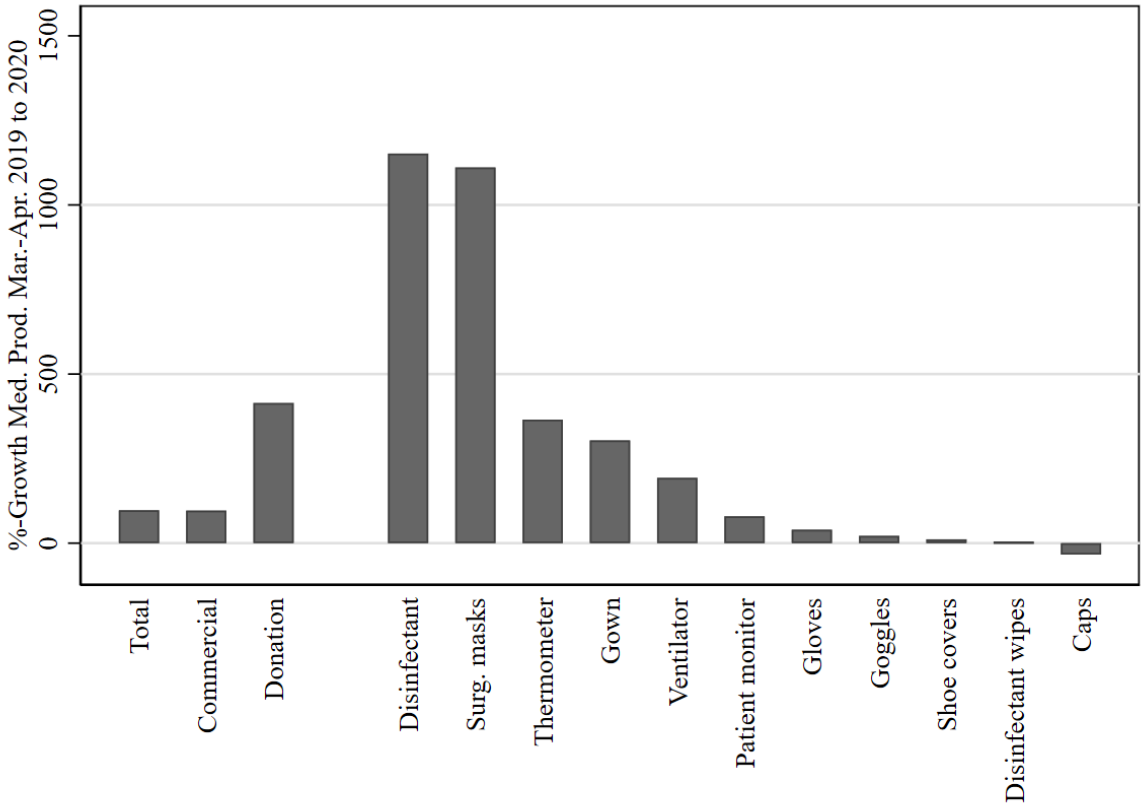



**Figure C.1** – Growth in medical equipment exports in March and April between 2019 and 2020

*Note:* The graph shows the growth rate for total, commercial, and donation exports of medical equipment (based on HS 6-digit classification), as well as for 11 medical products measured at the 8-digit level (HS8) that are deemed essential by the Chinese government for COVID-19 treatment and control. Data are taken from GACC (2020b). Rates refer to the percent increase between March and April 2020 and the reference months in 2019.

# D Tables

**Table D.1** – Top-15 export destinations of critical medical goods from China, March and April 2020

| Country | (1) Exports Mar-Apr 2020 | (2) Exports Mar-Apr 2019 | (3) Chinese donat. Mar-Apr 2020 | (4) Donat. to China Jan-Feb 2020 | (5) Sister Linkages | (6) Dipl. Rep. | (7) Death Rates End of Apr 2020 |
|---|---|---|---|---|---|---|---|
| 1. USA | 3,235 | 1,370 | 12 | 19 | 258 | 6 | 294 |
| 2. Germany | 1,353 | 206 | 3 | 10 | 91 | 5 | 131 |
| 3. Japan | 1,331 | 337 | 4 | 13 | 252 | 7 | 4 |
| 4. Italy | 623 | 74 | 14 | 3 | 67 | 4 | 1,064 |
| 5. France | 586 | 96 | 3 | 9 | 93 | 6 | 745 |
| 6. Spain | 444 | 65 | 1 | 2 | 25 | 3 | 1,148 |
| 7. UK | 437 | 185 | 4 | 4 | 56 | 5 | 675 |
| 8. Russia | 410 | 58 | 4 | 3 | 121 | 4 | 6 |
| 9. Netherlands | 356 | 141 | 0 | 3 | 26 | 4 | 553 |
| 10. South Korea | 332 | 137 | 9 | 16 | 169 | 9 | 13 |
| 11. Canada | 324 | 119 | 1 | 2 | 53 | 4 | 106 |
| 12. Australia | 319 | 103 | 0 | 2 | 97 | 5 | 7 |
| 13. Malaysia | 283 | 75 | 4 | 4 | 12 | 6 | 7 |
| 14. Singapore | 281 | 63 | 0 | 1 | 1 | 5 | 5 |
| 15. Belgium | 237 | 53 | 8 | 0 | 27 | 3 | 1,150 |

*Note:* All values in columns 1 to 4 are in millions of US dollar. Classification of medical goods is based on the HS-8 sector classification. Columns 5 and 6 list the number of countries' sister linkages with Chinese provinces and the number of countries' diplomatic representations in China. Death rates in column 7 refer to infected cases per 100,000 inhabitants at the end of April 2020.
*Sources*: Trade data from GACC (2020b), sister linkage information from Liu and Hu (2018), number of diplomatic representations from MFA (2020a) and MFA (2020b), and COVID-19 death rates from Wahltinez (2020).

**Table D.2** – Determinants of medical exports between province-country pairs (March and April 2020): Robustness check based on the HS 6-digit medical product list

| Exports by type (*asinh*): | (1) Total | (2) Comm. | (3) Donat. |
|---|---|---|---|
| Dipl. representation (=1) | 0.282 | 0.413* | 2.139*** |
| | (0.203) | (0.240) | (0.415) |
| No. of sister linkages | 0.031 | 0.029 | 0.323*** |
| | (0.042) | (0.041) | (0.044) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.024* | 0.033** | 0.064*** |
| | (0.014) | (0.015) | (0.019) |
| *asinh* Inward FDI | 0.083*** | 0.098*** | 0.092*** |
| | (0.019) | (0.020) | (0.021) |
| *asinh* Comm. med. exports 2019 | 0.408*** | 0.425*** | 0.012 |
| | (0.019) | (0.019) | (0.009) |
| *asinh* Donat. med. exports 2019 | 0.033 | 0.025 | 0.171** |
| | (0.047) | (0.045) | (0.067) |
| Observations | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.782 | 0.781 | 0.455 |

*Note:* Dependent variables measure the value of medical exports from each Chinese province to each partner country in March and April 2020, aggregated from the HS 6-digit medical product list. Columns distinguish between total medical exports, commercial medical exports, and donation medical exports, all transformed by *asinh*. All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.3** – Determinants of medical exports between province-country pairs (March and April 2020): Robustness check excluding Beijing

| Exports by type (*asinh*): | 11 medical products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 0.198 | 0.526** | 1.390*** | 0.549* | 0.840*** | 1.484*** |
| | (0.191) | (0.217) | (0.435) | (0.314) | (0.317) | (0.400) |
| No. of sister linkages | 0.031 | 0.029 | 0.333*** | 0.076 | 0.065 | 0.313*** |
| | (0.043) | (0.040) | (0.045) | (0.064) | (0.060) | (0.044) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.033** | 0.042** | 0.076*** | 0.073*** | 0.083*** | 0.069*** |
| | (0.016) | (0.017) | (0.018) | (0.023) | (0.022) | (0.018) |
| *asinh* Inward FDI | 0.096*** | 0.103*** | 0.101*** | 0.182*** | 0.181*** | 0.081*** |
| | (0.021) | (0.021) | (0.021) | (0.029) | (0.029) | (0.018) |
| *asinh* Comm. med. exports 2019 | 0.418*** | 0.435*** | 0.001 | 0.343*** | 0.369*** | 0.026** |
| | (0.022) | (0.022) | (0.010) | (0.024) | (0.025) | (0.012) |
| *asinh* Donat. med. exports 2019 | -0.033 | -0.054 | 0.375** | 0.321*** | 0.352*** | -0.077* |
| | (0.117) | (0.089) | (0.168) | (0.090) | (0.112) | (0.044) |
| Observations | 5,850 | 5,850 | 5,850 | 5,850 | 5,850 | 5,850 |
| $R^2$ | 0.769 | 0.770 | 0.385 | 0.705 | 0.704 | 0.378 |

*Note:* This table reports estimation results excluding exports from Beijing. Dependent variables measure the value of exports from each Chinese province to each partner country in March and April 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all transformed by *asinh*. All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.4** – Determinants of medical exports between province-country pairs (March 2020)

| Exports by type (*asinh*): | 11 medical products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 1.124*** | 1.431*** | 0.429 | 1.667*** | 1.869*** | 0.433 |
| | (0.230) | (0.239) | (0.300) | (0.276) | (0.271) | (0.281) |
| No. of sister linkages | 0.104** | 0.096*** | 0.167** | 0.168*** | 0.147*** | 0.140** |
| | (0.042) | (0.035) | (0.069) | (0.046) | (0.039) | (0.068) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.088*** | 0.098*** | 0.053*** | 0.130*** | 0.139*** | 0.038** |
| | (0.016) | (0.016) | (0.016) | (0.021) | (0.020) | (0.016) |
| *asinh* Inward FDI | 0.141*** | 0.144*** | 0.040*** | 0.144*** | 0.146*** | 0.025* |
| | (0.024) | (0.023) | (0.015) | (0.024) | (0.023) | (0.013) |
| *asinh* Comm. med. exports 2019 | 0.407*** | 0.414*** | 0.005 | 0.421*** | 0.429*** | 0.041*** |
| | (0.020) | (0.021) | (0.008) | (0.024) | (0.024) | (0.012) |
| *asinh* Donat. med. exports 2019 | 0.264*** | 0.173 | 0.247 | 0.507 | 0.591 | 0.508*** |
| | (0.092) | (0.164) | (0.153) | (0.452) | (0.468) | (0.168) |
| Observations | 6,045 | 6,045 | 6,045 | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.741 | 0.741 | 0.305 | 0.669 | 0.671 | 0.297 |

*Note:* Dependent variables measure the value of exports from each Chinese province to each partner country in March 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all transformed by *asinh*. All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.5** – Determinants of medical exports between province-country pairs (April 2020)

| Exports by type (*asinh*): | 11 medicak products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 0.532** | 0.647*** | 1.910*** | 1.141*** | 1.219*** | 1.989*** |
| | (0.224) | (0.224) | (0.391) | (0.307) | (0.289) | (0.362) |
| No. of sister linkages | 0.048 | 0.038 | 0.337*** | 0.100* | 0.083 | 0.319*** |
| | (0.038) | (0.036) | (0.042) | (0.059) | (0.055) | (0.042) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.048** | 0.058*** | 0.051*** | 0.094*** | 0.101*** | 0.049*** |
| | (0.019) | (0.019) | (0.019) | (0.021) | (0.021) | (0.018) |
| *asinh* Inward FDI | 0.120*** | 0.128*** | 0.072*** | 0.195*** | 0.196*** | 0.059*** |
| | (0.022) | (0.023) | (0.019) | (0.030) | (0.031) | (0.017) |
| *asinh* Comm. med. exports 2019 | 0.392*** | 0.410*** | 0.007 | 0.308*** | 0.331*** | 0.014 |
| | (0.022) | (0.022) | (0.010) | (0.024) | (0.025) | (0.013) |
| *asinh* Donat. med. exports 2019 | -0.038 | -0.161 | 0.297*** | 0.277*** | -0.103 | 0.145 |
| | (0.102) | (0.100) | (0.111) | (0.071) | (0.207) | (0.100) |
| Observations | 6,045 | 6,045 | 6,045 | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.752 | 0.751 | 0.394 | 0.699 | 0.695 | 0.377 |

*Note:* Dependent variables measure the value of exports from each Chinese province to each partner country in April 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all transformed by *asinh*. All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.6** – Determinants of medical exports between province-country pairs (March and April 2020): Robustness check using Poisson Pseudo-Maximum-Likelihood estimation

| Exports by type: | 11 medical products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 0.474*** | 0.460*** | 0.767** | 0.454*** | 0.448*** | 0.489 |
| | (0.102) | (0.101) | (0.365) | (0.127) | (0.128) | (0.442) |
| No. of sister linkages | 0.030*** | 0.029*** | 0.073** | 0.035*** | 0.034*** | 0.050** |
| | (0.007) | (0.007) | (0.033) | (0.010) | (0.011) | (0.025) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.019** | 0.020** | 0.031 | 0.024** | 0.024** | 0.035 |
| | (0.008) | (0.008) | (0.044) | (0.011) | (0.011) | (0.046) |
| *asinh* Inward FDI | 0.030** | 0.030** | 0.041 | 0.028* | 0.029* | -0.025 |
| | (0.013) | (0.012) | (0.069) | (0.016) | (0.016) | (0.063) |
| *asinh* Comm. med. exports 2019 | 0.276*** | 0.286*** | 0.046 | 0.084** | 0.083** | 0.071 |
| | (0.057) | (0.059) | (0.050) | (0.035) | (0.036) | (0.054) |
| *asinh* Donat. med. exports 2019 | 0.032 | 0.042 | -0.007 | 0.222*** | 0.228*** | 0.061 |
| | (0.081) | (0.088) | (0.039) | (0.022) | (0.021) | (0.085) |
| Observations | 5,952 | 5,952 | 5,115 | 5,921 | 5,797 | 4,890 |

*Note:* Dependent variables measure the value of exports from each Chinese province to each partner country in March and April 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all in levels. The regressions are estimated with the *ppmlhdfe* command in Stata 15.1 by Correia et al. (2020). All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.7** – Interactions between political and economic relations in dyadic medical exports (March–April 2020): Robustness check based on the HS 6-digit medical product list

| Measures of economic link (*asinh*): | Total med. exp. | Total mask exp. | Inward FDI |
|---|---|---|---|
| | (1) | (2) | (3) |
| *Link* | 0.420*** | 0.409*** | 0.229*** |
| | (0.019) | (0.025) | (0.027) |
| *Link* × Dipl. representation (=1) | -0.332*** | -0.260*** | -0.216*** |
| | (0.046) | (0.037) | (0.041) |
| *Link* × No. of sister linkages | -0.037*** | -0.042*** | -0.048*** |
| | (0.009) | (0.007) | (0.007) |
| *Link* × *asinh* Donat. to prov. in Jan.-Feb. | -0.007* | -0.007** | -0.020*** |
| | (0.004) | (0.003) | (0.003) |
| Dipl. representation (=1) | 5.206*** | 3.463*** | 2.434*** |
| | (0.709) | (0.517) | (0.415) |
| No. of sister linkages | 0.752*** | 0.754*** | 0.647*** |
| | (0.167) | (0.122) | (0.097) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.143** | 0.158*** | 0.150*** |
| | (0.058) | (0.036) | (0.021) |
| Observations | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.784 | 0.713 | 0.746 |

*Note:* Dependent variables measure the value of exports from each Chinese province to each partner country in March and April 2020, aggregated from the HS 6-digit medical product list and all transformed by *asinh*. Column titles refer to the interacted variables that are used to capture economic linkages. All regressions control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.8** – Determinants of quantities of Chinese medical exports between province-country pairs (March–April 2020)

| Export quantities by type (*asinh*): | 11 med. products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Dipl. representation (=1) | 0.917*** | 0.900*** | 0.310*** | 0.939*** | 0.932*** | 1.312*** |
| | (0.105) | (0.109) | (0.090) | (0.184) | (0.188) | (0.231) |
| No. sister linkages | 0.135*** | 0.125*** | 0.052*** | 0.103** | 0.094** | 0.199*** |
| | (0.018) | (0.015) | (0.012) | (0.042) | (0.040) | (0.026) |
| *asinh* Donat. to prov. in Jan.-Feb. | 0.076*** | 0.081*** | 0.009** | 0.073*** | 0.082*** | 0.045*** |
| | (0.007) | (0.007) | (0.004) | (0.015) | (0.015) | (0.011) |
| *asinh* Inward FDI | 0.100*** | 0.100*** | 0.014*** | 0.135*** | 0.135*** | 0.049*** |
| | (0.010) | (0.010) | (0.004) | (0.019) | (0.020) | (0.011) |
| *asinh* Export quantity 2019 | 0.451*** | 0.462*** | 0.124* | 0.339*** | 0.361*** | 0.084 |
| | (0.014) | (0.014) | (0.065) | (0.020) | (0.021) | (0.068) |
| Observations | 66,495 | 66,495 | 66,495 | 6,045 | 6,045 | 6,045 |
| $R^2$ | 0.696 | 0.695 | 0.349 | 0.747 | 0.744 | 0.448 |

*Note:* This table reports estimation results of determinants of quantities of Chinese medical exports based on a sample at the product-province-country level. Dependent variables measure each medical product's quantity exported from each Chinese province to each partner country in March and April 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all transformed by *asinh*. Columns 1 to 3 control for province-product and country-product fixed effects, and columns 4 to 6 control for province and country fixed effects. Standard errors clustered at the country level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table D.9** – Descriptive statistics of key variables at the country level

| | (1) Mean | (2) S.D. | (3) Min. | (4) Max. |
|---|---|---|---|---|
| *asinh* Total med. exports 2020 | 16.154 | 2.953 | 0.000 | 22.590 |
| *asinh* Comm. med. exports 2020 | 15.986 | 3.129 | 0.000 | 22.587 |
| *asinh* Donat. med. exports 2020 | 11.173 | 4.735 | 0.000 | 17.239 |
| *asinh* Total exports of surgical masks 2020 | 15.132 | 3.390 | 0.000 | 22.086 |
| *asinh* Comm. exports of surgical masks 2020 | 14.762 | 4.091 | 0.000 | 22.082 |
| *asinh* Donat. exports of surgical masks 2020 | 10.185 | 4.644 | 0.000 | 16.460 |
| Ideal point distance | 0.656 | 0.599 | 0.043 | 3.121 |
| Dipl. representation (=1) | 0.893 | 0.310 | 0.000 | 1.000 |
| No. of sister linkages | 12.316 | 33.091 | 0.000 | 258.000 |
| *asinh* Donat. to China in Jan.-Feb. | 7.531 | 6.442 | 0.000 | 17.477 |
| *asinh* Inward FDI | 7.822 | 4.080 | 0.000 | 15.669 |
| *asinh* Comm. med. exports 2019 | 14.714 | 3.213 | 0.000 | 21.731 |
| *asinh* Donat. med. exports 2019 | 1.031 | 2.861 | 0.000 | 12.971 |
| *asinh* Comm. exports of surgical masks 2019 | 11.784 | 4.262 | 0.000 | 20.193 |
| *asinh* Donat. exports of surgical masks 2019 | 0.270 | 1.539 | 0.000 | 11.832 |
| Government effectiveness | -0.072 | 0.967 | -2.246 | 2.216 |
| *asinh* COVID-19 infection rate | 1.764 | 1.647 | 0.000 | 6.207 |
| Contiguity (=1) | 0.070 | 0.255 | 0.000 | 1.000 |
| *asinh* Distance | 9.702 | 0.495 | 7.556 | 10.561 |
| *asinh* GDP | 25.007 | 2.355 | 18.260 | 31.347 |

*Note:* The number of observations is 187.

**Table D.10** – Cross-country correlates of Chinese medical exports (March–April 2020)

| Exports by type (*asinh*): | 11 medical products | | | Surgical masks | | |
|---|---|---|---|---|---|---|
| | (1) Total | (2) Comm. | (3) Donat. | (4) Total | (5) Comm. | (6) Donat. |
| Ideal point distance | 0.038 | 0.069 | -0.503 | -0.066 | 0.171 | -0.368 |
| | (0.103) | (0.109) | (0.594) | (0.217) | (0.270) | (0.598) |
| Dipl. representation (=1) | 0.254 | -0.033 | 8.093*** | 0.734 | 1.296 | 7.465*** |
| | (0.373) | (0.353) | (1.255) | (0.458) | (0.929) | (1.042) |
| No. of sister linkages | -0.002 | -0.005* | 0.023*** | -0.001 | -0.007* | 0.021*** |
| | (0.002) | (0.002) | (0.007) | (0.003) | (0.004) | (0.007) |
| *asinh* Donat. to China in Jan.-Feb. | 0.017 | 0.015 | 0.087 | 0.056* | 0.051 | 0.103 |
| | (0.020) | (0.020) | (0.073) | (0.029) | (0.032) | (0.070) |
| *asinh* Inward FDI | 0.016 | 0.034 | 0.039 | -0.015 | -0.056 | 0.033 |
| | (0.021) | (0.024) | (0.130) | (0.036) | (0.078) | (0.118) |
| *asinh* Comm. med. exports 2019 | 0.321*** | 0.374*** | 0.025 | 0.170*** | 0.254*** | -0.101 |
| | (0.070) | (0.084) | (0.186) | (0.058) | (0.083) | (0.109) |
| *asinh* Donat. med. exports 2019 | 0.022 | 0.024 | 0.169** | -0.005 | 0.010 | 0.044 |
| | (0.019) | (0.020) | (0.068) | (0.032) | (0.064) | (0.094) |
| Government effectiveness | 0.057 | 0.040 | 0.724 | 0.311* | 0.413* | 0.757 |
| | (0.099) | (0.098) | (0.476) | (0.167) | (0.243) | (0.473) |
| *asinh* COVID-19 infection rates | 0.230*** | 0.259*** | 0.001 | 0.271*** | 0.193 | -0.010 |
| | (0.056) | (0.061) | (0.291) | (0.090) | (0.150) | (0.280) |
| Observations | 187 | 187 | 187 | 187 | 187 | 187 |
| $R^2$ | 0.887 | 0.900 | 0.457 | 0.836 | 0.786 | 0.444 |

*Note:* Dependent variables measure the value of exports from China to each partner country in March and April 2020. Columns distinguish between total medical exports, commercial medical exports, donation medical exports, total exports of surgical masks, commercial exports of surgical masks, and donation exports of surgical masks, all transformed by *asinh*. Identification of medical products is based on HS 8-digit product classifications. All regressions control for a set of gravity determinants (contiguity, log of distance, and log GDP). Robust standard errors are in parentheses. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.