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CAN GLOBAL TRADE OF MEDICAL SUPPLIES SOLVE THE COVID-19 PUZZLE?

SABER ADLY SHAKER•

ABSTRACT

The main aim of this study to determine the explanatory variables of the Chinese exports of COVID-19 medical supplies to its 89 major trading partners in the first half of the year 2020. In addition, it explores the puzzle of COVID-19 pandemic outbreak from an economic perspective. We used the Ordinary-least-square (OLS) regression under a cross-sectional data framework to construct the quantitative analysis.

The main findings are: First, the number of old population and the number of COVID-19 confirmed cases in the trading partner have been drivers of Chinese exports of COVID-19 medical supplies. Second, tariff barriers levied on the trading partner significantly impedes the Chinese exports of COVID-19 medical supplies to its trade partners, especially from middle-income countries.

In future work, the analysis of this type of trade through the supply-side factors could be investigated. Also, some other variables such as non-tariff measures could be utilized. The study encourages literature for empirically analyzing the trade of medical supplies, in general, under econometric modeling. The results are illustrated based on consistent quantitative evidence.

JEL Codes: F140, F190, I150, O190, F400, F490.

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I. INTRODUCTION

On March 11, 2020, the World Health Organization (WHO), categorized the COVID-19 outbreak as a global pandemic. Since the number of confirmed cases increased to more than 118 thousand, and about 4,291 deaths. Also, COVID-19 was spread in more than 114 countries and regions around the world. By the end of June 2020, **WHO, (2020)** announced the number of confirmed cases worldwide has become more than 10 million and about 500 thousand deaths and has spread to 216 countries and regions in the world. In addition, USA is ranked to be number one at total confirmed cases with more than 2.5 million and also for death number with more than 126 thousand.

Furthermore**, Kose, Sugawara, & Terrones (2020)** clarified that the world economy faced four major global recessions since 1950 specifically in 1975, 1982, 1991, and 2009. These four global recessions are determined based on the following variables: the sharp decline in annual real global per capita GDP, world industrial production trends, world trade changes, the world investment flows, world oil consumption levels, and world employment directions. Likewise, the **World Bank (2020)** stated that COVID-19 is the greatest recession in history since 1871 with an annual contraction in per capita GDP by 92.9%, in comparison to the previously mentioned recessions in 1975, 1982, 1991, and 2009 which are equal to 39.4%, 44.6%, 46.8%, and 61.2% respectively. Also, the great depression era lasting from 1929 to 1939 was ranked as the maximum annual contraction in per capita GDP- mainly in the year 1931- by 83.8%, recently is ranked as number two in the history since 1871, while COVID-19 is ranked as number one.

Clearly, the main question appears now, how the COVID-19 outbreak pandemic affect the world economy? both **Carlsson-Szlezak, Reeves , & Swartz (2020)** and **Maliszewska, Mattoo, & van der Mensbrugghe (2020)**

answered this question by the following interconnected windows:

- The first is the structure of the household spending, where there was a contraction of consumption from unnecessary products due to the social distancing measures. **Baker, Farrokhnia, Meyer, Pagel, & Yannelis (2020)** analyzed this window in USA and found that after March 10, 2020, there is a sharp fall in household spending by approximately 50%, with raise levels of spending on grocery products followed by a sharp drop. This result is consistent with another survey that found a 35% fall in total household spending at the same period.
- The second one is the financial market window, which links between the financial market shocks and the real economy. **Albulescu (2020)** examined the impact of COVID-19 on the financial volatility based on S&P 500 index as a proxy for the US financial markets' volatility; and he found that the new confirmed cases reported at global level and in the US expand the financial volatility, in addition, the fatality rate has a positive and significant impact on the financial market volatility.
- The third is the production window where COVID-19 keeps some factories locked down, it inversely impacted both employment and supply chains. For employment, **Bell & Blanchflower (2020)** estimated the US unemployment rate in April 2020 by about 20%. On the other hand, for supply chains, **Gereffi (2020)** indicated that there is an imbalance between the governmental official strategy and the strategies of major multinational suppliers of face masks in USA, which resulted in a negative impact on health outcomes. Also, the U.S. shortage in some COVID-19 medical supplies such as N95 respirators is due to this imbalance.

- The fourth is the window of global trade and foreign direct investment (FDI). For the global trade, **Maliszewska, Mattoo, & van der Mensbrugghe (2020)** argued that COVID19 outbreak pandemic raises the international trade costs by 25% due to higher international transportation costs, additional inspections measures, foreign trade restrictions, etc. which has a negative impact in the global trade volume. For instance, according to International trade center data[1], the US total trade shrank from USD 2 trillion in the first half of the year 2019 to USD 1.79 trillion in the first half of the year 2020. For FDI, according to **World Investment Report (2020)**, the forecasting of FDI volume in 2020 will be lower than USD 1 trillion for the first time since the year 2005. In addition, FDI will fall around 40% in 2020 compared with 2019.

Healthcare products, in general, are widely extended in several Chapters of the Harmonized System (HS) classification. Indeed, both The World Customs Organization (WCO) and the World Health Organization (WHO) classified the Covid-19 medical supplies into eight groups with fifty-three products. This classification is based on the HS 2017. These groups are the following[2]:

i. COVID-19 Test kits/ Instruments and apparatus used in Diagnostic Testing, e.g., COVID-19 Test kits.
ii. Protective garments and the like, e.g., Gloves.
iii. Disinfectants and sterilization products for example Alcohol solution etc.
iv. Oxygen Therapy equipment and pulse oximeters, e.g., Medical ventilators (artificial respiration apparatus).
v. Other medical devices and equipment, e.g., Stethoscopes.

[1] https://www.trademap.org/Index.aspx
[2] http://www.wcoomd.org/en/media/newsroom/2020/april/joint-wco-who-hs-classification-list-for-covid_19-medical-supplies-issued.aspx

vi. Other Medical Consumables, e.g., Soap.
vii. Vehicles, e.g., Ambulances.
viii. Other products, e.g., Medical or surgical furniture.

This paper relates to two types of literature. The first is research on the COVID-19 puzzle. However, both theoretical and practical works on this puzzle have discussed only from purely medical view e.g., **Konieczny & Roterman (2020)** and **Ikizler (2020)**. However, some of this literature might be useful form an economic perspective, for instance, **Rochon, Wei, Vasily & Nathan (2020)** mentioned that mortality rates had higher in case of older people. Therefore, this finding was employed in our constructed econometric model.

Second, there is a rare literature focused on the global trade of medical supplies. Namely, **Vickers & Salamat (2020)** mapped the medical supply chains and analyzed the top exporters and importers of key medical products and assessed the potential impact of recent trade measures in less developed countries (LDCs), and found that both global support and collaboration have a significant role to boost the healthcare systems in LDCs.

As well as, **Evenett (2020)** investigated the recent trade policy stance towards the imported products used by healthcare sector to deal with COVID-19, and found that as of the end of March 2020, a total of 54 countries have applied some type of export restraints on COVID-19 medical supplies and medicines. As a result, the prices raised, and deficit created by export curbs which leads to a limit or deny consumers access to COVID-19 medical supplies and medicines.

Likewise, **Mikic, T, & James (2020)** examined the trade impacts of COVID-19 as one of the foreign shocks on the healthcare sector. They found that before COVID-19 time, there was a rise in the tariff rates levied on several pharmaceutical ingredients due to the trade war between China and the USA. Moreover, the temporary economies lockdown as a response to COVID-19 led to instant short-term confusion in the production and trade of key medical products. Also, they

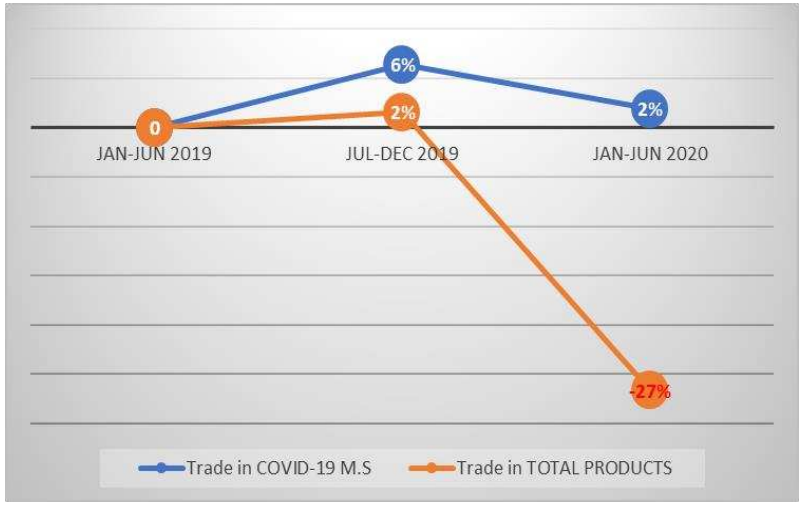
indicated to the deleterious effects of trade barriers on healthcare products. institutionally, **WTO (2020)** mentioned that tariff rates levied on some medical products remain very high. e.g., although, the applied tariff rate for hand soap is 17% some countries levy tariffs as high as 65%. Also, **OECD (2020)** claimed that there is an incomplete specialization in both production and exports of COVID-19 medical supplies. Therefore, no single producer supplies efficiently all the required medical products to meet COVID-19.

Finally, the research question can be formulated as "how global trade of medical supplies can solve the COVID-19 puzzle?", To investigate this question, firstly, we analyze the pattern for this type of trade, specifically in the first half of the year 2020 (section II). Secondly, we construct an econometric model to determine the explanatory variables for the Chinese exports of COVID-19 medical supplies (section III). Finally, we summarize the main findings that can help researchers to find the missing piece of the COVID-19 puzzle from the economic perspective (section IV).

II. PATTERN OF TRADE IN COVID-19 MEDICAL SUPPLIES

According to the International trade center (ITC), exports of COVID-19 medical supplies constitute a relatively small proportion of total products exports, and this ratio has stable between 3% to 4% during the period from 2001 to 2019. In contrast, trade of COVID-19 medical supplies grown a 6% share of total trade in the first half of 2020.

Figure (1) plot the trade relative growth rates (TRGR), which show two different times of growth. First, prior to COVID-19 pandemic, the two rates of growth moved in the same direction with different values. Second, in the period of COVID-19, the two rates of growth moved in the opposite direction with a wide gap.



TRGR was calculated by the following formula (value in time B – value in time A)/ value in time A.

FIGURE (1)
Trade relative growth rates (TRGR)

Globally, table (1) displays the ten leading exporters of COVID-19 medical supplies. Hence, it is possible to indicate that the monopoly degree has increased in the global market of COVID-19 medical supplies. This finding noted due to two reasons. First, there is a rise in the concentration ratio for the world export of COVID-19 medical supplies, Where, the top 10 exporters account for around 72% of the world exports in the year 2019. This ratio expands to 79% of the world exports in the first half of the year 2020. Second, in a comparison between the year 2019 and the COVID-19 time, it's clear that there is no change in the countries list but only changes in the rank.

Obviously, China has gained from the COVID-19 outbreak pandemic by doubled its share by more than twice from the global exports of COVID-19 medical supplies. Currently, China replaced Germany's position as the top exporter of COVID-19 medical supplies compared with the fifth rank of China in the year 2019.

TABLE (1)
TOP TEN EXPORTERS OF COVID-19 MEDICAL SUPPLIES

US$ thousands

The year 2019			The 1st half of the year 2020		
Exporter	Value	*Share %	Exporter	Value	*Share %
Germany	108464175	14	China	61967962	16
USA	90551085	12	Germany	55410875	14
Switzerland	77985202	10	USA	44189908	11
Netherlands	54667095	7	Switzerland	42440524	11
China	54237673	7	Netherlands	24134193	6
Belgium	44008858	6	Ireland	23321686	6
Ireland	42528652	5	Belgium	21272396	5
Italy	34052804	4	France	15634960	4
France	30704469	4	Italy	14464409	4
UK	27296188	3	UK	13613021	3
Total*	564496201	72	Total*	316449934	79
The world	786481124		The world	398492883	

*calculated by the author

Source: ITC calculations based on UN COMTRADE and ITC statistics

On the other hand, table (2) summarizes the list of ten leading importers of COVID-19 medical supplies. Generally, in the year 2019, the whole list dominated about 61% of global imports against 70% in the COVID-19 time. As the leading exporter list, there is no change in the leading importer list but only changes in the rank. In fact, the United States kept its rank as the first importer of COVID-19 medical supplies and increased its global share from 19% to 24% in 2019 and the COVID-19 period respectively. For China, the value of its imports decreased more than twice in the COVID-19 time compared with before the COVID-19 time.

TABLE (2)
TOP TEN IMPORTERS OF COVID-19 MEDICAL SUPPLIES

US$ thousands

The year 2019			The 1st half of the year 2020		
Importer	Value	*Share %	Importer	Value	*Share %
USA	153235555	19	USA	91508185	24
Germany	68029800	8	Germany	40873103	6
China	44271037	5	Japan	22489460	5
Netherlands	39164468	5	France	20426111	4
Belgium	38310286	5	Belgium	18360407	4
Japan	37031649	5	Switzerland	16700303	2
France	31008062	4	Netherlands	16600297	2
UK	28631023	4	UK	15872864	1
Italy	27567010	3	China	15633149	1
Switzerland	25381906	3	Italy	12659248	1
Total*	492630796	61	Total*	271123127	70

The world	805353306	The world	387933802

*calculated by the author
Source: ITC calculations based on UN COMTRADE and ITC statistics

At the product level with the latest available data, the global trade of COVID 19 medical supplies is highly concentrated: only two products namely Hydrogen peroxide presented as a medicament and COVID-19 Test kits account together for half of the world exports while the top five products account for 72% as the table (3) shows.

TABLE 3
TOP FIVE TRADED PRODUCTS OF COVID-19 MEDICAL SUPPLIES IN THE YEAR 2019

US$ thousands

Product	Value	Share %*	leading exporter	leading importer
Hydrogen peroxide presented as a medicament	297514738	38	Germany	USA
COVID-19 Test kits	114029575	14	Switzerland	USA
Plastic face shields (covering more than the eye area)	64691603	8	China	USA
Extracorporeal membrane oxygenation (ECMO)	58473386	7	USA	USA
Needles (except for tubular metal needles and needles for sutures), catheters, cannulae and the like	33301007	4	USA	USA
Total*	568010309	72		

*calculated by the author
Source: ITC calculations based on UN COMTRADE and ITC statistics

According to ITC data, there are some analytical notes can help to understand the trade gains of China due to COVID-19 as follow:

a. The surplus of Chinees trade balance of COVID-19 medical supplies grew by more than nine times in the second quarter of 2020 in a comparison with prior to the year 2020.
b. Both April and July in the year 2020 recorded the highest monthly surplus of the Chinees trade balance value.
c. Over two past decades, the Chinees trade balance of services recorded the lowest shortage level in the first quarter of the year 2020.

Clearly, both previous analysis and interpretation agree with the clarification of **Torrey (2018)**, **Eriksen (2020)**, and **Di Tommaso (2020)** through three justifications. First, the priority degree of the healthcare sector and related industries under the plan of "Made in China 2025", and how to adjust the structure of the global healthcare market as a Chinese goal. As mentioned before, we can claim that this goal has started to achieve by raising the China export share of COVID-19 medical supplies from 7% to 16% in the year 2019 and in the first half of 2020, respectively. Second, the position of China as the leading supplier of inputs using in the production of medicines. Numerically, more than 80% of the medicines' ingredients worldwide are made in China. This finding explains the short time for China to develop vaccines for protection against COVID-19, under a large global competition between the leading economies.

Third, the story of the Chinese new growth model that depends on innovation, and its impact on the healthcare industries. Here, it's possible to talk about a new concept of innovation which is disruptive innovation. this concept was discussed by **Wan, Williamson, & Yin (2015)** who highlighted that China is the Key supplier of disruptive innovation. Hence, we claim that the COVID-19 may be classified as a form of disruptive innovation to achieve the Chines economic goals in both the medium and long run.

III. THE ECONOMETRIC MODEL

One of the core issues of the COVID-19 pandemic is the global trade of medical supplies. Until the year 2019, the leading framework for understanding the explanatory variables of this type of trade is the supply-side theories. For example, Heckscher–Ohlin - Samuelson theorem which depend on both the cost and factor endowment with neglecting the demand side variables. Recently, the demand side emerging to select adequate explanatory variables of global trade in COVID-19 medical supplies. the last is our started point in the following econometric model.

A. MODEL SPECIFICATION

In this context, we will determine the relationship between Chines exports of COVID-19 medical supplies (CHEX) as a dependent variable and the following independent variables in the imported partner of China for this type of exports:

1. The number of population 65 years and more (OPOP),
2. The stock of COVID-19 confirmed cases (CASE),
3. The average applied imported tariff rate for these products (TARF).

All the variables – except TARF- are changed into logarithms. As result, the model occurred in linear functional form as follows:

$$\textbf{Log (CHEX)} = \alpha_0 + \alpha_1 \textbf{Log (OPOP)} + \alpha_2 \textbf{Log (CASE)} + \alpha_3 \textbf{TARF}$$

B. METHOD, PERIOD AND DATA

To estimate the above model in China, we will employ cross-sectional data and ordinary least square (OLS) method. Therefore, our appropriate point of time was the first half of the year 2020. In addition, our sample consists of 89 importing partners for Chines COVID-19 medical supplies. This sample categorized into two groups based on the World Bank classification of countries[3]. So, the first group is high-income partners and involves 44 members. And the second group is middle-income partners and involves 45 members. Finally, the full illustration of variables stated in Table (4).

TABLE 4
DESCRIPTION OF VARIABLES

Variable	Description	Source
CHEX	Value of Chinese exports of COVID-19 medical supplies to the partner (Thousands of USD)	ITC, Trade maps
OPOP	The number of population 65 years and more	The World Bank
CASE	The stock of COVID-19 confirmed cases	WHO
TARF	The average applied imported tariff rate for COVID-19 medical supplies	WTO

[3] The list of countries available in the appendix

C. ESTIMATION AND INTERPRETATION

Table (5) presents the results of estimated models of Chines exports of COVID-19 medical supplies and its partners, where model number one related to the full sample, while model number two related to the high-income partners. Finally, model number three related to Middle-income partners. The estimated models can be interpreted as follow:

a. There is a significant positive relationship between the number of old population 65 years and more from one side, and the chines exports of covid-19 medical supplies from the other side. In detailed words, based on the estimated coefficients, a one percent increase in the number of old population 65 years and more worldwide, this will yield a range from 0.44 percent to 0.60 percent increase in the Chines exports of covid-19 medical supplies.
b. Similarly, there is a significant positive relationship between the number of COVID-19 confirmed cases from one side, and the chines exports of COVID-19 medical supplies from the other side. In detailed words, based on the estimated coefficients, a one percent increase in the COVID-19 confirmed cases worldwide, will yield a range from 0.12 percent to 0.38 percent increase in the Chines exports of COVID-19 medical supplies. In the nonlinear estimated models, an increase in a new confirmed case of COVID-19 by one individual worldwide leads to an increase in the Chinese exports of COVID-19 medical supplies by 5702 USD and 825 USD in the case of high-income and middle-income countries respectively.
c. On the contrary, For the tariff barriers, in case of full sample, a one percent increase in the applied tariff rate on the world imports of covid-19 medical supplies will lead to an 0.18 percent cut of the Chines exports of covid-19 medical supplies. On the contrary, this relationship misses its significance completely in the case of high-income partners.

d. Based on the values of both R^2 and Adj.R^2, the independent variables explain a range from 66% to 80% of the Chinese exports of COVID-19 medical supplies.
e. The value of Durbin – Watson stat around two which means no serial correlation.

TABLE 5
ESTIMATED MODELS

Independent variables	1	2	3
C	3.39	2.74	1.87
	(4.09)	(3.07)	(1.59)
Log (OPOP)	0.44	0.45	0.60
	(6.7)	(6.46)	(6.16)
Log (CASE)	0.30	0.38	0.12
	(6.27)	(5.82)	(2.25)
TARF	- 0.18	- 0.08	- 0.05
	(-5.68)	(-0.9)	(-1.73)
R^2	0.67	0.80	0.69
Adj. R^2	0.66	0.78	0.67
Durbin – Watson stat	2.01	1.73	2
Number of observations	89	44	45

Note: ( ) denotes value of t statistic.

D. DIAGNOSTICS TESTS

Actually, **Baltagi (2005)** clarified that cross-sectional studies are plagued with two popular econometric problems. First, Heteroskedasticity where the sample units may be of widely different sizes which may lead to appear different variation. Second, Multicollinearity when there is a significant relationship between independent variables. According to the prior problems, Table (6) shows the appropriate conducted diagnostic tests. For the Heteroskedasticity problem, we applied the Breusch-Pagan-Godfrey test and the result is we accept the null hypothesis because the Probability Chi-Square is greater than 5 percent which means the homogeneity of variance or and the same scatter of data.

As well as, for the multicollinearity problem, **Gujarati (2003)** suggested a benchmark that if the value of centered variance inflation factor above ten this leads to multicollinearity. Clearly, the estimated Centered Variance Inflation Factors (VIF) for the three models meet this condition.

TABLE 6
ESTIMATED MODELS

Diagnostic tests		1	2	3
Breusch-Pagan-Godfrey test	Prob. F(3,40)	0.738	0.543	0.360
	Prob. Chi-Square(3)	0.728	0.519	0.340
Variance Inflation Factors Centered VIF	Log (OPOP)	1.37	1.41	1.70
	Log (CASE)	1.32	1.45	1.60
	TARF	1.04	1.15	1.12

IV. CONCLUSION

The global trade of medical supplies, in general, could be used as an answer for the puzzle of the COVID-19 pandemic outbreak. Although China is the country of origin for the COVID-19 virus it was the major winner compared with the rest of the world, this is the puzzle where our study tried to solve it form the economic perspective.

We constructed an econometric model of COVID-19 for China and 89 major trade partners. We used new appropriate variables to investigate the relationship of Chines exports of COVID-19 medical supplies to the old population, the number of COVID-19 confirmed cases and tariff barriers.

Our findings are consistent with models that investigated the significant role of export demand in the importing partner. The results suggested that the export opportunities of COVID-19 medical supplies more profitable in the case of high-income importing countries compared with middle-income importing countries. For instance, an increase in a new confirmed case of COVID-19 by one individual worldwide leads to an increase in the Chinese exports of COVID-19 medical supplies by 5702 USD and 825 USD in the case of high-income and middle-income countries respectively.

Further understanding of the global trade, in general, and medical supplies especially will be important to understand the Chinese role in the modern economic order in the middle-run under the plan of “Made in China 2025” and in the long-run through the initiative of One Belt and One Road.

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