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Abstract

In this study, we analyze the impact of the Covid-19 pandemic on bilateral trade using monthly data from January to June 2020. Imports of the OECD member states are analyzed using a structural gravity model of trade estimated with the Poisson pseudo maximum likelihood estimator. The analysis is conducted for total imports and for fruit and vegetables. Our findings show a significantly negative impact of the pandemic on both import measures, which is more pronounced for the perishable goods than for aggregate imports.

JEL Classification: F10, F13, F14
Keywords: Covid-19; Bilateral Trade; Structural Gravity; PPML; OECD

1 Introduction

One year after the outbreak of the pandemic, the cumulative number of Covid-19 cases worldwide reached 83 million, with a death toll of 1.8 million attributed to the corona virus (World Health Organisation, 2020). To help prevent transmission, countries across the globe have adopted various containment measures, including lockdowns, travel restrictions and border closures. These unprecedented measures collapsed international transport and trade activities worldwide, making future developments very uncertain (UNCTAD, 2020). The literature documents similar adverse impacts on trade as a result of the Severe Acute Respiratory Syndrome outbreak (Keogh-Brown & Smith, 2008), Ebola outbreaks (Abban, 2020) and the swine flu (Rassy & Smith, 2013).

The Covid-19 pandamic has a negative impact on both the supply and demand sides of the economy. The supply shock emanates from the under-utilization of the production capacity – factory closures, workers staying home, reduction in labor supply, travel bans, border closings – that reduces exports particularly in severely hit sectors in the most impacted nations (Baldwin, 2020; Baldwin & Weder di Mauro, 2020; Maliszewska, Mattoo, & Van Der Mensbrugghe, 2020). The pandemic has hindered business activity and restricted the movement of goods and services, thus, adversely affecting global trade and the global supply chain (Baldwin & Tomiura, 2020).

The distortions in the supply chain caused by the pandemic are particularly important for perishable goods. The requirement of additional certificates to cross borders translates into delays that are more detrimental for perishable goods than non-perishables. Moreover, social distancing, creates difficulties for export and import inspections that can exacerbate the delays along the supply chain (UNCTAD, 2020). Together with the risks and uncertainties related to the sale of perishable products, with low storage capacity and major production losses, all this makes perishable goods more vulnerable (Junior et al., n.d.).

Similarly, the Covid-19 pandemic has eroded aggregate demand mainly due to the reduced purchasing power. As industries are inter-connected, the reopening of a fully or partially closed business depends on the reopening of the related businesses, including retailers, distributors and suppliers (Balla-Elliott, Cullen, Glaeser, Luca, & Stanton, 2020). McKibbin and Fernando (2020) point not only to a fall in aggregate demand but also to distorted consumption patterns, resulting in market anomalies generated by situations of panic among consumers and producers.

A burgeoning literature has developed on the economic impact of the Covid-19 pandemic (Abiad, Arao, & Dagli, 2020; Baldwin & Weder di Mauro, 2020; Brodeur, Gray, Islam, & Bhuiyan, 2020; Chetty, Friedman, Hendren, Stepner, et al., 2020). However, despite the importance of the associated trade effects, the research on this specific issue is still limited. Covid-19 caused a huge dip in global trade, mainly through the resulting supply and demand shocks (Gruszczynski, 2020). Since external and unexpected shocks are expected to affect imports and exports in a similar way, the overall effect on net exports is unclear (del Rio-Chanona, Mealy, Pichler, Lafond, & Farmer, 2020). To the best of our knowledge, there

are no comprehensive studies that seek to explain the bilateral trade impact of Covid-19 using a gravity framework. This paper contributes to fill in the gap in the Covid–trade literature by assessing the impact of Covid-19 on bilateral trade, particularly for perishable goods i.e. fruit and vegetables.

2 Methodology

2.1 Econometric estimation approach

For the empirical estimation, we applied the gravity model of trade using the Poisson pseudo maximum likelihood (PPML) estimator as it is suitable in the case of zero trade and heteroscedasticity, as pointed out by Silva and Tenreyro (2006) and Silva and Tenreyro (2011). The traditional approach to estimate gravity models uses gross domestic product, bilateral distance and several of the so-called gravity variables – shared borders, common language, colonial relationship – to explain bilateral trade flows. Moreover, bilateral trade is expected to be higher if the countries are members of an economic integration agreement (EIA) such as a customs union or a free trade agreement. Going further, the structural gravity approach includes proxies for multilateral resistance (exporter-time, importer-time), and country-pair fixed effects (FE), to identify the effect of variables that vary by origin, destination and time, such as EIAs (e.g. Anderson & Yotov, 2020; Freeman & Pienknagura, 2019; Oberhofer & Pfaffermayr, 2018).

The current study estimates the impact of Covid-19 on bilateral trade using monthly imports of the OECD countries for the period from January 2020 to June 2020. The variable Covid_{it} (Covid_{jt}) measures the number of confirmed deaths per million inhabitants per month due to the virus in the exporting (importing) country. In order to keep the zero values of this variable after logarithmic transformation, we add 1 to the number of monthly deaths. An additional variable is included, DNoCovid_{ijt}, which takes a value of one if there were no deaths in a given month, and zero otherwise. This approach yields an unbiased estimation for the full sample, according to Battese (1997). Note that DNoCovid_{ijt} is a country-pair specific time variant variable. Thus, we expect $\delta_1 < 0$, $\delta_2 < 0$ and $\delta_3 > 0$ for Eq. 1.

$$\begin{aligned}\text{Imports}_{ijt} = \exp\big(&\alpha_i + \beta_j + \gamma_t + \delta_0 + \delta_1 \ln \text{Covid}_{it} + \delta_1 \ln \text{Covid}_{jt} + \delta_3 \text{DNoCovid}_{ijt} \\ &+ \delta_3 \ln \text{Distance}_{ij} + \delta_4 \text{Contiguity}_{ij} + \delta_5 \text{Colony}_{ij} + \delta_6 \text{EIA}_{ij}\big) + \epsilon_{ijt} \end{aligned} \tag{1}$$

In Eq. 1 the trade effect of Covid-19 is estimated separately for the exporting and importing countries. In this first specification we do not include exporter-time and importer-time FE as they would absorb the variable of interest. In the next specification, we re-formulate the target variable as $\text{Covid}_{ijt} = \text{Covid}_{it} \times \text{Covid}_{it}$ to capture the impact of Covid-19 on bilateral imports. Covid_{ijt} is country-pair specific and time variant and this allows for the inclusion of exporter-time, importer-time and country-pair FE, and hence offers a more

rigorous statistical estimation. Eq. 2 is given by,

$$\text{Imports}_{ijt} = \exp\big(\alpha_{it} + \beta_{jt} + \gamma_{ij} + \delta_0 + \delta_1 \ln \text{Covid}_{ijt}\big) + \epsilon_{ijt} \tag{2}$$

Finally, we analyze the trade impact of Covid-19 by grouping the countries according to the income levels of the exporting countries. Based on the World Bank's classification, we formulated two dummy variables: HighIncome_i takes a value of one when the exporter is a high income or upper-middle income country, and zero otherwise; LowIncome_i denotes lower-middle income and low income exporting countries. Eq. 3 is given by,

$$\begin{aligned}\text{Imports}_{ijt} = \exp\big(&\alpha_{it} + \beta_{jt} + \gamma_{ij} + \delta_0 + \delta_1 \ln \text{Covid}_{ijt} \times \text{Highincome}_i \\ &+ \delta_2 \ln \text{Covid}_{ijt} \times \text{Lowincome}_i\big) + \epsilon_{ijt}\end{aligned} \tag{3}$$

2.2 Data Sources and Variables

Data on imports are taken from the TRADE MAP database of the International Trade Centre, while the data on Covid-19 are retrieved from GitHub, [1]. Similarly, the traditional gravity variables – namely distance, contiguity, and colony – are taken from the CEPII database. Finally, we used Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008) which includes information on EIAs.

3 Results and Discussion

The results presented in Table 1 show a negative and statistically significant effect of Covid-19 on bilateral imports. The effect is negative for the variables lnCovid_{it} and lnCovid_{jt}, whereas it is positive for the variable DNoCovid_{ijt}. The signs of other gravity variables are as expected.

[1] For further references see, https://github.com/owid/covid-19-data.

Table 1: Trade effect of Covid-19: Estimations of Eq. 1

	Total Imports		Fruit & Vegetable Imports	
	1	2	3	4
$\ln\text{Covid}_{it}$	−0.044***	−0.039***	−0.016**	−0.014*
	(0.010)	(0.010)	(0.008)	(0.008)
$\ln\text{Covid}_{jt}$	−0.011	−0.007	−0.033**	−0.029*
	(0.013)	(0.012)	(0.016)	(0.016)
DNoCovid_{ijt}		0.152**		0.167**
		(0.066)		(0.078)
$\ln\text{Distance}_{ij}$	−0.498***	−0.500***	−0.831***	−0.832***
	(0.040)	(0.040)	(0.104)	(0.104)
Contiguity_{ij}	0.569***	0.568***	0.638***	0.638***
	(0.097)	(0.097)	(0.198)	(0.198)
Colony_{ij}	0.270***	0.272***	0.510**	0.510**
	(0.098)	(0.098)	(0.245)	(0.245)
EIA_{ij}	0.198***	0.197***	0.566***	0.565***
	(0.038)	(0.038)	(0.107)	(0.107)
N	22,206	22,206	22,206	22,206

Notes: Robust country-pair clustered standard errors are given in parentheses. Statistical significance is denoted as *** p<0.01, ** p<0.05, * p<0.1. Fixed effects for exporter, importer and time are included but not reported for the sake of brevity.

Finally, Table 2 presents the estimates corresponding to Eq. 2 and 3, where the variable Covid-19 is constructed as a country-pair variable. The impact of Covid-19 on trade is found to be negative and significant, for both total imports and fruit and vegetables. The table also shows the impact of Covid-19 for low income and high income countries. The results indicate that whereas the effect is not statistically different between groups for total imports, it is for imports of fruits and vegetables, being significantly higher for high income countries.

Table 2: Trade effect of Covid-19: Estimations of Eq. 2 and 3

	Total Imports		Fruit & Vegetable Imports	
	1	2	3	4
$\ln\text{Covid}_{ijt}$	−0.022**		−0.079***	
	(0.010)		(0.025)	
DNoCovid_{ijt}	0.163**	0.163**	0.056	0.062
	(0.078)	(0.077)	(0.088)	(0.088)
$\ln\text{Covid}_{ijt} \times \text{HighIncome}_i$		−0.022*		−0.098***
		(0.011)		(0.028)
$\ln\text{Covid}_{ijt} \times \text{LowIncome}_i$		−0.022*		−0.055**
		(0.012)		(0.026)
N	21,972	21,972	15,046	15,046

Notes: Robust country-pair clustered standard errors are given in parentheses. Statistical significance is denoted as *** p<0.01, ** p<0.05, * p<0.1. Exporter-time, importer-time and country-pair fixed effects are not reported for the sake of brevity.

The overall results indicate that the fruit and vegetable sector is particularly vulnerable to outbreaks in the importing countries. The impact on this sector is of critical importance and unless coordinated action is taken, supply chains will be distorted. For these reasons, the Covid-19 pandemic has far-reaching implications within the fruit and vegetable supply chain. Although much is being done to guarantee the stability and continuity of supply at points of sale, there are new costs and obstacles to deal with. These new costs are due to many factors, including the inefficiency introduced by the necessary social distancing in orchards and pack-houses, increases in logistical costs due to trucks returning empty to their base, additional safety measures, and delays. There are also market pressures and product losses. These factors put increasing pressure on growers and traders as these additional costs are not offset by higher returns on sales. Espitia, Rocha, and Ruta (2020) argue that export restrictions could drive up the average price of food by almost 50 percent. This rise is driven by products like fresh fruit and vegetables, whose import demand is much less elastic vis-à-vis specific producers, leading to higher price increases when they are hit by a supply shock.

Clearly the effects will differ between countries. For example, Canada relies heavily on seasonal imports of fresh products from the United States and Mexico, whereas the United States is a net importer of Canadian beef and cattle. As the pandemic passes the one-year mark, assessments of the supply-side effects will need to consider the vulnerability to international trade disruptions of the food categories for which Canada is a net importer. Efforts to maintain relatively frictionless cross-border trade in agri-food products during the Covid-19 pandemic are critical. This includes steps to mitigate any risk of inspection-related disruptions for imported fruit and vegetables from the United States and Mexico.

Net importers are therefore exposed to risks on the supply side. Export restrictions implemented by key commercial partners and disruptions in production and logistics chains may affect them directly in the short run, whereas a spiral of rising food prices would afflict

them indirectly. At the opposite end of the spectrum, net exporters are exposed to risks on the demand side. Rising costs and obstacles along the trade routes will negatively affect them in the short run. Whereas in the medium run the impact will depend on the dynamics of global demand and export prices, against the backdrop of a looming global recession.

4 Conclusions

Our analysis presents empirical evidence of the negative impact of Covid-19 on OECD imports, particularly for perishable products. As some OECD countries import fruit and vegetables mostly from developing countries, the drop in trade would adversely affect the smallholder growers in the exporting countries. This analysis will help inform governments as they consider national priorities for action, and more critically, it can help to build a sustainable and resilient global economy. In this regard, policy measures such as reducing tariffs, and strengthening electronic infrastructure to minimize human contact, would help to mitigate the negative impact of the pandemic.

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