COVID-19, agricultural trade and import prices: evidence from weekly firm-level data

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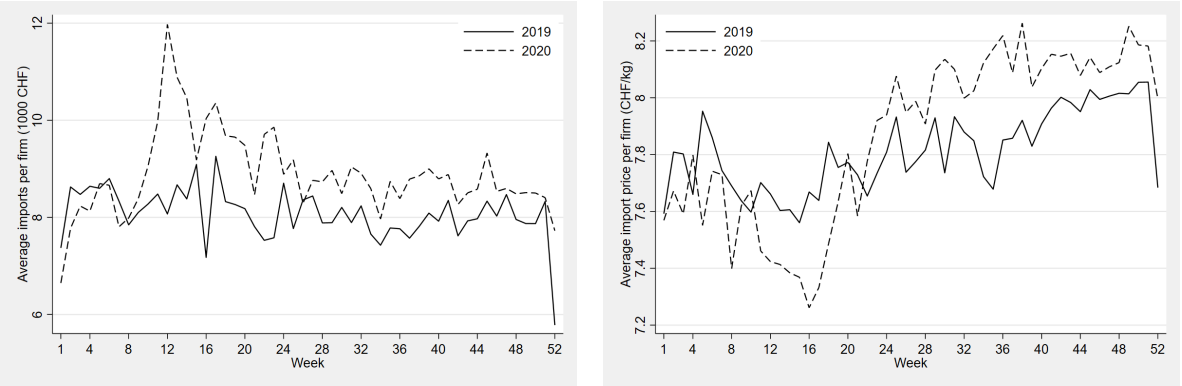
Introduction

Global agricultural trade in 2020 was described as resilient to the impacts of the COVID-19 pandemic. However, the size and channels of its quantitative impacts at the firm level are not yet clear. This is important because while countries as an aggregate may have survived the pandemic, this is not necessarily the case for individual firms. Secondly, COVID-19 incident rates occur daily yet publicly available trade data are only available on a monthly basis. This means existing studies exploit the pandemic incident rates at a more aggregated monthly level. Our work is thus novel in two ways: (i) we provide the first ex-post quantitative analysis of the COVID-19 and trade effect at the firm-level (ii) using trade and COVID data on a weekly basis.

Figure 1: Unit values and distance



(a) Import values

(b) Import prices

For this purpose, we use Switzerland as a case study. Switzerland has a low food self-sufficiency ratio of approximately 60%, and is therefore highly dependent on agro-food imports. To depict observed trade patterns prior to and during the pan-demic, Figure 1 shows weekly firm-level import values and import prices in Switzerland. In both cases, average values in 2020 are mostly higher than in 2019. In this paper, we assess the role that the COVID-19 pandemic played in the patterns we observe. Empirically, we estimate structural gravity models that regress trade values or unit values on COVID-19 incident rates, and a host of multi-way fixed effects.

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Methodology

For the empirical analysis, we estimate the following baseline equation:

$$\ln X_{fopwt} = \beta_0 + \beta_1 \ln \text{Covid19}_{owt} + \theta_{fpwt} + \lambda_{opt} + \varepsilon_{fopwt} \quad (1)$$

where X is a measure of the import values in CHF or unit values in CHF/kg of firm f importing from origin o of HS8 digit product p in week w of year t (t = 2019, 2020). Our variable of interest is the severity of COVID-19 cases measured either as the cumulative number of (i) confirmed cases or (ii) deaths reported in exporting country o in week w. θ_{fpwt} are firm-product-week-year fixed effects which control for all observable and unobservable firm-specific effects such as firm size and productivity. By including this term, our analysis exploits the within-firm-product variation in our dataset. λ_{opt} are origin-product-year fixed effects. We cluster the error terms at the firm-product-origin level. The parameter β_1 in equation (1) is the coefficient of interest. It measures the effect of an additional COVID-19 case or death in the exporting country on import values and the import prices paid by Swiss agro-food firms. We estimate equation (1) using ordinary least squares (OLS). However, for the trade effect, we will also use the PPML estimator as a robustness check.

To test our hypotheses, we use daily firm-level import data — which we aggregate at the weekly level — on Swiss agricultural and food importing firms in 2019 and 2020. The data comes from transaction-level declarations filed by importing firms with the customs in Switzerland. It contains information on HS8-digit product codes, import values in Swiss Francs (CHF), trade volumes in kilograms, import destinations, and date for every shipment within the HS01 to HS24 category. COVID-19 indicators are assessed from an online database maintained by the Johns Hopkins University (https://github.com/CSSEGISandData/COVID-19).

Results

The estimation results are in Table 1. The columns differ in either the dependent variables (i.e., import values and unit values), the estimator (i.e., OLS or PPML), or the measure of COVID19 incident rate (i.e., cases per million or deaths per million). In columns (1) – (4), we estimate structural gravity models that regress COVID-19 incident rates on trade values. In Columns (5) and (6) the dependent variable is firm-level import unit values. In all cases, our coefficient estimates are elasticities. Our findings show that a 10% increase in the number of COVID-19 cases and COVID-19 deaths decreased firm-level imports by 0.05% and 0.07%, respectively. The estimates from the PPML are similar to those in the OLS but are smaller in magnitude. On unit values, a 10% increase in COVID-19 cases or deaths increase firm-level prices by 0.01%. To put these magnitudes in perspective, the average firm imports a value of CHF 8501 per week with a CIF unit value of 7.84 CHF/kg. Thus, a doubling of COVID-19 incident rates in the producing country decreases Swiss firm-level imports by about 595 CHF per week and increases import prices by 0.08 CHF/kg per week.

Table 1: The effect of COVID-19 on firm-level import values and unit values

	Import values				Unit values	
	(1)	(2)	(3)	(4)	(5)	(6)
log Covid cases pm$_{owt}$	−0.005***		−0.003***		0.000	
	(0.001)		(0.001)		(0.000)	
log Covid deaths pm$_{owt}$		−0.007***		−0.002**		0.001*
		(0.001)		(0.001)		(0.000)
Firm-product-week FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin-product-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	978409	978409	978409	978409	827297	827297
Estimator	OLS	OLS	PPML	PPML	OLS	OLS

Notes: p values are in parentheses. ***, **, * denote significance at 1%, 5% and 10% respectively. Intercepts included but not reported. The PPML is estimated on a non-zero sample.

Discussion and conclusion

A rapidly growing body of scientific literature examines the impacts of COVID-19 on trade values. Yet, all existing works have used country-level data on a monthly basis. However, the effect of the corona pandemic may affect firms differently. The assumption of a representative firm in this aggregate country analyses imply that they miss the heterogeneous effects across firms within a country. Furthermore, existing works have only focused on the direct trade effects of the pandemic ignoring in large part the price effect. In this paper, we use weekly firm-level import data to analyze the effect of COVID-19 incident rates on firm-level import values and prices. For this purpose, we estimate structural gravity models and linear models that exploit the within-firm-product variation. In general, we estimate that COVID-19 reduced agricultural trade by 0.5% – 0.7%, and increased agricultural import prices by 0.1% at the firm-product level.