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Investigating the effect of COVID-19 on intra-COMESA trade

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Orientation: The outbreak of the coronavirus diease 2019 (COVID-19) pandemic directly and indirectly disrupted global production, consumption, and trade patterns. Regional blocs were not an exception.

Research purpose: The article aims to investigate the effects of COVID-19 pandemic on regional trade, with a specific focus on the Common Market for Eastern and Southern Africa (COMESA) regional trading bloc.

Motivation for the study: The outbreak of the COVID-19 pandemic generated remarkable economic adjustments with severe penalties affecting diverse communities and people globally. As such, regional communities such as COMESA were not an exception. However, relatively little is known about the effects of this pandemic on international trade within particular regional economic communities, and more specifically in the COMESA region.

Research design, approach and method: By employing a cross-sectional type gravity model and utilising the Poisson pseudo-maximum likelihood (PPML) method, the article explored trade data for 14 COMESA member states and explicitly regressed intra-COMESA trade values on various measures of the severity of COVID-19 in 2020. The article further assessed the impact of COVID-19 in the COMESA region within the framework of the traditional gravity model variables.

Main findings: The findings of this article confirm significant negative effects of COVID-19 cases and lockdown measures on intra-COMESA trade in the exporting country. In the importing country, the effect of COVID-19 on intra-COMESA trade was found to be insignificant regardless of the quantifying measure.

Practical/managerial implications: It is recommended in this article that the COMESA regional bloc and the African continent, in general, should expand their respective pharmaceutical production and research and development capacity to be able to respond and advance their future inoculation drives intended to restrain the trade-related impacts of communicable diseases of the COVID-19 nature.

Contribution/value-add: This article contributes to the COVID-19 epidemic knowledge base and the existing international trade COVID-19 nexus by enhancing the understanding of the impact of global health shocks on economic outcomes from developing countries perspective. It further presents new empirical evidence that can be utilised as a springboard for policymakers in COMESA to formulate future regional response mechanisms to health crisis of the COVID-19 form.

Keywords: COMESA; COVID-19; gravity model; international trade; lockdown measures.

Introduction

The outbreak of the novel coronavirus 2 (SARS-CoV-2), also known as the coronavirus disease 2019 (COVID-19), pandemic generated remarkable economic adjustments with severe penalties affecting diverse communities and people around the globe (Brunnermeier et al. 2020). Spreading swiftly across territorial boundaries, along the fundamental arteries of the global economy, the dispersion of the COVID-19 virus immensely benefited from the structural interlinkages and weaknesses of globalisation. As a consequence, this propelled a global health crisis into a global economic shock that significantly affected the welfare of the most vulnerable populaces (United Nations Conference on Trade and Development [UNCTAD] 2020a).

Since the COVID-19 virus initially commenced to spread in the late 2019, approximately 492.19 million cumulative cases have been registered globally, with 6.16 million deaths by the beginning

of April 2022. The African continent witnessed four major COVID-19 waves, driven by successive variants of the coronavirus, since 2020. By September 2022, Africa had recorded about 8.3 million cases and 166 354 deaths (World Health Organization [WHO] 2022). The Common Market for Eastern and Southern Africa (COMESA), in particular, recorded a 747% year-on-year surge in COVID-19 cases between September 2021 (364 927 cases) and September 2022 (2 753 502 cases). On a positive note, the rate of recoveries in the COMESA region increased from 67.82% to 86.91% over the same period. This could partially be the reason behind the reduction in the rate of COVID-related deaths recorded in COMESA from 3.13% in September 2020 to 2.82% in September 2021 (COMESA 2021).

It is not a secret that the prospective ramifications for trade and economic development became ostensible during the early phase of the COVID-19 pandemic (i.e. during the first quarter of 2020). In fact, the pandemic will undoubtedly be remembered as the main driving force in the trade and economic development discourse of 2020 and indeed spilling over into 2021 as well as 2022 and somehow beyond (Miroudot 2020). Hence, despite the expectation that international trade is vital to save lives and livelihoods in a unique global health calamity, the COVID-19 pandemic negatively impacted the global trade in both merchandise and services (Organisation for Economic Co-operation and Development [OECD] 2020). This mainly emanated from the disruptions in global production and supply chains because of restrictions in the movement of container ships, increases in the prices of air cargo freight, and confinements of people as a result of lockdown restrictions invoked by various countries, which interrupted the mobility of both freight and people (Galanakis 2020; Shih 2020).

In the COMESA region, countries also instituted numerous measures including lockdowns to monitor and curb the proliferation of the COVID-19 pandemic. However, Chong, Li and Yip (2021) argue that lockdown measures ushered in negative effects on employment, production, tariff income, and government fiscal stability. Banga et al. (2020) also contend that the isolation and shutdown policies rolled out by several countries across the globe, which entailed limiting or stopping work-related activities, led to a reduction in trade volume, more especially cross-border trade. Hence, the measures introduced to harness the spread of the pandemic in the COMESA region affected the volume of trade through several supply- and demand-side conduits.

The supply-side effects of the COVID-19 pandemic in COMESA exporting countries manifested as a reduction in production scale and the export supply in the affected member countries (Hayakawa & Mukunoki 2021). The general expectation was that exports would drop outstandingly in sectors and countries where remote work or functioning was triflingly practical. Furthermore, the pandemic led to a decline in commodity prices, which

affected COMESA oil and mineral products exporters, resulting in a sharp decline in export earnings and balance of payment challenges (COMESA 2020). The demand-side effects, on the other hand, mainly emanated from the decrease in aggregate demand in the respective COMESA importing countries, following the decline in consumer earnings and their visits to retail outlets.

An overview of the variations in the growth of intra-COMESA trade between 2019 and 2020 at country level is shown in Table 1-A2 in Appendix 2. It is apparent that intra-COMESA imports declined in 8 of the 14 COMESA members covered in this article. Zambia, Egypt and Mauritius registered the highest declines of 0.40%, 0.39% and 0.33%, respectively. However, intra-COMESA imports increased in the following six COMESA countries: Uganda (0.36%), Zimbabwe (0.23%), Malawi (0.12%), Burundi (0.11%), Ethiopia (0.07%) and Comoros (0.02). Intra-COMESA exports, on the other hand, weakened in 9 of the 14 COMESA countries with the highest declines of 0.86% and 0.64% being, correspondingly, registered in Seychelles and Comoros. However, intra-COMESA exports improved in 5 of the 14 COMESA members with Zimbabwe and the Democratic Republic of Congo witnessing a respective 0.82% and 0.35% growth in their intra-COMESA exports.

While it is obvious that the COVID-19 pandemic generated global instability in economic activity, relatively little is known about the effects of this pandemic on international trade within particular regional economic communities, and more specifically in the COMESA region. It is against this background that this article seeks to investigate the effects of COVID-19 pandemic on regional trade, with a specific focus on the COMESA regional trading bloc. Within the context of this prime objective, the present article specifically quantifies the effect of COVID-19 on the volume of intra-COMESA imports and exports. The article additionally assesses the impact of COVID-19 in the COMESA region within the framework of the traditional gravity model variables during the same period. Hence, this article contributes to the COVID-19 epidemic knowledge base and the existing international trade COVID-19 nexus by enhancing the understanding of the impact of global health shocks on economic outcomes from the perspective of developing countries. Through the application of the PPML method, the article further presents new empirical evidence that can be a point of departure for policymakers in COMESA to formulate future regional response mechanisms to pandemics such as COVID-19.

The article employed cross-sectional trade data from 14 COMESA member countries in 2020. The period was selected on the basis that the COVID-19 pandemic was at its peak with most countries registering peaks of confirmed cases and deaths during this period. Again, most countries were still learning how to behave and considering ways to respond to this global pandemic. Following Hayakawa and

Mukunoki (2021) and by employing a cross-sectional type gravity model, this article explicitly regressed intra-COMESA trade values on various measures of the severity of COVID-19 during 2020. In this regard, the subsequent three measures of the severity of COVID-19 were utilised: (1) the number of COVID-19 cases in the importing and exporting countries; (2) the number of COVID-19 deaths in the importing and exporting countries; and (3) the share of days in the year when stay-at-home orders were in effect in importing countries or when workplace-closing orders were in effect in exporting countries. The article also regressed intra-COMESA trade values on the following traditional gravity model variables: gross domestic product (GDP), distance, common border, common language, common coloniser, and landlockedness.

The rest of the article is structured as follows: first, insights from the theoretical and empirical literature of the COVID-19 pandemic are provided; this is followed by the data and empirical approach utilised to achieve the objectives of this article, and a presentation of its results and discussions; and lastly, the conclusions and recommendations of this article are provided.

Insights from theoretical and empirical literature

Epidemics are not a new phenomenon, and their emergence has at all times challenged human existence throughout documented history. In fact, the outbreak of COVID-19 is not the first communicable disease with intense economic and trade effects around the globe (Morens et al. 2020). Similar to other epidemics, such as the Spanish flu of 1918, the COVID-19 pandemic negatively impacted global production, consumption and trade patterns, both directly and indirectly, as a result of lockdowns, social distancing and other related measures introduced by various countries to curb the spread of the disease (Espitia et al. 2022; Karlsson et al. 2012). As such, temporary shutdowns of manufacturing plants in China, Europe, the United States and other countries led to a decline in the supply of exportable merchandise and to a disruption in global supply chains (GSCs). Interruptions in the transportation sector also meant proliferations in trade costs (Vo & Tran 2021). The global maritime transportation system, in particular, was ruffled by container imbalances, port congestion and low productivity (Cullinane & Haralambides 2021). Accordingly, the penalties were felt worldwide, given the interconnectedness of the GSCs.

The theoretical framework of this article on the relationship between COVID-19 and trade is, therefore, founded on the understanding that pandemics affect both the supply- and demand-sides of an economy (Hayakawa & Mukunoki 2021). In this setting, the channels through which the trade effects of COVID-19 can be analysed revolve around its direct and indirect effects on exporting countries (supply-side) and importing countries (demand-side).

Coronavirus disease 2019 trade implications in exporting countries

Multiple measures that were introduced to mitigate the spread of COVID-19, such as social distancing and lockdown measures, affected the mobility of people within and across international frontiers (Rahman, Thill & Paul 2020). These measures together with COVID-19-related deaths and prolonged ailments eventually culminated in a reduction of the workforce with a direct effect on production (Beland, Brodeur & Wright 2020). This could, in turn, lower the price elasticity of goods, shifting a country's supply curve upward. However, the decline in production must be viewed in light of industrial heterogeneity, as the degree of supply shocks was likely smaller in sectors producing essential products than in sectors producing nonessential products (Hayakawa & Mukunoki 2021). In fact, all countries that were affected by COVID-19 tried to maintain the supply of essential merchandises amid the execution of the mitigating measures.

Like any other major health shock, the decline in the scale of production that emanated from COVID-19-related effects also entailed a deterioration in export supply (Zhang et al. 2021). However, three elements were central in defining the net impact on the supply of exports. The first element was the decline in the internal demand for internationally traded merchandise. Coronavirus disease 2019 potentially minimised, not solely the domestic manufacturing of merchandise, but additionally the demand of the same merchandise (Setiati & Azwar 2020). If the resulting decline in local demand was adequately considerable than the decline in manufacturing, a net export expansion might have been realised by channelling the output not domestically consumed to international markets (Hayakawa & Mukunoki 2021). Expressed differently, the comparative volume of the manufacturing scale over the size of internal demand assumed a vital position in establishing the net impact on export supply.

The second element was the impact of commencing remote work on efficiency. Undoubtedly, the outbreak of the COVID-19 pandemic forced many countries to sustain economic activity through telecommuting systems (Abulibdeh 2020). In instances where these systems improved productivity or efficiency, then it can be hypothesised that export supply was enhanced. However, in countries where remote working was less feasible, the scale of production would diminish and ultimately reduce export supply (Hayakawa & Mukunoki 2021).

The third element was the level of amalgamation in the international manufacturing network. Here, the position of the global value chains (GVCs) in diffusing the economic shock stemming from the COVID-19 pandemic is probed (Friedt & Zhang 2020). In this context, the manifestation of GSCs amplified the impact of the pandemic-induced production shock (Sforza & Steiniger 2020; Meier & Pinto 2020).

Friedt (2021) points out that the true threat of the COVID-19-induced interruption of the international manufacturing networks was anchored on the feedback effects that magnified the initial shock and dispersed it throughout the whole production chain. A study by Friedt and Zhang (2020) reveals that the GVC contagion had the capacity to generate a vicious cycle in which linkages to the Chinese production not only inspired welfare deficiencies in foreign countries but also rebounded into China by disrupting foreign supplies of intermediate inputs critical to the Chinese exports.

Coronavirus disease 2019 trade implications in importing countries

For importing countries, the effect of the COVID-19 pandemic on trade manifested as a progression of the decline in domestic aggregate demand. Lockdown measures, for instance, negatively affected business earnings, resulting in closure and layoff of workers in some cases (Wang et al. 2021).

Considerably affected were business entities and workers in the tourism hospitality sector. Reduction and loss of earnings at both commercial and employee levels resulted in a decline in aggregate demand, except if the government had established safety nets with sufficient benefits to cover the earnings shortfall (Hayakawa & Mukunoki 2021).

Similar to the decline in production, industrial heterogeneity was also prevalent on the demand-side, as the adverse demand shocks possibly diminished the expenditure on durable merchandise greater than the spending on nondurable merchandise. This emanates from the fact that the demand of durable goods can be postponed (ed. Baldwin & Tomiura 2020). Alternatively, ambiguity concerning the future or panic-induced purchasing possibly enhanced demand for nondurable merchandises. Additionally, the import demand for health and hygiene merchandises increased because of a surge in demand for products that offered protection against COVID-19 infections (Espitia, Rocha & Ruta 2020). For instance, imports of COVID-19-related medical products (e.g. personal protective equipment, ventilators, thermometers, sanitisers, inter alia) experienced very significant growth in the second quarter of 2020 (UNCTAD 2020b).

The outbreak of COVID-19 also generated a postponement of purchases and a delay in investments (Di Mauro 2020). The resulting demand-side shocks triggered diverse effects, which include practical and psychological effects. The practical effects evolved as some customers were prevented from physically accessing retail outlets in order to make purchases and as such their demand disappeared (Baldwin & Di Mauro 2020). The psychological effects meant that some consumers and firms had to embrace the wait-and-see attitude when faced with what Baldwin and Di Mauro (2020) termed the Knightian uncertainty (i.e. the unknown-unknowns).

However, the advancement in online shopping infrastructure and platforms assisted in weakening the demand-side effects of COVID-19 stemming from prohibited mobility and physical access to retail shopping outlets (Hayakawa & Mukunoki 2021; Renu 2021). In fact, a shift in preference from face-to-face and showroom shopping behaviour to pure online shopping behaviour was observed during the COVID-19 pandemic (Sayyida et al. 2021). As such, e-commerce significantly expanded in 2020 and the trend is expected to continue into the future.

Empirical understandings

Since the outbreak of the SARS-CoV-2 in 2019, a large body of literature has studied various trade aspects of this pandemic. It is in this regard that this article observes four clusters of researchers that focused on diverse trade impacts of the COVID-19 pandemic. The first cluster focused on trade impacts of COVID-19 at the global level (Baldwin & Tomiura 2020; Cai & Hayakawa 2020; Carreño et al. 2020; Evenett 2020; Hayakawa & Mukunoki 2021; Maliszewska, Mattoo & Van der Mensbrugghe 2020; Vidya & Prabheesh 2020), regional level (Chong et al. 2021; Khorana, Martínez-Zarzoso & Ali 2021; Kumari & Bharti 2021; Meinen, Serafini & Papagalli 2021; Obayelu, Edewor & Ogbe 2020) and country level (Friedt & Zhang 2020; Davidescu, Popovici & Strat 2021; Shahriar et al. 2021; Ugaz & Sun 2020).

The second cluster concentrated on the trade impact of COVID-19 mitigating measures (Askitas, Tatsiramos & Verheyden 2020; Aum, Lee & Shin 2020; Conyon, He & Thomsen 2020; Deb et al. 2020; Dingel & Neiman 2020; Ghosh 2020; UNCTAD 2020b; Watanabe & Omori 2020). The third cluster focused on the supply- and demand-side trade impacts of COVID-19 (Baldwin & Di Mauro 2020; Batool et al. 2020; Mirza et al. 2020; Shaikh 2020). The last cluster focused on the trade in COVID-19 products (Espitia et al. 2020; Fuchs et al. 2020; Uttama 2021) and trade aspects of COVID-19 vaccines production and distribution (Binagwaho, Mathewos & Davis 2021; Evenett et al. 2021; Sorescu, González & Andrenelli 2021).

There is a general consensus among scholars that the COVID-19 pandemic negatively affected trade primarily through supply- and demand-side disruptions. For instance, Hayakawa and Mukunoki (2021) examined the effects of COVID-19 on international trade using a sample of 34 countries' exports to 173 countries and concluded that COVID-19 negatively and significantly affected trade in both the importing and exporting countries. More so, the study findings were robust to the different measurements of COVID-19, and the overall negative effects of COVID-19 were found to have heterogeneous effects across countries and products.

An investigation by Chong et al. (2021) of the effect of COVID-19 on intra-ASEAN trade revealed sluggishness in trade recovery within the regional bloc. Again, in developing countries and labour-intensive industries (e.g. agriculture)

that necessitate an in-person presence for production, exports were anticipated to decline because of a decline in productivity. In China, for example, LIN and Zhang (2020) observe that COVID-19 had mixed effects on the country's agricultural exports. Overall, Chinese agricultural exports declined with horticultural exports being the most affected by the outbreak of the pandemic. However, at the product level, the exports of grains increased.

The outcomes of a case study on bilateral trade in COVID-19 products by Uttama (2021) revealed that the ASEAN trading bloc is a deterrent to the rules-centred multilateral trading system of the World Trade Organization (WTO). The results of Uttama (2021) suggest that the productive competence of the home country, the absorptive capability of the host country, the similarity in member size and per capita income and the degree of remoteness of member countries have positive and significant relationships with trade in COVID-19 products within the Association of Southeast Asian Nations (ASEAN). In terms of COVID-19 vaccine production and distribution, Sorescu et al. (2021) acknowledged the strength of trade as a mechanism of distributing COVID-19 vaccines and called for the preservation of market openness through diminishing tariffs, rationalising trade-related procedures at and prior to points of entry while simultaneously necessitating enhanced management of logistical processes.

While a number of studies have investigated the trade impact of COVID-19 and related trade aspects of COVID-19 mitigating measures, products and vaccines production and distribution, relatively little is known about the effects of this pandemic on international trade within particular regional economic communities and more specifically in the COMESA region. It is in this regard that the present article investigates the effects of COVID-19 pandemic on regional trade with a specific focus on the COMESA regional trading bloc. The article further assesses the impact of COVID-19 in the COMESA region within the framework of the traditional gravity model variables during the same period.

Data and estimation technique

Data

The objective of this article is to investigate the effects of COVID-19 pandemic on regional trade with a specific focus on the COMESA regional trading bloc. The article further assesses the impact of COVID-19 in the COMESA region within the framework of the traditional gravity model variables. To achieve the aims of this article, cross-sectional trade data for 14 COMESA member countries in 2020 are explored. The period was selected on the basis that the COVID-19 pandemic was at its peak with most countries registering peaks of confirmed cases and deaths during this period. Most countries were also still learning how to behave and considering ways to respond to the COVID-19 pandemic. The choice of countries (see Appendix 1 Table 1-A1) was based on data availability, and Djibouti, Eritrea, Libya, Rwanda, Somalia, Sudan and Tunisia were excluded because of data-related constraints.

The variables utilised in this article are listed and described in Table 1. Annual data on trade values were obtained from the International Trade Centre (ITC) and the article used the import data in 14 COMESA reporting countries and their 19 COMESA partner countries (see the list in Appendix 1 Table 1-A1). As alluded to in Section 1, following Hayakawa and Mukunoki (2021), this article regresses intra-COMESA trade values on three measures indicating the severity of COVID-19 during 2020. The first measure is the number of COVID-19 cases in the importing and exporting countries. Data were collected from the European Centre for Disease Prevention and Control (ECDC 2021). As the data were collected on a daily basis from global reports of healthcare workers, the article used the summation of new cases in 2020. The second measure is the number of COVID-19 deaths in the importing and exporting countries. The data were also accessed from the ECDC, and the summation of new deaths in 2020 was utilised.

The third and final measure is the share of days in the year when stay-at-home orders were in effect in importing countries or when workplace-closing orders were in effect in exporting countries (i.e. lockdown orders). These variables were constructed using the Oxford COVID-19 Government Response Tracker (OxCGRT) of Hale et al. (2020). The OxCGRT scientifically gathers information on numerous diverse shared policy reactions that governments have implemented to react to the COVID-19 pandemic on 17 indicators for more than 160 countries. For the measure in exporting countries, this article used (Hale et al. 2020):

> C2 Workplace closure consisting of the following orders: 1 = recommend closure or recommend work from home, 2 = require closure or work from home for some sectors or categories of workers, and 3 = require closure or work from home for all but essential workplace. (n.p.)

The measure in importing countries was constructed using (Hale et al. 2020):

> C6 Stay-at-home requirements consisting of the following orders: 1 = recommend not leaving home, 2 = require not leaving home, with exceptions for daily exercise, grocery shopping, and essential' trips, and 3 = require not leaving home with minimal exceptions (e.g. allowed to leave once a week). (n.p.)

Irrespective of the extent of the orders, the article used the summative number of calendar days when a score of at least 1 was effective as a share of the number of calendar days in 2020.

The number of COVID-19 cases and deaths measures the damage caused by the pandemic. Lockdown orders, on the other hand, measure the existence of measures to mitigate the transmission of COVID-19 infections. The number of new cases and deaths in COMESA during 2020 is shown in Figure 1-A2 in Appendix 2. High numbers of new cases were recorded in Tunisia (139 140), Egypt (138 062), Kenya (124 264), Madagascar (100 277) and Libya (96 458). New deaths, on the other hand, were high in Egypt (7631),

Tunisia (4676) and Kenya (1923). There is a seeming positive correlation between the number of new cases and deaths within the COMESA countries. In terms of the share of lockdown days (see Figure 2-A2 in Appendix 2), workplace closures generally had a higher share relative to stay-at-home orders in the majority of the COMESA countries. Burundi and Comoros are the only COMESA members that did not implement lockdown measures in 2020.

This article also regresses intra-COMESA trade values on the following traditional gravity model variables: GDP, distance, common border, common language, common coloniser and landlockedness. Data for GDP were accessed from the World Development Indicators (WDI) of the World Bank (WB 2020), while data for all the other variables were accessed from the *Centre d'Études Prospectives et d'Informations Internationales* (CEPII 2020).

Descriptive statistics of all the variables included in this article are shown in Table 2. It can be seen that there are 223 observations and intra-COMESA imports averaged US\$26.1 million with a standard deviation of \$US74.7 million, a minimum of 0 and a maximum of \$US773.2 million. The standard deviations of most of the variables are relatively high indicating that the data are widely spread, which calls for an estimation technique that minimises standard errors.

From the correlation matrix in Table 2-A2, it is apparent that there is a high correlation (above 0.70) among some of the COVID-19 variables and between some of the COVID-19 variables and GDP. This suggests a strong presence of multicollinearity and the variables in question were isolated, and their effects on intra-COMESA trade were estimated individually.

Estimation technique

To investigate the impact of the COVID-19 pandemic on intra-COMESA trade and to assess its impacts within the framework of traditional gravity model variables, this article employs the gravity model of bilateral trade grounded on the theoretical gravity model of Anderson and van Wincoop (2003). Hence, the baseline gravity model in this article is specified as follows:

$$T_{ijy} = \beta_0 + \beta_1 \ln COVID_{iy} + \beta_2 \ln COVID_{jy} + \beta_3 Cborder + \beta_4 Clang + \beta_5 Ccolon + \beta_6 Land_i + \beta_7 Land_j + \beta_8 \ln Dist + \beta_9 \ln Gdp_i + \beta_{10} \ln Gdp_j + \lambda_{ijy} + \varepsilon_{ijy}$$

T_{ijy} is the import value of country i from country j in year y. As explained in the previous section, $COVID_{iy}$ and $COVID_{jy}$ are the extent of COVID-19 damage in the importing and exporting countries, correspondingly, in year y. λ_{ijy} is the country pair-year fixed effects, while ε_{ijy} is the error term. All the remaining variables are traditional gravity model variables described in Table 1.

In order to avoid biased estimation results, diagnostic tests were conducted first to ascertain the presence of multicollinearity, heteroscedasticity and serial correlation among the variables. The cross-sectional type gravity model was then estimated using the Poisson pseudo-maximum likelihood (PPML) method suggested by Silva and Tenreyro (2006). The PPML approach addresses the challenges of zero trade values, cross-sectional dependence and heterogeneity.

Results and discussions

This article commences by presenting the results of the baseline estimation, with standard errors clustered by country pairs, shown in Table 3. To measure the extent of COVID-19 damage on intra-COMESA trade, the article took natural logarithms of the number of new COVID-19 cases (Column 1), natural logarithms of new COVID-19 deaths (Column 2) and the percentage share of the number of days with lockdown measures (Column 3) in COMESA during 2020. Only the coefficients of new COVID-19 cases and lockdown measures were found to be significant and had the expected signs in the exporting country. As such, a percentage increase in new COVID-19 cases and the share of lockdown days in the exporting country result in a corresponding 0.33% and 2.37% decline in intra-COMESA trade.

TABLE 1: Description of variables.

Variable	Symbol	Measurement	Source
Imports	Imports	Annual intra-COMESA import value in US\$000.	ITC (2021)
Importer's COVID-19 lockdown	COV_lock_im	Share of days when stay-at-home measures were effective in the importing country.	Hale et al. (2020)
Exporter's COVID-19 lockdown	COV_lock_ex	Share of days when workplace-closing measures were effective in the exporting country.	Hale et al. (2020)
Importer's COVID-19 cases	LnCOV_cases_im	New COVID-19 cases in the importing country.	ECDC (2021)
Exporter's COVID-19 cases	LnCOV_cases_ex	New COVID-19 cases in the exporting country.	ECDC (2021)
Importer's COVID-19 death	LnCOV_death_im	New COVID-19 death in the importing country.	ECDC (2021)
Exporter's COVID-19 death	LnCOV_death_ex	New COVID-19 death in the exporting country.	ECDC (2021)
Common border	C_border	Dummy: = 1, if the exporter shares a common border with the importer; = 0, if otherwise.	CEPII (2020)
Common language	C_language	Dummy: = 1, if the exporter shares a common language with the importer; = 0, if otherwise.	CEPII (2020)
Common coloniser	C_coloniser	Dummy: = 1, if the exporter shares a common coloniser with the importer; = 0, if otherwise.	CEPII (2020)
Landlocked importer	Land_im	Dummy: = 1, if the importer is landlocked; = 0, if otherwise.	CEPII (2020)
Landlocked exporter	Land_ex	Dummy: = 1, if the exporter is landlocked; = 0, if otherwise.	CEPII (2020)
Distance	LnDist	Distance of the importer with exporter.	CEPII (2020)
Importer's GDP	LnGDP_im	Annual importer GDP at constant 2010 US\$.	WB (2020) WDI
Exporter's GDP	LnGDP_ex	Annual exporter GDP at constant 2010 US\$.	WB (2020) WDI

CEPII, *Centre d'Études Prospectives et d'Informations Internationales*; COMESA, Common Market for Eastern and Southern Africa; ECDC, European Centre for Disease Prevention and Control; GDP, gross domestic product; ITC, International Trade Centre; WB, World Bank; WDI, World Development Indicators.

TABLE 2: Descriptive statistics.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Imports	223	26082.22	74685.41	0.00	773230.00
COV_lock_im	223	50.90	26.05	0.00	78.63
COV_lock_ex	223	61.94	26.78	0.00	80.06
LnCOV_cases_im	223	9.27	1.95	5.43	11.84
LnCOV_cases_ex	223	9.20	1.91	5.43	11.84
LnCOV_death_im	223	5.20	2.36	0.00	8.94
LnCOV_death_ex	223	4.97	2.40	0.00	8.94
C_border	223	0.13	0.33	0.00	1.00
C_language	223	0.52	0.50	0.00	1.00
C_coloniser	223	0.43	0.50	0.00	1.00
Land_im	223	0.47	0.50	0.00	1.00
Land_ex	223	0.47	0.50	0.00	1.00
LnDist	223	7.71	0.59	5.09	8.90
LnGDP_im	223	23.56	1.48	20.94	26.47
LnGDP_ex	223	23.43	1.41	20.94	26.47

While the coefficient of the number of new COVID-19 deaths had the expected sign in the exporting country, it was found to be insignificant. In the case of the importing country, the effect of COVID-19 on intra-COMESA trade was found to be insignificant regardless of the COVID-19 quantifying measure. Again, all the quantifying measures did not have the expected sign in the importing country. Conducting the Wald test that the coefficients of the COVID-19 effects in importing and exporting countries are equal, this article found insignificant differences, except for new COVID-19 deaths (Table 3, Column 2) on the relative sizes of the margin effects.

The results of the traditional gravity model variables are shown in Table 4. In all the three estimated models, the coefficients of common border, common coloniser, distance and importing and exporting countries' GDP are found to be significant, and all have the expected sign. In econometric terms, sharing a common border with the importer increased intra-COMESA trade by 156.00%, while sharing a common coloniser increased intra-COMESA trade by 171.83%. A percentage increase in the GDP of the importing and the exporting country resulted in 0.40% and 1.12% increase in intra-COMESA trade, respectively. However, a 1% increase in distance between the importer and the exporter resulted in a 1.07% decline in intra-COMESA trade.

Being landlocked was found to be significant in the importing country in Model 1, but the level of significance is weak. As such, being landlocked in both the importing and exporting countries and sharing a common language is found to be insignificant. In addition, while being landlocked has the expected sign, sharing a common language does not have the expected sign. The R^2 in all the three estimated models is above 61%, therefore suggesting that the variation in intra-COMESA trade is explained for by the regression.

TABLE 3: Impact of coronavirus disease 2019 on intra-Common Market for Eastern and Southern Africa trade.

Variable	(1)	(2)	(3)
COVID-19 importer	0.088	0.012	0.007
	(0.138)	(0.118)	(0.007)
COVID-19 exporter	-0.333**	-0.092	-0.024***
	(0.149)	(0.142)	(0.008)
COVID-19 measure	**Cases**	**Deaths**	**Lockdown**
Wald statistics	6.550	0.260	12.110
Wald *p*-value	0.011	0.613	0.001
Log pseudolikelihood	-4125600.900	-4306731.500	-3970992.900
Pseudo *R*-squared	0.613	0.619	0.654
Number of observations	222.000	222.000	222.000

Standard errors are in parentheses.
***, *p* < 0.01; **, *p* < 0.05; *, *p* < 0.1.

TABLE 4: Traditional gravity variables.

Variable	(1)	(2)	(3)
C_border	0.940***	0.862**	0.848**
	(0.365)	(0.373)	(0.355)
C_language	-0.039	-0.130	-0.115
	(0.305)	(0.323)	(0.317)
C_coloniser	0.935***	1.000***	0.960***
	(0.279)	(0.275)	(0.280)
Land_im	-0.459*	-0.381	-0.368
	(0.261)	(0.262)	(0.247)
Land_ex	-0.197	-0.287	-0.180
	(0.344)	(0.319)	(0.308)
LnDist	-1.017***	-0.957***	-1.072***
	(0.261)	(0.229)	(0.236)
LnGDP_im	0.401**	0.453**	0.429***
	(0.190)	(0.199)	(0.122)
LnGDP_ex	1.122***	0.852***	0.946***
	(0.210)	(0.219)	(0.144)
Constant	-16.733***	-13.811***	-13.894***
	(4.889)	(4.922)	(3.646)
Observations	222.000	222.000	222.000
R-squared	0.613	0.619	0.654

Standard errors are in parentheses.
***, *p* < 0.01; **, *p* < 0.05; *, *p* < 0.1.

In terms of COVID-19 variables, the findings of this article are partially empirically supported by Hayakawa and Mukunoki (2021) who found significantly negative effects of COVID-19 on international trade in the exporting country. Moreover, Kumari and Bharti (2021) found the negative impact of COVID-19 on exports within the South Asian countries. The findings of this article are also consistent with the results of Khorana et al. (2021) who found that high numbers of COVID-19 cases, including deaths, in low-income importing countries led to a deterioration in commonwealth exports.

Conclusion and recommendations

The outbreak of the COVID-19 pandemic disrupted global production, consumption and trade patterns, both directly and indirectly, as a consequence of lockdowns, social distancing and other related measures instituted by several countries to mitigate the spread of the virus. This article investigated the effects of the COVID-19 pandemic on regional trade, with a specific focus on the COMESA regional trading bloc. Within the context of this prime objective, the

effect of COVID-19 on the volume of intra-COMESA imports and exports was specifically quantified by employing a cross-sectional type gravity model and explicitly regressing intra-COMESA trade values on various measures of the severity of COVID-19 during 2020. The article further assessed the impact of COVID-19 in the COMESA region within the framework of the traditional gravity model variables, during the same period, by regressing intra-COMESA trade values on the following traditional gravity model variables: GDP, distance, common border, common language, common coloniser, and landlockedness.

The results of this article confirm new COVID-19 cases and lockdown measures to be significant and possessing the expected signs in the COMESA exporting country. As such, a percentage increase in new COVID-19 cases and the share of lockdown days in the exporting country result in a corresponding 0.33% and 2.37% decline in intra-COMESA trade. COVID-19 deaths in the exporting country, however, had the expected sign but were found to be insignificant in intra-COMESA trade. In the importing country, the effect of COVID-19 on intra-COMESA trade was found to be insignificant, regardless of the COVID-19 quantifying measure, and all the quantifying measures did not have the expected sign.

In terms of the traditional gravity model variables, common border, common coloniser, distance and importing and exporting countries' GDP significantly affected intra-COMESA trade in 2020. Sharing a common border with the importer increased intra-COMESA trade by 156.00% while sharing a common coloniser increased intra-COMESA trade by 171.83%. An increase in the GDP of the importing and the exporting country by 1% resulted in 0.40% and 1.12% increase in intra-COMESA trade, respectively. However, a percentage increase in distance between the importer and the exporter resulted in a 1.07% decline in intra-COMESA trade. Being landlocked in both the importing and exporting countries and sharing a common language were found to be insignificant in explaining intra-COMESA trade in 2020.

Nonetheless, even though the pandemic adversely affected global trade, prospects have improved with indications of a recovery in merchandise trade and industrial production noticeably emerging in the fourth quarter of 2020. This trend is expected to continue into the future, and it is sensible to expect the recovery in global trade to draw significantly from the merits of the Fourth Industrial Revolution, which has the capacity to generate a supply-side miracle that will culminate in diminishing trade costs.

It is acknowledged in this article that a number of studies have investigated the trade impact of COVID-19 and related trade aspects of COVID-19 mitigating measures, products and vaccines production and distribution. However, relatively little is known about the effects of this pandemic on international

trade within particular regional economic communities, and more specifically in the COMESA region. The nature and novelty of COVID-19 meant that the process of navigating through and mitigating its economic and trade impacts is that of learning by doing. The current article is, therefore, significant in shaping future policy reactions by national governments when faced with a pandemic of comparable nature. It also contributes to the COVID-19 epidemic knowledge base and the existing international trade COVID-19 nexus.

Despite the substantial uncertainties and trade disruptions that originate from pandemics such as the COVID-19, there are 6 critical things that this article recommends to be done in order to sustain current and future trade flows within the regional bloc such as the COMESA and the world in its entirety (OECD 2020): (1) inspiring confidence in trade and international markets by enhancing openness regarding trade-related policy positions and objectives; (2) keeping supply chains operational at all times, particularly for essential merchandise such as food and health provisions; (3) avoiding escalating the consequences of pandemics, through avoidable export barriers and other trade-related restrictions; (4) promoting inoculation drives and vaccine manufacturing during pandemics by temporarily waiving certain intellectual property rights provisions covering the production of related vaccines; (5) the COMESA regional bloc and the African continent, in general, should expand their respective pharmaceutical production and research and development capacity to be able to respond and advance their future inoculation drives intended to restrain the trade-related impacts of communicable diseases of the COVID-19 nature; and (6) thinking beyond the prevailing economic growth and development circumstances when confronted with global health crisis.

Given the data constraints encountered in this article, future research can be directed towards the utilisation of econometric techniques other than the gravity model and the performing of an analysis that covers all COMESA countries, subject to data availability. The COMESA regional bloc and the African continent, in general, inclusively reported fewer COVID-19 cases per capita than other regions, though the testing rates and capacity in Africa were also low. Hence, in order to contain the adversities ushered in by the emergence of the COVID-19 virus and its related variants, African countries needed to encourage their populaces to be vaccinated and to also scale up their respective capacity to distribute vaccines to remote areas.

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Competing interests

Authors' contributions

G.M. and S.M. were responsible for the conceptualisation, methodology, formal analysis, the writing of original draft

and the review and editing of the final draft. D.F.M. was responsible for the conceptualisation, project administration, validation, resources, review and editing of the final draft and supervision of the project.

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Data availability

The data underlying this study are available on reasonable request from the corresponding author, G.M.

Disclaimer

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Appendix 1

TABLE 1-A1: Common Market for Eastern and Southern Africa countries covered in the study.
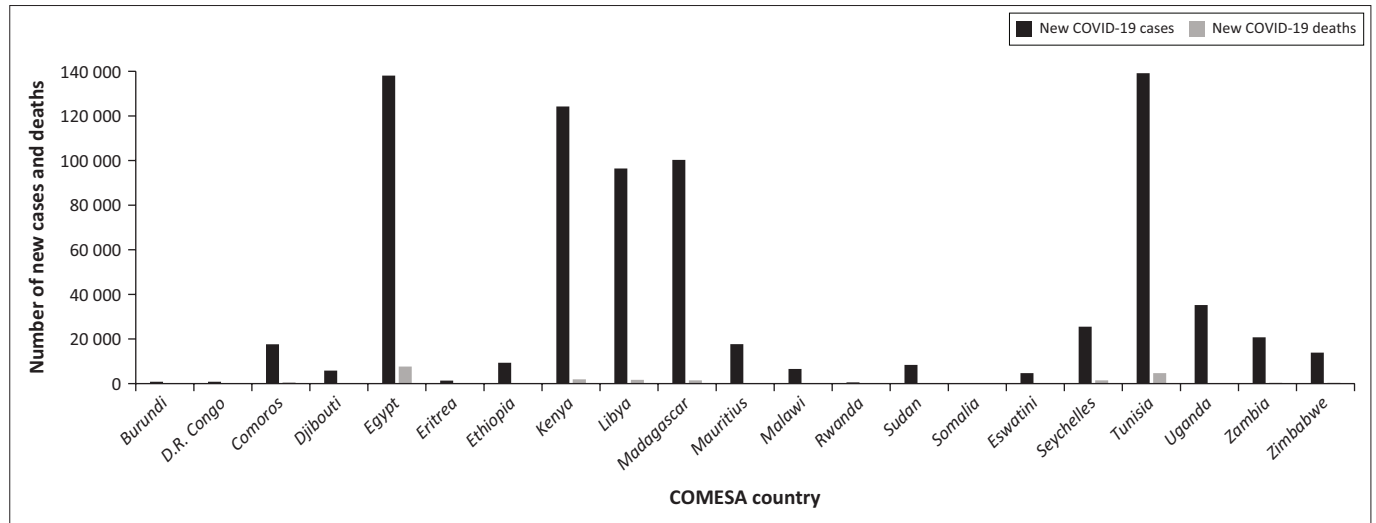
Importers

Burundi, Comoros, Democratic Republic of Congo, Egypt, Eswatini, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Seychelles, Uganda, Zambia and Zimbabwe.

Exporters

Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Eswatini, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Uganda, Zambia and Zimbabwe.
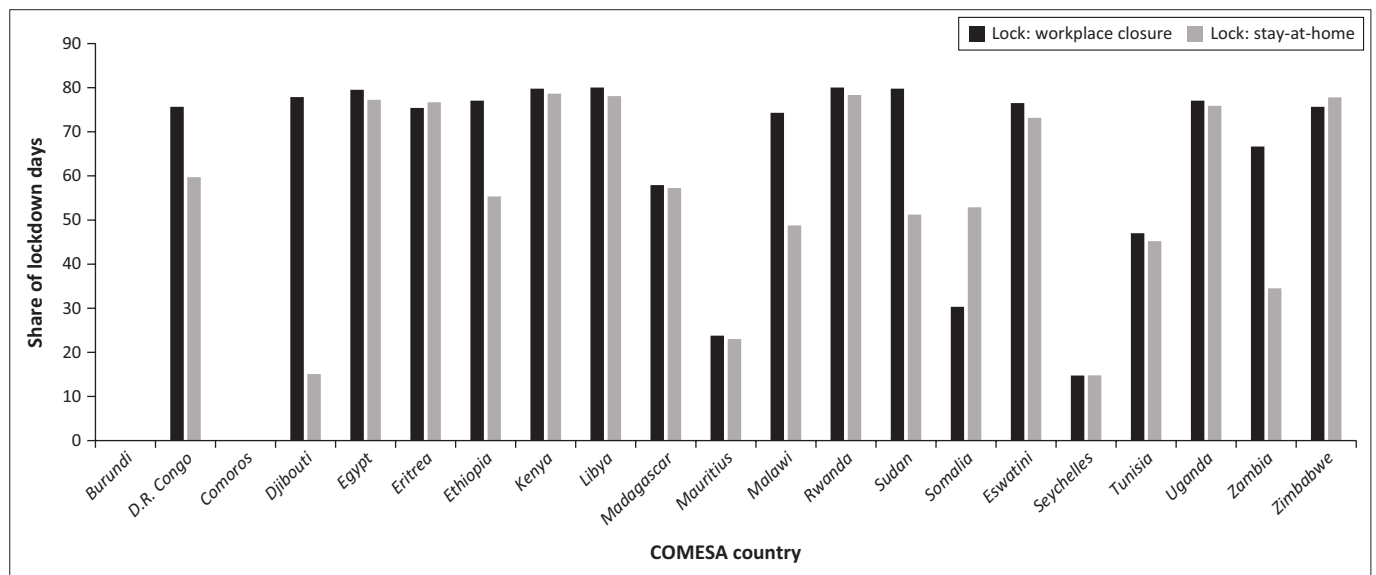
No import data reported for Djibouti, Eritrea, Libya, Rwanda, Somalia, Sudan and Tunisia.

Appendix 2

FIGURE 1-A2: Number of new coronavirus disease 2019 cases and deaths in Common Market for Eastern and Southern Africa during 2020.

'Lock: workplace closure' and Lock: stay-at-home denote the share of calendar dates with workplace-closing orders and stay-at-home orders in 2020, respectively.
FIGURE 2-A2: Share of lockdown days in Common Market for Eastern and Southern Africa during 2020 (%).

TABLE 1-A2: Growth in intra-Common Market for Eastern and Southern Africa trade between 2019 and 2020 (%).

Variable	Imports	Exports
Burundi	0.11	0.04
Comoros	0.02	-0.64
Democratic Republic of Congo	-0.05	0.35
Egypt	-0.39	-0.24
Eswatini	-0.20	-0.11
Ethiopia	0.07	-0.24
Kenya	-0.18	-0.01
Madagascar	-0.19	-0.37
Malawi	0.12	-0.25
Mauritius	-0.33	-0.17
Seychelles	-0.01	-0.86
Uganda	0.36	0.01
Zambia	-0.40	0.07
Zimbabwe	0.23	0.82

Source: Data retrieved from WB, 2020, *World Development Indicators*, viewed 10 December 2021, from https://databank.worldbank.org/source/world-development-indicators
Note: No data reported for Djibouti, Eritrea, Libya, Rwanda, Somalia, Sudan and Tunisia.

TABLE 2-A2: Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Imports	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(2) COV_lock_im	0.163	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-
(3) COV_lock_ex	0.104	-0.054	1.000	-	-	-	-	-	-	-	-	-	-	-	-
(4) LnCOV_cases_im	0.159	**0.812**	-0.057	1.000	-	-	-	-	-	-	-	-	-	-	-
(5) LnCOV_cases_ex	0.196	-0.052	**0.781**	-0.081	1.000	-	-	-	-	-	-	-	-	-	-
(6) LnCOV_death_im	0.132	**0.830**	-0.064	**0.965**	-0.078	1.000	-	-	-	-	-	-	-	-	-
(7) LnCOV_death_ex	0.212	-0.057	0.756	-0.088	**0.965**	-0.089	1.000	-	-	-	-	-	-	-	-
(8) C_border	0.285	-0.072	0.074	-0.015	0.082	-0.030	0.065	1.000	-	-	-	-	-	-	-
(9) C_language	0.045	0.048	0.051	-0.011	-0.025	-0.005	-0.026	0.080	1.000	-	-	-	-	-	-
(10) C_coloniser	0.179	0.114	0.062	-0.057	-0.065	-0.020	-0.028	0.016	0.491	1.000	-	-	-	-	-
(11) Land_im	0.009	0.073	0.025	0.148	-0.008	0.051	-0.005	0.006	0.057	0.028	1.000	-	-	-	-
(12) Land_ex	-0.038	-0.002	0.199	-0.029	0.152	-0.024	0.115	-0.021	0.111	0.065	-0.030	1.000	-	-	-
(13) LnDist	-0.194	0.059	0.019	-0.002	0.058	0.066	0.092	-0.524	-0.053	-0.007	-0.236	-0.274	1.000	-	-
(14) LnGDP_im	0.157	**0.702**	-0.057	0.875	-0.078	**0.887**	-0.090	-0.016	-0.021	-0.012	-0.017	-0.017	0.103	1.000	-
(15) LnGDP_ex	0.262	-0.069	0.646	-0.096	0.859	-0.095	**0.874**	0.063	-0.000	0.072	0.019	0.023	0.129	-0.118	1.000

Note: Bold figures indicate correlations considered to be high.