Journal of African Trade

An Empirical Analysis of the Impact of COVID-19 on Trade: Evidence from a Small Island African Economy
--Manuscript Draft--

Manuscript Number:	
Full Title:	An Empirical Analysis of the Impact of COVID-19 on Trade: Evidence from a Small Island African Economy
Article Type:	Research Article
Keywords:	COVID-19; Trade; Mauritius; Bayesian Structural Time Series
Corresponding Author:	Zameelah Khan Jaffur, Ph.D University of Mauritius Moka, MAURITIUS
Corresponding Author E-Mail:	zr.khanjaffur@gmail.com
Corresponding Author's Institution:	University of Mauritius
Other Authors:	Verena Tandrayen-Ragoobur, Ph.D
	Boopen Seetanah, Ph.D
Abstract:	This study investigates the potential impacts of the COVID-19 pandemic and related containment measures on the trade system of Mauritius for the period January 2020 to June 2021. As the pandemic spreads across the globe due to high interconnectedness across countries, stringent health containment measures in the form of restrictions on people and businesses have also been established by the authorities to slow the propagation of the virus. Being a small island economy highly dependent on international trade, Mauritius is facing the brunt of the pandemic which is disrupting its economic activities and trade flows with its main trading partners. COVID-19 incidence and lockdown measures have impacted both exports and imports in Mauritius. The analysis was conducted using monthly data and the Bayesian structural time-series framework for causal analysis, well-known for its feature in exploring the impacts of any intervention variable on time-series data. Our findings reveal that overall, the trade values for each trading partner have significantly decreased. The results also suggest that the stricter the containment measures, the bigger the size of the negative impact of the pandemic on the trade values for both imports and exports.
Suggested Reviewers:	
Opposed Reviewers:	

An Empirical Analysis of the Impact of COVID-19 on Trade: Evidence from a Small Island African Economy

Abstract

This study investigates the potential impacts of the COVID-19 pandemic and related containment measures on the trade system of Mauritius for the period January 2020 to June 2021. As the pandemic spreads across the globe due to high interconnectedness across countries, stringent health containment measures in the form of restrictions on people and businesses have also been established by the authorities to slow the propagation of the virus. Being a small island economy highly dependent on international trade, Mauritius is facing the brunt of the pandemic which is disrupting its economic activities and trade flows with its main trading partners. COVID-19 incidence and lockdown measures have impacted both exports and imports in Mauritius. The analysis was conducted using monthly data and the Bayesian structural time-series framework for causal analysis, well-known for its feature in exploring the impacts of any intervention variable on time-series data. Our findings reveal that overall, the trade values for each trading partner have significantly decreased. The results also suggest that the stricter the containment measures, the bigger the size of the negative impact of the pandemic on the trade values for both imports and exports.

Keywords: COVID-19, Trade, Mauritius, Bayesian Structural Time Series

1. Introduction

The COVID-19 pandemic is having massive consequences on the world economy, impacting communities, individuals, households, societies and varied economic sectors. Moving rapidly across borders, along the travel connections and transport corridors facilitated by globalisation and high interconnectedness across countries, the virus has spared no nation. Since the virus started to spread, with new variants being more dangerous and difficult to manage, the repercussions for development became apparent and more so for small developing nations which are highly vulnerable to shocks. The incidence of the COVID-19 pandemic along with containment measures have impacted countries' economic activities. Proceeding in waves, with countries succumbing and recovering at different times, the virus and its aftermath are likely to stay for some time. It is clear that in the midst of the pandemic, trade becomes a more valuable tool to ensure an undisrupted supply of essential products like medicines, vaccines and health equipment.

The pandemic has created disruptions on an unprecedented scale and uncovered the vulnerability of many countries; in particular small and developing economies. The evidence on the trade effects of the pandemic on small developing economies is rather scant. Existing writings have focussed mainly on developed or emerging economies or a sample of trading partners (Liu et al., 2021; Büchel et al.,2020; Minondo, 2021; Espitia et al., 2021). Small island economies are contingent on international trade and as such the COVID-19 burden is likely to be significant. Further little attention has been paid to the impacts of COVID-19 on trade for countries of different income levels (Barbero et al., 2021). For instance, the composition of trade costs (information, transport, and transaction costs) is more important for trade between high-, low- and middle-income economies while trade policy and regulatory differences better explain trade between low and middle-income economies (WTO, 2021). The impact of COVID-19 on trade may further differ across countries due to the composition of traded products. For example, products traded in high-income countries require higher skills, more embedded knowledge and tend to be more complicated than those in low- and middle-income economies (Minondo and Requena- Silvente, 2013). In addition, low-income countries present a lower share of jobs and activities that can be done at home so rendering them more sensitive to lockdowns and the effects of the virus (McMahon et al., 2020). The latter may also have a constrained and inappropriate health care system which makes them more vulnerable to the pandemic. Owing to these differences across countries, it becomes important to assess the

impact of COVID-19 on the trade structure of a small island economy like Mauritius which is highly dependent on international trade.

The purpose of this study is thus to assess the effects of the COVID-19 pandemic and related containment measures on the trade system of Mauritius. In this context, the main objectives of the present study are threefold: (1) to examine the overall impact of the COVID-pandemic, (2) to investigate its immediate impact, and (3) to identify the potential effects of different containment measures on the trade system of Mauritius. The Bayesian structural time-series (BSTS) framework, proposed by Brodersen et al. (2015), is employed. In line with the aim and objectives of this study, this technique is usually employed for examining the impact of any intervention variable (in our case the COVID-19 pandemic and related containment measures) on time series data. In other words, it outperforms other models for inferring causal impact. For our analysis, monthly 'total import' and 'total export' time-series data covering the period January 2010 to June 2021 (138 observations) are employed. This was further broken into five main time windows for deeper insights.

The paper is structured as follows. Section 2 reviews the existing literature on the impact of shocks on international trade by referring to recent studies analysing the effects of COVID-19 on exports and imports. Section 3 explains the data and sets out the methodology adopted. Section 4 discusses the findings, and we finally conclude in section 5.

2. Literature Review

The COVID-19 pandemic has had and is still having significant effects on international trade with disruptions in the economic activities of most countries around the globe. Amid the global impact of the pandemic on trade flows, the timing and the magnitude of these effects differ across countries. This heterogeneity in the impact results from the varied trade flows adjustments across nations. Nations differ in their trade structure, which depends on the import and export basket compositions, their exposure to global value chains, their varied policy responses such as import and export facilities and restrictions, domestic support packages and subsidies and measures adopted to contain the virus and improve their economic resilience against the pandemic (Comunale et al., 2021, Liu et al. 2021; Espitia et al. 2021; Baldwin and Tomiura, 2020; Evenett et al. 2020). Thus, the effects of the pandemic on international trade across nations will differ.

From a theoretical perspective, COVID-19 impacts significantly international trade via various channels. The transmission mechanism of the effects of the COVID-19 shocks can be

analysed in terms of demand, supply and global supply chains. The literature analysing the COVID-19 induced effects on trade can be classified as burgeoning but also currently inconclusive in many instances (Barbero et al., 2021). The effects on international trade originate from both demand and supply disruptions caused by health containment measures such as lockdowns, quarantines, and travel restrictions (UNCTAD, 2021). On the demand side, the most immediate trade effect of the novel coronavirus has been the sudden rise in the global demand for COVID-19 related medical supplies (McKibbin and Fernando, 2020), exceeding the present domestic production levels, hence resulting in an increase in import demand and as such leading to rising prices. However, pandemics also depress aggregate demand by reducing household spending. Decreased earnings and fewer visits to retail stores lead to a fall in demand. Further, increased business uncertainty about future demand depresses the business environment (Correia, Luck and Verner, 2020). In addition, declining trade flows may arise not only from a fall in consumption demand but maybe also more prolonged arising from distorted usual consumption patterns and market anomalies due to panic among consumers and firms as preferences for certain activities change with the outbreak (McKibbin and Fernando, 2020). Demand disruptions thus occur via macroeconomic declines in aggregate demand that is resulting from recessions but also from the wait and see purchase delays by consumers and the investment delays of enterprises (Baldwin and Freeman, 2020). Hence, the effect of the COVID-19 burden in an importing country is mainly due to decreased aggregate demand in that country.

On the supply side, the pandemic is affecting the health of workers and even causing deaths. This has led to reduced activity across all domestic economic sectors, including tradable sectors like manufacturing. Mortality and morbidity have led to the loss of a productive workforce and caused overall firm productivity to drop. Correia et al. (2020) noted that the Spanish flu depressed labour supply through self-isolation measures, restrictions on mobility, illness, and increased mortality, hence impacting on nations' supply capacity. A fall in total labour supply is often accompanied by an increase in the costs of production across sectors (McKibbin and Fernando, 2020). Moreover, the lower availability of workers may entail a lower demand for capital as firms need a combination of both labour and capital to produce goods and services (Maliszewska et al., 2020). A higher COVID-19 burden in an exporting country decreases its scale of production and as such reduced export supply. Exports will fall mainly across those industries and countries where remote operations are less feasible (Hayakawa and Mukunoki, 2020).

The international trade of a particular country may also be impacted by the COVID-19 burden in its neighbouring countries. For instance, falling exports from an affected country create an export opportunity for its neighbours whilst negative production shocks due to the pandemic in a country may reduce production in neighbouring countries via supply chain networks (Hayakawa and Mukunoki, 2020). As per Baldwin and Freeman (2020), the most important impact of the pandemic is the massive disruptions it has led to in international trade and global value chains (GVCs). The shocks to GVCs arise mainly because most economies are highly interconnected through globalisation. For instance, direct supply disruptions which started in East Asian economies which were the first hit by the novel coronavirus spread fast in other industrialised countries in different parts of the globe. Supply-chain contagion has amplified the direct supply shocks as manufacturing sectors in less affected regions find it either harder or more expensive to acquire the necessary imported industrial inputs from those countries most affected by the pandemic (Baldwin and Freeman, 2020). Balwin and Tomiura (2020) further argue that those sectors with large exposure to intermediate goods imports from China contracted more than other sectors. The decline in trade flows can also be viewed as a trade-induced effect caused by economic recessions (Maliszewska et al., 2020).

There are extensive empirical works on the impact of COVID-19 on trade (Liu et al., 2021). Though the common finding is that the pandemic is negatively affecting international trade flows, results vary across studies due to differences in the empirical approach, the methodology adopted, the level of aggregation, the types of goods being analysed and the data coverage (Lui et al., 2021). The existing studies on the COVID-19 induced effects on trade tend to be inconclusive and vary across sectors. Specific country studies like Büchel et al. (2020) for Switzerland observe that during the lockdown, Swiss trade fell by 11% compared to the same period of 2019 with a contraction in exports which was correlated with the number of COVID-19 cases in importing countries and at the same time the fall in Swiss imports was associated with the stringency measures set by the government in the exporter country. In terms of products, only pharmaceutical and chemical products remained resilient to the trade shock. Similar results have been obtained by Liu et al. (2021) for China when using a gravity model, they note that COVID-19 has a significant negative effect on trade and the impact is lessened for medical goods and products that involve working from home. Further, De Lucio et al. (2020) note that stringency measures put in place at the destination countries reduced Spanish exports while imports were not highly negatively impacted. Minondo (2021) builds on the above study to show that COVID-19 led to a more distinct decline in trade in services as the

tourism sector is a major contributor to the Spanish economy. Moreover, Liu et al. (2020) assess the impact of COVID-19 incidence and lockdown measures on the monthly growth rate of China's imports from 2019 to 2020. Their results indicate that the direct effects of the COVID-19 incidence measured by the number of deaths per capita, and COVID-19 induced government measures, computed by the stringency index of lockdowns are negative. This indicates that the negative own-demand effect on countries' imports from China prevails over the negative own supply effect. Government measures to curb economic activities had a larger impact on China's imports than the direct health and behavioural effects of the pandemic. In contrast, though average lockdowns in third countries do not appear to affect a nation's imports from China, the direct effects of the pandemic in third countries impact trade. In effect, more deaths in the main trading partners of a nation (non-China) cause that country to import more from China than it otherwise would. The positive effects of COVID-19 incidence in the main trading partners more than offsets the own negative pandemic incidence effect.

Other studies assessed the impact of COVID-19 on trade across a sample of countries. For instance, Kejzar and Velic (2020) analyse the role of chain forward linkages in the transmission of COVID-19 pandemic across EU member states. Applying the gravity model to monthly bilateral trade data, their results reveal that the spread of the virus together with containment measures imposed by the authorities led to a decline in demand causing a labour supply shortage and a halt in production. Espitia et al. (2021) further assess the impact of the novel coronavirus on trade across 28 countries and their most important trade partners. There is evidence that COVID-19 has reduced sectoral trade growth by decreasing countries' participation in the global value chains. Along the same line, Verschuur et al. (2021) use a larger sample of 35 reporting countries and 250 partner training nations and find a negative impact of COVID-19 stringency measures on exports of medical goods. Moreover, Barbero et al. (2021) examine the effects of the pandemic on bilateral trade flows using the gravity model and monthly trade data of 68 countries exporting across 222 destinations. Their findings show that the negative impact of the pandemic on bilateral trade is more pronounced for those nations which were members of regional trade agreements before the outbreak of the coronavirus. Their study also reveals that there is a significant negative impact of COVID-19 on trade when indicators related to governmental actions are included. There is further evidence that the negative trade effects are more intense when exporter and importer countries share identical income levels. The highest negative effects are noted for exports between high-income economies. Hence a country having the highest level of COVID-19 deaths per thousand people

in a month will experience a fall of the order of 13% from China in that month. Likewise, moving from no lockdowns to the maximum level of stringency index will generate a fall of 17.6% in imports from China. Lastly, Khorana et al. (2021) assess the impact of COVID-19 on trade among Commonwealth countries and find that a rise in the number of COVID-19 cases in low-income economies reduced Commonwealth exports while a similar scenario in high-income economies increased their export flows.

3. Methodology and Data

3.1 Model

Understanding the size and direction of the impact of an event and the effects of related policies remain a key ingredient of research and practice. This not only forms the basis of strategic decision-making but also helps in the development of appropriate policies and enhancement of existing ones to curb the impact. In line with recent advancements on the analysis of the influence of a certain intervention variable (see Scott and Varian, 2014; Brodersen et al., 2015) on a specific time series and previous studies (see Soto-Valero and Pic, 2019; Takyi and Bentum-Ennin, 2021; Campedelli et al., 2021; Perles-Ribes et al., 2021), this study employed the Bayesian structural time series framework, proposed by Brodersen et al. (2015), to investigate the potential impact of the COVID-19 pandemic and related containment measures on the trade system of Mauritius. The latter was implemented using the CausalImpact R-package (R Core Team, 2020). The model can be specified in terms of these two equations:

$$y_t = Z_t^T \alpha_t + \varepsilon_t \tag{1}$$

$$\alpha_{t+1} = T_t \alpha_t + R_t \eta_t \tag{2}$$

where y_t is a scalar observation, Z_t a d-dimensional output vector, T_t is a $d \times d$ transition matrix, R_t is a $d \times q$ control matrix, $\varepsilon_t \sim N(0, \sigma_t^2)$ is a scalar observation error with noise variance σ_t and $\eta_t \sim N(0, Q_t)$ is a q-dimensional system error with a $q \times q$ state-diffusion matrix Q_t, where $q \leq d$ and is independent of all unknowns. Equation (1) is the observation equation whereby the observed data y_t is linked to a latent d-dimensional state vector α_t whereas Equation (2) refers to the state equation, which governs the dynamic change of the state vector α_t over time (Brodersen et al., 2015).

The above equations estimate the difference between the observed time series of the response variable (in our case the trade values) and a simulated time series that would have occurred without the intervention variable (in our case the outbreak of the COVID-19 pandemic) during the post-intervention period (in our case post-COVID-19 period). It works

7

as follows: first, the observed data in the pre-intervention period are simulated, counterfactual scenarios are then used to create the predictions of the observed data for the post-intervention period and finally, the model provides the difference between the predicted values and the observed ones during the post-intervention period[1]. This is then interpreted as the causal impact of the occurrence of the intervention variable on the observed data.

Structural time series models are more useful in practice as compared to traditional univariate models. The Bayesian framework allows flexibility and inferential power, enabling the method to effectively capture important features of the data and as such, provides appropriate estimates of the cummulative difference between the actual data and a counterfactual scenario. It also controls the risk of excluding relevant patterns that may not be specifically related to the intervention variable and avoid the risk of ignoring long-term dynamics (Campedelli et al., 2021). Moreover, Bayesian structural time series models outperform intervention analysis based on univariate models; they enable the creation of counterfactual predictions by constructing a synthetic control based on a combination of markets that have not been treated (Perles-Ribes et al., 2021).

3.2 Data

The empirical analysis was undertaken using monthly imports and exports trade values (in US$) for the period January 2010 to June 2021 for the top ten trading partners of the country[2]. Based on the country's import and export partner shares for 2019, these countries include Belgium, China, France, Germany, Italy, Japan, South Africa, Spain, United Kingdom and United States of America (see Appendix Table A1). Data were collected from the International Trade Statistics Database of UN Comtrade (UN Comtrade, 2021). Summary statistics for the sample of countries considered are reported in Table A2 of the Appendix.

The time-series data were split into two, namely pre-COVID-19 (January 2010-December 2019) and post-COVID-19 (January 2020-June 2021) periods for all countries. The post-intervention period, in our case post-COVID-19 period, was further broken into five time windows to examine the overall impact of the COVID-19 pandemic (January 2020-June 2021), its immediate effect (January 2020-March 2020) and the influence of containment measures implemented at different time intervals on the trade values. Table 1 displays the date for each time window together with the different measures implemented.

Table 1. Time windows and measures implemented

Period	Measures implemented
January 2020-March 2020	First national lockdown as from 20 March 2020; Closure of national borders as from 19 March 2020; planes were grounded
January 2020-May 2020	Global lockdown in April 2020; planes grounded worldwide
January 2020-February 2021	Resumption of cargo/commercial flights as from 06 May 2020
January 2020-April 2021	Second national lockdown as from 10 March 2021; National borders were again closed and cargo/commercial flights were suspended until 15 July 2021

It can be observed from Figures A1-A2 of the Appendix that the series of both the imports and exports trade values departed from their original trends shortly after the outbreak of the pandemic was first declared in December 2019 in China: an overall decline can be seen. A closer look shows that exports were the most affected with the largest dip in April 2020 following national and global lockdowns. As for the import series, the latter varies according to the country of investigation due to the measures implemented for these countries. A question that arises here is whether these declines were due to the pandemic or global trade wars and uncertainties. For instance, in 2019, the container throughput index, an important indicator of global trade, experienced a fall reaching 134.1 in December 2019 (ISL, 2021). Similarly, during the same year, global air freight volumes registered negative growth (-3.3%), the first since 2012 and the slowest since the global financial crisis in 2009 (IATA, 2020).

4. Results and Discussion

This section presents the results obtained using the methodology proposed by Brodersen et al. (2015). As mentioned previously, the model was applied at different time windows; the first capturing the overall effect of the pandemic (January 2020-June 2021), the second consisting of the first three months following the outbreak of the pandemic in China (January 2020-March 2020) to assess the immediate impact of the pandemic and the remaining windows to examine the effects of the containment measures implemented at different time intervals: January 2020-May 2020, January 2020-February 2021, January 2020-April 2021. For each trading partner, the same analytical structure is provided: the overall impact is first reported, followed by the immediate impact and the effects of the containment measures. In this study, only the cummulative effects for the different time intervals are discussed. Table 2 provides a breakdown of the results according to the ten main trading partners investigated. A quick at the results show that imports to Belgium were the most affected, recording an overall decrease of

32% for the whole post-COVID-19 period (January 2020-June 2021) while exports towards France was the most impacted with an overall decline of 46% for the same period.

For both Belgium and China, it can be observed that only imports trade values were negatively affected by the pandemic and the containment measures implemented. For the overall period of investigation, imports from Belgium decreased by 32% while that of China by 17%. Nevertheless, these negative effects were not apparent for the first three months following the outbreak of the pandemic (January 2020-March 2020). It can be seen that the imports trade values from Belgium continued to fall reaching a minimum of -36% when the country enforced a second lockdown. As for China, the latter decreased by 19%, the lowest in the post-intervention period, in the third time window (January 2020-May 2020) before starting to slightly increase in the subsequent periods. This is because Mauritius restricted imports of live animals and fish from China, Italy and other European countries from 16 March 2020 to 03 June 2020 in an attempt to contain the spread of the virus.

Moreover, during the whole post-COVID-19 period, both the imports trade values and exports trade values of France experienced a fall: ranging from -29% to -23% for imports and -68% to -46% for exports. It can be seen that exports towards France were the most affected. The trade values plummeted the most during the third time window (January 2020-May 2020) due to the introduction of a global lockdown in addition to the ongoing national lockdown to curb the transmission of the virus worldwide. Subsequently, the trade values began to rise after the relaxation of containment measures.

Regarding Germany, it can be seen that the containment measures did not have any significant effect on its imports trade values. However, the cummulative relative effects depict a negative relationship between the pandemic and its exports trade values. For the whole post-COVID-19, this amounted to a decrease of 26% in exports trade values towards Germany. In the first time window, the latter was negative and significant; indicating that within the first three months following the outbreak of the pandemic, exports trade values decreased by 27%. This value decreased further to -44% during the third time window due to the global lockdown and national lockdown. The latter started to increase after the relaxation of the containment measures, whereby the national and global lockdowns were removed. Nevertheless, this again plunged by 1% in the following time window due to the imposition of a second national lockdown.

Similarly, it can be observed that exports from Italy were mostly affected by the pandemic as compared to its imports. The cummulative relative effects range from -43% to -30%. During the period January 2020 to June 2021, the exports trade values in Italy encountered an overall decrease of 33%. The global lockdown together with the national lockdown caused the latter to experience a sharp dip of -43%. The latter increased to -26% in the fourth time window (January 2020-February 2021) after the removal of the global and national lockdowns whereby cargo and commercial flights started operation from 06 May 2020. Nevertheless, the introduction of a second national lockdown in March 2021 and April 2021 due to a resurgence of local cases caused a further reduction of 4% in the exports trade values in the fifth time window. Surprisingly, it was found that despite the relaxation of containment measures in the fourth time window, the imports trade values from Italy encountered an overall decrease of 10%. One potential explanation is the restrictions imposed by Mauritius for imports of live animals and fish from the country.

Table 2. Relative cumulative effect per country

Trade Type	[1]	[2]	[3]	[4]	[5]
Belgium					
Imports	-32%*** (9.5%) [-51%, -13%] 99.95%	-17% (14%) [-43%, 11%] 89%	-34%*** (12%) [-56%, -11%] 99.78%	-34%*** (9.5%) [-53%, -15%] 99.95%	-36%*** (9.5%) [-55%, -17%] 99.98%
Exports	15% (23%) [-29%, 60%] 75%	2.3% (31%) [-56%, 65%] 57%	-23% (25%) [-70%, 25%] 82%	20% (23%) [-25%, 66%] 81%	18% (23%) [-27%, 63%] 79%
China					
Imports	-17%*** (4.5%) [-25%, -7.9%] 99.94%	-13% (11%) [-35%, 9.5%] 87%	-19%** (8.1%) [-35%, -3%] 99.02%	-16%** (4.9%) [-25%, -6.3%] 99.88%	-15** (4.7%) [-24%, -5.7%] 99.84%
Exports	-3.5% (21%) [-45%, 39%] 56%	29% (54%) [-77%, 137%] 71%	19% (43%) [-66%, 104%] 67%	-1.8% (23%) [-47%, 44%] 53%	0.5% (23%) [-44%, 45%] 52%
France					
Imports	-24%*** (4.6%) [-33%, -15%] 99.98%	-23%** (11%) [-45%, -1.8%] 98.23%	-29%*** (8.3%) [-46%, -13%] 99.92%	-24%*** (5.1%) [-34%, -14%] 99.98%	-23%*** (4.8%) [-33%, -14%] 99.98%
Exports	-46%*** (6%) [-58%, -35%] 99.98%	-58%*** (14%) [-85%, -32%] 99.98%	-68%*** (9.9%) [-87%, -48%] 99.98%	-48%*** (6.6%) [-61%, -35%] 99.98%	-47%*** (6.2%) [-59%, -35%] 99.98%
Germany					
Imports	-0.53% (5.3%) [-11%, 9.7%] 55%	16% (13%) [-8.4%, 41%] 90%	2.3% (9.6%) [-17%, 21%] 58%	1.2% (5.8%) [-10%, 12%] 57%	0.95% (5.6%) [-9.9%, 12%] 56%
Exports	-26%** (8.6%) [-43%, -9.7%] 99.86%	-27% (20%) [-68%, 13%] 92%	-44%*** (15%) [-74%, -15%] 99.90%	-23%** (9.7%) [-42%, -4.1%] 99.14%	-24%** (9.1%) [-42%, -6.9%] 99.68%
Italy					
Imports	-6.7% (4.7%) [-16%, 2.7%] 92%	-3.6% (12%) [-27%, 20%] 62%	-11% (8.4%) [-27%, 5.7%] 90%	-10%* (5.1%) [-20%, -0.1%] 97.61%	-6% (4.9%) [-15%, 4.1%] 89%
Exports	-33%*** (9.4%)	-34% (22%)	-43%* (16%)	-26%** (11%)	-30%* (10%)

	[1]	[2]	[3]	[4]	[5]
	[-52%,-15%]	[-77%, 8.6%]	[-75%, -12%]	[-47%, -5%]	[-49%, -10%]
	99.96%	*94%*	*99.63%*	*99.17%*	*99.80%*
Japan					
Imports	-14%** (5.9%)	4.1% (14%)	-14% (11%)	-15 (6.7%)	-13%* (6.2%)
	[-26%, -2.5%]	[-24%, 33%]	[-34%, 8.2%]	[-28%, -1.4%]	[-25%, -0.3%]
	99.19%	*61%*	*89%*	*93.40%*	*97.83%*
Exports	-35%* (18%)	90%* (46%)	39% (38%)	-28% (20%)	-31%* (19%)
	[-71%, -0.28%]	[-0.87%, 178%]	[-37%, 113%]	[-67%, 10%]	[-70%, 5%]
	97.54%	*97.30%*	*85%*	*93%*	*95.58%*
South Africa					
Imports	-12%* (5.9%)	-6.6% (14%)	-22%* (11%)	-19%** (6.5%)	-15%** (6.2%)
	[-23%, 0.15%]	[-34%, 21%]	[-42%, -0.57%]	[-31%, -5.8%]	[-27%, -2.8%]
	97.30%	*68%*	*97.76%*	*99.72%*	*99%*
Exports	3.3% (5.8%)	-6.2% (14%)	-34%** (11%)	-1.3% (6.3%)	0.43% (6%)
	[-8.1%, 14%]	[-34%, 21%]	[-56%, -12%]	[-14%, 11%]	[-11%, 12%]
	72%	*69%*	*99.84%*	*58%*	*53%*
Spain					
Imports	-11% (12%)	57%* (31%)	21% (23%)	-5% (13%)	-5.6% (12%)
	[-32%, 13%]	[-1.8%, 118%]	[-24%, 66%]	[-30%, 21%]	[-29%, 19%]
	82%	*97.06%*	*82%*	*65%*	*67%*
Exports	-26%** (8.4%)	-11% (20%)	-30%* (15%)	-28%** (9.2%)	-28%* (8.8%)
	[-43%, -9.7%]	[-51%, 27%]	[-59%, -1.2%]	[-46%, -9.6%]	[-45%, -11%]
	99.82%	*72%*	*97.89%*	*99.82%*	*99.84%*
United Kingdom					
Imports	-26%*** (7.9%)	-12% (20%)	-16% (15%)	-29%*** (8.6%)	-28%*** (8.2%)
	[-42%, -11%]	[-50%, 28%]	[-44%, 14%]	[-46%, -12%]	[-44%, -12%]
	99.94%	*72%*	*86%*	*99.94%*	*99.94%*
Exports	-22%** (9.2%)	-19% (14%)	-36%*** (11%)	-22%** (9.1%)	-25%** (9.1%)
	[-40%, -4.1%]	[-46%, 8.1%]	[-58%, -14%]	[-40%, -3.8%]	[-42%, -6.7%]
	99.03%	*92%*	*99.94%*	*99.13%*	*99.55%*
United States of America					
Imports	-28%** (10%)	-0.66% (25%)	-28% (18%)	-32%*** (11%)	-28%** (11%)
	[-47%, -7.8%]	[-51%, 48%]	[-63%, 7.3%]	[-54%, -10%]	[-49%, -7.1%]
	99.57%	*51%*	*94%*	*99.78%*	*99.43%*
Exports	-39%*** (5.6%)	-20% (14%)	-42%*** (11%)	-39%*** (6.2%)	-38%*** (6%)
	[-50%, -28%]	[-47%, 8.1%]	[-63%, -21%]	[-51%, -27%]	[-50%, -27%]
	99.98%	*92%*	*99.96%*	*99.98%*	*99.98%*

Notes: The values in the parentheses are standard deviations, those in the brackets show the 95% confidence interval while those in italics represent the posterior probability of a causal effect. [1]: whole post-intervention period (January 2020-June 2021), [2]: first post-intervention window (January 2020-March 2020), [3]: second post-intervention window (January 2020-May 2020), [4]: third post-intervention window (January 2020-February 2021), [5]: fourth post-intervention window (January 2020-April 2021); ***, **, * indicate significance at the 5%, 1% and 0.1% respectively.

For the specific case of Japan, it can be observed that the introduction of the global lockdown and the first national lockdown did not influence imports and exports. For the whole post-COVID-19 period, imports trade values decreased by 14% while exports trade values by 35%. One unanticipated finding was that the exports trade values towards Japan climbed to 90% during the first time window of our analysis. This could be explained by the high supply of frozen fish which amounted to a total of $10,787,823 for the said period. It can also be seen here that the introduction of the second national lockdown harmed both imports and exports; resulting in a decrease of 13% and 31% in total trade values for both imports and exports respectively.

Concerning South Africa, it has been found that the imports trade values were the most affected by the pandemic: a relative decrease of 22% to 15%. For the whole post-intervention period, this was about 12%. A closer look at the effects of the different containment measures on the trade values indicate that both the exports trade values and imports trade values of the country were disturbed during the introduction of the global lockdown; a decrease of 22% can be observed for imports and 34% for exports. The imports trade values started to climb up as soon as the containment measures were less strict in the fourth and fifth time window.

Furthermore, for Spain, it can be seen that the pandemic influenced more the exports trade values as compared to that of imports. The imports trade values were only found to be impacted during the second time window. In particular, a positive and significant impact of 57% was recorded, thereby suggesting an increase in the demand for imports from Spain for the first three months following the outbreak of the pandemic. As for the exports trade values, the relative effects varied from -30% to -26%. For the period January 2020-June 2021, a decrease of 26% was found for the exports trade values of the respective. Exports from Spain experienced the greatest dip (-30%) as a result of the global lockdown. Again here, it can be observed that the relaxation of containment measures, where cargo and commercial flights were allowed, led to an increase of 2% in the exports trade values.

Conversely, it can be observed that for the United Kingdom, the pandemic and related containment measures have impacted the trade values. In contrast to the exports trade values, imports were the most affected with a decrease of 26% for the whole investigation period (January 2020-June 2021) compared to a 22% decline for exports. The global lockdown has led to a sharp reduction of 36% in exports trade values emanating from the United Kingdom. This was also the case during the enforcement of the second national lockdown whereby a decline of 25% was noted. Again here, it can be seen that despite that cargo and commercial flights were allowed to operate, the imports trade values experienced the largest decline (-29%) in the fourth time window (January 2020-February 2021). One possible explanation resides in the depreciation of the country's currency; whereby the latter registered the highest depreciation in its currency during that period. This undoubtedly made importers less reluctant to trade.

Likewise, imports and exports with the respect to the United States of America were also reduced during the whole post-COVID-19 period (January 2020-June 2021). The pandemic caused a respective decline of 28% and 39% in imports and exports trade values. Zooming to the impact of the global lockdown, it can be seen that the latter only impacted the

exports trade values whereby the latter decreased further by 42% during the third time window. As for the remaining time windows, it can be deduced that the introduction of less strict measures led to a slight increase in both imports and exports trade values.

5. Conclusion

The paper analysed the impacts of the COVID-19 pandemic and different containment measures on Mauritian exports and imports. A quick look at the graphs of both the imports and exports trade series depicted clear evidence that the outbreak of the COVID-19 pandemic caused a decrease in the trade values of most trading partners: a departure from their original trends can be observed in most cases. The post-COVID-19 period (January 2020-June 2021) was subsequently broken into five time windows to examine: (i) the overall impact of the pandemic, (ii) its immediate effect, and (iii) the effects of the containment measures applied at different time intervals. The estimations and analysis were conducted using the Bayesian structural time series model, proposed by Brodersen et al. (2015). We found that for the whole post-COVID-19 period (January 2020-June 2021), overall the trade values encountered a reduction. The immediate impacts were only apparent for four out of the ten trading partners considered (France, Germany, Japan and Spain). It is worth noting that the trade values were much hindered with the introduction of the national and global lockdowns whereby commercial planes were suspended and planes were grounded in some countries. The results also show that on the whole, the relaxation of the containment measures, with the re-opening of borders and operation of commercial flights, helped to curb these negative impacts. The findings thus confirm the vulnerability of small island economies to the spread of the novel coronavirus and the restraint measures put in place to contain the virus. While the pandemic may be far from over, it has become clear that transforming global approaches to trade and development cannot be avoided when charting a sustainable course to recovery from the pandemic (UNCTAD, 2021).

The importance of trade for a small island economy like Mauritius is undeniable. The short-term response of trade recovery strategies must focus on strengthening important sectors that continue to grow despite global value chain breakdowns. These sectors include agriculture and food processing, health, pharmaceutical, sanitary industries, and information and communications technology. Likewise, support functions necessary for these sectors, such as transport, logistics management and e-commerce need to be further reinforced. To strengthen existing sectors despite the uncertainty created because of the pandemic, it is vital to identify

tailor-made solutions for enterprises to enable them to navigate trade disturbances such as uncertain trade relations and shifts in production capacity, amongst others.

Trade promotion is an important aspect (with the use of digital marketing and online networking, amongst others) to focus on. Supporting digitalisation of traditional value chains for enhanced quality, traceability and compliance will help the trade sector. To strengthen the resilience of exporters, it is critical to identify and plan for a sound business environment, especially competition, access to finance, trade facilitation and international logistics for businesses. This will help firms facing difficulties to adopt agile management practices and connect to digital platforms and go global through e-commerce.

Notes

1. The pre-intervention period is the period from the first data point to the one just before the outbreak of the pandemic was first declared (i.e. up until December 2019); The post-intervention period considers data from January 2020 to June 2021.

2. Despite that our sample size is relatively small, it is adapted to the recommendations of Brodersen (2016) on the application of Bayesian structural time-series (BSTS) models for causal analysis, which stipulates that the length of the pre-intervention period should be approximately two or three times that of the post-intervention period whenever the impact of an intervention variable (in our case the outbreak of the COVID-19 pandemic) is examined on another variable.

References

[1] A. Espitia, A. Mattoo, N. Rocha, M. Ruta, D. Winkler. Pandemic trade: COVID- 19, remote work and global value chains. The World Economy, 2021.

[2] A. Minondo, F. Requena- Silvente. Does complexity explain the structure of trade?. Canadian Journal of Economics/Revue canadienne d'économique, 2013, Volume 46(3), 928-955.

[3] A. Minondo. Impact of COVID-19 on the trade of goods and services in Spain. Applied Economic Analysis, 2021.

[4] C. Soto-Valero, M. Pic. Assessing the causal impact of the 3-point per victory scoring system in the competitive balance of LaLiga. International Journal of Computer Science in Sport, 2019, Volume 18(3), 69-88.

[5] D. E. McMahon, G. A. Peters, L. C. Ivers, E. E. Freeman. Global resource shortages during COVID-19: Bad news for low-income countries. PLoS neglected tropical diseases, 2020, Volume 14(7), e0008412.

[6] DCDM Research, Report on Impact of Covid-19 on Businesses in Mauritius [Internet], 2020. Available from: https://www.businessmauritius.org/wp-content/uploads/2020/12/BM_Report-on-Impact-of-COVID-19-on-Businesses_Dec-2020.pdf [Accessed 21 January 2021].

[7] G. M. Campedelli, A. Aziani, A., S. Favarin. Exploring the immediate effects of COVID-19 containment policies on crime: an empirical analysis of the short-term aftermath in Los Angeles. American Journal of Criminal Justice, 2021, Volume 46(5), 704-727.

[8] IATA (International Air Transport Association), Infographic: Economics Air freight Demand 2019 [Internet], 2020. Available from: https://www.iata.org/en/publications/ [Accessed 10 November 2021].

[9] ISL (Institute of Shipping Economics and Logistics), RWI/ISL Container Throughput Index, 2021. Available at: https://www.isl.org/en/containerindex [Accessed 10 November 2021].

[10] J. Barbero, J., J. J. de Lucio, E. Rodríguez-Crespo. Effects of COVID-19 on trade flows: Measuring their impact through government policy responses. PloS one, 2021, Volume 16(10), e0258356.

[11] J. F. Perles-Ribes, A. B. Ramón-Rodríguez, M. Jesús-Such-Devesa, P. Aranda-Cuéllar. The Immediate Impact of Covid19 on Tourism Employment in Spain: Debunking the Myth of Job Precariousness?. Tourism Planning & Development, 2021, 1-11.

[12] J. Verschuur, E.E. Koks, J.W. Hall. Global economic impacts of COVID-19 lockdown measures stand out in high-frequency shipping data. PloS one, 16(4), e0248818.

[13] K. Brodersen, How long should the period be? [Internet], 2016. Available from: https://stats.stackexchange.co/questions/128775/is-it-okay-to-run-causalimpact-in-r-on-successive-portions-of-a-time-series [Accessed 15 October 2019].

[14] K. Büchel, S. Legge, V. Pochon, P. Wegmüller. Swiss trade during the COVID-19 pandemic: an early appraisal. Swiss journal of economics and statistics, 2020, Volume 156(1), 1-15.

[15] K. Hayakawa, H. Mukunoki. Impacts of COVID- 19 on global value chains. The Developing Economies, 2021, Volume 59(2), 154-177.

[16] K. Z. Kejzar, A. Velic. Covid-19, trade collapse and GVC linkages: European experience. Covid Economics, 2020, Volume 61, 219-240.

[17] K.H. Brodersen, F. Gallusser, J. Koehler, N. Remy, S.L. Scott. Inferring causal impact using Bayesian structural time-series models. The Annals of Applied Statistics, 2015, Volume 9(1), 247-274.

[18] M. Comunale, J. Dainauskas, P. Lastauskas. What explains excess trade persistence? A theory of habits in the supply chains, 2021.

[19] M. Maliszewska, A. Mattoo, D. Van Der Mensbrugghe. The potential impact of COVID-19 on GDP and trade: A preliminary assessment. World Bank Policy Research Working Paper, 2020, (9211).

[20] P. O. Takyi, I. Bentum-Ennin. The impact of COVID-19 on stock market performance in Africa: A Bayesian structural time series approach. Journal of Economics and Business, 2021, 115, p.105968.

[21] R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, 2020.

[22] R. Baldwin, E. Tomiura. Thinking ahead about the trade impact of COVID-19. Economics in the Time of COVID-19, 2020, *59*.

[23] R. Baldwin, R. Freeman. Trade conflict in the age of Covid-19. 2021, *VoxEU. org*.

[24] R.J. Hyndman, Y. Khandakar, Automatic time series forecasting: The forecast package for R. Journal of Statistical Software, 2008, Volume 26(3), 1-22.

[25] Report on Impact of Covid-19 on Businesses in Mauritius

[26] S. Correia, S. Luck, E. Verner. Fight the pandemic, save the economy: Lessons from the 1918 flu. Federal Reserve Bank of New York, 2020, 5.

[27] S. Evenett, M. Fiorini, J. Fritz, B. Hoekman, P. Lukaszuk, N. Rocha, A. Shingal. Trade policy responses to the COVID- 19 pandemic crisis: Evidence from a new data set. The World Economy, 2021

[28] S. Khorana, I. Martínez-Zarzoso, S. Ali. The Impact of COVID-19 on the Global and Intra-Commonwealth Trade in Goods. International Trade Working Paper 2021/08. London: Commonwealth Secretariat, 2021.

[29] S. L. Scott, H.R. Varian. Predicting the present with Bayesian structural time series. International Journal of Mathematical Modelling and Numerical Optimisation, 2014, Volume 5(1-2), 4-23.

[30] Statistics Mauritius, National Accounts Estimates [Internet], 2020. Available from: https://statsmauritius.govmu.org/Slider/SitePages/NAE_Dec20.aspx [Accessed 21 January 2021].

[31] UN Comtrade, UN Comtrade International Trade Statistics [dataset], United Nations [distributor], Geneva (Switzerland), 2021. Available from: https://comtrade.un.org/ [Accessed 01 November 2021].

[32] W. McKibbin, R. Fernando. The economic impact of COVID-19. Economics in the Time of COVID-19, 2020, 45(10.1162).

[33] WITS (World Integrated Trade Solution), Trade Statistics by Country [internet], 2021. Available from: https://wits.worldbank.org/countrystats.aspx?lang=en [Accessed 10 November 2021].

[34] World Bank, Mauritius [Internet], 2020. Available from: http://pubdocs.worldbank.org/en/794311492188165385/mpo-mus.pdf [Accessed 21 January 2021].

[35] World Trade Organisation (WTO), Trade shows signs of rebound from COVID-19, recovery still uncertain [Internet], 2020. Available from: https://www.wto.org/english/news_e/pres20_e/pr862_e.htm [Accessed 21 January 2021].

[36] WTO, Trade Cost Index: Evolution, Incidence and Determinants: Background Note, 2021. Geneva: World Trade Organisation.

[37] Y. Liu, Q. Cui, Y. Liu, J. Zhang, M. Zhou, T. Ali, X. Li. Countermeasures against economic crisis from COVID-19 pandemic in China: An analysis of effectiveness and trade-offs. Structural Change and Economic Dynamics, 2021, Volume 59, 482-495.

Appendix

Table A3. Trade Partner Share (%)

Country/Year	Export					Import				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Belgium	1.92	1.46	1.17	1.51	1.5	0.73	0.88	1.5	2.17	2.03
China	0.77	2.07	1.31	1.73	1.71	18.23	17.71	16.4	16.51	16.69
France	11.88	14.79	15.82	14	12.65	7.15	7.85	8.02	8.2	7.01
Germany	1.12	1.65	2	2.28	2.08	2.4	3.09	2.68	2.83	2.99
Italy	5.43	7.14	6.88	4.59	5.47	2.14	2.27	2.24	2.26	2.34
Japan	1.12	1.31	1.2	1.12	1.81	2.45	3.1	3.34	3.11	3.09
South Africa	8.64	8.13	8.93	10.97	10.44	6.46	7.49	8.51	9.23	8.07
Spain	4.35	4.48	5.58	5.19	4.41	2.98	2.98	3.23	2	3.12
United Kingdom	13.1	12.01	11.8	11.28	11.13	2.19	2.17	2.11	2.21	3.02
United States of America	10.63	11.19	11.2	11.95	10.75	1.66	2.12	2.38	2.43	2.07

Source: WITS (2021)

Table A2. Descriptive Statistics

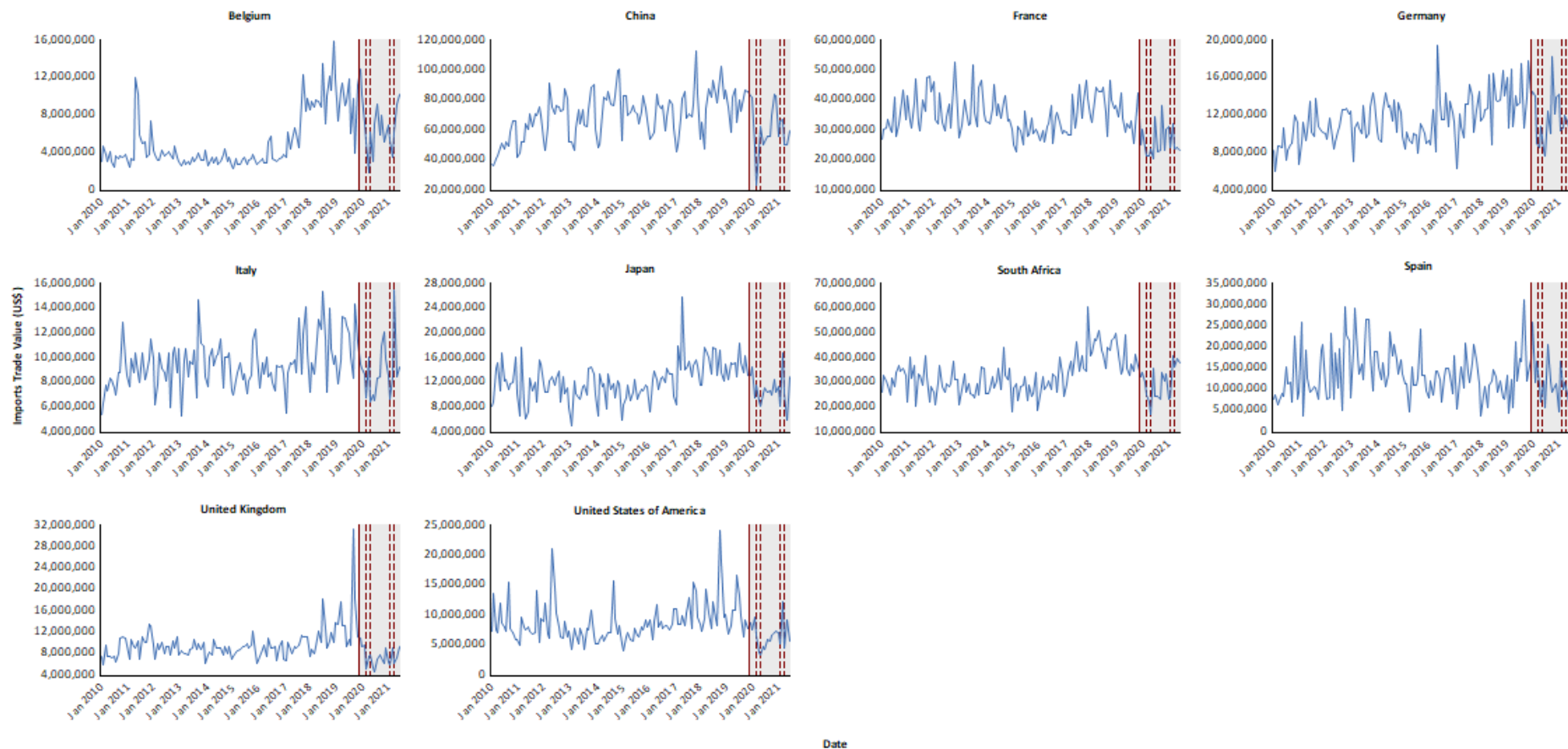| Country	Exports Trade Value (US$)				Imports Trade Value (US$)			
	Minimum	Mean	Standard Deviation	Maximum	Minimum	Mean	Standard Deviation	Maximum
Belgium	398021	3712991	1673710	8872075	1709579	5284393	3066683	1.58e+07
China	130922	1758177	1529570	9236755	2.27e+07	6.77e+07	1.55e+07	1.12e+08
France	4463388	2.59e+07	7501688	4.89e+07	1.99e+07	3.35e+07	6922224	5.21e+07
Germany	661676	3056040	1056305	6647947	5855816	1.14e+07	2530680	1.93e+07
Italy	3821131	1.18e+07	4466468	2.40e+07	523031	9354429	2016420	1.54e+07
Japan	358085	2170904	1601111	1.39e+07	4817045	1.19e+07	3051179	2.57e+07
South Africa	1009620	1.58e+07	4245628	2.45e+07	1.64e+07	3.19e+07	7545596	6.03e+07
Spain	3808693	9892192	3232106	1.85e+07	3478148	1.31e+07	5767021	3.10e+07
United Kingdom	3062276	2.59e+07	9054703	4.88e+07	4454597	9165117	2916774	3.11e+07
United States of America	2214341	1.86e+07	5344572	4.62e+07	3162286	8318297	3252156	2.39e+07

Source: Authors' computation

Figure A1. Overview of Imports Trade Value (US$) by country (January 2010-June 2021).

Notes: Shaded areas represent the post-intervention period (January 2020-June 2021); solid line showing the month in which the outbreak of the pandemic was first declared in Wuhan (December 2019); dotted lines indicating the ending points of different post-intervention windows (from left to right: March 2020, May 2020, February 2021 and April 2021).

Source: Authors' constructions based on UN Comtrade (2021).

Figure A2. Overview of Exports Trade Value (US$) by country (January 2010-June 2021).

Notes: Shaded areas represent the post-intervention period (January 2020-June 2021); solid line showing the month in which the outbreak of the pandemic was first declared in Wuhan (December 2019); dotted lines indicating the ending points of different post-intervention windows (from left to right: March 2020, May 2020, February 2021 and April 2021).

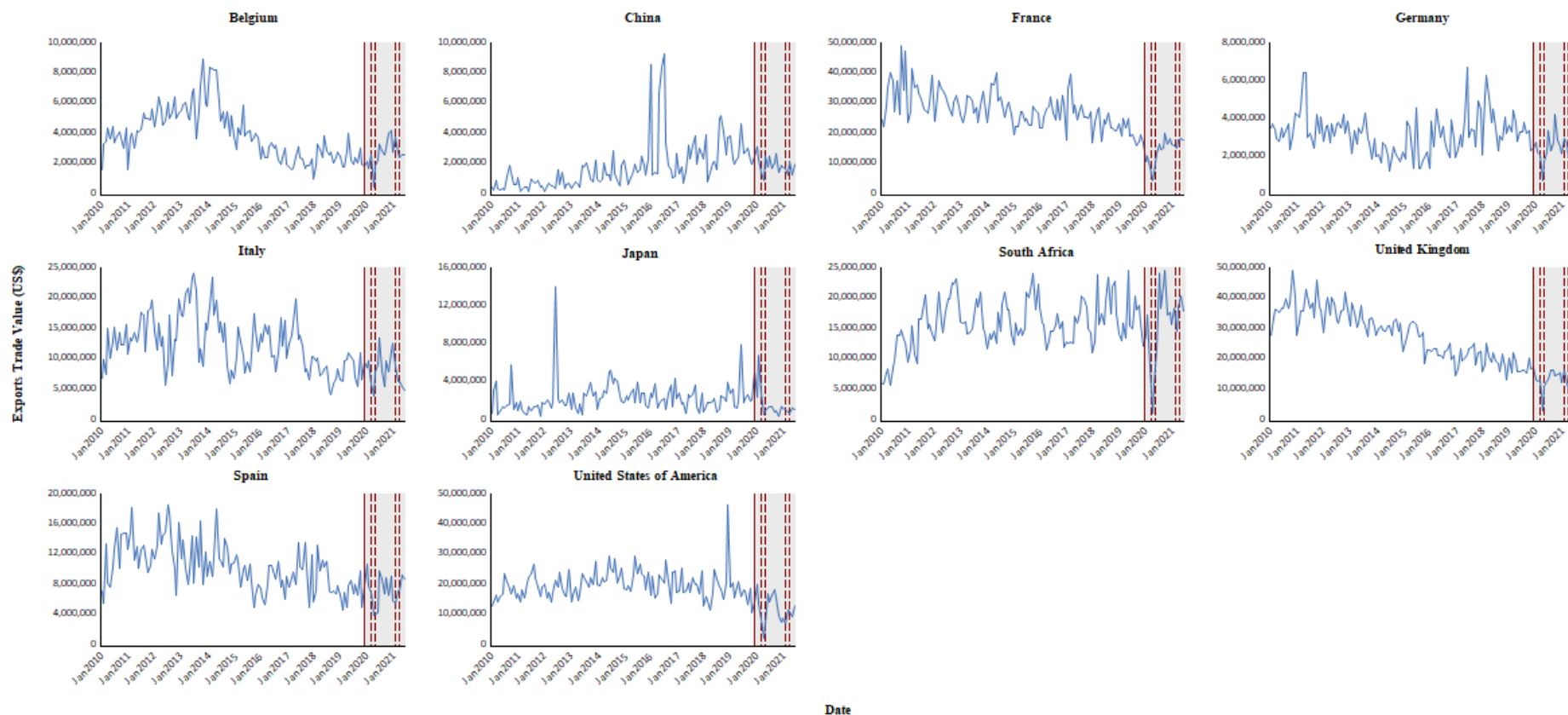Source: Authors' constructions based on UN Comtrade (2021).

Table 1. Time windows and measures implemented

Period	Measures implemented
January 2020-March 2020	First national lockdown as from 20 March 2020; Closure of national borders as from 19 March 2020; planes were grounded
January 2020-May 2020	Global lockdown in April 2020; planes grounded worldwide
January 2020-February 2021	Resumption of cargo/commercial flights as from 06 May 2020
January 2020-April 2021	Second national lockdown as from 10 March 2021; National borders were again closed and cargo/commercial flights were suspended until 15 July 2021

Table 1. Relative cumulative effect per country

Trade Type	[1]	[2]	[3]	[4]	[5]
Belgium					
Imports	-32%*** (9.5%) [-51%, -13%] 99.95%	-17% (14%) [-43%, 11%] 89%	-34%*** (12%) [-56%, -11%] 99.78%	-34%*** (9.5%) [-53%, -15%] 99.95%	-36%*** (9.5%) [-55%, -17%] 99.98%
Exports	15% (23%) [-29%, 60%] 75%	2.3% (31%) [-56%, 65%] 57%	-23% (25%) [-70%, 25%] 82%	20% (23%) [-25%, 66%] 81%	18% (23%) [-27%, 63%] 79%
China					
Imports	-17%*** (4.5%) [-25%, -7.9%] 99.94%	-13% (11%) [-35%, 9.5%] 87%	-19%** (8.1%) [-35%, -3%] 99.02%	-16%** (4.9%) [-25%, -6.3%] 99.88%	-15** (4.7%) [-24%, -5.7%] 99.84%
Exports	-3.5% (21%) [-45%, 39%] 56%	29% (54%) [-77%, 137%] 71%	19% (43%) [-66%, 104%] 67%	-1.8% (23%) [-47%, 44%] 53%	0.5% (23%) [-44%, 45%] 52%
France					
Imports	-24%*** (4.6%) [-33%, -15%] 99.98%	-23%** (11%) [-45%, -1.8%] 98.23%	-29%*** (8.3%) [-46%, -13%] 99.92%	-24%*** (5.1%) [-34%, -14%] 99.98%	-23%*** (4.8%) [-33%, -14%] 99.98%
Exports	-46%*** (6%) [-58%, -35%] 99.98%	-58%*** (14%) [-85%, -32%] 99.98%	-68%*** (9.9%) [-87%, -48%] 99.98%	-48%*** (6.6%) [-61%, -35%] 99.98%	-47%*** (6.2%) [-59%, -35%] 99.98%
Germany					
Imports	-0.53% (5.3%) [-11%, 9.7%] 55%	16% (13%) [-8.4%, 41%] 90%	2.3% (9.6%) [-17%, 21%] 58%	1.2% (5.8%) [-10%, 12%] 57%	0.95% (5.6%) [-9.9%, 12%] 56%
Exports	-26%** (8.6%) [-43%, -9.7%] 99.86%	-27% (20%) [-68%, 13%] 92%	-44%*** (15%) [-74%, -15%] 99.90%	-23%** (9.7%) [-42%, -4.1%] 99.14%	-24%** (9.1%) [-42%, -6.9%] 99.68%
Italy					
Imports	-6.7% (4.7%) [-16%, 2.7%] 92%	-3.6% (12%) [-27%, 20%] 62%	-11% (8.4%) [-27%, 5.7%] 90%	-10%* (5.1%) [-20%, -0.1%] 97.61%	-6% (4.9%) [-15%, 4.1%] 89%
Exports	-33%*** (9.4%) [-52%,-15%] 99.96%	-34% (22%) [-77%, 8.6%] 94%	-43%* (16%) [-75%, -12%] 99.63%	-26%** (11%) [-47%, -5%] 99.17%	-30%* (10%) [-49%, -10%] 99.80%
Japan					
Imports	-14%** (5.9%) [-26%, -2.5%] 99.19%	4.1% (14%) [-24%, 33%] 61%	-14% (11%) [-34%, 8.2%] 89%	-15 (6.7%) [-28%, -1.4%] 93.40%	-13%* (6.2%) [-25%, -0.3%] 97.83%
Exports	-35%* (18%) [-71%, -0.28%] 97.54%	90%* (46%) [-0.87%, 178%] 97.30%	39% (38%) [-37%, 113%] 85%	-28% (20%) [-67%, 10%] 93%	-31%* (19%) [-70%, 5%] 95.58%
South Africa					
Imports	-12%* (5.9%) [-23%, 0.15%] 97.30%	-6.6% (14%) [-34%, 21%] 68%	-22%* (11%) [-42%, -0.57%] 97.76%	-19%** (6.5%) [-31%, -5.8%] 99.72%	-15%** (6.2%) [-27%, -2.8%] 99%
Exports	3.3% (5.8%) [-8.1%, 14%] 72%	-6.2% (14%) [-34%, 21%] 69%	-34%** (11%) [-56%, -12%] 99.84%	-1.3% (6.3%) [-14%, 11%] 58%	0.43% (6%) [-11%, 12%] 53%
Spain					
Imports	-11% (12%) [-32%, 13%] 82%	57%* (31%) [-1.8%, 118%] 97.06%	21% (23%) [-24%, 66%] 82%	-5% (13%) [-30%, 21%] 65%	-5.6% (12%) [-29%, 19%] 67%
Exports	-26%** (8.4%) [-43%, -9.7%] 99.82%	-11% (20%) [-51%, 27%] 72%	-30%* (15%) [-59%, -1.2%] 97.89%	-28%** (9.2%) [-46%, -9.6%] 99.82%	-28%* (8.8%) [-45%, -11%] 99.84%

United Kingdom					
Imports	-26%*** (7.9%) [-42%, -11%] *99.94%*	-12% (20%) [-50%, 28%] *72%*	-16% (15%) [-44%, 14%] *86%*	-29%*** (8.6%) [-46%, -12%] *99.94%*	-28%*** (8.2%) [-44%, -12%] *99.94%*
Exports	-22%** (9.2%) [-40%, -4.1%] *99.03%*	-19% (14%) [-46%, 8.1%] *92%*	-36%*** (11%) [-58%, -14%] *99.94%*	-22%** (9.1%) [-40%, -3.8%] *99.13%*	-25%** (9.1%) [-42%, -6.7%] *99.55%*
United States of America					
Imports	-28%** (10%) [-47%, -7.8%] *99.57%*	-0.66% (25%) [-51%, 48%] *51%*	-28% (18%) [-63%, 7.3%] *94%*	-32%*** (11%) [-54%, -10%] *99.78%*	-28%** (11%) [-49%, -7.1%] *99.43%*
Exports	-39%*** (5.6%) [-50%, -28%] *99.98%*	-20% (14%) [-47%, 8.1%] *92%*	-42%*** (11%) [-63%, -21%] *99.96%*	-39%*** (6.2%) [-51%, -27%] *99.98%*	-38%*** (6%) [-50%, -27%] *99.98%*

Notes: The values in the parentheses are standard deviations, those in the brackets show the 95% confidence interval while those in italics represent the posterior probability of a causal effect. [1]: whole post-intervention period (January 2020-June 2021), [2]: first post-intervention window (January 2020-March 2020), [3]: second post-intervention window (January 2020-May 2020), [4]: third post-intervention window (January 2020-February 2021), [5]: fourth post-intervention window (January 2020-April 2021); ***, **, * indicate significance at the 5%, 1% and 0.1% respectively.

Table A1. Trade Partner Share (%)

Country/Year	Export					Import				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Belgium	1.92	1.46	1.17	1.51	1.5	0.73	0.88	1.5	2.17	2.03
China	0.77	2.07	1.31	1.73	1.71	18.23	17.71	16.4	16.51	16.69
France	11.88	14.79	15.82	14	12.65	7.15	7.85	8.02	8.2	7.01
Germany	1.12	1.65	2	2.28	2.08	2.4	3.09	2.68	2.83	2.99
Italy	5.43	7.14	6.88	4.59	5.47	2.14	2.27	2.24	2.26	2.34
Japan	1.12	1.31	1.2	1.12	1.81	2.45	3.1	3.34	3.11	3.09
South Africa	8.64	8.13	8.93	10.97	10.44	6.46	7.49	8.51	9.23	8.07
Spain	4.35	4.48	5.58	5.19	4.41	2.98	2.98	3.23	2	3.12
United Kingdom	13.1	12.01	11.8	11.28	11.13	2.19	2.17	2.11	2.21	3.02
United States of America	10.63	11.19	11.2	11.95	10.75	1.66	2.12	2.38	2.43	2.07

Source: WITS (2021)

Table A2. Descriptive Statistics

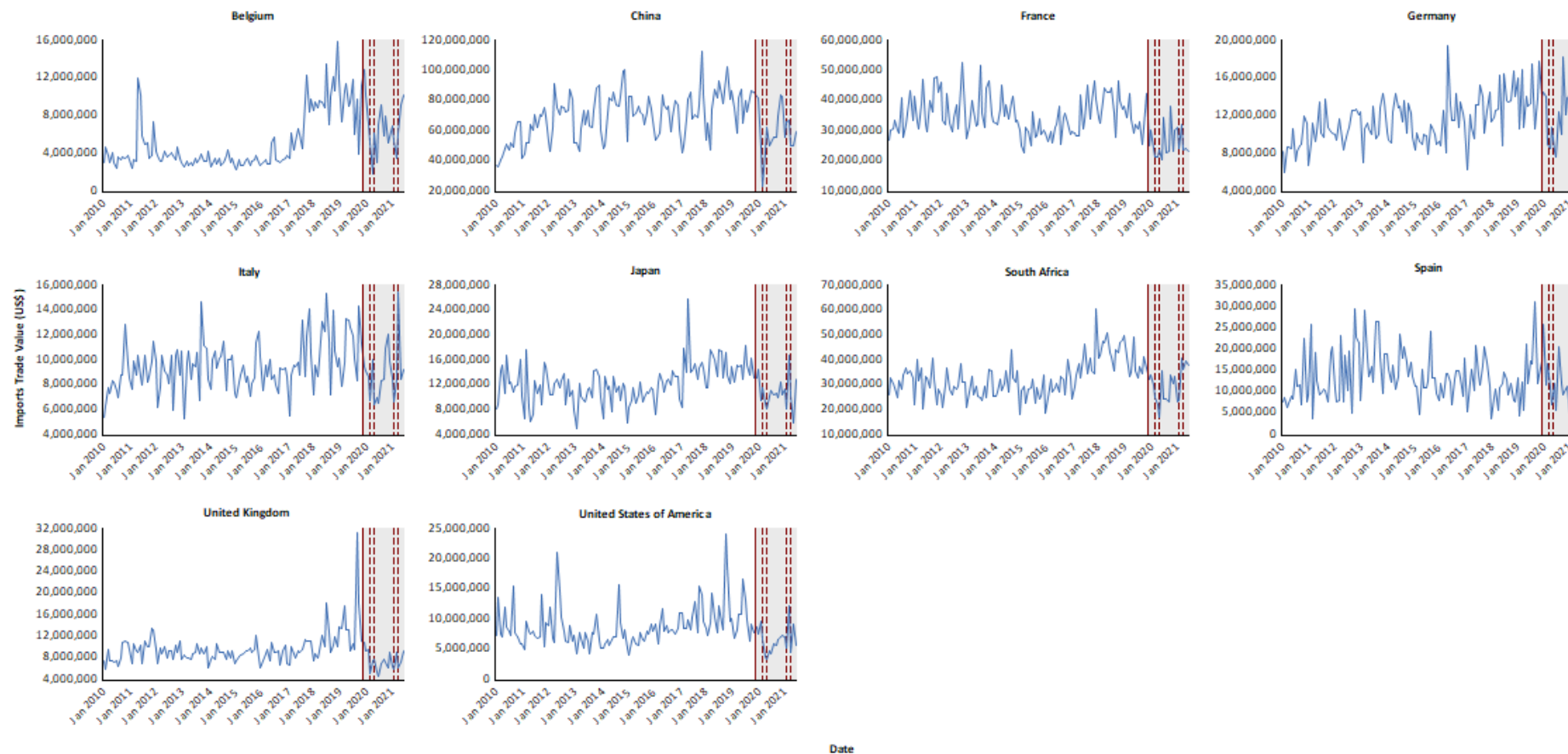| Country	Exports Trade Value (US$)				Imports Trade Value (US$)			
	Minimum	Mean	Standard Deviation	Maximum	Minimum	Mean	Standard Deviation	Maximum
Belgium	398021	3712991	1673710	8872075	1709579	5284393	3066683	1.58e+07
China	130922	1758177	1529570	9236755	2.27e+07	6.77e+07	1.55e+07	1.12e+08
France	4463388	2.59e+07	7501688	4.89e+07	1.99e+07	3.35e+07	6922224	5.21e+07
Germany	661676	3056040	1056305	6647947	5855816	1.14e+07	2530680	1.93e+07
Italy	3821131	1.18e+07	4466468	2.40e+07	523031	9354429	2016420	1.54e+07
Japan	358085	2170904	1601111	1.39e+07	4817045	1.19e+07	3051179	2.57e+07
South Africa	1009620	1.58e+07	4245628	2.45e+07	1.64e+07	3.19e+07	7545596	6.03e+07
Spain	3808693	9892192	3232106	1.85e+07	3478148	1.31e+07	5767021	3.10e+07
United Kingdom	3062276	2.59e+07	9054703	4.88e+07	4454597	9165117	2916774	3.11e+07
United States of America	2214341	1.86e+07	5344572	4.62e+07	3162286	8318297	3252156	2.39e+07

Source: Authors' computation

Figure A1. Overview of Imports Trade Value (US$) by country (January 2010-June 2021).

Notes: Shaded areas represent the post-intervention period (January 2020-June 2021); solid line showing the month in which the outbreak of the pandemic was first declared in Wuhan (December 2019); dotted lines indicating the ending points of different post-intervention windows (from left to right: March 2020, May 2020, February 2021 and April 2021).

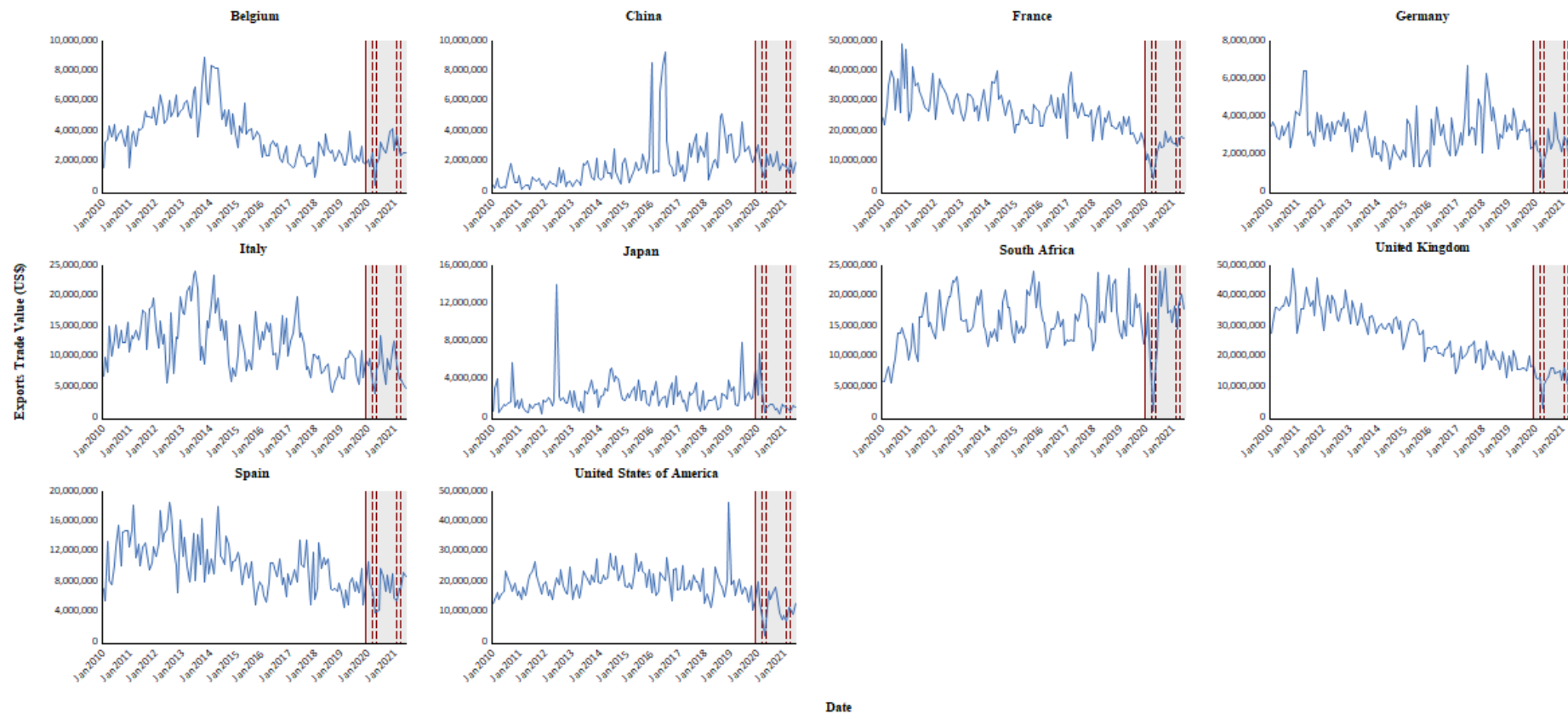Source: Authors' constructions based on UN Comtrade (2021).

Figure A1. Overview of Exports Trade Value (US$) by country (January 2010-June 2021).

Notes: Shaded areas represent the post-intervention period (January 2020-June 2021); solid line showing the month in which the outbreak of the pandemic was first declared in Wuhan (December 2019); dotted lines indicating the ending points of different post-intervention windows (from left to right: March 2020, May 2020, February 2021 and April 2021).

Source: Authors' constructions based on UN Comtrade (2021).

Professor Augustin K. Fosu

Editor-in-Chief

Journal of African Trade

23 February 2022

Dear Professor Fosu,

Re: Submission of Revised Paper

On behalf of my co-authors, I am submitting the revised article entitled "An Empirical Analysis of the Impact of COVID-19 on Trade: Evidence from a Small Island African Economy" for consideration in the special issue "COVID-19 and African Trade" of the *Journal of African Trade*. Thank you for your email dated 20 October 2021 enclosing the reviewers' comments. We wish to thank you and the reviewers for their valuable comments and suggestions on the paper. We have carefully reviewed the comments and have now incorporated all of these comments and suggestions in the revised manuscript accordingly. Our responses are given in a point-by-point manner next to each comment as it was received.

Without doubt, impact measures can be used to inform strategic decision making and hence, help in developing appropriate and necessary policy responses. As such, evaluating the immediate impact of the outbreak of the COVID-19 pandemic on economies, states and societies is crucial at a time when most countries around the globe are facing an unprecedented crisis and perhaps the biggest economic turmoil since the Second World War. Indeed, understanding its impact on any economic sectors, particularly those heavily dependent on international relationships, is of utmost importance since the latter have been mostly affected by the global measures taken to prevent the virus from spreading locally and internationally. Nevertheless, studies in this area focusing on small island economies remain scant. To this end, in this article, we empirically investigate the impact of the COVID-19 pandemic on the trade system of a small island African economy: Mauritius. In particular, we consider the trade system of the country and undertake an analysis in terms of its main trading partners. Our findings reveal that overall, the trade values for each trading partner have significantly decreased. The results also suggest that the stricter the containment measures, the bigger the size of the negative impact of the pandemic on the trade values for both imports and exports. As such, we believe that this article will be of great interest to a broad readership, particularly policymakers and economists working on the economic impacts of the COVID-19 pandemic and international trade system.

We confirm that this article has not been published elsewhere, nor is it currently under consideration for publication elsewhere. All authors have approved the article and agree with its submission in the *Journal of African Trade*. We have no conflicts of interest to disclose.

We hope that the revised version is now suitable for publication and look forward to hearing from you in due course.

Please address all correspondence concerning this manuscript to me at zr.khanjaffur@gmail.com.

Thank you for your consideration.

Yours Sincerely,
Dr. Zameelah Khan Jaffur
University of Mauritius
Réduit, Mauritius.

AUTHORS' RESPONSES TO COMMENTS: "AN EMPIRICAL ANALYSIS OF THE IMPACT OF COVID-19 ON TRADE: EVIDENCE FROM A SMALL ISLAND AFRICAN ECONOMY"

We wish to thank the editor and the reviewers for their valuable comments and suggestions on the paper. We have now incorporated all of these comments and suggestions, and please find below the responses to the comments. A detailed description of the changes made is provided next to the comments as they were received, for better clarity.

Reviewer Comments	Authors' Responses
1. The problem, rationale, objectives, analytical framework employed and results should be clear from the abstract.	The abstract was updated accordingly in the revised paper.
2. Briefly motivate the estimation technique; and tie it to the analytical framework used, missing in the abstract.	This has been taken into account in the revised paper.
3. The long-run impact reported, perhaps, suggests that there is a "lag effect", but the implication is not pursued rigorously.	In the revised paper, we have focused on the short-run effects at different time intervals relying upon the introduction of containment measures.
4. Figure A1 may be reported earlier (Section 1). Extend to Mauritius' comparator countries for both exports and imports.	The introduction was reworked and this figure was subsequently removed.
5. List all the papers cited.	All the papers cited are now listed in the revised paper.
6. There is a mix up between the methodology and result sections. From the methodology section, it is difficult to understand the control variables (country and sector). This can only be inferred from the result section that Japan and 030389 are the control variables. (Although this is understandable given that it was informed by the preliminary ARIMA check, explain in detail for clarity).	The "Methodology" and "Result" sections were reworked and the mentioned parts were removed from the revised paper.
7. It is difficult to read through the charts. The figures are identified by codes, not by variable names. This means that the reader must always refer to the result section to know the code or variable. The variables be clearly defined.	These parts have been removed from the revised paper.
8. Provide the source for the claim that "international trade costs" have increased by 25% referred in the introduction section.	The introduction was reworked in the revised paper.
9. Check the demand-side argument again as the pandemic has not necessarily made	This has been reviewed in the literature review attached in the revised paper.

consumers disinclined to spending, for this would depend on the income of households and the possibility of dissaving.	
10. Although the detailed analysis carried out in the paper focuses on exports, a brief discussion of imports is desirable to gain additional insights before digging into the more disaggregated import and export analysis. This is important because the evidence suggests that the country's exports of goods and services as a percentage of GDP is 38.52% and figure for import of goods and services is 53.67%.	A comparison of both imports and exports are now provided in the revised paper. To provide deeper insights on the impact of the pandemic on the Mauritian trade system and to prevent the paper from becoming too lengthy, we have focused only on the ten main trading partners and the cummulative effects in the revised paper. The part on sectors were removed in the revised paper.
11. Also, estimates from the IMF, in 2020 the COVID-19-induced crisis disrupted considerably Mauritius' international trade, with exports plummeting by -35.8% and imports decreasing by -12.6%.[1] This is largely in line with some of the numbers cited in the paper (at least in terms of the direction of impact but to a lesser extent in terms of the magnitude).	The introduction was reworked and this has been removed in the revised paper.
12. Clarify from the onset whether the empirical exercise is focused on assessing causation and effect or both. The story being told seems to suggest causality.	In fact, we examined the effects of the COVID-19 pandemic and related containment measures on the trade system of Mauritius. In other words, we try to investigate whether the declines observed were caused only by the COVID-19 pandemic and the related containment measures.
13. Justify the technique used since there are competing models.	Justifications have been provided in the "Methodology" section of the revised paper.
14. Consider some preliminary diagnostics of the data (summary stats, correlation, and stationarity tests (with and without breaks), etc.)	A summary statistics of the countries investigated has been included in the Appendix of the revised paper. The implementation of the Bayesian time-series framework for causal analysis, as proposed by Brodersen et al. (2015), does not require any preliminary diagnostics (correlation and stationary tests) and are thus not reported in the revised paper.
15. There is reliance on ARIMA models, the discussion is silent on the p (lag order), d (degree of differencing) and q (order of MA) statistics. The numbers are important because they form the basis of selecting the parsimonious model,	The "Methodology" section has been reworked and updated accordingly in the revised paper. A new approach was adopted in the revised paper and the parts on ARIMA models were removed. The approach was

perhaps, leading to Figure 3. Also, reveal the model evaluation/selection criteria. The abstract only captures one side of the finding i.e., the negative impact of COVID-19 on the export trade based on five main export sectors. Going through the section on results, 11 sectors were considered; and Fish, frozen, excluding filets, livers and other fish meat (HS Code: 030389) were found to exert a positive impact on the export trade. This finding is important given the negative impact of COVID-19 on sectoral export. Also, there is no reference to the other five sectors in the discussion. Why? i. The methodology appears fitting; however, the approach be clearly explained. ii. Provide information about the order of the optimal ARIMA models used vis-à-vis the selected (optimal) specification. iii. The statement "building upon existing empirical research such as Perles-Ribes et al. (2018, 2019a, 2019b)" appears to be "slippery". The paper adapted their methodology. Be explicit about it.	now explicitly explained with relevant citations in the revised paper.
16. Sketch the theory on which the model is erected.	Details have been provided in the "Methodology and Data" section of the revised paper.
17. Provide the intuition of the country-specific results of France, Germany, Spain, the UK, the US and Italy. Also, the values reported for the country-specific analysis (for France- 9.28M, 24.69M, etc.) are not clear and the same applies for other countries and the subsequent discussion of the sector-wise results. Clarity is required	The "Results" section has been reworked accordingly and clarifications have been made to avoid confusions.

An Empirical Analysis of the Impact of COVID-19 on Trade: Evidence from a Small Island African Economy

Z Khan Jaffur, V Tandrayen-Ragoobur and B Seetanah,

University of Mauritius, Réduit, Mauritius

Corresponding author. Email: b.seetanah@uom.ac.mu

Abstract

This study investigates the potential impacts of the COVID-19 pandemic and related containment measures on the trade system of Mauritius for the period January 2020 to June 2021. As the pandemic spreads across the globe due to high interconnectedness across countries, stringent health containment measures in the form of restrictions on people and businesses have also been established by the authorities to slow the propagation of the virus. Being a small island economy highly dependent on international trade, Mauritius is facing the brunt of the pandemic which is disrupting its economic activities and trade flows with its main trading partners. COVID-19 incidence and lockdown measures have impacted both exports and imports in Mauritius. The analysis was conducted using monthly data and the Bayesian structural time-series framework for causal analysis, well-known for its feature in exploring the impacts of any intervention variable on time-series data. Our findings reveal that overall, the trade values for each trading partner have significantly decreased. The results also suggest that the stricter the containment measures, the bigger the size of the negative impact of the pandemic on the trade values for both imports and exports.

Keywords: COVID-19, Trade, Mauritius, Bayesian Structural Time Series

Statements and Declarations

Competing Interests

The authors have no conflicts of interest to declare.

Funding

No funding was received for conducting this study.

Authors' Contributions

The authors contributed equally to the article.