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The impact of COVID-19 outbreak on the Mauritian export trade: a disaggregated analysis

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Abstract

Purpose – This study aims at evaluating the effect of the COVID-19 pandemic on the export trade system for Mauritius during the first half of 2020 (January 2020–June 2020).
Design/methodology/approach – An initial analysis of the monthly export time series data proves that on the whole, the series have diverged from their actual trends after the outbreak of the COVID-19 pandemic: observed values are less than those predicted by the selected optimal forecast models. The authors subsequently employ the Bayesian structural time series (BSTS) framework for causal analysis to estimate the impact of the COVID-19 pandemic on the island's export system.
Findings – Overall, the findings show that the COVID-19 pandemic has a statistically significant and negative impact on the Mauritian export trade system, with the five main export trading partners and sectors the most affected. Despite that the impact in some cases is not apparent for the period of study, the results indicate that total exports will surely be affected by the pandemic in the long run. Nevertheless, this depends on the measures taken both locally and globally to mitigate the spread of the pandemic.
Originality/value – This study thus contributes to the growing literature on the economic impacts of the COVID-19 pandemic by focussing on a small island economy.

Keywords COVID-19, Trade, Bayesian structural time series, Mauritius
Paper type Research paper

1. Introduction

Although worldwide trade has depicted signs of bouncing back from the deep downturn lately caused by the COVID-19 pandemic in 2020 as consumption and production have been scaled back across the globe, the trends in global trade in the coming years is still unclear since the health crisis is far from over. The pandemic has caused dramatic supply and demand shocks, causing major disruptions to trade through various channels, in the world economy. Numerous governments have ordered a temporary closure of non-essential manufacturing facilities, while many corporations have either taken such measures

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voluntarily (due to unavailability of labour) or simply reduced production due to disruptions in their supply chains. The impact of the COVID-19 pandemic is, however, most felt in the international service sector, with international tourism, passenger air travel and container shipping being the main victims. Moreover, the pandemic has resulted in an overall increase in international trade costs of imports and exports by around 25%. Indeed the likely increase in transport and transactions costs with respect to foreign trade is believed to be driven by reduced hours of operation, road and border closures, additional inspections and increase in transport costs itself among others. The demand side has also been affected as consumers around the globe are unwilling in the current situations to spend their money. This phenomenon can be attributed to a common fear of loss of income and increased uncertainty.

In the second quarter of 2020, global merchandise trade was marked down by the sharpest ever one-period decline: a fall of 14.3% as compared to the previous period. Nevertheless, this impact varied across regions (see Figures A1-A3 in Appendix). Europe and North America recorded the steepest declines where exports fell by 24.5 and 21.8%, respectively. In contrast, Asian exports were relatively unaffected with a drop of just 6.1%. During the same period, imports in North America, Europe and Asia were down by 14.5, 19.3 and 7.1%, respectively. The World Trade Organization (WTO) now forecasts a 7.2% rise in 2021 [1]. These estimates are subject to an unusually high degree of uncertainty since they rely upon the evolution of the pandemic and government reactions to it. It is noteworthy that the decline in services trade during the pandemic has been at least as strong as the fall in merchandise trade with the plunge worsened by restrictions on international travel, which represents a key source of export earnings for many developing countries. The WTO estimates point to a year-on-year decline in global services trade during the current recession (−23%, compared to −9% during the financial crisis).

Mauritius has not been spared by COVID-19, and this pandemic has been the greatest test that the island has ever encountered both as a sanitary and an economic crisis. Although the country dealt with the sanitary crisis relatively well as compared to most countries worldwide [2], however, the economy plunged in 2020, and according to the government's estimates and forecasts, the country contracted by 15.2% [3], marking the country's worst contraction since 1980. Indeed as an open and globally integrated economy, Mauritius simply bears the brunt of global effects. The impact of the pandemic on Mauritian export has also been consequential, with a 28% decline over the first half of the year 2020 [4], reaching an estimated 15% for the period January to November 2020 (Statistics Mauritius, 2020). A study by Business Statistics Mauritius (2020) [5] on over 2700 firms reported that over 65% of firms surveyed registered a decrease in their export in 2020, representing an estimated 40% decline in the value of exports.

Indeed, we cannot deny that impact measurement can be used to enlighten strategic decision making and hence assist in devising necessary and appropriate policy responses. As such, assessing the direct influence of the outbreak of the COVID-19 pandemic on economies, states and societies is of the utmost importance at a time where most countries around the globe are facing an unprecedented crisis and perhaps the biggest economic turmoil since the Second World War. Indeed, understanding its effect 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.

Against this backdrop, this study aims at empirically investigating the impact of the COVID-19 pandemic on the Mauritian export trade system, a sector which is crucial for this open small island economy. In this context, we employ the recently developed methodology of Bayesian structural time series (BSTS) framework for causal analysis. This was first proposed by Brodersen *et al.* (2015) and relies on the implementation of the CausalImpact package in R. As Perles-Ribes *et al.* (2019b) posited, the BSTS model is used mostly for the analysis of structural time series, and it is now widely used in the fields of philosophy, statistics, engineering as well as econometrics. Consistent with the aim of this study, this

technique is mainly used for short-term/long-term predictions of time series and inferring causal impact. Based on the availability of data, we have used "total export" time series data for our analysis. Moreover, both country-wise and sector-wise analysis are conducted. In particular, we consider ten main countries and sectors. The data consist of 126 monthly observations ranging from January 2010 to June 2020 for each country, and for each sector, 102 monthly observations spanning from January 2012 to June 2020. This study thus adds up to the growing literature on the economic impacts of the COVID-19 pandemic by focussing on a small island economy.

The remaining part of the paper proceeds as follows: section two provides a review of related literature on the topic followed by a description of the data used in section three, section four is concerned with the methodology employed for this study while section five focuses on the analysis and discussion of the results and the last section presents the conclusions drawn.

2. Literature review

Contagious diseases, which have shocked the world, have existed for long but diseases such as the COVID-19 virus has been spreading at a faster rate as people are better connected through various means. The most notable outbreaks, which have hit the world economy, are the "Spanish Influenza" of 1918, the "Asian flu" of 1957 and the "Hong Kong flu" of 1968. The start of the 21st century has also seen various epidemics, like the Severe Acute Respiratory Syndrome, bird flu, Middle East Respiratory Syndrome and Ebola. However, the worst outbreak of this century remains the COVID-19 pandemic in terms of its health, social and economic impacts (Stenseth *et al.*, 2021). It has impinged all countries irrespective of their level of development. Advanced as well as developing countries have been affected, hence leaving no one behind (Mirza *et al.*, 2020; Rizvi *et al.*, 2020). Whilst the human costs in terms of loss of lives are significant across countries, the preventive and control measures put in place by governments around the world to prevent the transmission of the virus are causing massive economic and social costs.

In essence, the COVID-19 pandemic has led to an unprecedented global shock with an overwhelming effect on international trade (WTO, 2020). The virus has led to both demand and supply disruptions, which have been exacerbated by the interconnectedness of the world economy (Chudik *et al.*, 2020). There are several dimensions to the pandemic that have affected international trade, namely its direct health impact and associated behavioural changes, the repercussions of governments' containment and stringency measures to prevent the spread of the virus and the impact of the pandemic on third countries (Liu *et al.*, 2021). In effect, the repercussions of the pandemic on international trade have been felt in two waves. The first one originating from China with supply-side disturbances, mainly via the manufacturing sector, but other nations also became a part of these effects, due to high degree of inter-linkages across economies. Production, consumption and trade patterns have been affected both directly and indirectly owing to lockdown and social distancing measures, and at the same time, factory closures have led to a drop in supply of exportable goods in affected countries. With the decline in production, the supply of exports is expected to follow a downward trend. The second effect has emerged in the form of a decline in demand. These supply shocks have been compounded by demand shocks as consumer outlets have been compelled to close down, and retail businesses have stopped taking orders of new stocks, both domestically and internationally. This has led to a fall in incomes of consumers, leading to a dip in demand. In addition, consumers and enterprises have had to amend their spending decisions in this new pandemic situation (Espitia *et al.*, 2021).

Through its impact on both the supply and demand dimensions, the pandemic has a bearing on the overall global trade in terms of goods and services (Baldwin and Di Mauro, 2020;

Batool *et al.*, 2020; Shaikh, 2021). The effects on international trade have occurred through different channels, namely changing commodity prices, reduced manufacturing output, disruptions in the global value chains whilst trade in services and remittances have plummeted. However, though it may seem intuitive to expect negative trade effects due to the pandemic, at the country level the effect could go in either direction and can be ambiguous (Baldwin and Tomiura, 2020). With negative demand and supply shocks, a country's import demand is *a priori* unclear. The consequences of the pandemic on other trading partners of a country and on the country's own demand for imports are also ambiguous, depending on how third-country demand and supply factors are altered (Liu *et al.*, 2021).

The old dispute on the comparative advantage versus resilience has now resumed due to the current pandemic (Zhang *et al.*, 2021). In fact, as per the theory of comparative advantage postulates, trade is beneficial if countries specialize in those goods in which they have a comparative advantage. Even so, the theory faces a trade-off in the presence of the global supply shocks, particularly when countries depend upon the supply chain for essential commodities. In addition, the standard trade theories, which assume that transport costs are given, are no longer applicable. COVID-19 has disrupted the classic assumptions of the conventional trade theories (Zhang *et al.*, 2021). From a theoretical perspective, the impact of COVID-19 must be assessed by its effects on the exporting country, on the importing nation and on neighbouring countries (Hayakawa and Mukunoki, 2021). First, a greater repercussion of the pandemic in the exporting country arises via a fall in the scale of production. Falling supplies of goods lower price elasticity and cause a decline in export supply. Exports have decreased mainly in those industries where remote operations have not been feasible. However, the COVID-19 burden has not only shrunk production of products but also reduced domestic demand for these commodities. Nonetheless, two important elements need to be probed into when determining the net effect of the pandemic on exports. The first one being a decrease in domestic demand for exported goods. If the decrease in domestic demand is sufficiently larger than the decline in production, the net increase in exports can be realized by reallocating the amount not consumed domestically to the export market. Hence, the net effect on exports will depend on the relative magnitude of the production scale over the size of domestic demand (Hayakawa and Mukunoki, 2021). The second one relates to the impact of the introduction of remote operations on productivity. If telecommuting systems improve productivity or efficiency, exports will increase while if industries are mainly labour-intensive whereby remote working becomes less feasible, exports will decline due to decreased productivity (Dingel and Neiman, 2020).

Moreover, the impact of the pandemic on an importing country arises essentially from a fall in aggregate demand in that nation. Falling earnings and loss of jobs lead to decreased demand, despite assistance measures by the authorities to cover partially the loss in earnings. Albeit, people attempt to maintain their earnings, the fear of infections reduces their visits to retail stores, groceries and supermarkets causing a dip in demand. Negative demand shocks can reduce spending on durable goods more than spending on non-durable goods because the former are "postpone-able" (Baldwin and Tomiura, 2020). In contrast, uncertainty about the future may lead to "panic buying" and hence increase in demand for non-durable goods. Examples of these sectors where demand has gone down are transport equipment, wood and leather products, machinery, plastics, rubbers and precious and base metals, amongst others. Moreover, the import demand of essential products, like vegetables and foodstuffs, has increased and that of sanitation products, such as facemasks and sanitizers, has gone up since the advent of COVID-19. Hence, the negative demand shocks may be smaller or even positive in some products.

The COVID-19 has also affected a country's foreign trade through its impact on its neighbouring countries. This has, however, conflicting effects on trade. The first effect arises from negative production shocks due to the pandemic that may reduce exports in the

neighbouring countries. This drop in exports from the country's neighbours can create an export opportunity for that nation as importing countries may change their import source from the neighbouring countries to the nation, in particular. In addition, decreased in imports in the neighbouring countries affected by the pandemic may lower market prices due to decreased demand. This decrease in prices on the world market will increase imports in other countries. This is known as the "substitution effect" (Hayakawa and Mukunoki, 2021) that generates positive trade outcomes for the country. The second effect is called the "contagion effect" (Hayakawa and Mukunoki, 2021) and is likely to be negative. Negative production shocks caused by COVID-19 in a country may reduce production of other nations via the supply-chain networks. International trade and foreign direct investment tend to transmit these shocks to domestic production in other countries, as the elasticity of substitution between imported intermediates and domestic factors is smaller (Boehm *et al.*, 2019). Further, reduced imported inputs tend to lower a producer's productivity (Halpern *et al.*, 2015) or increase the prices of products due to input–output linkages (Blaum *et al.*, 2018). Subsequently, exports of the country will fall if it depends on materials or intermediate goods from neighbouring countries, highly impacted by the pandemic.

Existing empirical work on the impact of COVID-19 on international trade have analysed the different channels via which the pandemic has impacted trade flows across both developed and developing nations. For instance, Hayakawa and Mukunoki (2021) assess the impact of COVID-19 on international trade among 186 countries in the first quarter of 2020. Their results indicate that the pandemic has influenced mainly exporting countries with a significant negative effect on trade while there is no impact of COVID-19 on importing nations. When differentiating between developed and developing countries, there is evidence of a negative impact of exporters' COVID-19 burden on exports from developing countries but not from developed ones. Further, Maliszewska *et al.* (2020) simulates the potential impact of COVID-19 on gross domestic product (GDP) and trade using a computable general equilibrium model. The study models the shock in terms of different indicators, namely an underutilization of labour and capital, a rise in international trade cost, a drop in travel services and a redirection of demand away from activities where social distancing cannot be respected. Their simulation shows a decline in GDP, which tends to be more pronounced across developing countries compared to advanced ones. They further note that the most significant negative effect is registered in the output of domestic services as well as traded tourist services. Likewise, Vidya and Prabheesh (2020) assess the trade interconnectedness across countries pre- and post-COVID-19 outbreak and analyse the future direction of trade. Their results reveal a drastic reduction in trade interconnectedness, connectivity and density amongst nations after the outbreak of the pandemic. Though there was a visible change in the structure of the trade network, China's position in the trade network was not affected.

Specific country analysis, like Liu *et al.* (2021), estimates the impact of COVID-19 incidence along with the lockdown measures on the monthly growth rate of China's imports from 2019 to 2020. Their results indicate that government measures to curb economic activities had a larger impact on China's imports than the direct health and behavioural effects of the pandemic. Most empirical works have been rather descriptive in nature with only a few recent ones focussing on a group of developing and developed countries. Evidence from country-specific studies on the impact of COVID-19 on trade has been quite limited, and this may be due to data limitations. Hence, this study innovates by empirically assessing the impact of the COVID-19 pandemic on the Mauritian export trade system, using the BSTS framework for causal analysis. As a small island economy, Mauritius depends highly on international trade and is extremely connected to the global market, especially with the traditional European and US markets. Hence, the COVID-19 pandemic is likely to cause a shock to the varied traded sectors and products.

3. Data

In this study, we employ monthly data for both the country-wise (January 2010–June 2020: a total of 126 observations) and sector-wise analyses (January 2012–June 2020: a total of 102 observations) [6]. Data were extracted from the International Trade Statistics Database of UN Comtrade (UN Comtrade, 2020). For the application of the methodology proposed by Brodersen *et al.* (2015), we first consider 11 main export trading partners and sectors. It can be observed from Tables 1 and 2 that as compared to the same period the previous year (January 2019–June 2019), exports' trade values experienced a fall in their values. For the case of export trading partners, the analysis shows that export trade values encountered a decrease ranging from a minimum of 4% from Spain to a maximum of 58% from France (see Table 1). On the other hand, the exportation of cotton shirts for boys and men, which are not knitted or crocheted (HS code: 620520), have plummeted the most: a decline of 51% can be observed in this sector and that of frozen fish (HS code: 030389) was the least affected with an approximate decline of 7% in its trade values (see Table 2) [7]. In general, it can be seen from Tables 1 and 2 that the largest decline both in country-wise and sector-wise occurred in June 2020. This could be explained by the fact that by mid-March 2020, most countries started to impose regional lockdowns and close their borders to foreign countries as local death tolls related to the virus shot up. In some countries, aeroplanes were grounded, and ships were not allowed in ports. This in turn severely affected international trade flows.

4. Methodology

As mentioned previously, this study aims at empirically investigating the effect of the COVID-19 pandemic outbreak on the Mauritius export trade system both in terms of main export trading partners and sectors. Building upon existing empirical research (such as Perles-Ribes *et al.*, 2019a, b, 2018; Khan Jaffur and Seetanah, 2020; Khan Jaffur *et al.*, 2021), we follow a two-step procedure to apply the BSTS framework for causal analysis (see Perles-Ribes *et al.* (2018) for details).

First, the autoregressive integrated moving average (ARIMA) models are employed to have a visual evaluation of the impact of the COVID-19 outbreak on the export trade system and to identify a suitable synthetic control for the causal analysis. This also allows us to verify whether the Mauritian export trade system is affected by any structural changes or the outbreak of the pandemic. For this purpose, each series is divided into two: the observations in the pre-COVID-19 period are used to estimate an optimal model based on the ARIMA framework, and the remaining to generate forecasts for the post-COVID-19 period, assuming that the pandemic never sprung up [8]. The series whose real values and predicted ones match closely is considered a suitable synthetic control. It should be noted that the most appropriate control is the one that has been less influenced by the occurrence of the COVID-19 pandemic or any structural changes.

The second step consists of evaluating the impact of the outbreak of the pandemic on the export trade system together by using the synthetic control identified in the initial step using the methodology proposed by Brodersen *et al.* (2015) (i.e. the BSTS framework for causal analysis). In this study, the intervention variable refers to the outbreak of the COVID-19 pandemic, which was officially declared in December 2019. We, thus, use data up until December 2019 to create the counterfactual scenarios for each series, and data between January 2020 and June 2020 are employed to assess the impact. In line with previous empirical research on the BSTS framework for causal analysis (see, for instance, Perles-Ribes *et al.*, 2019a, b, 2018; Soto-Valero and Pic, 2019; Takyi and Bentum-Ennin, 2020; Khan Jaffur and Seetanah, 2020; Khan Jaffur *et al.*, 2021), we favour the static regression technique to avoid any overfitting problems.

Table 1. Export trade value (US$) of main trading partners for the period January–June 2019/20

Country/Year	January		March		June		January–June		% Decrease
	2019	2020	2019	2020	2019	2020	2019	2020	2019–2020
Belgium	2,447,862	2,139,954	1,768,413	2,586,858	2,214,512	2,167,370	15,007,208	10,720,708	29
China	3,754,110	3,059,007	1,904,476	1,382,776	4,592,246	1,740,887	17,175,398	11,735,879	32
France	23,103,972	10,291,932	24,801,424	8,674,715	18,914,890	13,135,900	132,364,089	55,703,906	*58*
Germany	3,632,799	2,669,850	4,387,866	2,059,132	3,279,141	2,147,670	21,058,291	11,407,628	46
Italy	6,477,528	8,473,777	9,639,506	5,950,490	10,397,294	8,960,248	53,696,276	44,600,538	17
Japan	2,722,308	2,322,842	1,367,443	2,725,266	7,824,993	1,219,676	18,296,941	14,420,965	21
South Africa	14,087,881	13,834,090	15,888,629	8,786,727	15,378,287	11,687,729	95,991,159	58,129,379	39
Spain	6,479,087	10,574,815	6,902,767	6,909,226	8,455,937	4,203,356	39,108,006	37,382,030	*4*
Thailand	1,115,720	2,218,129	799,207	369,889	1,460,077	1,450,633	8,857,851	7,772,760	12
The UK	20,309,779	12,984,397	22,076,042	13,066,508	15,559,160	12,502,242	108,274,648	64,824,700	40
The USA	19,172,601	19,951,653	15,607,788	8,301,712	15,904,438	16,890,833	110,771,621	67,915,328	39

Source(s): Authors' elaboration based on UN Comtrade (2020)

Table 2.
Export trade value (US$) of main export sectors for the period January–June 2019/20

Sector#/Year	January 2019	January 2020	March 2019	March 2020	June 2019	June 2020	January–June 2019	January–June 2020	% Decrease 2019–2020
620520	10,237,990	9,234,418	7,023,952	5,254,659	11,581,446	7,388,162	68,960,782	33,944,763	*51*
160414	19,860,575	20,017,341	30,285,906	25,002,970	22,379,310	15,734,857	131,400,439	100,495,642	24
170199	5,764,913	9,131,695	10,731,455	6,710,556	8,967,254	7,439,261	49,394,849	44,220,947	10
620342	6,436,652	7,148,168	7,479,198	5,015,304	6,761,408	4,678,530	42,624,015	25,098,731	41
710239	6,332,105	4,380,527	7,982,167	8,839,673	7,935,661	290,562	48,587,198	27,631,993	43
610910	7,300,989	6,800,657	8,958,105	3,891,342	8,332,587	5,938,594	49,932,039	27,105,956	46
170114	10,744,201	7,193,697	9,884,228	5,255,639	7,596,409	10,639,611	50,694,583	42,721,511	16
030389	7,569,371	5,374,548	2,103,274	5,618,409	11,169,767	1,231,735	32,869,987	30,424,746	**7**
300490	4,124,604	2,400,448	3,596,891	1,549,050	2,898,002	2,094,305	16,669,967	11,772,163	29
610510	2,507,307	2,327,283	1,830,341	1,520,570	2,889,622	1,412,430	15,488,492	8,203,693	47
600622	1,639,027	1,497,849	1,742,871	1,945,758	2,305,073	2,234,761	11,487,952	8,797,966	23

Note(s): #Sector classified based on HS code; 620520: Shirts: men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter; 620342: Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds: non-industrial (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests: of cotton, knitted or crocheted; 170114: Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter; 030389: Fish: frozen, excluding fillets, livers, roes and other fish meat; 300490: Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts: men's or boys', of cotton, knitted or crocheted; 600622: Fabrics: knitted or crocheted fabrics, of cotton, dyed

Source(s): Authors' elaboration based on UN Comtrade (2020)

5. Results and discussion

In this section, we present the results obtained upon applying the two-step procedure discussed in the previous section. We first discuss the findings based on the ARIMA framework followed by the estimations of the impact of the outbreak of the pandemic on the different trading partners and sectors.

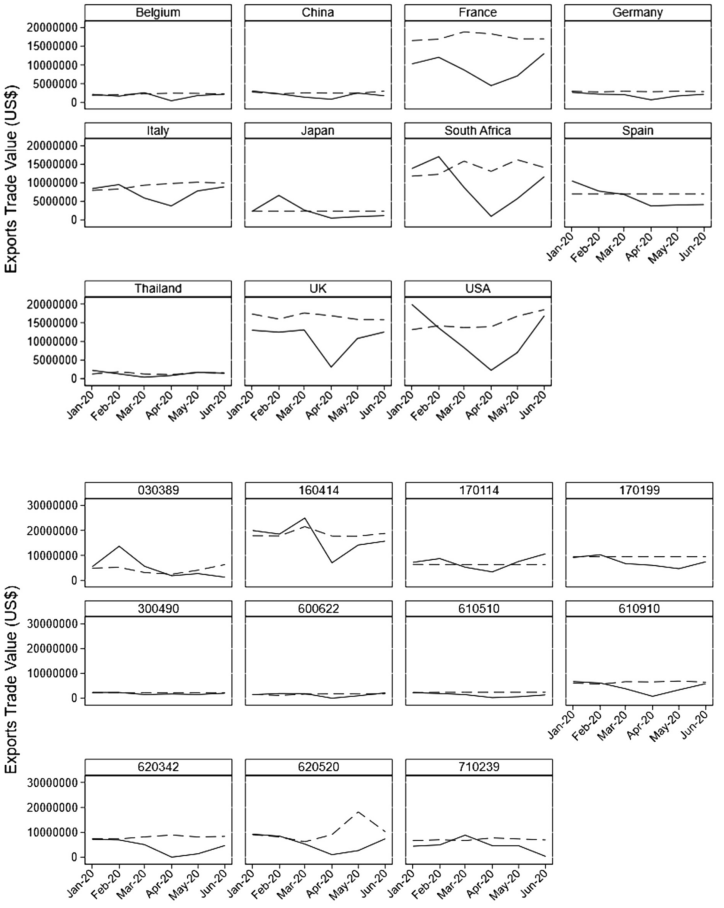
5.1 ARIMA results

Figure 1 depicts the forecasts obtained based on the optimal ARIMA models for the different export trading partner countries and sectors considered [9]. It can be seen that the series started to depart from their initial trends as, from February 2020, nearly two months after the outbreak of the COVID-19 pandemic was first declared: observed (real) values were less than those forecasted. The gap is larger for the four leading export trading partners of the country (France, the United Kingdom [UK], USA and South Africa) and four main products that the country exports: prepared or preserved fish, caviar (HS code: 160414), men's and boys' suits (HS code: 620342), men's and boys' shirts, not knitted or crocheted (HS code: 620520), T-shirts, singlets and other vests, knitted or crocheted (HS code: 610910) and diamonds, non-industrial, but not mounted or set (HS code: 710239) [10]. Moreover, it is clear from the diagrams that the largest dip occurred in April 2020, the month following the closure of borders in most countries. On the other hand, Tables 3 and 4 summarize the impact of the COVID-19 outbreak on each export trading partner and sector analysed based on the monthly forecasts provided by the optimal ARIMA models and the values of each series for the period January 2020–June 2020. A glimpse at the results shows that the outbreak of the pandemic has negatively influenced the export trade values towards each main trading partners and sectors. Exports towards Thailand were the least affected (−8%) and that of France were the most affected one (−47%) (see Table 3). Similarly, it can be seen that the export trade values in the sector fish preparations (HS code: 160414) were the least affected (−10%) and that of men's and boys' suits (HS code: 620342) were the most affected one (−48%). Surprisingly, in contrast to what was predicted by the optimal ARIMA models, it has been found that the export trade values towards Japan have increased by 1% and that in two of the main sectors – Cane and beet sugar and chemically pure sucrose in the solid form (HS code: 170199) and fish, frozen, excluding filets, livers and other fish meat (HS code: 030389) – have increased: an increase of 12 and 17%, respectively. The results thus give rise to one pertinent question of whether these changes were due to the outbreak of the COVID-19 pandemic or any other structural changes. This is investigated in the next step. Consequently, Japan and the sector "Fish: frozen, excluding filets, livers and other fish meat (HS code: 030389)" are employed as the potential controls since the export trade values in the latter appeared not to be negatively affected.

5.2 Causal impact results

In this section, we interpret the results of the estimations of the impact of the outbreak of the COVID-19 pandemic on the export trade values starting from January 2020 for each main trading partners and sectors using the methodology proposed by Brodersen *et al.* (2015). For each trading partner and sector, we provide the same analytical structure: the results are reported for the whole post-COVID-19 period (January 2020–June 2020) when the selected synthetic controls mentioned in Section 5.1 are employed. For the sake of brevity, we only discuss the average effects of the causal impact of the COVID-19 pandemic on the export trade values for each trading partner and sector. The cumulative effects are reported in Tables A3 and A4 in Appendix.

Tables 5 and 6 display a breakdown of the results obtained according to the country and sector investigated. It can be observed that most models show a negative coefficient for the absolute and relative effects, implying that the outbreak of the COVID-19 pandemic has



Note(s): ARIMA models; solid lines represent original values and dotted lines predicted ones; Exports trade value (US$) on y-axis and date on x-axis; Series in lower panel are classified based on HS Code; 620520: Shirts; men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations; tunas, skipjack and Atlantic bonito (sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars; sucrose, chemically pure, in solid form, not containing added flavoring or coloring matter; 620342: Trousers, bib and brace overalls, breeches and shorts; men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds; non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests; of cotton, knitted or crocheted; 170114: Sugars; cane sugar, raw, in solid form, not containing added flavoring or coloring matter; 030389: Fish; frozen, excluding fillets, livers, roes and other fish meat; 300490: Medicaments; consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts; men's or boys', of cotton, knitted or crocheted; 600622: Fabrics; knitted or crocheted fabrics, of cotton, dyed

Source(s): Author's elaboration

Figure 1.
Predicted and real export trade value January 2020–June 2020

Country	Predicted export trade value (US$) (January 2020–June 2020)	Original export trade value (US$) (January 2020–June 2020)	Absolute effect	Relative effect
Belgium	2,209,929	1,786,785	−423,144	−19
China	2,575,428	1,955,980	−619,448	−24
France	*17,471,229*	*9,283,984*	*−8,187,244*	*−47*
Germany	2,894,676	1,901,271	−993,404	−34
Italy	9,281,525	7,433,423	−1,848,102	−20
Japan	*2,389,919*	*2,403,494*	*13,575*	*+1*
South Africa	13,904,701	9,688,230	−4,216,471	−30
Spain	7,050,506	6,230,338	−820,168	−12
Thailand	*1,405,431*	*1,295,460*	*−109,971*	*−8*
The UK	16,573,167	10,804,117	−5,769,050	−35
The USA	15,023,570	11,319,221	−3,704,349	−25

Note(s): Average export trade value (US$) for the period January 2020–June 2020
Source(s): Authors' elaboration

Table 3.
Predicted and real export trade value (US$): January 2020–June 2020. ARIMA models

Sector[#]	Predicted export trade value (US$) (January 2020–June 2020)	Original export trade value (US$) (January 2020–June 2020)	Absolute effect	Relative effect
620520	10,122,303	5,657,461	−4,464,843	−44
160414	*18,595,027*	*16,749,274*	*−1,545,754*	*−10*
170199	9,506,155	7,370,158	−2,135,997	−22
620342	*8,034,230*	*4,183,122*	*−3,851,108*	*−48*
710239	7,031,799	4,605,332	−2,426,467	−35
610910	6,450,844	4,517,659	−1,933,185	−30
170114	*6,345,718*	*7,120,252*	*774,534*	*+12*
030389	*4,329,153*	*5,070,791*	*741,638*	*+17*
300490	2,304,840	1,962,027	−342,812	−15
610510	2,437,519	1,367,282	−1,070,237	−44
600622	1,656,827	1,466,328	−190,499	−11

Note(s): Average export trade value (US$) for the period January 2020–June 2020; [#]Sector classified based on HS code; 620520: Shirts, men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter; 620342: Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds: non-industrial (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests: of cotton, knitted or crocheted; 170114: Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter; 030389: Fish: frozen, excluding fillets, livers, roes and other fish meat; 300490: Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts, men's or boys', of cotton, knitted or crocheted; 600622: Fabrics: knitted or crocheted fabrics, of cotton, dyed
Source(s): Authors' elaboration

Table 4.
Predicted and real export trade value (US$): January 2020–June 2020. ARIMA models

negatively influenced the export trade values. Although this effect is only significant for seven of the countries investigated (France, Germany, Italy, South Africa, Spain, UK and USA) and insignificant for the sector "Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter (HS code: 170114)", the posterior probability of a causal effect is above 50% for all models (see Tables 5 and 6). This indicates that despite that the

Country		Average
Belgium	Actual	1,786,785
	Prediction (SD)	2,287,890 (524,159)
	95% confidence interval	[1,280,661, 3,293,630]
	Absolute effect (SD)	−501,105 (524,159)
	95% confidence interval	[−1,506,845, 505,924]
	Relative effect (SD)	−22% (23%)
	95% confidence interval	[−66%, 22%]
	Posterior tail-area probability	0.1620
	Posterior probability of a causal effect	84%
China	Actual	1,955,980
	Prediction (SD)	1,997,477 (569,069)
	95% confidence interval	[861,024, 3,092,736]
	Absolute effect (SD)	−41,497 (569,069)
	95% confidence interval	[−1,136,756, 1,094,955]
	Relative effect (SD)	−2.1% (28%)
	95% confidence interval	[−57%, 55%]
	Posterior tail-area probability	0.4636
	Posterior probability of a causal effect	54%
France	Actual	9,283,984
	Prediction (SD)	24,691,766 (2,223,828)
	95% confidence interval	[20,502,953, 29,113,459]
	Absolute effect (SD)	−15,407,782 (2,223,828)
	95% confidence interval	[−19,829,475, −11,218,969]
	Relative effect (SD)	−62% (9%)
	95% confidence interval	[−80%, −45%]
	Posterior tail-area probability	0.0003***
	Posterior probability of a causal effect	99.98%
Germany	Actual	1,901,271
	Prediction (SD)	3,315,990 (377,689)
	95% confidence interval	[2,572,334, 4,054,437]
	Absolute effect (SD)	−1,414,719 (377,689)
	95% confidence interval	[−2,153,166, −671,063]
	Relative effect (SD)	−43% (11%)
	95% confidence interval	[−65%, −20%]
	Posterior tail-area probability	0.0004***
	Posterior probability of a causal effect	99.96%
Italy	Actual	7,433,423
	Prediction (SD)	12,024,497 (1,560,774)
	95% confidence interval	[9,000,239, 15,132,280]
	Absolute effect (SD)	−4,591,074 (1,560,774)
	95% confidence interval	[−7,698,857, −1,566,816]
	Relative effect (SD)	−38% (13%)
	95% confidence interval	[−64%, −13%]
	Posterior tail-area probability	0.0015***
	Posterior probability of a causal effect	99.86%
South Africa	Actual	9,688,230
	Prediction (SD)	14,383,805 (1,252,564)
	95% confidence interval	[11,927,662, 16,825,413]
	Absolute effect (SD)	−4,695,575 (1,252,564)
	95% confidence interval	[−7,137,183, −2,239,432]
	Relative effect (SD)	−33% (8.7%)
	95% confidence interval	[−50%, −16%]
	Posterior tail-area probability	0.0002***
	Posterior probability of a causal effect	99.98%

(*continued*)

Table 5. Estimated impact of the COVID-19 pandemic on export trade value (US$) by country: January 2020–June 2020

Country		Average
Spain	Actual	6,230,338
	Prediction (SD)	9,384,656 (1,153,162)
	95% confidence interval	[7,073,535, 11,641,967]
	Absolute effect (SD)	−3,154,317 (1,153,162)
	95% confidence interval	[−5,411,628, −843,196]
	Relative effect (SD)	−34% (12%)
	95% confidence interval	[−58%, −9%]
	Posterior tail-area probability	0.0044***
	Posterior probability of a causal effect	99.56%
Thailand	Actual	1,295,460
	Prediction (SD)	1,060,790 (284,818)
	95% confidence interval	[506,354, 1,615,949]
	Absolute effect (SD)	234,670 (284,818)
	95% confidence interval	[−320,489, 789,106]
	Relative effect (SD)	22% (27%)
	95% confidence interval	[−30%, 74%]
	Posterior tail-area probability	0.2067
	Posterior probability of a causal effect	79%
The UK	Actual	10,804,117
	Prediction (SD)	16,907,538 (1,816,428)
	95% confidence interval	[13,302,153, 20,372,869]
	Absolute effect (SD)	−6,103,422 (1,816,428)
	95% confidence interval	[−9,568,752, −2,498,036]
	Relative effect (SD)	−36% (11%)
	95% confidence interval	[−57%, −15%]
	Posterior tail-area probability	0.0004***
	Posterior probability of a causal effect	99.96%
The USA	Actual	11,319,221
	Prediction (SD)	18,333,320 (1,537,756)
	95% confidence interval	[15,325,516, 21,276,044]
	Absolute effect (SD)	−7,014,099 (1,537,756)
	95% confidence interval	[−9,956,822, −4,006,295]
	Relative effect (SD)	−38% (8.4%)
	95% confidence interval	[−54%, −22%]
	Posterior tail-area probability	0.0002***
	Posterior probability of a causal effect	99.98%

Note(s): Analysis using the CausalImpact (Brodersen *et al.*, 2015) with Japan as synthetic control; standard deviations in parentheses; 95% confidence intervals in square brackets; ***, ** and * represent significance at the 1, 5 and 10%, respectively

Source(s): Authors' elaboration

Table 5.

impact of the pandemic is not apparent during the first six months after its outbreak (January 2020–June 2020), the latter will eventually have a greater influence on the export sector of Mauritius. Nevertheless, the size of the impact will subsequently depend on the measures taken by the government to mitigate the spread of the virus in the coming months. A detailed explanation of the impact of the outbreak in each country and sector investigated is given in the sub-sections 5.2.1 and 5.2.2, respectively [11].

5.2.1 Trading partners. As can be seen in Table 5, for each country where the effect proves to be significant (p-value less than 1%), the outbreak had a negative impact on their export trade values, and the posterior probability of a causal effect is much above 99%, thereby suggesting that the outbreak of the pandemic had a greater influence on exports towards these countries. In particular, exports towards three of the top five main trading partners

Sector[#]		Average
620520	Actual	5,657,461
	Prediction (SD)	11,620,107 (712,733)
	95% confidence interval	[10,209,803, 13,022,029]
	Absolute effect (SD)	−5,962,647 (712,733)
	95% confidence interval	[−7,364,568, −4,552,343]
	Relative effect (SD)	−51% (6.1%)
	95% confidence interval	[−63%, −39%]
	Posterior tail-area probability	0.0002***
	Posterior probability of a causal effect	99.98%
160414	Actual	16,749,274
	Prediction (SD)	23,697,634 (1,801,593)
	95% confidence interval	[20,179,992, 27,317,709]
	Absolute effect (SD)	−6,948,360 (1,801,593)
	95% confidence interval	[−10,568,436, −3,430,719]
	Relative effect (SD)	−29% (7.6%)
	95% confidence interval	[−45%, −14%]
	Posterior tail-area probability	0.0002***
	Posterior probability of a causal effect	99.98%
170199	Actual	7,370,158
	Prediction (SD)	12,247,288 (1,722,324)
	95% confidence interval	[8,858,453, 15,655,670]
	Absolute effect (SD)	−4,877,130 (1,722,324)
	95% confidence interval	[−8,285,512, −1,488,295]
	Relative effect (SD)	−40% (14%)
	95% confidence interval	[−68%, −12%]
	Posterior tail-area probability	0.0018***
	Posterior probability of a causal effect	99.82%
620342	Actual	4,183,122
	Prediction (SD)	7,779,939 (518,285)
	95% confidence interval	[6,779,163, 8,811,100]
	Absolute effect (SD)	−3,596,817 (518,285)
	95% confidence interval	[−4,627,978, −2,596,042]
	Relative effect (SD)	−46% (6.7%)
	95% confidence interval	[−59%, −33%]
	Posterior tail-area probability	0.0002***
	Posterior probability of a causal effect	99.98%
710239	Actual	4,605,332
	Prediction (SD)	6,634,658 (848,205)
	95% confidence interval	[4,963,145, 8,297,396]
	Absolute effect (SD)	−2,029,325 (848,205)
	95% confidence interval	[−3,692,064, −357,813]
	Relative effect (SD)	−31% (13%)
	95% confidence interval	[−56%, −5.4%]
	Posterior tail-area probability	0.0076***
	Posterior probability of a causal effect	99.24%
610910	Actual	4,517,659
	Prediction (SD)	8,552,440 (926,533)
	95% confidence interval	[6,847,922, 10,443,976]
	Absolute effect (SD)	−4,034,781 (926,533)
	95% confidence interval	[−5,926,317, −2,330,263]
	Relative effect (SD)	−47% (11%)
	95% confidence interval	[−69%, −27%]
	Posterior tail-area probability	0.00021***
	Posterior probability of a causal effect	99.98%

(*continued*)

Table 6. Estimated impact of the COVID-19 pandemic on export trade value (US$) by sector: January 2020–June 2020

Sector[#]		Average
170114	Actual	7,120,252
	Prediction (SD)	6,651,625 (569,892)
	95% confidence interval	[5,541,143, 7,761,175]
	Absolute effect (SD)	468,627 (569,892)
	95% confidence interval	[−640,924, 1,579,108]
	Relative effect (SD)	7% (8.6%)
	95% confidence interval	[−9.6%, 24%]
	Posterior tail-area probability	0.212
	Posterior probability of a causal effect	79%
300490	Actual	1,962,027
	Prediction (SD)	2,466,127 (277,207)
	95% confidence interval	[1,912,486, 2,981,793]
	Absolute effect (SD)	−504,100 (277,207)
	95% confidence interval	[−1,019,766, 49,541]
	Relative effect (SD)	−20% (11%)
	95% confidence interval	[−41%, 2%]
	Posterior tail-area probability	0.0382**
	Posterior probability of a causal effect	96.18%
610510	Actual	1,367,282
	Prediction (SD)	2,244,491 (284,209)
	95% confidence interval	[1,681,506, 2,789,362]
	Absolute effect (SD)	−877,209 (284,209)
	95% confidence interval	[−1,422,080, −314,224]
	Relative effect (SD)	−39% (13%)
	95% confidence interval	[−63%, −14%]
	Posterior tail-area probability	0.0024**
	Posterior probability of a causal effect	99.76%
600622	Actual	1,466,328
	Prediction (SD)	1,685,986 (149,036)
	95% confidence interval	[1,388,200, 1,968,737]
	Absolute effect (SD)	−219,658 (149,036)
	95% confidence interval	[−502,409, 78,128]
	Relative effect (SD)	−13% (8.8%)
	95% confidence interval	[−30%, 4.6%]
	Posterior tail-area probability	0.0730*
	Posterior probability of a causal effect	93%

Note(s): Analysis using the CausalImpact (Brodersen *et al.*, 2015) with sector bearing HS code 030389 as synthetic control; standard deviations in parentheses; 95% confidence intervals in square brackets; ***, ** and * represent significance at the 1, 5 and 10%, respectively; [#] Sectors classified based on HS code; 620520: Shirts, men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter; 620342: Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds: non-industrial (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests: of cotton, knitted or crocheted; 170114: Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter; 030389: Fish; frozen, excluding fillets, livers, roes and other fish meat; 300490: Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts: men's or boys', of cotton, knitted or crocheted; 600622: Fabrics: knitted or crocheted fabrics, of cotton, dyed

Source(s): Authors' own elaboration

Table 6.

(France, USA and South Africa) would be most affected, with a posterior probability of a causal effect of 99.98%. On the other hand, the relative effect varies from −62% (for France) to −33% (for South Africa).

On average, the export trade values towards France amounted to about 9.28 M during the whole post-COVID-19 period. The latter would have been 24.69 M in the absence of the COVID-19's outbreak. This represents an absolute decrease of 15.41 M in the trade values and a relative decrease of 62% with a 95% confidence interval of [−80%, −45%]. This negative effect is statistically significant as suggested by the posterior tail-area probability (0.0003).

Moreover, during the post-COVID-19 period, exports towards Germany also encountered a reduction. On average, the export trade values had an approximate value of 1.90 M. If the pandemic did not occur, these values would have been expected to be 3.32 M. In absolute terms, this effect has accounted for about 1.41 M decrease. Relatively, this represents a reduction of 43% with a 95% confidence interval of [−65%, −20%], indicating that the COVID-19 pandemic outbreak had a significant and negative impact on exports towards Germany.

Furthermore, it can be observed that the trade values of exports towards Italy had an appropriate value of 7.43 M during the post-COVID-19 period. We would have expected an average of 12.02 M in trade values if the pandemic did not occur. Thus, in absolute terms, the outbreak of the pandemic has reduced the trade values by 4.59 M. Relatively speaking, this represents a decrease of 33% with a 95% confidence interval of [−50%, −16%]. This means that indeed the outbreak of the pandemic has negatively influenced exports towards Italy.

Similarly, for Spain, we find that during the whole post-COVID-19 period, the export trade values had an average of 6.23 M compared to 9.38 M in the absence of the outbreak. This indicates a decrease of 3.15 M in absolute terms. In relative terms, it can be observed that the trade values have significantly reduced to about 34%. The posterior tail-area probability value of 0.004 also indicates that there is only 0.4% chance that the export trade values in this specific country would have been positively influenced by the emergence of the COVID-19 pandemic.

In addition, export trade values in South Africa had an average value of 9.69 M during the whole post-COVID-19 period (January 2020–June 2020). These values would have been anticipated to be 14.38 M if the pandemic did not take place. Thus, in absolute terms, exports towards South Africa have reduced to about 4.70 M in trade values. Relatively, this amounts to a reduction of 33% in export trade values. The posterior tail-area probability (0.0002) once again indicates that there is no chance that the outbreak of the pandemic would have led to an increase in exports towards South Africa.

With regards to exports towards the UK and USA, the latter were not spared by the outbreak of the COVID-19 pandemic. Exports towards both countries encountered a relative decrease of 36 and 38%, respectively. On average, during the post-COVID-19 period, export trade values in the UK and the USA were 10.80 and 11.32 M, respectively, compared to 16.91 and 18.33 M in the absence of the outbreak. This represents an absolute impact of −6.10 M for the UK and −7.01 M for the USA. Again here, there are very low chances (posterior tail-area probability values of 0.04 and 0.02%, respectively) that exports towards these countries would have been increased due to the outbreak of the pandemic.

On the other hand, it can be seen from Table 5 that exports towards Belgium, China and Thailand were not affected by the pandemic during the first six months preceding its outbreak. This could be explained by the fact that these countries did not close their borders with Mauritius and exports could be carried on. Nevertheless, the results obtained for the posterior probability of a causal effect (84% for Belgium, 54% for China and 79% for Thailand) point out that in the long run, exports towards these countries will surely be affected by the pandemic.

5.2.2 Sectors. It can be observed from Table 6 that for each sector where the effect proves to be significant (p-value less than 10%), the outbreak had a negative impact on their export trade values, and the posterior probability of a causal effect is above 90%: this means that exports in these sectors were mostly affected by the outbreak of the pandemic. On the other hand, the relative effect varies from −51% (for the sector men's and boys' shirts of cotton (not knitted or crocheted) (HS code: 620520)) to −13% (for the sector fabrics, knitted or crocheted, of cotton or dyed (HS code: 600622)). Moreover, it is eminent from our analysis that there exists a relationship between the decline in trade values in the different sectors and the closure of borders in different countries. The sectors which have been most affected by the pandemic, whereby a decrease of beyond 30% can be noted, consist of products that are mainly exported towards South Africa, USA, UK and France (see Table A2 in Appendix). The decline in export values in these sectors can obviously be explained by the closure of the Mauritian border to these countries during this period (March 2020–June 2020) to contain the spread of COVID-19 infections and the closure of the South African border to foreigners as from March 2020.

A glance at the results of the sector "Shirts: men's or boys', of cotton (not knitted or crocheted) (HS code: 620520)" reveals that the export trade value in this sector had an approximate value of 5.66 M during the post-COVID-19 period. As compared to the absence of the pandemic (11.62 M), this indicates an absolute decrease of 5.96 M in trade values. In relative terms, this represents a decline of 51%. The 95% confidence interval for this percentage [−63%, −39%] shows that the respective sector was indeed negatively affected by the outbreak of the COVID-19 pandemic.

In the same way, it can be seen that the export trade values in the sector "Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced) (HS code: 160414)" also experienced a reduction. In the case that the pandemic did not spring up, the export trade values in this sector would have been an approximate value of 23.70 M. However, the latter had an average value of 16.75 M during the post-COVID-19 period. Thus, in absolute terms, exports in this sector have decreased by about 6.95 M. Relatively, this depicts a decrease of 29% with a 95% confidence interval of [−45%, −14%].

Moreover, during the whole post-COVID-19 period (January 2020–June 2020), the export trade values in the sector "Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter (HS code: 170199)" had an average value of 7.37 M as compared to a value of 12.25 M had the outbreak of the pandemic not occurred. This illustrates an absolute decrease of 4.88 M and a relative reduction of 40% with a 95% confidence interval of [−68%, −12%]. The confidence interval clearly shows that the outbreak of the pandemic had a significant and negative effect on exports in this sector.

Additionally, exports in the sector "Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted) (HS code: 620342)" also experienced a relative reduction of 46% in its trade values. During the post-COVID-19, the export trade values averaged to about 4.18 M. This represents a decrease of 3.60 M in the latter as compared to a value of 7.78 M in the absence of the pandemic. Also, with a posterior tail-area probability as low as 0.02%, it is unlikely that the pandemic would have caused exports in this sector to increase.

With regards to the sector "Diamonds: non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set (HS code: 710239)", the export trade values had an average value of 4.61 M during the post-COVID-19 period. In the absence of the outbreak of the pandemic, we would have expected a value of 6.63 M. As such, this depicts an absolute reduction of 2.03 M in trade values for this specific sector. In relative terms, this decrease is about 31 with a 95% confidence level of [−56%, −5.4%], thereby suggesting that the outbreak of the COVID-19 pandemic had a negative and significant on the exports in this sector.

Furthermore, it can be observed that the export trade values for the sector "T-shirts, singlets and other vests: of cotton, knitted or crocheted (HS code: 610910)" would have been 8.55 M if the pandemic did not spring up. However, the latter had an approximate value of 4.52 M. In other words, this indicates, in absolute terms, that the outbreak of the pandemic decreased the trade values by 4.03 M. Quantifying this in relative terms reveals that the export trade values in this sector reduced by about 47%. Clearly, a posterior tail-area probability of 0.00021 shows that there is relatively no chance that the trade values would have been positively influenced by the outbreak of the pandemic.

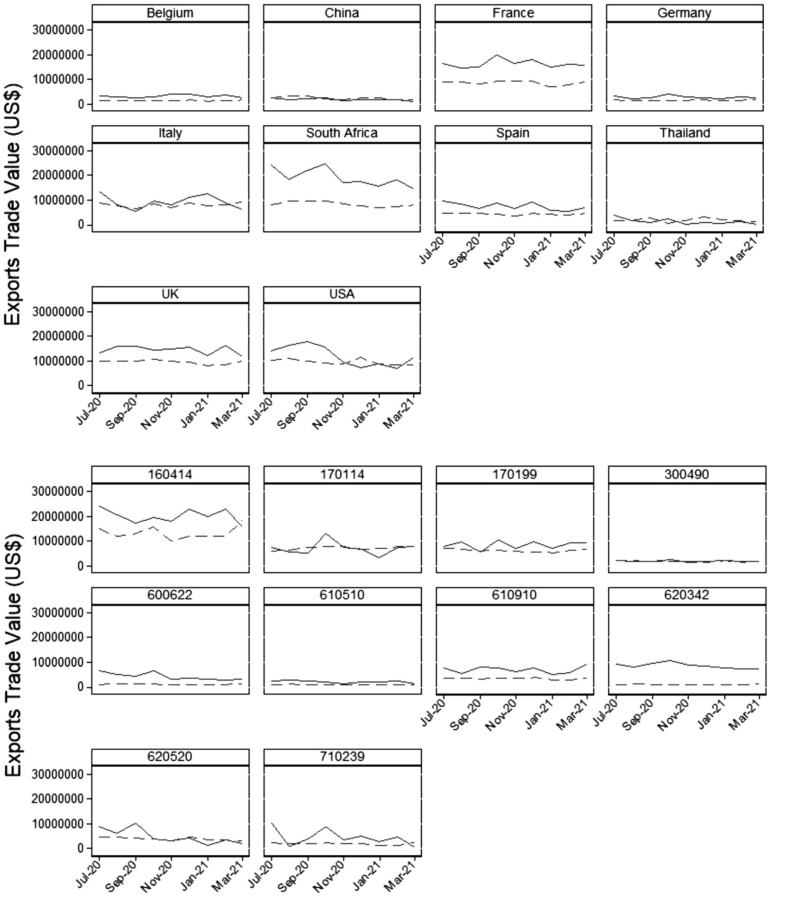
Turning to the sector "Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale (HS code: 300490)", exports trade values had an approximate value of 1.96 M during the whole post-COVID-19 pandemic. If the pandemic did not occur, this would have been about 2.47 M, thereby depicting an absolute decrease of 0.50 M in trade values. Despite that this represents a relative reduction of 20% in trade values, the 95% confidence interval of [−41%, 2%] indicates that the negative effect exerted by the pandemic on this sector is significant at the 5% significance level.

Likewise, exports in the sector "Shirts: men's or boys', of cotton, knitted or crocheted (HS code: 610510)" has also reduced due to the outbreak of the pandemic. The export trade values in this specific amounted to about 1.37 M during the post-COVID-19 period as compared to a value of 2.24 M in the absence of the pandemic. This indicates that the trade values have reduced by 39%, depicting a decrease of 0.88 M in absolute terms. It can also be seen that with a 95% confidence interval of [−63%, −14%] and a posterior tail-area probability of 0.0024, this negative effect is highly significant, thereby suggesting that there is no chance that the outbreak of the pandemic would have increased exports in this specific sector.

Zooming now to the sector "Fabrics: knitted or crocheted fabrics, of cotton, dyed (HS code: 600622)', it can be seen that the export trade values were on average approximately 1.47 M during the whole post-COVID-19 period. If the pandemic did not occur, we would have expected a value of 1.69 M, which represents an absolute decrease of 0.22 M in trade values. In relative terms, exports in this sector have reduced by about 13%. As compared to the other sectors, this sector appeared to be less affected by the outbreak of the pandemic. This may be due that these products are mostly exported to Madagascar, South Africa, Lesotho and India by ship, and Mauritius did not close its freight transport by ship. Although this effect is very low, the posterior tail-area probability shows that the latter is significant at the 10% significance level.

Conversely, it can be observed that the outbreak of the pandemic exerted a negative impact on all sectors except for the sector "Sugars, cane sugar, raw, in solid form, not containing added flavouring or colouring matter (HS code: 170114)". One potential explanation for the non-significance of the effect in this specific sector relies upon the fact that the products from this sector are mainly exported to countries such as Kenya, UK, US, Germany and France, and the latter did not close their borders with Mauritius (see Table A2 in Appendix).

5.2.3 Forecast scenarios. It is obvious that the COVID-19 pandemic remains a great concern worldwide at a time when uncertainty prevails. The global and regional lockdowns together with the closure of borders in some countries have disrupted international trade flows. The WTO has projected a decline of 9.2% in global trade in 2020 and a 7.2% rise in the latter in 2021 (WTO, 2020). In light of this, we use the BSTS model to provide nine months ahead forecasts (July 2020–March 2021) for the ten main trading partners and sectors investigated previously. A comparison with real values (see Figure 2) shows that on the whole, our predictions are below those observed. One potential explanation is that during this period, Mauritius relaxes its border restrictions as from October 2020 after a decline in local cases. Thus, the effect of the pandemic on the export trade system of the country is highly reliable on the measures taken both locally and internationally to mitigate the spread of the virus worldwide.



Note(s): Solid lines represent original values and dotted lines predicted by the BSTS models; Exports trade value (US$) on y-axis and date on x-axis; Series in lower panel areclassified based on HS Code; 620520: Shirts; men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations; tunas, skipjack and Atlantic bonito (sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars; sucrose, chemically pure, in solid form, not containing added flavoring or coloring matter; 620342: Trousers, bib and brace overalls, breeches and shorts; men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds; non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests; of cotton, knitted or crocheted; 170114: Sugars; cane sugar, raw, in solid form, not containing added flavoring or coloring matter; 300490: Medicaments; consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts; men's or boys', of cotton, knitted or crocheted; 600622: Fabrics; knitted or crocheted fabrics, of cotton, dyed
Source(s): Authors' elaboration

Figure 2.
Predicted and real export trade value July 2020–March 2021

6. Conclusion

Needless to say that the COVID-19 pandemic is much more than a global health crisis, it remains the most challenging crisis and biggest economic turmoil that the world is facing since the Second World War. This pandemic is believed to lead to an economic recession with no parallel in the recent past. The international service sector remains one of the most affected sectors due to travel restrictions and global measures taken to contain the spreading of the pandemic. As a result, global demand and supply of goods and services have been affected. The export trade system in the small island economy, Mauritius, has not been spared.

This study has thus set out to empirically examine the impact of the COVID-19 pandemic on the Mauritian export trade system for the first half of 2020 (January 2020–June 2020). In particular, its effect was investigated on the total export trade values in the main export sectors and export trading partners of the country. A quick manipulation of the data showed that as compared to the same period of the previous year (i.e. January 2019–June 2019), there was an overall decline in the total export values both in terms of sectors and countries of exports. Moreover, a preliminary analysis of the monthly export time series data also confirmed that in general, the series departed from their original trends after the outbreak of the pandemic: observed values were below those predicted by the optimal forecast models. Surprisingly, contrary to what was predicted, our results also revealed an increase in total exports to Japan and in sectors such as "Sugars: cane sugar, raw, in solid form (HS code: 170114)" and "Fish: frozen, excluding fillets, livers, roes and other fish (HS code: 030389)". The BSTS framework for causal analysis was subsequently used to evaluate the impact of the COVID-19 pandemic on the island's export trade system during the first six months following its outbreak (January 2020–June 2020). The findings indicated that in most cases, there was a significant and negative relationship between the pandemic and the total export values. In other words, the decline in the total export values in the different sectors and countries was somehow directly related to the outbreak of the pandemic. In terms of export trading partners, France was found to be most affected with a relative decline of 62% in its total export values while South Africa was the least affected one (a 33% decline). On the other hand, sector "Men's and boys' shirts, of cotton (not knitted or crocheted) (HS code: 620520)" seemed to be the most affected with a relative decrease of 51% whereas the sector "Fabrics: knitted or crocheted, of cotton or dyed (HS code: 600622)" was least affected (a 13% decrease). It is worth noting that the main sectors and trading partners are directly linked together. Thus, the reduction in the total export values in the main sectors and main export trading partners could be explained by the closure of the Mauritian border to these countries in mid-March 2020 and the global lockdown. As for the sectors, the decrease could also be explained by the fact that some countries have cut the importation of some goods due to high freight costs and the global uncertainty that prevails. Additionally, the results also pointed out that in the long run, the total export values in both the main sectors and export trading partners will surely be affected by the pandemic although it was not apparent in the first six months following the outbreak.

Taken together, the findings from this study have some important implications for future practice for Mauritius in view to mitigate the effect of the pandemic on its export trade system. First, the government should devise an appropriate export financing scheme to support companies with export activities affected by the pandemic. Small and medium enterprises (SMEs) with a certain amount of export activities should also be supported. Second, the waiving of the export charges imposed by the Mauritius Ports Authority and Cargo Handling Corporation Ltd should further be extended to one year. Similarly, the Freight Rebate Scheme on exports to South Africa and Tamatave should also be extended. The government should also come up with an international freight assistance mechanism to have better control on airfreight rates until commercial airfreight capacity can be restored. Nevertheless, the situation should be evaluated every six months and measures adjusted

accordingly. Moreover, the appreciation/depreciation of a country's currency also plays a significant role in the evolution of its merchandise trade. In this respect, the government should prevent the country's currency from depreciating further as the US dollar keeps on appreciating globally.

Notes

1. Conversely, the forecast for next year is more pessimistic than the previous estimate of 21.3% growth, leaving merchandise trade well below its pre-pandemic trend in 2021.
2. With a total case per million of population of 467, a death per million of population of eight (ten deaths in total) and a PCR test standing at 227,443 per million of population, the country is among the best worldwide in terms of the COVID-19 crisis management.
3. Statistics Mauritius (2020).
4. World Bank (2020) forecasted total exports of goods and services for 2020 to decrease by around 28% compared with 2019 and total imports to decline by 20.0%.
5. DCDM Research (2020).
6. 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.
7. Refer to Table A1 Appendix for a detailed description of each sector.
8. The pre-intervention (pre-COVID-19) 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 (post-COVID-19) period considers data from January 2020 to June 2020.
9. The optimal ARIMA model is selected based on the automated procedures of the forecast package of *R* (Hyndman and Khandakar, 2008).
10. Based on 2019's data (UN Comtrade, 2020).
11. Only significant results are discussed. The impact of the outbreak in each country and sector discussed is illustrated in Figures A4-A5 in Appendix.

References

Baldwin, R. and Di Mauro, B.W. (2020), *Economics in the Time of COVID-19*, A VoxEU.org eBook, CEPR Press, available at: https://voxeu.org/article/economics-time-covid-19-new-ebook.

Baldwin, R. and Tomiura, E. (2020), "Thinking ahead about the trade impact of COVID-19", *Economics in the Time of COVID-*, Vol. 19, p. 59.

Batool, M., Ghulam, H., Hayat, M.A., Naeem, M.Z., Ejaz, A., Imran, Z.A., Spulbar, C., Birau, R. and Gorun, T.H. (2020), "How COVID-19 has shaken the sharing economy? An analysis using Google trends data", *Economic Research-Ekonomska Istraživanja*, Vol. 34 No. 1, pp. 1-13.

Blaum, J., Lelarge, C. and Peters, M. (2018), "The gains from input trade with heterogeneous importers", *American Economic Journal: Macroeconomics*, Vol. 10 No. 4, pp. 77-127.

Boehm, C.E., Flaaen, A. and Pandalai-Nayar, N. (2019), "Input linkages and the transmission of shocks: firm-level evidence from the 2011 Tōhoku earthquake", *Review of Economics and Statistics*, Vol. 101 No. 1, pp. 60-75.

Brodersen, K. (2016), "How long should the period be?", available at: 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).

Brodersen, K.H., Gallusser, F., Koehler, J., Remy, N. and Scott, S.L. (2015), "Inferring causal impact using Bayesian structural time-series models", *Annals of Applied Statistics*, Vol. 9 No. 1, pp. 247-274.

Chudik, A., Mohaddes, K., Pesaran, M.H., Raissi, M. and Rebucci, A. (2020), *Economic Consequences of Covid-19: A Counterfactual Multi-Country Analysis*, Center for Economic and Policy Research, Washington DC, available at: https://voxeu.org/article/economic-consequences-covid-19-multi-country-analysis.

DCDM Research (2020), "Report on impact of covid-19 on businesses in Mauritius", available at: 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).

Dingel, J.I. and Neiman, B. (2020), "How many jobs can be done at home?", *Journal of Public Economics*, Vol. 189, p. 104235.

Espitia, A., Mattoo, A., Rocha, N., Ruta, M. and Winkler, D. (2021), "Trade and COVID-19: lessons from the first wave", CEPR, United Kingdom, 18 January, available at: https://voxeu.org/article/trade-and-covid-19-lessons-first-wave (accessed 18 October 2021).

Halpern, L., Koren, M. and Szeidl, A. (2015), "Imported inputs and productivity", *American Economic Review*, Vol. 105 No. 12, pp. 3660-3703.

Hayakawa, K. and Mukunoki, H. (2021), "The impact of COVID-19 on international trade: evidence from the first shock", *Journal of the Japanese and International Economies*, Vol. 60, p. 101135.

Hyndman, R.J. and Khandakar, Y. (2008), "Automatic time series forecasting: the forecast package for R", *Journal of Statistical Software*, Vol. 26 No. 3, pp. 1-22.

Khan Jaffur, Z. and Seetanah, B. (2020), *The Immediate Impact of COVID-19 Pandemic on Tourism in Mauritius*, (unpublished manuscript, December 05 2020), available at: http://wtochairs.org/mauritius/research/immediate-impact-covid-19-pandemic-tourism-mauritius.

Khan Jaffur, Z., Seetanah, B., Tandrayen-Ragoobur, V., Fauzel, S., Teeroovengadum, V. and Ramsohok, S. (2021), "Impact of COVID-19 outbreak on the Mauritian export trade: a disaggregated analysis", (unpublished manuscript, April 08 2021), available at: http://wtochairs.org/mauritius/research/impact-covid-19-outbreak-mauritian-export-trade-disaggregated-analysis.

Liu, X., Ornelas, E. and Shi, H. (2021), "The trade impact of the Covid-19 pandemic", Working paper [19109], Munich Society for the Promotion of Economic Research – CESifo GmbH, Munich, May, pp. 1-30.

Maliszewska, M., Mattoo, A. and Van Der Mensbrugghe, D. (2020), "The potential impact of COVID-19 on GDP and trade: a preliminary assessment", Working paper [9211], The World Bank Group, Washington, 21 May.

Mirza, N., Rahat, B., Naqvi, B. and Rizvi, S.K.A. (2020), "Impact of Covid-19 on corporate solvency and possible policy responses in the EU", *The Quarterly Review of Economics and Finance*, Advance online publication, doi: 10.1016/j.qref.2020.09.002.

Perles-Ribes, J.F., Ramón-Rodríguez, A.B., Moreno-Izquierdo, L. and Torregrosa Martí, M.T. (2018), "Winners and losers in the Arab uprisings: a Mediterranean tourism perspective", *Current Issues in Tourism*, Vol. 21 No. 16, pp. 1810-1829.

Perles-Ribes, J.F., Ramón-Rodríguez, A.B., Such-Devesa, M.J. and Moreno-Izquierdo, L. (2019a), "Effects of political instability in consolidated destinations: the case of Catalonia (Spain)", *Tourism Management*, Vol. 70, pp. 134-139.

Perles-Ribes, J.F., Ramón-Rodríguez, A.B. and Ortuño Padilla, A. (2019b), "Brexit announcement: immediate impact on British tourism in Spain", *Cornell Hospitality Quarterly*, Vol. 60 No. 2, pp. 97-103.

Rizvi, S.K.A., Yarovaya, L., Mirza, N. and Naqvi, B. (2020), "The impact of COVID-19 on valuations of non-financial European firms", Unpublished manuscript, 11 October 2020, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3705462.

Shaikh, I. (2021), "Impact of COVID-19 pandemic disease outbreak on the global equity markets", *Economic Research-Ekonomska Istraživanja*, Vol. 34 No. 1, pp. 2317-2336.

Soto-Valero, C. and Pic, M. (2019), "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*, Vol. 18 No. 3, pp. 69-88.

Statistics Mauritius (2020), "National accounts estimates", available at: https://statsmauritius.govmu.org/Slider/SitePages/NAE_Dec20.aspx (accessed 21 January 2021).

Stenseth, N.C., Dharmarajan, G., Li, R., Shi, Z.L., Yang, R. and Gao, G.F. (2021), "Lessons learnt from the COVID-19 pandemic", *Frontiers in Public Health*, Vol. 9, Advance online publication, doi: 10.3389/fpubh.2021.694705.

Takyi, P.O. and Bentum-Ennin, I. (2020), "The impact of COVID-19 on stock market performance in Africa: a Bayesian structural time series approach", *Journal of Economics and Business*, Advance online publication, doi: 10.1016/j.jeconbus.2020.105968.

UN Comtrade (2020), *UN Comtrade International Trade Statistics*, United Nations Data, Geneva, Switzerland, available at: https://comtrade.un.org/.

Vidya, C.T. and Prabheesh, K.P. (2020), "Implications of COVID-19 pandemic on the global trade networks", *Emerging Markets Finance and Trade*, Vol. 56 No. 10, pp. 2408-2421.

World Trade Organization (WTO) (2020), "Trade shows signs of rebound from COVID-19, recovery still uncertain", available at: https://www.wto.org/english/news_e/pres20_e/pr862_e.htm (accessed 21 January 2021).

World Bank (2020), "Mauritius", available at: http://pubdocs.worldbank.org/en/794311492188165385/mpo-mus.pdf (accessed 21 January 2021).

Zhang, W.-W., Dawei, W., Majeed, M.T. and Sohail, S. (2021), "COVID-19 and international trade: insights and policy challenges in China and USA", *Economic Research-Ekonomska Istraživanja*, Advance online publication, doi: 10.1080/1331677X.2021.1930091.

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Appendix

	2015	2016	2017	2018	2019	2020	2021
Volume of world merchandise trade[b]	2.3	1.4	4.7	2.9	−0.1	−9.2	7.2
Exports							
North America	2.6	0.7	3.4	3.8	1.0	−14.7	10.7
South and Central America	0.6	1.3	2.9	0.1	−2.2	−7.7	5.4
Europe	2.9	1.1	3.7	2.0	0.1	−11.7	8.2
Asia	1.3	2.3	6.7	3.7	0.9	−4.5	5.7
Other regions[c]	1.8	3.5	0.7	0.7	−2.9	−9.5	6.1
Imports							
North America	5.2	0.3	4.4	5.2	−0.4	−8.7	6.7
South and Central America	−7.6	−9.0	4.3	5.3	−2.1	−13.5	6.5
Europe	3.6	3.0	3.0	1.5	0.5	−10.3	8.7
Asia	2.1	2.2	8.4	4.9	−0.6	−4.4	6.2
Other regions[c]	−3.9	−4.5	3.4	0.3	1.5	−16.0	5.6
Real GDP at market exchange rates	2.8	2.4	3.1	2.8	2.2	−4.8	4.9
North America	2.8	1.7	2.4	2.8	2.1	−4.4	3.9
South and Central America	−0.8	−2.0	0.8	0.6	−0.2	−7.5	3.8
Europe	2.4	2.1	2.8	2.1	1.5	−7.3	5.2
Asia	4.3	4.2	4.8	4.1	3.9	−2.4	5.9
Other regions[c]	1.5	2.4	1.9	2.1	1.4	−5.5	3.5

Note(s): [a]Figures for 2020 and 2021 are projections, [b]Average of exports and imports, [c]Other regions comprise Africa, Middle East and Commonwealth of Independent States (CIS), including associate and former member States

Figure A1. Merchandise trade volume and real GDP, 2015-2021[a]: Annual % change

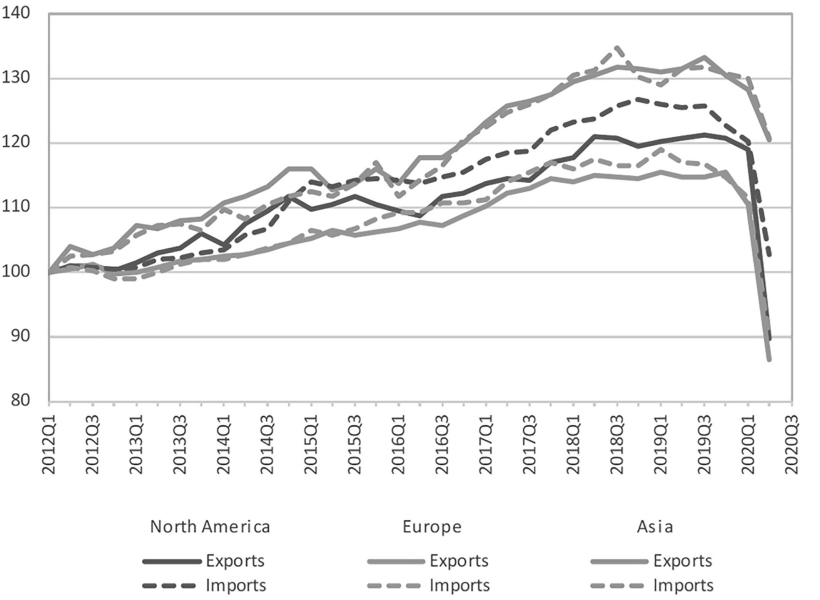


Figure A2.
Merchandise exports and imports by region

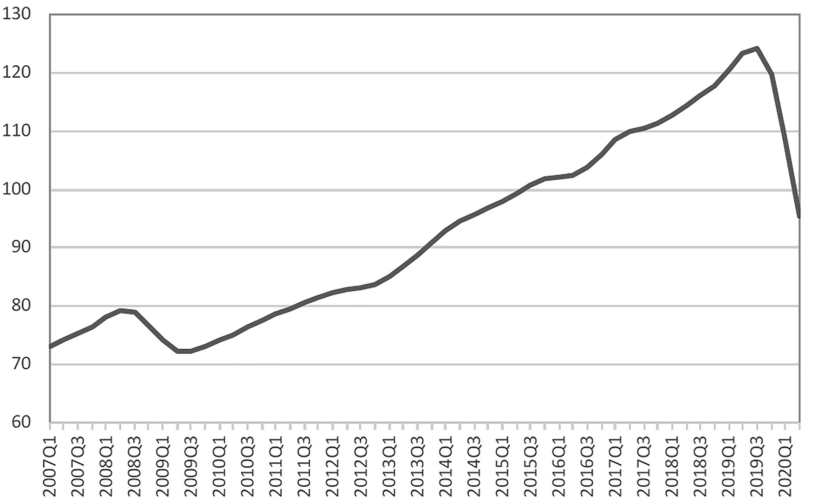


Figure A3.
World services trade activity index

HS code	Description
620520	Shirts: men's or boys', of cotton (not knitted or crocheted)
160414	Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced)
170199	Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter
620342	Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted)
710239	Diamonds: non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set
610910	T-shirts, singlets and other vests: of cotton, knitted or crocheted
170114	Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter
030389	Fish: frozen, excluding fillets, livers, roes and other fish meat
300490	Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale
610510	Shirts: men's or boys', of cotton, knitted or crocheted
600622	Fabrics: knitted or crocheted fabrics, of cotton, dyed

Table A1.
Description of main trading export sectors

HS code	Description	Top five trading partners[#]
620520	Shirts: men's or boys', of cotton (not knitted or crocheted)	USA, Netherlands, South Africa, France, Canada
160414	Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced)	UK, Italy, Spain, Netherlands, France
170199	Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter	Italy, Spain, Greece, Kenya, UK
620342	Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted)	South Africa, USA, Netherlands, Italy, Czech republic
710239	Diamonds: non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set	Vietnam, Belgium, USA, Switzerland, India
610910	T-shirts, singlets and other vests: of cotton, knitted or crocheted	South Africa, UK, France, USA, Italy
170114	Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter	Kenya, UK, USA, France, Germany
030389	Fish: frozen, excluding fillets, livers, roes and other fish meat	Japan, Spain, other asia, China, the Republic of Korea
300490	Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale	Singapore, France, Madagascar, United Arab Emirates, Seychelles
610510	Shirts: men's or boys', of cotton, knitted or crocheted	South Africa, Italy, France, USA, UK
600622	Fabrics: knitted or crocheted fabrics, of cotton, dyed	Madagascar, South Africa, Lesotho, India, France

Note(s): [#]Based on 2019's data
Source(s): UN Comtrade (2020)

Table A2.
Sector and top five trading partners

Country		Cumulative
Belgium	Actual	10,720,708
	Prediction (SD)	13,727,338 (3,144,952)
	95% confidence interval	[7,685,164, 19,761,781]
	Absolute effect (SD)	−3,006,630 (3,144,952)
	95% confidence interval	[−9,041,073, 3,035,544]
	Relative effect (SD)	−22% (23%)
	95% confidence interval	[−66%, 22%]
China	Actual	11,735,879
	Prediction (SD)	11,984,861 (3,414,413)
	95% confidence interval	[5,166,146, 18,556,416]
	Absolute effect (SD)	−248,982 (3,414,413)
	95% confidence interval	[−6,820,537, 6,569,733]
	Relative effect (SD)	−2.1% (28%)
	95% confidence interval	[−57%, 55%]
France	Actual	55,703,906
	Prediction (SD)	148,150,597 (13,342,970)
	95% confidence interval	[123,017,720, 174,680,756]
	Absolute effect (SD)	−92,446,691 (13,342,970)
	95% confidence interval	[−118,976,850, −67,313,814]
	Relative effect (SD)	−62% (9%)
	95% confidence interval	[−80%, −45%]
Germany	Actual	11,407,628
	Prediction (SD)	19,895,943 (2,266,135)
	95% confidence interval	[15,434,005, 24,326,625]
	Absolute effect (SD)	−8,488,315 (2,266,135)
	95% confidence interval	[−12,918,997, −4,026,377]
	Relative effect (SD)	−43% (11%)
	95% confidence interval	[−65%, −20%]
Italy	Actual	44,600,538
	Prediction (SD)	72,146,984 (9,364,647)
	95% confidence interval	[54,001,435, 90,793,683]
	Absolute effect (SD)	−27,546,446 (9,364,647)
	95% confidence interval	[−46,193,145, −9,400,897]
	Relative effect (SD)	−38% (13%)
	95% confidence interval	[−64%, −13%]
South Africa	Actual	58,129,379
	Prediction (SD)	86,302,830 (7,515,383)
	95% confidence interval	[71,565,973, 100,952,475]
	Absolute effect (SD)	−28,173,452 (7,515,383)
	95% confidence interval	[−42,823,096, −13,436,594]
	Relative effect (SD)	−33% (8.7%)
	95% confidence interval	[−50%, −16%]
Spain	Actual	37,382,030
	Prediction (SD)	56,307,933 (6,918,971)
	95% confidence interval	[42,441,209, 69,851,800]
	Absolute effect (SD)	−18,925,903 (6,918,971)
	95% confidence interval	[−32,469,770, −5,059,179]
	Relative effect (SD)	−34% (12%)
	95% confidence interval	[−58%, −9%]
Thailand	Actual	7,772,760
	Prediction (SD)	6,364,740 (1,708,906)
	95% confidence interval	[3,038,123, 9,695,694]
	Absolute effect (SD)	1,408,020 (1,708,906)
	95% confidence interval	[−1,922,934, 4,734,637]
	Relative effect (SD)	22% (27%)
	95% confidence interval	[−30%, 74%]

Table A3.
Estimated impact of the COVID-19 pandemic on export trade value (US$) by country: January 2020–June 2020

(*continued*)

Country		Cumulative
The UK	Actual	64,824,700
	Prediction (SD)	101,445,230 (10,898,566)
	95% confidence interval	[79,812,915, 122,237,213]
	Absolute effect (SD)	−36,620,530 (10,898,566)
	95% confidence interval	[−57,412,513, −14,988,215]
	Relative effect (SD)	−36% (11%)
	95% confidence interval	[−57%, −15%]
The USA	Actual	67,915,328
	Prediction (SD)	109,999,921 (9,226,534)
	95% confidence interval	[91,953,097, 127,656,261]
	Absolute effect (SD)	−42,084,593 (9,226,534)
	95% confidence interval	[−59,740,933, −24,037,769]
	Relative effect (SD)	−38% (8.4%)
	95% confidence interval	[−54%, −22%]

Note(s): Analysis using the CausalImpact (Brodersen *et al.*, 2015) with Japan as synthetic control; standard deviations in parentheses; 95% confidence intervals in square brackets; ***, ** and * represent significance at the 1, 5 and 10%, respectively
Source(s): Authors' elaboration

Table A3.

Sector#		Cumulative
620520	Actual	33,944,763
	Prediction (SD)	69,720,642 (4,276,399)
	95% confidence interval	[61,258,820, 78,132,172]
	Absolute effect (SD)	−35,775,879 (4,276,399)
	95% confidence interval	[−44,187,409, −27,314,057]
	Relative effect (SD)	−51% (6.1%)
	95% confidence interval	[−63%, −39%]
160414	Actual	100,495,642
	Prediction (SD)	142,185,803 (10,809,561)
	95% confidence interval	[121,079,954, 163,906,257]
	Absolute effect (SD)	−41,690,162 (10,809,561)
	95% confidence interval	[−63,410,615, −20,584,312]
	Relative effect (SD)	−29% (7.6%)
	95% confidence interval	[−45%, −14%]
170199	Actual	44,220,947
	Prediction (SD)	73,483,729 (10,333,924)
	95% confidence interval	[53,150,717, 93,934,020]
	Absolute effect (SD)	−29,262,781 (10,333,924)
	95% confidence interval	[−49,713,072, −8,929,769]
	Relative effect (SD)	−40% (14%)
	95% confidence interval	[−68%, −12%]
620342	Actual	25,098,731
	Prediction (SD)	46,679,635 (3,109,707)
	95% confidence interval	[40,674,980, 52,866,600]
	Absolute effect (SD)	−21,580,904 (3,109,707)
	95% confidence interval	[−27,767,869, −15,576,249]
	Relative effect (SD)	−46% (6.7%)
	95% confidence interval	[−59%, −33%]

(*continued*)

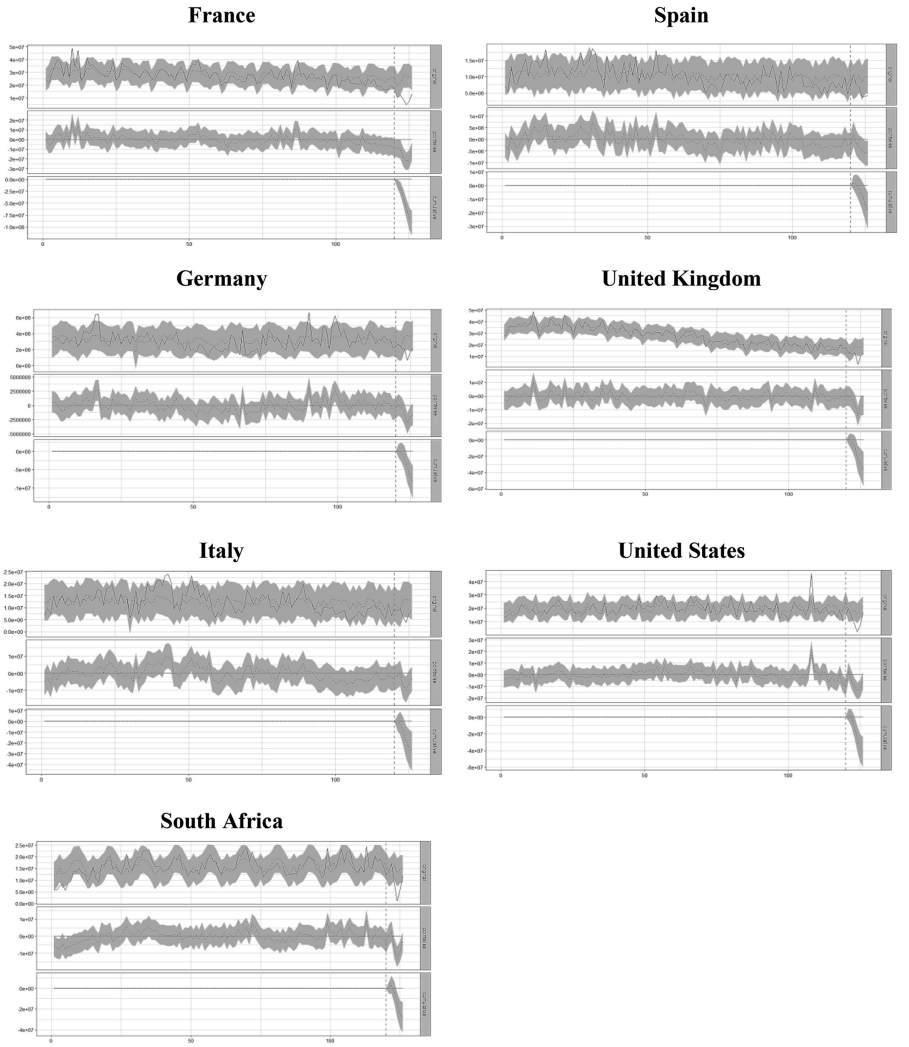
Table A4. Estimated impact of the COVID-19 pandemic on export trade value (US$) by sector: January 2020–June 2020

Sector[#]		Cumulative
710239	Actual	27,631,993
	Prediction (SD)	39,807,945 (5,089,232)
	95% confidence interval	[39,807,945, 29,778,868]
	Absolute effect (SD)	−12,175,953 (5,089,232)
	95% confidence interval	[−22,152,382, −2,146,875]
	Relative effect (SD)	−31% (13%)
	95% confidence interval	[−56%, −5.4%]
610910	Actual	27,105,956
	Prediction (SD)	51,314,639 (5,559,198)
	95% confidence interval	[41,087,534, 62,663,855]
	Absolute effect (SD)	−24,208,684 (5,559,198)
	95% confidence interval	[−35,557,900, −13,981,578]
	Relative effect (SD)	−47% (11%)
	95% confidence interval	[−69%, −27%]
170114	Actual	42,721,511
	Prediction (SD)	39,909,750 (3,419,350)
	95% confidence interval	[33,246,861, 46,567,052]
	Absolute effect (SD)	2,811,760 (3,419,350)
	95% confidence interval	[−3,845,541, 9,474,650]
	Relative effect (SD)	7% (8.6%)
	95% confidence interval	[−9.6%, 24%]
300490	Actual	11,772,163
	Prediction (SD)	14,796,764 (1,663,240)
	95% confidence interval	[11,474,917, 17,890,757]
	Absolute effect (SD)	−3,024,600 (1,663,240)
	95% confidence interval	[−6,118,593, 297,247]
	Relative effect (SD)	−20% (11%)
	95% confidence interval	[−41%, 2%]
610510	Actual	8,203,693
	Prediction (SD)	13,466,947 (1,705,253)
	95% confidence interval	[10,089,037, 16,736,174]
	Absolute effect (SD)	−5,263,254 (1,705,253)
	95% confidence interval	[−8,532,481, −1,885,345]
	Relative effect (SD)	−39% (13%)
	95% confidence interval	[−63%, −14%]
600622	Actual	8,797,966
	Prediction (SD)	10,115,914 (894,219)
	95% confidence interval	[8,329,198, 11,812,421]
	Absolute effect (SD)	−1,317,948 (894,219)
	95% confidence interval	[−3,014,455, 468,768]
	Relative effect (SD)	−13% (8.8%)
	95% confidence interval	[−30%, 4.6%]

Note(s): Analysis using the CausalImpact (Brodersen *et al.*, 2015) with sector bearing HS code 030389 as synthetic control; standard deviations in parentheses; 95% confidence intervals in square brackets; ***, ** and * represent significance at the 1, 5 and 10%, respectively; [#] Sectors classified based on HS code; 620520: Shirts: men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations: tunas, skipjack and Atlantic bonito (Sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars: sucrose, chemically pure, in solid form, not containing added flavouring or colouring matter; 620342: Trousers, bib and brace overalls, breeches and shorts: men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds: non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests: of cotton, knitted or crocheted; 170114: Sugars: cane sugar, raw, in solid form, not containing added flavouring or colouring matter; 030389: Fish: frozen, excluding fillets, livers, roes and other fish meat; 300490: Medicaments, consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts: men's or boys', of cotton, knitted or crocheted; 600622: Fabrics: knitted or crocheted fabrics, of cotton, dyed

Source(s): Authors' own elaboration

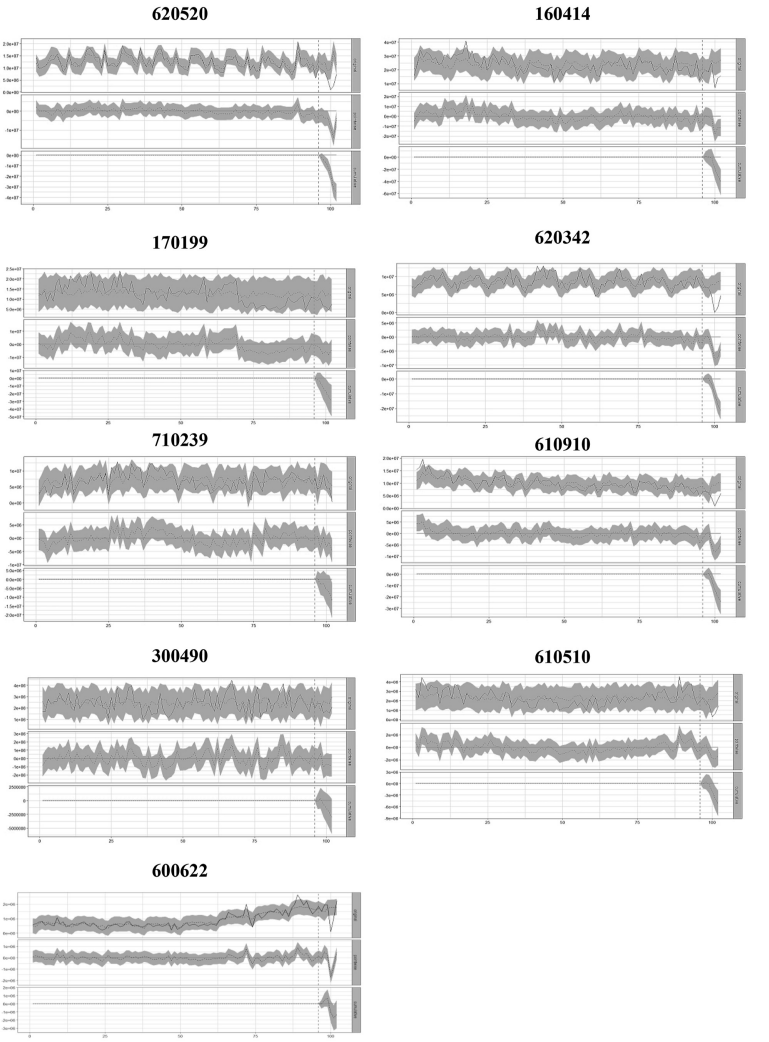
Table A4.



Note(s): y-axis: Exports Trade Value (US$); Dotted vertical line representing the month in which the COVID-19 outbreak was first identified in Wuhan, China (December 2019 -Observation 120 on the x-axis); Top plot showing the observed series (black) and its predicted values (dotted blue); Middle plot showing the difference between the prediction and the observed values; Bottom plot showing the total effect of these differences within the post-intervention period

Source(s): CausalImpact R-package output

Figure A4. Bayesian posterior distribution graphs for the impact of COVID-19 pandemic on export trading countries



Note(s): See Figure A4;620520: Shirts; men's or boys', of cotton (not knitted or crocheted); 160414: Fish preparations; tunas, skipjack and Atlantic bonito (sarda spp.), prepared preserved, whole or in pieces (but not minced); 170199: Sugars; sucrose, chemically pure, in solid form, not containing added flavoring or coloring matter; 620342: Trousers, bib and brace overalls, breeches and shorts; men's or boys', of cotton (not knitted or crocheted); 710239: Diamonds; non-industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set; 610910: T-shirts, singlets and other vests; ofcotton, knitted or crocheted; 170114: Sugars; cane sugar, raw, in solid form, not containing added flavoring or coloring matter; 300490: Medicaments; consisting of mixed or unmixed products, for therapeutic or prophylactic uses, packaged for retail sale; 610510: Shirts; men's or boys', of cotton, knitted or crocheted; 600622: Fabrics; knitted or crocheted fabrics, of cotton, dyed

Source(s): CausalImpact R-package output

Figure A5.
Bayesian posterior distribution graphs for the impact of COVID-19 pandemic on sectors