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ARTICLE

COVID-19 and Trade in Zimbabwe: An Auto-Regressive Distributed Lag (ARDL) Analysis

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Abstract
This study examined the impact of COVID-19 pandemic on trade in Zimbabwe for the period 03/2020 to 06/2022. The pandemic necessitated the enforcement of lockdown measures. Prudent as they are, they brought several socio-economic problems. However, during this period, trade outperformed the previous comparable period. This motivated the current study which provides a novel contribution to the impact of COVID-19 in Zimbabwe. The current study is the first to provide an econometric COVID-19 impact analysis, let alone on trade in Zimbabwe. The auto-regressive-distributed-lag (ARDL) estimation technique was used to analyze the relationship. The headline result is that the COVID-19 pandemic had an unfavorable impact on total trade and exports and a favorable impact on imports. The impact was bigger and more significant on imports than exports. This suggested expenditure switching from foreign to locally produced goods. The results provide a case for revamping the import substitution industrialization approach. Specifically, the government should support firms producing import-substituting goods. To avoid failures of previous ISI approaches, the focus should be on reducing import dependency through increasing local firms' productivity and competitiveness through value-addition and beneficiation. Furthermore, it is time for Zimbabwe to penetrate emerging foreign markets. This can be done by export incentive schemes such as favorable export surrender requirements and (2) simpler import and export procedures. Also, the private sector needs to (1) glocalise (attracting foreign investment towards local production) and (2) enhance value addition and beneficiation to produce high-end goods that are currently exported as raw materials and/or semi-finished.

Keywords: COVID-19; Trade; Exports, Imports, Lockdown; ARDL

JEL classification: F14; I18

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1. Introduction

During the past few months, the global foresight of a healthy life and well-being for all, key to the achievement of most Sustainable Development Goals [1] (SDGs) (United-Nations, 2016) has been shaken by the COVID-19 pandemic. The pandemic has been the most topical global issue since its outbreak in late 2019. It affects every sphere of life, making it increasingly difficult to ignore its broad and profound effects. The pandemic has adversely affected most sectors, including health (Burril et al., 2020; Etyang, 2020; Matsungo & Chopera, 2020; Mbiba et al., 2020), tourism (UNCTAD,

1. SDG 3 Ensure healthy lives and promote well-being for all at all ages

2021a), agriculture, and food security (Erokhin & Gao, 2020; FAO, 2021; Rukasha et al., 2021), education (Marioni et al., 2020; Pokhrel & Chhetri, 2021), trade (UNCTAD, 2021b; Zhang et al., 2021), and informal economy (Chaora, 2020; Moyo-Nyede & Ndoma, 2020) among others. It has also added pressure on social inequality issues (Obeng-Odoom, 2020). Ultimately, the International Monetary Fund (IMF) (2020) projected a global gross domestic product (GDP) growth rate of -4.4% for 2020, with an impact higher for advanced countries (-5.8%). In 2021, COVID-19 economic losses were forecasted to be between US$1.7 trillion and US$2.4 trillion (UNCTAD, 2021a). The impact of COVID-19 is, as expected, heterogenous from country to country, mainly due to different incidence and response strategies.

Zimbabwe is no exception. Having recorded its first case on 20 March 2020, Zimbabwe enforced several lockdown measures to curb the spread of COVID-19 starting 30 March 2021. As measured by the stringency index[2], the strictness of the lockdowns in Zimbabwe is relatively high compared to its peers. As a result of the measures, many facets of life such as healthcare, informal traders, education, and tourism were hard hit. Surprisingly, the industrial and trade sectors have shown resilience to register growth. The Confederation of Zimbabwe Industries (CZI) (2021) reports that capacity utilisation significantly increased from 36.4% in 2019 to 47% in 2020. The increase was attributed to a good agricultural season and improved macroeconomic stability. Statistics from the Zimbabwe National Statistical Agency (ZimStat) (2021) show that during the period March 2020-June 2021, growth in trade (4.20%) was higher than the pre-COVID period (1.77%). This is against the backdrop of a 6.15% growth in exports against 1.96%. Globally, trade recorded negative growth, with the most significant (-21%) being recorded in the second quarter of 2020 (UNCTAD, 2021b). The occurrence of favourable trade performance amidst COVID-19-induced lockdown measures constraining global value chains and trade has motivated this study.

The study is the first to provide an econometric COVID-19 impact analysis on Zimbabwe, let alone in the trade sector. However, evidence is available in other socio-economic spheres. Evidence is available in such areas as health, nutrition, and lifestyles (Gavi et al., 2021; Matsungo & Chopera, 2020; Mbiba et al., 2020; Murewanhema et al., 2020), informal sector economy, and small to medium enterprises (Chaora, 2020; Moyo-Nyede & Ndoma, 2020). Other studies looked at socio-economic effects and livelihoods (Banda & Malinga, 2021; Zimbabwe Peace Project, 2021), agriculture (Rukasha et al., 2021), and the public sector (Muzvidziwa-Chilunjika et al., 2020). These studies are based on descriptive approaches and neglect the international effects of COVID-19. The pandemic is global and therefore affects every other country connected to Zimbabwe via the trade umbilical cord. As an open country, supply chains for both imports and exports have been disturbed. Even so, there has not been a study that examined the impact of COVID-19 on trade in Zimbabwe. Hence, this study fills in the gap by providing econometric evidence on the impact of COVID-19 on trade.

The study is organised as follows. Section two briefly highlights the background to the study; section three reviews related empirical literature on the subject. Research methods, data, and techniques are highlighted in section four. Section five presents and discusses the main findings, while section 6 concludes and gives policy recommendations.

2. COVID-19 emergence, lockdowns, and trade

COVID-19, the disease caused by a novel respiratory syndrome coronavirus 2 (SARS-CoV-2), broke out in the City of Wuhan, Hubei Province, China, in December 2019. It was first reported to WHO on 31 December 2019, declared a global health emergency on 30 January 2020, and subsequently declared a global pandemic on 11 March 2020. As of 30 August 2022, reported COVID-19 cases and related deaths stood at 599,071,265 and 6,467,023 (World Health Organization (WHO), 2022). Zimbabwe recorded its first case and death due to COVID-19 on 20 and 23 March 2020, respectively.

2. The stringency index is a composite measure based on nine response indicators including school closures,workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest)

As of 30 August 2022, the figures have amassed to 256,704 cases and 5,593 deaths (WHO,2022). Early evidence suggested that the coronavirus mainly spreads among people in close contact with each other (WHO, 2020). Specifically, one is infected when virus-infected droplets are inhaled or are directly in contact with the nose, mouth, or eyes. Accordingly, several countries enforced lockdowns to minimise the spread, and measures targeted at minimising the movement of people were adopted globally. The enforcement of the lockdown measures disrupted the economic (Ibrahim & Boako, 2021) and social spaces (Boateng et al., 2021). Ultimately, the pandemic graduated from a health shock to a global economic and social crisis (UNDP, 2020).

Zimbabwe enforced the first of its many lockdown measures on 30 March 2020 after declaring COVID-19 as a state of disaster on 23 March 2020 through Statutory Instrument 76 of 2020 (SI76/2020) (Government Gazette Extraordinary, 2020). The lockdown measures, initially to last for 21 days subject to review, were promulgated through SI 83/2020 at level 4[3]. The highlights were that all citizens were required to stay at home, save for those involved in providing essential services like health, transport, and food services (Statutory Instrument 83 of 2020: Public Health (COVID-19 Prevention, Containment, and Treatment) (National Lockdown) Order, 2020, 2020). Outside that, movement was only allowed, within a gazetted distance of 5km, to get these essential services. Schools, colleges, universities, and all other industries deemed not essential were closed. Major borders were also closed at most and restricted entry at best. The lockdown measures were then reviewed frequently, with education institutions being allowed to open gradually and under strict regulations (Statutory Instrument 110 of 2020. Public Health (COVID-19 Prevention, Containment, and Treatment) (National Lockdown) (Amendment) Order, 2020 (No. 8), 2020). However, following the resurgence of COVID-19 cases during the third wave, in July 2021, Zimbabwe reverted to Level 4 lockdown. The intensity of the lockdown measures by the government has been largely successful.

The level of lockdown intensity, measured by the stringency index, and its effect in reducing the spread of COVID-19 in Zimbabwe and its bordering countries are shown in Table 1. The statistics are as of three dates 31 December 2020, 31 December 2021, and 30 June 2022. Total cases and deaths per million are cumulative. As shown in the table, Zimbabwe's cases per million people are relatively lower than most of its peers. Cases per million were only higher than in Mozambique across all the dates and Zambia as of 31 December 2021. The total deaths per million are also relatively low against its peers, though they rose above continental levels. The lower morbidity and mortality reflect the level of stringency and effectiveness of the lockdown measures taken by the Zimbabwean government. Despite the lower morbidity and mortality, Zimbabwe had the highest stringency index across all periods. The higher index shows that the lockdown measures adopted in Zimbabwe were severer than in neighbouring countries.

Table 1: COVID-19 lockdown stringency, morbidity, and mortality.

	Total Cases per Million People			Total Deaths per Million People			Stringency Index		
	31 December 2020	31 December 2021	30 June 2022	December 2020	December 2021	June 2022	December 2020	December 2021	June 2022
Africa	1 982.52	7 006.76	8663.63	47.02	164.07	183.16			
Botswana	5719.70	84 804.15	12 4697.16	16.23	944.20	1 062.42	56.48	21.3	13.89
Mozambique	581.16	5894.55	7105.36	5.16	5.311	68.96	50	37.04	28.7
Namibia	9 422.19	58 484.26	66 865.18	80.68	1 435.88	1606.08	38.8	28.7	23.15
South Africa	17 824.72	58 227.90	67 238.46	480.01	1 534.63	1 713.42	50.93	44.44	11.11
Zambia	1 127.34	13 057.69	16 733.68	21.11	191.75	205.72	49.07	37.96	2.78
Zimbabwe	932.99	13 334.02	15 980.59	24.42	312.88	347.33	69.44	52.78	38.39

Source: WHO (2022). https://covid19.who.int/region/afro/country/

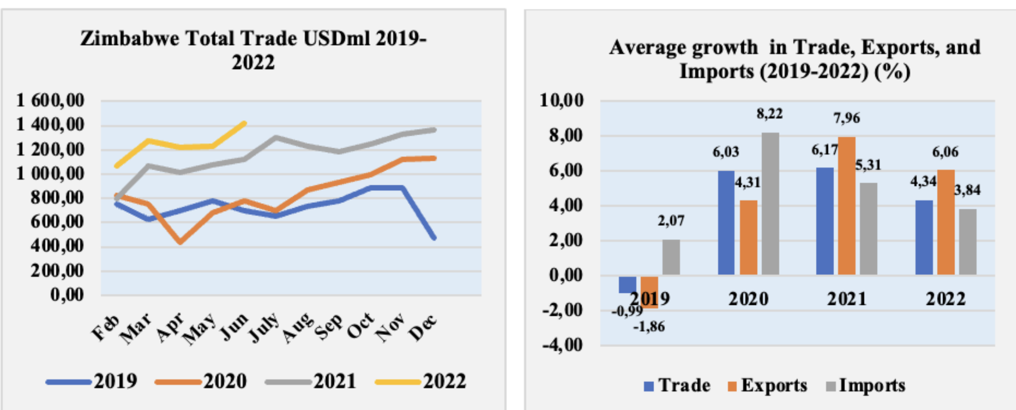
3. The lockdown measures range from Level 1 to Level 4 with increasing restrictiveness.

Necessary as they are and effective as they have shown to be, the lockdown measures have brought wide-ranging socio-economic problems. Studies have shown that COVID-19-induced lockdowns reduced revenues for small to medium enterprises (Chaora, 2020), increased food prices, and worsened malnutrition (Matsungo & Chopera, 2020). Also, informal business operators and vendors were thrown into poverty (Moyo-Nyede & Ndoma, 2020). A survey by ZimStat (2020) reported a significant decrease in income for two-thirds of non-farm business owners and 31% of wage earners. The eventual decrease in aggregate demand, coupled with reduced working industrial hours and the closure of borders, meant that industries would be affected severely.

Nonetheless, a report by the Confederations of Zimbabwe Industries (CZI) shows otherwise. Against all odds, capacity utilisation significantly increased by 10.6 percentage points from 36.4% in 2019 to 47% in 2020 (Confederation of Zimbabwe Industries, 2021) and, later, to 56% in 2021 (CZI, 2022). While capacity utilisation needs to be higher, its resurgence amidst the effects of COVID-19 tells an important story. The surprising increase has been attributed to receding inflationary pressures, improved foreign currency availability in the last quarter of 2020, and steady energy and fuel supply (CZI, 2021).

Without discounting these developments, the increase in capacity utilisation may have been significantly explained by international trends, mainly trade. Comparing trade performance pre and post-COVID-19 reflects an unexpected trend. This is shown in Figures 1a and 1 b. Figure 1a shows the monthly trade value for the years 2019 (pre) and 2020, 2021, and 2022 (first six months). It can be seen from Figure 1a that save for the first two months after the outbreak of COVID-19 in Zimbabwe, trade values post-COVID-19 have been higher than pre. If anything, the pandemic has caused an important change in the composition of trade. This can be deduced from Figure 1b, which shows the average monthly growth rates of trade, exports and imports pre and post-COVID19.

In 2019 , total trade fell by 0.99% mainly driven by a 2.07% increase in imports and a 1.86% decrease in exports. In 2020 , growth in trade bounced back to 6.03% while exports and imports grew by 4.31% and 8.22%. As a result of increased capacity utilization and domestic production, in 2021 , the growth in exports (7.96%) was greater than that of imports (5.31%) while growth in total trade continued to increase (6.17%). A similar trend is observed for the period January-June 2022 , where growth in exports outweighs that of imports. The headline observation here is that (1) trade is on the increase since the outbreak of COVID-19 and (2) the composition of trade is shifting from import dominance to export dominance. All this points to improved trade performance post COVID-19 pandemic.



1(b) 1(b)

Figure 1. Trade Performance and Growth for the periods January 2019-June 2022

Hence despite Zimbabwe enforcing lockdown measures comparably stricter than its peers, it enjoyed a strong trade performance. In light of this, the current study assesses the impact of COVID-19 pandemic on trade in Zimbabwe over the period March 2020-June 2021. While other studies have looked at the impact of COVID-19 in Zimbabwe no study has been devoted to trade effects.

3. Literature Review

Given its broad and profound effects on socio-economic facets of life, COVID-19 has, as expected, attracted deservedly high and growing research interest. In the education sector, COVID-19 has primarily led to the closure of schools, and reduced funding for education. This has led to increasing educational inequalities (Grewenig et al., 2010; Marioni et al., 2020; Pokhrel & Chhetri, 2021; Schleicher, 2020). Studies on the health sector (Burril et al., 2020; Etyang, 2020) reveal that the pandemic has seen an increase in demand for virtual health services and compromised the WHO pillars of health delivery (service delivery, health workforce, access to essential equipment, and medication and adequate resources). This has also led to increased health inequalities. In Finance, (Ledwani et al., 2021) examined the performance of the leading stock markets of G-7 nations against BRICS countries. Results from Buy and Hold Abnormal Returns (BHAR) confirm the negative effect of COVID-19 across all the G-7 and BRICS countries but for China. Further evidence of the detrimental effects of COVID-19 is confirmed in Agriculture (Erokhin & Gao, 2020; FAO, 2021), tourism (UNCTAD, 2021a), and transport (Lakshmi, 2020).

Evidence on the trade sector is still very scant. Zhang et al. (2021) examined the impact of COVID19 on international trade using monthly exports and imports data from China and the USA for the period December 2019 to December 2020. COVID cases and deaths were used as proxies for the pandemic. Following Rodrigues & Taylor (2012) and Enders & Lee (2012), the study used the Fourier ADF and causality approaches for analysis. The study revealed that the impact of COVID19 on trade is country-sensitive. In China, COVID-19 induced deaths were found to directly cause both exports and imports of China. However, no causality relationship could be ascertained from COVID-19 cases to exports and imports. In the USA, it was established that both COVID-19 cases and deaths directly cause exports and imports. The study recommended that governments and trade practitioners develop contingency measures to avoid unnecessary trade frictions and restrictions. Priority should be given to trade in health and food products and services.

Another study by Erokhin & Gao (2020) assessed the effects of COVID-19 on food trade and economic facets of food security using data from 45 developing countries. They divided the countries into three income groups: low-income, upper-middle-income, and high-income. The study used the ARDL model, Yamamoto's causality test, and variance decomposition techniques. Specifically, the study evaluated the cointegration between trade parameters of food availability and the number of undernourished people. As in Zhang et al. (2021), the impact of COVID-19 on the variables under investigation varies according to income groups and individual countries within the same income groups. The results revealed that COVID-19 cases led to higher food insecurity across three income levels, save for 12 countries[4] of Sub-Saharan Africa, the Middle East and North Africa, and East Asia and the Pacific. However, the study did not examine the direct effect of COVID-19 cases on food trade but implicitly assumed that food security had been indirectly affected by depressed food trade. Also, Zimbabwe, the country under investigation in the current study, is not part of the 45 countries under investigation.

The review above shows that evidence on the trade effects of COVID-19 is still very scarce, and to the best of knowledge of the author, there is yet a study on Zimbabwe. However, several studies are found examining the impact of COVID-19 on various areas, including health, nutrition, and lifestyles (Gavi et al., 2021; Matsungo & Chopera, 2020; Mbiba et al., 2020; Murewanhema et al.,

4. Sub-Saharan Africa (Burkina Faso, Chad, Ethiopia, Zambia, Botswana, and Namibia), Middle East and North Africa (Yemen, Iran, Jordan, and Libya), and East Asia and Pacific (Cambodia and Vietnam).

2020), informal sector economy and small to medium enterprises (Chaora, 2020; Moyo-Nyede & Ndoma, 2020). Other studies looked at socio-economic effects and livelihoods (Banda & Malinga, 2021; Zimbabwe Peace Project, 2021), agriculture (Rukasha et al., 2021), and the public sector (Muzvidziwa-Chilunjika et al., 2020).

Rukasha et al. (2021) evaluated how COVID-19 impacted Zimbabwe's agricultural supply chains and markets and the consequent effect on livelihoods. The study is founded on a systematic desk review of journals and policy reports from national and international institutions related to the area under study. The study gathered that COVID-19 had disturbed agricultural value chains and markets. It was argued that this exacerbated food insecurity in Zimbabwe. Chaora (2020) focused on Micro, Small-to-Medium Scale Enterprises (MSMEs) in Zimbabwe. The primary aim was to assess the effects of the lockdown restrictions and evaluate strategies adopted by MSMEs. Data were collected from 44 respondents during May 2020 using Survey monkey. It was established that 32% of the respondents closed shop, while 62.77% lost between USD1000 and USD3000. As a result, 68.5% could not restock, with over half incapable of paying next month's (June) salaries. Only 28% managed to diversify into other business adventures.

The ZPP (2021) covered the socio-economic rights effects of COVID-19. Using similar research methods as Rukasha et al. (2021), the study noted that human rights were seriously abused in sectors such as education, the informal economy, and healthcare and nutrition. Likewise, Moyo-Nyede & Ndoma (2020) revealed that informal traders were hugely disadvantaged by actions and inactions. Earlier on, Gukurume & Oosterom (2020) have shown that vendors, who mainly survive on hand-to-mouth, were severely affected. The World Bank (2021), in collaboration with Zimstat, conducted a telephone survey involving 1,747 households from July 6–24, 2020. The study showed significant income reduction effects. Out of all urban people who worked for a wage or to obtain a household business income before the onset of the COVID-19 pandemic, 23% were no longer doing so in July 2020. This figure is lower (19%) in rural areas. These studies are in unionism to the point that COVID-19 had severe effects on workers' livelihoods, informal traders, and entrepreneurs.

In the health sector, a similar trend is observed. Matsungo & Chopera (2020) investigated the effect of the COVID-19-forced lockdown on nutrition, physical activity, alcohol consumption, and smoking among Zimbabwean adults. The study collected data from a cross-sectional online survey using a structured questionnaire. A total of 507 respondents, of which the majority (63%) were women. The study documented that 94.8% responded that the lockdown led to an increase in food prices, while 64% and 62.5% confirmed a reduction in the availability of nutritious foods and physical activity levels. Murewanhema et al. (2020) used a descriptive study to track the trends of COVID-19 in Zimbabwe from March-June 2020. The study noted that most reported cases (82%) were returning residents during that period, while the case fatality was just 1%.

Instead of looking at the direct effects of COVID-19, Gavi et al. (2021) looked at the effects on a perennial disease, malaria. They argued that the rapid response that was given to COVID-19 neglected attention to an equally chronic disease, malaria. They collected district-level data on the incidence and mortality of malaria from the national health management information system (HMIS) for the period 2017-2020. The study found that over the period January-June 2020, 30 000 more cases were recorded compared to similar periods between 2017-2019. It was also indicated that districts that usually record low malaria cases recorded significantly higher cases. In another dimension, Mbiba et al. (2020) analysed the effects of COVID-19 on Zimbabwean healthcare professionals in the United Kingdom. Weekly zoom discussions and data were obtained from a google-forms online survey that targeted Zimbabwean health practitioners. A total of 103 respondents participated, and data were processed and analysed using MAXQDA software. It was discovered that the respondents were subjected to discrimination in the allocation of equipment, moral injury, and trauma. It was predicted that this might cause long-term mental health problems.

The review above shows that a fair share of studies has been devoted to COVID-19 impacts on several areas. That as it may, these studies are mainly grounded on descriptive and qualitative data approaches. While the evidence is important, it cannot show the causal and impact relationships on the variables of interest. Also, the studies only considered the internal effects of COVID-19. COVID-19 is a global pandemic that affects every other country connected to Zimbabwe via the trade umbilical cord. As an open country, supply chains for both imports and exports have been disturbed. Even so, there has not been a study that examined the impact of COVID-19 on trade in Zimbabwe. As such, this study is not only the first to provide an econometric analysis on the impact of COVID-19 in Zimbabwe but the first to examine the impact on trade. The following section details the econometric approach that has been used for this purpose.

4. Materials, data, and methods

The study used a battery of econometric approaches to deliver the results. Monthly data on COVID-19 cases and stringency were collected from WHO (2022) while exports and imports data were obtained from ZimStat (2022). The Augmented-Dick-Fuller (ADF) unit root tests were used to check for stationarity of variables. Thereafter, the auto-regressive distributed lag model (ARDL) estimator was used to determine the short-run and long-run impact of COVID-19 on the trade variables. Post-estimation diagnostic tests such as normality, autocorrelation, heteroskedasticity, and stability were carried out to ensure the robustness of the results.

4.1 Model Specification and Data Description

The study's main objective was to assess the impact of the COVID-19 pandemic on trade in Zimbabwe. Given the recency of COVID-19, no theoretical transmission mechanisms are yet to be established. As such, the assumed relationship, in functional form, is given as follows:

$$TRADE = f(\text{ COVID 19 }) \tag{1}$$

Where TRADE is total trade (exports + imports), COVID-19 refers to reported COVID-19 cases. In addition to COVID-19 cases, lending interest rate (*IR*) and exchange rate (XCH) were also included in the model. Their inclusion is informed by previous empirical studies such as Kang (2016), Ngondo & Khobai (2018), and Nicita (2013). With these variables, the theoretical model becomes:

$$TRADE = f(\text{ COVID 19}, IR, XCH) \tag{2}$$

To allow inference, the functional form is transformed into the following econometric model:

$$Trade_t = \beta_0 + \beta_1 COVID19_t + \beta_2 IR_t + \beta_3 XCH_t + \varepsilon_t \tag{3}$$

Where $\beta = 0; \ldots ; 3$ are parameters to be estimated, ε is the conventional error term and t is time in months. To disaggregate the effects on the components of trade, the following models are also specified

$$Exports_t = \beta_0 + \beta_1 COVID19_t + \beta_2 IR_t + \beta_3 X_{CH} + \varepsilon_t \tag{4}$$

$$Imports_t = \beta_0 + \beta_1 COVID19_t + \beta_2 IR_t + \beta_3 XCH_t + \varepsilon_t \tag{5}$$

The data description sources and descriptive statistics are given in Table 2 .

Table 2: Data description, sources, and descriptive statistics

Variable	Description	Data Source	Mean	Std. Dev.	Min	Max
Trade	Total Trade (Exports + Imports) in US$ Mill	ZimStat*	1050	239	438	1420
Exports	Total monthly Exports in US$ Mill	ZimStat	463	126	200	666
Imports	Total monthly Imports in US$ Mill	ZimStat	587	120	237	771
Cases	Reported monthly COVID_19 Cases	WHO	3767	4846	8	19521
Interest Rates	Lending annual interest rates	RBZ	29.38	12.64	7.31	64.02
Exchange Rates	ZWL units exchanges for 1 USD	RBZ	99.51	61.99	25.00	345.54

WHO-World Health Organisation; ZimStat-Zimbabwe National Statistical Office, WHO (World Health Organisation, and RBZ (Reserve Bank of Zimbabwe). Data on trade variables were available up to May 2022. Values for June 2022 were obtained by using a simple rolling moving average starting from April-May values

The mean monthly trade amounted to US$1 050 mil, recording maximum and minimum values of US$1 420 ml (June 2022) and US$438 million (April 2020). Over the period the country recorded an average monthly deficit of US$124 million. Maximum exports (US660 million) and imports (US$771 million) were recorded in June 2022 and December 2021, respectively. Since the turn of 2022, the level of stringency has been falling. Lessening restrictions may have allowed industries to up their capacity utilisation. Imports hit the highest value during the festive month when expenditure is high. The least number of cases (8) was recorded in March 2020, during which the country recorded its first case on the 20th. The highest number of cases (19521) was recorded in January 2021. The month also recorded the most significant percentage increase (398.36%) in cases since 524.21% between June and July 2020. The resurgence in the cases forced the government to call for another lockdown level.

4.2 Econometric techniques

4.2.1 Unit Root Tests

It is a common characteristic that time-series data may contain a unit root. Such data will be non-stationary. Using such data in regression analysis is known to cause spurious regression. To avoid that, data were tested for stationarity using the Augmented-Dick-Filler (ADF) test. For robustness, two stationarity models are tested (1) with trend and (2) with drift. The results are given in Table 3.

Table 3: ADF Unit Root Tests

	Trend model			Drift model		
Variable	Test-Statistic	p-value	Decision	Test-Statistic	p-value	Decision
$lgTRD$	-4.045**	0.010	I(0)	-3.388***	0.001	I(0)
$lgXP$	-3.843**	0.015	I(0)	-2.757***	0.006	I(0)
$lgMP$	-4,427***	0.002	I(0)	-4.133***	0.002	I(0)
$lgCases$	-3.3706**	0.022	I(0)	-3.804***	0.005	I(0)
IR	-4.455***	0.002	I(1)	-4.457***	0.000	I(1)
$lgXCH$	-3.479**	0.042	I(1)	-3.681***	0.001	I(1)

***, **, and * denotes signficance at 1%, 5%, and 10%, respectively

As shown in Table 3, the two models are consistent. The first four variables are stationary in levels [I(0)] while the last two are stationary after first difference [I(1)]. Therefore, the order of integration for these variables is mixed. This is based on the significant test statistics. It can be drawn that at the specified level of significance, the null hypotheses of a unit root are not accepted

4.2.2 Bound Testing Cointegration Test and Auto-regressive distributed lag (ARDL)

The unit root tests revealed that the variables have a mixed order of stationarity. It follows that the Johansen cointegration approach is compromised. In such circumstances, the auto-regressive-distributed-lag (ARDL) Bound Testing approach to cointegration becomes the alternative approach, and for good reasons. Unlike the Johansen (1990) approach, the ARDL softens the order of integration restriction by allowing mixed order of stationarity (Bist & Bista, 2018; Elijah et al., 2015; Pesaran, 1997; Sunge & Makamba, 2020). Also, in the presence of endogenous regressors, it gives unbiased estimates of the long-run model and valid t- statistics (Harris & Sollis, 2003; Nkoro & Uko, 2016). Furthermore, and more importantly for this study, ARDL results are valid for small samples Pesaran et al. (2001). In addition to cointegration testing, ARDL also provides both short-run and long-run estimates.

According to Pesaran et al. (1999), the ARDL model regresses the dependent variable against its lags, p, and lags of the independent variables, q. The model can be expressed as:

$$y_t = \sum_{j=1}^{p} \lambda_j y_{t-j} + \sum_{j=0}^{q} \delta_j x_{t-j} + \varepsilon_t \tag{6}$$

Here y_t is the regressant, x_t represents a $kx1$ vector of regressors, δ_j is a $kx1$ parameter vector, λ_j is the vector of scalars, and ε_t is the disturbance term distributed with a zero mean and a finite variance. Eq. (6) can be expressed in error correction terms as below:

$$\Delta y_t = \phi y_{t-1} + \beta' x_t + \sum_{j=1}^{p-1} \lambda_j^* \Delta y_{t-j} + \sum_{j=0}^{q-1} \delta_j^* \Delta x_{t-j} + \varepsilon_t \tag{7}$$

Where $=-1\left[1-\sum_{j=1}^{p}\lambda_j\right]$; $\beta' = \sum_{j=0}^{q}\delta_j$; $\lambda_j^* = \sum_{m=j+1}^{p}\lambda_m, j = 1, 2, \ldots p-1$; $\delta_j^* = \sum_{m=j+1}^{q}\delta_m, j = 1, 2, \ldots .q-1$.

Reorganising (6) gives:

$$\Delta y_t = \phi\left(y_{t-1} + \theta' x_t\right) + \sum_{j=1}^{p-1} \lambda_j^* \Delta y_{t-j} + \sum_{j=0}^{q-1} \delta_j^* \Delta x_{t-j} + \varepsilon_t \tag{8}$$

Where $\theta = -\left[\frac{\beta}{\phi}\right]$ shows the long-run elasticities of x_t on y_t.ϕ is the error correction term. It measures the speed of adjustment or how fast y_t moves to its long-run equilibrium following shocks in x_t (Sunge & Makamba, 2020). To ensure convergence and stability in the long-run association, ϕ must be negative and statistically significant. Δ is a delta prefix and λ_j^* and δ_j^* are short-run elasticities on y_t, respectively. Transforming Eq. (2)-(4) in ARDL framework gives:

$$\Delta lgTRADE_t = \alpha_0 + \phi\left(\beta_1 TRADE_{t-1} + \beta_2 lgCOVID19_{t-1} + \beta_3 IR_{t-1} + \beta_4 lgXCH_{t-1}\right) + \sum_{i=1}^{p}\delta_{1i}\Delta lgTRADE_{t-i} + \sum_{i=1}^{q}\delta_{2i}\Delta lgCOVID19_{t-i} + \sum_{i=1}^{p}\delta_{3i} IR_{t-i} + \sum_{i=1}^{q}\delta_{4i}\Delta lgXCH_{t-i} + \varepsilon_t \tag{9}$$

$$\Delta lgEXPORTS_t = \alpha_0 + \phi\left(\beta_1 \text{ EXPORTS }_{t-1} + \beta_2 lgCOVID19_{t-1} + \beta_3 IR_{t-1} + \beta_4 lgXCH_{t-1}\right) + \sum_{i=1}^{p}\delta_{1i}\Delta lgEXPORTS_{t-i} + \sum_{i=1}^{q}\delta_{2i}\Delta lgCOVID19_{t-i} + \sum_{i=1}^{p}\delta_{3i} IR_{t-i} + \sum_{i=1}^{q}\delta_{4i}\Delta lgXCH_{t-i} + \varepsilon_t \tag{10}$$

$$\Delta lgIMPORTS_t = \alpha_0 + \phi\,(\beta_1 IMPORTS_{t-1} + \beta_2 lgCOVID19_{t-1} + \beta_3 IR_{t-1} + \beta_4 lgXCH_{t-1}) + \sum_{i=1}^{p} \delta_{1i}\Delta lgIMPORTS_{t-i} + \sum_{i=1}^{q} \delta_{2i}\Delta lgCOVID19_{t-i} + \sum_{i=1}^{p} \delta_{3i} IR_{t-i} + \sum_{i=1}^{q} \delta_{4i}\Delta lgXCH_{t-i} + \varepsilon_t \quad (11)$$

The ARDL also tests cointegration using the bound testing approach, whose hypotheses are given below: $H_0 : \beta_{1i} = \beta_{2i} = \beta_{3i} = \beta_{4i} = 0$, (No Cointegration) and $H_1 : \beta_{1i} \neq \beta_{2i} \neq \beta_{3i} \neq \beta_{4i} \neq 0$, (Cointegration)

The decision is made by comparing the computed F-statistic with the lower and upper-bound critical values (Pesaran et al., 2001). The null hypothesis (H_0) is rejected when the value of the F-statistic exceeds the upper critical bounds value. Otherwise, it cannot be rejected if the F-statistic is lower than the lower bounds critical value. The ARDL short-run, and long-run results and ARDL bound test cointegration results are shown in Table 4.

5. Main Results Presentation and Discussion

The short-run and long-run estimation results are shown in Table 4. There are three models, TRADE, EXPORTS, and IMPORTS. The optimum lags for all the models were selected using the Bayesian Information Criteria (BIC). It is the default criteria for ARDL the model. Coefficients for COVID-19 are all negative and statistically significant. Considering the total trade model, the elasticity of -0.095 tells that a 1% increase in COVID-19 cases reduced trade by 0.095%. This is not a surprising result. The health pandemic quickly transformed into a global economic shock that disrupted the arteries of production, movement, and trade (Kituyu, 2022). The best response to the pandemic was to impose lockdowns. Zimbabwe enforced the first of its many lockdown measures on 30 March 2020 after declaring COVID-19 as a state of disaster on 23 March 2020. The lockdown measures were initially to last for 21 days, subject to review.

Most production units closed shop, and borders were also closed at most and restricted entry at best. This altogether explains the negative impact COVID-19 had on trade in Zimbabwe. It can be seen from the model that interest rates and exchange rates had positive effects on trade. However, the former is statistically insignificant, suggesting that no meaningful conclusions can be made. For exchange rates, a 1% increase caused a 0.567% increase in trade. This suggests that trade is relatively inelastic to exchange rate movements.

Disaggregating the impact of COVID-19 on trade components revealed uneven effects. The COVID-19 coefficient for imports is higher (–0.195) and more significant [5%] than that of exports (–0.136)[10%]. This entails that imports were more sensitive to COVID-19 induced disruptions than exports. The higher elasticity of imports can also be seen by comparing the R^2 among the three models. The values are 53.4%, 53.2%, and 73% for trade, exports, and imports respectively. It follows that COVID-19 explained variations in imports by 23 percentage points higher than that of total trade and exports. This finding shows the change in the structure of trade resulting in COVID-19 induced disturbances. This reflects an expenditure-switching effect by domestic consumers from foreign to locally produced goods. Data from ZimStats (2022) shows that when the first case of COVID-19 was reported in March 2020, the trade balance was -USD$205ml. However, by November 2020 , it has fallen to -USD $76ml, averaging -USD 110ml over the period. Following a sharp increase in January 2021 to -USD 246ml, the trade balance improved to just-USD $32ml in August 2021. The improvement in the trade balance owes much to several factors.

First, the lockdown measures did not significantly disrupt local production and trade facilitation systems. While the lockdown restrictions limited the movement of people, they were carefully crafted to keep essential services up and running. Essential services, as spelt out in SI83/2020, included water and electricity generation, transport services (terrestrial, airborne, or waterborne) engaged in the carrying of staff providing other essential services, and transportation of food and essential goods into and out of the country (Statutory Instrument 83 of 2020: Public Health (COVID19 Prevention, Containment, and Treatment) (National Lockdown) Order, 2020). Also, a provision was made to ensure that manufacturing units whose operations required continuous production were allowed to function with a minimum possible workforce. This helped domestic production to continue with increased productivity and efficiency despite the lockdown. It was not a coincidence that industrial capacity utilisation significantly increased by 10.6 percentage points from 36.4% in 2019 to 47% in 2020 (Confederation of Zimbabwe Industries, 2021) and 56% in 2021 (CZI, 2022).

Table 4: ARDL short-run and long-run estimation results.

Variable	***lgTRADE*** *ARDL(1,0,0,1)*	***lgEXPORTS*** *ARDL(1,0,0,1)*	***lgIMPORTS*** *ARDL(3,2,0,0)*
		LONGRUN ESTIMATES	
ECT	-0.517*** (0.153) [0.003]	-0.569*** -0.416***	(0.168) [0.003] (0.125) [0.005]
lgCASES	-0.095* (0.052) [0.087]	-0.136* (0.075) [0.081]	-0.195** (0.090) [0.046]
IR	0.005 (0.005) [0.286]	0.005 (0.007) [0.519]	0.004** (0.004) [0.308]
lgXCH	0.567** (0.243) [0.031]	0.765** (0.359) [0.047]	0.156 (0.131) [0.253]
Constant	9.768*** (2.946) [0.004]	9.981*** (3.122) [0.005]	8.748*** (2.469) [0.003]
		SHORT RUN ESTIMATES	
lgXCH_D1	-0.647* (0.314) [0.054]	-0.943*	(0.484) [0.064 -
lgIMP_LD			-0.510*** (0.157) [0.005]
lgIMP_L2D	-	-	-0.493*** (0.133) [-.002]
lgCASES_D1	-	-	0.050** (0.020) [0.023]
lgCASES_LD			0.025 (0.015) [0.126]
R_Squared	0.534	0.532	0.730
D.Watson	1.914	1.877	1.838
BG LM Test	0.061 [0.806]	0.257 [0.612]	0.19 [0.663]
LM χ^2	0.021 [0.885]	0.636 [0.225]	0.746 [0.100]
Ramsey	2.41 [0.108]	0.33 [0.804]	0.48 [0.704]
VIF	2.98	2.74	2.45

In parenthesis ( ) and brackets [ ] are standard errors and probabilities, respectively. ***,**, and * denotes significance at 1%, 5%, and 10%,respectively.

Second, the government also came up with domestic measures to cushion local production from the COVID-19 effects. The government, using resources from the international community and internal sources (2% IMT tax revenue, etc.), provided some relief funds to the industrial sector, small to medium enterprises, and youth-owned businesses (Ministry of Finance and Economic Development, 2020). The amount of credit to the private sector gradually increased from USD 16ml in March 2020 to USD$45ml in August 2020 (RBZ, 2022). As the stringency level averaged above 60% at the end of 2020 , the monthly amount of credit averaged over USD 110ml. Of importance is that the share of credit to manufacturing sector also increased, doubling from 9.7% in March 2020 to 18.6% by September 2022. Thereafter it stabilised above 11%. The MoFED (2021) confirmed that a total of ZW25 Billion or US $300 million, excluding stimulus package, was channeled towards COVID-19 mitigation.

Lastly, a stable macroeconomic environment is also credited with resilience in the trade sector. In particular, there was a notable success in inflation control. Month-on-month and year-on-year inflation rates recorded at 26.6% and 676.4% in March 2020 dropped to 3.9% and 106.6% in June 2021 and further to 60% in January 2022 (RBZ, 2022). Such stability has been conducive to increasing capacity utilisation and contributing to improved trade balance.

5.1 Post estimation diagnostics

5.1.1 ARDL bound testing cointegration

The bound testing approach was also executed to check for cointegration relationships in the ARDL models. The results are shown in Table 5. For all three models, the F-statistic is significantly higher than the upper-bound critical value at 1% for the exports model and 5% for the total trade and imports models. This indicates that the null hypothesis of no cointegration is firmly rejected. Also, for all the models, the t statistic is lower than the upper bound critical value at 1%. Again the null hypothesis of no cointegration is strongly rejected. This confirms that there is a long-run relationship among the variable in all three models. This is in tandem with the error correction terms (ECT) in Table 4. Across all three models, the ECT is all negative and statistically significant at the 1% level. This shows that following any exogenous shock in the relationship, the dependent variable will revert to its equilibrium at a speed equal to the ECT coefficient. For instance, in the exports model, a coefficient of -0.56 suggests a speed of adjustment of 56%. The imports mode is the least reactive, doing so at a speed of 46%.

Table 5: ARDL bound testing results

	1 % Critical Values				5 % Critical Values			
	F-Statistic		t-Statistic		F-Statistic		t-Statistic	
Model F-Statistic	Lower Bound 4.29	Upper Bound 5.61	Lower Bound -3.43	Upper Bound -4.37	Lower Bound 3.23	Upper Bound 4.35	Lower Bound -2.86	Upper Bound -3.78
lgTRADE	5.142		-3.38		5.142**		-3.38	
lgEXPORTS	6.687***		-3.332		6.687***		-3.332	
lgIMPORTS	5.111		-3.385		5.111**		-3.385	

***,**, and * denotes significance at 1%, 5%, and 10%,respectively.

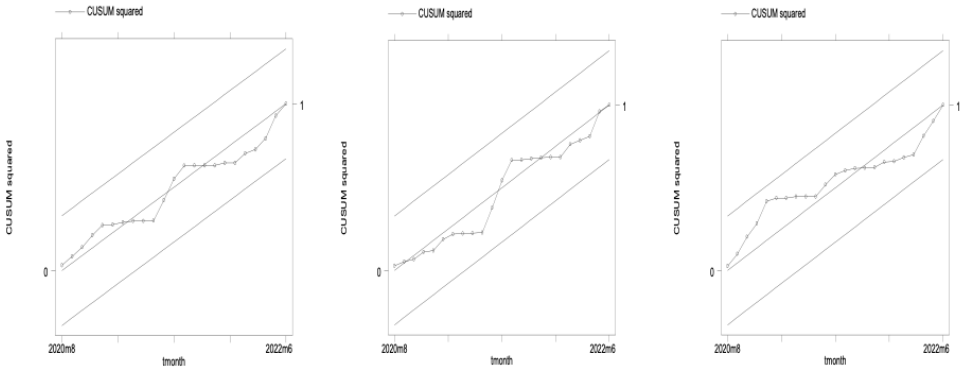
After the ARDL bound testing, post-estimation model diagnostic tests were carried out to check the robustness of the results.

5.1.2 Robustness

The Durbin-Watson (DW) and the Breusch-Pagan tests were used to check for serial autocorrelation problem. As shown in panel B in Table 5, across all models, the DWs of 1.914, 1.877, and 1.838 respectively, are well within the vicinity of the benchmark of 2 . The same goes for the Breusch-Pagan test where all probability values are greater than 0.05. It follows that the null hypothesis of serial independence could not be rejected. Hence there is no serial dependence problem in the models. The LM test was used to test for the presence of autoregressive conditional heteroskedasticity (ARCH). The null hypothesis of the test is that there is constant variance (homoskedasticity). The LM χ^2 probabilities are all greater than 0.05 for all the models. It can be deduced that there is no sufficient evidence across all standard significance levels to reject the null hypothesis of homoskedasticity. Hence the models do not have some heteroskedasticity problem. Given that the model has few explanatory variables (because of the unavailability of monthly data for possible trade factors), there was a possible risk of omitted variables problem. However, the Ramsey tests confirmed otherwise. The test examines the null that the model has no omitted variables. Again, for all models, the null hypothesis cannot be rejected. Also, the variance inflation factor (VIF) was carried out to check for multicollinearity. No values are found to be too close to 10, suggesting that no multicollinearity issues are detected in the models.

5.1.3 Stability

The Cusum test was used to check for model stability. The results are shown in Figure 2:



(a) trade *(b) exports* *(c) imports*

Figure 2. Cusum Stability Tests

The Cusum test tells whether the coefficients abruptly change in ways not predicted by the model. As can be seen from the graphs, across all models the Cusum squared values are within the Cusum 5% confidence bands. Accordingly, the null hypothesis of instability is rejected. This means that the results from the three models are stable.

6. Conclusion

This study examined the impact of COVID-19 on trade in Zimbabwe using monthly time series data from March 2020 to June 2022. The COVID-19 pandemic necessitated the enforcement of lockdown measures to reduce the spread of the virus. Prudent as they are, the measures brought several socio-economic problems. However, during the period under review, industrial capacity utilisation increased while trade outperformed the previous comparable period. Such an anomaly motivated this study which provides a novel contribution to the impact of COVID-19 in Zimbabwe. Existing studies are mainly micro-based, descriptive, and concern internal effects. The novelty of the current study is not only that it is the first econometric analysis but also one examining the trade effects of COVID-19.

A series of econometric approaches were used in this study. First, the ADF unit root tests were carried out to check the stationarity of variables. Secondly, the longrun and short run estimates using the ARDL estimator. Thirdly, the bound testing to cointegration was carried. Out. Lastly, a number of post-estimation diagnostic tests were carried out to ensure robust results. The headline result is that the COVID-19 pandemic was responsible for reduced trade, exports, and imports. Comparing the analysis according to trade components revealed uneven effects. The COVID-19 coefficient for imports is higher and more significant than that for exports. This entails that imports were more sensitive to COVID-19 induced disruptions than exports. This finding shows the change in the structure of trade resulting from the COVID-19 induced disturbances. This reflects an expenditure-switching effect by domestic consumers from foreign to locally produced goods which led to an improvement in the trade balance.

The results reflect domestic production resilience. Though restricting the movement of people, the lockdown measures were carefully crafted such that the production and provision of essential goods and services continued. Accordingly, increased local production substituted imported demand.

The results provide a strong case for reducing import dependency in an increasingly globalizing environment. Realizing that trade promotion requires complementary efforts from the government and private sector, recommendations are made below.

The government is encouraged to ensure that the productive sectors of the economy keep running while being conscious of the need to save lives. Specifically, the government should offer more support to local firms. Priority should be given to those firms producing import substitution goods. This is in tandem with the assertion by Taylor (2022) that the COVID-19 pandemic has re-ignited the need for African countries to consider an import substitution industrialization (ISI) approach. However, in Zimbabwe, the ISI approach should be different from the past versions of 1965-1980 and 1980-1990[5]. During these periods, the focus was on the direct protection of imports through highly restrictive import controls such as licenses and high tariffs see. This led to low productivity, industrial inefficiency, market distortions, public sector dilapidation, and rent-seeking behavior (Dube, 2004; Ndudzo, 2014). Instead, more focus is on reducing import dependency by increasing the productivity and competitiveness of local firms through value addition and beneficiation. This can go a long way in achieving the aspirations of the country's National Development Strategy 1 (NDS1) and Vision 2030 (Republic of Zimbabwe, 2020).

While other countries are battling more with COVID-19, it is time for Zimbabwe to penetrate emerging foreign markets. As such, the government should also (1) come up with export incentive schemes in the form of favorable export surrender requirements, and (2) streamline the regulatory environment through provision of simpler import and export procedures for trade. On the part of the private sector, there is need to (1) glocalise (attracting foreign investment towards local production) and (2) enhance value addition and beneficiation to produce high-end goods that are currently exported as raw materials and/or semi-finished. Lastly, there is need for government and the private sector to engage progressively and set a good tone to the market.

Biographical Notes

Regret Sunge holds a Ph.D. in Economics from the University of Johannesburg in the School of Economics. Also, he holds a Master of Commerce in Industrial Strategy and Trade Policy and a Bachelor of Commerce (Honours) in Economics from Great Zimbabwe University where he is currently a lecturer. He lectures economics research, econometrics, monetary economics, and mathematical economics among other courses. His research interests are in international trade, agricultural and environmental economics, productivity and efficiency analysis, and monetary economics. He is a senior researcher for the African Institute for Inclusive Growth (AIIG) and a member of the United Nations Economic Commission for Africa (UN-ECA) Young Economists Network (YEN).

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5. For a history of ISI in Zimbabwe, see (Dube, 2004; Ndudzo, 2014; Rattsø et al., 1998)

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