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Analysing the effect of Covid-19 and fuel price on the South African motor vehicles export

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ABSTRACT

The manufacturing sector is vital in the South African economy, especially in international trade. Nonetheless, the covid-19 and fuel price fluctuations have convulsed both global and domestic production and trade. This study analsed how an increase in new cases of covid-19 and fuel price shocks affected motor vehicles export in South Africa. The assessment used monthly time series from March 2020 to March 2022. The autoregressive distributed lag (ARDL) and error correction models assisted in determining both long-run and short-run relationships among variables. The results suggested an inverse relationship between new covid-19 cases, fuel prices and motor vehicle exports in both the long and short run. This study recommends introducing new vehicle models that are fuel efficiency, tax and levy reduction on fuel to reduce the effect of the high fuel price of vehicles export. Increasing awareness, precaution and encouraging vaccination could assist in lowering COVID-19 infection.

Introduction

The advent of the COVID-19 pandemic has pushed social and economic life into a disaster. Tring to control the speed and spread of the pandemic countries and governments imposed various measures that include nationwide lockdown, social distance, wearing a face mask in public, cleaning hands often and using sanitisers. Although these measures, especially nationwide lockdown, assisted in reducing the spread of the COVID-19, they impede economic growth and production in the manufacturing sector (Nayak et al. 2020). Owing to Covid-19, the South African manufacturing industry experienced a decline of 49.4 percent of its output, of which 7.8 percent was from motor vehicles, transport equipment, vehicle parts and accessories (Liedtke, 2020). A decline in motor vehicle production might have a significant impact on the total number of motor vehicles extorted from South African to global markets. Therefore, it is important to analyse the effect of the COVID-19 pandemic on South African motor vehicle exports.

While the Covid-19 pushed motor vehicle production to a serious decline, fuel price fluctuations came in as another factor that would impact on mot vehicles export. At the beginning of the pandemic, the fuel price experienced a significant decline. For instance, in April 2020, the fuel price was below $20 per barrel (Habanabakize & Dickson, 2021; The Economic Times, 2020). However, the fall in fuel price did not last for long as in December 2021 the average oil price was $83 a barrel (Citizen Reporter, 2021). The situation was worsened by the war between Russia and Ukraine. According to the World Bank (2022), the average price of Brent crude oil is expected to move around $100 a barre in 2022l. All these changes and fluctuations in fuel prices are expected to impact the South African manufacturing sector and motor vehicles export in a particular way. Consequently, this study aims at determining the effects of Covid-19 and fuel price fluctuations on motor vehicles export in South Africa.

The rest of the paper is structured as follows: section two provides brief literature on the recent situation in the South African automotive industry, focusing on both domestic and international sales. Section three deals with data and methodology while the

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fourth section represents and discussed findings. The last section, section 5, provides a concluding summary and policy recommendations.

Literature Review

South African automotive industry

The automotive industry is one of the manufacturing industries that largely contribute to global economic growth. Challenges within this industry have spillover effects on other economic industries, job creation and the economy as a whole (Prodromou, 2021). The role of the automotive industry, especially in developing countries, is not limited to economic growth but expands its benefits to social cohesion (Bharadwaj, 2015). In South Africa, as in most other developing countries, an interaction between the strength of the economy and the motor vehicles sale. The fluctuations or challenges faced by the domestic economy implications on motor vehicle sales. Table 1 displays changes experienced in sales of passenger cars and commercial vehicles between 2015 and 2019 as a result of economic instabilities. Between 2018 and 2019, the sale of passenger cars declined by 2,7 percent while the sales of light commercial vehicles were down by 4 percent. Nonetheless, during this period, motor vehicle sales experienced an increase of 2.1 within the track market (Lamprecht, 2020). Irrespective of this growth, South African motor vehicle sales decline by 29.2 percent between 2019 and 2020.

Table 1: Sales of Passenger Cars and Commercial Vehicles (2015 – 2019)

Category	2015	2016	2017	2018	2019
Passenger cars	412 397	361 265	368 114	365 247	355 378
Light commercial vehicles	174 812	159 316	163 317	159 525	153 192
Medium and heavy commercial vehicles and buses	30 441	26 971	26 273	27 455	28 041
Total new vehicle sales	617 650	547 552	557 704	552 227	536 611

Source: Naamsa (2020)

Besides the vehicles sold within domestic markets, a significant share of produced vehicles is sold within the international markets. As mentioned above, shocks in vehicle sales within domestic markets are generally caused by domestic economic conditions and some other endogenous and exogenous factors. Changes within the international, however, are caused by factors that are beyond the South African's control. These factors include global economic conditions, fuel price and various pandemics among other factors. Irrespective of challenges faced during the Covid-19 outbreak, the NAAMSA report (2022) indicates that the South African motor export sales experienced an increase between 2020 and 2021. All motor vehicle exports increased except for passenger cars. This is justified by the statistics displayed in Table 2.

Table 2: Industry's Export Sales Performance between 2017 And 2021

Category	2017	2018	2019	2020	2021	2020/2021 % change
Cars	230.96	221.68	260.84	178.79	170.79	-4.5%
Light Commercials	106.15	128.32	125.42	91.94	123.90	+34.8%
Trucks & Buses	990	1.136	827	558	584	+4.7%
Total Exports	338.10	351.14	387.10	271.29	295.27	+8.8%

Source: Naamsa (2022)

The decline in some of the categories of domestic sales or export might have been the results of the Covad-19 pandemic or shocks in fuel prices. This is what this intends to assess. Prior to that analysis, it would be essential to have a close review of the literature relating to the link between Covid-19, fuel price shocks and motor vehicles export. However, due to the absence of a litterer on the relationship between the proposed independent variables and the motor vehicle exports and covid-19, the next section focuses on data and approaches employed for regression analysis.

Methodology

Data Discussion

The study analyses the relationship between fuel price, covid-19 (new cases) and motor vehicles from the South African manufacturing sector. To achieve the main objective, the study employed monthly time series spanning from March 2020 to March 2022. The dependent variable is motor vehicle export measure in millions of Rand. Two independent were used namely COVID-19 is measured in the number of new cases and fuel price is measured in the South African currency (Rand per litre). For uniformity and consistency of variables, the latter was transformed into a natural logarithm. The study data was acquired from quantec EasyData website. A simple model or relationship between variables is mathematically expressed as follows:

$$LVEXP_t = \beta_0 + \beta_1 LCOV_t + \beta_2 LFPR_t + \varepsilon_t \quad (1)$$

Where β_0 is the intercept, β_1 and β_1 are the respective slope parameters of $LC0V$ and $LFPR$. While ε_t represents a random error term which is expected to be stationary.

Model Framework

The Pesaran, Shin and Smith, (2001) ARDL model is the selected model for cointegration. The choice of the model was stimulated by its econometric advantages. The first advantage is that the ARDL is a suitable model to analyse a single equation. Secondary the model does not necessitate a pre-testing of the series to establish the integration order (provided that none of them is integrated at the second difference. Furthermore, the ARDL model, unlike Johansen (1991), is appropriate for a small sample and flexible to analyse series that are either purely I(0), purely I(1) or a combination of the two. The ARDL equation that represents the study variables is expressed as follows:

$$\Delta LVEXP_t = \propto_0 + \sum_{i=1}^{p} \beta_i \, \Delta LVEXP_{t-i} + \sum_{j=1}^{p} \varphi_i \, \Delta LCOVID_{t-i} + \sum_{i=1}^{p} \delta_i \, \Delta LFPR_{t-i}$$

$$+ \gamma_1 LVEXP_{t-1} + \gamma_2 LCOVID_{t-1} + \gamma_3 LFPR_{t-1} + u_t \qquad (2)$$

Where Δ represents the operator of the first difference, $\propto_0$ denotes the intercept, p denotes optimal lag selected using the Schwarz Information Criterion (SIC); β_i, φ_i and δ_i designate the short-run model changes; γ_1, γ_2 and γ_3 are the long-run coefficients and u_t represents the model stochastic error term.

Equation 2 is used to determine the presence or absence of cointegration or relationship among variables. This is achieved using the ARDL bounds test introduced by Pesaran et al. (2001). The null hypothesis (H_0) suggests the absence of cointegration while the alternative (H_1) suggests the existence of the long-run relationship between variables. The decision of rejecting or not rejecting the H_0 is made through the comparison of the computed F-statistics and bounds critical values. This study expectation is the rejection of the H_0. In other words, the computed F-statistic exceeds the upper bound critical values. Once the long-run relationship is established the study proceeds with the estimation of the error correction model (ECM). The following equation represents the estimated ECM:

$$\Delta LVEXP_t = \propto_0 + \sum_{i=1}^{p} \beta_i \, \Delta LVEXP_{t-i} + \sum_{j=1}^{p} \varphi_i \, \Delta LCOVID_{t-i} + \sum_{i=1}^{p} \delta_i \, \Delta LFPR_{t-i} + \varphi ECT_{t-1} + u_t \qquad (3)$$

Where the ECT_{t-1}represents the lagged error correction term and φ represents the speed of adjustment. Prior to an estimation of equations 2 and 3, we performed the unit root test to ascertain integration order to select an adequate approach for cointegration.

Empirical Results

Descriptive Statistics

Table 3 displays descriptive statistics for all variables. When comparing the results in Table3, it can be concluded that the LCOVID has a high mean, high standard deviation, Kurtosis and Jarque-Bera probability compared to Kurtosis. Kurtosis and Jarque-Bera probability in the table denotes that LVEXP and LCOVID are normally distributed. Their J-B probability is greater than the 0.05 level of significance; on the other, the J-B probability value of LCOVID is zero suggesting the absence of normal distribution.

Table 3: Descriptive Statistics

	LVEXP	**LCOVID**	**LFPR**
Mean	4.58	18.23	7.36
Maximum	4.63	20.00	7.64
Minimum	4.51	9.22	7.05
Std. Dev.	0.03	2.17	0.15
Skewness	-0.58	-3.08	-0.02
Kurtosis	3.03	13.06	2.30
Jarque-Bera	1.41	145.15	0.52
Probability	0.49	0.00	0.77

Unit Root Test

As highlighted above, the unit root test is one of the essential steps of regression analysis. It assists a researcher in determining the integration order of study variables. For that purpose, the current study employed the Augmented Dickey-Fuller test (ADF) test. The test outcome is reported in Table 4. According to these results, the variables of the study are a mixture of I(0) and I(1). Therefore, the ARDL is the appropriate approach to assess the relationship among variables.

Table 4: Results of Unit Root Tests

Variables	Model	Levels	1st Difference	Integration order
LC0V	Intercept	0.35	0.00***	I(1)
	intercept & trend	0.77	----------	
LFPR	Intercept	0.98	----------	I(0)
	intercept & trend	0.01**	----------	
LVEXP	Intercept	0.01**	----------	I(0)
	intercept & trend	----------	----------	

Note: ***, ** rejection of null hypothesis at 1% and 5% significant level respectively

Bounds Test for Cointegration and Long-Run Relationship Coefficients

The ARDL bounds test results are reported in Table 5. The computed F-statistic is compared to bounds critical values acquired from the Pesaran *et al*. (2001) table. The value of the computed F-statistic is 18.84 greater than all upper bounds critical values (4.14 at 10 percent significant level, 4.45 at 5 percent significant level, and 6.36 at 1 percent significant level). The conclusion from the bounds test results suggests the existence of a long-run relationship between COVID-19 new cases, fuel price fluctuations and motor vehicles export from the South African manufacturing sector.

Table 5: Bound Tests

F-statistic	Critical values		
18.83971	**Signif.**	**Lower bounds I(0)**	**Upper bounds I(1)**
	10%	3.17	4.14
	5%	3.79	4.85
	1%	5.15	6.36

Since a cointegration exists between the study variables, it is important to analyse the extent to which changes in independent variables influence the behaviour of the dependent variables. The coefficients of parameters displayed in Table 6 suggest an inverse relationship between explanatory variables and the dependent variable. Therefore, a one percent increase in COVID-19 new cases causes motor vehicles export to decline by 0.009 percent. On the other hand, a one percent increase in fuel price leads to 0.083 percent contraction in causes motor vehicles export. When comparing the effect of independent variables on the dependent variable, it can be concluded that fuel price influence more changes in vehicles export compared to COVID-19 new cases.

Table 6: Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCOVID	-0.009	0.004	-2.551	0.043**
LFPR	-0.083	0.0190	-4.381	0.005***
C	5.377	0.176	30.639	0.000***

Note: ***, ** rejection of null hypothesis at 1% and 5% significant level respectively

Analysis of Vcm and Short-Run Dynamics

The presence of long run relationship is an adequate evidence that supports the estimation of the error correction model and short-run dynamics. Both error correction term (ECT) and short run coefficient are reported in Table 7. The value of the ECT is negative and statistically significance with an absolute t-statistic of 6.93. The negative sign and the significance of ECT confirm the existence of long-run equilibrium after the short-term shocks in the system. Additionally, besides the short-run effect of both independent variables on the motor vehicles export, the lagged value of the latter influences its current behaviour. In other words, the positive history of motor vehicles export encourages current exports. It is important to highlight that the motor vehicles export does not only undergo a negative impact of growing COVID-19 new cases and high fuel prices in the long-run but also in the short-run as indicated in Table 7. Both ΔLCOVID and ΔLFPR coefficients are negative and statistically significant.

Table 7: Etc and Short-Run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔLVEXP	0.68	0.14	4.99	0.00***
ΔLCOVID	-0.01	0.00	-369	0.01**
ΔLFPR	-0.15	0.05	-2.69	0.04**
ETC(-1)	-0.46	0.21	-6.93	0.00***

Note: ***, ** rejection of null hypothesis at 1% and 5% significant level respectively

When employed variables are a mixture of I(0) and I(1) integration order, it is required to use the Toda-Yamamoto (1995) Granger causality test to investigate the causation effect between variables. The results in Table 8 confirm the result in Table 6 as all independent variables are significant to cause short-term changes in the dependent variable. Nonetheless, it important to note that the causality relationship is a unidirectional as both LCOVID and LFPR cause changes in LVEXP not otherwise.

Table 8: Toda–Yamamoto Granger Causality Results.

Excluded Variable	**Dependent variables**			
	LVEXP	**LCOVID**	**LFPR**	**All**
LVEXP	……………..	3.47	1.44	49.45
		(0.48)	(0.84)	(0.00)
LCOVID	40.76	……………..	1.88	5.03
	(0.00)		0.76	(0.75)
	39.96	2.26	……………..	2.73
LFPR	(0.00)	(0.69)		(0.95)

Note: () represents p-values while *** indicates rejection of the null hypothesis at 1% significant level

Model Robustness Check

The pertinence and relevance of employed model was authenticated based on various diagnostic tests that include heteroscedasticity, normality, serial correlation as well as model stability. The outcome of diagnostic test reported in Table 9 confirm that the employed ARDL model fittingly specified, homoscedastic and free of serial correlation. Therefore, the estimated results are reliable and useful for policy recommendation.

Table 9: Model Diagnostic Results

Test		**P-value**	**Decision**	**Conclusion**
J-B	Normal distribution	0.16	H_0 not rejected	Residuals are normally distributed
L-M	Serial correlation	0.18	H_0 not rejected	No serial correlation
Breusch-Pagan-Godfrey	Heteroscedasticity	0.99	H_0 not rejected	No heteroscedasticity

In addition to the aforementioned diagnostic test, the authors verified the model stability using both Cumulative Sum (CUSUM) residuals stability tests. As indicated in Figure 1 all coefficients of the estimated ARDL model lie within the critical bounds at 5 percent level of significance.

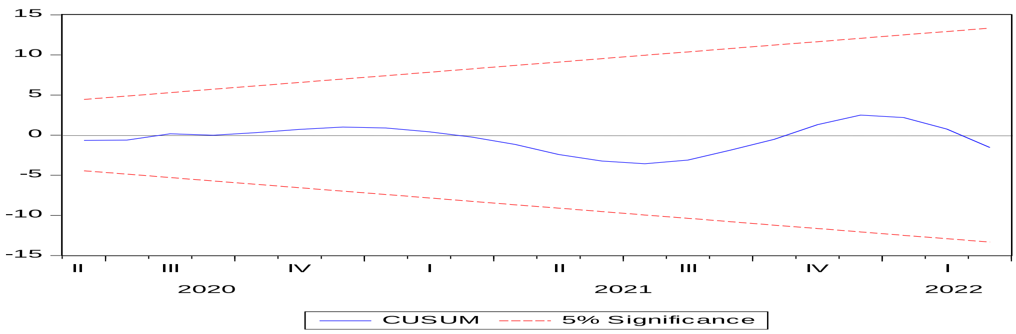

Figure 1: CUSUM Stability Test

Concluding Summary and Policy Implications

The main objective and purpose of the study were to assess the impact of fuel price shocks and COVID-19 new cases on the motor vehicles export in the south African manufacturing sector. The study utilised the ARDL estimation approach to determine the effect of explanatory variables on the dependent variable. Through the bounds test, the results indicated that changes in both COVID-19 new cases on the motor vehicles export have a significant long-term effect on the number of motor vehicles exported from the South African manufacturing sector. An increase in the number of people infected by COVID-19 causes a decline in the number of vehicles sold within the foreign markets. Additionally, an increase in fuel price causes a decrease in vehicle exports. Furthermore, the short-run regression and Toda-Yamamoto Granger causality result suggested causality between variables and significant short-term implications of COVID-19 new cases on the motor vehicle export.

Grounded on these results, and since South Africa is a fuel import county, the authors recommend that the South African policymakers and government should reduce taxes and levy on imported oil (fuel) to reduce the effect of fuel price. Additionally, fuel reserve should be increased to delay the effect of the fuel price increase. Production of fuel-efficiency motor vehicles should also serve as a solution to vehicle export decline. Regarding COVID-19, government and health authorities should increase awareness and encourage people to be more cautious and vaccinated.

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