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Appraising The Fuel Price And Financial Risk Components Effects On Sales In The South African Automotive Industry

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Abstract: The automotive industry is one of the manufacturing sub-sectors that play a vital role in countries' economies. However, this industry is not exempt from the effect of fuel price and financial risk components. This study investigates the effect of fuel price and financial risk components on the South African motor trade sales for the period 2008-2021. The research is built on previous work and research on the linkage between fuel price and country risks. Auto-regression Distributed Lag (ARDL) model was applied to monthly financial data (exchange rate, interest rate), fuel price and motor trade sales. Findings suggested the presence of a long-run relationship among these variables. Findings suggested the presence of a long-run relationship among these variables. It was found that both interest rate and exchange rate have negative impacts on long-run motor trade sales. Nonetheless, the fuel price was found to be statistically insignificant to influence motor-trade sales in the long run. The results also indicated that both interest rate and exchange rate cannot impact motor trade sales in the short run. Based on these results, the study stressed that policies that strengthen and stabilise the South African currency (exchange rate) are imperative to increase sales in the automotive industry and economy in general. Easing and lowering interest rates can also assist in boosting motor trade sales irrespective of the fuel price. The paper uniquely provides the interactions between fuel price, financial risk and sales within the South African automotive industry. It also suggests strategies that can be implemented to improve sales within the aforementioned industry.

Keywords: automotive industry; fuel price; financial risk; interest rate; South Africa

JEL Classification: E43; F14; F41; L62

1. Introduction

It is an ongoing debate about what can assist a country to enhance its economic growth, particularly in developing countries, like South Africa, which is experiencing macroeconomic and financial challenges (Gordhan, 2012). Increments

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in production capacity are one of many factors that can lead to a country's economic growth and social wellbeing (Maia & Hanival, 2013). Unfortunately, owing to productivity and other macroeconomic challenges together with financial uncertainties, the South African economic growth has been fluctuating around 2.83 percent per year between 1993 and 2017 and this was considered a significant improvement compared to 1.4 percent growth between 1988 and 1992 (STATSSA, 2018). The South African economic growth volatility is, in some cases, caused by the linkage between the domestic and global economic conditions. Any change that occurs within the global economy has repercussions on the South African economy (De Waal, 2014). Fuel price volatility is one of those global factors that influence local industries and the automotive industry in a particular way.

The automotive industry's sales have been playing an important role in the global economy. In 2015, this industry was able to generate more than $ 3.5 trillion and it was counted as one of the most significant economic sectors. During this period - in 2015 - more than 87.4 million vehicles were sold in the global markets and the number was expected to grow to 95 million vehicles in 2016 and 111 million vehicles in 2020 (Barnes et al., 2018). Between 2014 and 2015, global vehicle production encountered an increase of 1.1 percent, that is 90.88 million in 2015 compared to 89, 78 million vehicles produced in 2014 (AIEC, 2016). During the same period, global vehicles sales increased from 87.92 million in 2014 to 89.78 million vehicles sold in 2015. In other words, between 2014 and 2015 global vehicles sales increased by 1.1 million vehicles which make a sales growth of 2.0 percent (AIEC, 2016).

The South African automotive industry plays an important role in boosting economic growth and creating employment in the manufacturing sector (Ambe, 2014; Bronkhorst *et al.*, 2013). However, despite its importance to the domestic economy, the South African automotive industry is seen as a small industry when considered in the global automotive arena. Its market share in global vehicle production is even less than 1 percent. For example, in 2015 the market share of the South African automotive industry was 0.68 (AIEC, 2016) which, due to covid-19 declined to 0.58 percent in 2020 (Country Commercial Guide, 2021).

Regardless of the low market share of the South African automobile industry towards global industries, this industry plays a vital role in South African exports. In 2017, the motor industry earned exports revenue of R164.9 billion and this counted as 13.9 percent of South Africa's total export revenue. However, this contribution was lower compared to R171.1 billion achieved in 2016 which comprised 15.6 percent of the total South African export revenue in the same year (Venter, 2018). Despite the contribution of the motor trade industry, it has been experiencing a decline in its total sales. Table 1 depicts the total number of cars (light and heavy) sold between 2014 and 2018, it can be deduced that the total number of new cars sold decreased from 644 257 in 2014 to 552 226 in 2018. This decline might result from various factors that include exchange rate, economic growth, fuel price and interest rate, emission taxes and the VAT increment from 14 percent to 15 percent (Automotive Industry Export Council (AIEC), 2019).

Table 1. Sales of Passenger Cars and Commercial Vehicles – 2014 to 2018

Year	Passenger cars	Light commercial vehicles	Medium and heavy commercial vehicles and buses	Total new vehicle sales
2014	438 937	173 811	31 509	644 257
2015	412 397	174 812	30 441	617 250
2016	v361 265	159 316	26 971	547 552
2017	368 114	163 317	26 272	557 703
2018	365 242	159 449	27 535	552 226

Source: NAAMSA/Lightstone Auto (2019)

Additionally, in recent years, the international fuel price has been experiencing substantial volatility and then led to a significant price change within countries that imports fuel. The South African currency has also been fluctuating and this might have an impact on the motor trade exports. Based on these mentioned issues, the present study aims to determine the effect of fuel price, exchange rate and the real interest rate on total sales within the motor trade industry.

2. Literature Review

Vehicle and/or automotive sales are one of the economic activities that apply some of the trade theories. This type of trade depends on the country's exchange rate, interest rate and commodities prices such as crude oil prices. Theoretically, it is assumed that a country's currency depreciation allows that country to increase its exports while lowering its imports. On the other sides, if a country's currency appreciates the level of exports from that country will decline leading to import growth (Chiloane et al., 2014). Applying this theory to the South African motor industry, more cars will be sold abroad when the South African currency is weak, thus more cars will be sold within the domestic markets owing to the Rand appreciation. Nonetheless, it is important to note that there may be other factors that may influence the motor sales levels besides the strength or weaknesses of the country's currency. Fuel price and interest rate are among those other factors. An increase in crude oil price influences the consumers' decision of buying new cars. Consumers decide either to keep their existing cars or may buy where cars are less expensive; and consequently, this leads to a decline in the number of cars to be sold (Van der Post, 2018). Additionally, given that a car is considered an investment or durable good, the buyer may consider the current price of fuel and predict what should happen in the future. If today's fuel price is high, the buyer believes that servicing and maintaining his/her car will be costlier than today, thus buying a new car is considered as creating or increasing future expenses (McManus, 2007).

Furthermore, the earliest theoretical and empirical works traced a close link between economic growth, production and sales growth or decline with the oil price fluctuation (Hamilton, 2009; Rasche & Tatom, 1977). A rise in fuel price impact production capacity and reduces productivity and the total outputs, which results in low sales. However, the effect of fuel price increase on the number of cars sold depends on the elasticity among various types of cars. For instance, high fuel prices might lead to low demand for low-fuel efficiency cars while increasing demand for high-fuel efficiency cars (Busse et al., 2009).

2.1. A Close Review and Discussion of Variables Interactions

2.1.1. Exchange Rate and Motor Sales Nexus

Nowadays, the global economy is experiencing the significant effects of the exchange rate, interest rate and fuel price on various motor industries' sales. This is happening because demand elasticity and quantity of foreign revenue towards a domestic firm depend mostly on the form of competitiveness and the value of the domestic currency on the international market (Williamson, 2001). Analysing the effect of shocks from the exchange rate on the automobile industry based in Europe; Barumwete and Rao (2008) found that the exchange rate fluctuations have a long terms impact on companies' sales (revenue) whilst the short term effect was found significant only for one company out of five analysed. In the same line, the study of Avsar and Turkcan (2013) analysed the effect of exchange rate volatility on the number of cars and parts from the US auto industry and found that the exchange rate volatility possesses a positive impact on the US auto-industry trade. In contrast to these studies that supported the positive relationship between the motor industry's sales and the exchange rate fluctuations, the study of Thorbecke (2008) exhibited empirical evidence suggesting an inverse relationship between the motor industry's sales and the exchange rate volatility. He argues that due to volatility within the exchange rate, locational benefits of fragmentation decline and as a result, the trade volume decreases. Interest rate growth not only increases the cost of purchasing on the buyer's side, but it also increases the cost of holding inventory on the automobile makers' side (Copeland, 2019), consequently negatively impacting both total output and sales.

Financial and international trade theory argues that the value of any industry or firm is firmly influenced by the country's exchange rate (Mall et al., 2011). This is, according to Eiteman et al. (1995) and Shapiro (1992), the exchange rate exposure is unadventurously regarded as economic and transaction exposure. These authors distinguish economic exposure from transaction exposure. While the latter has short term implications and denotes the effect of exchange rate fluctuations on committed cash flow, the former has long term implication implications on the industry's cash flows. Theories on the exchange rate exposure support the common idea that the level of a country's imports and exports within the foreign markets depends on the exchange rate oscillations (Shapiro, 1975).

2.1.2. Interest Rate And Motor Sales Nexus

Besides the exchange rate, financial constraints can also present other types of limitations that may reduce consumers' willingness to purchase. Since the purchase of durable properties involves several terms and conditions that mode and period of payment, price and interest rate; the rate may have a crucial influence on the number of cars demanded. Investigating the effect of interest rates on consumers and purchasing decisions, wonder et al. (2008) found that buyers prefer downpayment and low-interest rates. Contrary to these findings, the study of Doyle (1997) opined that motor vehicle sales are not affected by the hike in interest rate as long as the motor trader is able and willing to counteract the high-interest rate with lower prices. Additionally, Feng et al. (2011) posited that the most factor of trade motor sales remains the purchasing power or consumer income levels. The study was conducted to analyse the effect of high-interest rates not purchasing power and the finding revealed that, in 2015, the rise of interest rates curbed the buying power of over 80 percent of buyers who purchase through a loan (DeBord & Rudegeair, 2014). If a person is not able to purchase a car from his/her pocket, he/she has to take a loan from a bank. However, if the interest rate associated with that loan is high, the person might not be willing to take that risk as the high-interest rate rises the cost of the purchased vehicle. Thus a significant inverse relationship exists between the interest rate and the number of cars to be sold (Ludvigson, 1998). An increase in interest rate forces people to hold on to their existing cars leading to low demand for new cars, thus the total sales decline. Besides that, the high-interest rate may have a direct effect on the number of vehicles sold, it can also have an indirect negative effect on motor industry sales through its influence on the fuel price (Carley, 2016).

2.1.3. Fuel Price And Motor Trade Sales Nexus

Broadly, various options are evaluated before a person or company decides on purchasing a vehicle. These options include the price of the car itself and the fuel price. Although it is difficult for the buyer to forecast the future price of fuel, McManus (2007) assessing the relationship between cars sales and fuel price in the US automotive industry found out that the number of vehicles sold depends on fuel price. The high price of fuel results in low demand for new and expensive cars. The study of McManus (2007) on the effect of fuel price on the number of vehicles sold found that if the fuel price increases the buyers associates the fuel price and vehicle price and conclude that owing a new vehicle becomes very expensive and they can buy only if the price of the vehicle is reduced. Reducing the vehicle price not only negatively affects the number of vehicles sold, but also diminishes the automobile industry’s revenue and profit. Additionally, fuel price affects both the demand and supply side of the automobile industry. On the supply-side, fuel increase leads to the high cost of inputs, thus reducing production and quantity supplied. On demand-fuel price increase results in a high cost of vehicles maintenance, thus reducing the quantity demanded (Baur & Todorova, 2018). The oil or fuel price has a significant spillover effect on the automobile industry’s sales (Arouri et al., 2011). Analysing the effect of the exchange rate on the number of new cars sold, Busse et al. (2009), found that increase in fuel price leads to a decline in demand for none fuel efficiency cars whilst those that are more fuel-efficiency are highly demanded. These results suggested that the fuel price effect within the automotive industry depends on the types of cars in the markets. However, in a general way, one might assume that an increment in fuel prices may affect the willingness to buy as well as the willingness to supply.

3. Data and Methodology

3.1. Data Collection, Sample Size and Source

The study employed secondary data obtained from two sources. The interest rate was collected from the South African Reserve Bank (SARB), whereas the fuel price, exchange rate and moto trade-sales data were sourced from collected from Quantec EasyData. The data consists of 156 monthly observations starting from January 2008 to December 2021. Two reasons motivated the choice of sample size. The first was that the author aimed to analyse the effect of regressors on the dependent variable during the post-2008 financial crisis and the second was the availability of data.

3.2. Description and Transformation of Data

The analysis includes four variables namely the moto trade-sate (dependent variable), real interest rate, effective exchange rate and fuel price. The number of new cars sales is used as a proxy for the motor trade sales measured in millions of rand. The real effective rate against the most important currencies (Index: 2010=100) was used as a proxy for the exchange rate. The average price between 93 and 95 Octane was used as a proxy of the fuel price measured in cents. Finally, the real interest rate was used to assess how the cost of the following might affect the motor trade sales. Given that these variables differ in terms of measurements, each variable was transformed into the natural logarithm to create a common basis and measure the responsiveness of the dependent variable towards shocks in regressors. Additionally, stationarity for each variable was checked before the application of statistical and econometric approaches.

3.3. Unit Root Test (Test for Stationarity)

A variable is stationary if its mean and variance are constant over time. If a variable is not stationary at level, it has to be differenced until it reaches the stationarity state. This formula is used when differencing any nonstationary dataset: $\Delta Y_t = Y_t - Y_{t-1}$. Various approaches or tests are used to assess the presence of unit root within the series. These tests include the Augmented Dickey-Fuller (ADF) test, the Phillips-Perron test, and the KPSS test. The KPSS test is applied as a counterpart of these other two mentioned tests. The KPSS is used to test for stationarity while others test for unit root. Although the order of integration does not matter if the ARDL model is applied, it is necessary to ensure that none of the variables is stationary after the first difference. For this purpose, the current study employed the Augmented Dickey-Fuller (ADF). The ADF can follow any of the following three forms of regression:

$$\Delta Y_t = \propto_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + e_t$$

$$\Delta Y_t = \propto_0 + \propto_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + e_t$$

$$\Delta Y_t = \propto_0 + \propto_1 Y_{t-1} + \propto_2 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + e_t \quad (1)$$

Where e_t denotes the white noise or error term. To evade correlation among errors, the extra lagged terms are included in the model. Before the ADF test is performed, the following hypotheses are formed:

H_0: Y_t is not I(0) or Y_t is not stationary

H_1: Y_t is I(0) or Y_t is stationary

The conclusion on whether the variable is stationary at the level or not is made based on the comparison between the critical values from Fuller's table with calculated ADF statistics. The null hypothesis (H_0) for nonstationary is rejected if the value of the calculated ADF statistics is greater than the critical value and the conclusion will be that the variable has no unit root (it is stationary). Besides, the p-value can also use in concluding. A variable is stationary at the level or integrated of zero I(0) if it is stationary without being differenced. It is I(1) if it becomes stationary after being differenced once.

3.4. Cointegration And The ARDL Approach

Cointegration relationship among variables implies that these variables tend to move tougher in the long run. In order words, a cointegration exists among variables if a stationary linear combination exists between them. A long-run relationship between two or more variables can be analysed either by either the Engle-Granger (1987), the Phillips and Hansen (1990), the Johansen-Juselius (1992) or the ARDL approaches. While the two previous approaches are limited to variables with the same order of integration, ARDL model, in its flexibility, can be applied to a mixture of variables. Additionally, it is more useful on small sample sizes and when using a single equation. For this reason and its other advantages, the ARDL model was selected for this study. Some of this approach's advantages are that it possesses the ability to estimate the short-run and long-run parameters simultaneously, and it avoids issues that emanated from nonstationary time series data. Additionally, the ARDL model does not necessitate a prior determination of the order of the integration. Moreover, allows the use of diverse optimal lags of series. The following is a description of the ARDL approach is both simple and generalised forms:

3.5. ARDL Model In A Simple Form (ARDL (1,1))

$$y_t = \propto_0 + \propto_1 y_{t-1} + \beta_0 x_t + \beta_1 x_t + e_t \quad (2)$$

Where it is expected that $e_t \sim (0,\sigma^2)$ and $|\propto_1| < 1$. The coefficients β_0 and β_1 represent the long-run effects. The ARDL (1, 1) implies that a single lag was used for both dependent and independent variables. Therefore it is expected that in the long run $y_t = y_{t-1}$ and $x_t = x_{t-1}$; from this, Equation 2 can be rewritten as:

$$y_t = \propto_0 + \propto_1 y_{t-1} + \beta_0 x_t + \beta_1 x_t \Longleftrightarrow (1- \propto_1)\, y_t = \propto_0 + (\beta_0 + \beta_1)x \quad (3)$$

Consequently, the responsiveness of *y* of variation in *x* is obtained from

$$k = \frac{\beta_0 + \beta_1}{1- \propto_1} \quad (4)$$

To establish the link between the ARDL model and the error correction model (ECM) the y_{t-1} is subtracted from the sides of equation 2, then the $\beta_0 x_{t-1}$ is added and subtracted from the right-hand side to obtain

$$y_t - y_{t-1} = \propto_0 + (\propto_1 - 1)\, y_{t-1} + \beta_0(x_t - x_{t-1}) + (\beta_0 + \beta_1)\, x_{t-1} + e_t \quad (5)$$

Substituting $(\beta_0 + \beta_1) = k(1 - \propto_0)$ from equation 4 and putting $\Delta y = y_t - y_{t-1}$ and $\Delta x = x_t - x_{t-1}$ into Equation 5, we obtain the following:

$$\Delta y = \propto_0 + (\propto_1 - 1)\,(y_{t-1} - \mathrm{k}x_{t-1}) + \beta_0 \Delta x_{t-1} + e_t \quad (6)$$

Equation 6 represents the ECM implied by the ARDL (1, 1) model. In estimating the error correction model (ECM) some other transformations have been considered.

3.6 Generalization Of The ARDL Model To Multiple Regressors

In the description, we consider one dependent and two independent variables. An ARDL (m, n) model with p exogenous variables. This can also be written as ARDL (m, n; p) and expressed as:

$$y_t = \propto_0 + \sum_{i=1}^{m} \propto_i y_{t-i} + \sum_{j=1}^{p} \sum_{i=0}^{n} \boldsymbol{\beta_{ij}}\, \boldsymbol{x_{jt-i}} + e_t \quad (7)$$

Where $e_t \sim (0,\sigma^2)$. If lags operators $L^n z_t = z_{t-n}$ are considered then equation 7 is written as follow:

$$\propto (L)y_t = \propto_0 + \sum_{j=1}^{p} \beta_j(L)x_{ij} + e_t \quad (8)$$

Where $\propto (L) = 1 - \sum_{i=1}^{m} \propto_i L^i$, $\beta_j(L) = \sum_{j=1}^{n} \beta_{ji} L^i$

Nonetheless, in case only one dependent and three regressors such ARDL (m, n, 1), ARDL (m, n, 2) and ARDL (m, n, 3) as in the case of this study the equation 7 can be written as

$$y_t = \propto_0 + \propto_1 y_{t-1} + \ldots. \propto_m y_{t-m} + \beta_{01}x_{1t} + \ldots \beta_{n1}x_{1t-n} + e_t \quad (9)$$

$$y_t = \propto_0 + \propto_1 y_{t-1} + \ldots. \propto_m y_{t-m} + \beta_{01}x_{1t} + \ldots \beta_{n2}x_{1t-n} + \beta_{02}x_{1t} + \beta_{12}x_{1t-1} \ldots \beta_{n2}x_{1t} + e_t \quad (10)$$

$$y_t = \propto_0 + \propto_1 y_{t-1} + \ldots. \propto_m y_{t-m} + \beta_{01}x_{1t} + \ldots \beta_{n2}x_{1t-n} + \beta_{02}x_{1t} + \beta_{12}x_{1t-1} \ldots \beta_{n3}x_{1t} + \beta_{03}x_{1t} + \beta_{13}x_{1t} + \beta_{23}x_{t-1} \ldots \beta_{n}x_{1t-n} \quad (11)$$

3.7. ARDL Model Specification

A single linear ARDL equation is specified and estimated. This equation represents the implication of exchange rate, interest rate and fuel prices fluctuations on the South African motor trade sales. The study model is constructed by five variables namely motor trade-sale (MOTOS), interest rate (INTER) and the exchange rate (EXCH). Accordingly, their relationship can be expressed as follow:

$$\Delta LMOTOS_t = \alpha_0 + \sum_{j=1}^{k} \beta_j \Delta LMOTOS_{t-j} + \sum_{j=1}^{k} \varphi_j \Delta LINTER_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LEXCH_{t-j} + \sum_{j=1}^{k} \vartheta_j \Delta LPETP_{t-j} + \gamma_1 LMOTOS_{t-1} + \gamma_2 LINTER_{t-1} + \gamma_3 LEXCH_{t-1} + \gamma_4 LPETP_{t-j} + u_t \quad (12)$$

Where $\Delta LMOTOS_t$,$\Delta LINTER_t$, $\Delta LEXCH_t$ and $\Delta LPETP_t$ denote changes in natural log of motor trade-sale, interest rate, exchange rate and fuel price respectively in period *t*. while β_j, φ_j , δ_j and ϑ_j denote the short-run model dynamism, γ_1, γ_2 , γ_3 and γ_4 represent the long-run coefficients.

Additionally, α_0 , k and u_t are the intercept, lag operator and white error term respectively. The presence of cointegration between variables results in performing the error correction model which is expressed as follow:

$$\Delta LMOTOS_t = \alpha_0 + \sum_{j=1}^{k} \beta_j \Delta LMOTOS_{t-j} + \sum_{j=1}^{k} \varphi_j \Delta LINTER_{t-j} + \sum_{j=1}^{k} \delta_j \Delta LEXCH_{t-j} + \sum_{j=1}^{k} \vartheta_j \Delta LPETP_{t-j} + \lambda_1 ECT_{t-j} + u_t \quad (13)$$

The λ_1 coefficient of the ECT has to be negative and statistically significant. The fulfilment of these two conditions implies that any model's disequilibrium will converge to the long-run equilibrium. Before the cointegration estimation, it is important to perform a unit root test to ensure that the selected model is appropriate for the analysis.

4. Empirical Analysis and Discussion

4.1. Unit Root Test

Unit root test is one of the preliminary processes that precede any cointegration analysis. This test assists in determining the variables' order of integration and thereafter allow the selection of the appropriated model to assess the long-run relationship between variable. The application of the ARDL model does not necessarily require the order of integration to be known. However, given that this model leads to spurious regression when applied to I(2) variables, it is significant to ensure that variables under the study are either purely I(0), I(1) or a mixture of these two orders of integration. In this regard, the Augmented Dickey-Fuller test (ADF) test is used to ensure that none of the variables is stationary beyond the first difference. Since the study aims to use the simple equation procedure and all variables are I(1), the ARDL method is appropriate for cointegration assessment.

Table 1. ADF Unit Root Test at Levels

Variables	Model type	Critical value	Test statistics	P-value
	intercept	-2.883073	-0.422709	0.9008
MOTOS	Intercept & trend	-3.443704	-1.482902	0.8308
	None	-1.943229	2.630669	0.9980
	intercept	-2.883073	-0.967134	0.7636
PETP	Intercept & trend	-3.443704	-2.868082	0.1763
	None	-1.943229	1.004633	0.9165
	intercept	-2.882910	-2.252382	0.1891
	Intercept & trend	-3.443450	-2.454130	0.3504
INTER	None	-1.943193	-0.238813	0.5985
	intercept	-2.882910	-0.821995	0.8094
EXCH	Intercept & trend	-3.443450	-2.362730	0.3973
	None	-1.943210	0.849108	0.8926

Table 2. ADF Unit Root Test After the First Difference

Variables	Model type	Critical value	Test statistics	P-value
MOTOS	intercept	-2.883073	-11.54266*	0.0000*
	Intercept & trend	-3.443704	-11.49860*	0.0000*
	None	-1.943247	-6.185225*	0.0000*
PETP	intercept	-2.883073	-9.286495*	0.0000*
	Intercept & trend	-3.443704	-9.252242*	0.0000*
	None	-1.943229	-9.184683*	0.0000
INTER	intercept	-1.943210	-9.934604*	0.0000*
	Intercept & trend	-3.443450	-9.904179*	0.0000*
	None	-1.943210	-9.934604*	0.0000*
EXCH	intercept	-2.882910	-8.805492*	0.0000*
	Intercept & trend	-3.443450	-8.779586*	0.0000*
	None	-1.943210	-8.731218*	0.0000*

Note: * Denotes a rejection of null hypothesis (variable has a unit root) at 5% significant level.

4.2. Unit Root Test

The results that estimate the long-run relationship between the dependent and independent variables are represented in Table 3. From the table, the value of the computed F-statistic is 5.803. This value is larger than the upper bound critical value of 4.23 at 5 percent level of significance. This implies that the null hypothesis of no cointegration among variables can be rejected following Pesaran et al. (2001). By rejecting the null hypothesis, it means that shocks in fuel price, exchange rate and interest rate may have a long term impact on sales from the motor trade industry.

Table 3. Cointegration Results

Test Statistic	Value	Number of regressors
Computed F-statistic	5.803	3
Critical Value Bounds		
Significance	Lower bound value	Upper bound value
5%	3.38	4.23

In establishing the responsiveness of the motor trade sales towards shocks in interest rate, exchange rate and fuel price, the ARDL (3, 0, 0, 1) was estimated. The result in Table 4 exhibits the long-run coefficient of the model. As can be seen from the Table, motor trade sales respond negatively to positive changes in both interest rate and exchange rate. A 1 percent increase in both interest rates and exchange rates leads to approximately 0.794 percent and 0.495 percent decline in total motor trade sales respectively. Contrary to our expectation, a positive linear relationship exists between fuel price and motor trade sales. Subsequently, a 1 percent increase in fuel price results in a 0.176 increase in motor trade sales. Although this result might be surprising at it would be expected that the fuel price increase may read to a decline in the number of cars sold. Different reasons can justify these findings. For instance, it is hard for a person who is planning to buy a car to consider the fuel price. Additionally, even if customers might consider the fuel price and shift from heavy car cars that require high fuel consumption to light cars that are friendly in terms of fuel consumption. Consequently, the hike in fuel price might not reduce the number of cars sold. Looking at the overall effect of independent variables on dependent variables, it can be concluded that interest rate has a large impact on motor trade-sale compared to the influence of exchange rate and fuel price. Besides, both interest rate and exchange rate possess a negative impact on the number of vehicles sold; whereas the fuel price positively impacts the motor trade industry. A small and positive effect of fuel price may suggest that the motor trade industry responds more to the volatility of other economic indicators than the fuel price. The study's overall results are in line with the findings of Chisasa and Dlamini (2013), Copeland et al. (2019), Leard et al. (2017) and ILO (2018).

Table 4. Estimated Long-Run Coefficients: ARDL (3, 0, 0, 1)

Regressors	**Coefficient**	**Standard error**	**T-statistic**	**P-value**
LNINTER	-0.793969	0.380810	-2.084949	0.0391
LNEXCH	-0.494844	0.230096	-2.150599	0.0334
LNPETRP	0.176426	0.193414	0.912165	0.3634
C	1.737372	0.327338	5.307583	0.0000
@TREND	0.006805	0.002125	3.201768	0.0017

The presence of a long-run relationship allows the estimation of the error correction model (ECM) and short-run relationship. Table 5 depicts the outcome from the estimation of both ECM and short-run relationships. Contrary to long-run results, both interest rate and exchange rate are not statistically significant to impact the motor trade sales. Only the lagged effects can influence negatively the motor trade sales. On the other side, the fuel price remains with its positive effect on motor trade sales. The error correction term met its required features as it is negative and significant with a coefficient of -0.127 and p-value of 0.000. This implied a moderate speed of adjustment towards the long-run equilibrium.

Table 5. Error Correction and Short Run Dynamic Representation

Regressor	Coefficient	Standard error	T-statistic	P-value
D(LNMOTOS(-1))	-0.476461	0.072943	-6.531927*	0.0000
D(LNMOTOS(-2))	-0.220420	0.073790	-2.987124*	0.0034
D(LNINTER)	0.067100	0.098860	0.678740	0.4986
D(LNEXCH)	0.014551	0.048772	0.298349	0.7659
D(LNPETRP)	0.227417	0.041969	5.418668*	0.0000
ECM (-1)	-0.127049	0.023993	-5.295263*	0.0000

*Note: * significant of t-statistic at 5% level*

Residual Diagnostic

The validity of the model is supported by the diagnostic result represented in Table 6. The Lagrange multiplier test was used to assess serial correction and ARCH test assisted to test whether the model is homoscedastic or heteroscedastic. Both Lagrange multiplier ARCH tests attested to the absence of autocorrelation and the presence of homoscedasticity respectively. Using the Jarque-Bera test for normality, the obtained p-value (0.000) indicated that the residuals are not normally distributed. According to Frain (2007), in most cases when a large sample size is employed, it is more likely to encounter the abnormality of residual distribution for sample size is not inherent to normal distribution.

Table 6. Residual Diagnostic

Diagnostic test result	
Serial correlation: F-Stats (p-value)	1.196 (0.3059)
Normality: Jarque-Bera (p-value)	32.107 (0.000)
Heteroscedasticity: F-Stats (p-value)	3.508 (0.0625)
Durbin-Watson stat	2.051

5. Conclusion and Recommendations

The study aimed to assess the short-run and long-run effects of exchange rate, interest rate and fuel price variations on South African motor trade sales. In establishing these relationships among variables, the study adopted the ARDL cointegration approach. The regression results indicated an increase in the interest rate and currency devaluation reduces the number of cars to be sold. In other words, both the interest rate and exchange rate have an inverse relationship with motor trade sales. However, the fuel price appears to have an insignificant effect on motor trade sales. This implies that if the South African currency is strong and the cost of borrowing is low, people will buy cars regardless of the fuel price. In the short run, both exchange rate and exchange rate are not statistically significant to influence sales within the motor trade. However, the fuel price is statistically significant to impact motor trade sales. Additionally, the short term result suggested that both interest rate and exchange rate cannot influence the motor Trade-Sales in the short term. Unexpectedly, an increase in fuel price is statistically significant to generate more sales from the motor trade-sale.

Based on these findings, it is imperative that measure that strengthens and stabilise the South African currency should be considered as an emergency to firstly enhance economic growth and then increase the motor trade sales. Furthermore, reduction of interest rates and easing access to loans can also assist in snowballing sales in the motor trade industry.

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