Dynamic Response of the Effects of Automotive Oil and Gas on the Manufacturing Sector Performance in Asian and African Countries

HUSSAINI ABDULLAHI[1] AND UMAR MUHAMMAD GUMMI[2]

[1]Department of Economics, Usmanu Danfodio University, Sokoto, Sokoto State, Nigeria.
E-mail: Hussainiabdullahi9@gmail.com
[2]Department of Economics, Sokoto State University, Sokoto, PMB 2134 Sokoto, Nigeria.
E-mail: muhammadgummiu@gmail.com

Abstract: This study examines the impact of automotive oil and gas prices on the performance of the manufacturing sector in major industrial countries of Asia and Africa, using a panel dataset from 1980 to 2020. The findings show that manufacturing performance in Asian and African countries responded positively to changes in automotive oil and gas prices. Specifically, an increase in automotive oil and gas prices was linked to improved manufacturing sector performance in these regions. However, the study also found no significant relationship between automotive oil and gas prices and manufacturing performance in Asian countries. This lack of effect could be attributed to the adoption of advanced energy technologies and alternative energy sources, which have made Asian countries more resilient to fluctuations in automotive oil and gas prices. On the other hand, the results for African countries indicated that their manufacturing sectors are negatively affected by changes in automotive oil and gas prices. This suggests that the manufacturing sector in Africa is vulnerable to price shocks due to its heavy dependence on automotive oil and gas, with limited access to energy alternatives. The study recommends that African nations explore renewable energy options to reduce their reliance on automotive oil and gas, ensuring the more stable operation of their manufacturing industries.

Keywords: Automotive oil and gas, fixed effects, Random effects, Manufacturing Performance

ORCID: https://orcid.org/0009-0003-3408-7239

1.   Introduction

Automotive oil and gas have become a crucial indicator of global economic activity due to its vital role in meeting international energy demands. Its significance goes beyond economics, influencing various aspects of social life. Automotive oil and gas are essential raw materials for industrial production (Chen et al., 2020), and many manufacturing sectors in Africa and Asia depend heavily on them to power their production facilities, catering to both local and international markets. This reliance on automotive oil and gas as a key input means that a large portion of a firm's earnings, which could have been invested elsewhere, is instead directed towards addressing energy shortages.

The widespread use of automotive oil and gas makes various sectors vulnerable to unexpected price increases (Nwosa & Ajibola, 2013; Loungani, 1986). Price fluctuations in automotive oil and gas impact manufacturing performance through multiple channels. On the supply side, any disruption in their prices increases production costs, leading to a decline in output. On the demand side, higher oil prices raise the cost of manufacturing products, reducing consumers' purchasing power and negatively affecting the spending and savings decisions of both firms and households (Jiranyakul, 2006; Suhair, 2016; Chen, 2020).

Numerous studies have documented the economic impact of automotive oil and gas price fluctuations, particularly in oil-importing developed economies, where price increases tend to negatively affect macroeconomic indicators, especially manufacturing performance. Higher automotive oil and gas prices reduce manufacturing output and, through increased production costs, hamper economic growth (Jiménez-Rodríguez & Sanchez, 2012; Wang & Zhang, 2014). Bjornland (2009) found that while automotive oil and gas price increases can negatively affect manufacturing performance by raising costs and reducing revenue, they can also positively impact a country's economy by boosting income and revenue. From a theoretical perspective, a rise in their prices is expected to hurt manufacturing output, while a decrease in oil prices should encourage growth in the sector.

The impact of automotive oil and gas on manufacturing performance may differ across economies due to varying characteristics. Lee et al. (1995) argued that oil price changes can have more significant effects on real output in the manufacturing sector, with volatility in prices also affecting output growth (Jiranyakul, 2016). Given this context, the study aims to examine the effects of automotive oil and gas price

fluctuations on manufacturing performance in industrialised Asian and African countries.

2.   Review of Literature

2.1. Theoretical Literature

There is a body of literature and theoretical frameworks exploring the impact of automotive oil and gas prices on manufacturing performance in developing and emerging economies. Oil prices influence manufacturing performance through various channels. An increase in oil prices raises production costs, which in turn leads to a reduction in productivity and a decrease in investment, as seen from the supply side (Brown & Yucel, 2002). On the demand side, higher production costs, resulting from rising oil prices, lead to higher product prices, which ultimately reduce overall productivity (Hunt et al., 2001).

The theoretical framework surrounding the effects of automotive oil and gas on manufacturing performance in five African and five Asian countries suggests that lower oil prices could drive manufacturing performance. Lower prices may also be a response to external shocks that affect global manufacturing. In the first case, the lower price might be driven by factors unrelated to the general economic trend, such as technological advancements in oil processing that increase supply. In the second case, lower oil prices could result from unexpected changes in the global economy, such as a downturn in the economies of major countries, which leads to a reduction in demand for oil, impacting several other nations. Studies have shown that both supply and demand factors have contributed to significant drops in oil prices, with a larger share of the decrease driven by supply-side factors (Husain et al., 2015). Slower demand, particularly from Europe and Asia, has been a major factor, while increased supply from non-OPEC countries and higher production from Iraq, Libya, and Saudi Arabia have contributed to the price decline.

2.2. Empirical Literature

There is a substantial body of empirical literature examining the effects of automotive oil and gas prices on manufacturing performance. For instance, Suhair and Al-Risheq (2016) studied the impact of oil prices on manufacturing sectors using an annual panel dataset from 1970 to 2002, applying fixed effects techniques.

Their findings revealed a negative and statistically significant effect of oil prices on industrial production, concluding that oil price shocks have a considerable negative impact on industrial production in developing countries. The study suggested that improving oil reserves in developing nations could help mitigate the impact of oil price shocks. Similarly, Wang and Zhang (2014) investigated the effects of global oil price fluctuations on China's manufacturing sector, using a monthly dataset from 2001 to 2011. Using the Autoregressive Distributed Lag (ARDL) model and Generalised Conditional Heteroskedasticity (GARCH), they found a negative and significant relationship between oil prices and manufacturing performance in China.

In Nigeria, Ojapinwa and Ejumedia (2012) studied the impact of oil prices on the industrial sector from 1970 to 2010, using the VAR impulse response method. Their results indicated a negative and significant relationship between oil prices and the industrial sector in Nigeria. Similarly, Aye et al. (2014) examined the effects of oil price shocks on manufacturing production in South Africa from 1974 to 2012, employing VAR, GARCH-in-Mean VAR, and maximum likelihood tests. Their findings confirmed that oil price increases negatively affected South African manufacturing. Mehrara and Sarem (2009) explored the influence of oil price shocks on the industrial sectors of three oil-exporting countries, Iran, Saudi Arabia, and Indonesia, using annual data from 1970 to 2005. Their study employed co-integration and Granger causality tests, and the results revealed a negative and statistically significant relationship between oil prices and industrial production in Iran and Saudi Arabia.

Papapetrou (2009) analysed the asymmetric effects of oil price changes on industrial production in Greece, using annual data from 1982 to 2008. The study applied Regime Switching and Threshold models to assess both the relationship and asymmetries between oil prices and industrial production. The findings showed a negative and significant association between oil prices and industrial production. Reyes and Quiros (2005) examined the impact of oil prices on industrial production and stock returns in Granada from 1963 to 2004, using a Markov Switching model and maximum likelihood tests. Their results also indicated a negative and significant effect of oil prices on both industrial production and stock returns. Lee and Ni (2002) analysed oil price shocks on demand and supply in different US industries from 1959 to 1997, using a vector autoregressive (VAR) model. They found a significant

negative effect of oil prices on industrial output, particularly reducing supply in oil-intensive industries and demand in others, especially the automobile sector.

In contrast, Gummi et al. (2018) studied the effect of oil price fluctuations on manufacturing performance in Nigeria using annual data from 2009 to 2017. Using the ARDL model, their results showed a positive and significant relationship between oil prices and manufacturing performance. Jiranyakul (2006) examined the impact of international oil prices on industrial production in Thailand, using annual data from 1990 to 2004 and Johansen co-integration techniques. The study found a positive and significant relationship between oil prices and industrial production in Thailand. Kumar (2009) investigated the asymmetric effects of oil price shocks on industrial production in India using quarterly data from 1975 to 2014 and VAR and Granger causality tests. The results revealed significant asymmetric impacts of oil price shocks on industrial growth. Taghizadeh-Hesary and Yoshino (2015) explored the macroeconomic effects of oil price fluctuations on emerging and developed economies, specifically China, Japan, and the USA, using a panel dataset from 2000 to 2013. Their results indicated a positive and statistically significant relationship between oil prices and economic activity in all three countries during the first period (2000-2013). However, in the second period (2008-2013), no relationship was found for China, while Japan and the USA showed a negative and significant relationship.

Berument, Ceylan, and Dogan (2010) investigated the impact of oil price shocks on economic growth in several Middle Eastern and North African countries, including Libya, Algeria, Egypt, Djibouti, Morocco, and Tunisia, using an annual panel dataset from 1952 to 2005. Their results showed a positive and significant relationship between oil price shocks and manufacturing output in Algeria and Libya, while Egypt, Djibouti, Morocco, and Tunisia showed negative associations. Nwonso and Ajibola (2013) studied the effect of gasoline prices on economic sectors in Nigeria from 1980 to 2010. Using co-integration and error correction models, they found that gasoline prices had significant positive effects on most sectors, except for construction. They recommended a stable electricity supply to reduce reliance on gasoline for energy. Jiranyakul (2016) examined the influence of oil prices on industrial production in Thailand for the period 1993-2015. Using multivariate tests and Johansen co-integration, the study found a stable long-run relationship between industrial production and real oil prices.

Scholtens and Yurtsever (2012) investigated the impact of oil price shocks on European industries using an annual panel dataset from 1983 to 2007. The study found that the effects of oil price shocks varied across industries, with some asymmetries in the response, though most were not statistically significant. Yoshino and Taghizadeh-Hesary (2014) analysed the economic impact of oil price volatility in developing and emerging countries, including Japan, the USA, and China, using a panel dataset from 1973 to 2013. Their results revealed no relationship between oil prices and economic growth in China, while Japan and the USA showed positive and significant relationships. Lastly, Chen, Gummi, Lu, and Mu'azu (2020) studied the impact of oil price fluctuations on food prices in high- and low-income oil-exporting countries using quarterly panel data from 2013 to 2019. They found a positive and statistically significant relationship between oil prices and food prices in low-income exporting countries, while high-income exporting countries showed a negative relationship.

3.   Data and Methodology

3.1. Data

This study examines the effect of automotive oil and gas on manufacturing performance in Asian and African Countries of China, Japan, Indian, Malaysia, South Korea, Nigeria, Egypt, South Africa, Algeria and Mauritius over the period 1980 to 2020. The data used for this study is secondary data; the dataset was sourced from the statistical bulletin of the Central Bank of Nigeria and the World Bank Indicator (WBI). The study employs a panel dataset for the estimation of the parameters. The data collected covers 40 years.

3.2. Theoretical Framework

This study relies on the growth theory to examine the effects of automotive oil and gas on manufacturing output growth. Following Solow (1975), it is assumed that output (Y) depends positively on both capital (K) and Labour (L). Thus, the production function is stated as:

$$Y = f(K, L) \qquad (1)$$

Where: Y = Aggregate Real Output, K = Stock of Capital, L = Stock of Labour. This study aims to examine the effects of automotive oil and gas on manufacturing

output growth in Asian and African countries. Therefore, the study augments the above traditional neo-classical production function with automotive oil, gas, exchange rate, inflation rate, and interest rate. Therefore, equation (1) can be restated as:

$$MPA = f(AOG, EXR, INFR, INR) \qquad (2)$$

3.3. Model Specification

This study adapts an econometric model with modifications, which is in line with the work of Al Risheq (2016) and Korkmaz (2016).

$$MPA = f(AOG, EXR, INFR, INR) \qquad (3)$$

Where: "*MPA*" represent the Manufacturing performance, "*AOG*" denote Automotive oil and gas, "*EXR*" is the Exchange rate, "*INFR*" represents Inflation Rate and "*INR*" is Interest Rate. Thus, the equation above can be restated into an econometric model as follows:

$$MPA_{it} = \beta_0 + \beta_1 AGO_{it} + \beta_2 EXR_{it} + \beta_3 INFR_{it} + \beta_4 INR_{it} + \delta_t \qquad (4)$$

Where: β_0 Is the Constant term, β_{1-4} represent Parameters to be estimated, δ_t connotes the Error term or Disturbance term.

3.4. Methods of Data Analysis

The analysis for this study employs both descriptive and inferential statistical techniques to assess the effects of automotive oil and gas prices on manufacturing performance in Asian and African economies. Descriptive statistics provide a way to summarise large datasets clearly and understandably, presenting both numerical and graphical representations. These techniques simplify complex data by reducing it into more digestible summaries (Jaggi, 2012). Descriptive statistics in this study include measures such as mean, median, standard deviation, minimum, maximum, skewness, and kurtosis, along with graphical tools like bar charts and pie charts (Salvatore & Reagle, 2002; Garba, 2021).

Inferential statistics, on the other hand, involve hypothesis testing and concluding based on the statistical significance of the model's estimated parameters (Salvatore & Reagle, 2002; Garba, 2021). For this study, the inferential techniques include a Multicollinearity test, fixed effects, and random effects. Multicollinearity is a concern in the classical linear regression model, as it occurs when there is a

perfect or nearly perfect linear relationship between some or all of the explanatory variables. This can complicate the estimation of the model's parameters, making it difficult to isolate the individual effects of the independent variables on the dependent variable (Gujarati, 1995). To detect multicollinearity, correlation analysis is used to examine the relationships between the variables. If correlation values are close to ±1, it indicates a perfect linear relationship, while values near 0 suggest no significant relationship. Significance levels are considered between 0.01 and 0.05, with values above 0.05 indicating an insignificant relationship (Zakari, 2017).

According to Gujarati (2007), when the number of time series data exceeds the number of cross-sectional units, a fixed effects model is more appropriate, which is typically the case with long panel datasets. Unlike ordinary least squares, the fixed effects model accounts for heterogeneity across both groups and time, resulting in more efficient estimates (Torres, 2010). This model is useful for analysing the relationship between predictor and outcome variables within a specific entity (e.g., a country, person, or company). Fixed effects models control for time-invariant differences between entities, ensuring that the estimated coefficients are not biased due to omitted characteristics that remain constant over time (Oscar, 2007).

The fixed effects model assumes that certain unobservable factors within the entity could influence the outcome variables, so it controls for these factors. If the error terms are correlated with the outcome variables, the fixed effects model may not be appropriate, and a random effects model may be more suitable. This is why the Hausman test is often used to determine the best approach (Oscar, 2007). The fixed effects model can be specified as follows:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \mu_{it} \tag{5}$$

Where: Y_{it} represents the dependent variable, β_1 is the coefficient of the parameters, X_{it} is the independent variables, i represents the entity, t is the time, α_i is the unknown intercept for each entity and μ_{it} represent the error term.

In contrast to the fixed effects model, the random effects model assumes that the variation across entities is random and uncorrelated with the predictor or independent variables in the model. The random effects model is appropriate when a researcher believes that differences across entities may influence the dependent variable. One key advantage of the random effects model over the fixed effects model is that it allows for the inclusion of time-invariant variables, such as gender, which the fixed effects model absorbs into the intercept.

The Random Effects Model (REM) assumes that the error term for each entity is not correlated with the predictor variables, which makes it possible for time-invariant variables to serve as explanatory variables. In this model, researchers must specify individual characteristics that may or may not affect the predictor variables. However, if some of these variables are unavailable, it can lead to omitted variable bias. One benefit of the REM is that it allows for generalisation of the findings beyond the specific sample used in the study (Oscar, 2007). The Random Effects Model can be specified as follows:

$$Y_{it} = \beta X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \tag{6}$$

Where: Y_{it} represents the dependent variable, β_1 is the coefficient of the parameters, X_{it} is the independent variables, i represents the entity, t is the time, α_i is the unknown intercept for each entity and μ_{it} represent the error term.

This study applied the Hausman (1978) test to determine if there was a significant difference between the Fixed Effects Model (FEM) and the Random Effects Model. The null hypothesis of the test posited that individual effects are not correlated with any of the model's regressors. If this hypothesis is rejected, it suggests that there are systematic differences in the coefficients, making the Fixed Effects Model more appropriate. In other words, if the null hypothesis is not rejected, it indicates that there is no significant difference between the two models, and the Fixed Effects estimator, being more efficient, will be used. On the other hand, if the null hypothesis is rejected, it implies a significant difference between the Fixed Effects and Random Effects models, in which case the average estimator will be employed (Abdulrashid, 2013; Oscar, 2007).

$$H_0 = E(X, \mu) = 0 \tag{7}$$

$$H_1 = E(X, \mu) = 0$$

4. Results and Discussion

This section presents an analysis and discussion of the results of the effects of automotive oil and gas on manufacturing performance.

4.1. Descriptive Statistics

This section presents the descriptive statistics test in the major Asian and African countries to see the nature of the trends among the parameters.

Table 1.1: Descriptive Statistics Test for the five Asian countries

Variable	Obser.	Mean	Medi.	Std. dev.	Min. Val.	Mx. Val.	Skew.	Kurt.
MPA	205	3.0376	1.0896	4.0608	0.0000	11.5974	1.4198	3.1399
AGO	205	0.2237	0.0086	0.7810	-0.7959	2.2563	1.3873	3.6012
EXR	205	423.87	101.11	474.66	2.1769	1403.18	0.5997	1.6430
INFR	205	1.8385	1.9199	0.2491	0.9884	2.2563	-1.1948	4.0047
INR	205	7.8405	7.1267	4.2401	0.9940	18.9167	0.4306	2.4646

Source: Author's Computation, EViews 12

Table 1.1 shows the descriptive statistics of the panel dataset covering five (5) Asian countries with two hundred and five (205) observations for forty years (40). The main statistics are mean, standard deviation, maximum and minimum values of the variables over the selected number of years. Major attention is given to manufacturing performance (MPA) and automotive oil and gas (AOG) as the main variables of interest.

The average mean value of the manufacturing performance is 3.0376. The value revealed that the mean value of manufacturing performance lies at the middle level of the distribution. The highest value of manufacturing performance is 11%, and the lowest value of manufacturing performance is 0%. This implies that the mean value drifts toward the higher level as suggested earlier. On average, therefore, the performance of the manufacturing sector among the five Asian countries is high. On comparison, the mean average value of 0.2237 of automotive oil and gas (AOG) falls at the lower end of the distribution, which implies that automotive oil and gas is relatively lower than manufacturing performance.

The standard deviation of manufacturing performance is 4.0608, whereas that of automotive oil and gas is 0.7810. This is an indication that manufacturing performance is more dispersed than automotive oil and gas. This implies that a one standard deviation shock in automotive gas oil has a positive or negative effect

Table 1.2: Descriptive Statistics Test for the Five African countries

Variable	Obser.	Mean	Medi.	Std. dev.	Min. Val.	Mx. Val.	Skew.	Kurt.
MPA	203	0.4460	0.3210	0.6183	-1.2801	2.0506	0.7258	3.3863
AGO	203	-0.3958	-0.3468	0.4076	-1.6990	0.1399	-0.8936	3.7576
EXR	205	40.2715	13.3238	62.9905	0.6100	379.000	2.7481	11.7905
INFR	205	11.1070	8.4758	10.3946	-0.6920	72.8355	2.8968	13.8260
INR	205	14.8779	15.0833	4.6683	8.0000	31.6500	0.1687	2.4931

Source: Author's Computation, EViews 12

on manufacturing performance. This could be a result of high manufacturing performance among the countries.

Table 1.2 shows the descriptive statistics of the panel dataset covering five (5) African countries with two hundred and five (205) observations for forty years (40). The main statistics are mean, standard deviation, maximum and minimum values of the variables over the selected number of years. Attention is given to manufacturing performance (MPA) and automotive oil and gas (AOG) as the main variables of interest.

The average mean value of the manufacturing performance (MPA) is 0.4460 with a standard deviation of 0.6183, showing a high variation. This implies that a one standard deviation shock in automotive gas and oil has a positive or negative effect on manufacturing performance. The average mean value of 0.4460 for manufacturing performance implies that the mean value lies at the lower end of the distribution. The highest value of manufacturing performance is 2%, and the lowest value of manufacturing performance is -1%. This implies that the mean value drifts toward the lower end, as suggested earlier. The value of the skewness is 1.4198, indicating that the manufacturing performance is skewed to the right. On the other hand, the average mean value of the automotive oil and gas (AOG) is -0.3958. The value confirms that the mean is at the lower end of the distribution. Relatively, the mean value of -0.3958 of automotive oil and gas falls at the lower end of the distributions, which is a signal that automotive oil and gas is somewhat lower when compared to the mean value of manufacturing performance.

4.2. Multicollinearity Test

To avoid the problem associated with Multicollinearity among the regressors, a correlation test was carried out to investigate the degree of association among the independent variables.

Table 1.3: Correlation Test for the five Asian countries

Variables	LMG	LAGO	EXR	INFR	INR
MPA	1	0.3219	0.2329	-0.0845	-0.3405
AGO	0.3219	1	0.3219	0.3219	0.3219
EXR	0.2329	0.2329	1	-0.2329	0.2329
INFR	-0.0845	0.0845	-0.0845	1	-0.0845
INR	-0.3405	-0.3405	-0.3405	-0.3405	1

Source: Author's Computation, EViews 12

Table 1.3 proves the correlation and covariance nature of the variable employed in the model. The variables exist in diverse forms of connection with one another. The result revealed that there is no excessive correlation among the parameters. The correlation between automotive oil and gas (AGO) and manufacturing performance (MPA) is 0.3219. This shows that there is no inverse relationship between automotive oil, gas and manufacturing performance. And more importantly, the value of the coefficient is very low, as the coefficient value indicates a weak correlation between automotive oil and gas and manufacturing performance.

The coefficient values of other variables such as exchange rate, inflation rate and interest rate are 0.2329, -0.0845, and 0.3405, respectively. The result shows that there is a positive and very weak correlation between exchange rate, interest rate and manufacturing performance. Other results also revealed a negative and very low correlation between the inflation rate and manufacturing performance. The empirical result from the Pearson correlation revealed that there is no presence of Multicollinearity among the estimated parameters. This is because the Multivariate coefficient values of automotive oil and gas, exchange rate, inflation rate and interest rate are less than 0.7.

Table 1.4: Correlation Test for the five African countries

Variables	LMG	LAGO	EXR	INFR	INR
MPA	1	-0.1264	-0.1202	-0.0057	0.4367
AGO	-0.1264	1	-0.1264	-0.1264	-0.1264
EXR	-0.1202	-0.1202	1	-0.1202	-0.1202
INFR	-0.0057	-0.0057	-0.0057	1	0.4367
INR	0.4367	0.4367	0.4367	0.4367	1

Source: Author's Computation, EViews 12

Table 1.4 shows that there is no excessive correlation between automotive oil and gas (AGO), exchange rate (EXR), inflation rate (INFR), interest rate (INR) and manufacturing performance (MPA). This is because the coefficient of exchange rate (EXR), inflation rate (INFR), and interest rate (INR) of -0.12, -0.12 and -0.005 and 0.43, respectively, show a low correlation coefficient. There is a positive and direct correlation between interest rate (INR) and manufacturing performance (MPA). There exists a negative correlation between automotive oil and gas, exchange rate, inflation rate and manufacturing performance. The empirical result from the Pearson

correlation revealed that there is no presence of Multicollinearity among the estimated parameters. This is because the Multivariate coefficient values of automotive oil and gas, exchange rate, inflation rate and interest rate are less than 0.7.

4.3. *Fixed Effects Model and Random Effects*

This section presents the results of the fixed effect and random effect for the estimation of the effect of automotive oil and gas on manufacturing performance in Asian and African countries. This section is divided into three, viz: Fixed effect results for all the countries, the result for the Asian countries and the result for the African countries.

Table 1.5: Fixed Effect and Random Effect Model for all countries

Variables	Fixed Effect				Random Effect			
	Coef.	*Std. Er.*	*T-Stat.*	*P-Value*	*Coef.*	*Std. Er.*	*T-Stat.*	*P-Value*
AGO	0.3731	0.0987	3.7710	0.0002	0.4494	0.0976	4.6018	0.0000
EXR	-0.0011	0.0002	-4.5687	0.0000	-0.0011	0.0002	-4.8362	0.0000
INFR	-0.0006	0.0025	-0.2512	0.8018	-0.0003	0.0025	-0.1008	0.9197
INR	0.0387	0.1008	5.9197	0.0000	0.0395	0.0065	1.0550	0.0000
R^2: 0.98, Adj. R^2: 0.98, F-Sta.: 4476.54, Prob. F: 0.0000				R^2: 0.99, Adj. R^2: 0.99, F-stat: 4476.54, Prob. F-statistics:0.0000				
Hausman test	Chi-square St.		0.0000					

Dependent Variable: LMPA (spanning top of table)

Source: Author's Computation, EViews 12

Table 1.5 presents the results of the fixed effect and random effect estimation for all the countries. The result from the Hausman test revealed that the fixed effects model is more appropriate. This is because the probability value of the Hausman test is statistically significant at the 1% level of significance. This led to the rejection of the result of the random effect estimation and the acceptance of the result of the fixed effect estimation. The fixed effect estimation revealed that there is a positive and statistically significant association connecting automotive oil, gas and manufacturing performance for all the countries under investigation. A 1% increase in automotive oil and gas will result in about a 0.37% increase in manufacturing performance for all the countries under investigation. This result indicated that increases or raises in the automotive oil and gas raise the manufacturing performance for all five African and five Asian countries. This is in conformity with the work of Ceylan and Dogan (2010).

Table 1.6: Fixed Effects Model and Random Effects for the Asian Countries

Variables	Fixed Effect				Random Effect			
	Coef.	Std. Er.	T-Stat.	P-Value	Coef.	Std. Er.	T-Stat.	P-Value
LAGO	0.1319	0.1070	1.2322	0.2194	4.2393	0.0918	46.1706	0.0000
EXR	-0.0012	0.0002	-5.6983	0.0000	4.2393	5.9600	-34.769	0.0000
INFR	-0.0025	0.0026	-0.9573	0.3396	0.0440	0.0025	17.4716	0.0000
INR	-0.0142	0.0115	-1.2412	0.2194	0.6672	0.0071	93.3779	0.0000
R^2: 0.99, Adj. R^2: 0.99, F-stat: 4476.54, Prob. F-statistics: 0.0000					R^2: 0.53, Adj. R^2: 0.52, F-stat:55.9317, Prob. F-statistics:0.0000			
Hausman Test	Chi-square St.		0.0000					

Source: Author's Computation, EViews 12

Table 1.6 revealed the result of the fixed-effect and random-effect estimation for the Asian countries. The result from the Hausman test revealed that the fixed effects model is more appropriate. This is because the probability value of the Hausman test is statistically significant at a 1% level of significance. Hence, this led to the rejection of the result of the random effect estimation and acceptance of the fixed effect result. The fixed effect estimation revealed that there is no association linking automotive oil, gas and manufacturing performance in Asian countries. This entails that an increase in the price of automotive oil and gas has no effect on the manufacturing sector performance in the major Asian countries. This may be a result of another energy substitute, such as renewable energy and a stable supply of electricity. This is in agreement with the work of Taghizadeh-Hesary and Yoshino (2015).

Table 1.7: Fixed Effects and Random Effects Model for the Five African Countries

Variables	Fixed Effect				Random Effect			
	Coef.	Std. Er.	T-Stat.	P-Value	Coef.	Std. Er.	T-Stat.	P-Value
LAGO	-0.5099	0.1968	-2.5913	0.0103	-0.2074	0.0960	-2.1590	0.0321
EXR	-0.0043	0.0010	-4.2880	0.0000	-0.0011	0.0006	-1.9842	0.0486
INFR	-0.0027	0.0042	-0.6533	0.5143	-0.0082	0.0041	-1.9998	0.0459
INR	0.0503	0.0086	5.8218	0.0000	0.0374	0.0085	4.4457	0.0000
R^2: 0.39, Adj. R^2: 0.36, F-Sta.: 15.04, Prob. F-stat.: 0.0000					R^2: 0.09, Adj. R^2: 0.07, F-stat.: 4.84, Prob. F-statistics: 0.0001			
Hausman test	Chi-square St.		0.0000					

Source: Author's Computation, EViews 12

Table 1.7 shows the result of the fixed effect and random effect estimation for the five African countries under investigation. The result of the Hausman test revealed that the fixed effects model is more desirable. This is because the probability value of the Hausman test is statistically significant at a 1% level of significance. For this reason, the result of the random effect estimation was rejected and which led to the acceptance of the fixed effect result.

The fixed effect estimation results revealed that there is a negative and statistically significant relationship between automotive oil and gas and manufacturing performance for the African countries. A 1% increase in the price of automotive oil and gas will lead to about 0.51% decrease in manufacturing performance in African countries, justifying the theoretical argument that an increase in the automotive oil and gas affects the performance of manufacturing performance. This implies that for the African countries, there is an inverse relationship between automotive oil and gas and manufacturing performance. It implies that an increase in the price of automotive oil and gas decreases the manufacturing performance. This is due to the fact that most of the manufacturing sector in African countries depends largely on automotive oil and gas to power their manufacturing plant due to irregular supply from the power holding company (electricity) and inadequate energy substitutes. This is in conformity with the work of Omolade and Ngalawa (2014), Nwonso and Ajibola (2013), Wang and Zhang (2014).

5.　Conclusion and Policy Recommendations

5.1. Conclusion

This study presents evidence on the impact of automotive oil and gas prices on manufacturing performance in major industrial countries in Asia and Africa. The results indicate a significant positive effect of automotive oil and gas on manufacturing performance in both regions. For Asian countries, however, the findings show no relationship between automotive oil and gas prices and manufacturing performance. This suggests that changes in automotive oil and gas prices do not influence the manufacturing sector, likely due to the increased use of alternative energy sources such as nuclear power, gas, and renewables.

In contrast, the results for African countries reveal a statistically significant negative relationship between automotive oil and gas prices and manufacturing

performance. This indicates an inverse correlation, with the performance of manufacturing sectors in the five African countries declining as automotive oil and gas prices rise. The magnitude of the coefficient underscores the substantial role that automotive oil and gas play in determining manufacturing performance in these countries.

The study concludes that automotive oil and gas have no significant impact on manufacturing sector performance in major Asian countries, likely due to the availability of energy substitutes. In African countries, however, the manufacturing sector is negatively affected by price shocks, as these nations heavily rely on automotive oil and gas to power their industries. The study recommends exploring alternative energy sources to reduce the impact of rising automotive oil and gas prices on manufacturing performance in African countries.

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