Network Intelligence Studies

Article

Panel estimating exports and imports of the automotive industry on economic growth: evidence of Austria, Hungary, and Romania

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Abstract: The emerging automotive sector in Europe is again a concern after the COVID-19 pandemic storm. The automotive industry is essential to increasing revenue for a country and influencing an open economy. Even so, there are several manufacturers whose supply and demand for raw materials, costs, and employees are critical to the business activities of this sector. The objective of this study is to analyze the effect of exports and imports in the automotive industry on economic growth. The technical analysis used in this study is multiple regression to see the effect of the independent variables, exports, and imports, has on GDP as the dependent variable using panel data for 2017-2021. The data used is secondary, with the research object being Austria, Hungary, and Romania, countries in emerging markets in the European automotive sector. Findings regarding of the multiple-regression model, f-test and t-test show that the Austrian, Hungarian, and Romanian automotive industries significantly influence overall GDP, even though there are demands in the era of energy sustainability which is a significant concern for the government in creating an energy-efficient automotive industry.

Keywords: Export; Import; GDP; Automotive sector;

JEL Classification: L91, M21, O14

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INTRODUCTION

One indicator that assesses the size of a country's industrial, the automotive industry, is related to productivity. The automotive industry is one of the dynamic sectors supporting a country's economic growth; apart from having a sizeable contribution to GDP, the manufacturing industry, especially the automotive sector, also contributes to exports, imports, and employment. The automotive industry is also one of the largest commodities traded between international countries, not only in the form of finished goods but also intermediate products, such as components or spare parts, that attract investors to make competitive decisions in this industry (Mukherjee & Sastry, 1996). In 2020 the emerging European automotive sector experienced its worst year due to the covid-19 pandemic, with production and sales levels falling to their lowest level based on EMIS Insight report 2022/2023. Even in uncertain monetary and fiscal conditions, this still provided a positive stimulus for the government, industry, and society to continue maximizing income from this sector. As a result, in 2021, based on OICA data, the production of the automotive industry in Europe can revive with a value of 8.1% y/y, nearly 4.7mn unit's base on STATISTA 2022 report. Economic growth, which is reflected in changes in economic activity in GDP, can increase if the value of net exports of a country is experiencing positive growth. The positive export value indicates that the goods or services produced by the estate are much in demand by other countries, so the value of exports is more significant than imports. The EU automotive sector is an essential part of the economy; according to this Industry, IPOL data generating turnover representing more than 7% of the EU GDP, which amounted to around EUR 936 billion in 2020. Strategically, the EU automotive sector contributes to the EU trade balance, generating a surplus of EUR 74 billion, and more than 5.6 million vehicles exported annually worldwide.

Figure 1 shows the emerging market for the automotive industry in Europe significantly controlling exports and imports with a significant value of 53% for exports with relatively stable fluctuations in export values of around 3 billion US in the 2018-2020 period for the import value economically it has a real value stable at 49%. From figure 1, the value of exports which is more significant than imports will undoubtedly increase people's economic activities. In neoclassical theory and theoretical competitive advantage, it is said that trade activity occurs because there is an advantage in the resources of the country, so the process of accumulation of output will increase economic growth (Bakari & Mabrouki, 2017). Export and import activities are critical in establishing relations between countries to increase the value of GDP compared to the total population in the country. Export is one of the advantages of cooperation with other countries to improve the country's foreign exchange (Batubara, 2013). Based on the importance of export and import of the automotive industry in Europe for economic development, through this research, we will analyze the relationship between economic indicators (export and import) to GDP. Then, this research investigates the determinants of export and import in three European countries, namely Austria, Hungary, and Romania, which have the potential for significant development of the automotive industry and are also supported by accurate data from independent sources. Figure 2 shows the automotive industry's position in Austria, Hungary, and Romania in an intermediate position compared to other European countries. From this data, the emerging industrial markets for these three countries will continue to grow and contribute to GDP growth.

Based on panel data collected from 2017-2021 from STATISTA and EMIS, data on the development of exports, imports, and GDP of Austria, Hungary, and Romania can be seen in table 1. Table 1 shows a positive relationship between exports and imports from the three countries used as research objects. However, there are significant differences in GDP in 2020 due to the Covid-19 pandemic. Of course, the impact of the Ukraine and Russia wars needs to be considered for the future automotive industry's future development in Europe.

LITERATURE REVIEW

Several studies address the importance of exports and imports to a country's economic development, particularly in the automotive industry. The findings from these studies indicate a positive effect of exports and imports on GDP statistically. Chakraborty et al. (2020) examine India's global product industry and standards; this study investigated whether domestic policy reforms regarding exports and imports in India are sufficient to conform to international GDP standards. The results of the study show that after there was an adjustment to the 1998 UNECE standard, India's relative trade with these countries has increased both in terms of automotive components and car products. Barnes et al. (2017) investigated the development of the automotive sector in South Africa and Thailand. The idea was motivated by

high levels of domestic demand, government support, and rapid international integration, but the Thai industry was growing much faster. The results of this study indicate that the Thai automotive industry has cost advantages and a sizeable enterprise-level market. Another study (Abedini & Péridy, 2009) examines Iran's export potential in the automotive industry with an empirical bilateral trade model approach on new theoretical developments of the gravitational equation, sectorial variables (car production, import tariffs), and other native variables, such as expectations and hysteresis. The research findings show Iran's current car exports are around 100 times less than their exact value. This suggests a significant export potential for Iran, especially for India, China, Russia, and its smaller neighbors (Turkey, Pakistan, and Central Asian countries). The description of the research above is also supported by the research (Smith & Sarabi, 2021), which analyzes the role of the UK in the automotive sector, with a focus on UK trade relations within and between regions. The findings of the research show a high level of integration in Europe & Central Asia; while in the East Asia & Pacific region there are opportunities to acquire resources with the Middle East & North Africa as export destinations. Most of these studies use the VAR analysis technique to show the correlation between exports and imports and the GDP value(Brown et al., 2021) . However, in contrast, studies conducted (Bakari & Mabrouki, 2017) using the Counteraction Test and Granger-Causality Test analysis. As a result, the VAR estimation shows that exports and imports have no effect on economic growth, and the causality test of exports and imports does not cause economic growth in Panama. Referring to (O'Rourke, 2003) as the basic concept of the H-O trade theory approach, where productivity differences occur because the production factors needed by each country in producing certain goods are not the same, so the price of the goods produced is different. Referring to some of these studies, *the hypothesis of this study is H-O: exports and imports are negatively associated with GDP in the automotive industry in Austria, Hungary, and Romania, H-1: exports and imports are positively associated with GDP in the automotive industry in Austria, Hungary, and Romania.*

RESEARCH METHODOLOGY

This research uses data type in the form of quantitative descriptive data using several time series data in the form of figures in the form of export (X1), import (X2), and gross domestic product (Y) variables from the three countries of Austria, Hungary, and Romania. The processed data is secondary and accessed via STATISTA and EMIS 2022. Multiple linear regression analysis is used as a technique in data analysis to determine the effect of two or more linear variables on the independent variables. Linear regression is a method used to express the relationship pattern between the response variable and the predictor variable. Multiple linear regression analysis is used if there is more than one predictor variable (Walpole et al., 2012). the multiple regression model used in this study is a modification of the neo-classical economic model adopted by (Zang & Baimbridge, 2012) with the following formula:

$$Yt = f\ (Lt, Kt, X, A, Xt\ N,)$$
$$YGDPt = Ln\beta o + Ln\beta_1 EX_1 t + Ln\beta_2 t\ IM_2 t$$

YGDPt = GDP Austria, Hungary, and Romania
$Ln\beta_1 EX_1 t$ = Export Austria, Hungary, and Romania
$Ln\beta_2 t\ IM_2 t$ = Import Austria, Hungary, and Romania
t = period 2017-2021

RESULT AND DISCUSSION

Data management is carried out in several stages, such as the classical assumption test, which consists of normality, multicollinearity, heteroscedasticity, and autocorrelation tests, then continued with multiple regression tests, *t*-tests, *f*-tests, and finally, the coefficient of determination test. This study uses statistical analysis in the normality test, namely the Kolgomorov-Smirnov test, as shown in table 2.
According to (*The Concise Encyclopedia of Statistics*, 2008) Kolmogorov–Smirnov test is a nonparametric fit test used to determine whether two distributions are different or whether the underlying probability distribution is different from the hypothesized distribution. It is used when we have two samples from two diverse populations. The results of the normality test it can be concluded that testing the comparative hypothesis of two independent samples with ordinal data forms arranged in a cumulative frequency distribution table with an interval system can be carried out in three countries, namely Austria, Hungary, and Romania because they have fulfilled the requirements where the value if p > 0, 05.
The next step is to perform a multicollinearity test to find out whether the regression model finds a correlation between the independent variables or the independent variables (Daoud, 2018).

It is reflected in the tolerance value, and the variance inflation factor (VIF) value find whether or not multicollinearity exists in the regression model based on table 3; the cut-off tolerance value used in the correlation between export and import variables from the three countries is 0.949 > 0.10 or the VIF value above number 10 is 1,054.Heteroscedasticity is defined as the variation of the phrase "variable error is not constant" after predictors are included in the regression model, where the variability changes as a function of something that is not in the model (Astivia & Zumbo, 2019). The basis for deciding that there is no heteroscedasticity in the data is by using the scatter plot shown in figure 3, where there is no clear pattern, and the dots are spread (Ramos, 2001). The last stage in the classical assumption test (see table 4) it is an autocorrelation test that aims to test the linear regression model; there is a correlation between confounding errors in period t and crushing mistakes in the previous t-1 period (Baltagi, 2011). One of the most popular formal tests to detect autocorrelation is the Durbin-Watson Test. From the results of the SPSS test in table 4, the DW value is 1,782 then compared to the Durbin Watson (DW) table where in this study, the number of independent variables is two (k = 2) and the sample (n = 15) then the value du = 1,543 is obtained. From the above results, it can be concluded that there is no autocorrelation because of the importance of DW > DU (1.782 > 1.543). To analyze the multiple regression models in this study, researchers used panel data for the 2017-2021 periods. Panel data is combined between time series data and cross-sectional data and can also be interpreted as integrated data where the behavior of cross-sectional units (e.g., companies, countries, and individuals) can be observed over time (Ghozali,2017). The results of multiple regression data processing using SPSS 27 can be seen in table 4.

Multiple linear regressions are a statistical method widely used to model the relationship between dependent and independent variables to create a model to predict the value of a variable. This research can be continued in modeling a multiple linear regression model (with the OLS approach) because it meets the classical assumption test requirements(Zang & Baimbridge, 2012). Based on table 5, the estimated model obtained is:

$$YGDPt = Ln\beta o + Ln\beta_1 EX_1 t + Ln\beta_2 t\ IM_2 t$$

Or

$$YGDPt = 589.364 + 18.594\ EX_1 t + -72.171\ IM_2 t + e$$

The regression coefficient for exports is 18,594 and for imports is -72,171 for the three countries in the time period (t) 2017-2021. The export regression coefficient is positive, meaning that the total automotive industry exports in Austria, Hungary, and Romania will also increase when GDP increases. Likewise, when GDP falls, exports also fall. An increase in GDP by 1 billion(euro) will increase the number of automotive exports in the three countries by 18,594 billion(euro) and vice versa. The positive Import regression coefficient has the same meaning as the Export regression coefficient. When the Automotive Import Value in Austria, Hungary, and Romania decreases, the GDP will increase. An increase in the GDP value of 1 billion (euro) impacts a decrease in the import value of -72 billion (euro) in the three countries. To test whether the parameters of both the regression coefficients and constants have estimated the equation or multiple linear regression models, the t-test is used. The point is that these parameters can explain the behavior of the independent variables in influencing the dependent variable. Based on table 5, the calculated t value (SPSS output is shown in column sig.) is smaller than the error rate (alpha) of 0.05, so it can be it is said that the independent variable (from the t count) has a positive associated with the dependent variable, whereas if the probability value, in other words, the hypothesis (H1) of this study, can be accepted that the Export and Import of the Automotive industry in Austria, Hungary, and Romania have a positive effect on GDP. The initial stage is to identify whether the regression model's estimation is feasible. A model reliability or feasibility test, more popularly known as the f- test, is carried out (Sureiman & Mangera, 2020). The results of the f-test can be seen in the ANOVA table (see table 6), showing a significant value smaller than the level error (alpha) of 0.05; it can be said that the estimated regression model is feasible.

The coefficient of determination explaining the variation in the effect of the independent variables on the dependent variable can be measured by the R-Square or Adjusted R-Square value. The R-Square value (see table 4), which is 0.885, shows that the proportion of the influence of the Export and Import variables of the automotive industry in Austria, Hungary, and Romania on the GDP variable is 88.5%. In comparison, the remaining 11.5% is influenced by other variables, not in linear regression models.

CONCLUSION AND RECOMMENDATION

The classic assumption test, namely the normality test, heteroscedasticity test, multicollinearity, and autocollinearity test, there are no symptoms at the classical assumption stage, so the research model is considered eligible. Based on the research results show the results of statistical tests Austrian, Hungarian and Romanian export and import variables shows a significant effect on each country's gross domestic product (GDP). The industry has recently had to shift its current production to zero-emission drives. This poses a significant challenge for the Emerging European automotive sector as this transition period is so short that it will require massive investment in employee reskilling and up skilling, development of new technologies, robotics, and automation. This is in line with the sustainability program in the automotive sector, which will be directed towards developing electric cars to save energy resources that are increasingly limited and prices are soaring. Researchers provide recommendations to continue to support growth in the automotive sector not only in Austria, Hungary, and Romania but also in the EU as a whole by maximizing existing technological resources and reducing the volume of imports so that GDP can increase.

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Table 1
Automotive Exports, imports, and GDP of Austria, Hungary, and Romania (In Bn Euro)

Year	Country	Export	Import	GDP
2017	Austria	18.46	7.89	417.11
2017	Hungary	17.7	9.98	143.14
2017	Romania	10.16	6.91	211.70
2018	Austria	20.48	7.47	455.37
2018	Hungary	17.35	10.48	160.59
2018	Romania	11.73	8.22	241.46
2019	Austria	21.7	8.05	445.06
2019	Hungary	19.41	10.74	163.52
2019	Romania	11.68	8.59	249.88
2020	Austria	18	6.17	432.91
2020	Hungary	17.16	9.59	156.74
2020	Romania	10.67	7.27	249.51
2021	Austria	20.1	6.61	477.08
2021	Hungary	18.49	10.57	182.28
2021	Romania	11.05	7.68	284.09

Sources: Statista, EMIS2022

Table 2
Kolgomorov-Smirnof Test

One-Sample Kolmogorov-Smirnov Test			
			Unstandardized Residual
N			15
Normal Parameters[a,b]	Mean		0.0000000
	Std. Deviation		42.34462400
Most Extreme Differences	Absolute		0.127
	Positive		0.127
	Negative		-0.117
Test Statistic			0.127
Asymp. Sig. (2-tailed)[c]			.200[d]
Monte Carlo Sig. (2-tailed)[e]	Sig.		0.729
	99% Confidence Interval	Lower Bound	0.717
		Upper Bound	0.740

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.
e. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 2000000.

Source: spss 27

Table 3
Multicolinearity Test

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1	X1_Export	0.949	1.054
	X2_Import	0.949	1.054
a. Dependent Variable: Y_GDP			

Source: spss 27

Table 4
Autocorrelation Test

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.376[a]	0.141	-0.002	21.94463
a. Predictors: (Constant), X2_Import, X1_Export				
b. Dependent Variable: ABRESID				

Source: spss 27

Table 5
Multiple-Regression Result

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	192889.889	2	96444.944	46.104	.000[b]
	Residual	25102.941	12	2091.912		
	Total	217992.829	14			
a. Dependent Variable: Y_GDP						
b. Predictors: (Constant), X2_Import, X1_Export						

Source: spss 27

Table 6
ANOVA

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	589.364	77.488		7.606	0.000
	X1_Export	18.594	3.123	0.599	5.954	0.000
	X2_Import	-72.171	8.310	-0.873	-8.685	0.000
a. Dependent Variable: Y_GDP						

Source: spss 27

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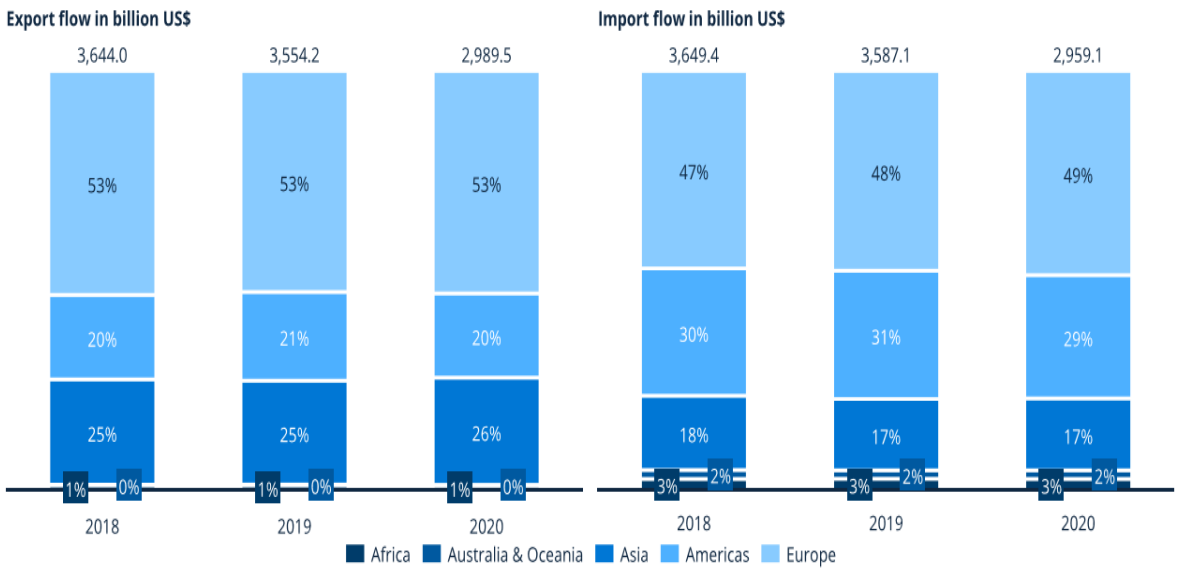

Figure 1
International Trade: Imports and Exports Automotive Industry in Europe
Sources: Sources: Statista 2022; WTO 2022

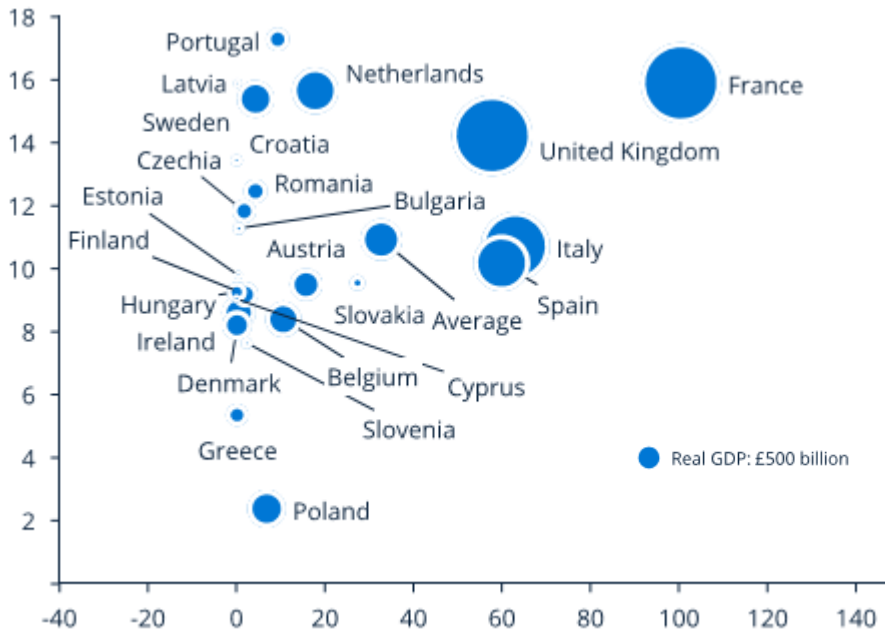

Figure 2
Automotive Industry Revenue to GDP in 2021
Sources: Statista 2022

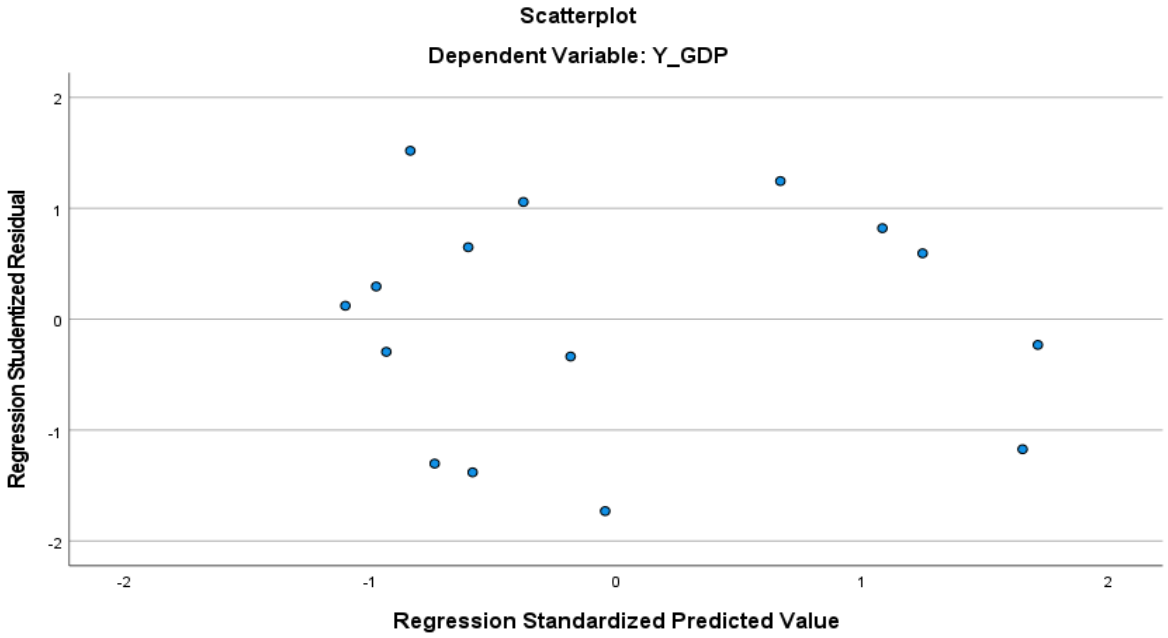

Figure 3
Heterocedascity Test
Source: spss 27