

THE EFFECTS OF BRENT SPOT OIL VARIATION ON MACROECONOMICS INDICATORS: CASE STUDY FOR FIVE EUROPEAN COUNTRIES

Bogdan Ion BOLDEA¹, ORCID ID: 0000-0002-9731-4625
Costin Radu BOLDEA², ORCID ID: 0000-0002-7688-563X

***Abstract:** This paper was purposed to analyses the correlation between Brent Spot Oil price per barrel and the following macroeconomic indicators: Gross Domestic Product, Balance of Payments, Balance of Trade and Net Exports, for the each of the following countries Romania, Germany, France, Italy, and Spain. We did a comparison between the countries indicators in order to examine how they are related and make a correlation of their evolution from 1971 to 2021. The Pearson's coefficient was used in order to identify whether the correlation is positive or negative, and if there is a connection between them or not. In addition, we ran a linear regression for each country independently to see what kind of relationship there is between current Brent Spot Oil price/barrel and the selected macroeconomic indicators.*

***Keywords:** Financial stability, GDP, Balance of Trade, Balance of Payments, Regression analysis*

JEL classification codes: Q41; G41

Introduction

Oil has become one of the most essential sources of energy for many years. Oil and gasoline products are consumed by all countries and both consumers and producers are interested in the price of oils. The level of expenditures in all areas of production is affected by the volatility of oil prices. Because many countries' economies are built on oil manufacturing and distribution in petroleum products, predicting the price of oil is a critical undertaking. It's also worth mentioning that oil prices have a direct impact on various sectors of the economy, as well as on economic and political processes that influence the stock value of oil businesses, the inflation rate in oil-importing countries, and the rate of economic development. It's vital to remember that oil prices have an impact on the cost of other energy sources.

Brent Oil prices have been wildly fluctuating over the last few years, climbing and decreasing substantially at different times. Because oil is a strategic commodity with a large effect on world economic and macroeconomic variables such as the consumer price index, consumer confidence index, gross domestic product per capita, and gross national product per capita, it has been one of the most fascinating topics for both energy researchers and economists.

The goal of this paper is to discover the factors that influence oil prices, show descriptive data analyses, and study the results of a linear regression in the following countries; Romania, France, Germany, Italy and Greece, in order to pin point the discrepancies that may appear among developed and developing countries. When building the base for our study, we decided to consider several indicators and they are as follows: Gross Domestic Product, Balance of Payments, Balance of Trade and Net Exports. In this paper, we perform an indicator evolution analysis for all of the four indicators and considering all the data, we have computed a simple linear regression.

¹ „West University of Timisoara”, Timișoara, ROMANIA, bogdan.boldea@e-uvv.ro

² University of Craiova, Craiova, ROMANIA, cboldea@info.ucv.ro

Indicators used in our Analysis

As mentioned previously, the following indicators were used in order to properly compute the statistical analysis in regards with the Brent Oil Prices for our chosen countries:

Brent Oil Prices

The literature presents several studies which have found a negative relationship between Brent Oil price and GDP. However, energy efficiency measures enacted in the preceding decade, as well as a global movement toward renewable energy sources, reduced the usage of oil (Lardic & Mignon 2006), (Katircioglu et al. 2015), (Adeosun et al. 2022).). Considering the significance of oil prices in influencing both economic activity as well as inflation, authorities must properly estimate oil prices (Bondarenko 2019). Nevertheless, from the perspective of policymakers, the new literature on oil price forecasting contains two major flaws. To begin with, most research has concentrated on projecting crude oil price benchmarks other than Brent. Brent oil, on the other hand, is now widely regarded as the worldwide standard reference for oil price, and is thus closely monitored and projected by national authorities.

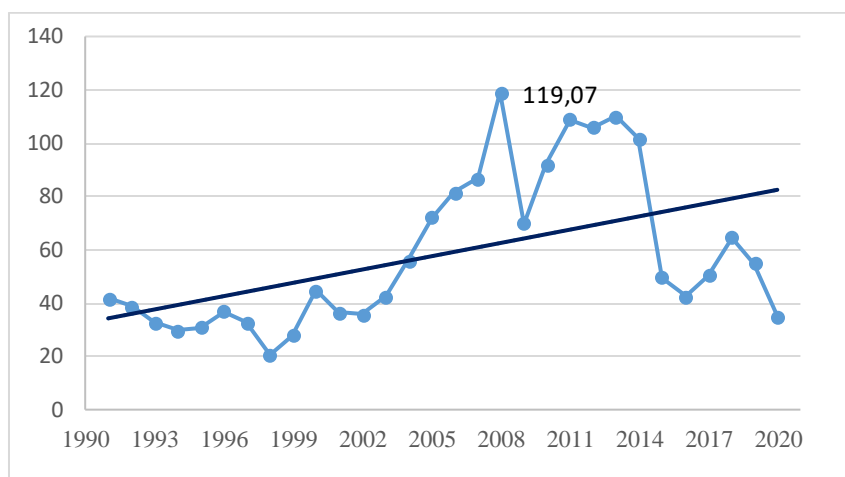


Fig. 1 Evolution of Brent Oil Prices per barrel in US\$ (1991-2021)

Source: Own computation based on data from Inflationdata.com

Figure 1 showcases the evolution of Brent Oil Prices from the last 30 years. It is worth mentioning beforehand that the price has been continuously fluctuating since the oil shock crisis from the 70', reaching its peak in 1980. Since year 2000, the price per barrel continuously grew through the years, hitting the highest value in 2008, due to the 2008 Financial Crisis (reaching 119.07 US\$ per barrel). As the price began to slowly decrease around year 2015, the 2020 pandemic meant another beginning trend in increasing the price per barrel of Brent oil.

Gross Domestic Product per capita

The gross domestic product, or GDP, is a measure of the entire value of a country's aggregate domestic products and services. The gross national product (GNP) is a similar but that assesses the value of all produced goods and services owned by the country's population throughout time. The most generally used economic statistics are GDP and GNP, which both measure the total market value of all items and services produced during any given period of time.

Several study articles discuss how national output is utilized as a measure of development, which is a difficult concept in and of it. One can wonder if the only way to "develop" is to increase output and acquire more and more commodities. A popular justification of utilizing GDP as a country's financial objective is that by expanding the total budget and gross domestic product, additional funds are available to spend on goods and commodities that would otherwise be

prohibitively costly, and that expanding the budget makes it simpler to allocate money for various reasons. According to Johan Norberg, growing income with the usage of GDP would allow us to accomplish the things we need for a good and healthy economy (Norberg 2010, p.8).

The gross domestic product does not include the notion of wealth in its computations because it is solely concerned with newly produced goods. So, a nation may have massive reserves of natural resources, however if they are unused, they are not reflected in GDP in any manner. The constant need to create new products in order to maintain high growth rates is unsustainable. Other measuring techniques, or a totally revamped system of national accounts, which would display the country's both assets and liabilities, might help to prevent this type of difficulty (Hoffrén et al. 2011).

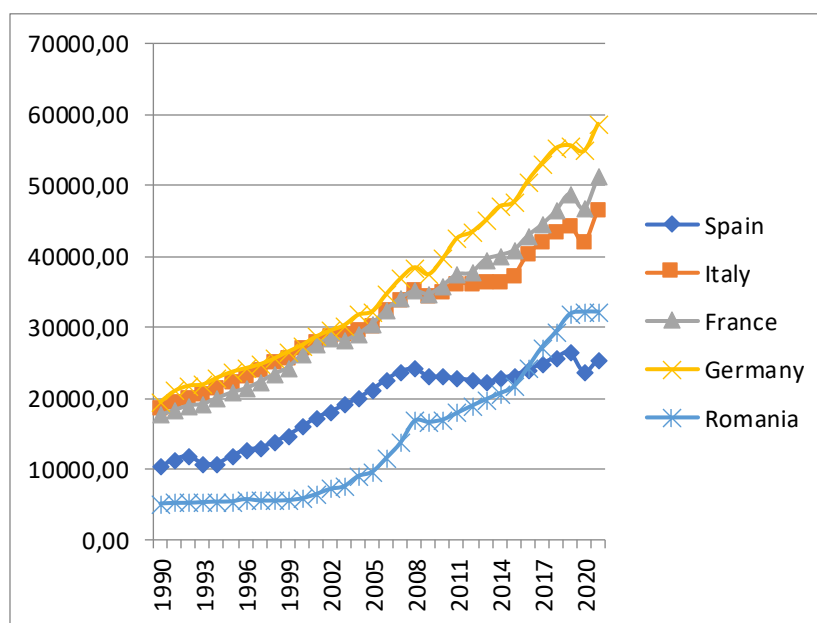


Fig. 2 Evolution of GDP per capita in US\$ (1991-2021)

Source: Own computation based on data from World Data Bank

The 2nd Figure depicts the evolution of the gross domestic product per capita as measured in million US\$. As expected, Romania maintained the lowest place in terms of GDP per capita throughout all years of analysis, with an average of 5,852.874 million US\$. The developed countries (meaning Germany, France and Italy) have a continuous similar trend across all years; however, Germany was by far the country with the highest GDP per capita, with an overall average of 35,920.410 million US\$. All countries have the highest peak in GDP per capita right before the 2008 Financial Crisis, followed by a short downfall, and then a full recovery in 2014. 2019 was another year with a good economic development, however due to the COVID-19 pandemic, the trend met a recession, and economists are forecasting that the trend will continue in this negative direction.

Others indicators: Balance of Trade, Balance of Payment and Net Exports

In Figure 3 we can see the evolution of the Balance of Trade as measured in billions US\$.

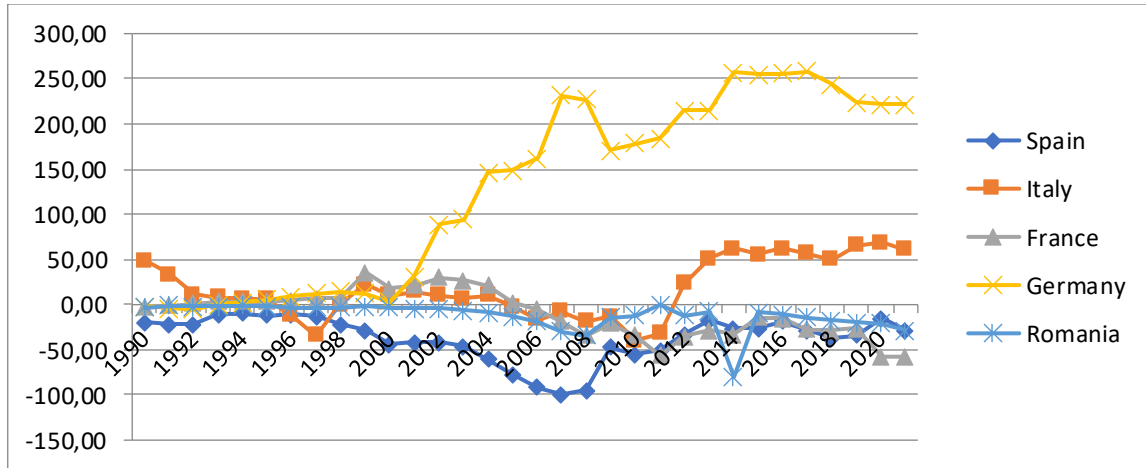


Fig. 3 Evolution of BOT in billions US\$ (1991-2021)

In Figure 4 we can see the evolution of the Balance of Payments as measured in million US\$.

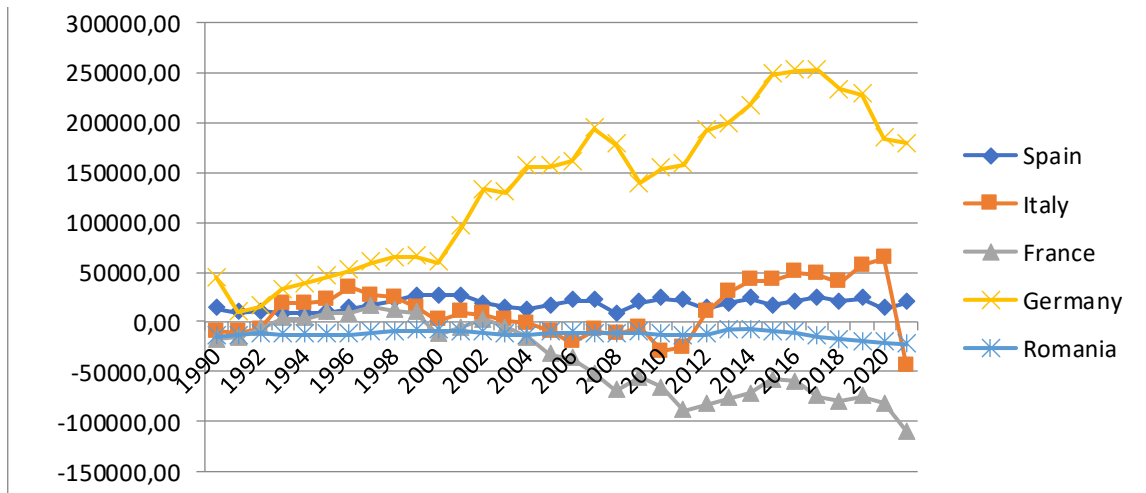


Fig. 4 Evolution of BOP in millions US\$ (1991-2021)

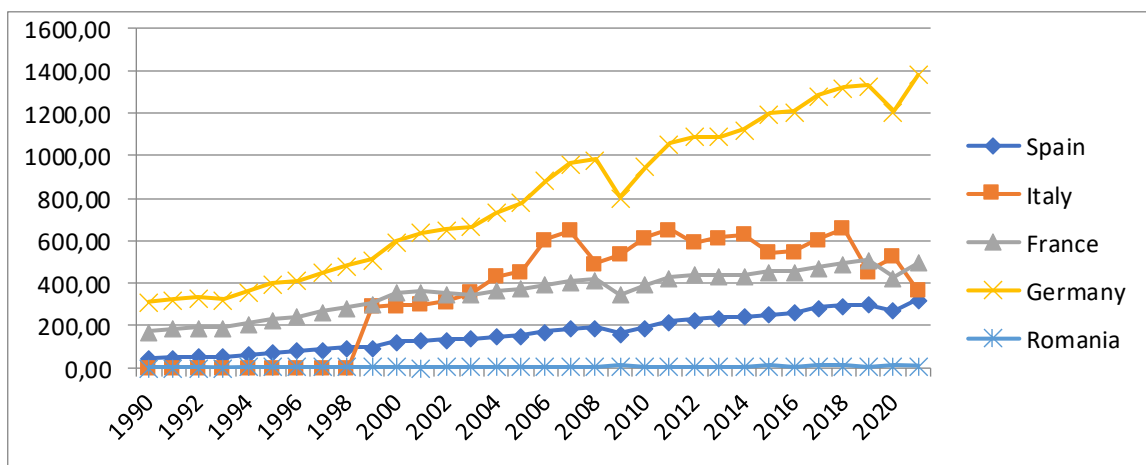


Fig. 5 Evolution of Net Exports in billions US\$ (1991-2021)

The main search sources from which we have extracted our data are World Data Bank and Stooq.com Trading.

Statistical Analysis: Method and Results

In this paper, we study the dynamics of influence of Brent Oil Prices throughout the years from the point of view of our chosen macroeconomic indicators. In order to portray these estimations, the statistical approach that was chosen was the simple linear regression method.

The variation in one metric as a result of the change in the other is calculated using correlation analysis. If there is a significant correlation between two or more variables or metrics, and one of them is seen operating in a certain way, we assume that the others are also being influenced in the same way at the same intensity.

The simple regression analysis is used to determine the relative influence of a predictor variable on a certain result, which is not the same as correlation analysis, which further looks at the intensity of a relation between two stochastic processes (Pfeifer, 2010). Furthermore, the model is categorized as “simple” since the independent variable is singular X_i , for i being equal with $1, 2, \dots, n$ issues and is linear within the parameters of regression and the dependent variable. The equation is portrayed as follows:

$$Y_i = a + bX_i + e_i \tag{1}$$

Where Y denotes the dependent variable; X is the independent variable; b expresses the slope of the regression; a is the intercept, and e is the residual error coefficient.

We tested this simple linear regression model with Brent Oil Prices as dependent variable and all indicators as our independent variables. We observe a direct and statistically significant relationship.

In terms of the F-test and its statistical significance confirm the ability to explain the variance in the dependent variable. In addition, the R squared indicates that approximately 80% of the variance in the dependent variable may be explained through the independent one.

Case of Spain

As can be seen, a scatter plot has been used to compare the different macroeconomic indicators with Brent Spot Oil. Certain indicators show little dispersion, but in the case of GDP and net exports, the dispersion is higher.

	BRENT SPOT OIL	GDP PER CAPITA			BRENT SPOT OIL	NET EXPORTS
BRENT SPOT OIL	1			BRENT SPOT OIL	1	
GDP PER CÁPITA	0,122899861	1		NET EXPORTS	0,214492259	1
	BRENT SPOT OIL	BALANCE OF TRADE			BRENT SPOT OIL	BALANCE OF PAYMENTS
BRENT SPOT OIL	1			BRENT SPOT OIL	1	
BALANCE OF TRADE	-0,10943779	1		BALANCE OF PAYMENTS	-0,212859739	1

Figure 6. Pearson coefficient of correlation between the four indicators and Brent Spot Oil price

Considering the correlation analysis, we can observe a positive relationship of both GDP per capita and net exports with Brent spot oil. On the other hand, the relationship with the balance of payments and the balance of trade is negative (Table 1).

Table 1. Regression analysis in the case of Spain

Spain	Regression equation	Pearson correlation	Multiple R	Null hypothesis probability
GDP	GDP=47.38+0.00045·BSO	0.1228	0.0151	39.02%
Net Exports	NE=45.59+0.00007·BSO	0.2144	0.0460	19.06%
BOT	BOT=45.59-0.00018·BSO	-0.1094	0.0119	44.9%
BOP	BOP=45.59-0.00262·BSO	-0.2128	0.0258	13.37%

In figures 7 and 8 is presented the regression computation of coefficients and the regression analysis, for all the four indicators considered. We observe a direct and statistically in-significant relationship in all four cases. Therefore, we expect a higher price in Brent Oil if the GDP per capita.

SUMMARY OUTPUT							SUMMARY OUTPUT																	
Regression Statistics							Regression Statistics																	
Multiple F	0,1229						Multiple F	0,21449																
R Square	0,0151						R Square	0,04601																
Adjusted F	-0,005						Adjusted F	0,02654																
Standard Error	30,5277						Standard Error	30,045																
Observations	51						Observations	51																
ANOVA							ANOVA																	
	df	SS	MS	F	Significance F		df	SS	MS	F	Significance F		df	SS	MS	F	Significance F							
Regression	1	700,321	700,321	0,75146	0,39024	Regression	1	2133,13	2133,13	2,36306	0,13067	Regression	1	2100,78	2100,78	2,32552	0,1337							
Residual	49	45665,1	931,941			Residual	49	44232,3	902,7			Residual	49	44264,7	903,361									
Total	50	46365,5				Total	50	46365,5				Total	50	46365,5										
Coefficients							Coefficients																	
		Standard Error	t Stat	P-value	Lower 95%	Upper 95%			Standard Error	t Stat	P-value	Lower 95%	Upper 95%			Standard Error	t Stat	P-value	Lower 95%	Upper 95%				
Intercept	47,3857	8,29428	5,71305	6,5E-07	30,7177	64,0536	Intercept	45,5431	6,69414	6,80343	1,3E-08	32,0907	58,9955	32,0907	58,9955	Intercept	54,3078	4,23812	12,8141	2,9E-17	45,7909	62,8246	45,7909	62,8246
X Variable	0,00045	0,00052	0,86687	0,39024	-0,00059	0,00149	X Variable	6,9E-05	4,5E-05	1,53722	0,13067	-2,1E-05	0,00016	-2,1E-05	0,00016	X Variable	-0,00262	0,00172	-1,52497	0,1337	-0,00607	0,00083	-0,00607	0,00083

Figure 7. Regression analysis of Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Spain

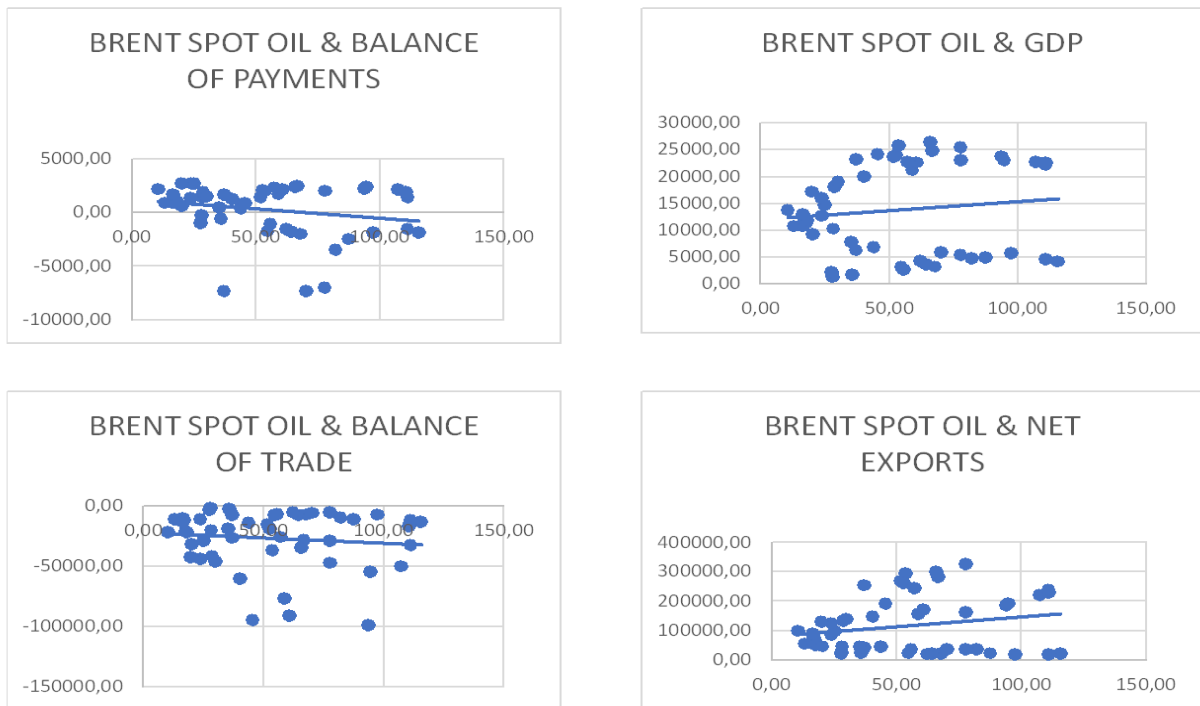


Fig. 8 Regression line for Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price in the case of Spain

For all regression models, the F-test and its statistical significance confirm the ability to explain the variance in the dependent variable. Furthermore, the R squared indicates that approximately 10% of the variance in the dependent variable may be explained through the independent one.

In the case of Spain, no one of the indicators depends significantly on Oil price.

Case of Italy

As can be seen, a scatter plot has been used to compare the different macroeconomic indicators with Spot Brent Oil price. Some indicators show little dispersion, but in the case of the balance of payments and balance of trade this is totally different, as it is possible to observe a very high dispersion graph (figure 11).

BRENT SPOT OIL		GDP PER CÁPITA		BRENT SPOT OIL		NET EXPORTS	
BRENT SPOT OIL	1			BRENT SPOT OIL	1		
GDP PER CÁPITA	0,718515357	1		NET EXPORTS	0,829868893	1	
BRENT SPOT OIL		BALANCE OF TRADE		BRENT SPOT OIL		BALANCE OF PAYMENTS	
BRENT SPOT OIL	1			BRENT SPOT OIL	1		
BALANCE OF TRADE	0,039552163	1		BALANCE OF PAYMENTS	-0,145324988	1	

Fig. 9 Pearson coefficient of correlation between the four indicators and Brent Spot Oil price in the case of Italy

In this correlation analysis of the following macroeconomic values, both GDP per capita and Net Exports, present significant positive dependence to Oil price, however, the balance of payments presents a negative relationship with Brent Spot Oil price (figure 9).

Figure 10 and Table 2 presents the regression analysis for the four Indicators.

SUMMARY OUTPUT									
<i>Regression Statistics</i>									
Multiple R	0,71859								
R Square	0,51637								
Adjusted R Square	0,50172								
Standard Error	22,2555								
Observations	35								
<i>ANOVA</i>									
	df	SS	MS	F	Significance F				
Regression	1	17451,9	17451,9	35,2343	1,2E-06				
Residual	33	16345,2	495,309						
Total	34	33797,1							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	-18,433	11,6208	-1,5862	0,12223	-42,076	5,20957	-42,076	5,20957	
X Variable 1	0,00213	0,00036	5,93585	1,2E-06	0,0014	0,00286	0,0014	0,00286	
SUMMARY OUTPUT									
<i>Regression Statistics</i>									
Multiple R	0,74946								
R Square	0,56169								
Adjusted R Square	0,54799								
Standard Error	21,3256								
Observations	34								
<i>ANOVA</i>									
	df	SS	MS	F	Significance F				
Regression	1	18649,7	18649,7	41,0078	3,4E-07				
Residual	32	14553,1	454,783						
Total	33	33202,7							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	38,3671	3,85274	9,95839	2,5E-11	30,5193	46,2149	30,5193	46,2149	
X Variable 1	-1,0242	0,15994	-6,4037	3,4E-07	-1,35	-0,6984	-1,35	-0,6984	
SUMMARY OUTPUT									
<i>Regression Statistics</i>									
Multiple R	0,84952								
R Square	0,72168								
Adjusted R Square	0,7124								
Standard Error	16,9349								
Observations	32								
<i>ANOVA</i>									
	df	SS	MS	F	Significance F				
Regression	1	22308,8	22308,8	77,788	7,8E-10				
Residual	30	8603,68	286,789						
Total	31	30912,5							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	23,2173	4,23264	5,48529	5,9E-06	14,573	31,8615	14,573	31,8615	
X Variable 1	-0,0007	8,1E-05	-8,8198	7,8E-10	-0,0009	-0,0005	-0,0009	-0,0005	

Figure 10. Regression analysis of Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Italy

Table 2. Regression analysis in the case of Italy

Italy	Regression equation	Pearson correlation	Multiple R	Null hypothesis probability
GDP	$GD21 = -18.43 + 0.0021 \cdot BSO$	0.7185	0.516	0.0001%
Net Exports	$NE = -31.195 + 0.00023 \cdot BSO$	0.7281	0.5259	0.0002%
BOT	$BOT = 38.59 + 1.024 \cdot BSO$	0.0395	0.5616	0.0003%
BOP	$BOP = 23.29 - 0.0007 \cdot BSO$	-0.1453	0.7216	0.0000007%

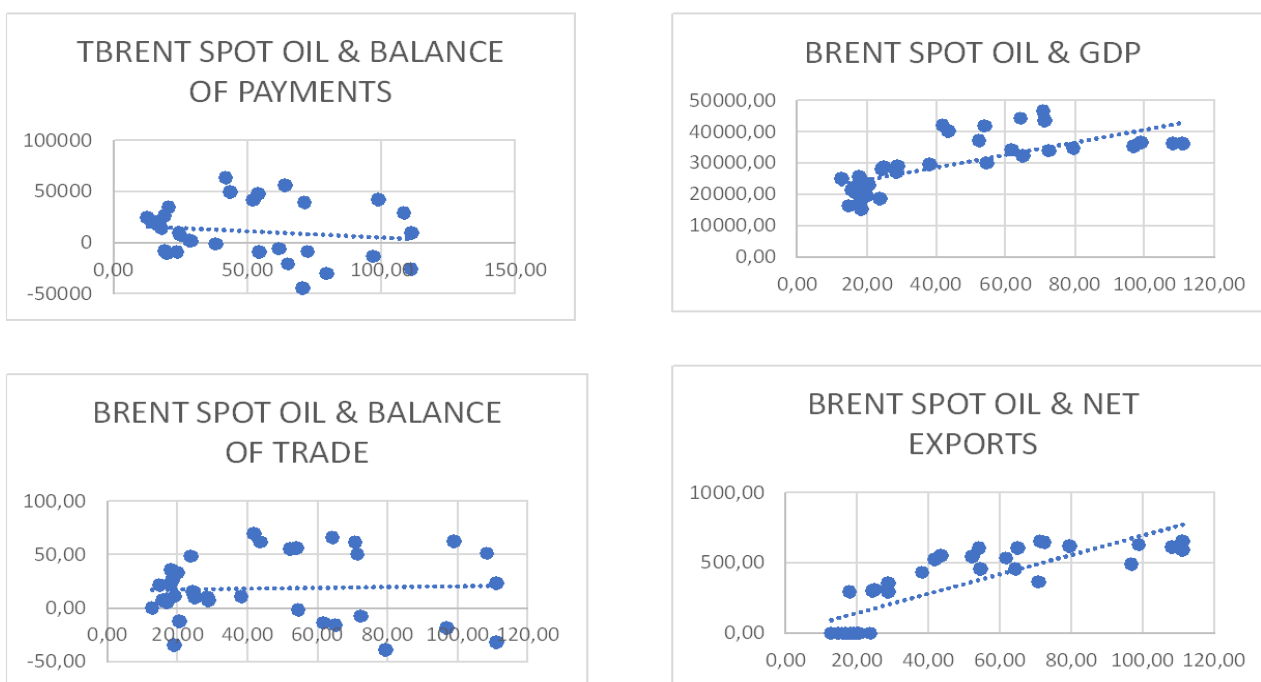


Fig. 11 Regression line for Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Italy

Case of France

As can be seen, a scatter plot has been used to compare the different macroeconomic indicators with Brent Spot Oil. In this case, in France, the four indicators show a large dispersion in relation to BSO. The only one showing less dispersion is net exports (figure 12).

	<i>BRENT SPOT OIL</i>	<i>GDP PER CAPITA</i>		<i>BRENT SPOT OIL</i>	<i>NET EXPORTS</i>
BRENT SPOT OIL	1		BRENT SPOT OIL	1	
GDP PER CAPITA	0,718590574	1	NET EXPORTS	0,724807546	1
	<i>BRENT SPOT OIL</i>	<i>BALANCE OF TRADE</i>		<i>BRENT SPOT OIL</i>	<i>BALANCE OF PAYMENTS</i>
BRENT SPOT OIL	1		BRENT SPOT OIL	1	
BALANCE OF TRADE	-0,749460407	1	BALANCE OF PAYMENTS	-0,849515088	1

Fig. 12 Pearson coefficient of correlation between the four indicators and Brent Spot Oil price in the case of France

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,71852								
R Square	0,51626								
Adjusted R Square	0,50161								
Standard Error	22,258								
Observations	35								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	17448,2	17448,2	35,2191	1,2E-06				
Residual	33	16348,8	495,42						
Total	34	33797,1							
		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept		-30,873	13,6234	-2,2662	0,03012	-58,59	-3,1559	-58,59	-3,1559
X Variable 1		0,00258	0,00044	5,93457	1,2E-06	0,0017	0,00347	0,0017	0,00347

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,82987								
R Square	0,68868								
Adjusted R Square	0,67925								
Standard Error	17,856								
Observations	35								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	23275,4	23275,4	73,0011	7,1E-10				
Residual	33	10521,6	318,837						
Total	34	33797,1							
		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept		13,9679	4,88921	2,85687	0,00735	4,02068	23,915	4,02068	23,915
X Variable 1		0,09979	0,01168	8,54407	7,1E-10	0,07603	0,12356	0,07603	0,12356

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,03955								
R Square	0,00156								
Adjusted R Square	-0,0287								
Standard Error	31,9774								
Observations	35								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	52,8712	52,8712	0,05171	0,82153				
Residual	33	33744,2	1022,55						
Total	34	33797,1							
		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept		46,0791	6,33803	7,27025	2,4E-08	33,1843	58,9739	33,1843	58,9739
X Variable 1		0,04044	0,17787	0,22739	0,82153	-0,3214	0,40231	-0,3214	0,40231

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,14532								
R Square	0,02112								
Adjusted R Square	-0,0115								
Standard Error	31,7593								
Observations	32								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	652,851	652,851	0,64725	0,42743				
Residual	30	30259,6	1008,65						
Total	31	30912,5							
		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept		51,6005	6,13654	8,40873	2,2E-09	39,068	64,133	39,068	64,133
X Variable 1		-0,0002	0,00021	-0,8045	0,42743	-0,0006	0,00026	-0,0006	0,00026

Fig. 13 Regression analysis of Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of France

In the correlation analysis of the following macroeconomic values, two of them show a positive relationship with respect to the base indicator, which are GDP per capita and net exports, while the balance of trade and balance of payments shows a negative relationship (figure 12 and 14 and Table 3), in this case, the values of Pearson coefficient are -0.7494 and -0.8495 respectively (figure 12).

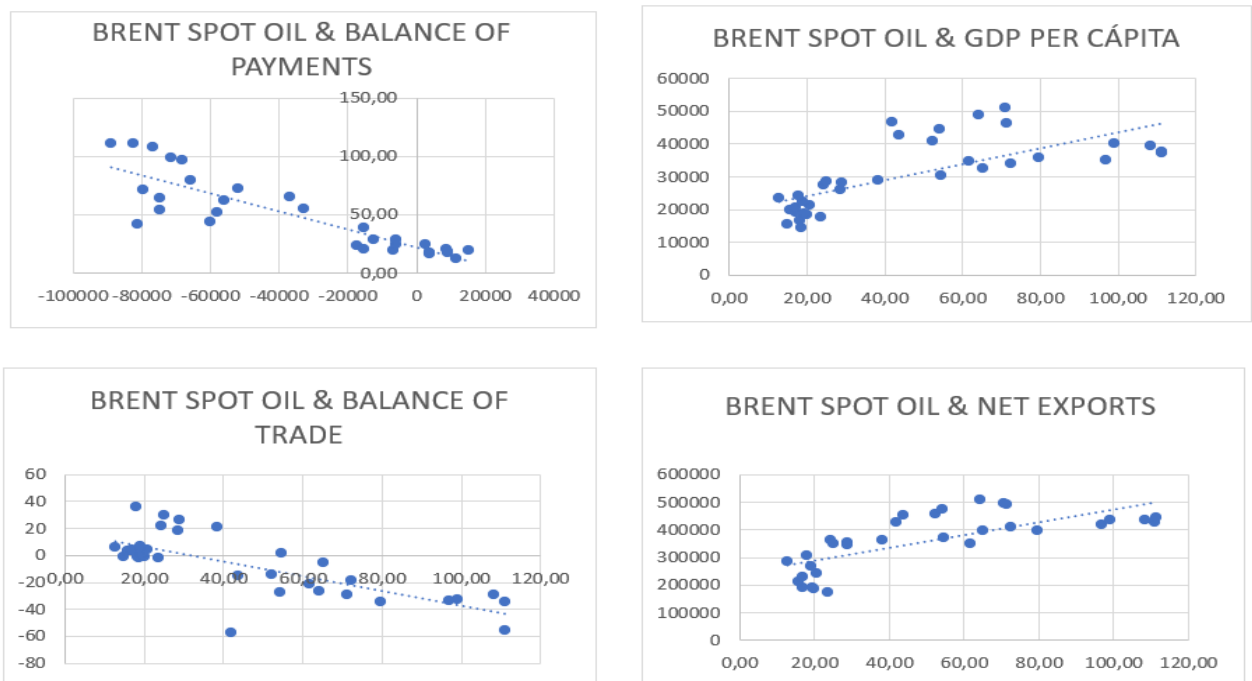


Fig. 14 Regression line for Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of France

Table 3. Regression analysis in the case of France

France	Regression equation	Pearson correlation	Multiple R	Null hypothesis probability
GDP	$GD21 = -30.83 + 0.00258 \cdot BSO$	0.7182	0.516	0.0012%
Net Exports	$NE = 13.195 + 0.99 \cdot BSO$	0.8289	0.688	0.000007%
BOT	$BOT = 46.507 + 0.04 \cdot BSO$	0.095	0.001	82%
BOP	$BOP = 51.61 - 0.0002 BSO$	-0.1453	0.021	42.7%

Case of Germany

For Germany, the dependences of GDP per capita, BOT, BOP and Net Exports on Oil price are very significant, as can be seen in figure 15.

	BRENT SPOT OIL	GDP PER CAPITA		BRENT SPOT OIL	NET EXPORTS
BRENT SPOT OIL		1		BRENT SPOT OIL	1
GDP PER CAPITA	0,702005996			NET EXPORTS	0,741885135
		1			1
	BRENT SPOT OIL	BALANCE OF TRADE		BRENT SPOT OIL	BALANCE OF PAYMENTS
BRENT SPOT OIL		1		BRENT SPOT OIL	1
BALANCE OF TRADE	0,810082256			BALANCE OF PAYMENTS	0,703706172
		1			1

Fig. 15 Pearson coefficient of correlation between the four indicators and Brent Spot Oil price in the case of Germany

In the correlation analysis of the considered macroeconomic values, all of them present positive values of great magnitude, since they all exceed the figure of 0.7, even the balance of trade reaches 0.8101.

In Germany, the 4 indicators show a medium dispersion and there is in this case a significant relationship of values with Brent Spot Oil price (figure 16 and Table 4). Figure 17 presents a scatter plot has been used to compare the different macroeconomic indicators with Spot Brent Oil price.

SUMMARY OUTPUT										
<i>Regression Statistics</i>										
Multiple R	0,70201									
R Square	0,49281									
Adjusted R Square	0,47744									
Standard Error	22,7912									
Observations	35									
<i>ANOVA</i>										
	df	SS	MS	F	Significance F					
Regression	1	16655,6	16655,6	32,0647	2,6E-06					
Residual	33	17141,4	519,438							
Total	34	33797,1								
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%		
Intercept	-12,833	11,2189	-1,1439	0,2609	-35,658	9,99178	-35,658	9,99178		
X Variable 1	0,00174	0,00031	5,66257	2,6E-06	0,00111	0,00236	0,00111	0,00236		
SUMMARY OUTPUT										
<i>Regression Statistics</i>										
Multiple R	0,74189									
R Square	0,55039									
Adjusted R Square	0,53541									
Standard Error	21,524									
Observations	32									
<i>ANOVA</i>										
	df	SS	MS	F	Significance F					
Regression	1	17014	17014	36,725	1,2E-06					
Residual	30	13898,4	463,281							
Total	31	30912,5								
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%		
Intercept	-3,9482	9,6217	-0,4103	0,68447	-23,598	15,702	-23,598	15,702		
X Variable 1	6,6E-05	1,1E-05	6,06012	1,2E-06	4,4E-05	8,9E-05	4,4E-05	8,9E-05		
SUMMARY OUTPUT										
<i>Regression Statistics</i>										
Multiple R	0,81008									
R Square	0,65623									
Adjusted R Square	0,64549									
Standard Error	18,8862									
Observations	34									
<i>ANOVA</i>										
	df	SS	MS	F	Significance F					
Regression	1	21788,7	21788,7	61,0864	6,5E-09					
Residual	32	11414	356,687							
Total	33	33202,7								
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%		
Intercept	18,5791	4,78666	3,88144	0,00049	8,82903	28,3293	8,82903	28,3293		
X Variable 1	0,24344	0,03115	7,81578	6,5E-09	0,17999	0,30688	0,17999	0,30688		
SUMMARY OUTPUT										
<i>Regression Statistics</i>										
Multiple R	0,70371									
R Square	0,4952									
Adjusted R Square	0,47838									
Standard Error	22,8068									
Observations	32									
<i>ANOVA</i>										
	df	SS	MS	F	Significance F					
Regression	1	15307,9	15307,9	29,4298	7E-06					
Residual	30	15604,5	520,151							
Total	31	30912,5								
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%		
Intercept	10,2886	8,29372	1,24053	0,2244	-6,6495	27,2266	-6,6495	27,2266		
X Variable 1	0,00029	5,4E-05	5,42492	7E-06	0,00018	0,0004	0,00018	0,0004		

Figure 16. Regression analysis of Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Germany

Table 4. Regression analysis in the case of Germany

Germany	Regression equation	Pearson correlation	Multiple R	Null hypothesis probability
GDP	$GD21 = -12.833 + 0.00174 \cdot BSO$	0.702	0.49	0.0026%
Net Exports	$NE = 18.575 + 0.24 \cdot BSO$	0.749	0.65	0.0012%
BOT	$BOT = -5.07 + 0.000006 \cdot BSO$	0.801	0.55	0.000065%
BOP	$BOP = 10.28 + 0.0003 \cdot BSO$	0.703	0.472	0.0007%

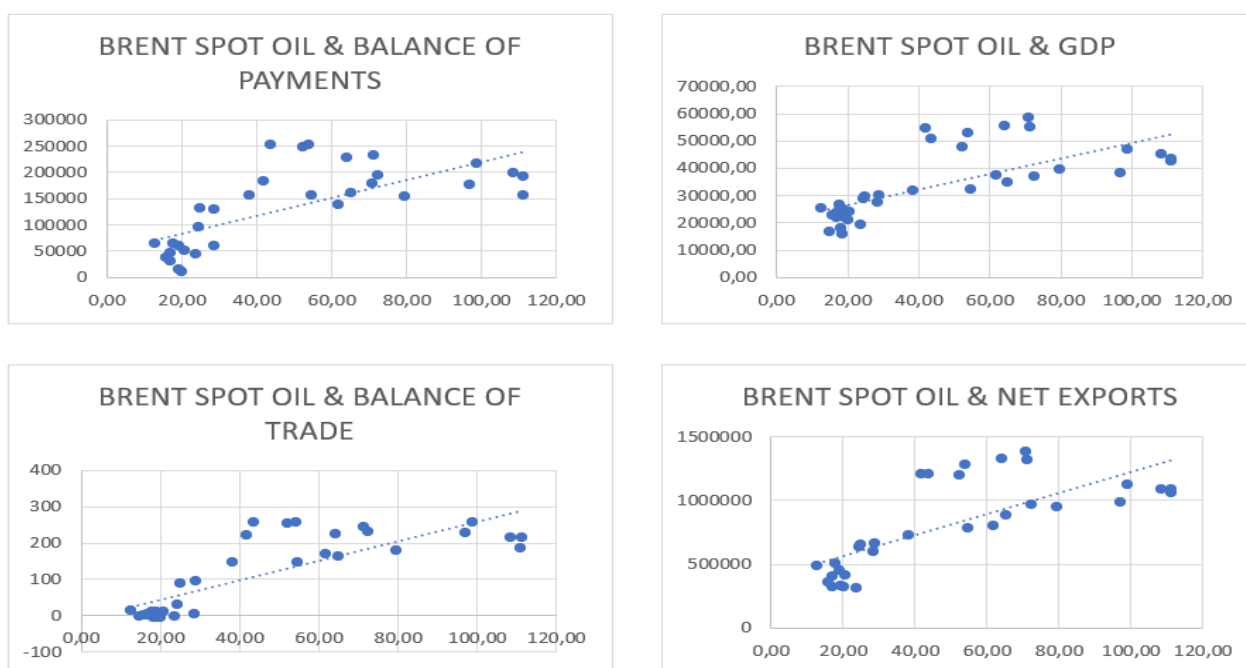


Fig. 17 Regression line for Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Germany

Case of Romania

In the case of Romania, there are three positive values of Pearson coefficient, which are net exports, GDP per capita, and the balance of payments, while the balance of trade presents a negative value, in this case, -0.5892 (figure 18).

	<i>BRENT SPOT OIL</i>	<i>GDP PER CAPITA</i>		<i>BRENT SPOT OIL</i>	<i>NET EXPORTS</i>
BRENT SPOT OIL	1		BRENT SPOT OIL	1	
GDP PER CAPITA	0,271577859	1	NET EXPORTS	0,585401929	1
	<i>BRENT SPOT OIL</i>	<i>BALANCE OF TRADE</i>		<i>BRENT SPOT OIL</i>	<i>BALANCE OF PAYMENTS</i>
BRENT SPOT OIL	1		BRENT SPOT OIL	1	
BALANCE OF TRADE	-0,58917402	1	BALANCE OF PAYMENTS	0,585401929	1

Fig. 18 Pearson coefficient of correlation between the four indicators and Brent Spot Oil price in the case of Romania

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,54301								
R Square	0,29486								
Adjusted R Square	0,26548								
Standard Error	27,1787								
Observations	26								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	7413,26	7413,26	10,0358	0,00415				
Residual	24	17728,4	738,683						
Total	25	25141,7							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	25,1539	10,7253	2,34528	0,02761	3,01794	47,28989	3,01794	47,28989	
X Variable 1	0,00195	0,00062	3,16793	0,00415	0,00068	0,003224	0,00068	0,00322	

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,5854								
R Square	0,3427								
Adjusted R Square	0,32278								
Standard Error	25,9457								
Observations	35								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	11582,1	11582,1	17,205	0,00022				
Residual	33	22215	673,181						
Total	34	33797,1							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	-8,4949	14,041	-0,605	0,54931	-37,062	20,0716	-37,062	20,0716	
X Variable 1	0,00733	0,00177	4,1479	0,00022	0,00373	0,01092	0,00373	0,01092	

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,58917								
R Square	0,34713								
Adjusted R Square	0,32734								
Standard Error	25,8581								
Observations	35								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	11731,8	11731,8	17,5457	0,0002				
Residual	33	22065,2	668,643						
Total	34	33797,1							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	33,4566	5,41294	6,18085	5,7E-07	22,4439	44,4693	22,4439	44,4693	
X Variable 1	-0,0012	0,00029	-4,1888	0,0002	-0,0018	-0,00062	-0,0018	-0,0006	

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0,10648								
R Square	0,01134								
Adjusted R Square	-0,0299								
Standard Error	31,3631								
Observations	26								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	270,717	270,717	0,27522	0,60466				
Residual	24	23607,5	983,645						
Total	25	23878,2							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%	
Intercept	46,2962	20,7795	2,22797	0,03551	3,40931	89,183	3,40931	89,183	
X Variable 1	-0,0008	0,0016	-0,5246	0,60466	-0,0042	0,00247	-0,0042	0,00247	

Fig. 19 Regression analysis of Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Romania

The regression analysis is presented in figure 19 and summarized in Table 5. The regression lines for Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price in the case of Romania are presented in figure 20. The dependence of all four indicators on Oil price is weak, and insignificant in the case of GDP and BOP.

Table 5. Regression analysis in the case of Romania

Romania	Regression equation	Pearson correlation	Multiple R	Null hypothesis probability
GDP	GDP=25.15+0.00195·BSO	0.271	0.294	0.45%
Net Exports	NE=-8.4949+0.0073·BSO	0.585	0.342	0.022%
BOT	BOT=33.47-0.0012·BSO	-0.589	0.347	0.02%
BOP	BOP=46.29-0.0016·BSO	0.586	0.011	60.4%

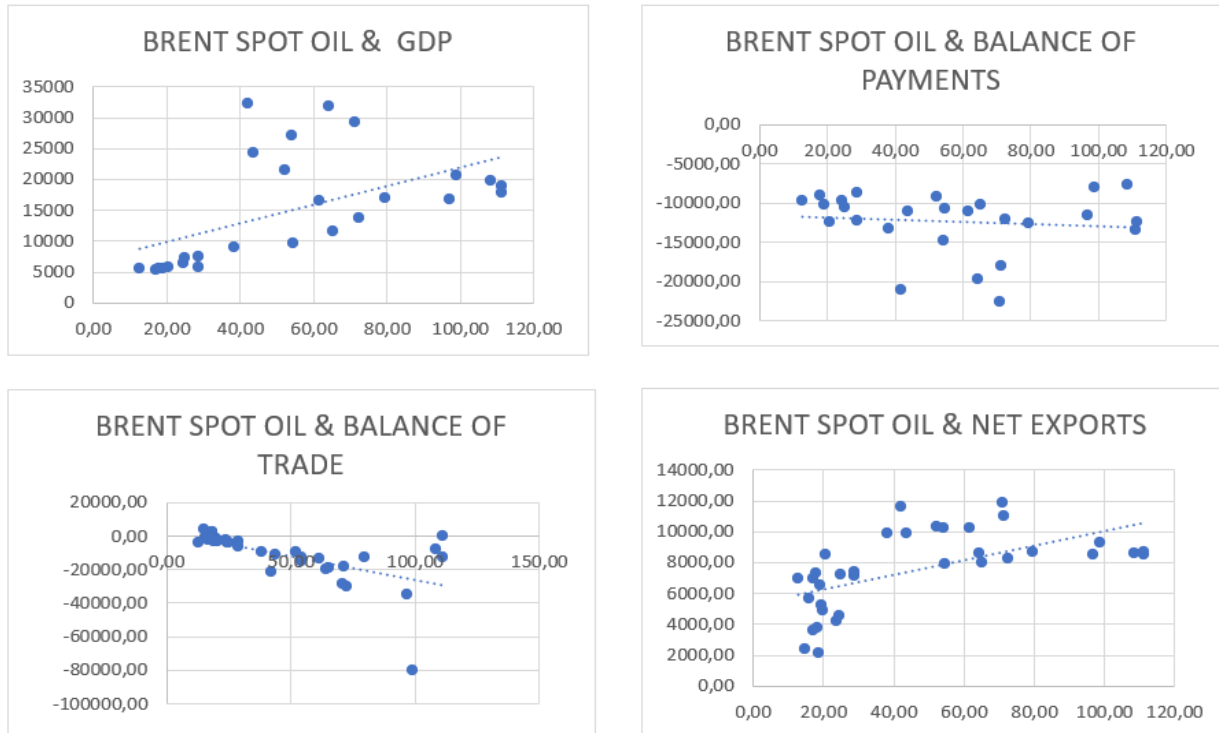


Figure 20. Regression line for Balance of Payments, GDP per capita, Balance of Trade and Net Exports in function of Brent Spot Oil Price, in the case of Romania

Conclusions

Throughout this analysis, we have seen how, by means of such an important indicator as to the price of a barrel of oil, other macroeconomic indicators of great importance can be related. These show signs of the financial health of the countries analyzed, through net exports, the balance of payments, and the balance of trade.

Another very important indicator is the GDP per capita analyzed in our study, which shows the purchasing power of a country's population. If it is high, it reflects a good economy, which also represents a country exporting goods and services.

By means of the correlation and regression analysis, we can see how these countries share similar characteristics and indicator values, but on the other hand, they are very different from each other, since a country like Romania, whose accession to the EU was much later than the rest of the countries, will not have the same number of exports, since they have a more consolidated international position.

For economic development, oil is vital, while fluctuations in international prices have a considerable influence on the performance of the economies of the world. There should be an appropriate and timely policy reaction to high oil price developments to allow countries to adapt to the environment. To be effective, regulations must be inclusive of all usage patterns and include more ambitious fuel efficiency objectives, improved standards for vehicles and fuels, as well as cuts on road and air transport through price, organizational and other behavioral changes. The downward consequences through indirect impacts are to be expected in overall terms, over and above some very considerable and straightforward effects of the recent oil price reductions. By and large, uncertainties remain about the size as well as about the timing of these impacts. However, it is essential that such short-term shifts in the annual rate of price change, like the direct effects, is temporary and linked to the time needed to accommodate oil price fluctuations.

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