DOI: 10.2478/vjbsd-2020-0011

FUTURE OF OIL AND GAS TRADE OF KAZAKHSTAN IN THE EUROPEAN UNION CONTEXT – APPLICATION OF TIME SERIES ANALYSIS

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Energy is a fundamental factor in cooperation between Kazakhstan and the European Union; both sides strive for energy security but understand it differently. For Kazakhstan, the European Union is the primary export market for energy resources, a source of investment and technology. For the European Union, Kazakhstani oil and gas are the most valuable energy resources of the Central Asian region. The relevance of the chosen topic is that oil and gas are of crucial importance for the economy of Kazakhstan. In the future, Kazakhstan is going to increase production with the European Union. Kazakhstan's oil and gas industry can be attributed to one of the leading sectors of the country's economy. The purpose of the scientific paper is to analyse the oil and gas trade between Kazakhstan and the European Union using a time series model to examine Kazakhstan's oil and gas trade flow, in order to describe its top 5 trade partners in the European Union, also providing objective information on the results and prospects of development of cooperation between Kazakhstan and the European Union in the field of oil and gas trade.

Keywords: oil; gas; trade; export; import; production; barrel

Since the beginning of this century, the economy of Kazakhstan has demonstrated stable high growth rates: the gross domestic product (GDP) of the country increases annually by more than 9%. This circumstance arouses particular interest in the study of the role of the oil and gas sector in the development of the Republic's economy – the main stimulator of its current economic boom (Babak, 2006).

The fuel and energy sectors are a vital area and a fundamental factor in cooperation between Kazakhstan and the European Union. This is reflected in the strategic documents and the state program of Kazakhstan "Way to Europe" (Laumulin, 2020). The Republic belongs to a group of States that have strategic reserves of hydrocarbons and are gradually increasing their influence on the formation of the energy market of the world oil market. In 2015, the parties signed a new long-term Partnership Agreement, the central place in which is given to energy issues.

At the same time, Kazakhstan faces specific difficulties and risks in connection with accelerated plans to develop its energy sector. Among them are ensuring the sustainability of the industry, a price shock, and a decrease in the growth rate of production, which leads to a reduction in income and a reduction of economic growth. The most essential task remains the rational use and distribution of oil and gas revenues (Ketova, 2017).

In order to analyse Kazakhstan's oil and gas trade with the European Union, we decided to conduct statistical macro and micro analyses, such as time series, namely multiplicative model in order to predict future trends and trading potentials of the two markets and identify Kazakhstan's top 5 partners in the European Union trade in oil, gas and oil products and give a quarterly forecast of dynamics of oil and gas export from Kazakhstan to the European Union members.

Material and methods

In this research paper, we used a time series analysis method, namely a multiplicative model for reviewing and analysing the dynamics of exports in the field of oil and gas from the Republic of Kazakhstan to the members of the European Union. During the study of this topic, we used historical data for the last 20 years, namely quarterly financial data from 1999 to 2019. As a result of the initial analysis, the ranking of the top 5 partners in the European Union was determined. The objectives of studying multiplicative model are seeking to predict the future based on knowledge of the past, manage the process generating the series, try to find out the mechanism underlying the process, and clear the time series of components that obscure its dynamics (Egger, 2003). At the final part we predicted the dynamics of growth and decline in the export of these products between the two trading partners. In the conclusion of this work, we identified the critical internal and external factors that affect the dynamics of growth and decline of this trade model (Baier, 2009).

Multiplicative model

The primary assumption underlying the analysis of time series is as follows: factors affecting the object under study in the present and in the past will change it in the future. Thus, the main goals of time series analysis are to identify and identify factors that are relevant to forecasting (Anderson, 1979). To achieve this goal, many mathematical models have been developed that are designed to study the oscillations of the components included in the time series model. Probably the most common one is the classic multiplicative model for annual, quarterly, and monthly data. As we mentioned above, we used quarterly data from 1999 to 2019.

First of all, we examined the dynamics of growth and recession with the European Union member states as a whole, then based on the total volume of trade in the industry data, and afterwards, we identified the top 5 partners. They are Germany, Italy, France, the Netherlands, and Poland.

For the purpose of analysis and forecasting, we used a multiplicative model of time series analysis:

$$Y_t = S_t \times I_t \times T_t \quad (1)$$

where:

Y_t – time series value
Y_t – seasonal component
Y_t – irregular component
Y_t – trend component

All components comprise historical time series data. The goal is that we want to be able to understand how to export value moves through time and then be able to project that into perhaps next coming years. By the end of this analysis, we should be able to give prediction or forecasts.

Results and discussion

Kazakhstan – the European Union (table 1, figure 1)

As a part of the analysis, it is known that the dynamics of growth in oil and gas exports from the Republic of Kazakhstan to the EU countries had a fluctuating trend. The maximum export volume was recorded in the 3rd quarter of 2013, where it was equal to € 808 082 689. The minimum export volume was in the 1st quarter of 1999, where it was equivalent to € 56 069 136. As you can see, the long-term trend of product exports is obscured by many fluctuations. Thus, visual analysis of the graph does not allow us to say that the data is trending. Considering this issue, we applied the moving average and centred moving average methods. After using these methods, we calculated that the maximum and minimum centred moving values are equal to € 663 353 078 in 3rd quarter, 2013 and € 77 728 036 in 3rd quarter, 1999, respectively.

As a result of the analysis of the multiplicative model of time series there was predicted the dynamics of export of oil and gas of Kazakhstan to the EU for 2020. Thus, 1st quarter is equal to €428 433 854; 2nd quarter is equal to €654 663 179; 3rd quarter is equal to €685 481 701; and 4th quarter is equal to €716 744 895. The dynamics of the time series will be positive from 1st quarter till 4th quarter of 2020.

Kazakhstan – Germany (table 2, figure 2)

As a part of the analysis, it is known that the dynamics of growth in oil and gas exports from the Republic of Kazakhstan to Germany had a fluctuating trend. The maximum export volume was in the 3rd quarter of 2013, where it was equal to € 368 667 412. The minimum export volume was in the 1st quarter of 1999, where it was equivalent to € 16 490 127. As you can see, the long-term trend of product exports is obscured by many fluctuations. Thus, visual analysis of the graph does not allow us to say that the data is trending. Considering this issue, we applied the moving average and centred moving average methods. After using these methods, we calculated that the maximum and minimum centred moving values were equal to € 215 081 565 in 2nd quarter of 2013 and € 19 859 975 in 3rd quarter of 1999, respectively.

As a result of the analysis of the multiplicative model of time series there was predicted dynamics of export of oil and gas of Kazakhstan to

Table 1 Historical data of time series from 1999 till 2020 for export of oil and gas to the EU

t	Year	Quarter	Export value	Moving average (4)	Deseasonalize	Tt	Forecast
81	2019	1	€469 509 710	€514 449 040	€670 728 157	€589 814 726	€412 870 308
82		2	€473 243 627	€507 930 250	€446 456 252	€595 373 135	€631 095 524
83		3	€612 292 986	€515 461 761	€556 629 987	€600 931 545	€661 024 699
84		4	€506 800 720		€444 562 035	€606 489 954	€691 398 548
85	2020	1				€612 048 364	€428 433 855
86		2				€617 606 773	€654 663 180
87		3				€623 165 183	€685 481 701
88		4				€628 723 592	€716 744 895

Source: own elaboration based on ec.europa.eu (2020)

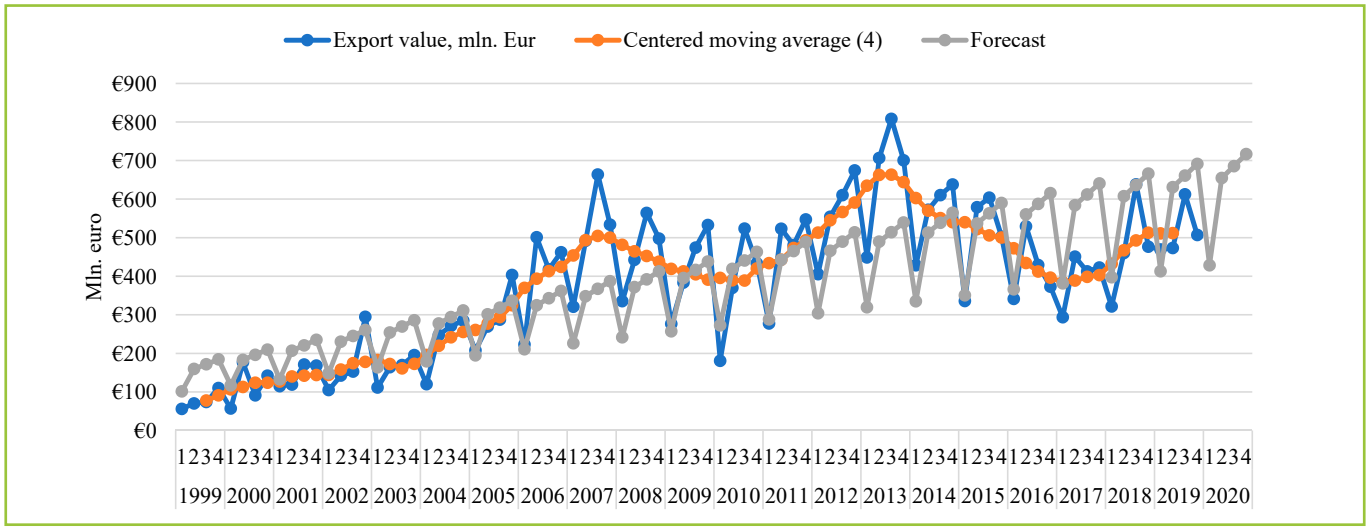

Figure 1 Time Series analysis and forecasts for oil and gas export to the European Union
Source: own elaboration based on ec.europa.eu (2020)

Table 2 Historical data of time series from 1999 till 2020 for export of oil and gas to Germany

t	Year	Quarter	Export value	Moving average (4)	Deseasonalize	Tt	Forecast
81	2019	1	€94 435 874	€124 224 960	€131 046 941	€144 782 631	€104 334 173
82		2	€108 519 976	€107 252 968	€104 046 449	€145 900 169	€152 173 216
83		3	€114 240 743	€101 472 100	€99 348 889	€147 017 707	€169 054 855
84		4	€88 691 806		€82 157 063	€148 135 245	€159 917 868
85	2020	1				€149 252 783	€107 555 482
86		2				€150 370 321	€156 835 565
87		3				€151 487 859	€174 195 059
88		4				€152 605 397	€164 743 575

Source: own elaboration based on ec.europa.eu (2020)

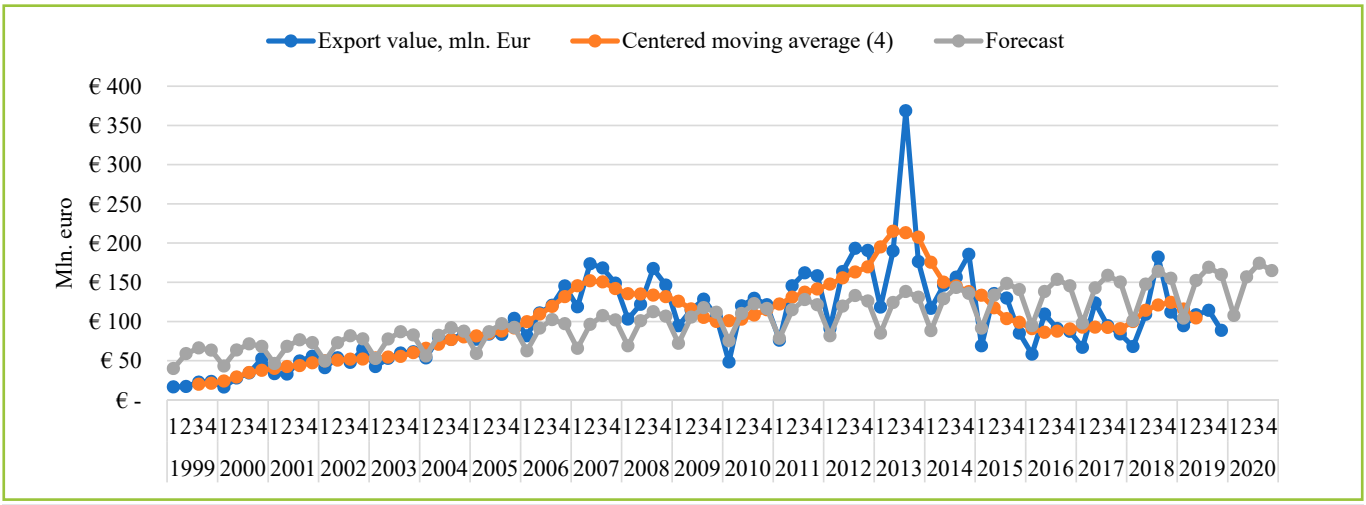

Figure 2 Time Series analysis and forecasts for oil and gas export to Germany
Source: own elaboration based on ec.europa.eu (2020)

Germany for 2020. Thus, 1st quarter is equal to € 107 555 482; 2nd quarter is equal to € 156 835 564; 3rd quarter is equal to € 174 195 058; and 4th quarter is equal to € 164 743 574. The dynamics of time series for 2020 will be positive from 1st till 3rd quarter, and from 3rd quarter to 4th quarter, it will decrease.

Kazakhstan – Italy (table 3, figure 3)

As a part of the analysis, it is known that the dynamics of growth in oil and gas exports from the Republic of Kazakhstan to Italy had a fluctuating trend. The maximum export volume was marked in the 3rd quarter of 2010, where it was equal to € 169 916 522. The minimum export volume was in the 1st quarter of 1999, where it was equivalent to € 3 858 915. As you can see, the long-term trend of product exports is obscured by many fluctuations. Thus, visual analysis of the graph does not allow us to say that the data is trending. Considering this issue, we applied the moving average and centred moving average methods. After using these methods, we calculated that the maximum and minimum centred moving values are equal to € 111 692 650 in 4th quarter in 2018 and € 11 677 127 in 3rd quarter in 2000, respectively.

Table 3 Historical data of time series from 1999 till 2020 for export of oil and gas to Italy

t	Year	Quarter	Export value	Moving average (4)	Deseasonalize	Tt	Forecast
81	2019	1	€144 912 503	€113 446 459	€215 155 314	€83 916 811	€56 520 078
82		2	€73 161 584	€91 401 073	€76 567 982	€84 794 274	€81 021 900
83		3	€67 048 467	€87 452 729	€55 364 585	€85 671 737	€103 751 497
84		4	€64 688 360		€56 831 538	€86 549 199	€98 514 416
85	2020	1				€87 426 662	€58 884 051
86		2				€88 304 125	€84 375 602
87		3				€89 181 587	€108 002 050
88		4				€90 059 050	€102 509 495

Source: own elaboration based on ec.europa.eu (2020)

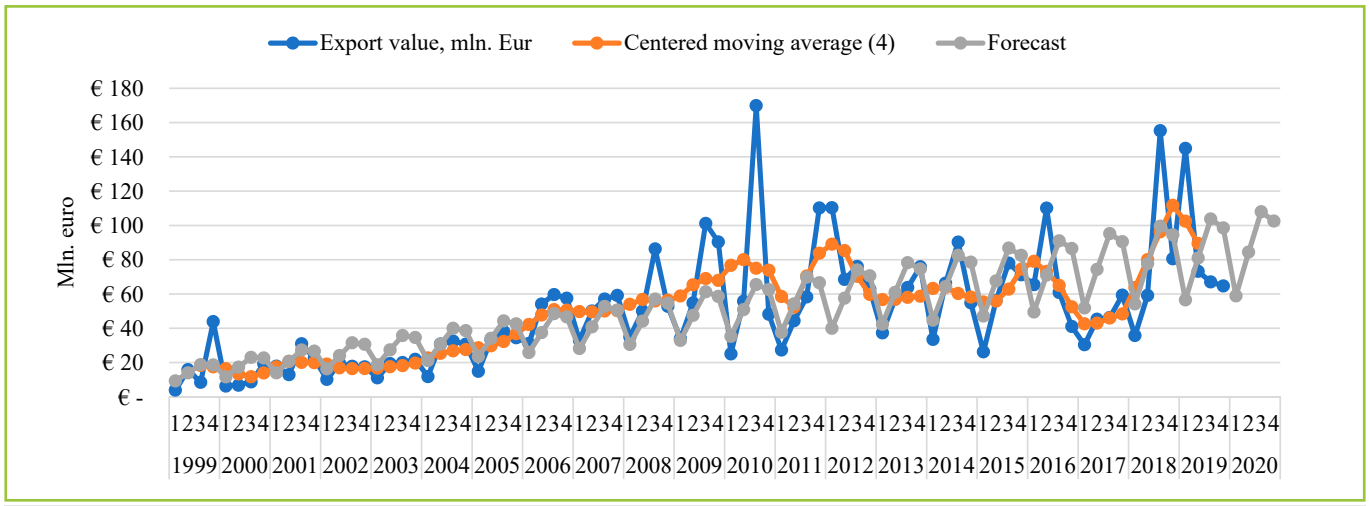

Figure 3 Time Series analysis and forecasts for oil and gas export to Italy
Source: own elaboration based on ec.europa.eu (2020)

As a result of the analysis of the multiplicative model of time series there was predicted the dynamics of export of oil and gas of Kazakhstan to Italy for 2020. Thus, 1st quarter is equal to € 58 884 050; 2nd quarter is equal to € 84 375 602; 3rd quarter is equal to € 108 002 050 and 4th quarter is equal to € 102 509 495. The dynamics of time series for 2020 will be positive from 1st till 3rd quarter, and from 3rd quarter to 4th quarter will decrease.

Kazakhstan – France (table 4, figure 4)

As a part of the analysis, it is known that the dynamics of growth in oil and gas exports from the Republic of Kazakhstan to France had a significant fluctuating trend. The maximum export volume was in the 2nd quarter of 2006, where it was equal to € 166 995 943. The minimum export volume was

Table 4 Historical data of time series from 1999 till 2020 for export of oil and gas to France

t	Year	Quarter	Export value	Moving average (4)	Deseasonalize	Tt	Forecast
81	2019	1	€19 006 298	€25 300 352	€29 132 163	€51 653 430	€33 699 540
82		2	€28 974 487	€41 922 110	€25 255 751	€52 065 542	€59 731 836
83		3	€97 669 017	€45 232 422	€111 887 169	€52 477 653	€45 809 013
84		4	€35 279 887		€29 777 256	€52 889 764	€62 663 428
85	2020	1				€53 301 876	€34 775 013
86		2				€53 713 987	€61 623 004
87		3				€54 126 099	€47 247 981
88		4				€54 538 210	€64 616 495

Source: own elaboration based on ec.europa.eu (2020)

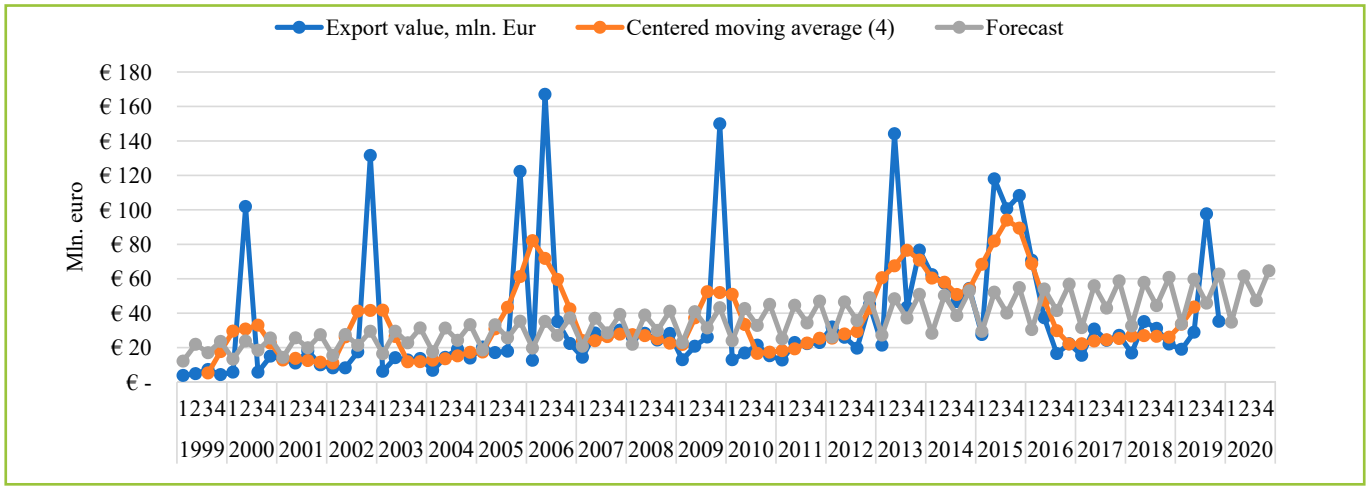

Figure 4 Time Series analysis and forecasts for oil and gas export to France
Source: own elaboration based on ec.europa.eu (2020)

in the 1st quarter of 1999, where it was equivalent to € 3 876 695. As you can see, the long-term trend of product exports is obscured by many fluctuations. Thus, visual analysis of the graph does not allow us to say that the data is trending. Considering this issue, we applied the moving average and centred moving average methods. After using these methods, we calculated that the maximum and minimum centred moving values are equal to € 93 997 970 in 3rd quarter in 2015 and € 5 315 431 in 3rd quarter in 1999, respectively.

As a result of the analysis of the multiplicative model of time series there was predicted the dynamics of export of oil and gas of Kazakhstan to France for 2020. Thus, 1st quarter is equal to € 34 775 013; 2nd quarter is equal to € 61 623 003; 3rd quarter is equal to € 47 247 981 and 4th quarter is equal to € 64 616 495. The dynamics of the time series for 2020 will be positive from 1st to 2nd and 3rd to 4th quarters.

Kazakhstan – the Netherlands (table 5, figure 5)

As a part of the analysis, it is known that the dynamics of growth in oil and gas exports from the Republic of Kazakhstan to the Netherlands had a fluctuating trend. The maximum export volume was in the 4th quarter of 2012, where it was equal to € 52 360 782. The minimum export volume was in the 4th quarter of 1999, where it was equivalent to € 3 613 666. As you can see, the long-term trend of product exports is obscured by many fluctuations. Thus, visual analysis of the graph does not allow us to say that the data is trending. Considering this issue, we applied the moving average and centred moving average methods. After using these methods, we calculated that the maximum and minimum centred moving values were equal to € 43 801 802 in 4th quarter in 2012 and € 4 628 571 in 3rd quarter, 1999, respectively.

As a result of the analysis of the multiplicative model of time series there was predicted the dynamics of export of oil and gas of Kazakhstan to the Netherlands for 2020. Thus, 1st quarter is equal to € 36 748 945; 2nd quarter is equal to € 42 292 080; 3rd quarter is equal to € 42 767 699 and 4th quarter is equal to € 47 908 338. The dynamics of time series will be positive from 1st quarter till 4th quarter of 2020.

Kazakhstan – Poland (table 6, figure 6)

As a part of the analysis, it is known that the dynamics of growth in oil and gas exports from the Republic of Kazakhstan to Poland had a fluctuating trend. The maximum export volume was in the 3rd quarter of 2019, where it was equal to € 74 563 190. The minimum export volume was in the 1st quarter of 2000, where it was equivalent to € 2 318 207. As you can see, the long-term trend of product exports is obscured by many fluctuations. Thus, visual analysis of the graph does not allow us to say that the data is trending. Considering this issue, we applied the moving average and centred moving average methods. After using these methods, we calculated that the maximum and minimum centred moving values were equal to € 39 633 463 in 1st quarter in 2013 and € 3 140 391 in 3rd quarter, 1999, respectively.

As a result of the analysis of the multiplicative model of time series there was predicted the dynamics of export of oil and gas of Kazakhstan to Poland for 2020. Thus, 1st quarter is equal to € 28 581 488; 2nd quarter is equal

Table 5 Historical data of time series from 1999 till 2020 for export of oil and gas to the Netherlands

t	Year	Quarter	Export value	Moving average (4)	Deseasonalize	Tt	Forecast
81	2019	1	€28 524 534	€36 857 173	€32 659 433	€40 542 147	€35 409 245
82		2	€42 633 225	€38 671 540	€42 802 021	€40 925 623	€40 764 227
83		3	€42 648 921	€39 415 285	€42 724 014	€41 309 099	€41 236 493
84		4	€43 854 459		€39 568 764	€41 692 574	€46 208 299
85	2020	1				€42 076 050	€36 748 945
86		2				€42 459 526	€42 292 080
87		3				€42 843 001	€42 767 700
88		4				€43 226 477	€47 908 339

Source: own elaboration based on ec.europa.eu (2020)

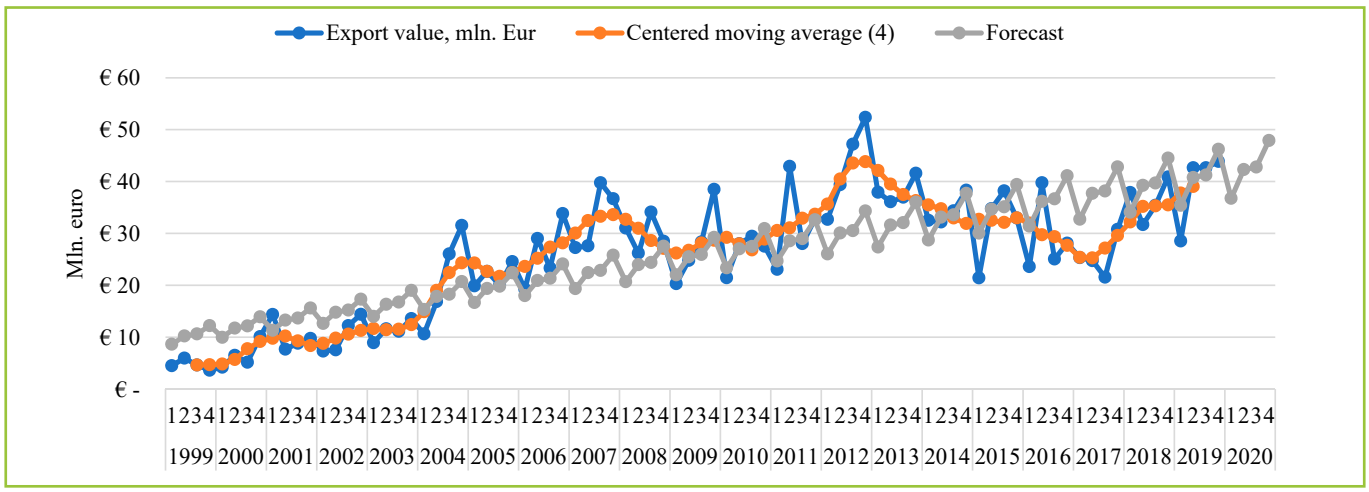

Figure 5 Time Series analysis and forecasts for oil and gas export to the Netherlands
Source: own elaboration based on ec.europa.eu (2020)

Table 6 Historical data of time series from 1999 till 2020 for export of oil and gas to Poland

t	Year	Quarter	Export value	Moving average	Deseasonalize	Tt	Forecast
81	2019	1	€22 339 738	€32 704 713	€34 125 911	€41 746 995	€27 328 705
82		2	€43 320 598	€43 034 482	€43 415 316	€42 225 429	€42 133 307
83		3	€74 563 190	€48 023 072	€66 760 244	€42 703 864	€47 695 097
84		4	€51 868 760		€43 081 299	€43 182 298	€51 990 359
85	2020	1				€43 660 732	€28 581 488
86		2				€44 139 167	€44 042 870
87		3				€44 617 601	€49 832 512
88		4				€45 096 035	€54 294 449

Source: own elaboration based on ec.europa.eu (2020)

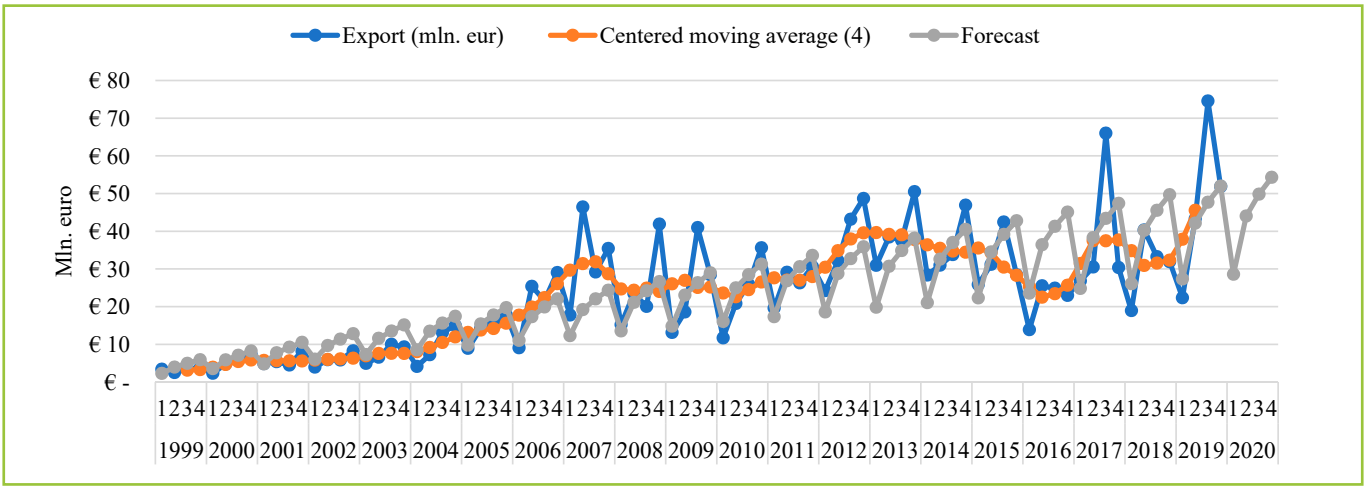

Figure 6 Time Series analysis and forecasts for oil and gas export to Poland
Source: own elaboration based on ec.europa.eu (2020)

to € 44 042 869; 3rd quarter is equal to € 49 832 511 and 4th quarter is equal to € 54 294 449. The dynamics of time series will be positive from 1st quarter till 4th quarter of 2020.

Conclusions

The purpose of the research paper was to analyse the oil and gas trade between Kazakhstan and the European Union using a time series model to examine Kazakhstan's oil and gas trade flow, in order to describe its top 5 trade partners in the EU, also providing objective information on the results and prospects of development of cooperation between Kazakhstan and the European Union in the field of oil and gas trade. In order to analyse Kazakhstan's oil and gas trade with the European Union, we conducted statistical macro and micro analyses, such as time series, namely multiplicative model in order to predict future trends and trading potentials of the two markets and identify Kazakhstan's top 5 partners in the European Union trade in oil, gas and oil products and give a forecast of dynamics of oil and gas export from Kazakhstan to the European Union members. Based on the results, we identified the top 5 partners of Kazakhstan in the European Union. They are Germany, Italy, France, the Netherlands, and Poland.

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