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DYNAMIC INTERRELATIONSHIPS BETWEEN EAEU FOREIGN TRADE AND MACROECONOMIC INDICATORS: AN EMPIRICAL ANALYSIS

International trade contributes to the development of Eurasian Economic Union (EAEU) as a regional integration alliance and, as stated by classical economists, plays a decisive role in the economic growth of any country (region). Most studies of EAEU international trade flow analysis focus on the trade component. The present paper attempts to display the connection between EAEU trade and macroeconomic indicators. The applied technical methods of statistical analysis have enabled the researchers to evaluate SARIMA models for export and import, and forecast EAEU 2020 trade dynamics based on these models. Then keeping in mind, the idea that the basis of the constructed model is the assumption that the series will maintain its trend, the actual value was simply subtracted from the forecast value to measure the 2020 shock effect. Due to the fundamental methods of statistical analysis the EAEU member countries' trade and macroeconomic indicators elasticity ratios have been calculated, which are likely to measure the impact rate and become new empirical knowledge in assessing the interaction of trade turnover and the economic growth of the countries.

Keywords: *EAEU international trade, export, import, trade structure, ARIMA, elasticity ratios*
JEL: F10, F17
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Introduction. EAEU, established in 2015 by Belarus, Kazakhstan and Russia, is a young international organization of regional economic integration (Eurasian Studies, 2020). Today, the union consists of five member countries (Armenia, Belarus,

Kazakhstan, Kyrgyzstan and Russia), which have undertaken to create favorable conditions for sustainable development of member states and improve the nations' living standards (Mišević P, 2021, p. 187-195). However, looking from the standpoint of the current stages of classical regional integration among the EAEU responsibilities undertaken, the Eurasian Customs Union is the only to function, thus making the trade flow analysis of the EAEU countries even more topical.

Most EAEU trade studies in economic literature emphasize the analysis of trade indicator dynamics and structure. Based on the analysis of the EAEU - third countries, trade flows, dynamics, structure and geography, the interaction rates of the EAEU trade turnover and macroeconomic indicators have been measured, thus resulting in identifying the interaction between the dynamics of trade turnover volume and resource use.

Literature Review. In modern economic literature there are many studies on the interrelations of international trade and macroeconomic indicators of countries. It should be noted that studies have been conducted for various countries and regions applying different variables and methodologies. A critical analysis of such studies will help us better understand the potential role of the international trade on economic growth and macroeconomic indicators.

The international trade balance is one of the components of GDP and can have a positive or negative effect on the GDP of a country and consequently on its economic growth rate (Sujova A., Simanova L. at al, 2021).

However, according to Belloumi and Alshehry, this interaction can be positive if countries are specialized in producing goods, for the production of which they have resources and comparative advantages (Belloumi M., Alshehry A., 2020). According to the international trade theories (Maureen W, 2015, p. 71-85) specialization enables countries to focus on their core products, thus being more resource-efficient (Nazarczuk J. M., Uminski S., and Gawlikowska-Hueckel K., 2018). The article entitled "EAEU: The analysis of the current state and perspective vectors of cooperation" (2019) written by K. Podkina, is quite interesting and worth considering in this context. Presenting a qualitative evaluation of the EAEU current economic state through SWOT analysis, the author concludes that it is possible for the EAEU to become a world supplier of raw materials in case of optimal use of resources. It can be implied that the EAEU has a comparative advantage in producing and exporting items that use more resources.

Considering the geographical distribution of international trade, we can turn to the theory of new economic geography by M. Fujita and P. Krugman (2013), though it can hardly be called an international trade theory, nevertheless the authors put together the countries' trade and location aspects from the angle of economies of scale. The theory of new economic geography highlights the benefits of international trade among cooperating countries which are geographically close. However, in his article "EAEU-EU foreign economic cooperation; strategy, dynamics and growth conditions" N. Yevchenko (2021) analyzes the trade dynamics of geographically close EAEU and EU and concludes that regardless of EU being an important and in some respects a central partner for EAEU, the trade volumes tend to decline due to tough political processes as shown by absolute and relative indicators.

In another article "EAEU: analysis from a trade policy perspective" (Giucci R., Mdinaradze A., 2017) the authors discuss the significance of the EAEU member states in the world economy due to different macroeconomic indicators, then compare EAEU-EU trade/customs policies. They arrive at a conclusion that the EU, being the main trade partner of the EAEU, is not complementary to the latter.

The EAEU trade flow analysis is on the agenda of the annual international conference on economic and social development problems. Thus, the annual report series "Evaluation of the EAEU trade integration processes" (2020) presents the approaches and methods of measuring the integration process in trade. The indicators of

service trade, between the EAEU and its major trade partner alliances, as well as the methods and approaches of studying trade dynamics are discussed there. Moreover, it presents a methodology for modeling and measuring the effects of GDP and investments on the trade turnover. The authors come to a conclusion that the EAEU needs to create a united service market with the third countries which will become an intensive trigger for mutual trade development.

A number of studies have been conducted to evaluate the preliminary and further consequences of economic integration on the Eurasian continent. Felbermayer and Gröschl, e.g., have applied a common balance model to initially measure the effects of the possible agreement on free trade from Lisbon to Vladivostok. Studying various scenarios they have come to a conclusion that there is a remarkable potential in additional trade of goods and services between EAEU and EU. The authors find that the possible free trade agreement, compared to 2011, is likely to increase the Russian exports to the EU by 32 % and Armenian exports by 80%. Belarus and Kazakhstan may double their exports (Felbermayr and Gröschl, 2017, p. 52-62).

The studies dedicated to time series modeling of international trade apply the following technical methods of analyzing time series: autoregressive, vector autoregressive, trend method, additive, multiplicative and so on. ARIMA is the method most widely used for this purpose. In the course of numerous studies ((Keck, Raubold, Truppia, 2009), (Burgert M., Dées S., 2008), (Khan T. 2011), (Rafiq,Yun, Ali, 2016) the authors have concluded that the given models are rather effective and the forecasts, which have used these models, are quite accurate and realistic.

In the studies of international trade and macroeconomic indicators the main focus is on assessing the link between trade and GDP. The gravity model of international trade is the one most used for modeling that connection (Isard, 1954). This model predicts bilateral trade flows considering the link in countries' GDPs and the distance between them. The model has continuously been modified, adding other variables to it.

GDP modeling theories are divided into those explained by demand and supply. The classical/new-classical authors explain the GDP model by supply factors presenting GDP as a production depending on labor and capital (Cobb, Douglas, 1928), while the representatives of Keynesian theory explain the GDP model by demand factors; they particularly promote the idea of marginal propensity to import (MPM) for modeling the international trade: MPM is the proportion of change in the volume of imports due to a change in income (Keynes, 1973). This means that the income growth of the firms and households increases or decreases the demand of imports. The countries that consume more imports, at the same time increasing the income of their population, make a significant impact on the world trade. As a rule, the developed countries, within their limits of natural resources, have a lower MPM than the developing ones without those resources.

Thus, most studies in this field present the dynamics of the international trade and macroeconomic indicators and conclusions drawn on those trends.

Research methodology. This research has applied a set of statistical analysis and modeling tools. In order not to deviate from our goal, we have combined the tools of technical and fundamental analysis. The use of technical analysis tools is justified by the fact that the components of time series rely on factors to describe the series without naming those factors: trend is the effect of long-term factors while seasonality - short-term; false variables describe instant factors, cyclical component shows the business cycle effects, whereas the casual component, not taking the remaining factors into account, describes occasional factors. A time series analysis displaying EAEU-third countries trade flows has been carried out by means of dynamics sequential and basic indicators[1].

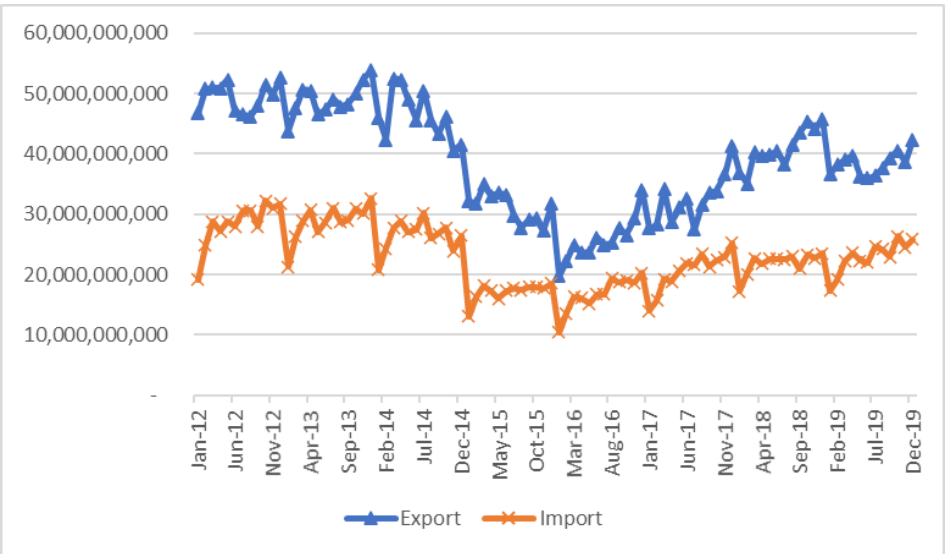
[1] https://univer-nn.ru/statistika/pokazateli-dinamiki-temp-rosta-i-prirosta/ Accessed 18/05/2020

The most flexible tool describing the time series dynamics – the SARIMA model (p,d,q) (P,D,Q,) [m] (Jonathon, Cryer, Chan, 2008, p. 191-245) has been applied in this research. The model encloses several other models like autoregressive, sliding median as well as integration model with their seasonal demonstrations (seasonal auto-regression, drift, sliding median component).

The data have been prepared and passed a preliminary processing with MS Excel software package. The calculations are made with R 3.6.0 software[2]. Factor regression models have been built as a fundamental analysis tool, and elasticity analysis has been conducted based on these models.

Analysis and discussion. The basis for the formation of any integration union is the large volume of mutual trade between the cooperating countries. Further deepening of economic integration processes within the EAEU is part of the economic development policy of the member states, which will allow the cooperating countries to get out of the raw material "trap" in the near future, to pursue the path of building an innovative and knowledge-based economy (Galoyan, 2014, p. 140-150). Although one of the main directions in the regional integration process for the EAEU countries is the deepening and expansion of trade relations within the Customs Union, nevertheless, the strengthening of trade relations with the third countries of the world is of paramount importance, especially from the context of cooperation with other integration structures, investment growth, knowledge and technologies acquirement.

To begin, let us introduce the subject matter of the research by presenting the dynamics (Figure 1) and the descriptive statistics (Table 1) of the data used, which includes monthly data from 2012 to 2019, and is used for modeling up to 2020.



Source: *eabr.org*

Figure 1. ***EAEU export, import dynamics***

[2] https://www.r-project.org/, Accessed 18/05/2020

Table 1

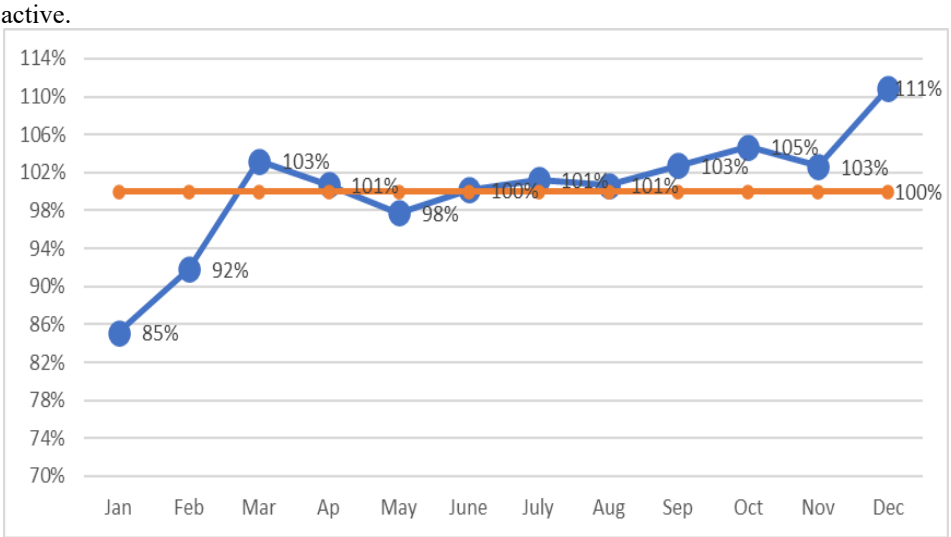
Descriptive statistics of the time series

Statistics	*Export*	*Import*
Mean	39,140,115,845.11	22,872,463,536.83
Standard Error	906,385,616.11	522,987,643.07
Median	39,678,823,482.00	22,634,768,901.00
Mode	-	-
Standard Deviation	8,880,729,078.67	5,124,211,469.26
Variation coefficient	23%	22%
Kurtosis	(1.07)	(0.81)
Skewness	(0.18)	(0.01)
Range	34,085,666,508.00	22,288,036,827.00
Minimum	19,736,749,197.00	10,384,249,726.00
Maximum	53,822,415,705.00	32,672,286,553.00
Count	96.00	96.00
Largest(1)	53,822,415,705.00	32,672,286,553.00
Smallest(1)	19,736,749,197.00	10,384,249,726.00

We will also examine the behavior of the data throughout the year by analyzing its seasonality.

Seasonality analysis of export-import dynamics series.

In order to measure the sensitivity to the seasonality of the EAEU external trade flows, an analyze of the seasonality of the export-import monthly time series was done, which gave an idea of the cycles of seasonal peaks of the EAEU external trade flows. This means, we can measure the harm if we skip a season of activity, and the benefit, if we start the activity season earlier. To quantify the seasonality wave, seasonality indices were calculated by months (Figure 2). The seasonality index is calculated based on the aggregation of values recorded in different years in the same season. To obtain the relative index, this aggregation value is divided to cumulative value reflecting the overall trend of all seasons. The seasonality of the gross trade turnover, Figure 2 shows that the EAEU carries out the most intensive foreign trade in December, and the most passive in January. The seasonality index is less than 100% only in case of 3 months, which means that during the remaining 9 months the EAEU trade turnover is quite active.



Source: *own calculations*

Figure 2. ***EAEU Gross Trade Turnover Seasonality Indices***

EAEU trade turnover analysis with SARIMA model.

To get a more general picture, the SARIMA model (Jonathon D. Cryer, Chan K.S., 2008, p. 191-245) was applied not to the trade turnover time series, but separately to the export-import time series indicators, covering the period up to COVID-19. Afterwards, on the basis of the models built, the export and import were forecast. At the same time, the difference between the forecast values and the actually recorded values of the first 9 months of 2020-2021 period will be considered as the effect of COVID-19.

Export: The order of component I was selected by the analysis of the stationary series of export dynamics. Based on the graphs of autocorrelation and partial autocorrelation functions, the corresponding AR, seasonal AR and MA components were selected. Akaike (AIC), Bayesyan (BIC) and other criteria that show the quality of the approximation (mean approximation error, mean absolute error, mean absolute percentage error, etc.) were used to determine the degree of more accurate approximation.

As a result, the SARIMA (0,1,0) (0,0,0) [12] model was chosen to describe the EAEU monthly export time series. The results of the model evaluation show that the quality of the model approximation is high, because the average, average percentage errors (MPE=0.63%) are less than 5%, and the average absolute percentage, average absolute square errors (MAPE=7.44%, MASE=0.41%) are less than 10%.

Having subtracted the actual values from the forecast values, it turns out that the average decrease in export conditioned by COVID-19 is 7.4 billion USD or 27%. Moreover, since June 2021, the situation has already stabilized, even improved as actual forecast is >0.

Import: The order of component I was selected by the stationary analysis of the import dynamics series. Based on the graphs of autocorrelation and partial autocorrelation functions, the corresponding AR, seasonal AR and MA components were selected. Akaike (AIC), Bayesyan (BIC) and other criteria that show the quality of the approximation (mean approximation error, mean absolute error, mean absolute percentage error, etc.) were used to determine the degree of more accurate approximation.

As a result, the SARIMA (3,1,0) (0,1,2) [12] model was chosen to describe the monthly EAEU import time series.

The results of the model evaluation are presented in Table 2.

Table 2

Evaluation results using the SARIMA model of the EAEU import dynamics series

SARIMA (3,1,0) (0,1,2) [12]	
Model estimation results	
Coefficient	**Value**
ar1	-0.4482
ar2	0.0980
ar3	0.3661
sma1	-0.217
sma2	-0.3525

Where:

ar1, ar2, ar3 are correspondently 1st, 2nd, 3rd order autocorrelation coefficients
sma1, sma2 - 1st, 2nd order seasonal moving average coefficients

From Table 2. we can see that 1 order autoregression has negative impact and next 2 orders have positive impact on dependent variable. And seasonal ma coefficients are both negative. The results of the model evaluation show that the quality of the model approximation is high, because the average percentage errors (MPE=0.35%) are less than 5%, and the average absolute percentage, average absolute square errors (MAPE=4.34%, MASE=0.28%) are less than 10%.

Subtracting the actual values from the forecast values, it turns out that on average, the decrease in import due to COVID-19 is 2.1 billion USD or 10%. Moreover, the situation has already been stabilizing since March 2021, and the actual values are almost no different from the values predicted by the model.

The concept of modeling the process prior to the shock, predicting values during the shock, and then comparing them to the actual values to determine the difference, which signifies the impact of the shock, is a means to truly comprehend the shock wave's effects. Merely subtracting 2019 from 2020 yields an absolute growth value that does not provide an accurate representation of the situation. This method only displays the difference between 2020 and 2019, while the forecast value derived from the model contains the trend or pattern of the series. Therefore, the forecast value reveals how the series would have behaved if the shock situation had not taken place.

The connection between the EAEU foreign trade and macroeconomic indicators.

To find out the connection between foreign trade and macroeconomic indicators of the EAEU the following indicators were chosen: for foreign trade - import, export and trade turnover, for macroeconomic indicators - GDP_{EAEU}, $GDP_{\text{key partners}}$, quantity of employed, investments in fixed capital. All indicators are annual.

Eurasian Commission proposes to consider the dependence between foreign trade and GDP_{EAEU}: Trade turnover = c1+c2 x GDP_{EAEU} + ε

On the other hand, according to classical theory (Cobb C.W., Douglas P.H., 1928, p. 139-165) GDP is a function from labor and capital. As an indicator of labor force we shall take the number of employees, and as an indicator of capital - investments in fixed capital. The result is the following.

$$\begin{cases} Trade\ turnover\ = c_1 + c_2 * GDP_{EAEU} + \acute{\varepsilon}_1 \\ GDP_{EAEU}\ = c_3 + c_4 * L + c_5 * K + \acute{\varepsilon}_2 \end{cases} \quad (1)$$

Thus, system (1) was used as the basis for the analysis.

Partial elasticity coefficients were calculated by the formula given below:

$$E = \frac{\partial Y}{\partial X_i} \times \frac{\bar{X}_i}{\bar{Y}} \quad (2)$$

Where:

$\bar{Y}$ – is the average of the time series of dependent variable,

$\bar{X}_i$ – is i-th regressor's average value,

$\frac{\partial Y}{\partial X_i}$ - shows how much Y will change if X_i changes by one unit, that is, the coefficients of the regressors in the model

The following coefficients of elasticity were excluded from the correlation-regression analysis:

Average elasticity coefficient	*Value*
$E_{GDP}^{Trade.}$	1.02
E_{L}^{GDP}	2.73
E_{K}^{GDP}	0.86

According to the data, a 1% change in the EAEU GDP leads to a 1.02% change in trade turnover. A 1% change in the number of the employed leads to a 2.73% change in the EAEU GDP (strong impact) and a 1% change in the ratio of investments in fixed capital leads to a change of 0.86% of GDP.

Based on the above mentioned, we can calculate the following cross-elasticities:

- Trade Turnover - Capital,
- Trade Turnover – Labor.

Thus, 1% increase in the number of the employed leads to an increase of GDP by 2.73%, which in turn leads to an increase in trade turnover of 1.02 * 2.73 = 2.78%. 1% increase of investment in fixed capital leads to an increase of 0.86% of GDP, which in turn leads to an increase in trade turnover of 1.02 * 0.86 = 0.88%.

Nowadays reality: Comparing the official sources of the Russian Federation and the trade data of the EAEU countries, we have the following picture. According to an official source in the Russian Federation[3], cumulative exports for 9 months of 2022 amounted to $ 431 billion, and imports - $ 180 billion. For 9 months of 2021, these figures amounted to $ 340 billion and $ 218 billion, respectively. It turns out that Russia's exports have increased by 27% compared to 2021, and imports decreased by 18%. The trade surplus has doubled from $121 billion to $ 251 billion. Let's exclude trade with the EAEU countries from this number[4]. It turns out about $396 billion of exports and $166 billion of imports took place outside the EAEU. The same indicator in 2021 amounted to $309 billion exports and $196 billion imports. It turns out that Russia's exports to non-EAEU countries have increased by 8%, whereas imports decreased by 28%.

Currently, the Russian economy is under the influence of a shock, to overcome which irrational economic and foreign policy approaches and tools are used. As a result, the behavior of the simulated variables in this study differs significantly from the real one. However, given the fact that, for example, from the point of view of exports, the Russian Federation has found new markets and exports have grown, the model built to describe exports is adequate. The import model will sooner or later approach its normal behavior when the Russian Federation finds another source of external imports replacing the EU. Macroeconomic indicators will also return to their normal behavior when the Russian economy comes out of the shock period, ***at least, the economic literature claims, that, in the end, the countries come out of the crisis.***

Conclusion. The analysis of trade flows of the EAEU with the third countries revealed the dynamics, seasonality of those flows, and the analysis of the dynamics of 2020/2019 showed the effect of COVID-19 on the EAEU foreign trade.

In 2020, compared to 2019, the EAEU export decreased by 95.9 mln USD or 21%. From the geographical point the decrease was due to the decline in export to the EU and from the structural view the decrease was conditioned by the decline of export of raw materials. During the same period, import decreased by 15.2 mln USD or 5.5%. The decrease was due to the decline of import (machinery and chemical products).

The analysis shows, that in dynamics the EAEU export-import geographies are changing in the same direction. This is a consequence of the change in the vector of the EAEU trade policy from the EU to the APEC.

The analysis of seasonality indices shows that COVID-19 had no essential effect on either export or import seasonality.

The results of the analysis and forecast of the SARIMA model show that COVID-19 effected export by about 27% and import by 10% decrease. At the same time, since the second quarter of 2021 the situation has stabilized. Thus, COVID-19 had a greater impact on the EAEU export rather than import, both by annual and monthly analysis.

In order to reveal the connection between the EAEU foreign trade and macroeconomic indicators a system of regression equations has been evaluated. The need to build the system was due to the dual role of the regressor as an explanatory variable of GDP. On the one hand, GDP acted as an explanatory factor for estimating

[3] https://www.rbc.ru/economics/05/01/2023/63a449789a79477778972b81

[4] https://www.armstat.am/am/?nid=160 , https://www.nbrb.by/statistics/foreigntrade, https://stat.gov.kz/official/industry/31/statistic/7 In the absence of statistical data, an approximation of the increase in heat was applied.

the impact on variation in trade, on the other hand, it was an explanatory variable. This approach made it possible to calculate the coefficients of indirect elasticity between the factors that determine GDP and trade turnover.

The results of modeling the relationship between trade and macroeconomic indicators showed that the elasticity of labor is greater than that of capital, that is, one unit of labor yields more output than one unit of capital. The effect of trade turnover - GDP scale is about 1, that is, 1% GDP growth leads to 1.02% growth of trade turnover.

Taking into account the fact that the main player of the EAEU is the Russian Federation, we can state that about 80-85% of foreign trade accounts for the Russian Federation, it can be concluded that, in general, imports in the EAEU foreign trade have sharply decreased due to sanctions. That is, the Russian Federation has simply changed its trade vector in terms of exports, and imports have decreased due to sanctions (High-Tech main products, machinery equipment from the EU, etc.).

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