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THE IMPACT OF THE ASSOCIATION AGREEMENT WITH THE EU ON UKRAINE, GEORGIA, AND MOLDOVA: VAR-MODEL, MONETIZATION INDEX, CUSTOMER PRICE INDEX.

ВПЛИВ УГОДИ ПРО АСОЦІАЦІЮ З ЄС НА УКРАЇНУ, ГРУЗІЮ ТА МОЛДОВУ: VAR-МОДЕЛЬ, ІНДЕКС МОНЕТИЗАЦІЇ, ІНДЕКС СПОЖИВЧИХ ЦІН.

ВЛИЯНИЕ ДОГОВОРА ОБ АССОЦИАЦИИ С ЕС НА УКРАИНУ, ГРУЗИЮ И МОЛДОВУ: VAR-МОДЕЛЬ, ИНДЕКС МОНЕТИЗАЦИИ, ИНДЕКС ПОТРЕБИТЕЛЬСКИХ ЦЕН.

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Abstract. *This article assesses the impact of the association agreement with the European Union on Georgia, Ukraine, and Moldova. The monetization index is the ratio of the money supply of the M2 aggregate to the GDP of the studied economy. The consumer price index reflects the change in the value of a certain consumer basket. This index is the ratio of the money supply of the M2 aggregate to the GDP of the analyzed economy. The article substantiates the expediency of using such particular indicators due to their monthly update and lower susceptibility to artificial manipulation. For each country, two specific time periods were selected, before and after the entry into force of the association agreement with the European Union. The time intervals were chosen to exclude abnormal events that could affect the accuracy and objectivity of the study. The data obtained were reduced to a general form through econometric transformations. For the selected time intervals, using vector autoregression and the Granger causality test, the dependences of the analyzed indicators of each country on such indicators of the euro area were determined. The*

dependence coefficients of the Granger causality test were compared for the time periods before and after the association agreement for each country. Based on the transformed monetization index and consumer price index, conclusions were drawn regarding the change in the degree of mutual influence of the European Union economy on the economies of the countries represented. The conclusions analyze the possible reasons for the data obtained, as well as compare the geographical and economic conditions of each country in the context of the results of the study. The impact of the association agreement with the European Union on the overall economic dependence of Georgia, Ukraine and Moldova on the European Union has been assessed. The countries actively participate in European integration. The study builds an understanding of the depth of integration of each country, as well as analyzes the dynamics of its change in recent periods.

Key words: *VAR model, monetization index, M2 aggregate, money supply, Georgia, Moldova, Ukraine, European integration, Customer Price Index, Granger causality test*

Анотація. *У цій статті досліджується вплив договору про асоціацію з Європейським Союзом на Грузію, Україну та Молдову. У якості аналізованих індикаторів було обрано індекс монетизації економіки та індекс споживчих цін, а індекс споживчих цін відображає зміну вартості певного споживчого кошика. Такий індекс обчислюється через відношення грошової маси агрегату М2 до ВВП економіки, що досліджується. Стаття розглядає доцільність використання саме таких показників з точки зору їх щомісячного оновлення, а також меншої схильності до штучних маніпуляцій. Для кожної країни було виділено два конкретні часові відрізки, до і після набрання чинності договору між країнами та Європейським Союзом про асоціацію. Часові відрізки обрані з урахуванням виключення аномальних подій, які б вплинути на точність і об'єктивність дослідження. Отримані дані було приведено до загального вигляду через економетричні перетворення. Для обраних часових відрізків шляхом векторної авторегресії та тесту причинності Грейнджера було визначено залежності аналізованих показників кожної країни від таких показників для зони євро. Зроблено порівняння коефіцієнтів залежності тесту причинності Грейнджера для тимчасових відрізків до та після договору про асоціацію з ЄС для кожної країни. На підставі конвертованого індексу монетизації та індексу споживчих цін зроблено висновки щодо зміни рівня взаємного впливу економіки Європейського Союзу на економіки представлених країн. У висновках аналізуються можливі причини отриманих даних, а також проводиться порівняння географічних та економічних умов кожної країни у розрізі результатів дослідження. Здійснено оцінку впливу договору про асоціацію з Європейським Союзом на загальну економічну залежність Грузії, України та Молдови від економіки Європейського Союзу. Країни активно беруть участь у європейській інтеграції. У процесі дослідження створюється розуміння глибини інтеграції кожної країни, а також аналізується динаміка її змін за останні періоди.*

Ключові слова: *модель VAR, індекс монетизації, агрегат М2, грошова маса, Грузія, Молдова, Україна, Європейська інтеграція, індекс споживчих цін, тест причинності Грейнджера*

Аннотация. *В данной статье оценивается влияние договора об ассоциации с Европейским Союзом на Грузию, Украину и Молдову. В качестве анализируемых индикаторов было выбрано индекс монетизации экономики и индекс потребительских цен. Индекс монетизации является отношением денежной массы агрегата М2 к ВВП исследуемой экономики, а индекс потребительских цен отражает изменение стоимости определенной потребительской корзины. Статья рассматривает целесообразность использования именно таких показателей с точки зрения их ежемесячного обновления, а так же меньшей подверженности к искусственным манипуляциям. Для каждой страны было выделено два конкретных временных отрезка, до и после вступления в силу договора об ассоциации с Европейским Союзом. Временные отрезки выбраны с учетом исключения аномальных событий, которые могли бы повлиять на точность и объективность*

исследования. Полученные данные были приведены к общему виду через эконометрические преобразования. Для выбранных временных отрезков путем векторной авторегрессии и теста причинности Грейнджера были определены зависимости анализируемых показателей каждой страны от таких показателей зоны евро. Произведено сравнение коэффициентов зависимости теста причинности Грейнджера для временных отрезков до и после договора об ассоциации для каждой страны. На основании преобразованных индекса монетизации и индекса потребительских цен сделаны выводы касательно изменения степени взаимного влияния экономики Европейского Союза на экономики представленных стран. В выводах анализируются возможные причины полученных данных, а так же производится сравнение географических и экономических условий каждой страны в разрезе результатов исследования. Произведена оценка влияния договора об ассоциации с Европейским Союзом на общую экономическую зависимость Грузии, Украины и Молдовы от Европейского Союза. Страны активно принимают участие в европейской интеграции. В процессе исследования выстраивается понимание глубины интеграции каждой страны, а так же анализируется динамика ее изменения за последние периоды.

Ключевые слова: *модель VAR, индекс монетизации, агрегат М2, денежная масса, Грузия, Молдова, Украина, Европейская интеграция, индекс потребительских цен, тест причинности Грейнджера*

General statement of problem. European integration involves the gradual reform and adoption of agreements with the European Union. One such step is the signing of the Association Agreement. Georgia, Ukraine and Moldova signed the Association Agreement with the European Union around the same time. In Georgia and Moldova the Association Agreement with the EU entered into force simultaneously, while in Ukraine there was a one-year delay due to political conflicts. Enough time has passed to assess the implications of this stage of integration with the EU for Georgia, Ukraine and Moldova.

The aim of the article is to determine whether the influence of the European Union on the economies of Georgia, Ukraine and Moldova has increased since the signing of the Association Agreement.

Introduction. As the analyzed indicator, the Monetization Ratio and Consumer Price Index was chosen, which reflects the economic situation in the countries and which, at the same time, is protected from artificial manipulations. The Monetization coefficient is the ratio of the money supply of the M2 aggregate to the country's GDP:

$$Monetization\,ratio = \frac{M\,2}{GDP}, M\,2 - Monetary\,aggregate, GDP - Gross\,domestic\,product \quad (1).$$

Monetary aggregate M2 includes the amount of all cash in circulation, as well as the amount of deposits in national and foreign currencies [11]. The monetization ratio is protected from the influence of uncontrolled money emission, since such actions will only lead to its decrease [1]. A rapid increase in the nominal money supply in a period of inflation would lead to a faster artificial increase in GDP, so that the divisor in the equation would progress faster. When the growth rate of the nominal money supply decreases during GDP growth, confidence in national money increases, which leads to an increase in the monetization ratio of the economy. More developed countries have a higher monetization ratio, as it reflects the degree of efficiency of the financial sector.

The consumer price index reflects the level of inflation, which characterizes the state of the economy as a whole [3]. The Consumer Price Index is the ratio of the cost of the consumer goods basket for a given month to the cost of the consumer goods basket for the base year, multiplied by one hundred percent:

$$Consumer\,Price\,Index\,(CPI) = \frac{Cost\,of\,the\,Market\,Basket, Given\,Month}{Cost\,of\,the\,Market\,Basket, Base\,Year} \times 100\,\% \quad (2).$$

In this study, Granger's causality test will examine short time intervals from 2 to 3 years before and after the signing of the Association Agreement with the European Union. The main problem is the lack of observations when using quarterly or annual data for a valid vector autoregression. The Monetization Ration and the Consumer Price Index are calculated by the economies on a monthly basis. Consequently, for the two years under study we will have 24 observations, and for the three years we will have 36 observations. This is sufficient for the Granger causality test. The minimum requirement for its objective indicators is at least 20 observations. For example, GDP per capita is also a good economic indicator, but it is observed annually and quarterly. Taking quarterly data for 2 and 3 years we get 8 and 12 observations, which is not enough for a qualitative VAR model. Quarterly and annual indicators are inefficient for building VAR models on short timeframes.

Recent literature review.

The topic of the Association Agreement with the EU is actively studied by Ukrainian and foreign researchers. In particular, in Ukraine the impact of European integration on the development of national economies is studied in the scientific works of P. Dziuba, O. Rogach, O. Shnyrkov, S. Yakubovskiy [O. Shnyrkov and D. Pliushch, 2021: 13; O. Rogach, O. Shnyrkov, P. Dziuba, 2019: 14].

At the same time, the existing studies do not fully use all the econometric modeling tools that make it possible to establish the relationship between individual key indicators of integrating countries. In particular, the topic of changes in the dependence of economic indicators of countries on the European Union after the signing of the Association Agreement requires further exploration.

The relationship between the debt indicators and the economic growth of the European Union through the Granger causality test was investigated by A. Marton [A. Marton, 2021: 19]. The author considered the public debt of the European Union as a potential source of danger to economic growth. The author concluded that only public debt has a causal effect on economic growth, and there is no reverse effect.

The impact of foreign capital inflows on Eastern European countries is studied in scientific work of S. Yakubovskiy, T. Rodionova and A. Kyfak [S. Yakubovskiy, T. Rodionova and A. Kyfak, 2019: 8]. By conducting the Granger causality test, the authors confirmed the significant impact of foreign investment on exports, imports, trade, and current account balances showed for countries such as the Czech Republic, Slovakia, Hungary, Poland, and Ukraine.

As an alternative for the European Union economical area, the trade relation between India and other BRICS countries was analyzed using the Granger causality test by N. Kubendran [N. Kubendran, 2020: 20]. BRICS is an acronym for the following countries: Brazil, Russia, India, China and South Africa. The Granger causality tests results showed a positive impact on Indian Economy for trading with BRICS countries. The study also insists that India should strengthen its trade ties with the BRICS countries, which would help it get better economic growth.

Granger's causality test, while having enormous scientific potential, has many unexplored areas in which it can be applied. One such unexplored area is the consequences of the Association Agreement with the European Union.

Research method. For each country, two periods were selected before and after the Association Agreement with the EU. The data period varies from two to three years, depending on the situation in each country. In Georgia and Moldova, the Association Agreement entered into force on July 1, 2016 [7, 10]. The initial task is to choose the period before and after this event, taking into account the exclusion of anomalous economic events. Such an event can be considered a lockdown, which in these three countries began simultaneously in March 2020 [6, 9, 21]. In Ukraine on September 1, 2017 [22]. It is also worth considering the military conflict in Ukraine, which began in early 2014 [2]. Since our data is monthly and seasonal, it is a good idea to take an integer number of years. With such criteria in mind, the periods of two years, namely 2012-2013 and 2018-2019, were chosen for Ukraine. For Georgia and Moldova, three-year periods were chosen, namely 2013-2015 and 2017-2019.

The Monetization Ratio and Customer Price Index for each of the periods were calculated. The same calculations were made for the euro area. The data obtained is not normalised, has a

trend, changing volatility and pronounced seasonality. To normalise the data, the average value and standard deviation were calculated. Each data value were recalculated using the following formula:

$$Normalized\ value = \frac{x-\overline{x}}{\sigma},\ where\ x-current,\ \overline{x}=\frac{x_1+...+x_n}{n},\ \sigma=\sqrt{\frac{\sum_{i=1}^{n}(x_i-\overline{x})}{n}} \quad (3).$$

The resulting data has a trend and no centre point, this can be corrected by subtracting the previous value from each value:

$$Stationary\ value = x_n - x_{(n-1)},\ where\ x-current\ value,\ n-current\ index \quad (4).$$

After such calculation we still have a changing volatility. To eliminate the change in volatility, the data was divided by the standard deviation of its year:

$$Normalized\ value\ for\ each\ year = \frac{x}{\sigma},\ where\ x-current,\ \sigma=\sqrt{\frac{\sum_{i=1}^{n}(x_i-\overline{x})}{n}} \quad (5).$$

The last step is to remove the monthly seasonality. From each month, the arithmetic average of that month for all existing years was subtracted:

$$Value\ without\ seasonality = x-\overline{x},\ where\ x-current\ value,\ \overline{x}=\frac{x_1+...+x_n}{n} \quad (6).$$

Based on the normalized data obtained, the following 12 VAR-models of interdependence of the Monetization Ratio and Consumer Price Index of Georgia, Moldova and Ukraine on the eurozone before and after the Association Agreement were calculated to test Granger non-causality:

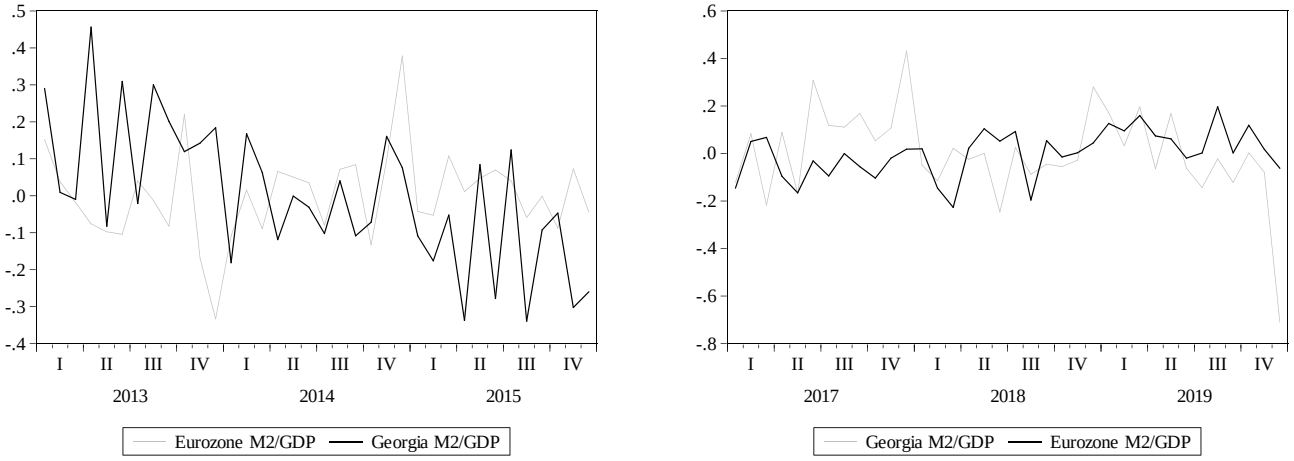
$$CAI_t = \alpha_1 + \sum_{i=1}^{p}\beta_{1i}EZAI_{t-i} + \sum_{i=1}^{p}\gamma_{1i}CAI_{t-i} + \varepsilon_{1t},\ EZAI_t = \alpha_2 + \sum_{i=1}^{p}\beta_{2i}CAI_{t-i} + \sum_{i=1}^{p}\gamma_{2i}EZAI_{t-i} + \varepsilon_{2t} \quad (7),$$

where CAI, EZAI, ε imply: a current country analyzed index – Monetization Ratio or Consumer Price Index of Georgia, Ukraine or Moldova; a eurozone analyzed index – Monetization Ratio or Consumer Price Index of eurozone and error value. Where α is a constant term, β and γ are estimated coefficients and p is the analyzed time series lag length. For the purpose of the study, the Granger null hypothesis of non-causality will be used, where $\beta_{1i}=0$ and $\gamma_{2i}=0$. Granger causality test helps to determine the existence of dependencies between the studied indicators. The EViews 8 program was used as a tool for constructing the VAR model. First, the VAR is evaluated with a maximum of 5 lags. The number of lags was determined by the total score of the criteria LR, FPE, AIC, SC, HQ. One month was chosen as the unit of the time interval. After that, the model is built taking into account the new number of lags. After choosing the number of lags, the Granger non-causality ε error value was used to assess the dependence of the indicators of these countries on the eurozone.

Research results. Looking at the graph of the monetization coefficient for Georgia (Illustration 1), it is difficult to characterise the differences between the periods before and after the signing of the Association Agreement. Visually, the graph cannot show a noticeable structural changes in the dynamics of indicators.

Illustration 1.

Georgia and Eurozone Monetization Ratio after normalization

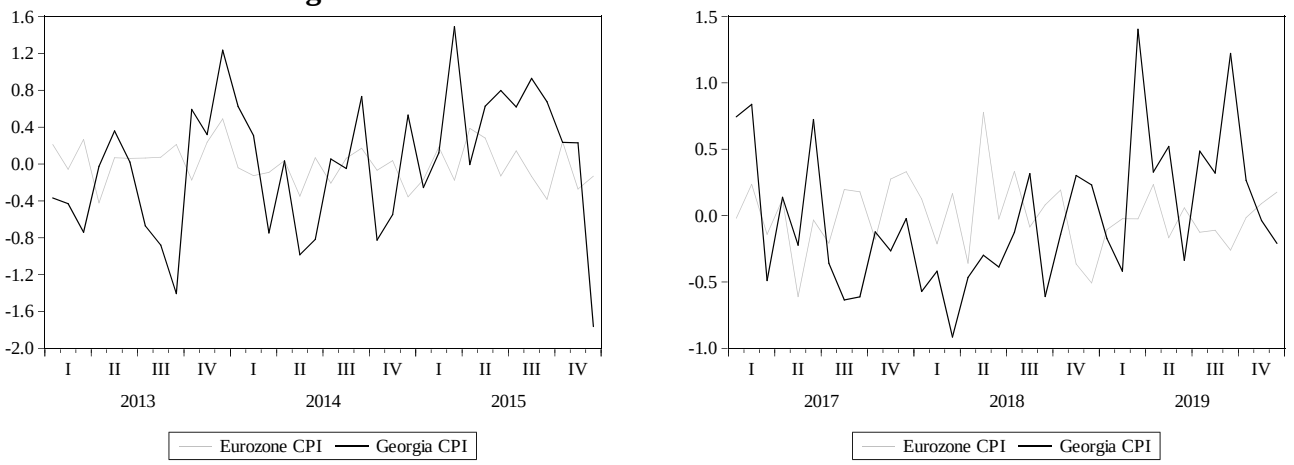


Source: created by authors based on [5, 15, 18].

It is also difficult to characterize any dependencies on the graph of the normalized consumer price index of Georgia and the Eurozone (Illustration 2).

Illustration 2.

Georgia and Eurozone Consumer Price Index after normalization



Source: created by authors based on [3].

Using the lag length criteria of the Monetization Ratio VAR model, 3 lags were selected for the first period and 1 lag for the second period in order to optimise the model. Using the coefficients of the Granger causality test from Table 1, we can conclude that there is no correlation between the monetization indicators of the economies of Georgia and the Eurozone. For the consumer price index, 3 lags were chosen for the first period and 1 lag for the second. Georgia's consumer price index was dependent on the European Union before the association period. After the treaty, as we can see, the data does not fall into any criterion of dependence.

Table 1. Granger causality test for Georgia and Eurozone on 2013-2015 and 2017-2019 with monthly time periods

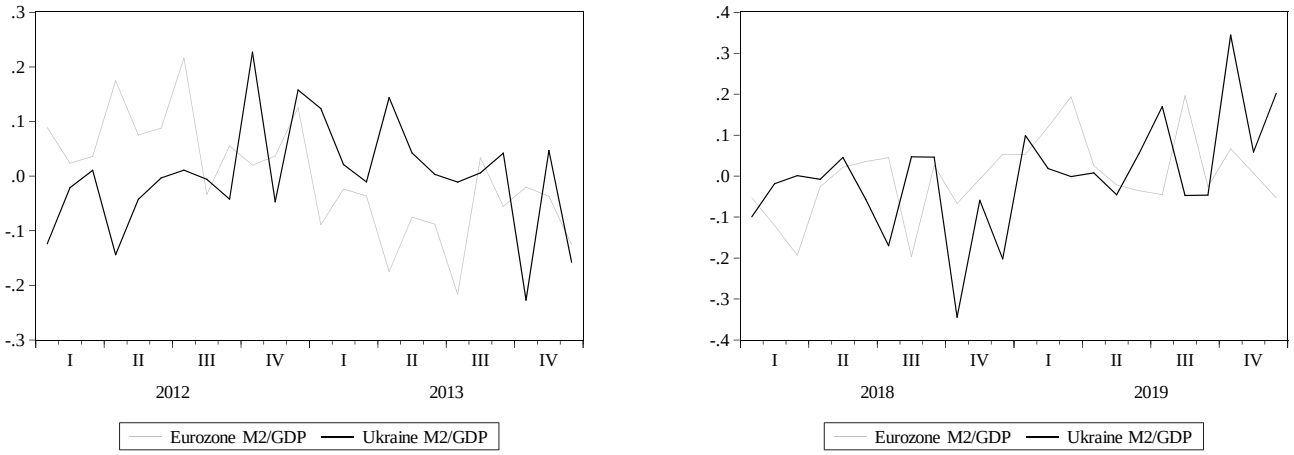
Dependent index and economy		**2013M1-2015M12**	**2017M1-2019M12**
M2/GDP	Eurozone	5,70 (0,1269)	0,12 (0,7213)
	Georgia	0,38 (0,9429)	1,52 (0,2165)
CPI	Eurozone	16,50 (0,0009)[a]	0,57 (0,4489)
	Georgia	6,56 (0,0871)[c]	0,46 (0,4941)

Note: The values before the parentheses indicate the chi-square value. The numbers in parentheses indicate the error ε, which are defined into 3 groups: a, b, c. Letters mean hitting an error in the 1%, 5%, and 10% dependence criteria respectively.
Source: created by authors based on [3, 5, 15, 18].

Illustration 3 shows the changes in the monetization indicator for the economy of Ukraine before and after the Association Agreement, if we consider such an indicator relative to the Eurozone. In the period after the Association Agreement 2018-2019, both graphs have a smaller spread and are concentrated in the same range. Whereas the period 2012-2013 is less measured.

Illustration 3.

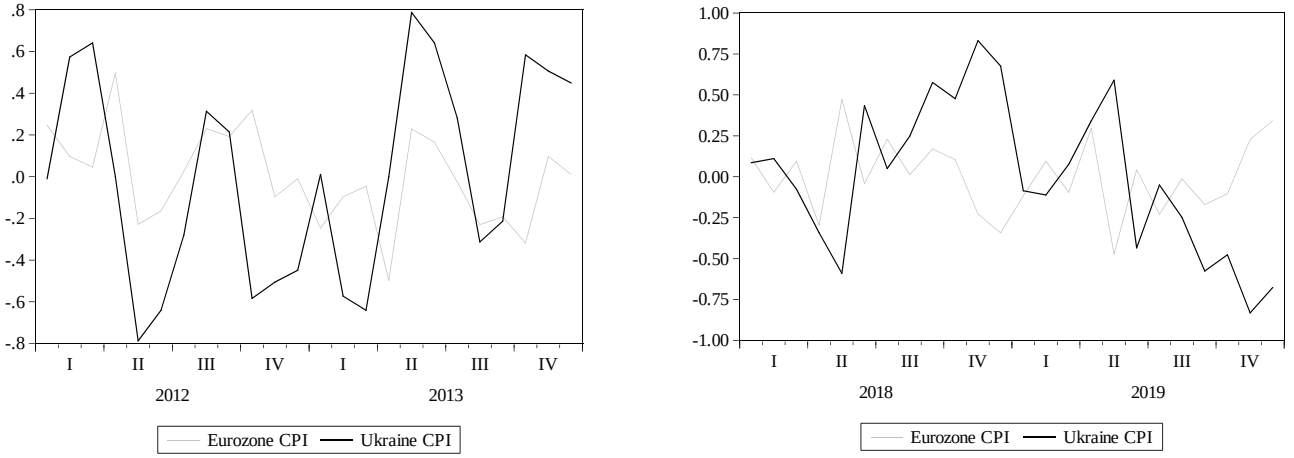
Ukraine and Eurozone Monetization Ratio after normalization



Source: created by authors based on [5, 15, 17].
The graph of the consumer price coefficient after normalization does not allow us to determine any regularities (Illustration 4). The coefficients move together in some periods and separately in others.

Illustration 4

Ukraine and Eurozone Consumer Price Index after normalization



Source: created by authors based on [3].

The Granger causality test shows more specific results for Ukraine and the Eurozone. In the period 2012-2013, the dependence of the Eurozone monetization indicator on Ukraine in Table 2 slightly goes beyond the 10 percent criterion. For Ukraine's dependence on the Eurozone, such a coefficient falls even in the 1% dependence criterion. The period 2018-2019 after the signing of the Association Agreement shows a clear interdependence of the monetization indicators of the Eurozone and Ukraine, meeting the 1% criterion. The consumer price index was interdependent before the signing of the association agreement, falling under the one percent criterion. After the agreement was signed, this interdependence persisted. The dependence of the eurozone indicator fell within the 5% criterion.

Table 2. Granger causality test for Ukraine and Eurozone on 2012-2013 and 2018-2019 with monthly time periods

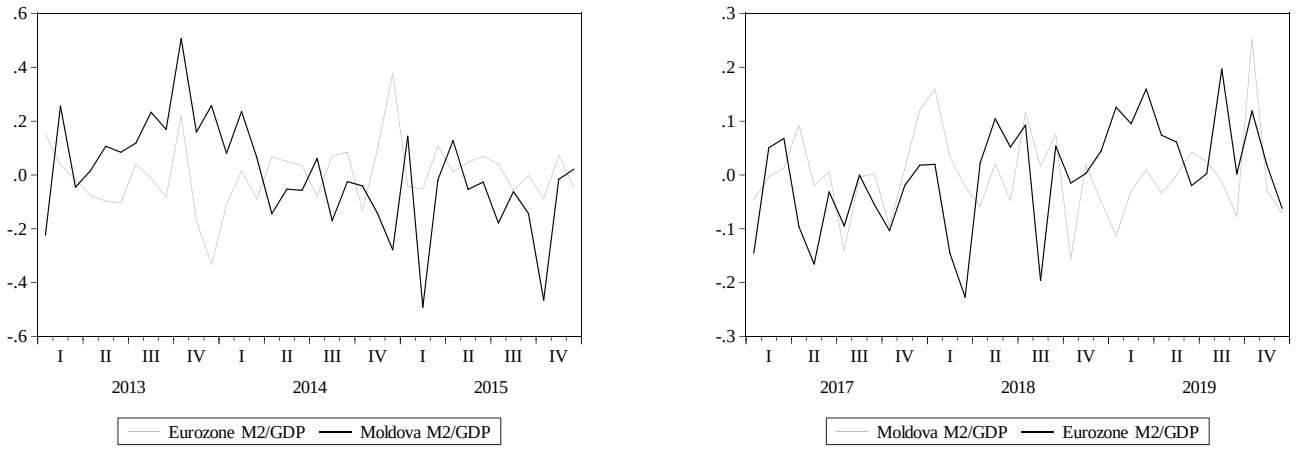
Dependent index and economy		2012M1-2013M12	2018M1-2019M12
M2/GDP	Eurozone	7,60 (0,1071)	20,88 (0,0009)[a]
	Ukraine	16,91 (0,0020)[a]	22,40 (0,0004)[a]
CPI	Eurozone	17,82 (0,0013)[a]	24,93 (0,0124)[b]
	Ukraine	17,93 (0,0013)[a]	8,77 (0,0000)[a]

Note: The values before the parentheses indicate the chi-square value. The numbers in parentheses indicate the error ε, which are defined into 3 groups: a, b, c. Letters mean hitting an error in the 1%, 5%, and 10% dependence criteria respectively.
Source: created by authors based on [3, 5, 15, 17].

Considering the graph of the dependence of the monetization indicators of Moldova and the Eurozone on Illustration 3, one can also notice a large mutual concentration of data on the graph of the period 2017-2019. This graph illustrates the period after the signing of the Association Agreement by Moldova.

Illustration 5.

Moldova and Eurozone monetization ratio after normalization

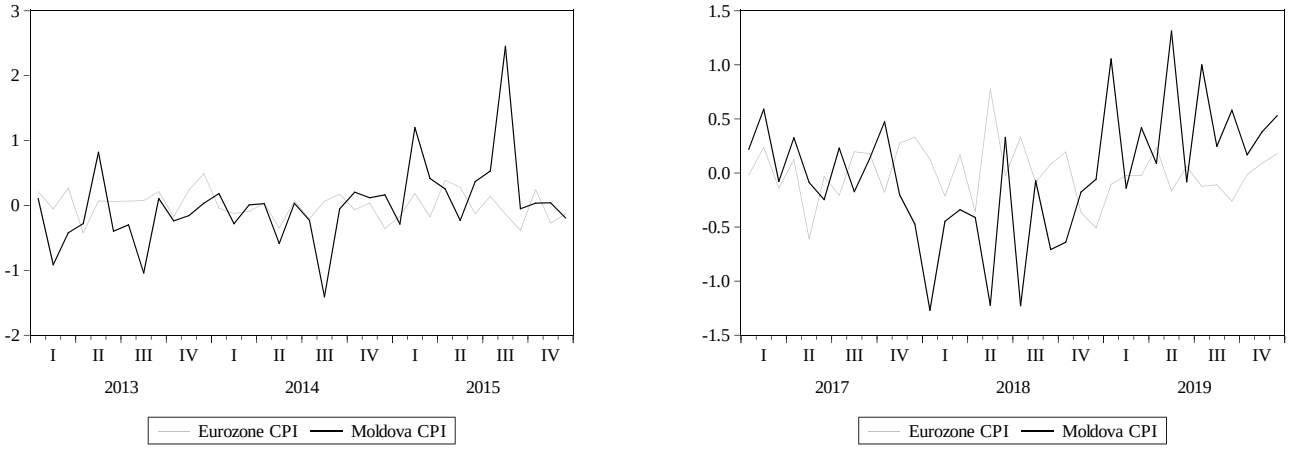


Source: created by authors based on [5, 15, 16].

The dependence between the normalized inflation rates of Moldova and the eurozone is difficult to determine on the graph (Illustration 6). The graphs are chaotically arranged, it is difficult to identify common patterns.

Illustration 6.

Moldova and Eurozone Consumer Price Index after normalization



Source: created by authors based on [3].

The Granger causality test for Moldova and the Eurozone also allows conclusions to be drawn (Table 3). Before the signing of the Association Agreement, only the monetization indicator of the Eurozone fell under the 10% criterion of dependence on Moldova, which can be attributed to external factors. There is a mutual dependence of the indicators of the monetization of Moldova and the Eurozone, which fall under the 5% dependence criterion. The consumer price index had a reciprocal relationship before the signing of the association agreement. After it was signed, the dependence of the Moldova index on the Eurozone disappeared, and the dependence of the Eurozone index on Moldova, on the contrary, increased.

Table 3. Granger causality test for Moldova and Eurozone on 2013-2015 and 2017-2019 with monthly time periods

Dependent index and economy		2013M1-2015M12	2017M1-2019M12
M2/GDP	Eurozone	5,28 (0,0710)[c]	8,66 (0,0131)[b]
	Moldova	3,88 (0,1437)	7,84 (0,0198)[b]
CPI	Eurozone	7,80 (0,0991)[c]	23,05 (0,0003)[a]
	Moldova	9,55 (0,0486)[b]	1,25 (0,9399)

Note: The values before the parentheses indicate the chi-square value. The numbers in parentheses indicate the error ε, which are defined into 3 groups: a, b, c. Letters mean hitting an error in the 1%, 5%, and 10% dependence criteria respectively.

Source: created by authors based on [3, 5, 15, 16].

Discussion of results and conclusions. Georgia showed the absence of any dependence of the monetization indicator of the economy on the Eurozone, while Ukraine and Moldova showed such dependence. Before the signing of the Association Agreement for Ukraine and Moldova, dependence by monetization index with the European Union was not observed. In the period after the signing of such an agreement, there is a clear interdependence of Moldova and Ukraine separately from the Eurozone in the context of the indicator of economic monetization. The maximum interdependence of monetization indicators can be traced between Ukraine and the Eurozone. There, the Granger causality test falls under the 1 percent criterion for both the monetization rate of Ukraine and the Eurozone. This is a strong indicator of interdependence that emerged after the signing of the Association Agreement. For Moldova there is also a strong, though less pronounced, dependence compared to Ukraine. There is a characteristic interdependence of the Moldova monetization indicator on the Eurozone after the signing of the Association Agreement, which was not observed before its signing. Based on the monetization index, Ukraine and Moldova

are economically deeply integrated with the European Union. The fact of the influence of the Association Agreement on the increase in the mutual dependence of the economies of the countries on the economy of the European Union has been proved. The consumer price index showed less specific results. For Georgia, before the signing of the Association Agreement, there was an interdependence of the consumer price index. After the agreement, this dependence disappeared. The interdependence of such an index for Ukraine and the eurozone was strong and persisted after the signing of the Association Agreement. Moldova had an interdependence of the consumer price index with the European Union, which turned into one-sided on the part of the eurozone as a dependent indicator. Such results seem to be less objective than for the monetization index. The consumer price index is influenced by many external factors, and it can hardly be called successful for assessing the degree of integration of a country into the EU. The integration process is complex, the data obtained is also the result of the mass of decisions that countries have taken on the way to European integration. The main part of the Association Agreement from an economic point of view is the simplification of the terms of trade. In this study, the monetization index is a better indicator for assessing integration on short timeframes than the consumer price index. Since geographically, Moldova and Ukraine are closer to the European Union, the interdependence of economies is inevitable. Georgia has an effective domestic policy and is geographically surrounded by alternative trading partners. Based on the study, the influence of the European Union on the Georgian economy is less pronounced in terms of the rate of monetization of the economy.

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