Analysis of the Dynamics of Foreign Currency Exchange Rates in Ukraine Including Seasonality Factors and Demand for Domestic Government Loans Bonds (Over 5-10 Years)

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Abstract. The relevance of the scientific article lies in the need to substantiate the importance of the role of currency exchange rates for the robust functioning of the country's economy. The purpose of the article is to analyse the dynamics of foreign currency exchange rates, mainly the dollar, and the euro, in Ukraine, taking into account factors of seasonality and demand for government bonds. The main methods used in the paper are statistical empirical research methods, in particular modelling. It was determined that the export of raw materials, mainly steel, and various agricultural crops such as wheat, corn, sunflower oil, soybeans, etc., plays a particularly important role in Ukraine. It was found out that the mentioned fluctuations in export are one of the reasons for the currency seasonality, but not the only one or the main reason, as the exchange rate is strongly influenced by oil, gas, and other energy resources prices, which the country needs constantly, especially during the heating season. The exchange rate of the hryvnia over the last five years within the context of the National Bank of Ukraine has also been analysed. It was found that the demand for government loans bonds is one of the most important factors in considering the foreign currencies exchange rates in Ukraine. To make models more plausible and to reduce the influence of other factors in determining seasonality of the currency with certain currency pairs with the dollar, euro, yen, zloty, and ruble, the data for the last several years has been used, which are less likely to be distorted by the influence of external factors. It has been confirmed that a successful trade policy is a key source of currency stabilisation in Ukraine. The article is useful for studying the functioning of currencies in general; for studying the economy of Ukraine, especially the country's currency issues; for students of various economic disciplines

Keywords: Ukrainian economy, currency exchange rates, seasonality, bond market, finance

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Introduction

An overview of the financial sector has always been important for the analysis of a national economy that has the real (goods and services markets) and, in particular, the financial sector interacting closely [1]. According to many academic economists, the foreign currency market is one of the most important macroeconomic indicators, which has a major impact on a range of economic processes [2]. Over time, this role is only increasing. Nowadays, the foreign currency market and its functions are an integral part of the financial market [3]. This is primarily due to globalisation processes in the world, as well as some political processes and even modifications in the form of currencies as such. The stability of the national currency is important for a healthy relationship with foreign partners. Therein lies the relevance of the research.

For Ukraine, as a developing country win economy in transition, it is important to support its national currency, the hryvnia, as the currency exchange rate is of great importance in the improvement of currency relations as well as in the formation and regulation of a normal foreign currency market [4]. This support can be provided through various instruments, including direct interventions by the National Bank of Ukraine (NBU). Nevertheless, the hryvnia is a relatively volatile and unstable currency, which exchange rate, especially in the past, was very similar to that of the ruble, which was due to the significant amount of ties that remained between the countries since the existence of the Union of Soviet Socialist Republics (hereinafter, the USSR). Now the trend is not so pronounced. Nevertheless, with all the attempts to diversify the economy, Russia still takes a large share of the country's exports and imports.

Throughout its history, the Ukrainian currency has continually devalued. For example, at the time of the currency's introduction, the dollar exchange rate was 1.76 hryvnia and held for some time in front of the 2-hryvnia mark. However, by 2000, the rate reached 5 hryvnias per dollar, by 2008 – 8 hryvnia, by 2014 to 16 hryvnia, and 2015 to 26 hryvnia. Currently, the rate fluctuates within the range of 26 to 28 hryvnia per dollar. Such instability was caused not only by problems within the country but also by the global crises, which, due to the openness of the Ukrainian economy, like many other post-Soviet countries, severely affected both the economic situation in the country as a whole and the exchange rate. According to some international organisations, the currency will stay in the same range and slowly devaluate towards the 30 hryvnias per dollar point. The Ukrainian budget for 2022 projects the exchange rate to be around 28.6-28.7 hryvnia per dollar [5]. In fact, such a gradual and projected rate depreciation could have some kind of positive impact on economic development through increased exporters' revenues.

Although the currency exchange rate is influenced by many factors, the determining factor in its formation belongs to the market [6]. It has already been described in the abstract that in Ukraine the fluctuations of the dollar exchange rate are seasonal, which will be shown and described in more detail in the paper itself. However, it is also important to note that other factors, such as the issuance of domestic government loans bonds, affect the exchange rate too. They are issued every Tuesday, which leads to currency strengthening. At the moment, Ukrainian securities are quite attractive for foreign investors in terms of profitability, which also has an impact on the hryvnia strengthening [7].

Thus, *the paper aims* to analyse the dynamics of the Ukrainian currency exchange rate, based on seasonality factors and demand for domestic government loans bonds. The object of the study is the hryvnia/euro and hryvnia/dollar exchange rates over the last few years. The novelty of the paper lies in the absence of such an analysis of Ukrainian national currency exchange rates in modern economic literature.

Materials and Methods

The methodology of the article is based on statistical research methods, as the paper itself is an analysis of the dynamics of exchange rates in Ukraine over the past 5 years. The paper uses empirical statistical data, as well as the statistical calculations supported by tables and graphs, on the basis of which conclusions are drawn about the interaction of factors. In addition, theoretical research methods are applied to analyse the data not only on the statistical side but also their economic interpretation. In particular, based on theoretical conclusions about the factors which influence currency exchange rates, statistical analysis was carried out to empirically confirm the relationship between the factors. In the course of this study, numerous scientific papers, reports, documents, and other publications were analysed. The currency market of Ukraine was researched and the latest news related to its functioning was studied. The research method applied: historical; abstract-logical; statistical methods (modelling, forecasting, statistical observation, graphical method); monographic method, abstraction.

There are a large number of theories and approaches to currency exchange rate formation in modern economic thought [8]. To conduct a statistical study on the effect of seasonality on the exchange rate of the hryvnia, an adaptive model was used, which met this objective better than a multiplicative model. The results were the most plausible and realistic, which is most likely due to the inconstant differences in seasonal deviations of currency exchange rates. The most frequently used statistical techniques in the paper were non-linear regression analysis and correlation analysis. Regression was chosen due to its ease of understanding and versatility. For the most part, there was no clear relationship between the factors, even though it should have existed from the theoretical point of view. The fact is that there was mostly a non-linear relationship between the factors, namely hyperbolic rather than linear, which was the reason for the non-linear regression analysis. Correlation analysis is also widely used for the same purpose (confirming factor relationships). Many graphs and tables are included in the

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article in order to clearly show the described and induced relationships. Other analysis methods such as fundamental and technical analysis can also be used, but will not be applied in the course of this study [9].

The research on this topic was conducted in three stages. The first stage involved a general analysis of the hryvnia: its volatility, the influence of the National Bank of Ukraine (NBU) on its exchange rate, and recent trends in the exchange rate influenced by changes in the price of certain resources, etc. The second stage provides an analysis of currency seasonality with several currency pairs, the dollar, the euro, the yen, the zloty and the ruble; it shows which currencies demonstrates stronger seasonal variations and which has weaker seasonality and what it is associated with. In addition, the impact of a country's exports and imports in different months on the currency exchange rate and its seasonality is shown. The third stage demonstrates the impact of the demand for domestic government loans bonds on the currency exchange rate, as well as the effect of changes in average domestic government loans bond rates on the exchange rate. The conclusions on the impact of the analysed factors on foreign currency exchange rates in Ukraine are provided at the end of the study.

Results and Discussion

As mentioned above, the hryvnia is a very volatile currency, with a monthly standard deviation of 1.14 UAH, or roughly 4% of its value over the past five years (the numbers relate the hryvnia/dollar, as compared to 0.002 in euro/dollar, which is roughly 0.18% of the average value for the study period). Furthermore, it is a currency of a country with an unstable transition economy, which makes Ukraine less

attractive for investments. This is also one of the reasons for the relatively high rates of domestic government loans bonds in the country and the increased demand for them in particular.

The NBU plays an important role in the pricing of the hryvnia as it directly purchases or sells currency on the currency market to keep it within certain price limits to meet long-term and short-term government objectives. In addition, the NBU hinders currency volatility to a certain extent and is a kind of guarantee for investors due to its influence on currency fluctuations. Such NBU actions also increase the investment attractiveness of the country as it makes future investors' returns on Ukrainian securities more predictable, and thus, more favourable in their eyes. It is important to mention the Ukrainian currency market itself which, as already mentioned, is partly regulated and relatively small having on average about 400-500 million dollars traded per day [10].

Nevertheless, during the COVID-19 crisis, the Ukrainian currency started to strengthen. The main reason for this is the booming prices of some raw materials, which are the main export component of the country. A good harvest in 2020 and even better in 2021 (compared to 2020, in 2021 16.4% more wheat was harvested, 40% more barley, 35.5% more soybeans, etc) [11]. However, in 2021, due to the unstable political situation and the energy crisis caused by high energy prices in preparation for winter, the national currency could not gain as much strength as in 2020 and lost some ground. In addition to agricultural crops, steel, which is also an important export crop for the country, rose significantly in value. Figure 1 and 2 below show price charts for steel, wheat, and soybeans in dollars and growth percentages.
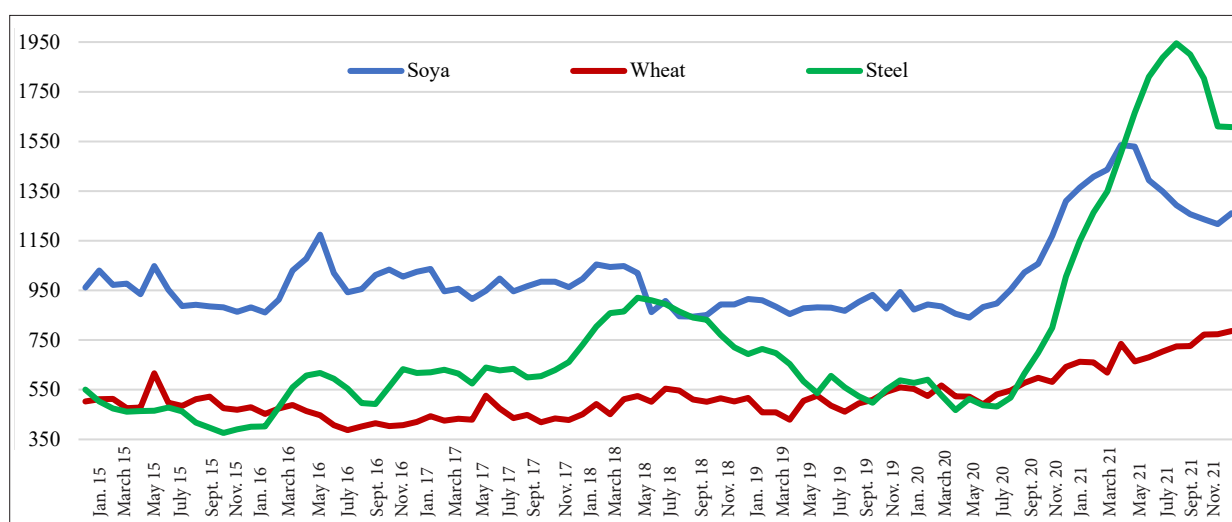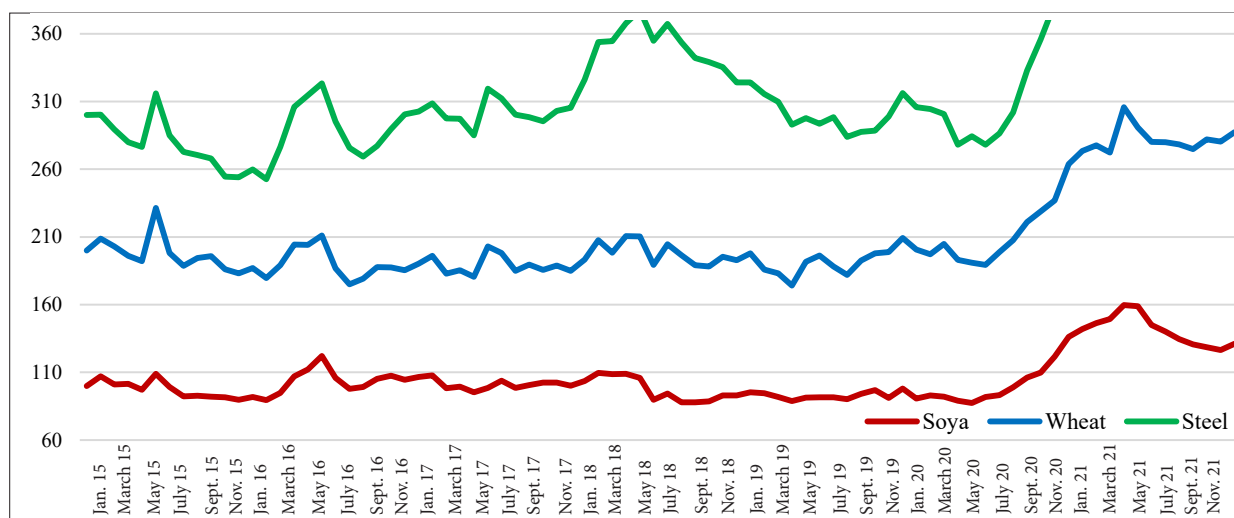

Figure 1. Coil steel, soybeans, and wheat prices from 2015 to 2021, USD
Source: compiled by the author based on data from [12]

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Figure 2. Coil steel, soybeans, and wheat prices from 2015 to 2021, %
Source: compiled by the author based on data from [12]

Such price increases (especially for steel, which amounted to almost 400%) could not help but affect the hryvnia. Overall, a significant strengthening of the hryvnia in 2020 can be observed. A non-linear relationship has been found between the price of commodities, and the hryvnia exchange rate using regression analysis, namely a hyperbolic relationship in which the function values were significant at a significance level of 0.05 Thus, the price of wheat should explain 8.3% of hryvnia-dollar exchange rate variation, soybeans – 10.6%, and for steel – 11.4%, although, in reality, those values could be lower if absolutely all factors affecting the exchange rate are taken into account. Nevertheless, the prices of Ukraine's main export crops have a clear and serious impact on the currency. To begin with, in most developed markets, agents are aware of the presence of seasonality in the markets and try to get rid of this factor, smoothing the dynamics of exchange rates to get more clear and correct price signals [13]. Thus, the absence of seasonality is important primarily for macroeconomists, in order to better analyse the situation in the country. In general, seasonality is absent only in very efficient markets, but not always either. In Ukraine, however, the seasonality factor plays a certain role, which can be seen in the graph but can also be confirmed statistically. A graph of the hryvnia/dollar exchange rate from 2016 to November 2021 is shown below (Fig. 3).
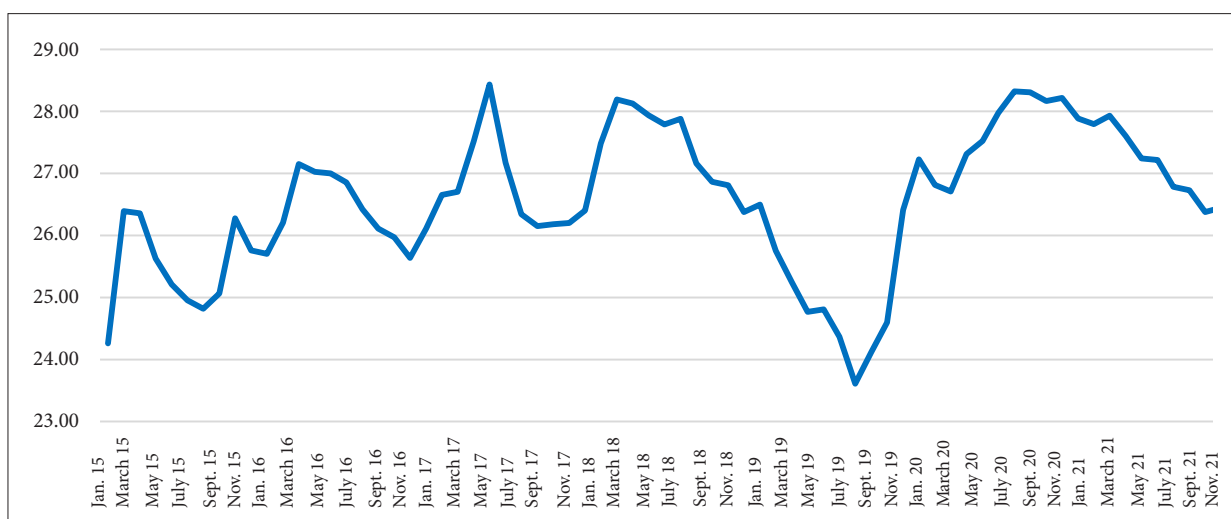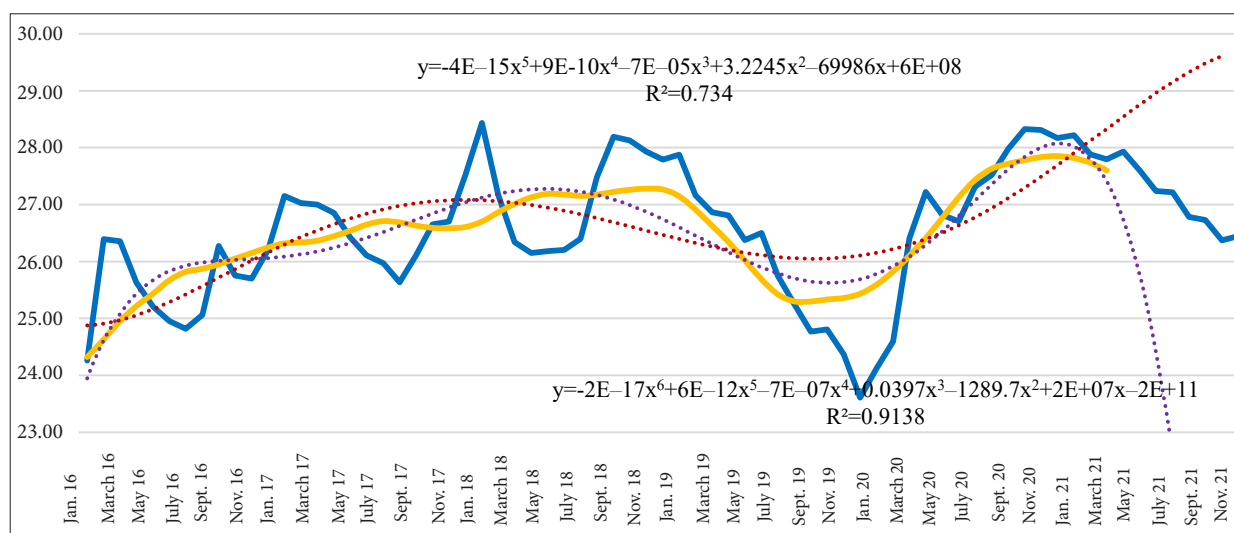

Figure 3. Hryvnia/dollar exchange rate from 2016 to November 2021
Source: compiled by the author based on data from [14]

Figure 3 shows that the hryvnia starts to weaken during winter, which is associated with the start of the heating season, and vice versa, it becomes stronger closer to spring and summer. However, in order to more accurately and clearly detect the seasonality of the hryvnia exchange rate, a time series model was built. The Adaptive model was chosen, as it provides the best accuracy and the highest R^2 value, i.e., the model of the biggest significance. For this purpose, annual (12 months) moving averages and trend lines were drawn on the hryvnia graph. A graph with these additional lines describing the hryvnia-dollar exchange rate chart is demonstrated below (Fig. 4).

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Figure 4. Trend lines and moving averages on the hryvnia-dollar exchange rate graph 2016-2021
Source: compiled by the author based on data from [14]

Two polynomial trend lines are marked on the graph: of the fifth and sixth-degree, but neither of them describes the possible future exchange rate of the hryvnia well enough. Although the polynomial curve of the sixth degree has an R^2 value above 0.91, its predicted values are difficult to believe, so it is obviously impossible to use only one seasonal indicator to predict the dollar exchange rate. Nevertheless, the following calculation will show that it does occur. The adaptive model has the form (1):

$$Y_t = T_t + S_t + E_t \qquad (1)$$

In this formula Y_t is the final value, T_t is the trend value, S_t is the seasonality factor, E_t is the random factor. Since Y_t and T_t are known, $S_t + E_t$ can be found. To do this, the difference between the actual value of the exchange rate and the moving average for each of the selected months should be found, as well as the average value of these deviations. In fact, we get the value of $S_t + E_t$, but for simplicity, we can assume that the value of the random factor is 0, as from time to time it acquires positive and negative values respectively and levels out. Table 1 shows the calculating process of this indicator.

**Table 1.** Calculation of seasonality factor impact on the hryvnia-dollar exchange rate, UAH

Year	Month											
	Jan.	**Feb.**	**March**	**Apr.**	**May**	**June**	**July**	**August**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
2016	0.21	2.07	1.73	0.67	-0.01	-0.48	-0.86	-0.75	0.40	-0.19	-0.35	0.05
2017	0.90	0.71	0.67	0.49	-0.02	-0.43	-0.68	-1.07	-0.58	0.02	0.11	0.93
2018	1.83	0.47	-0.52	-0.86	-0.95	-0.99	-0.78	0.33	1.02	0.90	0.67	0.51
2019	0.61	0.01	-0.05	0.18	0.04	0.48	0.06	-0.18	-0.53	-0.49	-0.97	-1.75
2020	-1.31	-1.00	0.59	1.12	0.40	-0.06	0.18	0.09	0.35	0.61	0.53	0.33
2021	0.37	0.07	0.06	0.33	x	x	x	x	x	x	x	x
Amount	2.60	2.33	2.47	1.93	-0.54	-1.00	-2.07	-1.59	0.66	0.85	0.00	0.08
S_t	0.43	0.39	0.41	0.32	-0.11	-0.30	-0.41	-0.32	0.13	0.17	0.00	0.02

Source: compiled by the author based on data from [14]

A positive S_t value indicates that the actual value in a given period is higher than the moving average, while a negative value indicates a correspondingly lower value of the actual exchange rate from the average. Table 1 demonstrates that the cold months – January, February, March, and April have positive St value steadily, while the warm months – May, June, July, and August have negative values. Although this model is not comprehensive and complex

enough to determine the exact values of the impact of the seasonality factor on the Ukrainian hryvnia, it shows that this factor does exist and affects the exchange rate of the hryvnia.

The same method was used to analyse the effect of seasonality on the hryvnia and the euro. Below are the graphs (Fig. 5, 6) of the hryvnia/euro exchange rate with and without averages and trend lines, respectively.

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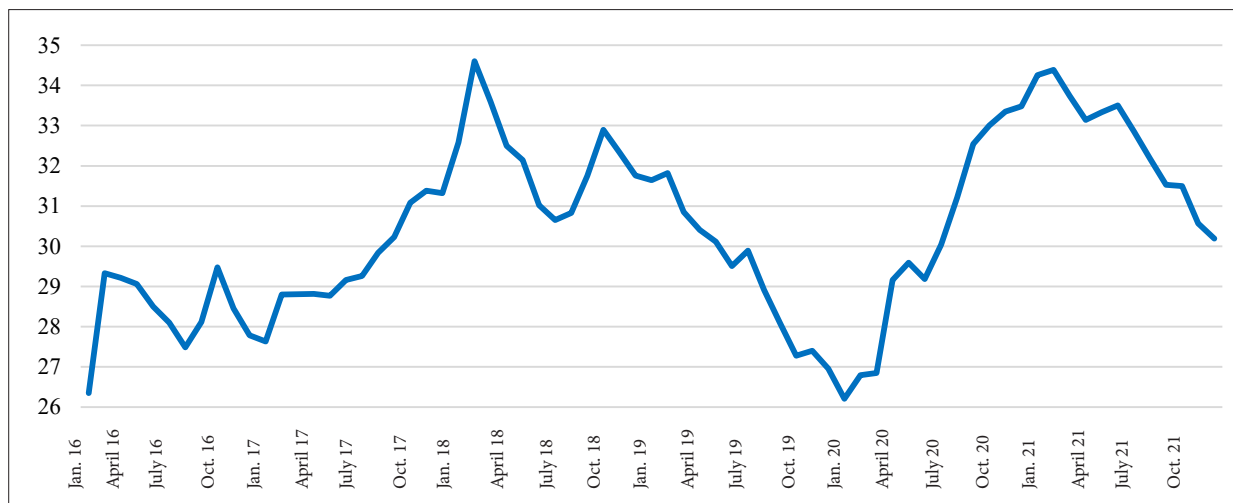
Figure 5. Hryvnia to the euro exchange rate from 2016 to October 2021
Source: compiled by the author based on data from [14]

$$y=-4E-17x^6+1E-11x^5-1E-06x^4+0.0661x^3-2145x^2+4E+07x-3E+11$$
$$R^2 = 0.9881$$
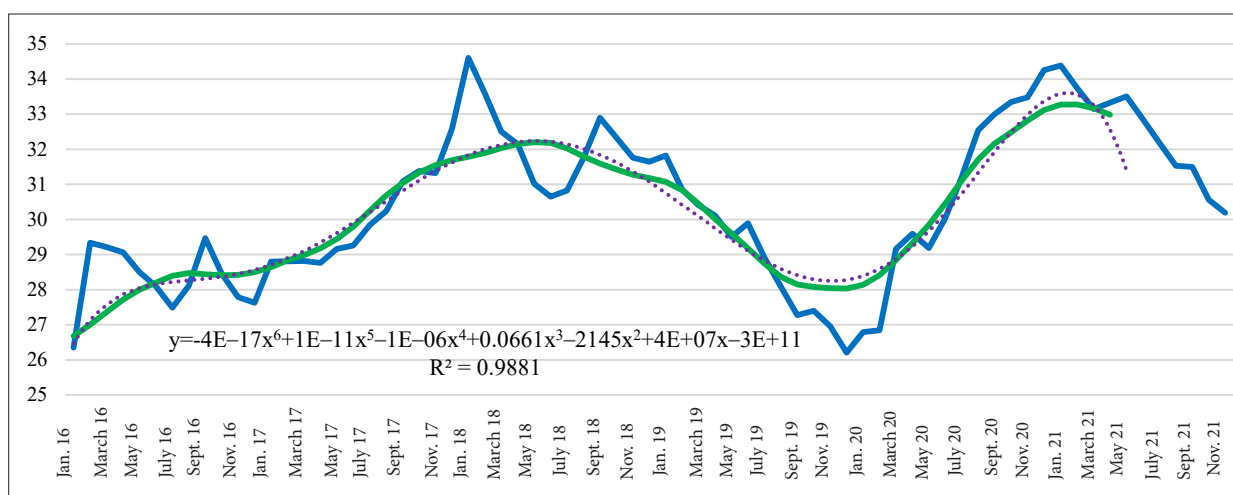
Figure 6. Trend lines and moving averages on the hryvnia/euro exchange rate graph for 2016-2021
Source: compiled by the author based on data from [14]

As can be seen, the trend line has also turned out to be polynomial to degree 6. Such lines best describe the movements of all hryvnia currency pairs over the study period. Figure 5 and Figure 6 included below show that the movements of the hryvnia-dollar exchange rate and the hryvnia-euro exchange rate are quite similar externally (there is indeed a high correlation between them, 0.868). However, the movement of the euro to hryvnia is not difficult to model. Table 2 below also provides a calculation of the S_t values:

**Table 2.** Calculation of seasonality effects on the hryvnia exchange rate against the dollar

Year	Month											
	Jan.	Feb.	March	Apr.	May	June	July	August	Sep.	Oct.	Nov.	Dec.
2016	-0.33	2.33	1.85	1.34	0.51	-0.10	-0.90	-0.36	1.04	0.05	-0.64	-0.87
2017	0.16	-0.02	-0.17	-0.41	-0.28	-0.54	-0.41	-0.45	0.04	0.05	-0.23	0.89
2018	2.82	1.70	0.47	0.00	-1.18	-1.53	-1.20	-0.05	1.30	0.91	0.48	0.46
2019	0.75	0.01	-0.05	0.10	-0.10	0.71	0.17	-0.28	-0.87	-0.67	-1.08	-1.83
2020	-1.34	-1.57	0.32	0.27	-0.66	-0.41	0.11	0.83	0.84	0.87	0.66	1.14
2021	1.11	0.47	-0.03	0.34	x	x	x	x	x	x	x	x
Amount	3.16	2.93	2.40	1.65	-1.72	-1.87	-2.23	-0.31	2.35	1.20	-0.81	-0.20
S_t	0.53	0.49	0.40	0.27	-0.34	-0.37	-0.45	-0.06	0.47	0.24	-0.16	-0.04

Source: compiled by the author based on data from [14]

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As we can see, a certain seasonality is observed in this currency pair as well. Figure 7, 8, and 9 included below show the graphs of other currency pairs for the same period, namely yen/hryvnia, zloty/hryvnia as well as ruble/hryvnia:

$$y=-3E-18x+7E-13x^5-8E-08x^4+0.0044x^3-141.79x^2+2E+06x-2E+10$$
$$R^2=0.9573$$
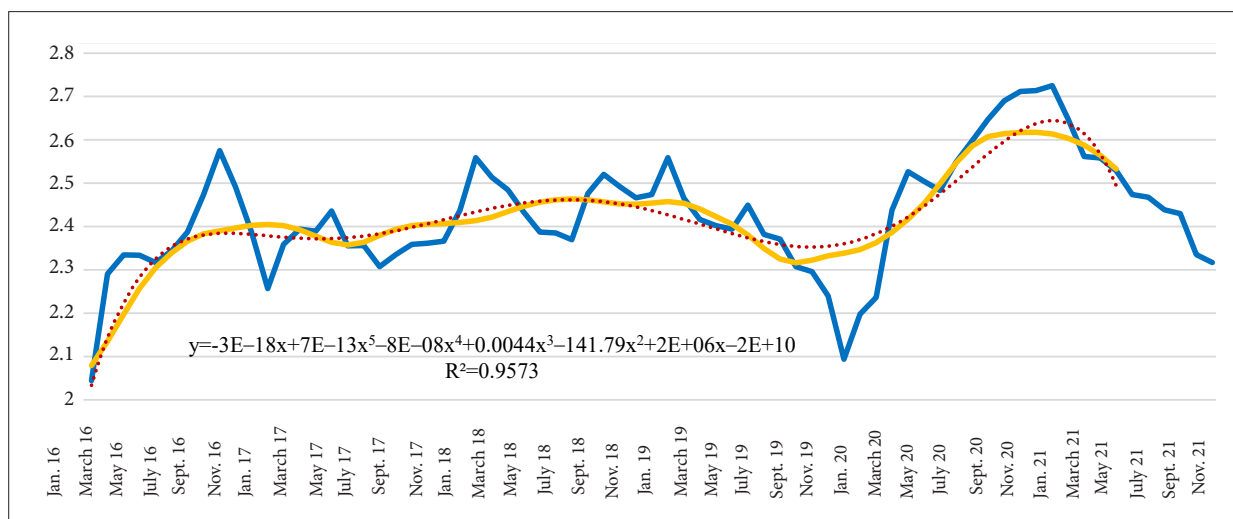
Figure 7. Trend lines and moving averages on the hryvnia/yen exchange rate graph in 2016-2021
Source: compiled by the author based on data from [14]

$$y=-7E-18x^6+2E-12x^5-2E-07x^4+0.0105x^3-341.29x^2+6E+06x-4E+10$$
$$R^2=0.9811$$
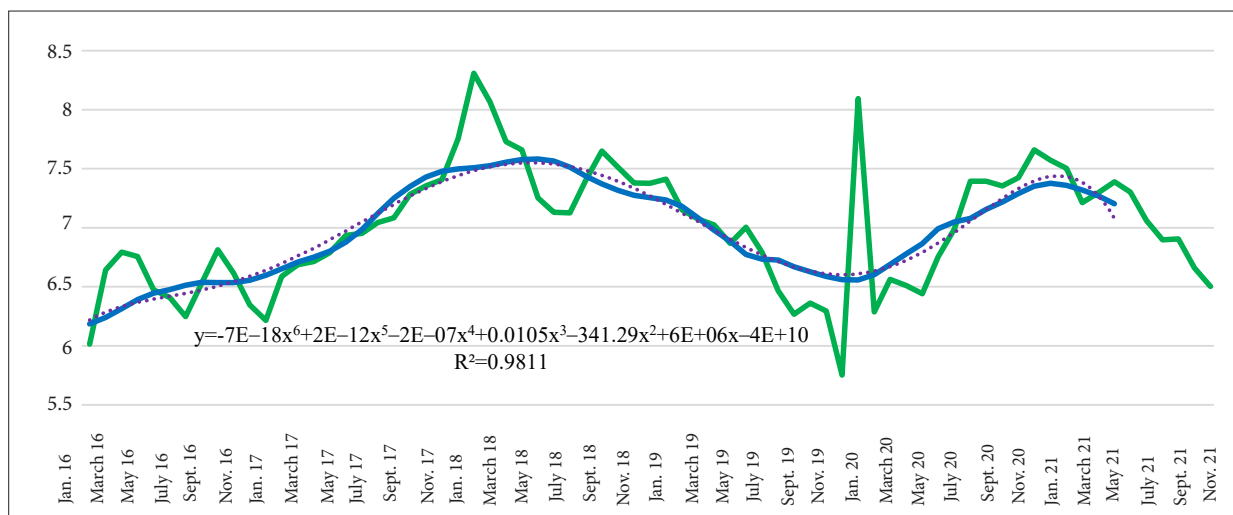
Figure 8. Trend lines and moving averages on the hryvnia/zloty exchange rate chart for 2016-2021
Source: compiled by the author based on data from [14]
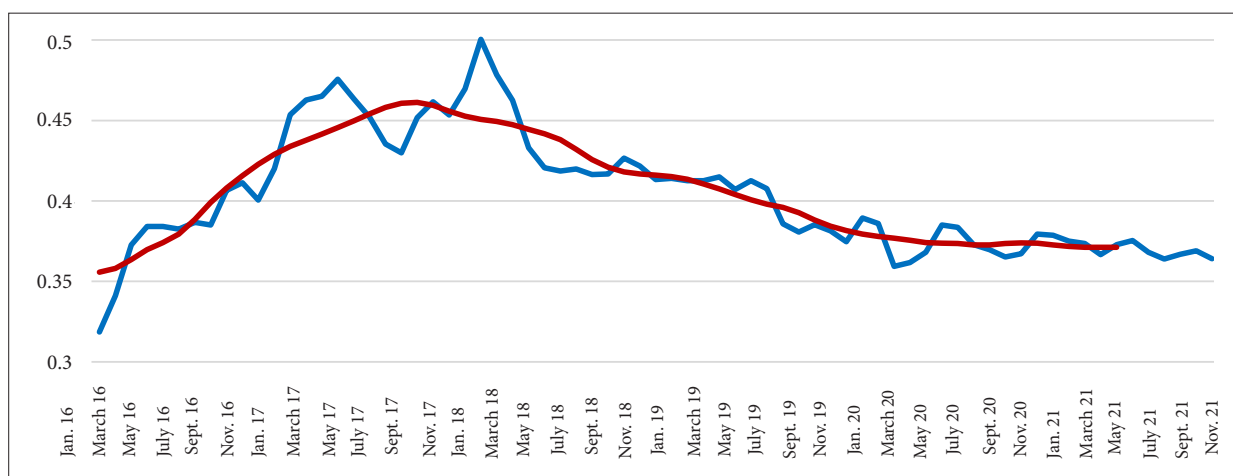
Figure 9. Trend lines and moving averages on the hryvnia/ruble exchange rate chart in 2016-2021
Source: compiled by the author based on data from [14]

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A certain seasonality was found in all of these currency pairs, as shown in the following Table 3.

In order to estimate which of the currencies is affected by seasonality more, average seasonal deviations and their share to the average exchange rate were calculated. Thus, a value of 0.92% was obtained for the dollar, 1.08% for the euro, 0.77% for the yen, 1.58% for the zloty, and 1.33% for the ruble. Therefore, the most seasonally exposed pair is the zloty/hryvnia, which can be explained by seasonal currency inflows from Ukrainian migrants in Poland. Moreover, we can notice that the two currencies most exposed to seasonality are relatively less developed countries and more open in terms of foreign trade (their export and import quotas are higher). Also, the charts show that the unstable exchange rate of the ruble is different from that of the other currencies. This is also confirmed by the correlation values between the currencies, which are provided in Table 4.

Table 3. Calculation of seasonality effects on hryvnia against yen, zloty, and rouble for 2016-2021 in nominal terms

Indicator	Month											
	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sen.	Oct.	Nov.	Dec.
S_t (yen)	0.022	0.029	0.033	0.036	-0.004	-0.005	-0.030	-0.003	0.025	0.004	-0.019	-0.059
S_t (zloty)	0.412	0.119	0.062	0.040	-0.083	-0.108	-0.140	-0.059	0.027	-0.028	-0.085	-0.119
S_t (ruble)	0.008	0.008	0.006	0.004	0.000	0.001	0.000	-0.016	-0.011	-0.003	-0.005	-0.003

Source: compiled by the author based on data from [14]

Table 4. Correlation between currency pairs in 2016-2021

	Yen	Zloty	Ruble	Dollar	Euro
Yen	1	0.578	-0.007	0.822	0.794
Zloty	0.578	1	0.404	0.655	0.818
Ruble	-0.007	0.404	1	0.166	0.130
Dollar	0.822	0.655	0.166	1	0.868
Euro	0.794	0.818	0.130	0.868	1

Source: compiled by the author based on data from [14]

Indeed, the hryvnia/dollar pair has the lowest correlation with the other currencies, mostly non-significant, which indicates the peculiarity and distinctiveness in the pricing of this currency pair. To assess the seasonality of the currency, it is important to cite the country's exports and imports, which have already been discussed above, as they largely determine the seasonality of the currency. It is important to note that Ukraine is, basically, a country with a negative foreign trade balance, which pushes the currency to a gradual weakening in the long term. This has to do with the fact that Ukraine needs to borrow foreign currency to buy essential imports, as its currency is not an international one. Countries such as the USA, Japan, or EU countries do not borrow money to support their foreign trade because their currencies are freely tradable at currency markets, which is not the case with Ukraine. Figure 10 included below provides a graph of Ukraine's monthly exports and imports, as well as its trade deficit, for 2016-2020.
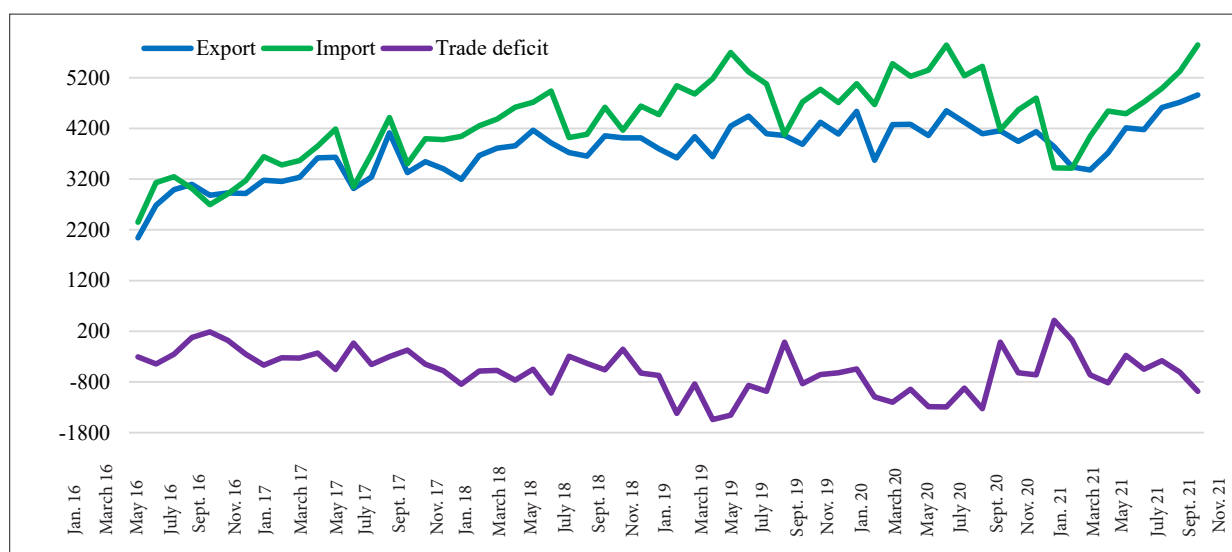
Figure 10. Ukraine's exports, imports, and trade deficit from 2016 to 2020, billion USD

Source: compiled by the author based on data from [15]

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The seasonality of Ukraine's foreign trade is also shown in Table 5 below, which provides a breakdown of the calculated seasonality of exports, imports, and trade balance.

Table 5. Values calculations of seasonality effects on the hryvnia to dollar exchange rate

Indicator	Month											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sen.	Oct.	Nov.	Dec.
S_t (export)	-262.17	-192.57	233.06	-34.17	-50.00	-340.53	-150.20	43.77	-13.33	194.01	292.02	164.08
S_t (import)	-654.27	-171.44	173.61	-495.57	-323.39	-314.16	80.90	109.78	199.97	519.14	319.55	372.14
S_t (balance)	392.11	-21.14	59.45	461.40	273.38	-26.37	-231.10	-66.01	-213.30	-325.14	-27.53	-208.06

Source: compiled by the author based on data from [15]

The Table 5 demonstrates that the seasonal values of the foreign trade balance are similar in their movements to the seasonal values of exchange rates. Indeed, there is an insignificant correlation between the values of seasonal deviation of foreign trade balance and the dollar exchange rate with a value of 0.37, for the yen – 0.48, for the zloty – 0.54, and the ruble – 0.5. This may be evidence of the influence of foreign trade balance on the rates of these currencies and be the main reason for its seasonality (the correlation value was too low for the euro).

Bonds and the currency exchange rate are theoretically linked, as when demand for government loans bonds increases, the national currency must strengthen. The reason for this is that in order to buy government securities, non-residents must exchange currency for hryvnias. In other words, the more government sells its debt securities, the higher the demand for the currency is and the stronger it becomes. Conversely, exchange rate risk is a key determinant of sovereign bond yields [16]. Thus, currency exchange rate appreciation weakens the financial position of developing countries (including Ukraine) and increases bond rates [17]. However, when analysing the impact of domestic government loans bonds on the hryvnia, quite different results were obtained. Below there is a graph of monthly primary sales of domestic government loans bonds in the local currency from 2016 to 2021 (Fig. 11) and Table 6 with correlation values of demand for it.
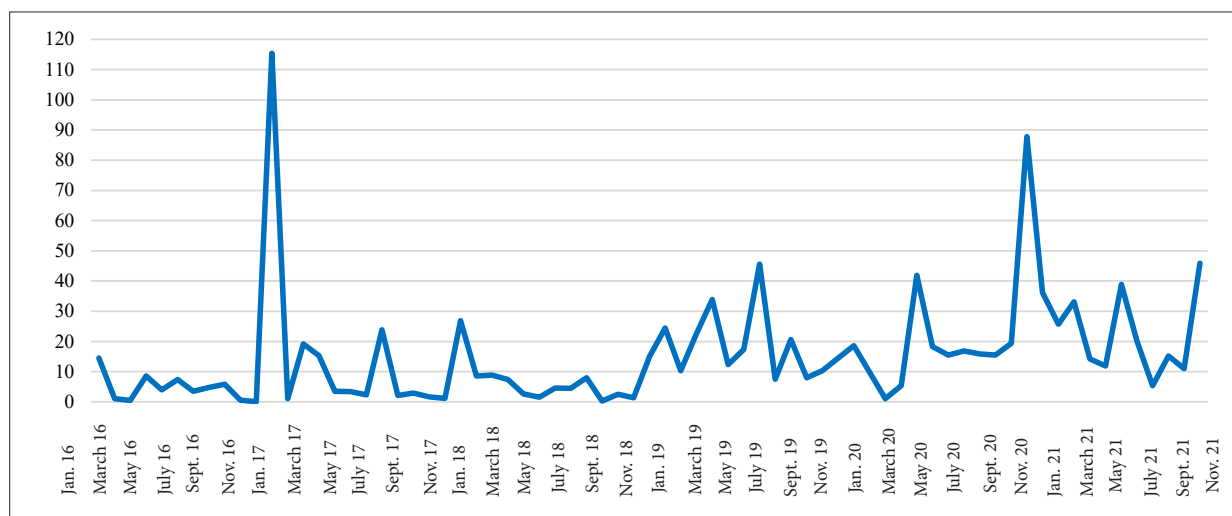
Figure 11. Primary sales amounts of domestic government loans bonds in Ukraine from 2016 to 2021, billion UAH
Source: compiled by the author based on data from [14]

Table 6. Correlation values of domestic government loans bonds demand and exchange rate

Year	Correlation value	
	Dollar	Euro
2016	0.212	-0.289
2017	0.346	0.152
2018	0.145	0.214
2019	0.307	0.314
2020	0.288	0.411
2021	0.167	0.101
2016-2021	0.164	0.106

Source: compiled by the author based on data from [14]

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Therefore, according to Table 6, the correlation between the demand for domestic government loans bonds and the exchange rate was very low and positive, although, in theory, it should have been negative, since, as described above, an increase in demand for domestic government loans bonds should be supported by a strengthening of the currency. In addition, such correlation Graphs should not be taken into account and can be considered random. This was also confirmed by regression analysis, where R^2 values were at or below 0.05 in all cases. The same results were obtained when analysing not only hryvnia-denominated domestic government loans bonds but also when analysing all government securities, including those in dollars and euros. Moreover, no significant correlation was found between bond rates and exchange rates. Figure 12 the Table 7 below, respectively, show the average monthly government bond rates from 2016 to 2021 and the correlation between the exchange rate and the domestic government loans bonds rates.
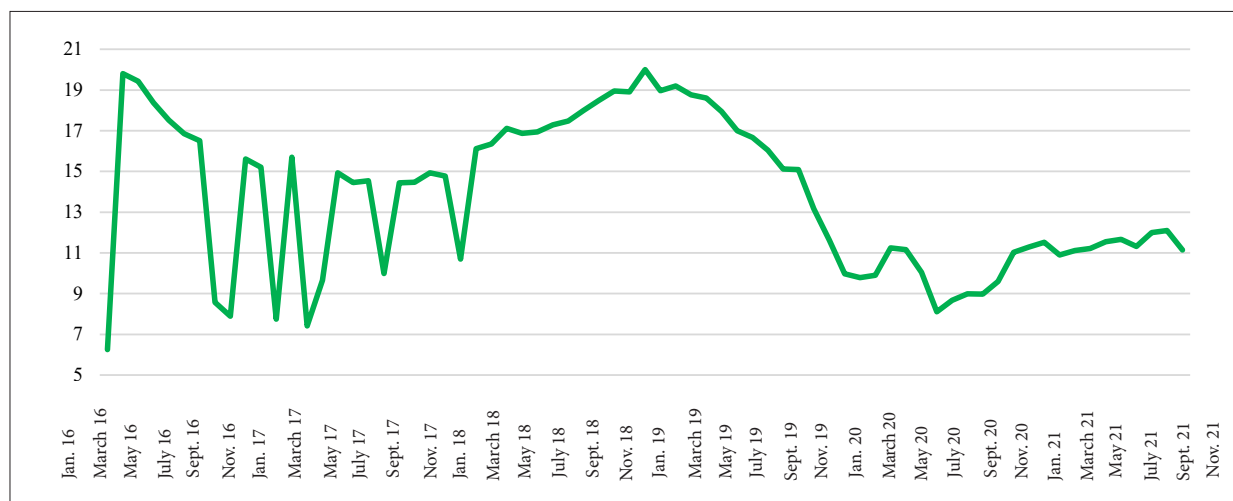

Figure 12. Government bonds rates from 2016 to 2021, %

Table 7. Correlation values of government bonds rates and exchange rates

Year	Correlation	
	Dollar	**Euro**
2016	0.246	-0.464
2017	-0.284	-0.666
2018	0.436	0.329
2019	0.962	0.252
2020	-0.155	0.401
2021	-0.534	-0.244
2016-2021	0.011	0.028

Source: author's devising

This suggests that the impact of the demand for government bonds on the exchange rate in the country has very little if any, impact. Most likely the reason for this is that the government itself chooses the number of government bonds it issues and increases the demand for them by increasing the interest rate (which is confirmed by the existing negative correlation of -0.35 between interest rates and sales of hryvnia securities). In this way, it issues more securities when there is a need to finance various projects and tasks. It is quite possible that at the time of the largest government bond issuance the exchange rate has already been appreciating and, as one of the measures to prevent this increase, the government raises the bond rates and issues a larger number of bonds. Thus, the effect of the bond issuance remains unnoticed or levels within a month, as other factors, including political instability, play an excessive role in the country.

Therefore, the paper examined the influences on exchange rates of several factors, including seasonality, prices of the country's main export resources, and bonds demand. The study traced the presence of seasonality in all of the examined hryvnia exchange rates (in some it had more influence, in some less), which is consistent with the research of other authors, who also found the seasonality of the hryvnia [18]. Moreover, the seasonality factor is found not only in the exchange rate but also in the growth of GDP and other economic indicators [19]. All this points to the strong dependence of the Ukrainian economy on external seasonal factors and the low efficiency of the economy and markets. Thus, Ukraine needs to diversify its main export

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crops, develop new industries that can become a part of Ukraine's global specialisation, and make it more resilient to the price of external resources.

The development of domestic bond markets is also important for the development of the state, which has been confirmed by the example of Latin American countries. They have thus been able to reduce dollar-denominated debt, reduce the factors that influence currency inefficiencies, and move towards longer maturities of domestic debt, lower interest rates, and refinancing risks [20]. The securities market, in general, is not very developed in Ukraine, especially the share market. However, both domestic and corporate bonds are mainly in demand by foreign investors looking for profits and some domestic ones. While other authors have been able to find some correlations between rates on government bonds and the exchange rate, this has not been achieved within the scope of this paper and using available research methods. This could also be due to the inefficiency of the Ukrainian economy or other reasons. In any case, the question of the impact of government bonds on exchange rates needs further consideration.

Conclusions

The article analysed exchange rates in Ukraine from different angles. The main researched factors were the demand for government bonds and seasonality. In the course of the study, it was found that there is a seasonality factor in all hryvnia currency pairs, which affects the exchange rate: in winter the hryvnia exchange rate is consistently above the annual average curve, while in warmer periods it is lower. This is most likely due to the relatively low efficiency of the Ukrainian currency market, as this factor is absent (or almost absent) in more widely spread and traded pairs, such as euro/dollar. Seasonality is most pronounced in pairs of hryvnia with the ruble and zloty; the most likely reasons for this are that they are currencies of comparatively less developed countries than currencies of other comparable countries (US, Japan, and EU countries). It is also because foreign trade with these states has a more pronounced seasonal character: in the case of Russia, it is forced gas supplies, and with Poland, it is seasonal incomes of labour migrants.

In addition, other factors such as the price of certain resources were analysed. Wheat, steel, and soya were chosen for the analysis as they are among the major crops exported by the country. A significant hyperbolic regression relationship was found between the prices of these resources and the exchange rate, which empirically and statistically confirms the impact of these factors on the exchange rate. At the same time, when using this model, no similar evidence was found for the demand side of the country's government bonds, either from the analysis of government bond sales or from movements in interest rates. Possible theories for the absence of this relationship, which should exist from a theoretical point of view, have been described in the paper. It can be concluded that for Ukraine, the most important factors that influence the exchange rate are the successful trade policy of the government, which in turn depends to a large extent on resource prices.

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Аналіз динаміки курсів іноземної валюти в Україні з урахуванням факторів сезонності та попиту на облігації внутрішніх державних позик (понад 5–10 років)

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Анотація. Актуальність наукової статті полягає в обґрунтуванні важливості ролі валютних курсів для надійного функціонування економіки країни. Метою статті є аналіз динаміки курсів іноземної валюти, переважно долара та євро, в Україні з урахуванням факторів сезонності та попиту на державні облігації. Основними методами, використаними в роботі, є статистичні та емпіричні методи дослідження, зокрема моделювання. Визначено, що в Україні особливо важливу роль відіграє експорт сировини, переважно сталі, та різноманітних сільськогосподарських культур, таких як пшениця, кукурудза, соняшникова олія, соя тощо. З'ясовано, що зазначені коливання експорту є однією з причин сезонності валюти, але не єдиною чи основною причиною. Оскільки на обмінний курс сильно впливають ціни на нафту, газ та інші енергоносії, які потребуються постійно, особливо в опалювальний сезон. Також проаналізовано курс гривні за останні п'ять років у контексті Національного банку України. Виявлено, що попит на облігації державних позик є одним із найважливіших факторів при врахуванні курсів іноземних валют в Україні. Щоб зробити моделі більш правдоподібними та зменшити вплив інших факторів на визначення сезонності валюти з певними валютними парами: з доларом, євро, йеною, злотим та рублем, використано дані за останні кілька років, які є меншими хибними під впливом зовнішніх факторів. Підтверджено, що успішна торговельна політика є ключовим джерелом валютної стабілізації в Україні. Стаття корисна для вивчення функціонування валют загалом; для вивчення економіки України, особливо валютного питання країни; для студентів різних економічних дисциплін

Ключові слова: економіка України, курси валют, сезонність, ринок облігацій, фінанси

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