An ARCH/GARCH Approach on Euro/RON Exchange Rate Volatility

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Abstract

Our study investigates the influence of political events, such as elections, censure motions, and economic policies, on the financial markets. We analyzed using ARCH/ GARCH models daily EURO-Ron exchange rates from January 2017 to December 2020 to highlight the interconnection between political and economic shocks and the volatility of the financial markets. The results indicate a strong correlation between turbulence caused by political events and decisions and the volatility of the exchange rates in the studied period. It is necessary to understand better this link between the political factor and the effects that economic measures have on financial markets, especially in the current economic context, health, and, financial crisis generated by the COVID-19 pandemic, which caused governments to respond in unprecedented ways and lead to exceptional measures.

Key words: politics, exchange rate, volatility, Garch
J.E.L. classification: C10, G14, G18

1. Introduction

Our study investigates the influence of political events, such as elections, censure motions, and economic policies, on the financial markets. We analyzed using ARCH/ GARCH models daily EURO-Ron exchange rates from January 2017 to December 2020 to highlight the interconnection between political and economic shocks and the volatility of the financial markets.

The model successfully indicates that the ARCH and GARCH coefficients are statistically significant and the graphic outputs capture the volatility periods of the exchange rate.

The results indicate a strong correlation between turbulence caused by political events and decisions and the volatility of the exchange rates in the studied period.

Political uncertainty, in general, has the gift of creating long-term effects, unfortunately, because investors pay special attention to policymakers who influence the economic environment. A significant aspect of the investment process is given by predictability and legislative stability.

It is necessary to understand better this link between the political factor and the effects that economic measures have on financial markets, especially in the current economic context, health, and, financial crisis generated by the COVID-19 pandemic, which caused governments to respond in unprecedented ways and lead to exceptional measures.

2. Literature review

The article analyzes the influence of political events and economic measures on the exchange rate evolution between January 2017 and December 2020. The exchange rate evolved from 4.51 lei to 4.8694 lei for one euro.

The volatility of financial markets has been intensively studied and analyzed in numerous specialized studies. Financial markets are generally characterized by a high degree of uncertainty reflected in the volatility of stock prices, bonds, exchange rates, interest rates. Volatility is an essential variable in assessing the state of financial markets and for decision-making by investors, managers, regulators.

Schwert (1989) studies the volatility of stocks on the US market and concludes that inflation and other economic factors seem to explain only some fluctuations in volatility. It suggests that changes at the political level would explain differences in capital market volatility over time. Berkman and Jacobsen also confirm the results of their study. They are expanding data internationally and demonstrating that political uncertainty at the international level is correlated with the volatility of the international financial markets. Markets react more strongly (higher volatility) when crises are stronger or when strong states are involved, concludes Schwert.

Berkman and Jacobsen (2006) studied how financial markets were affected by crises and wars. The impact of political uncertainty on volatility is substantial. International crises have a strong effect on capital markets' profitability and volatility. The more severe a crisis, the greater the adverse effects. Their research confirms the importance of political uncertainty in the volatility puzzle (Schwert, 1989), namely that political uncertainty is correlated with market volatility.

Frot and Santiso (2010) studied the effect of parliamentary elections on bonds and capital flows in emerging countries; the study results indicated that parliamentary elections affect the evolution of the portfolio if a candidate is not re-elected. Hence, political uncertainty plays an important role in explaining the effect of the polls. Investors want continuity and especially stability in the political environment, not like the changes. Investors value transparency. Events in the political environment cause increased volatility.

Chau et al. (2013) study the volatility of stock markets in the Middle East and North African Region (MENA) determined by the political uncertainty caused by the civil uprisings in the Arab World i.e. "Arab Spring,".

Vancea et al. (2017) study the influence that political events have on the financial markets in Romania, in this case, the foreign exchange market and the capital market. In their study, Vancea and Aivaz (2017) show a correlation between the political turmoil in Romania in 2012 and the volatility of the exchange rate.

The relationship between election uncertainty, economic policy uncertainty, and financial market uncertainty in seven US presidential election campaigns (from 1992 to 2016) was also examined by Goodell et al. (2019).

3. Methodology and database

In our study, we analyzed using ARCH/ GARCH models (Gherghina et al., 2021; Predescu and Stancu, 2011; Banerjee, 2021; Bora and Basistha, 2021; Curto and Serrasqueiro, 2021; Alexandru et al, 2013; Duttilo et al., 2021; GHERGUȚ et al., 2013 Fakhfekh et al., 2021; Vancea and Aivaz, 2012; Ftiti et al.,2021; Vancea et al, 2017; Ghorbel and Jeribi, 2021) daily EURO-Ron exchange rates, starting from January 3rd2017 to December 31th2020 to highlight the interconnection between political events and economic measures and the financial markets volatility.

Firstly introduced in 1982 (Engle, 1982), to estimate the variance of UK inflation, the ARCH (AutoRegressive Conditional Heteroscedasticity) developed over time. Bollerslev (1986) firstly introduced GARCH (Generalized Autoregressive Conditional Heteroscedasticity). Conditional variation in a GARCH model dependent on its precursory lags. GARCH models modulate the autoregressive (AR) process from the ARCH model into an ARMA process by adding a moving average (MA) process. Below we have the equation for a GARCH model (Bollerslev, 1986).

$$y_t = yx_t + \varepsilon_t$$

Where: y_t −stands for the dependendent variable in t period; x_t- independent variable in the time t; γ - coefficient that shows the influence of x_t on y_t; ε_t residual terms in current t period.

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$$

Where: σ_t^2- stands for the variance, .. ω – „white noise" - the constant in the dispersion equation, α - "ARCH" coefficient; ε_{t-1} residual terms in previous period t–1; β -"GARCH" coefficient.

ARCH (1) model takes into account the volatility to predict the next values of the time series. The basic idea in an Arch model is that if volatility is high in period t-1, the volatility will be high in time t and vice versa. With other words the value of a time series in t moment is affected by the random error (ε_t) and the volatility in time t (σ_t).Since the volatility in time t is a function of the time series in t-1, σ_t is affected by the value of time series in t-1.

GARCH (1, 1) model is equivalent with ARCH (2) model, while GARCH (p, q) is equivalent with ARCH (q + p) (Gujarati, 2003). In GARCH (1, 1) the value of a time series in t moment is affected by the white noise (ε_t), the values of time series in t-1, and the volatility yesterday (σ_{t-1}).For really long time series the GARCH (1,1) model can be generalized as GARCH(p, q) model and when q=0 GARCH reduces to ARCH.

In our study, the variable that we used is the Ron/Euro exchange rate from 03.01.2017 to 31.12.2020. The time series was logarithmically transformed in order to attenuate the monostatic nature. The formula for daily rate is in line with Vancea et al, (2017); Bora and Basistha (2021); Predescu and Stancu, (2011); Curto and Serrasqueiro (2021); Gherghina et al., (2021); Fakhfekh et al. (2021);

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right)$$

where R_t stands for the exchange rate in period t , P_t is the ron/euro exchange price at time t and subscriptions the price in ron for one euro t-1 period.

Figure no. 1. The evolution of the daily exchange rate fluctuation of the RON/EUR exchange rate
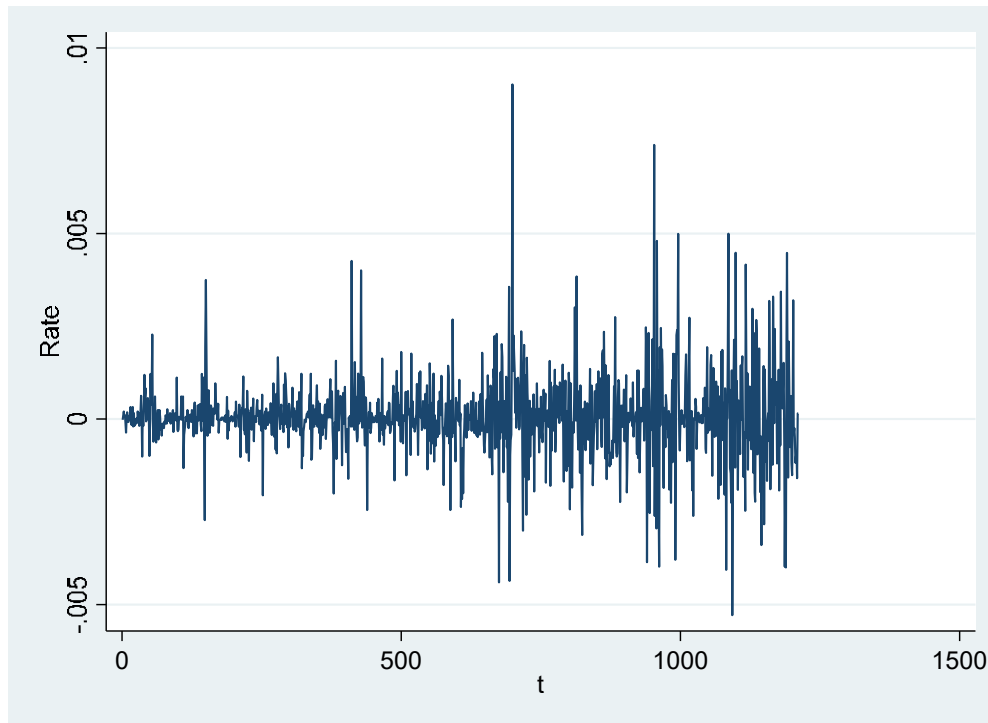
Source: Authors computation, Stata

In Fig. 1, we can observe the high volatility of the exchange rate. In the first period, we can identify volatility clusters (significant fluctuations are succeeded by the same volatile periods, but also they seem to be correlated with political turbulence) followed by high volatility at the beginning of the Covid-19 crisis (March 2020).

At this point in our study, we tested the exchange rate stationarity using the ADF (Augmented Dickey-Fuller) and Phillips-Perron (PP) tests. Were tested the following hypotheses:

H0: The exchange rate series has a root unit and is non-stationary.

H1: The exchange rate series is stationary.

Table no. 1. Results for Augmented Dickey-Fuller Test

```
Dickey-Fuller test for unit root                    Number of obs   =      1210

                          ————— Interpolated Dickey-Fuller —————
               Test        1% Critical     5% Critical    10% Critical
             Statistic        Value           Value           Value
        ———————————————————————————————————————————————————————————————
  Z(t)       -33.579         -3.430          -2.860          -2.570
        ———————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000
```
Source: Authors computation, Stata

Table no. 2. Results for Phillips-Perron test

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Phillips-Perron test for unit root              Number of obs   =      1210
                                                Newey-West lags =         6

                          ————— Interpolated Dickey-Fuller —————
               Test        1% Critical     5% Critical    10% Critical
             Statistic        Value           Value           Value
        ———————————————————————————————————————————————————————————————
 Z(rho)     -1092.736       -20.700         -14.100         -11.300
 Z(t)        -33.575         -3.430          -2.860          -2.570
        ———————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0000
```
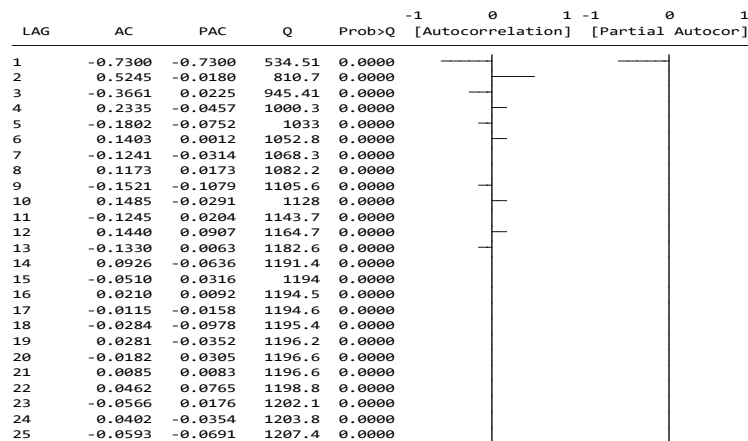*Source:* Authors computation, Stata

Table 1 and Table 2 from above indicate that we can reject the null hypotheses; the time series is stationary for a significance level of 5%. Results suggest that the test values are much higher than the theoretical critical values.

The presence of the ARCH effects can be observed in the correlograms graph. Therefore the next step in our study is to represent and interpret the correlogram of the exchange rate variance.

Figure no. 2. The correlogram of the exchange rate variance

LAG	AC	PAC	Q	Prob>Q
1	-0.7300	-0.7300	534.51	0.0000
2	0.5245	-0.0180	810.7	0.0000
3	-0.3661	0.0225	945.41	0.0000
4	0.2335	-0.0457	1000.3	0.0000
5	-0.1802	-0.0752	1033	0.0000
6	0.1403	0.0012	1052.8	0.0000
7	-0.1241	-0.0314	1068.3	0.0000
8	0.1173	0.0173	1082.2	0.0000
9	-0.1521	-0.1079	1105.6	0.0000
10	0.1485	-0.0291	1128	0.0000
11	-0.1245	0.0204	1143.7	0.0000
12	0.1440	0.0907	1164.7	0.0000
13	-0.1330	0.0063	1182.6	0.0000
14	0.0926	-0.0636	1191.4	0.0000
15	-0.0510	0.0316	1194	0.0000
16	0.0210	0.0092	1194.5	0.0000
17	-0.0115	-0.0158	1194.6	0.0000
18	-0.0284	-0.0978	1195.4	0.0000
19	0.0281	-0.0352	1196.2	0.0000
20	-0.0182	0.0305	1196.6	0.0000
21	0.0085	0.0083	1196.6	0.0000
22	0.0462	0.0765	1198.8	0.0000
23	-0.0566	0.0176	1202.1	0.0000
24	0.0402	-0.0354	1203.8	0.0000
25	-0.0593	-0.0691	1207.4	0.0000

Source: Authors computation, Stata

In figure 2, we can observe the ARCH effect, and that is a strong suggestion that we need to estimate the heteroskedastic model.

Table no. 3. Estimating the GARCH model (1,1) for the exchange rate variance series

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ARCH family regression

Sample: 03jan2017 - 31dec2020, but with gaps      Number of obs   =      1,000
Distribution: Gaussian                            Wald chi2(2)    =      21.62
Log likelihood =  790.0934                        Prob > chi2     =      0.0000
```

Exchangerate	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf. Interval]	
Exchangerate						
_cons	.0017823	.0031415	0.57	0.570	-.0043749	.0079394
ARCH						
arch L1.	.5017646	.0518346	9.68	0.000	.4001707	.6033585
garch L1.	.4822552	.0680673	7.08	0.000	.3488457	.6156647
_cons	.001919	.0006267	3.06	0.002	.0006907	.0031473

Source: Authors computation, Stata

The coefficients of the ARCH and GARCH terms are highly significant, meaning that there is significant predictability in the variance term. According to the information criteria from Table 3, the GARCH model (1,1) is robust and the variance equation is expressed below:

$$\sigma_t^2 = 0.0017823 + 0.5017646\, \varepsilon_{t-1}^2 + 0.4822552\, \sigma_{t-1}^2$$

The sum between the ARCH and the GARCH terms is <1 ensuring the stationarity and the non-negativity of the variance process; the sum is very close to 1, indicating the persistence in volatility.

*Figure no. 3 Volatility of the RON/ EUR exchange rate based on GARCH (1,1) model*
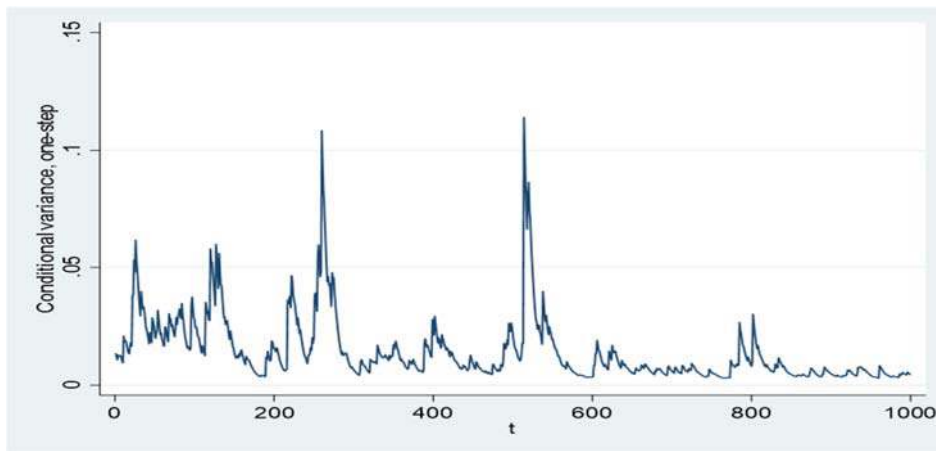
Source: Authors computation, Stata

Testing the validity of the model

We will run several validation tests for our estimated GARCH (1,1) model. We will test the homoscedasticity of the errors terms, the non-correlation of errors terms, and the normal distribution of the errors terms.

Figure no. 4. The distribution histogram of the daily variance series of the exchange rate
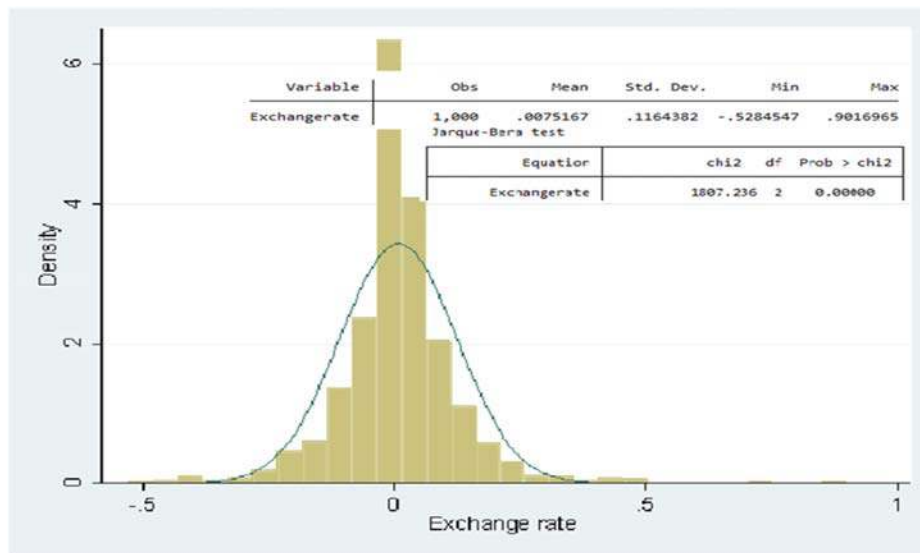
Source: Authors computation, Stata

The result of the Jarque-Bera test and histogram for the daily logarithmic exchange rate indicates that the residual terms of the time series do not have a normal distribution

Table no. 4. Testing ARCH effects

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LM test for autoregressive conditional heteroskedasticity (ARCH)
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lags(*p*)	chi2	df	Prob > chi2
1	0.000	1	0.9993

```
H0: no ARCH effects      vs.  H1: ARCH(p) disturbance
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Source: Authors computation, Stata

Using the ARCH LM test (Lagrange multiplier), we can check for ARCH effects in the residuals. In our case, we accept the null hypothesis-no arch effects with a probability higher than 95%.

Analyzing the residual correlogram, we conclude that there is no autocorrelation in terms of error.

4. Research results and interpretation

In this study, we analyze the influence of political events and economic measures on the evolution of the exchange rate between January 2017 and December 2020. The exchange rate evolved from 4.51 lei to 4.8694 lei for one euro.

From the political context point of view, in the studied period, in addition to presidential, parliamentary, European, and local elections, seven censure motions took place, three of them being approved and leading to the fall of the government (Grindeanu, Dancila, Orban).

There were resignations of the Prime Minister (Tudose), large-scale protests in the country and abroad for the amendments to the justice laws, one of the most controversial legislative amendments, Emergency Ordinance 114/2018. In the last year of the analyzed period, a sizeable sanitary crisis was generated by the Covid pandemic.

The year 2017 began with the investment of the Grindeanu government, followed by a series of protests both in the country and abroad, due to the adoption by political decision-makers of Emergency Ordinance 13, which brought amendments to the justice law. Following the protests of GEO 13/2017, the Minister of Justice, Florin Iordache, resigned.

A premiere on the Romanian political scene was the fall of the Grindeanu government on June 21, 2017, by voting a censure motion filed by the PSD + ALDE parties against their government. In his place, Mihai Tudose was appointed prime minister, but only for a few months, and he resigned at the beginning of 2018. Viorica Dancila was appointed prime minister; the government resisted a censure motion (June 27, 2018).

The year 2018 was also marked by protests against changes in justice laws, one of the largest anti-government rallies in Bucharest, on August 10. The end of the year blew up the financial markets by issuing the Emergency Ordinance 114.

Emergency Ordinance 114 of December 29, 2018, established new taxes on turnover for the energy and telecom sector and taxes on assets in the banking system.

2019 was an election year, with European elections on May 26. In October, the Dancila Government is dismissed by a censure motion, and in November, the Orban government is invested. Following the presidential elections of November 24, 2019, Klaus Iohanis is re-elected President of Romania.

Analyzing the above-mentioned political events, the national currency has not declined in a way that reflects panic.

An example of influence is the statement of the former Minister of Finance, Eugen Teodorovici, from December 18, 2018, announcing that the government will tax banks, energy companies, telecommunications, and bring amendments to Pillar II. Following the Minister's statement and the issuance of the Emergency Ordinance 114, in December 2018 and January 2019 sessions, the national currency registered significant depreciation to a maximum of 4,78 lei. The panic caused by the issuance of Emergency Ordinance 114 had a substantial impact on the exchange market, causing high volatility, Predictability and legislative stability are essential aspects for the financial markets and the investment process.

The National Bank interventions and the clarifications brought at the beginning of 2019 by politicians on the measures provided by the ordinance and the issuance of GEO 19 / March 2019, which improves GEO 114, also restored investor confidence and brought stability for the national currency.

The year 2020 is marked by the Covid pandemic. Although a censure motion fired the Orban government in February 2020, it was reinvested on March 14, forced by the pandemic outbreak. On February 26, the first coronavirus case was recorded in Romania, followed by establishing the state of emergency, our country following the example of other states.

In March 2020, following the declaration of the pandemic by the World Health Organization and the establishment of a state of emergency, we noticed a significant increase in exchange rate volatility. In the March 16 session, immediately after the declaration of the state of emergency, the exchange rate registered a strong fluctuation, oscillating in a single trading session between 4.7888 lei and a maximum of 4.8830 lei, ending the session at 4.8391 lei

The pandemic led to unprecedented measures by the authorities. In an attempt to support the economy during an emergency, the government has taken several measures, such as postponing certain taxes and utilities and technological unemployment. In the banking system, suspending the loan rates was taken for the debtors whose incomes were affected by the situation generated by the Covid-19 pandemic. Another critical measure is support for SMEs by guaranteeing loans through working capital and investment capital and subsidizing interest.

In the second part of the year, local elections (September 27, 2020) and parliamentary elections (December 6, 2020) occurred, these generated increases to up to a percentage for the national currency.

5. Conclusions

In our study, we used GARCH (1, 1) model to characterize the volatility of the Euro-Ron exchange rate from Jan 2017 to Dec 2020. The model successfully indicates that the ARCH and GARCH coefficients are statistically significant and the graphic outputs capture the volatility periods of the exchange rate.

Our results confirm the results of other studies, that is political events and economic policies influence the evolution of the Euro / Ron exchange rate. But not all the political events or financial measures have the same impact on the evolution of the Euro / Ron exchange rate. Scheduled political events, such as the Parliamentary and presidential elections, have led to increases, but volatility has not been very high, the currency fluctuated approximately 0,5% to 1%.

In the period studied, the highest level of volatility was determined by GEO 114 / 2018 and also by establishing a state of emergency, following the declaration of the pandemic (March 2020), volatility was very high. The investors panicked withdrew their money from the market and the exchange rate suffered a sharp depreciation.

Our study shows that the highest influence on the Euro/ Ron evolution has the events that generate political instability like protests due to amendments to the justice laws and also unexpected events, like GEO 114.

That is evidence once more that all of these events and political uncertainty, in general, have the gift of creating long-term effects, unfortunately, because investors pay special attention to policymakers who influence the economic environment. A significant aspect of the investment process is given by predictability and legislative stability.

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