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About Econometric Analysis of Factors Affecting the Change in the USD/AZN Rate

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Abstract. In the study, on the basis of real indicators covering the period from 01.01.2013 to 10.01.2017 [10], an econometric analysis of changes in the USD/AZN rate was conducted. As a result of study, the dependence of several factors provided a serious influence on the change in the USD/AZN rate and the relationship of interdependence with their endogenous variability were gained by carrying out empirical analysis. Verification of the optimality and adequacy of the model is tested using the tools of the software package Eviews. To build a regression equation for the model and test its coefficient of determination, F-Fisher statistics, t – Student criterion, etc., the execution of the Quick → Equation order of the Eviews software package is considered, to check the stationarity of factors, the execution of the test order Quick → Series statistics → Unit root and as a result, conclusions were drawn and recommendations were made for a predictive-analytical computing system.

Key Words and Phrases: Regression, correlation, determination, F-Fisher statistics, t-Student criterion, prediction, VAR, inpatient, Unit root test

JEL code: C10; C12; C13; C14; C15; C22; C32; C51; C53

The exchange rate in the system of international economic relations is a tool of dependence on the value indicators of world and national markets. The exchange rate, as an important component of the world monetary system, is one of the factors affecting the macroeconomic position of each country. The dynamics of the exchange rate, amplitude and frequency of its changes are clear evidence of the economic and political stability of the country. Formation of the exchange rate is a multifactorial process. These factors can be predictable and unpredictable internal and external factors, structural and opportunistic factors. The factors shaping exchange rates are fairly mobile, and their mutual influence can either strengthen or even neutralize the effect on the exchange rate. It should be noted that multifactor dependencies and other macroeconomic processes relevant to the case research were studied in relation to some fundamental economic indicators (for example, [7, 8, 9]). However, for the first time, an analysis of the correlation-regression dependence of the influence of factors with delay on the change in the USD / AZN exchange rate and the construction of the corresponding models are being studied.

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To build an econometric optimal model for changes in the USD / AZN exchange rate, at first each of the factors that can influence it was considered separately, and a general regression equation was established (Table 1).

Table 1

Dependent Variable: USD_AZN
Method: Least Squares
Date: 03/26/18 Time: 08:26
Sample: 2014M02 2017M10
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.096385	1.150521	0.952946	0.3478
GDP	1.88E-05	2.21E-05	0.847511	0.4030
TRADE_BALANCE	0.004072	0.007142	0.570128	0.5726
REPO_INTEREST	-0.012209	0.023162	-0.527117	0.6017
OIL	0.000560	0.001666	0.336206	0.7389
EXPORT	-0.004078	0.007136	-0.571378	0.5717
INFLATION	0.018750	0.008356	2.244049	0.0319
INPORT	0.003977	0.007132	0.557633	0.5810
GBP_EUR	0.452617	0.531777	0.851141	0.4010
FED	-0.044484	0.097009	-0.458554	0.6497
INTEREST	0.023441	0.028851	0.812476	0.4225
COUNTER_REPO_INTER	0.038649	0.007609	5.079250	0.0000
EUR_USD	-0.938357	0.461383	-2.033791	0.0503

R-squared	0.975141	Mean dependent var	1.254932
Adjusted R-squared	0.965819	S.D. dependent var	0.396210
S.E. of regression	0.073251	Akaike info criterion	-2.152987
Sum squared resid	0.171705	Schwarz criterion	-1.631063
Log likelihood	61.44222	Hannan-Quinn criter.	-1.958419
F-statistic	104.6065	Durbin-Watson stat	2.537828
Prob(F-statistic)	0.000000		

Table 1 summarizes both its own grades and the probable grades of several tests. Let's analyze some tests in the table separately. As you can see, the coefficient of determination (R-squared) and the adjusted coefficient of determination (Adjusted R-squared) are very large. This means that the factor signs of the coefficients of the established regression equation can explain 96–97% of the signs of the result. Let's take a look at the F-Fisher test. Since the probability value (F-statistic $= 104.6$, the probability value $p = 0$) is much less than $\alpha = 0.05$, we can consider the factors of the model as valid. Let's take a look at the Durbin-Watson test ($DW = 2.54$). If we compare the results obtained here with tabular prices, we must say that the existence of negative autocorrelation of residuals ($d_l = 0.79, d_u = 2.044, 4 - d_l = 2.21$ and $4 - d_u = 1.956$; $4 - d_l < 2.54 < 4$) accepted.

As a result of the study, let's analyze the question of whether the model in Table 2 was the optimal model that was established with the introduction of the Least Squares Method.

Table 2

Dependent Variable: USD_AZN_D
Method: Least Squares
Date: 10/29/18 Time: 12:38
Sample (adjusted): 2014M03 2017M10
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000537	0.022135	0.024280	0.9808
EUR_USD_D(-1)	-1.281899	0.311269	-4.118302	0.0002
FED_D(-1)	0.233846	0.113924	2.052647	0.0470
INFLATION_D(-1)	0.050949	0.005287	9.636359	0.0000
OIL	0.003686	0.001505	2.449618	0.0190
OIL(-1)	-0.003686	0.001441	-2.557816	0.0146

R-squared	0.798188	Mean dependent var	0.020143
Adjusted R-squared	0.771634	S.D. dependent var	0.099869
S.E. of regression	0.047725	Akaike info criterion	-3.120601
Sum squared resid	0.086552	Schwarz criterion	-2.877302
Log likelihood	74.65321	Hannan-Quinn criter.	-3.030374
F-statistic	30.05882	Durbin-Watson stat	2.043172
Prob(F-statistic)	0.000000		

The analytical form of the model is as follows:

$$y_t = 0.0005 - 1.28x_{1,t-1} + 0.23x_{2,t-1} + 0.051x_{3,t-1} + 0.0037x_{4,t} - 0.0037x_{4,t-1}.$$

Here: x_1 is the first difference in the course of the EUR / USD exchange rate, x_2 is the 1st difference FED, x_3 is the first difference of inflation, and x_4 is the indicator of oil prices. In addition, t represents the value of the indicator itself, and $t-1$ represents the value of the delay from the 1st power.

Let us explain the results obtained in Table 2. If we look at the t-Student criteria for each of the factors of the model individually, we will see that the probability of all factors outside the constant c is less than 5%. This means that the model is individually significant for each factor. In general, let's look at the F-Fisher test statistics to check the importance of the model. As you can see, the probability is close to 0, which means that the model is usually considered important. In addition, since the Durbin Watson test model is close to 2, it can be said that there is no autocorrelation model (other tests were considered to check for the presence of autocorrelation). The coefficient of determination ($R^2 = 79.8188\%$) means the disclosure of about 80% of the model, which is not considered to be quite important. The main reason for this is that there is another factor that can affect fluctuations in the exchange rate of the US dollar / manat. Whether the constructed model is optimal is tested by the following tests.

The correlation coefficients of all factors were calculated in the **multicollinearity** test, and the following results were obtained as a result of the Quick → Group statistics → Correlations command of the Eviews software test (Table 3):

Table 3

	Trade_balance	GDP	REPO_INTEREST	OIL	EXPORT	IMPORT	INFLATION	GBP_EUR	FED	INTEREST	EUR_USD	COUNTER_REPO_INETEREST
Trade_balance	1,000	0,039	-0,361	0,858	0,931	-0,211	-0,594	-0,030	-0,391	-0,354	0,803	-0,471
GDP	0,039	1,000	0,555	0,004	0,068	0,078	0,386	-0,590	0,564	0,584	0,027	0,454
REPO_INTEREST	-0,361	0,555	1,000	-0,322	-0,398	-0,087	0,833	-0,782	0,796	0,990	-0,408	0,892
OIL	0,858	0,004	-0,322	1,000	0,881	0,037	-0,596	-0,120	-0,376	-0,305	0,902	-0,400
EXPORT	0,931	0,068	-0,398	0,881	1,000	0,160	-0,644	-0,065	-0,352	-0,365	0,872	-0,486
IMPORT	-0,211	0,078	-0,087	0,037	0,160	1,000	-0,116	-0,096	0,118	-0,020	0,162	-0,026
INFLATION	-0,594	0,386	0,833	-0,596	-0,644	-0,116	1,000	-0,597	0,843	0,846	-0,582	0,908
GBP_EUR	-0,030	-0,590	-0,782	-0,120	-0,065	-0,096	-0,597	1,000	-0,694	-0,825	-0,154	-0,763
FED	-0,391	0,564	0,796	-0,376	-0,352	0,118	0,843	-0,694	1,000	0,840	-0,316	0,821
INTEREST	-0,354	0,584	0,990	-0,305	-0,365	-0,020	0,846	-0,825	0,840	1,000	-0,366	0,919
EUR_USD	0,803	0,027	-0,408	0,902	0,872	0,162	-0,582	-0,154	-0,316	-0,366	1,000	-0,421
COUNTER_REPO_INETEREST	-0,471	0,454	0,892	-0,400	-0,486	-0,026	0,908	-0,763	0,821	0,919	-0,421	1,000

Let's explain the results. In (Table 3), the highest value is the correlation coefficient of interest rates with repo percentage. That is, these indicators explain 99% of each other. The high correlation coefficient is evidence of the multicollinearity problem in the embedded model, demonstrating a strong correlation between the indicators. To eliminate multicollinearity, at least one of these factors should be excluded. To do this, review the t-Student values for both indicators in (Table 1). Note that among these two factors, the value of the t-Student criterion is higher at the repo rate. Therefore, this factor should be excluded from the model. Once the factor was removed, the model was re-modeled, and the results were closer to the results in Table 1. Thus, this rule excludes several other factors from the model.

Stationarity. One of the most important tasks is to test the stationarity of an optimal econometric model. Thus, for each factor, the stationary test in the Eviews software package was checked by the Quick → Series statistics → Unit root tests command to determine that several factors (including FED, Inflation, EUR / USD, etc.), are considered to be non- stationary , oil (at the level of 10% significance) and the trade balance are considered stationary.

Granger test. The overall result, including all factors included in the regression equation, was first used to process this test for a computer package. The main goal here is to check, with the removal of multicollinearity, whether Granger is the cause of the USD / AZN indicators of all factors, including the excluded factors. The Eviews software package revealed Granger's causal relationship for 5 factors that directly or indirectly affect the change in the USD / AZN exchange rate, so the test results can be compiled in the following table (Table 4) compactly. The (+) sign is a causal link, and (-) indicates the absence of this link).

Table 4

Granger Causality Tests					
EUR/USD	$\underset{-}{\rightarrow}$	USD/AZN	EUR/USD	$\underset{-}{\rightarrow}$	USD/AZN
USD/AZN	$\underset{-}{\rightarrow}$	EUR/USD	USD/AZN	$\underset{-}{\rightarrow}$	EUR/USD
FED	$\underset{+}{\rightarrow}$	USD/AZN	FED	$\underset{+}{\rightarrow}$	USD/AZN
USD/AZN	$\underset{-}{\rightarrow}$	FED	USD/AZN	$\underset{-}{\rightarrow}$	FED
İnflation	$\underset{+}{\rightarrow}$	USD/AZN	İnflation	$\underset{+}{\rightarrow}$	USD/AZN
USD/AZN	$\underset{-}{\rightarrow}$	İnflation	USD/AZN	$\underset{-}{\rightarrow}$	İnflation
Oil	$\underset{+}{\rightarrow}$	USD/AZN	Oil	$\underset{+}{\rightarrow}$	USD/AZN
USD/AZN	$\underset{-}{\rightarrow}$	Oil	USD/AZN	$\underset{-}{\rightarrow}$	Oil
Trade balance	$\underset{+}{\rightarrow}$	USD/AZN	Trade balance	$\underset{+}{\rightarrow}$	USD/AZN
USD/AZN	$\underset{-}{\rightarrow}$	Trade balance	USD/AZN	$\underset{-}{\rightarrow}$	Trade balance
EUR/USD	$\underset{-}{\rightarrow}$	FED	EUR/USD	$\underset{-}{\rightarrow}$	FED
FED	$\underset{-}{\rightarrow}$	EUR/USD	FED	$\underset{-}{\rightarrow}$	EUR/USD
EUR/USD	$\underset{+}{\rightarrow}$	İnflation	EUR/USD	$\underset{+}{\rightarrow}$	İnflation
İnflation	$\underset{-}{\rightarrow}$	EUR/USD	İnflation	$\underset{-}{\rightarrow}$	EUR/USD
EUR/USD	$\underset{+}{\rightarrow}$	Oil	EUR/USD	$\underset{+}{\rightarrow}$	Oil

Note that the check of this test is carried out on the basis of the probable value of α (prob) and is estimated by the probability $\alpha = 5\%$. If we look at the values of the probabilities, we get that FED ($\alpha = 0.13\%$), Oil ($\alpha = 4.64\%$), Inflation ($\alpha = 1,256 \cdot 10^{-9}\%$) can be counted as a Granger-cause of USD / AZN. In addition, we note that the oil exchange rate ($\alpha = 0.69\%$) and the EUR / USD exchange rate are the Granger-cause of oil ($\alpha = 0.23\%$) and inflation ($\alpha = 4.51\%$).

Testing heteroscedasticity. Let's look at the implementation of the White test [3, pp. 386-387] to test heteroscedasticity (Table 5).

Table 5

Heteroskedasticity Test: White

F-statistic	1.710014	Prob. F(18,25)	0.1061
Obs*R-squared	24.27976	Prob. Chi-Square(18)	0.1461
Scaled explained SS	42.40716	Prob. Chi-Square(18)	0.0010

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 10/29/18 Time: 13:08
Sample: 2014M03 2017M10
Included observations: 44
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011034	0.013201	0.835844	0.4112
EUR_USD_D(-1)^2	1.800454	1.572769	1.144767	0.2631
EUR_USD_D(-1)*FED_D(-1)	-6.915193	6.724561	-1.028349	0.3136
EUR_USD_D(-1)*INFLATION_D(-1)	0.159528	0.061246	2.604691	0.0153
EUR_USD_D(-1)*OIL	-0.025398	0.013356	-1.901649	0.0688
EUR_USD_D(-1)*OIL(-1)	0.024083	0.013136	1.833325	0.0787
EUR_USD_D(-1)	0.085939	0.131043	0.655809	0.5179
FED_D(-1)^2	7.341197	8.748055	0.839180	0.4093
FED_D(-1)*INFLATION_D(-1)	-0.135257	0.153497	-0.881172	0.3866
FED_D(-1)*OIL	-0.035316	0.042686	-0.827330	0.4159
INFLATION_D(-1)^2	0.000993	0.002324	0.427231	0.6729
INFLATION_D(-1)*OIL	-0.001207	0.000845	-1.427448	0.1658
INFLATION_D(-1)*OIL(-1)	0.001109	0.000696	1.594613	0.1234
INFLATION_D(-1)	0.013920	0.012300	1.131683	0.2685
OIL^2	6.10E-05	3.16E-05	1.927163	0.0654
OIL*OIL(-1)	-0.000121	6.48E-05	-1.858851	0.0749
OIL	2.60E-05	0.000701	0.037124	0.9707
OIL(-1)^2	6.20E-05	3.45E-05	1.796556	0.0845
OIL(-1)	-0.000378	0.000730	-0.518380	0.6088

R-squared	0.551813	Mean dependent var	0.001967
Adjusted R-squared	0.229118	S.D. dependent var	0.004306
S.E. of regression	0.003781	Akaike info criterion	-8.019412
Sum squared resid	0.000357	Schwarz criterion	-7.248967
Log likelihood	195.4271	Hannan-Quinn criter.	-7.733694
F-statistic	1.710014	Durbin-Watson stat	1.768087
Prob(F-statistic)	0.106141		

The model is considered to be homoscedastic, since the significance level of trial prices in the upper right-hand corner of the table exceeds 5% significance level.

To test the autocorrelation of the residual model, 2 tests are used for the Q-statistical (AR) and Serial L_m tests (MA). To verify the accuracy of the hypothesis of the absence of autocorrelation, consider the following tables (Tables 6 and 7):

Table 6

	AC	PAC	Q-Stat	Prob
1	-0.024	-0.024	0.0277	0.868
2	-0.078	-0.078	0.3173	0.853
3	-0.121	-0.126	1.0458	0.790
4	0.000	-0.014	1.0458	0.903
5	0.186	0.169	2.8325	0.726
6	-0.147	-0.159	3.9856	0.679
7	0.009	0.028	3.9899	0.781
8	-0.026	-0.003	4.0277	0.855
9	-0.005	-0.042	4.0294	0.909
10	-0.047	-0.084	4.1620	0.940
11	-0.026	0.022	4.2033	0.964
12	-0.105	-0.163	4.9027	0.961
13	-0.125	-0.149	5.9191	0.949
14	0.077	0.064	6.3210	0.958
15	0.027	-0.010	6.3714	0.973
16	0.011	-0.048	6.3799	0.983
17	-0.094	-0.034	7.0399	0.983
18	0.074	0.092	7.4618	0.986
19	0.026	-0.065	7.5173	0.991
20	0.006	0.013	7.5204	0.995

Table 7

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.250479	Prob. F(4,34)	0.9074
Obs*R-squared	1.259484	Prob. Chi-Square(4)	0.8682

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 10/29/18 Time: 13:16
Sample: 2014M03 2017M10
Included observations: 4
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001815	0.023200	-0.078220	0.9381
EUR_USD_D(-1)	-0.136491	0.358360	-0.380876	0.7057
FED_D(-1)	-0.020787	0.126753	-0.163999	0.8707
INFLATION_D(-1)	0.000974	0.005747	0.169497	0.8664
OIL	0.000492	0.001665	0.295244	0.7696
OIL(-1)	-0.000458	0.001595	-0.287320	0.7756
RESID(-1)	-0.051468	0.177744	-0.289564	0.7739
RESID(-2)	-0.119908	0.192764	-0.622047	0.5381
RESID(-3)	-0.148864	0.179426	-0.829668	0.4125
RESID(-4)	-0.031735	0.186675	-0.170003	0.8660

R-squared	0.028625	Mean dependent var	5.78E-17
Adjusted R-squared	-0.228504	S.D. dependent var	0.044865
S.E. of regression	0.049727	Akaike info criterion	-2.967825
Sum squared resid	0.084074	Schwarz criterion	-2.562327
Log likelihood	75.29214	Hannan-Quinn criter.	-2.817447
F-statistic	0.111324	Durbin-Watson stat	1.977868
Prob(F-statistic)	0.999211		

Here, the null hypothesis is that there is no autocorrelation, and an alternative hypothesis is the existence of autocorrelation.

Table 6 shows that this model was tested for an autoregressive model with 20 lags and received more than 5% for each lag (the lowest probability was observed at the 6th delay $\alpha = 67.9\%$). This means that the model we establish indicates acceptance of the null hypothesis as a result of the Q-statistical test (i.e. there is no autocorrelation in the model we established).

Now let's explain the results of Table 7. Here the null hypothesis is the absence of autocorrelation of residuals, and the alternative hypothesis is the existence of autocorrelation of residues. Remind that the results of this test, as a rule, are checked with 5% probable accuracy. To verify the test, 4 lag cases were considered. When choosing the optimal variant, the condition is assumed that the probable value, like the Q-statistical test, will be more than 5%. As can be seen from the table, the probable values are rather large than the 5% probability values. If we specify the result with the hypothesis, the results will be the adoption of the null hypothesis and the failure of the alternative hypothesis. That is, there is no autocorrelation of residuals on the model.

To determine which lags are included in the model, the VAR is selected in the Eviews software package instead of the Equation tool, and by executing the Lag sturucture $\rightarrow$ Lag length criteria command in an open window, a new table is formed (Table 8).

Table 8

VAR Lag Order Selection Criteria
Endogenous variables: USD_AZN_D EUR_USD_D FED_D INFLYASIYA_D NEFT TICARET_BALANSI
Exogenous variables: C
Date: 10/21/18
Time: 20:16
Sample: 2013M01 2017M10
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-337.8910	NA	1.182168	17.19455	17.44788	17.28615
1	-234.2502	171.0073*	0.041052*	13.81251	15.58584*	14.45369*
2	-203.5986	41.37970	0.060773	14.07993	17.37325	15.27069
3	-174.9210	30.11149	0.124541	14.44605	19.25936	16.18639
4	-114.4260	45.37126	0.081436	13.22130	19.55460	15.51122
5	-59.71112	24.62169	0.192247	12.28556*	20.13885	15.12506

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4th of the star symbols indicate an inevitable delay to the 1st degree, and 1 to a delay to the 5th degree. Since the first lag is taken basic by the 4th criteria, the model was re-estimated using the least squares method, introducing the 1st lag (Table 9).

Table 9

Dependent Variable: USD_AZN_D
Method: Least Squares
Date: 10/21/18 Time: 20:22
Sample (adjusted): 2014M03 2017M10
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.038211	0.048931	0.780918	0.4406
~~USD_AZN_D(-1)~~	-0.074854	0.086008	-0.870312	0.3906
EUR_USD_D	0.054378	0.359104	0.151426	0.8806
EUR_USD_D(-1)	-1.435419	0.353779	-4.057385	0.0003
FED_D	-0.106016	0.122313	-0.866763	0.3925
FED_D(-1)	0.210132	0.127133	1.652850	0.1081
INFLATION_D	-0.004672	0.005978	-0.781536	0.4402
INFLATION_D(-1)	0.049029	0.005947	8.243755	0.0000
OIL	0.003844	0.001667	2.305641	0.0278
OIL(-1)	-0.004556	0.001916	-2.377944	0.0236
TRADE_BALANCE	8.98E-06	3.75E-05	0.239448	0.8123
TRADE_BALANCE(-1)	1.94E-05	3.73E-05	0.520867	0.6060

R-squared	0.814241	Mean dependent var	0.020143
Adjusted R-squared	0.750386	S.D. dependent var	0.099869
S.E. of regression	0.049896	Akaike info criterion	-2.930759
Sum squared resid	0.079667	Schwarz criterion	-2.444162
Log likelihood	76.47669	Hannan-Quinn criter.	-2.750305
F-statistic	12.75146	Durbin-Watson stat	1.996700
Prob(F-statistic)	0.000000		

Although the results are considered normal by many criteria, the results of the t-Student test are not considered acceptable. To eliminate this drawback, we need to remove some factors from the model. After subtracting the negative factors, we get the results of the optimal model, i.e. Table 2.

Forecasting. The following operations must be performed sequentially to make predictions through the built model:

First, the regression equation for the model is again set. The main difference between this regression equation and the original regression equation is that the equation is not executed for all observed moments, but from the time it starts to the moment when the observation prices at that moment are used for forecasting. The results for the newly created regression equation are shown below (Table 10):

Table 10

Dependent Variable: USD_AZN_D
Method: Least Squares
Date: 10/21/18 Time: 20:58
Sample (adjusted): 2014M03 2016M06
Included observations: 28 after adjustments

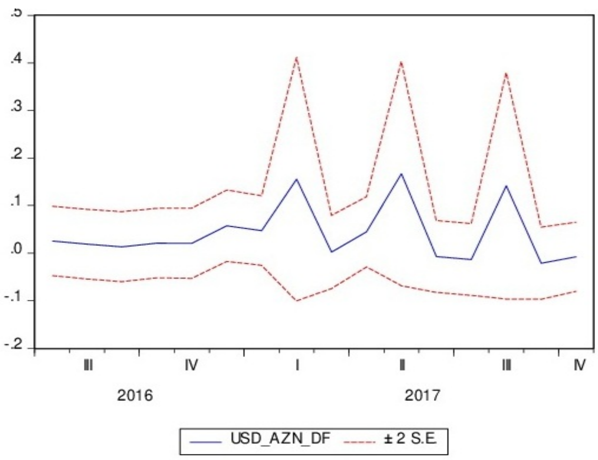
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008925	0.019400	0.460057	0.6500
EUR_USD_D(-1)	-0.972143	0.283976	-3.423321	0.0024
FED_D(-1)	0.640711	0.476624	1.344271	0.1926
INFLATION_D(-1)	0.042808	0.011207	3.819926	0.0009
OIL	0.001839	0.001208	1.521712	0.1423
OIL(-1)	-0.001931	0.001166	-1.656244	0.1119

R-squared	0.925163	Mean dependent var	0.025246
Adjusted R-squared	0.908155	S.D. dependent var	0.115460
S.E. of regression	0.034991	Akaike info criterion	-3.680029
Sum squared resid	0.026937	Schwarz criterion	-3.394556
Log likelihood	57.52040	Hannan-Quinn criter.	-3.592757
F-statistic	54.39447	Durbin-Watson stat	2.136338
Prob(F-statistic)	0.000000		

Analysis of the results shows that there have been some changes in the values of the indicators. This change is a result of the difference in moments when the moments used in the model were not used in the prediction.

Now let's look at the prediction results for the remaining moments:

Table 11

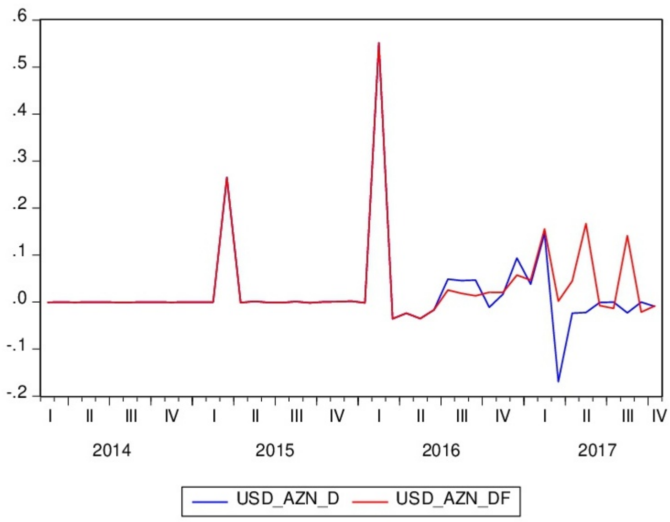


Forecast: USD_AZN_DF	
Actual: USD_AZN_D	
Forecast sample: 2016M07 2017M10	
Included observations: 16	
Root Mean Squared Error	0.079929
Mean Absolute Error	0.050603
Mean Abs. Percent Error	1655.816
Theil Inequality Coefficient	0.581606
Bias Proportion	0.144156
Variance Proportion	0.005912
Covariance Proportion	0.849933
Theil U2 Coefficient	7.103336
Symmetric MAPE	121.3647

Each test interval is two times longer than the standard error ($\sigma^2 \approx 0,08$). Note that the closer the standard error is to zero, the more accurate the model prediction can be.

Now let's look at the following chart to compare the forecast of the USD / AZN exchange rate curve (Chart 1):

Chart 1



Here, the USD / AZN exchange rate curve is shown in blue, and the projected exchange rate curve is shown in red.

As you can see, the curve model obtained using the forecast was located at some distance from the curve itself. This difference is due to the fact that the model is not fully explained by the factors mentioned.

Conclusion

Thus, as a result of comparative testing of many tests using the Eviews software package, the optimal regression model was tested, which shows that the model covering the time segment 01.01.2013-01.10.2017 changed significantly depending on four factors. A separate analysis of the results of each test shows that the model residues are homoscedastic, do not depend on autocorrelation, and can be considered to be generally significant. At the end of the model, the most optimistic version was predicted.

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