

1 Determinants of Exchange Rate Fluctuations of Uzbek Sum

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5 **Abstract**

6 This paper examines the determinants of exchange rate fluctuations of Uzbek sum by using
7 three econometric models OLS (Ordinary Least Squares), ARIMA (Autoregressive Integrated
8 Moving Average) and ML ARCH (Multivariate Long memory Autoregressive Conditional
9 Heteroskedasticity). Model results show that the effects of money supply and remittances to
10 the nominal and real exchange rates (USD/UZS) are found statistically significant; the
11 impacts of inflation and interest rate are not econometrically meaningful. Also, it should be
12 noted that the level of net trade influences to the exchange rate is not conclusive in our
13 econometric analysis.

14

15 **Index terms**— exchange rates, interest rate, money supply, net trade, remittance

16 **1 Introduction**

17 It is a well-known fact that trade policy plays a crucial role in ensuring a higher level of output and stable price
18 level. To guarantee a high level of Gross Domestic Product and stable price level, the main focus of the economy
19 should be on exchange rate policy. Therefore, here for monetary policy one way to reach its aim is by having a
20 stable exchange rate. It is widely believed that too highly appreciation of local currency depresses the external
21 demand for domestic goods meaning that the amount of export is affected negatively. But at the same time,
22 with too rapid depreciation of local currency, the exporters are unlikely to get benefit from selling their goods.
23 Having considered all, to control and keep the foreign exchange rate at a desirable level for the economy, it is
24 necessary for each economy to define main influencing factors (determinants) of the exchange rate.

25 **2 II.**

26 **3 Literature Review**

27 Since the economic importance of foreign exchange rate will play a desirable factor for trading economies, there
28 has been taken significant emphasis on the study of foreign exchange rate determinants in recent decades.
29 Determinants of exchange rate volatility have frequently been an area of interest for many macroeconomists
30 worldwide. Still, this subject in transition economies remains empirically unexplored. Some of the researches in
31 the cases of other countries will be reviewed in chronological order as follows.

32 The preliminary interests on this study commenced after the introduction of optimal currency area by R.
33 Mundell [1] in the 1960s and constitution of European Monetary Union where floating exchange rate has been
34 considered an optimal policy for Euro zone. Consequently, majority macroeconomists were involved to examine
35 the factors of exchange rate volatility. One of them, A. Rose et al. [2] reported that the best interference
36 instrument in exchange changes in interest rate which is an independent variable which explains the sensitivity of
37 exchange rate. Whereas, D. Ariccia [3] proved that exchange rate volatility is also affected by financial variables,
38 especially external debt.

39 'Fisher effect' a theory proposed by Irving Fisher also describes interest rate differential tend to reflect the
40 exchange rate expectation. The assumption further illustrates that an expected change in the current exchange
41 rate between any two currencies is approximately equivalent to the differences between the two countries the
42 nominal interest rates for that time [4,5]. Spot exchange rate is expected to change equally but in the opposite
43 direction of the interest rate differential. Thus, the currency of the country with the higher nominal interest
44 rate expected to depreciate against the currency of the country with the lower nominal interest rate, as higher

6 EMPIRICAL METHODOLOGY

45 nominal interest rate reflect an expectation of inflation. High real interest rate significantly reduces exchange
46 rate volatility [6].

47 Madura, J. [7] proved that in the long run, it is not the ideal relationship between exchange rates and inflation
48 rates differential. However, he argued that in the long run, inflation differentials might be used for forecasting
49 of exchange rate volatility. An exchange rate is not only determined by the domestic interest rate, but it is also
50 influenced by the changes in the interest rate by the major world economies. Hence, it may be concluded that in
51 case of a single economy, a negative correlation exists between exchange rate volatility and interest rate [8].

52 While the focus of the previous literature has been on the effect of exchange rate uncertainty on the incentive
53 impacts on net trade, a few authors have examined the "reverse" relationship on the impacts of international
54 trade on the exchange rate. Mundell's [9] optimal currency area assumptions suggest inverse causality, whereby
55 trade flows stabilize real exchange rate fluctuations, hence reducing real exchange rate volatility. Broda and
56 Romalis [10] state additionally that such causality should be addressed as "?most of the exciting studies have
57 focused on the effects of exchange rate regimes or volatility on trade by assuming that the exchange rate process
58 is driven by exogenous shocks and is unaffected by other variables.

59 Broad research has been accomplished to check the remittance and exchange rate relationship. During the
60 panel data analysis of 13 Latin American economies over 20 years, Amuedo-Dorantes and Pozo [11] exposed
61 that worker remittance appreciates exchange rates. Also, the researchers claim that doubling the remittances
62 to GDP ratio led to a real exchange rate appreciation above 22%. In a relevant analysis, Barajas et al. [12]
63 disagree that the effect of remittances on exchange rates varies across countries. More lately, Mandelman and
64 Acosta ??13, 14 and 15] checked that remittances are a cause of real exchange rate appreciation. Similar results
65 are taken in other panel initiatives conducted by Hassan and Holmes [16]. In contrast, Rajan and Subramanian
66 [17] for instance, argue that remittances do not result in the phenomenon known as the Dutch disease (negative
67 consequences arising from considerable increases in the value of a country's currency from any significant influx
68 of foreign currency into a country).

69 Lately, Tariq [18] conducted research to examine the correlation of money supply and exchange rate volatility
70 in the case of Pakistan. By empirical evidence, it is concluded that money supply has a reverse relationship with
71 exchange rate volatility. It has also been found that money supply (policy variable) has an inverse relationship
72 with exchange rate volatility. Therefore, to restraint the exchange rate volatility, money supply may be efficient.

73 4 III.

74 5 Data Description

75 To define exchange rate determinants in Uzbekistan, the study hypothetically sets the following five variables
76 throughout 2007q1-2018q1: money Supply (M2); net export (export-import); inflation; remittances and interest
77 rate (see Table 1). According to the table of the summary statistics, quarterly average official exchange rate (\$1
78 USD=UZS) was equal to approximately 2342 UZS for the period. Indeed, the figure above illustrates that the
79 minimum exchange rate stood at 1243 UZS at the beginning of the selected period, while the maximum exchange
80 rate was 8156 UZS per a US dollar. However, quarterly interest rate and inflation rate fluctuated over the period
81 and made up an average of 16% and 3% respectively. Even though there were some fluctuations in interest rate,
82 its overall trend was downward. The quarterly inflation rate was unstable between 2007q1 and 2018q1. The
83 mean of money supply (M2) during 2007Q1 -2018Q1 was equal to around 27.3 billion per quarter.

84 According to the summary statistics table, minimum money supply equals 47.2 billion UZS, while maximum
85 M2 was equal to 74.1 billion UZS. Furthermore, the quarterly average of the net export was around 547 million
86 USD. It should be noted that the minimum level of net export for the period was negative, namely 770 million
87 USD, while the highest point was almost 2 billion of US dollars. The last but not least determinant of the
88 exchange rate, the average amount of remittances to the host economy recorded approximately 4.896 billion USD
89 in 2017 and 3.827 billion in 2018Q3 (accumulated).

90 In general, while exchange rate, money supply (M2) and remittances showed an upward trend during the
91 selected period, interest rate and the amount of net trade in the economy decreased over the time-frame.

92 Quarterly inflation rate fluctuated over the period ranging from roughly 0 to 8% (See below graph).

93 6 Empirical Methodology

94 Since the underlying research aims to define the determinants of the exchange rate in Uzbekistan economy, it
95 initially approaches to the OLS method to analyze and estimate the extent of the abovementioned variables
96 on the exchange rate. Then, due to the presence of non-stationary and heteroskedasticity, the research is also
97 conducted using one of the time-series models ARIMA and ML ARCH respectively.

98 The current study also approaches some econometric specification tests. Namely, Breusch-Pagan-Godfrey and
99 ARCH tests are applied to determine whether heteroskedasticity or not in the obtained data (see Appendices,
100 Table 1 and Table 2). Breusch-Godfrey Serial Correlation LM Test is used to define whether the residuals are
101 correlated across the series (Table ??). Also, whereas the underlying study carries out the Ramsey test (Table ??)
102 to check whether there is the sign of omitting variable or not, the Chow test (Table ??) is applied for detecting
103 the structural break within the taken period.

104 In this empirical study, the standard model is as follows: $Y = X(0) + C(??$

105 7 Specification Tests and its Results

106 It is evident from Table 1 illustrated in the appendices that p-value of the Breusch-Pagan-Godfrey test is not
107 statistically significant meaning that there is insufficient evidence to conclude that variances are not constant
108 across the series. But ARCH test shows that variances are constant across the series and the sum of the ARCH
109 and GARCH coefficients is very close to one. Moreover, when Breusch-Godfrey Serial Correlation LM test was
110 applied, it was found that there is strong firstlevel of autocorrelation (serial correlation) across the residuals. At
111 the same time, to define whether the constructed model has omitted variables or not, the study approaches to
112 the Ramsey test. As it is clear from the p-value, which is equal to almost 0, there is enough evidence to conclude
113 that the constructed model has no omitted variables. Also, to ensure the reliability of the estimates, the study
114 checks whether the data is normally distributed or not, and it found that the residuals are normally distributed
115 by Jarque-Bera (see Table ?? in appendices).

116 The following table indicates the corresponding coefficients of each regressor included in the model (standard
117 errors of the coefficients in parentheses). Significance levels are depicted by the stars, * $p<0.05$, ** $p<0.01$ and ***
118 $p<0.001$ respectively. Before turning to the next section, it is highly essential to note that interpretations of the
119 obtained results will be provided based on the three models, namely OLS, ARIMA, and MARCH. Starting with
120 the OLS model, the obtained results present that the interest rate has no impact on determining the exchange
121 rate in Uzbekistan economy during the period of 2007q1 and 2018q1. This insignificant relationship between
122 exchange rate and the interest rate is also confirmed by the statistics provided by ARIMA and MARCH models
123 at even 1% significance level. Meanwhile, inflation is not found to have a statistically significant effect on the
124 exchange rate by three econometric models namely OLS, ARIMA, and MARCH.

125 Turning to the discussion of money supply and its impact on the exchange rate, it is clear that money supply
126 (M2) is found to be a essential factor in determining the exchange rate. Specifically, all selected models, namely
127 OLS, ARIMA, and MARCH indicate that a 1% increase in M2 results in approximately 1% depreciation of
128 Uzbek sums against US dollars. Obtaining the same result through using different models highly confirms and
129 increases the reliability of the coefficient obtained. More strikingly, according to the all models above, net trade
130 and exchange rate are positively associated during the selected period. However, the ARIMA model shows
131 that the effect of net trade on rate is statistically insignificant (pvalue 0.519). As previously mentioned in the
132 literature part, the number of remittances and exchange rate are positively correlated meaning that if the inflow
133 of remittances to the host country increases, it leads to the appreciation of local currency. In our empirical
134 analysis, it is found that a 1% rise in the inflow of remittances in USD to Uzbekistan economy should cause
135 roughly 0.24% appreciation of Uzbek sums against US dollars. The underlying correlation is also affirmed by all
136 three models.

137 8 VI.

138 9 Conclusion

139 All in all, while the effects of remittances and money supply on the dynamic of exchange rate are found statistically
140 significant, the impacts of inflation and interest rate are not econometrically meaningful. It is also should be
141 noted that the way the level of net trade influences the exchange rate is not conclusive in our econometric analysis.

142 Having considered all above, the following might be suggested to policymakers and related parties:
143 ? First of all, Central bank should carefully control the level of money supply (M2) in the economy so that
144 it can keep the exchange rate at an appropriate level for the economy; ? Secondly, all conducted econometric
145 models within the study did not affirm the significance of net trade on the level of exchange rate; it is highly
146 emphasized by other studies as stated in the literature review part that it has its positive impact on shaping
147 the level of exchange rate. Therefore, the responsible parties of the government should highly pay attention to
148 the participation of Uzbekistan workforce in other foreign economies, and redirect their salary to Uzbekistan; ?
149 Thirdly, regardless of the fact that the study did not find strong simultaneous evidence to confirm the sensible
150 effect of the interest rate by commercial banks, at least one model shows a strong negative correlation between
151 commercial interest rate and the level of exchange rate meaning that an increase in interest rate should appreciate
152 UZS against USD;

153 ? Finally, since the study found no credible evidence concerning the effect of inflation on shaping the level
154 of exchange rate, while the goal of the government is keeping an appropriate level of exchange rate, holding the
155 desirable inflation rate should not be at the center of feature to consider.

9 CONCLUSION

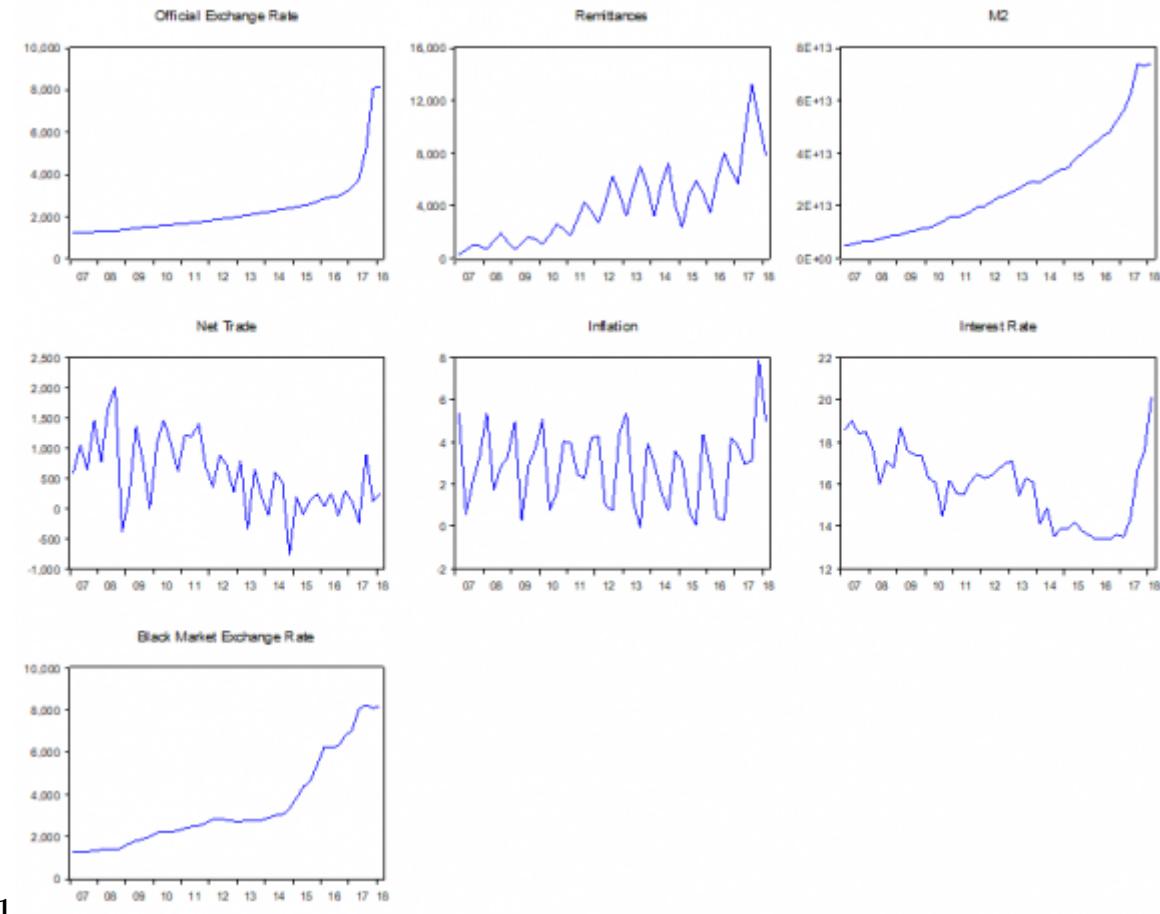


Figure 1: Graph 1 :

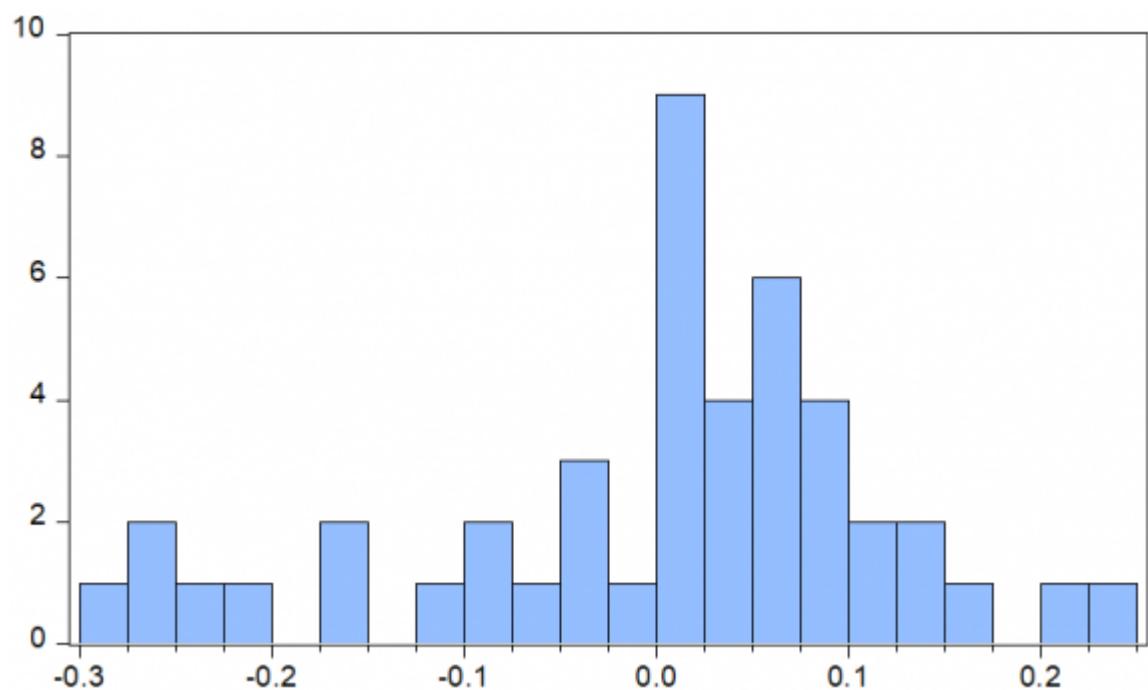


Figure 2:

1

	Nominal Exrate_Official	Rem_S	M2	Net_Trade	Infl	I_Rate
Mean	2342.109	4044.035	2.73E+13	547.2689	2.877647	15.98889
Median	1914.800	3500.145	2.32E+13	595.1000	2.986291	16.20000
Maximum	8156.680	13223.96	7.41E+13	2015.500	7.871467	20.20000
Minimum	1243.600	356.8818	4.72E+12	-769.0000	-0.034984	13.40000
Std. Dev.	1485.075	2912.185	1.95E+13	602.3994	1.813764	1.795857
Skewness	2.806774	0.975118	0.951092	0.259045	0.213938	0.133564
Kurtosis	11.07957	3.766163	3.068164	2.648873	2.635516	2.188610
Jarque-Bera	181.4839	8.232043	6.793035	0.734452	0.592361	1.368210
Probability	0.000000	0.016309	0.033490	0.692653	0.743653	0.504542
Sum	105394.9	181981.6	1.23E+15	24627.10	129.4941	719.5000
Sum Sq.	97039753	3.73E+08	1.67E+28	15966942	144.7486	141.9044
Dev.						
Observations	45	45	45	45	45	45

Figure 3: Table 1 :

2

Explanatory Variables	OLS	ARIMA	ML ARCH
I_RATE			
Coefficient	0.0103	0.0103	-0.0124
Std. error	(0.0153)	(0.0247)	(0.0092)
P-value	0.5030	0.675	0.1776
INFLATION			
Coefficient	-0.0022	-0.0022	-0.0060
Std. error	(0.0131)	(0.0172)	(0.0068)
P-value	0.8654	0.896	0.3823
M2			
Coefficient	1.0073***	1.0073***	0.8175
Std. error	(0.0823)	(0.1153)	(0.0470)
P-value	0.0000	0.000	0.0000
NET_TRADE			
Coefficient	0.0382*	0.0382*	0.0317*
Std. error	(0.0181)	(0.0592)	(0.0165)
P-value	0.0422	0.519	0.0554
REMITTANCE			
Coefficient	-0.2467	-0.2467	-0.2039
Std. error	(0.0676)	(0.0731)	(0.0338)
P-value	0.0028	0.001	0.0000
CONSTANT			
Coefficient	-14.4112	-14.4112	1.4124
Std. error	(1.6076)	(2.6104)	(0.3852)
P-value	0.3850	0.000	0.0002
R-SQUARED	0.9549	0.9549	0.9167
Adjusted R-squared	0.9492	0.9492	0.9061
p> F or CHI2	0.0000	0.0000	0.0537

Figure 4: Table 2 :

156 .1 Appendices

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