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By: Mesut Yilmaz, Yessengali Oskenbayev, Kanat Abdulla

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Mesut Yılmaz
Suleyman Demirel University Department of Economics,
Almaty, Kazakhstan
e-mail: mesutyilmaz01@gmail.com

Yessengali Oskenbayev
Suleyman Demirel University Department of Economics,
Almaty, Kazakhstan
e-mail: oskenbay@gmail.com

Kanat Abdulla
National Analytical Center under the Government
and National Bank of Kazakhstan,
Astana, Kazakhstan
e-mail: kanat_nac@.gov.kz

Abstract

This paper aims to investigate the demand for money in Kazakhstan. This study covers the period starting from 2000:01, when capital liberalization program was launched and National Bank approved managed float regime (National Bank employed adjustable exchange rate regime before exchange rate crisis in Kazakhstan in 1999) to 2007:12 as recent available data for investigation variables. In order to achieve the goal we set demand for money function is estimated using cointegration methodology aimed for variables integrated of order one. The results show important key factors for controlling money demand could be applied by National Bank of Kazakhstan. Besides, there was reversal of currency in Kazakhstan over the period under the investigation.

Keywords: Demand for money, currency substitution, dollarization, Kazakhstan

JEL Classification Codes: C32(Time-Series Models), F31(Foreign Exchange), F41(Open Economy Macroeconomics),F43(Economic Growth of Open Economies), E31(Price Level; Inflation; Deflation), E41(Demand for Money)

1. Introduction

The purpose of this paper is to present an empirical analysis of currency substitution phenomenon as it is important determinant of money growth.

Kazakhstan government move from a fixed exchange rate to a floating exchange rate in April 1998. In a natural manner , It was followed by wide adjustments in the Kazakh tenge during 1998 and 1999. Therefore, the tenge is reduced in value against the dollar up to 2003, when the dollar fell. (in this session, the exchange rate Kazakh tenge per dollar (KZT/USD) became larger from 76 to a high of 156. The downturn at the end of this trend indicates the beginning of USD depreciation. The tenge may have begun to float in 1998, but the real depreciation came in one year, when the price of a dollar in tenge increased 34 percent.) Eicher (2004). Financial crisis took place in Russia in 1998 led to a tenge depreciation and National Bank of Kazakhstan introduced flexible exchange rate regime. Revaluation Kazakhstan currency (tenge) against national currencies of trade partners worsened the competitiveness and deteriorated balance of trade of Kazakhstan as exports started to decline. With the introduction of flexible exchange rate regime, National Bank and Government launched currency liberalization program (Resolution of the Board of the National Bank of Kazakhstan, N369, September 11, 2002).

The National Bank of Kazakhstan changed the official exchange rate mechanism. New mechanism started from the June 9, 2003. The official exchange rate of tenge to US dollar is the weighted average rate of tenge to US dollar set on the morning session of the Kazakh Stock Exchange on the previous business day.

As the borders of Kazakhstan becoming free in the world of globalization, the dynamics of currency substitution process is crucial for establishing the relationship between real money balances and essential monetary aggregates. In case of depreciation of domestic currency, especially in countries of high inflation, households tend to lose confidence on domestic currency and start using more stable foreign currency. In short, the causes of currency of currency substitution are high inflation, the real depreciation of domestic currency and interest rate (Girton, L., Don, R., 1981).

Currency substitution has significant inferred meanings for the macroeconomic performance of countries, financing government deficit, determining an appropriate foreign exchange regime. Currency substitution, leading to the decline in domestic money holdings, could cause an economic slowdown and hence worsen the economic crisis (Bahmani- Oskooee and Techaratanachai, 2001).

Currency substitution, an increase in the size of foreign currency deposits leads to a decline in the amount of credits in domestic currency forcing domestic private firms to borrow in foreign currencies. This increases the currency and default risks of firms making them more vulnerable to speculative activities. In addition, borrowing in foreign currency leads to an increase in the domestic currency value of foreign currency debt obligations in the face of devaluation. This causes an enlargement in the demand for foreign currency and, in turn, may result in a downward spiral in the price of domestic currency (Hausmann, 1999).

Oomes and Ohnesorge (2005), estimate the money demand function of Russia, suggest that money demand does not depend on currency substitution in Russia. One of the previous studies, concerning currency substitution, is done by Eicher (2004) suggest that inflation is more important than exchange rates.

Our aim in this paper is to investigate the process currency of substitution through the prism of money demand function. To achieve this goal we employed the tools of time series modeling. The remainder of the paper is constructed as follows. Section 2 briefly

summarizes the model, data and methodology used in the paper. In section 3, we discuss empirical results and results of short-term demand for money relationship. The last, Section 4, concludes the paper.

2. Data and Methodology

Demand for money function, applied by Aranga and Nadiri (1981) and Jayaraman and Ward (2000), is employed in our research. The desired demand for real money balanaces is specified as follows.

$$LM2_t = \alpha_0 + \alpha_1 LIIP_t + \alpha_2 IR_t + \alpha_3 LREER\_EURO_t + \alpha_4 LREER\_USD_t + \varepsilon_t , \quad (1)$$

where M2 real money balances realized by CPI, IIP stands for industrial index of production used as a proxy for GDP, IR refers to interest rate for saving deposits, LREER_EURO and LREER_USD are real effective exchange rates for euro and dollar, respectively represent proxy variables for expected exchange rates. In order to eliminate heteroskedasticity of series except interest rate, we take their natural logarithm and define them as LM2, LIIP, LREER. The data from 2000:01 to 2007:12 is used and obtained National Bank of Kazakhstan web-site except two variables such as real money balances and industrial index of production, which is supported by National Analytical Center under the Government and National Bank of Kazakhstan. Series of index of industrial of production are deseasonalized Hodrick-Prescott methodology. Calculation methodology of real effective exchange rate index (REER), carried by National Bank, is as follows

$$REER=100*\Pi_i(\Delta S_i * (P^d/P_i^f))^w, \quad (2)$$

where P_i^f - price level in i country – trade partner of Kazakhstan;

P^d - price level in Kazakhstan;

Π_i - multiplication of tenge exchange rate against trade partner countries currencies change indices, corrected for relative prices taking into account normalized weight of a country in the total country group commodity trade turnover;

ΔS_i – tenge exchange rate change (S_i is direct quotation of tenge, meaning domestic currency per unit of foreign currency).

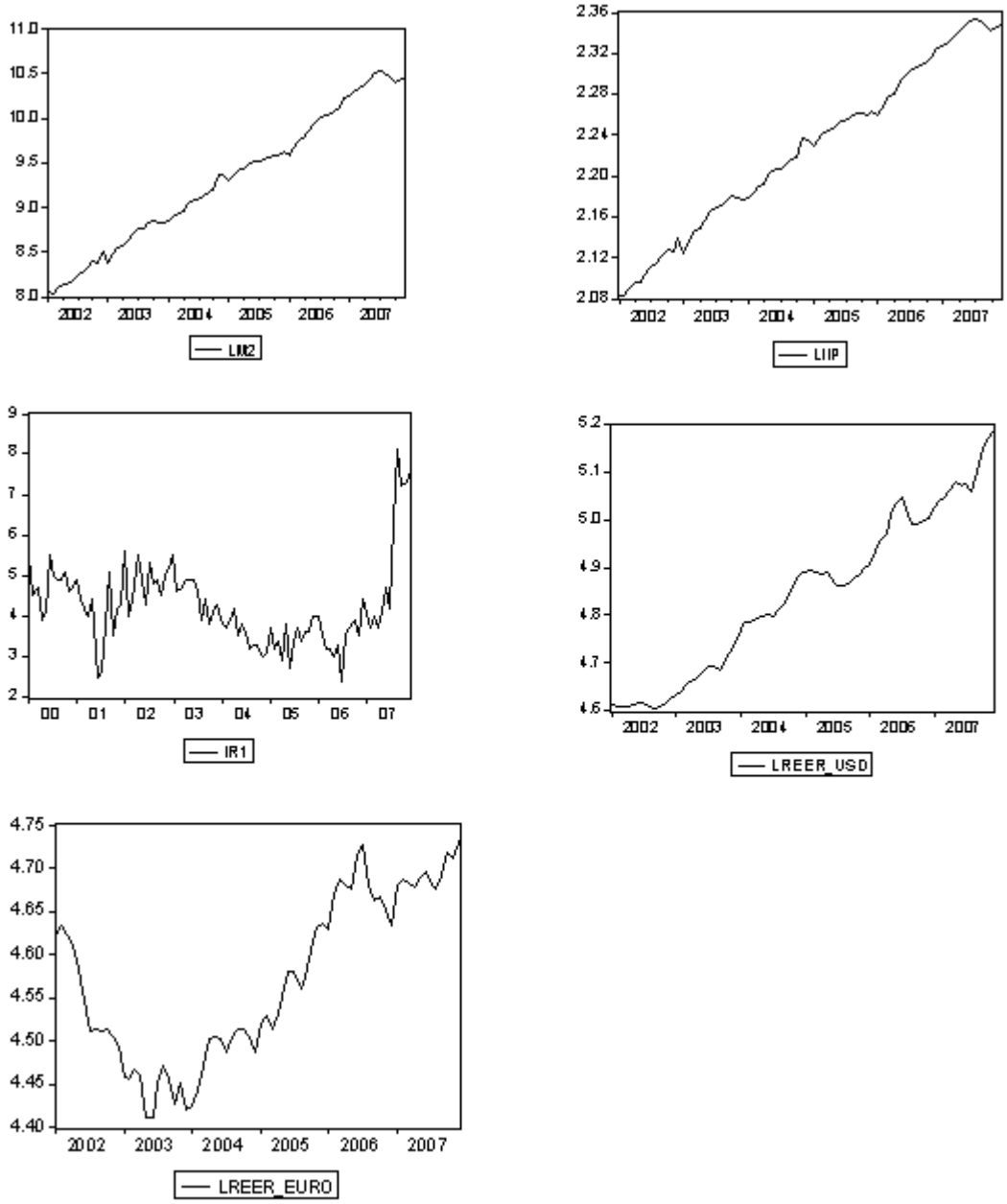
Concerning the directions of the coefficients, the following sign are expected

$$\alpha_1, \alpha_2, \alpha_3, \alpha_4 > 0$$

We expect positive sign for IIP as an increase in economic activity causes a greater demand for money. Identically, the sign for interest rate expected to be positive meaning that interest rate for deposits increase leads to money demand increase as well. Exchange rate expectations of euro and dollar sings, estimated as domestic currency per unit of foreign currency, are expected to be positive also because an increase in expected appreciation leads to an increase of the demand for domestic currency due to the fact that domestic currency becomes more preferable as the expected return from domestic currency.

The dynamics and trend of the variables graphically presented in Figure 1.

Figure 1. Trend of The Variables in The Model (Period 2000:01-2000:12)



As seen from the figure 1 above M2, IIP, REER variables have increasing trend. Although, interest rate has most of the time unstable and fluctuating trend, it started to go up over recent years. Besides, the figure 1 shows that variables are not stationary. Non-stationarity of the variables implies that we face spurious regression problem. In order to avoid the spurious regression problem several methods are suggested. If series are integrated of order one, meaning they are stationary at first differences cointegration relationship could be examined by two methods: Engle and Granger (1987); Johansen (1988) and Johansen and Juselius (1990) approaches. Advantage of the Johansen approach is that Engle and Granger becomes invalid if there is more than one cointegrating relationship. Error Correction Models method developed by them has been proved successful as it separates out long-run and short-run equilibrium.

3. Empirical Analysis of Demand for Money in Kazakhstan

Unbiasedness is an important property of an estimator, which is held in the LS case for static models. In dynamic models and more generally in the models with stochastic regressors, unbiasadness can no longer be achieved. In such cases, consistency replaces inbiasadness as a desirable property.

Therefore, it is necessary to conduct unit root tests in first step before proceeding with the model in consideration. At present Augmented Dickey-Fuller (ADF, 1979) and Phillips-Perron (PP, 1988) tests are widely applied in the academia to examine the stationarity of time series. The key characteristic of these tests is that the performance of these tests can be sensitive to the lag choice. Comparing with ADF test PP unit root test shows relatively good power (Cheung, Y., Lai, K. S., 1997). It is well know that ADF test statistics, in case of autocorrelation of error term, are affected asymptotically. Schwert (1989) states that the PP tests reject the true null hypothesis too often in the case of negative correlation and too seldom when positive correlation occurs. All in all the clear advantage of operating both tests is that they keep us from choosing the truncation lag arbitrarily and possibly incorrectly. The unit root tests are summarized in Table 1 below.

Table1. The ADF test results

Variables	**ADF t-statistics (Level)**		**ADF t-statistics (First Difference)**		**Likely degree of integration**
	Without Tend	**With Trend**	**Without Tend**	**With Trend**	
LM 2	-0.299(0)	-2.331(3)	-10.103(0)*	-10.086(0)*	I(1)
LIIP	-0.166(0)	-2.892(3)	-10.441(0)*	-10.384(0)*	I(1)
LREER_USD	1.150(1)	-1.993(1)	-5.666(0)*	-6.001(0)*	I(1)
LREER_EURO	-0.452(4)	-0.961(2)	-7.895(1)*	-7.904(1)*	I(1)
IR	-1.510(1)	-0.247(2)	-12.926(0)*	-9.935 (0)*	I(1)

Numbers in brackets are the duration of delays determined according to Akaike Information Criterion.
***** Implies 1% level significance,** implies 5% level significance, *** implies 10% level significance.

Table2. The Phillips-Perron test results

Variables	**Phillips-Perron t-statistics (Level)**		**Phillips-Perron t-statistics (First Difference)**		**Likely degree of integration**
	Without Tend	**With Trend**	**Without Tend**	**With Trend**	
LM 2	-0.288(2)	-3.424(4)***	-8.845(2)*	-8.781(2)*	I(1)
LIIP	-0.697(3)	-3.133(4)	-9.415(3)*	-9.388(3)*	I(1)
LREER_USD	0.946(2)	-2.696(2)	-4.927(4)*	-5.044(4)*	I(1)
LREER_EURO	-0.251(3)	-2.418(12)	-6.729(7)*	-7.031(14)*	I(1)
IR	-2.334(3)	-2.008(2)	-13.684(1)*	-14.439(0)*	I(1)

Numbers in brackets are the duration of delays determined according to Newey-West using Bartlett kernel bandwidth. * Implies 1% level significance,** implies 5% level significance, *** implies 10% level significance.

As it is seen from Table 1 and 2, all variables in questions appear to be stationary at first difference according to ADF and PP tests. As the number of lagged differences included in the Dickey-Fuller test, we use values suggested by the AIC criterion when employing maximum lag order of p(max)=24, while PP test employing Bartlett kernel bandwidth. Moreover, in ADF test, compared with level test regressions, the number of lagged differences keeps decreasing. The conclusions of the ADF test for these variables are quite clear, as well as PP test. The test statistic for the real money balances and interest rates, however, is only slightly appearing to be stationary at levels. This situation satisfies of error correction model that all variables in question. Given the integration and trending properties of the time series the cointegration between the five variables is possible.

3.1. Cointegration Test

Therefore, the next step in our analysis is the specification of an initial, unrestricted VAR model that forms the basis for cointegration tests and error correction representation. For this purpose we employ information criteria to select the lag length of VAR specification. The typical model selection process is related to the trade off the bias with specific parametrization and inefficiency of overparametrization.

Different criteria specifying the lag length are used in our research. One of them Final Prediction Error by Akaike (1969 and 1970), which gives more weight to unbiasadness over efficiency, while selects too large lags. The second one, Schwartz Information Criterion (1978), which selects correct lags asymptotically, however selects too short lags. Next one, Akaike Information Criterion (1970, 1973 and 1974) assumed generally not consistent according to Shibata (1976). The last one is Hannan-Quinn information criterion (1979) selects optimal lags correctly, while it has a disadvantage in being biased for large samples.

Table 3. Statistics for Selecting The Lag Order

Lag	FPE	AIC	SC	HQ	LM-Stat
0	1.92E-17	-24.301	**-24.155***	-24.243	NA
1	**1.33E-17***	-24.669	-23.795	**-24.318***	**35.489*****
2	1.64E-17	-24.468	-22.865	-23.824	27.258
3	1.80E-17	-24.391	-22.060	-23.455	32.209
4	2.37E-17	-24.147	-21.088	-22.918	19.124
5	3.14E-17	-23.919	-20.130	-22.397	30.072
6	3.69E-17	-23.839	-19.322	-22.025	23.427
7	3.92E-17	-23.896	-18.650	-21.788	19.511
8	4.34E-17	-23.959	-17.985	-21.559	30.232
9	4.35E-17	-24.188	-17.485	-21.495	24.192
10	4.61E-17	-24.443	-17.012	-21.458	19.353
11	5.14E-17	-24.763	-16.603	-21.485	22.114
12	4.08E-17	**-25.594***	-16.705	-22.023	31.336

* indicates lag order selected by the criterion;
NA – not applicable;
* shows 1%,** 5%, ***10% significance levels and imply hat there is autocorrelation between error terms.

*** indicates autocorrelation in lag order

The results of the procedures are given in Table 3. We report the information criteria FPE, AIC, SC and HQ together with the test statistics for LM autocorrelation test. According to the statistics of these tests the smallest critical value is determined as the optimal duration of the lag. However, the hypothesis of autocorrelation existence has to be rejected. In this study maximum duration of lags has been taken as 12. The number of lags which minimize AIC is detected to be 12, while there is no lag number that satisfies SC. Although, the number of lags which satisfies FPE and HQ is 1, there is autocorrelation problem exists. Therefore, lag order 12 seems promising as no autocorrelation has been rejected for the lag order in question.

Following Johansen and Jueselius (1990) cointegration test is conducted. Cointegration refers to the possibility that non-stationary series may have a linear combination that is stationary. Such a linear combination implies that long run equilibrium relationship among variables exists. Table 4 below represents the cointegration test which indicates a long run equilibrium relationship between the series. A brief description of this test is as follows.

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \pi X_{t-1} + \varepsilon_t, \qquad (1)$$

where Xt and Et are (n*1) vectors and Pi is (n*n) matrix of parameters.

Table 4. Johansen Cointegration Test (Trace Statistic)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.691885	221.81	68.52	76.07
At most 1 **	0.565459	124.09	47.21	54.46
At most 2 **	0.343755	54.91	29.68	35.65
At most 3 **	0.210215	19.95	15.41	20.04
At most 4 **	0.004391	0.37	3.76	6.65

Table 5. Johansen Cointegration Test (Max-Eigen Statistic)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.691885	97.71	33.46	38.77
At most 1 **	0.565459	69.18	27.07	32.24
At most 2 **	0.343755	34.96	20.97	25.52
At most 3 **	0.210215	19.59	14.07	18.63
At most 4 **	0.004391	0.37	3.76	6.65

Trace test indicate 4 cointegrating equations at 5% significance level and 3 cointegrating equation 1% levels, while Max-Eigen Statistic determines 4 equations at both 5% and 1% levels. Therefore, it is expected that these real money balances, economic performance, real exchange rates of the currencies and interest rate will show a long-run equilibrium relationship.

Table 6. The Cointegration Estimates

Variables	**Coefficients**	**T-statistics**
LM2(-1)	1	
LIIP(-1)	-7.978	102,12*
IR(-1)	-0.036	15,71*
LREER_EURO(-1)	-0.016	12,28*
LREER_USD(-1)	-0.431	7,36*
Log likelihood	1338.711	

*****Significant 1% level.

The second column of standardized eigenvectors in Table 6 can be interpreted as the long-run demand for real M2 and the equation is as follows:

LM2 = 7.978*LIIP + 0.036*IR + 0.016*LREER_EURO + 0.431*LREER_USD (1)

All coefficients have the expected positive signs. Thus, we conclude that all of the coefficients signs are consistent with theory. Moreover, all of them significant even at 1% level. Generally speaking, the coefficients carry the expected magnitudes. The only variables which causes probably some concern is LIIP is much greater than one. The coefficients could be interpreted as 1% increase of LIIP, IR, LREER_EURO and LREER_EURO leads to 7.978, 0.036, 0.016 and 0.431 percent increase in real money balances (LM2).

3.2. Short-Run Relationship

Once the long-run relationship is established, short-run equilibrium can be obtained. For determening the short-run relationship between the variables the error correction model can be obtained of the form:

$$\Delta LM2_t = \alpha_0 + \alpha_1 ECM_{t-1} + \sum_{i=1}^{m} \alpha_{2i} \Delta LM2_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta LIIP_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta LREER\_USD_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta LREER\_EURO_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta IR_{t-i} + \mu_t \quad (2)$$

In equation above, ECM_{t-1} is one period lag value of error terms that are obtained from the long-run relationship. It shows how much of the disequilibrium in the short-run will be eliminated in the long-run.

Table 7. The Estimation of Error Correction

Variables	Coefficients	T-statistics
DLM2(-1)	0.389	4.375*
DLM2(-2)	0.021	2,634**
DLM2(-3)	0.321	2,974*
DLM2(-4)	0.001	0,157
DLM2(-6)	0.302	2,839*
DLM2(-12)	0.251	2,490**
DIR(-1)	-0.002	-2,671*
DIR(-7)	-0.002	-2,506**
DIR(-8)	-0.003	-3,760*
DIR(-9)	-0.002	-2,863*
DLREER_USD(-4)	-0.072	-1,977***
DLREER_USD(-8)	-0.145	-3,865*
DLREER_USD(-10)	0.100	2,343**
DLREER_USD(-11)	-0.091	-2,086**
DLREER_EURO(-9)	-0.055	-3,230*
DLIIP	8.795	104,678*
DLIIP(-1)	-3.162	-4,050*
DLIIP(-3)	-2.774	-2,974*
DLIIP(-6)	-2.469	-2,715*
DLIIP(-12)	-2.263	-2,628**
C	-0.001	-1,543
ECM(-1)	-0.079	-3,876*
R-squared	0.996700	
Adjusted R-squared	0.995564	
S.E. of regression	0.003157	
Durbin-Watson stat.	1.941228	

Significant at *1%, **5%, ***10%.

Diagnostic Test	
Serial Correlation	
Breusch-Godfrey serial correlation F-statistic	0.418 (0.949)
LM test (c2-statistic)	7.713 (0.807)
AR Conditional. Heteroskedasticity	
ARCH LM test	0.885 (0.566)
c2-statistic	10.990 (0.530)
White Heteroskedasticity Test	
F-statistic	1.631 (0.061)
c2-statistic	52.402 (0.130)
Specification Error	
Ramsey RESET test F-statistic	2.740 (0.103)
LR Statistic	3.706 (0.054)
Normality	
Jarque-Bera statistic	0.066 (0.967)

The results indicate that in the short-run most of the variables are significant in explaining short-run variations in the demand for money, meaning that economic agents in Kazakhstan are responsive as well as in the long-run. However, most of the variables have the wrong signs, which contradicts the theory. The intuition behind this phenomenon could be an interplay between variables.

Besides, ECM term has been found to be equal to the number between 0 and 1 possessing a negative sign. This result show that currency substitution is reversed for Kazakhstan over short-run.

4. Concluding Remarks

The results of the study has an importance as to point some crucial findings on regulating monetary policy in Kazakhstan. The challenge for policymakers, for example, could be sustaining low inflation rates.

One of the concerns here is the currency substitution phenomenon in Kazakhstan. This phenomenon is an important issue for most transition countries, especially during the implementation of liberal regime. Currency substitution takes place due to the fact that economic agents lose their confidence in the domestic currency and start more sound currencies such as euro and dollar in case of Kazakhstan. However, reversed currency substitution in Kazakhstan implies that effective and sound monetary policy resulting in stability of domestic currency (Kazakhstan tenge), eventually causes the reversal of the currency substation process according to our model results and estimates. This is the fact for Kazakhstan, derived from data between years 2000:01 and 2007:12 for short-run as well as for the long-run. An improvement of monetary policy in Kazakhstan tenge started to gain confidence, meaning that economic agents preferred domestic currency more over this period. This finding is important because it frames the viability of stable monetary policy.

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