Confirmation of the relationship between stock market parameters and interbank credit market on the example of the Kazakhstan Stock Exchange.

Magomet Yandiev [1]

Lomonosov Moscow State University, Faculty of Economics

Altana Andzhaeva [2]

Lomonosov Moscow State University, Faculty of Economics

Abstract. This article presents the calculations confirming practical applicability of earlier formulated theoretical model explaining relationship between the rate of one-day credits in the interbank market, volume of speculative investments and total securities under which transactions have been closed. This article is written based on the Kazakhstan stock exchange data[3].

Keywords: interbank credit market, equity market, stock market, speculations, trading volumes, KASE

JEL Classification: G12, G14, G17, G21

1. Review of literature

The interconnection of the stock market and the interbank loans market is known in financial science as a fact. Many papers describe different aspects of this connection. For example, the paper written by Ekrem Tufan (2005) searched whether day of the week effects be explained by interbank rates or not. And the result is that day of the week effect can be explained by interbank rates for an emerging market.

The study by Recep Bildik (2001) examines the daily seasonalities in emerging Turkish Stock and Money Markets and results have shown the existence of significant day-of-the-week-effects both in overnight interest rate changes and stock returns.

In the paper by Tanju Yorulmazer (2008), the influence of the interbank market rates on the financial situation of banks is affirmed: «In particular, banks that rely on funding from

---

[1] Magomet Yandiev, mag2097@mail.ru

[2] Altana Andzhaeva, altana.andzhaeva@mail.ru

[3] Authors express their gratitude to the management of the Kazakhstan stock exchange and personally to Ms. Zarina Konkasheva for assistance in receiving necessary input data.

wholesale markets were significantly affected, which is consistent with the drying up of liquidity in wholesale markets and the record high levels of the London Interbank Offered Rate (LIBOR) during the crisis».

In the paper by Ivo Pezzuto (2012) it is said about the negative impact of mortgage securities on the market in the interbank market: «As hundreds of billions in mortgage-related investments went bad, banks became suspicious of one another's potential undisclosed credit losses and preferred to reduce their exposure in the interbank markets, thus causing interbank interest rates and credit default swaps increases, a liquidity shortage problem and a worsened credit crunch condition to consumers and businesses».

In the paper by Nyborg and Ostberg (2013) the authors argue that there is a connection between the interbank market for liquidity and the broader financial markets, which has its basis in demand for liquidity by banks.

The general point is that money matters in financial markets but there is no formal model that can explain it.

This article represents continuation of a series of the studies devoted to an examination of the relationship between the rate of one-day credits in the interbank market and some parameters of stock market, as well as to the proof of this relationship.

In the original article (Yandiev, 2011) the following formula is derived:

$$u = I * R * \frac{1}{365} * \frac{1}{U}$$

- u is the mean loss per a deal involving one stock;
- I is the volume of speculative investments (amount of money on accounts in the authorized bank to the stock exchange and intended for speculations);
- R is the rate of one-day credits in the interbank market, in fractions;
- U is the total amount of stocks involved in deals;

The logic of the formula is as follows: the rate of one-day credits in the interbank market is inversely proportional to the number of securities traded on the stock exchange. The formula is purely theoretical as for its proof some assumptions and assumptions were used, but because of its simplicity, it is quite suitable for implementation of practical calculations. According to the logic of the formula, it can be considered workable in practice if the parameter u remains constant during calculations.

Calculations in paper (Pakhalov, Yandiev, 2013) were carried out on the basis of data received from the Moscow Stock Exchange. In another paper (Matveev, 2014) calculations were carried out based on the Bahrain Stock Exchange. In both cases, positive results were obtained, indicating that the formula correctly reflects the relationship of the parameters for the studied time intervals.

It should be noted that exchanges usually prefer not to disclose some parameters of the formula – the amount of clients' money and number of securities deposited within the exchange system. This situation is clear – disclosure of this information under certain circumstances may be a bad marketing capable to undermine investor confidence to validity of the quotations received at the exchange. On the other hand, general lack of such information in a free access only aggravates consequences of quite common situations when the quotation of particular issuer is formed at the exchange during the course of trading of absolutely scanty number of actions.

In the present article, we test the formula using the data of Kazakhstan stock exchange for the period 2010 – 2014.

2. Input data

In order to test the applicability of the formula, the following data provided by Kazakhstan Stock Exchange were used (on a daily basis, for the period 2010-2014.):

- total amount of money deposited within the exchange system in m. tenge (analogue of I parameter, refer to Appendix 1);
- number of stocks (blue chips) deposited in the clearing exchange system, in pcs (U parameter, refer to Appendix 2);

  We examined data on 10 most liquid stocks traded on KASE rather than on all of them, i.e. blue chips: Bank CenterCredit, Kazkommertsbank, KEGOC, Kazakhtelecom, KazMunaiGas Exploration Production, KazTransOil, KAZ Minerals, Kcell, Halyk Bank, Eurasian Natural Resources Corporation;
- fraction of blue chips in the total volume of stock trading, % (this information is needed to be sure that blue chips data is representative and reflect the situation on the stock market, refer to Appendix 3);
- rate of one-day credits in the interbank market, % a year (R parameter, refer to Appendix 4);
- number of securities involved in the stock exchange deals (as the analogue and substitute for the “number of all deposited stocks within the exchange system”, refer to Appendix 5).

Verification of practical applicability of the formula is performed as follows. The parameter u is calculated for every day during the entire analyzed period (1232 trading days for

2010-2014). Next, we use two different approaches. The formula will be considered correct if the parameter u has the minimum volatility (the first approach). The formula will be considered correct if the constructed regression equation corresponds to the theoretical model (the second approach)

At the same time in both approaches, the parameter U is substituted in two ways. As the quantity of all deposited stocks within the exchange system (the first option, the main) and as the quantity of securities involved in the stock exchange deals (the second option).

It is noteworthy that substantially more securities are deposited in the exchange system, than it is necessary for daily trading, 5000 times approximately (refer to Appendix 6). This reserve provides the Kazakhstan Stock Exchange an extremely high degree of resistance to possible surge in demand for the shares.

3. First approach. Formula verification based on standard deviation of the "u" parameter

The purpose of the first approach is to make sure that the standard deviation of parameter u is insignificant. We calculated mean and standard deviation for both options and plotted graphs for visual analysis of parameter u dispersion degree.

On the basis of performed calculations one can draw the following conclusions:

- If we compare the standard deviation of parameter u with the average value of the parameter u for the entire period of our analysis, it should be noted that the range of values of the parameter u looks rather wide, but if we compare the standard deviation with the average quotation per share, the volatility of the parameter u seems insignificant value (refer to Appendix 7).
- From a visual assessment of the u parameter dispersion, it is obvious that in general it is insignificant (refer to Appendices 8, 9 – parameter u is shown in historical sequence and to Appendices 10, 11 – parameter u is shown after sorting "from bigger to smaller").

Thus, it can be argued that the parameter u has low volatility and can be considered as a value close to a constant.

4. Second approach. Formula verification based on linear regression

This approach involves the use of regression analysis of time series in order to identify relationships between the model parameters and check them for compliance with the theoretical model under consideration.

Input set of data consists of 1232 observations for each of six variables (refer to Appendix 12). Calculations were performed in the Gretl econometric package.

Since the regression analysis of time series requires all variables to be stationary, the first stage of econometric analysis involves an augmented Dickey-Fuller test (ADF) for each of the variables. Lag length in each case was set based on the Schwarz information criterion (SIC). All time series were examined for stationarity excluding trend. Results of tests are given in Appendix 13.

ADF test has shown that all variables except u_big_dep are stationary, therefore variable has to be tested for cointegration. According to Verbeek M., the existence of cointegration between the variables allows to get super consistent estimates of the model parameters, and the received results will make sense. Residuals of both regressions based on the deposited quantity and trading volume are stationary at the 1% level of significance (refer to Appendix 14). It allows us to formulate some conclusions from these regressions:

- The first regression equation is in general significant, as well as all its variables. The second equation is in general insignificant, and only one variable in it is significant at the 10% level of significance, which implies that the option of U calculation as the number of securities involved in the stock exchange deals is unreliable, and the impact of the variables included in the equation on the dependent variable may not even exist.
- Despite this, in both regression equations the I and R variables have positive coefficients, and the variable U has negative coefficient that completely corresponds to the logic of theoretical model.

Thus, the regression analysis confirms the significance of the tested formula.

5. Summary

Results of calculations for both options prove that the tested formula as a whole accurately reflects the relationship of parameters of the interbank credit market and the stock market.

Calculation of parameter U as the number of all deposited stocks within the exchange system is more correct, than understanding under it the number of securities involved in the stock exchange deals.

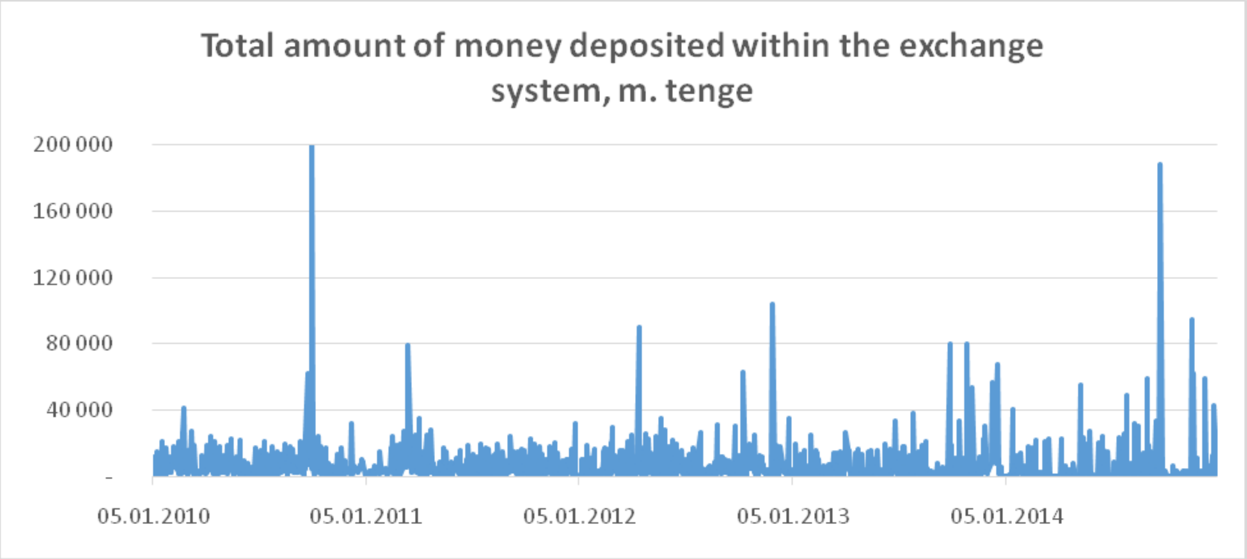
The findings of this work are consistent with the conclusions obtained in previous similar studies in Moscow (Pakhalov, Yandiev, 2013) and Bahrain stock exchanges (Matveev, 2014).

6. References

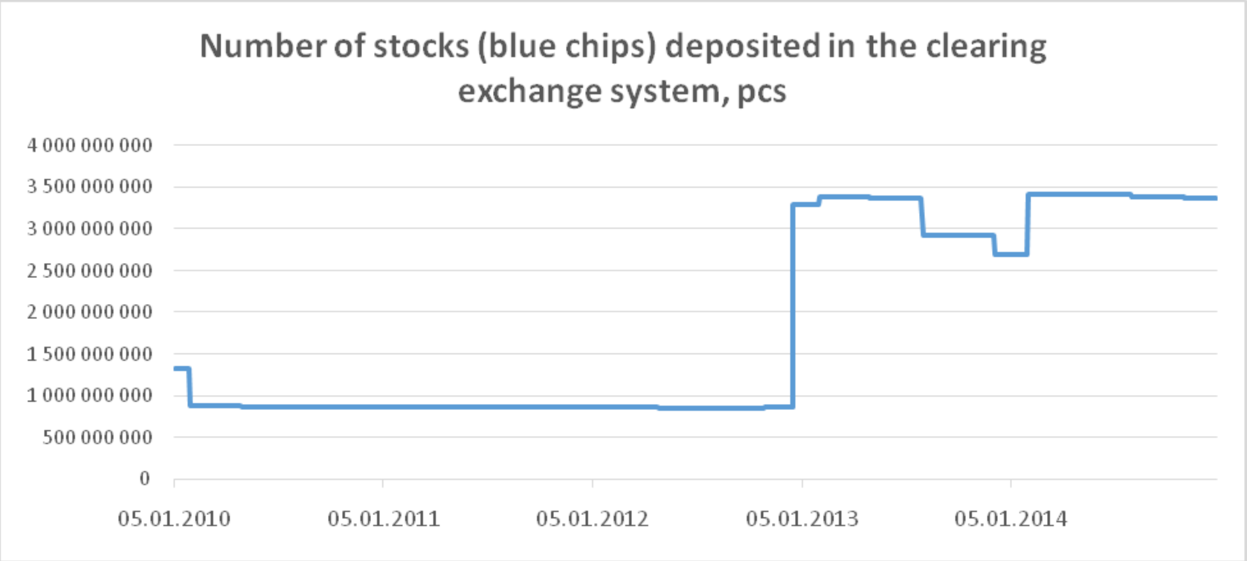
- Tufan, Ekrem, Can Day of the Week Effect be Explained by Interbank Rates: An Evidence from an Emerging Market (April 12, 2005). Available at SSRN: https://ssrn.com/abstract=633481
- Bildik, Recep, Day of the Week Effects in Turkish Stock and Money Markets. Available at SSRN: https://ssrn.com/abstract=259222 or http://dx.doi.org/10.2139/ssrn.259222
- Yorulmazer, Tanju, Liquidity, Bank Runs and Bailouts: Spillover Effects during the Northern Rock Episode (February 1, 2008). Available at SSRN: https://ssrn.com/abstract=1107570
- Ivo Pezzuto. Miraculous Financial Engineering or Toxic Finance? The Genesis of the U.S. Subprime Mortgage Loans Crisis and its Consequences on the Global Financial Markets and Real Economy. Journal of Governance and Regulation, Volume 1, Issue 3, 2012
- Nyborg, Kjell G. and Ostberg, Per, Money and Liquidity in Financial Markets (June 2013). Swiss Finance Institute Research Paper No. 10-25. Available at SSRN: https://ssrn.com/abstract=1625648
- Yandiev M. The Damped Fluctuations as a Base of Market Quotations // Economics and Management. 2011. N 16. URL: http://ssrn.com/abstract=1919652
- Yandiev, Magomet and Pakhalov, Alexander, The Relationship between Stock Market Parameters and Interbank Lending Market: An Empirical Evidence (September 23, 2013). Available at SSRN: http://ssrn.com/abstract=2329871
- Matveev, Aleksandr (2014) "Proving The Association Between Stock Market And Interbank Lending Market Parameters: The Bahrain Stock Exchange". Journal of Russian Review (ISSN 2313-1578), VOL. (0), 21-32. Available at: http://rusreview.com/journal/vol-0-2014/14-proving-the-association-between-stock-market-and-interbank-lending-market-parameters-the-bahrain-stock-exchange-aleksandr-matveev.html
- Verbeek M. A Guide to Modern Econometrics. 2nd ed. Chichester, 2004.

Appendices 1-6. Input data

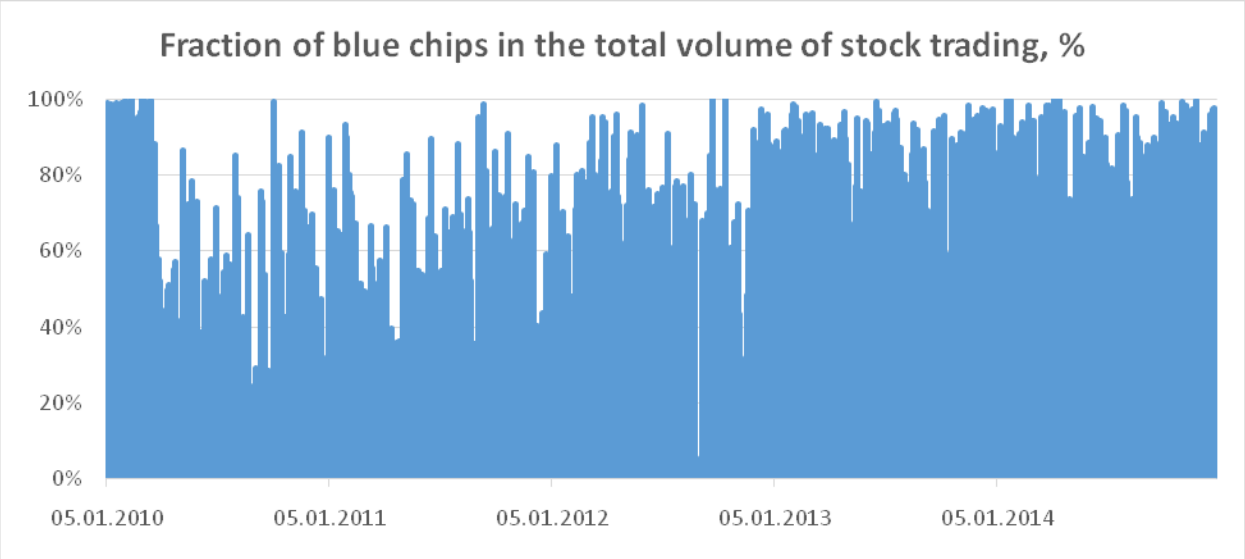
Appendix 1



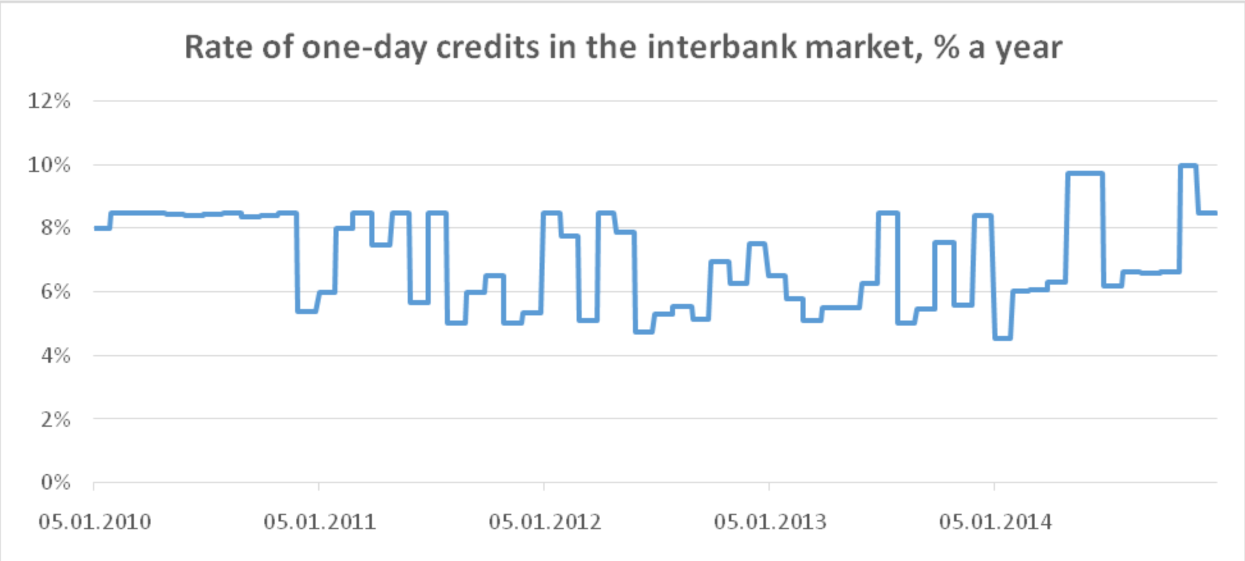
Appendix 2



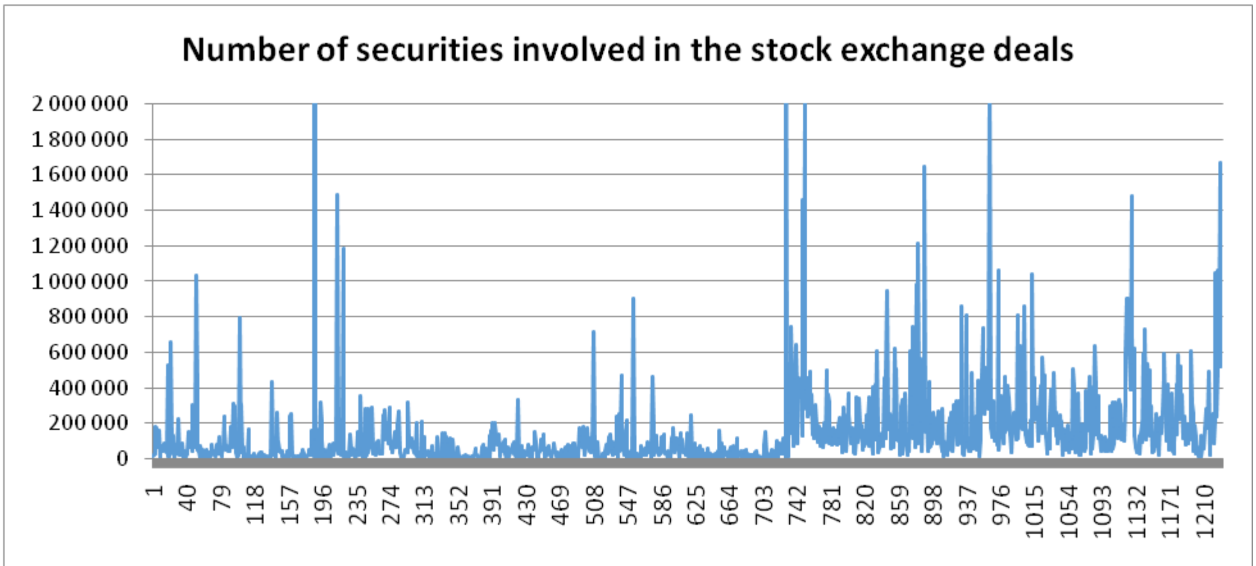
Appendix 3



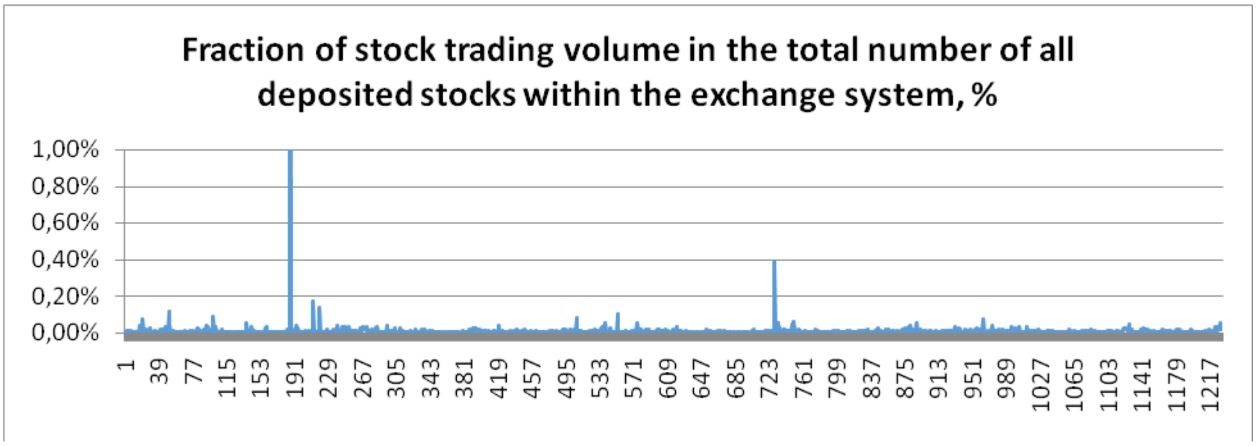
Appendix 4



Appendix 5



Appendix 6



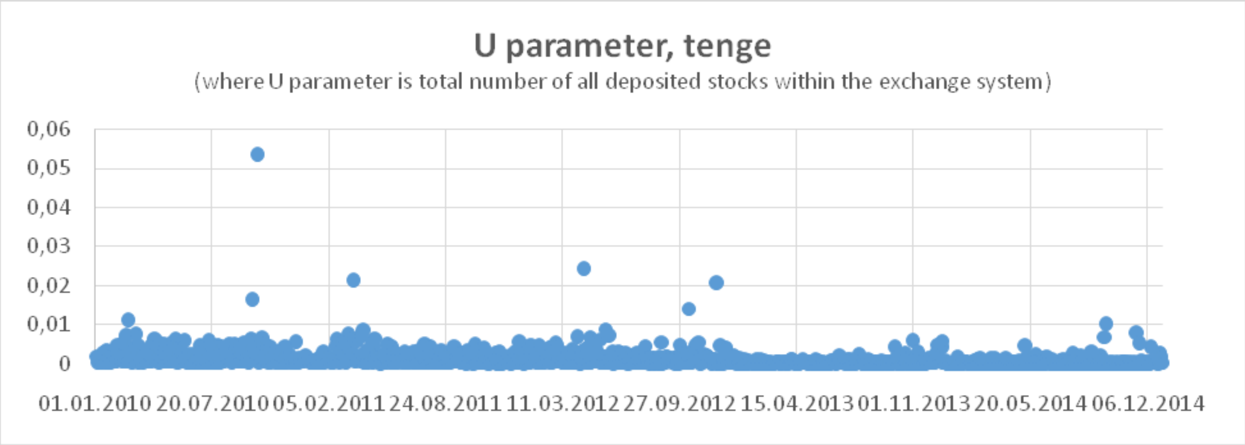
Appendices 7-11. Results of the first approach calculations

Appendix 7

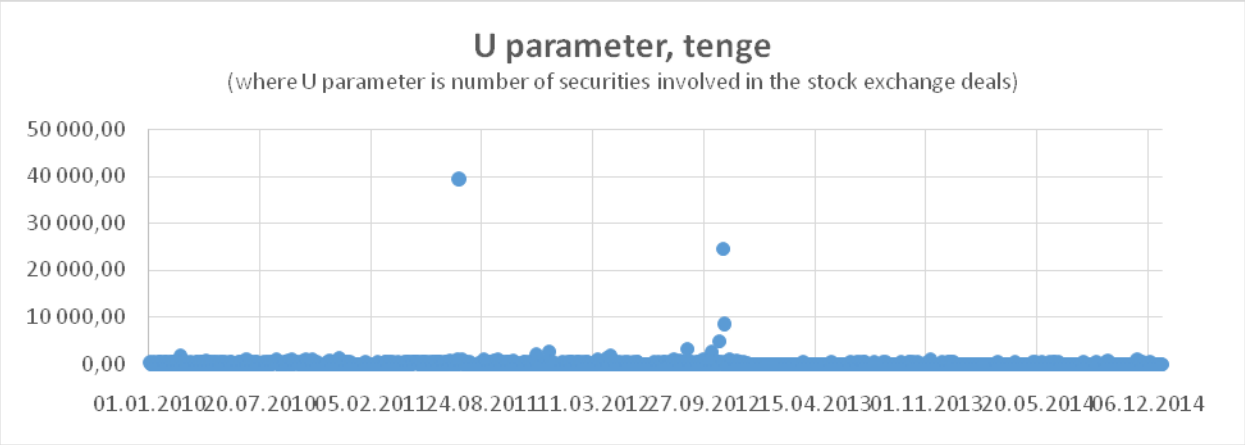
U parameter calcualtions

	Calculation, where U parameter is number of securities involved in the stock exchange deals	Calculation, where U parameter is total number of all deposited stocks within the exchange system
Arithmetic mean, tenge	0,0011	124,90
Standard deviation, tenge	0,0024	1 357,60

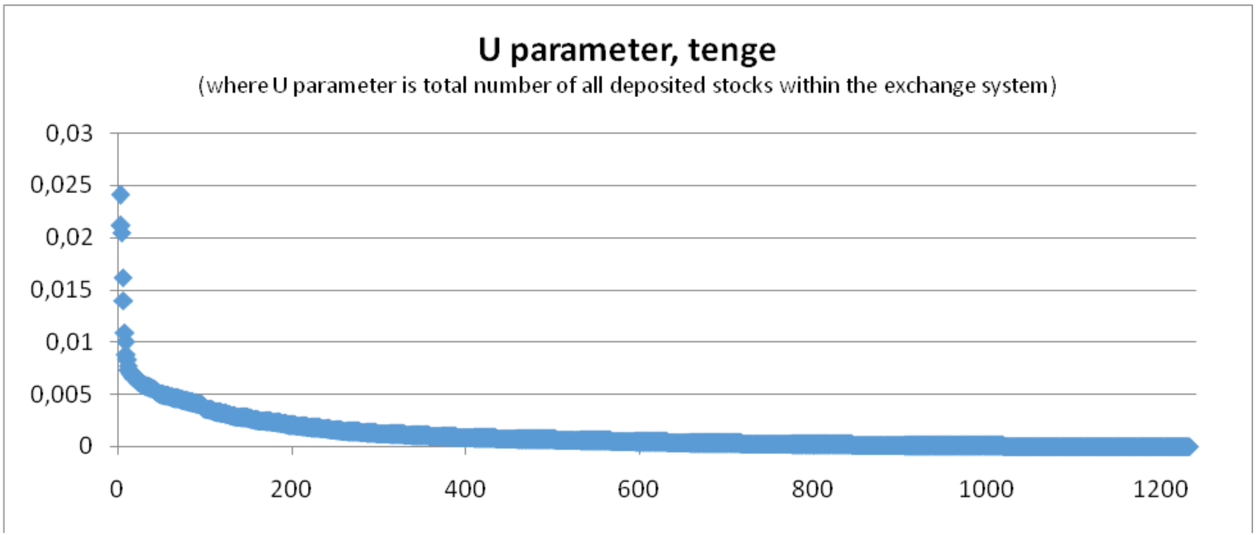
Appendix 8



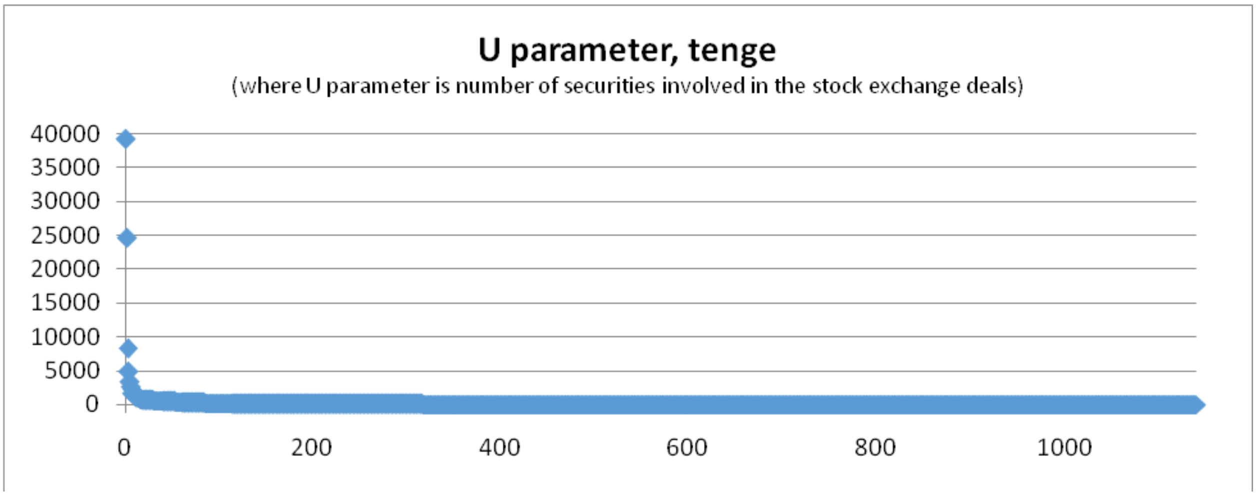
Appendix 9



Appendix 10



Appendix 11



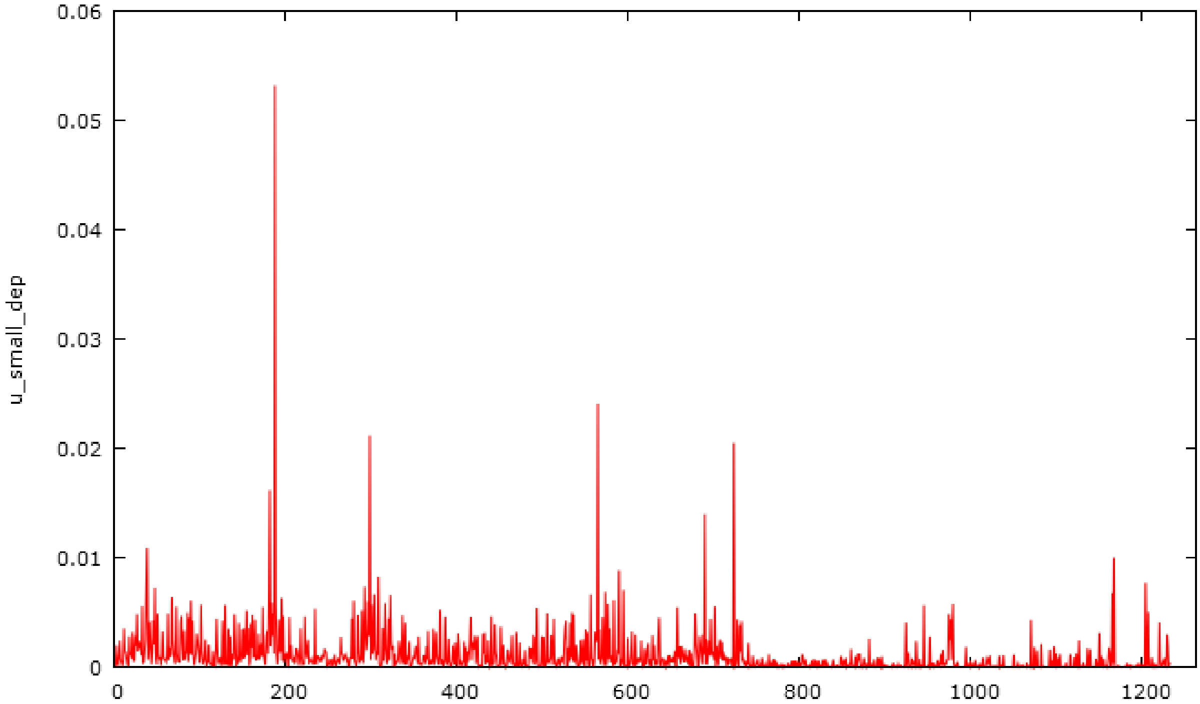
U parameter, tenge
(where U parameter is number of securities involved in the stock exchange deals)
40000
35000
30000
25000
20000
15000
10000
5000
0
0
200
400
600
800
1000

Appendices 12-14. Results of the second approach calculations

Appendix 12

Variable name in the theoretical model	Variable name in Gretl	Definition
u	u_small_dep	Mean loss per a deal involving one stock (calculated using the amount of deposited stocks)
u	u_small_vol	Mean loss per a deal involving one stock (calculated using the amount of stocks involved in deals)
I	I	Volume of speculative investment (amount of money in the exchange's authorized bank)
R	R	Rate of one-day credits in the interbank market
U	U_big_dep	Total amount of deposited stocks within the exchange system
U	U_big_vol	Total amount of stocks involved in the stock exchange deals

13. 1 Unit root test for u_small_dep



Augmented Dickey-Fuller test for u_small_dep

including 18 lags of (1-L)u_small_dep (max was 22)

sample size 1213

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

1st-order autocorrelation coeff. for e: -0.001

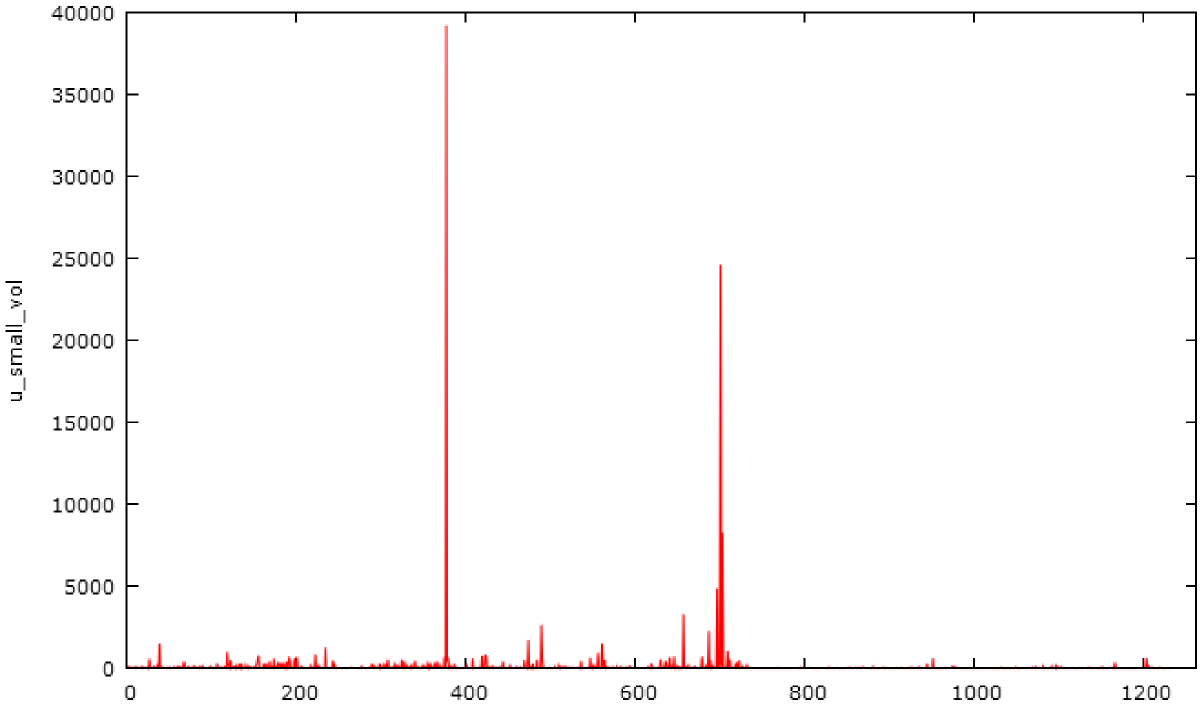
lagged differences: F(18, 1193) = 6.776 [0.0000]

estimated value of (a - 1): -0.363392

test statistic: tau_c(1) = -5.24083

asymptotic p-value 6.397e-006

13.2 Unit root test for u_small_vol



Augmented Dickey-Fuller test for u_small_vol

including one lag of (1-L)u_small_vol (max was 22)

sample size 1230

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

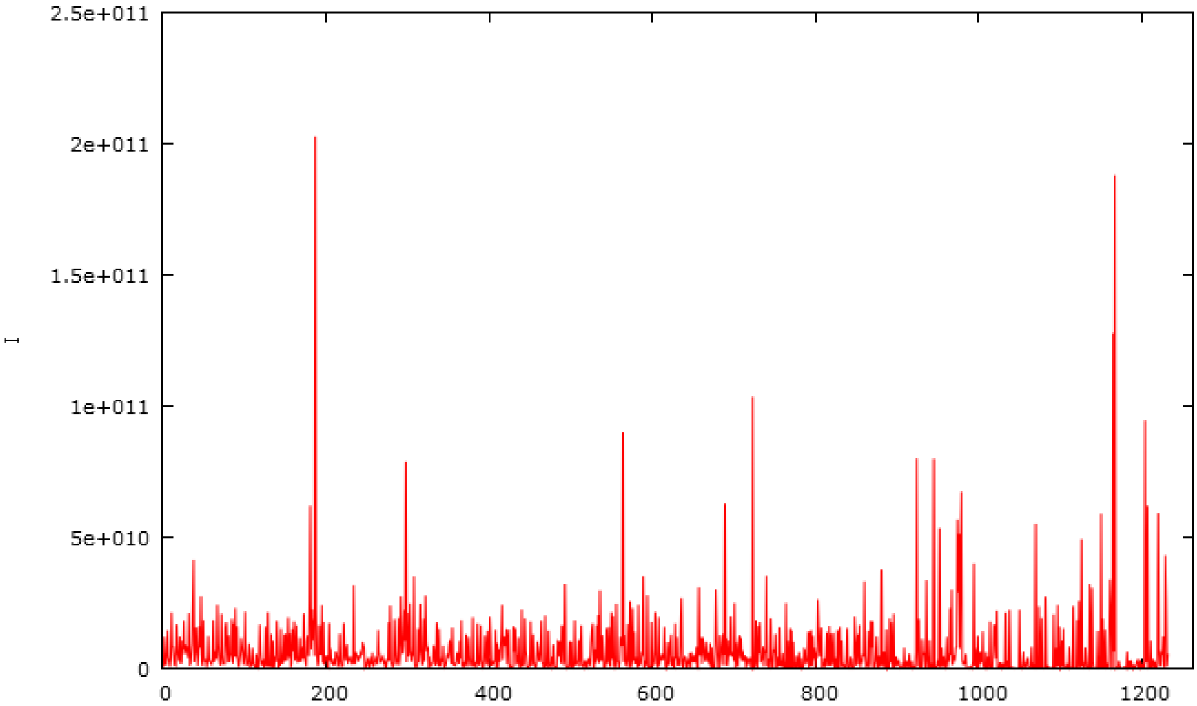
1st-order autocorrelation coeff. for e: 0.000

estimated value of (a - 1): -0.886475

test statistic: tau_c(1) = -22.1575

asymptotic p-value 1.601e-050

13.3 Unit root test for I



Augmented Dickey-Fuller test for I

including 17 lags of (1-L)I (max was 22)

sample size 1214

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

1st-order autocorrelation coeff. for e: -0.001

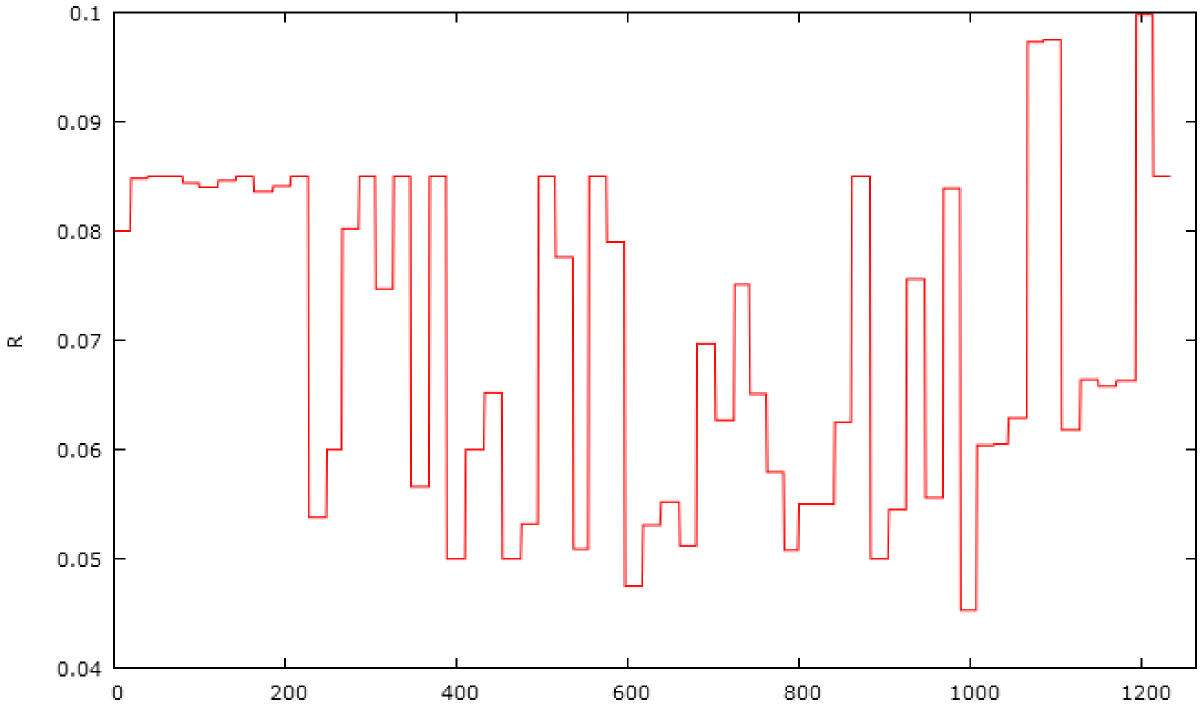
lagged differences: F(17, 1195) = 2.007 [0.0088]

estimated value of (a - 1): -0.793051

test statistic: tau_c(1) = -7.75998

asymptotic p-value 2.491e-012

13.4 Unit root test for R



Augmented Dickey-Fuller test for R

including 22 lags of (1-L)R (max was 22)

sample size 1209

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

1st-order autocorrelation coeff. for e: 0.001

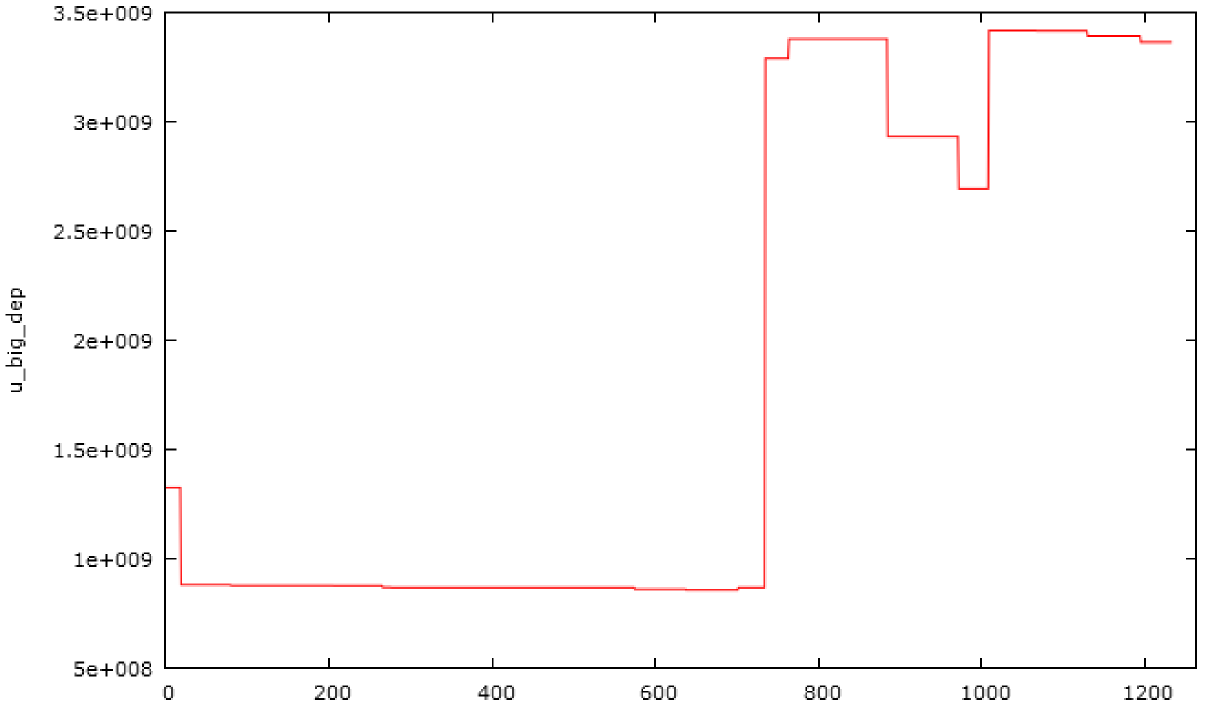
lagged differences: F(22, 1185) = 2.461 [0.0002]

estimated value of (a - 1): -0.0349829

test statistic: tau_c(1) = -3.67816

asymptotic p-value 0.004453

13.5 Unit root test for u_big_dep



Augmented Dickey-Fuller test for u_big_dep

sample size 1231

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + e

1st-order autocorrelation coeff. for e: 0.000

estimated value of (a - 1): -0.00140949

test statistic: tau_c(1) = -0.778644

p-value 0.8242

Augmented Dickey-Fuller test for d_u_big_dep

sample size 1230

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + e

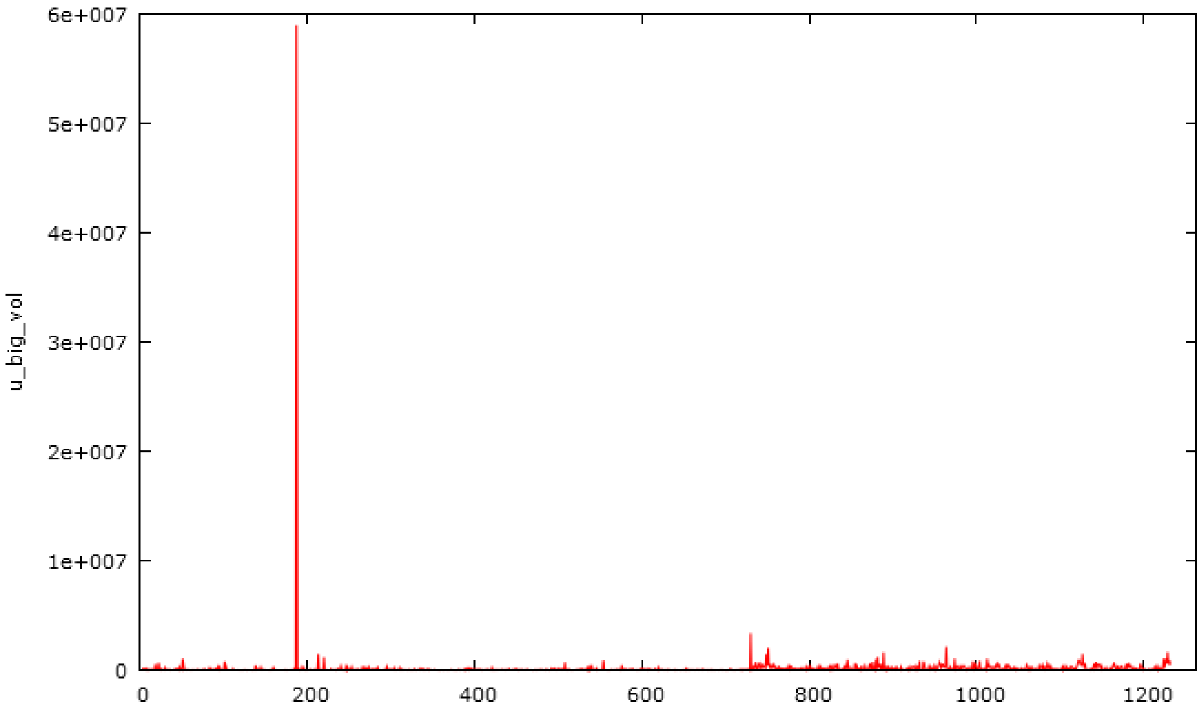
1st-order autocorrelation coeff. for e: -0.000

estimated value of (a - 1): -1.00049

test statistic: tau_c(1) = -35.0601

p-value 9.696e-025

13.6 Unit root test for u_big_vol



Dickey-Fuller test for u_big_vol

sample size 1231

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + e

1st-order autocorrelation coeff. for e: -0.000

estimated value of (a - 1): -1.00024

test statistic: tau_c(1) = -35.0651

p-value 9.836e-025

ADF test results summary:

Variable name in Gretl	ADF test result
u_small_dep	Variable is stationary at the 1% level of significance
u_small_vol	Variable is stationary at the 1% level of significance
I	Variable is stationary at the 1% level of significance
R	Variable is stationary at the 1% level of significance
U_big_dep	Variable is stationary in first differences at the 1% level of significance
U_big_vol	Variable is stationary at the 1% level of significance

14.1 Calculation with amount of deposited stocks

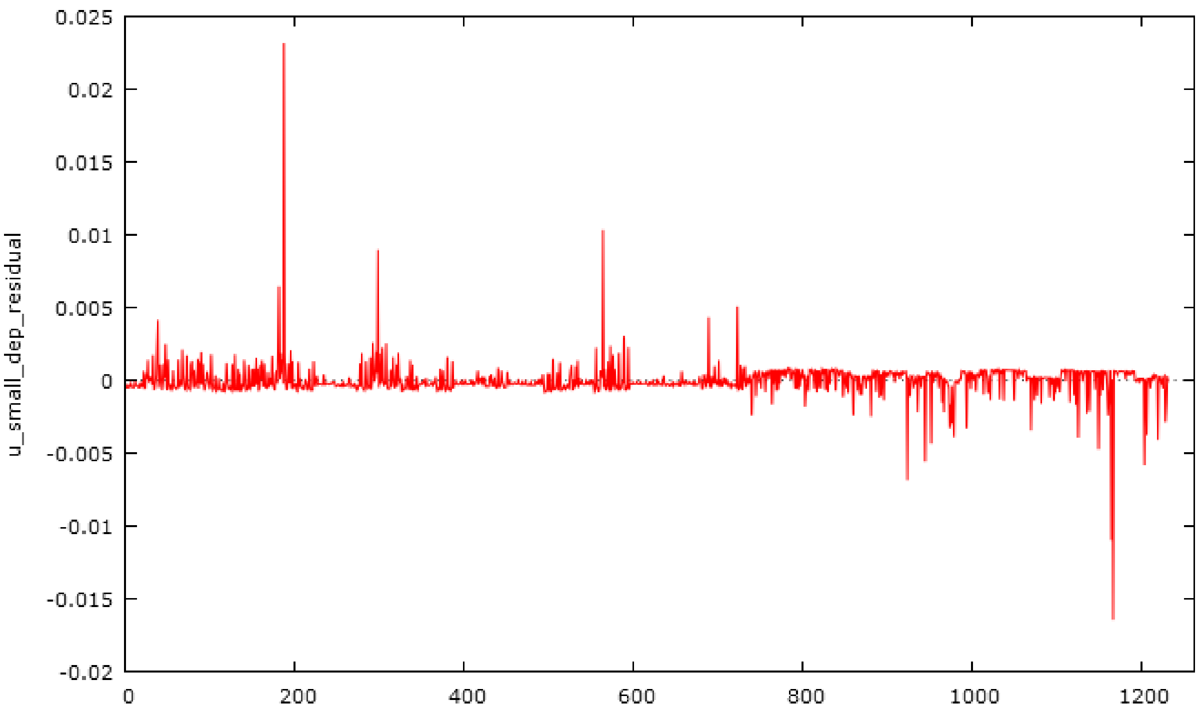
Linear regression of u_small_dep using u_big_dep, I, R and constant

Model 1: OLS, using observations 1-1232
Dependent variable: u_small_dep

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-5.39328e-05	0.000191808	-0.2812	0.77862	
I	1.44129e-013	0	52.9767	<0.00001	***
R	0.0148303	0.00249189	5.9514	<0.00001	***
u_big_dep	-4.66606e-013	0	-15.0063	<0.00001	***

Mean dependent var	0.001137	S.D. dependent var	0.002413
Sum squared resid	0.002000	S.E. of regression	0.001276
R-squared	0.721051	Adjusted R-squared	0.720369
F(3, 1228)	1058.078	P-value(F)	0.000000
Log-likelihood	6463.734	Akaike criterion	-12919.47
Schwarz criterion	-12899.00	Hannan-Quinn	-12911.77
rho	0.014530	Durbin-Watson	1.970819

ADF test results for residuals:



Augmented Dickey-Fuller test for u_small_dep_residual

including 5 lags of (1-L)u_small_dep_residual (max was 22)

sample size 1226

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

1st-order autocorrelation coeff. for e: -0.002

lagged differences: F(5, 1219) = 9.465 [0.0000]

estimated value of (a - 1): -0.671148

test statistic: tau_c(1) = -11.0798

asymptotic p-value 1.053e-022

14.2 Calculation with volume of trade

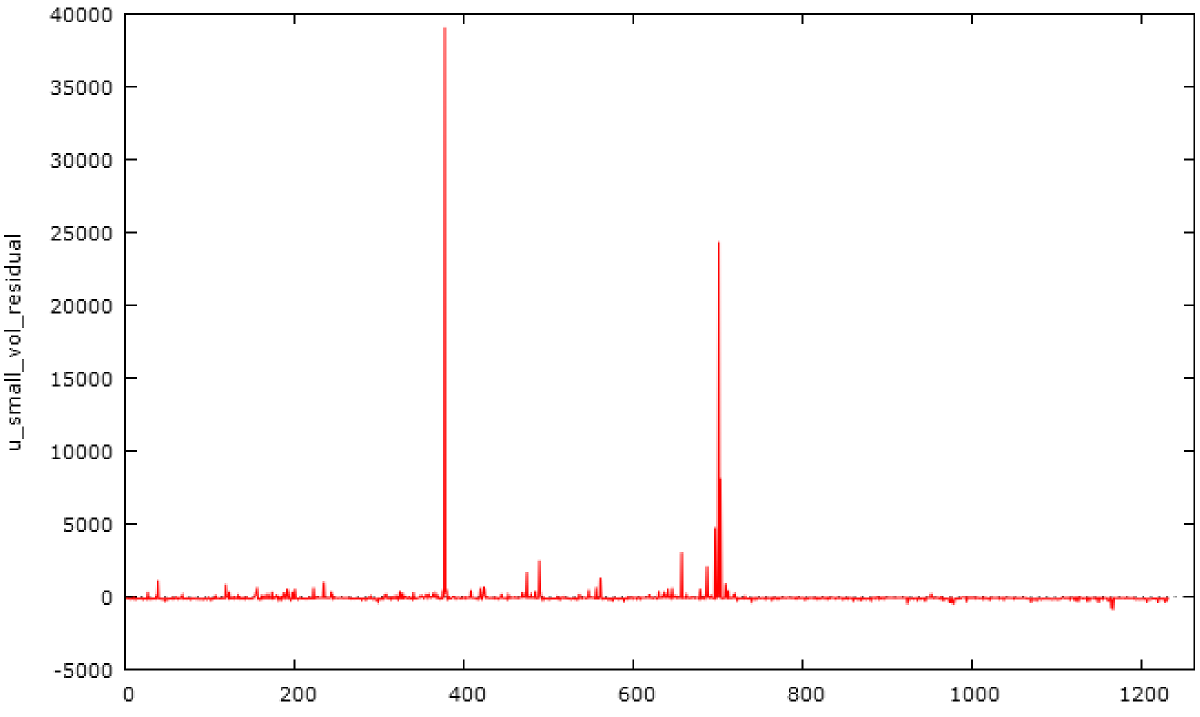
Linear regression of u_small_vol using u_big_vol, I, R and constant

Model 2: OLS, using observations 1-1232
Dependent variable: u_small_vol

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-48.3371	188.06	-0.2570	0.79720	
I	6.18352e-09	3.17654e-09	1.9466	0.05181	*
R	1934.66	2636.76	0.7337	0.46325	
u_big_vol	-2.8605e-05	2.51251e-05	-1.1385	0.25513	

Mean dependent var	124.9018	S.D. dependent var	1357.595
Sum squared resid	2.26e+09	S.E. of regression	1356.684
R-squared	0.003776	Adjusted R-squared	0.001342
F(3, 1228)	1.551350	P-value(F)	0.199535
Log-likelihood	-10632.30	Akaike criterion	21272.59
Schwarz criterion	21293.06	Hannan-Quinn	21280.29
rho	0.007715	Durbin-Watson	1.984558

ADF test results for residuals:



Augmented Dickey-Fuller test for u_small_vol_residual

including one lag of (1-L)u_small_vol_residual (max was 22)

sample size 1230

unit-root null hypothesis: a = 1

test with constant

model: (1-L)y = b0 + (a-1)*y(-1) + ... + e

1st-order autocorrelation coeff. for e: 0.000

estimated value of (a - 1): -0.886062

test statistic: tau_c(1) = -22.1592

asymptotic p-value 1.594e-050