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[Volume 7, Issue 2(15), 2018]

TESTING EFFICIENCY OF GEORGIAN LARI US DOLLAR EXCHANGE MARKET

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Abstract
Georgian business and academic circles time and again debate whether the exchange rate for the national currency, Lari (GEL), is determined by a free and efficient market or can be predicted and/or manipulated. This paper attempts to resolve that debate. It addresses whether the GEL/US$ exchange market is weak form efficient, i.e., are GEL/US$ daily fluctuations truly independent from its past values? In order to test the efficiency of the market we analyzed daily GEL/US$ rates for years 2001 to 2017. The results of statistical tests are mixed. We conclude that in 2006 and for the period 2009-2017 the exchange market is weak form efficient with exception of December 2014. The market was inefficient in other years, in particular in 2007 and 2008. This paper identifies global as well as local reasons which might be the cause of this inefficiency. For 2007 and 2008 the main reasons were (1) irrational market growth globally followed by the financial crisis and (2) an attempt of Georgian ruling elite to create an appearance of solidification of economy. Other reasons were imperfect rules for determining the official exchange rate (revised in 2009) and the absence of transparent interbank trading platform, again before 2009.

Key words: *GEL/US$ exchange rate, efficient market, serial correlation*

JEL Classification: *F31, E58*

I. INTRODUCTION

Fluctuations in the exchange rate between Georgia's national currency, the Lari (GEL), and the United States Dollar (US$) is a hotly debated topic inside both political and economic circles in Georgia. Although it is obvious that the impact of the GEL/US$ rate is overemphasized, for most of the public it is main indicator of the health of Georgian economy.Volatility in the rate is due to the fact that the National Bank of Georgia (NBG) while maintaining an inflation targeting regime, lets GEL/US$ exchange rate float. Hence the Georgian currency absorbs the impact of external economic shocks.

Since May 2009 the GEL/US$ exchange rate is derived from the interbank market's results as published through a trading platform provided by Bloomberg. The official exchange rate is calculated by the NBG at the end of each business day using a weighted average of reported spot trades within a period spanning from 16:30 of the previous business day to 16:30 of the current day. Trades before 16:30 of previous day can also be included in the calculation if there are less than 3 trades during the current period or if the volume of trades is less than 3 million US$ (US$ 1.5 million from January 2018). Although the NBG can intervene in the interbank market, by selling or buying foreign currency reserves, it uses this mechanism infrequently now. Thus with minimal exceptions the official rate is derived exclusively from private sector transactions.

Georgian business and academic circles time and again debate whether the GEL/US$ exchange rate is determined by a free and efficient market, or can influenced by other factors and thus whether it can be predicted and/or manipulated. The subject of this paper is to check whether GEL/US$ daily changes are truly independent.

II. METHODOLOGY

To check independence of GEL/US$ exchange movements we apply a popular method used to test the efficient market hypothesis for stock price changes. The autocorrelation (serial correlation) coefficient measures the relationship between a series of numbers with lagged numbers in the same series. A positive serial correlation indicates the presence of trends. A negative serial correlation indicates the existence of more reversals than might occur randomly. Only random numbers have serial correlation close to zero.

The tests used to measure the correlation is not performed directly on GEL/US$ exchange rates changes, but instead on the differences between natural logarithms of exchange rate. The variable of interest is R_t, where:

$R_t = ln(ER_t/ER_{t-1}) = lnER_t - lnER_{t-1} = ln(ER_{t-1}+\Delta ER_t) - lnER_{t-1}$

In this formula ER_t is the GEL/US$ rate at the day t, ER_{t-1} is exchange rate on the previous day and ΔER_t is change of exchange rate between days t and t-1. When changes in exchange rates are small $\Delta ER_t/ER_{t-1}=R_t$.

Serial correlation coefficients are measured by estimating the correlation between R_t and its lagged values. To estimate the k-th autocorrelation coefficient, which is equal to CORELL(R_tR_{t-k}), we regress R_t

(dependent variable) against independent variable R_{t-k}. By definition OLS estimator of the slope b_k =COV(R_{t-k},R_t)/VAR(R_{t-k}), also by definition COV(R_{t-k},R_t)=CORELL(R_{t-k},R_t)*(STDEV(R_t)*STDEV(R_{t-k}).We review the same series hence STDEV(R_t)=STDEV(R_{t-k}) and it follows that CORELL(R_{t-k},R_t)=COV(R_{t-k},R_t)/VAR(R_{t-k}) which is equal to b_k. For example for k=1 serial correlation the coefficient equals to the OLS estimator for b_1 in the first order autoregressive model AR(1):

$R_t = b_0+b_1R_{t-1}+u_t$

Where u_t is an error term.

Statistically significant autocorrelation between R_t and its k-th lagged value indicates that an exchange rate change k days before affects exchange rate changes today. The values of coefficients closer to -1 or 1 indicates stronger influence. If autocorrelation coefficients are close to zero, changes in the GEL/US$ exchange rate are random numbers independent from its past movements and cannot be predicted and were not manipulated.

The data for this empirical experiment are the official daily GEL/US$ rates published by NBG. Such rates are available from January 1, 2001. Regression analysis was conducted for the entire 17 year population, as well as for each year separately. Only exchange rates changes between workdays are included in the statistical tests. Official rates published for the weekends and public holidays, when GEL/US$ trades did not take place, are omitted for the official exchange rate as that day simply repeats the value from previous day.

A summary of descriptive statistics is provided in Table 1 below:

Years	Observations	Mean	STD	Variance	Skewness	Kurtosis
2001-2017	4178	0.0001	0.0047	0.00	3.74	74.70
2001	249	0.0002	0.0055	0.00	1.04	12.83
2002	249	0.0001	0.0046	0.00	5.40	55.79
2003	245	-0.0002	0.0003	0.00	0.32	10.16
2004	249	-0.0006	0.0005	0.00	2.60	17.87
2005	249	-0.0001	0.0003	0.00	-1.11	16.40
2006	248	-0.0002	0.0010	0.00	0.05	1.92
2007	248	-0.0003	0.0006	0.00	-0.31	3.93
2008	223	0.0002	0.0005	0.00	12.02	160.60
2009	246	0.0000	0.0002	0.00	-0.25	6.05
2010	245	0.0002	0.0033	0.00	0.27	5.54
2011	246	-0.0002	0.0035	0.00	-0.95	7.81
2012	249	0.0000	0.0022	0.00	0.10	11.52
2103	249	0.0002	0.0017	0.00	0.14	4.84
2014	247	0.0003	0.0045	0.00	1.20	18.41
2015	243	0.0010	0.0066	0.00	-0.85	10.45
2016	245	0.0004	0.0059	0.00	0.19	4.95
2017	248	-0.0001	0.0057	0.00	-0.46	4.77

Summary of regressions up to 6-th lag is presented in the Table 2.

Table 2. Serial Correlation Coefficients

Years	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5	Lag 6
2001-2017	0.24*	0.08	-0.03	0.05	0.06	0.06
2001	0.12	0.03	-0.06	-0.10	-0.19*	-0.05
2002	0.27*	-0.03	-0.14**	-0.04	-0.01	-0.04
2003	0.12	-0.09	-0.24*	0.01	0.07	0.02
2004	0.19*	0.09	0.12	-0.15**	-0.19*	-0.20*
2005	-0.24*	-0.17*	0.09	-0.01	-0.06	0.00
2006	0.10	0.09	0.12	-0.01	-0.04	0.22*
2007	0.53*	0.41*	0.31*	0.24*	0.19*	0.15**
2008	0.32*	0.04	0.07	0.03	0.04	0.03
2009	0.10	0.20*	-0.14**	0.09	0.12	0.03
2010	0.23*	0.14**	0.14**	0.11	0.11	-0.04
2011	-0.03	0.08	0.00	0.06	0.03	0.13**
2012	0.27*	0.04	0.10	-0.14**	-0.06	-0.21*
2013	0.05	-0.05	0.02	0.04	0.01	0.06
2014	0.45*	0.14**	-0.15**	-0.38*	-0.33*	-0.07
2015	0.27*	0.10	-0.11	-0.15**	-0.11	-0.14**

2016	0.43*	0.25*	0.09	0.05	0.02	0.02
2017	0.32*	0.11	0.05	0.02	0.03	0.02

*p value less than 0.01
**p value between 0.01 and 0.05

III. ANALYSIS OF THE RESULTS

The mean daily change in rates is approximately zero for each year as well as for the entire period. Variance is zero for all years separately as well as for entire sample. Kurtosis is very high for the period between 2001-2017 (74.7) and years 2002 (55.78), 2004 (17.87), 2005 (16.4), 2014 (18.41) and is extremely high for year 2008 (160.06). Significant positive skewness is presented in years 2002 (5.40), 2008 (12.02) and for years 2001 to 2017 (3.74). Significant skewness and kurtosis clearly indicate that distribution is not standard normal distribution.

The result of the regression analysis is mixed. Null hypothesis (H_0) of exchange rate fluctuations dependence on their past values can be clearly rejected only for years 2013 and 2011. In these years serial correlation coefficients are equal to zero for all lags. The dependence of the exchange rate fluctuations on their first lag is obvious for all years except 2001, 2003, 2006, 2011 and 2013, although H_0 cannot be rejected in years 2001, 2003, and 2006 for 5-th, 3-rd and 6-th lag correspondingly.

The explanation on dependence on the first lag from year 2009 is that since May 2009 the NBG may calculate official rates using trade results from previous business day (please see above). This implies efficient market for year 2017 as well. In year 2016 H_0 cannot be rejected for the second lag, though value of serial correlation coefficient is relatively small to presume strong influence in the practical terms. The same is true for years 2012 2009 and 2006.

For year 2014 serial correlation coefficients for 3-rd, 4-th and 5-th lags are negative, indicating existence of more reversals than might occur randomly. Further analysis shows that in December 2014 GEL/US$ plummeted from 1.75 to 1.95 then strengthened to 1.83 and dropped back to 1.92. In this period NBG intervened in the interbank market and sold its reserves to protect GEL. This action had deep impact on the market efficiency. If this period of high volatility is excluded, regression analysis indicates efficient market for the rest of the year.

Year 2007 is marked by inefficiency. Daily changes in the exchange rates show dependence on the changes during the several business days before. Serial correlation coefficients for 6 lags are positive, which implies the presence of a strong trend of daily strengthening of GEL (Chart 1). The same trend continues in year 2008 (Chart 2) and stops at the eve of Russian Georgian war in August, followed by limited trading on the interbank market and a sharp depreciation of GEL in November 2008, which is reflected in abnormally high kurtosis in 2008 (160.06).

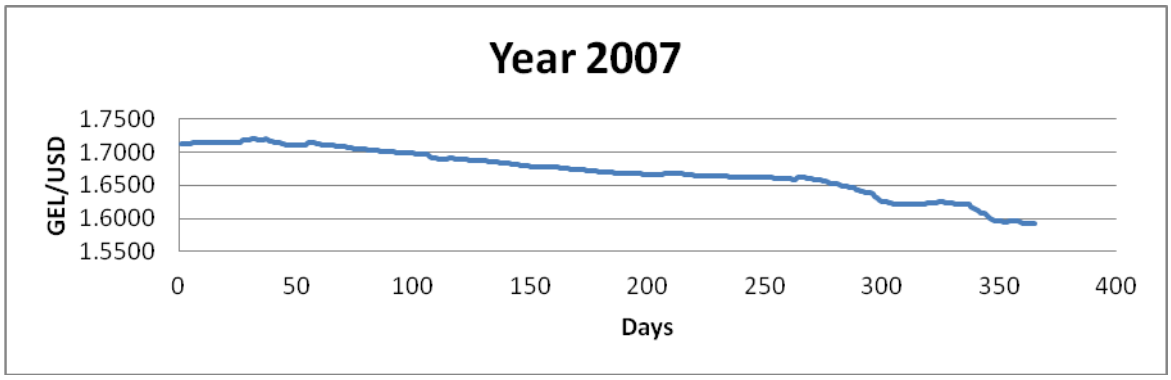

Figure 1. Official Daily Exchange Rates 2007

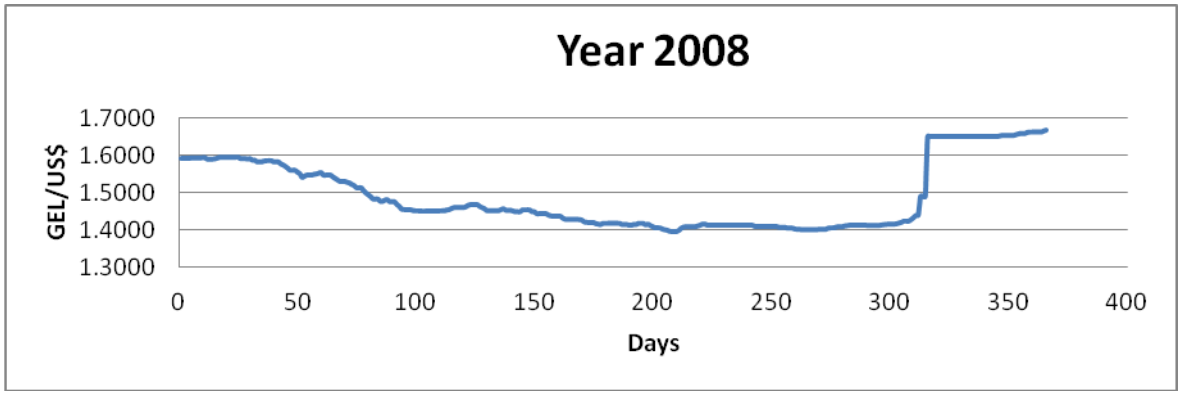

Figure 2. Official Daily Exchange Rates 2008

IV. CONCLUSIONS

The result for GEL exchange market is mixed. For years 2010, 2011, 2013 and 2017 null hypothesis can be rejected meaning that the GEL/USD$ exchange market was weak form efficient, save the officially allowed influence of previous day trades.

For years 2016, 2015, 2012, 2009 and 2006, we cannot reject dependence for certain amount of lags (see Table 2). On the other hand, serial correlation coefficients for these lags, although statistically significant, are relatively small and cannot indicate considerable influence of past rate fluctuations on the current rate. Hence, in practical terms, we can assume efficient market in these years as well.

In 2014 market is inefficient if we analyze 12 months data, but becomes efficient if we exclude data for December. This month was marked by negative influence of external economic shock on the Georgian economy which resulted in sharp depreciation of GEL. In this period of high volatility of GEL/US$ rate NBG intervened on the interbank market to protect GEL several times. It should be mentioned here though, that, unlike other countries in the neighborhood which were under the negative influence of the same external forces, Georgia sold only small portion of NBG reserves to protect its currency. Facing heavy political and public pressure to protect GEL, NBG managed to maintain independent monetary policy notwithstanding and let GEL/US$ rate to absorb external economic shock.

In 2007 and 2008 market was clearly inefficient. Results of the statistical analysis indicate existence of the trend. GEL was gradually strengthened during 2007 and first 8 months in 2008. The inefficiency period coincided in time with the period of irrational market growth globally, followed by the financial crisis. It is also a fact, that in 2007 Georgia attracted a record amount of FDI which supported GEL strengthening as well.

Another possible reason which caused inefficiency is that Georgian ruling elite was deliberately supporting the GEL exchange rate to create an appearance of solidification of the economy. This was quite possible for combination of two reasons: (1) imperfect rules for determining the official exchange rate and (2) the fact that the interbank trading platform was not provided by Bloomberg and was much less transparent. This combination might be the cause of inefficiency between years 2001 and 2005 as well.

V. REFERENCES

1. National Bank of Georgia www.nbg.gov.ge