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ANALYSIS OF FINANCIAL DEVELOPMENT AND CHALLENGES OF ARBITRAGE IN GEORGIAN BANKING SYSTEM

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Abstract. There are many methods to estimate country's financial development and the stability of banking system. In this article we check arbitrage opportunity in Georgia testing period from 2003 to 2012 and discuss the "level of health" of Banking System of a country. For this purpose we use simple interest rate parity. This article aims to explain reasons of deviations from interest rates parity for interest rates of deposit. We use multinomial model, make conclusions and give recommendations for termination of arbitrage opportunities.

Keywords and phrases: Financial markets, arbitrage, interest rate parity, multinomial distribution.

AMS subject classification: 74K25, 74B20.

The Research is based on the following assumptions:

- Rational expectations about the exchange rates of Gel (Georgian Lari) and US Dollar;
- Symmetric information (equally distributed information);
- All investors are risk averse, rational, profit-oriented;
- Markets are efficient, which means that real arbitrage is impossible to be maintained in longer period unlike short term period and transaction costs are eliminated. We eliminate transaction costs in the paper because of their insignificant effect.

The model. We develop interest rate parity between Georgian Lari (GEL) denominated deposits in the "average" Georgian Bank and US Dollar denominated deposit interest rate in USA[1]. At the international market optimal interest rate is formed by taking into account the condition of interest rate parity, which refers to the following equation to be realized:

$$1 + \rho_t^{for} = (1 + \rho_t^{dom})\frac{S_{t+1}^e}{S_t},$$

where: ρ_t^{for} - describes spot interest rate on deposit in the foreign country in time t.
ρ_t^{dom} - spot interest rate in the home Country in t;
S_{t+1} - expected currency exchange rate, in the period $t+1$;
S_t - current currency Exchange rate, period t.

For developing interest rate parity we need to estimate expected Exchange rate Gel/USD. Exchange rate dynamics between 2003-2012 is given on the fig. 1.

[1]Data is taken from national bank of Georgia and Federal Reserve System

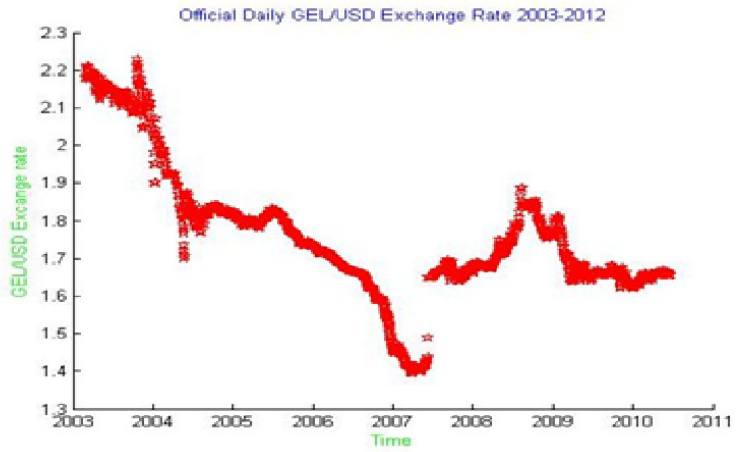

Fig. 1.

The only stochastic variable above is S^e_{t+1}. In order to estimate it, we use multinomial model and simulate changes of exchange rate from period t to $t+1$. First of all we should assume that Exchange rate in period $t+1$ is a function of exchange rate in period t. Thus, we introduce AR(1) model:

$$S_{t+1} = f(S_t),$$

$$R_t = \frac{(S_{t+1} - S_t)}{S_t},$$

where, R_t, describes daily percentage return(deviation) of exchange rate which is random variable. We assume that it has multinomial distribution. In 1979 Cox, Ross and Rubinstein have developed a binomial model of stock return[2]. We have generalized this model with multinomial model. Besides, in our model we introduce a Monte-Carlo Simulation to determine optimal number of Factors in our Multinomial Model and with the historical data we get 10 factor model

$$f(x_1, ..., x_k | n, p_1, .., p_k) = Pr(X_1 = x_1, ..., X_k = x_k) \ \frac{n!}{x_1! ... x_k!} p_1^{x_1} ... p_k^{x_k}.$$

By our 10 factor model we can forecast S_{t+1}. Some quality tests of these forecasts are summarized in the Table 1 below.

Quality test forecast	
Mean of Residuals	-2.25E-04
Mean of Absolute value of residuals	2.25E-04
Standard Deviation of Residuals	2.26E-05
Mean Absolute Deviation	2.25E-04
Mean Squared Error	5.12E-08
SSE	1.33E-04
MAPE	0.0128
MPE	-0.0128

Table 1: Quality tests of Forecasts

[2]Cox J., Ross S.A, Rubinstein M. Option Pricing: A Simplified Approach, Journal of Financial Economics, 229-64 1979

So, we can conclude that 10 factor multinomial model is effective for estimating exchange rate on the daily basis. Furthermore, the model is effective for monthly basis as well and the deviations are not big as we see on the following figures.

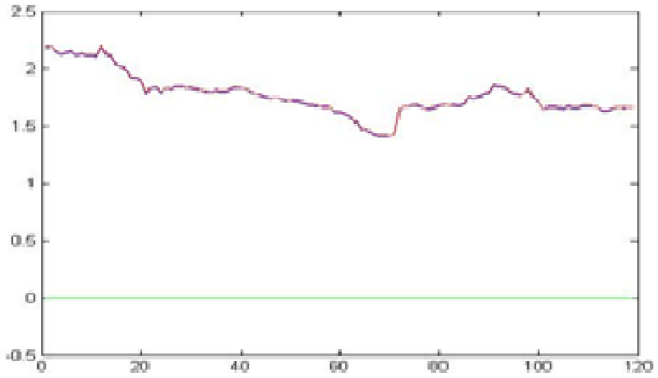

Fig. 2.

According to interest rate parity we can simply calculate monthly deviation from no arbitrage equilibrium. We can interpret this term as arbitrage opportunity. If the financial system is stable and capital market is efficient, demand-supply forces provide that of the deviation from interest rate parity in the long run should be zero. However, in Georgia during the period from 2003 to 2012, it was positive and equaled to 6,97.

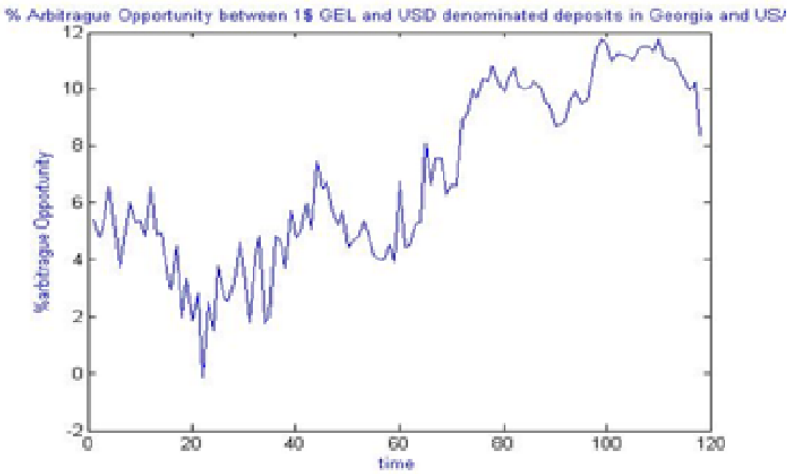

Fig. 3.

Descriptives of arbitrage opportunities	
Mean	6.97
Median	6.48
Standard Deviation	3.11
Skewness	0.0168
Kurtosis	1.742

Table 2: Descriptive statistic of arbitrage opportunity

From here we receive that in 2003-2012 in Georgia there always was positive arbitrage opportunity, average arbitrage was 6.97the beginning of our article we made assumption about no long term stabile arbitrage opportunity in Financial sector, because otherwise investments would increase and interest rate on deposits would decrease. Also we can conclude that the following arbitrage opportunity was compensated by Risk Premiums. Fundamentally there are two main components of Risk Factor: "Country Banking system Risk Premium" and "Currency Risk Premium". We have estimate Premium of this risk factors based on the interest rate parity (clearly these risk premiums can be estimated in a different manner also). Country Banking System Risk Premium can be determined as the difference between USD denominated deposit interest rates in Georgia and in the USA.

$$Country\ Banking\ System\ Risk\ Premium = \rho^{Geo}_{t,USD} - \rho^{USA}_{t,USD}.$$

Currency Risk premium can be defined as arbitrage opportunity between GEL and USD denominated deposit interest rates in Georgia.

$$Currency\ Risk\ Premium = (1 + \rho^{Geo}_{t,GEL}) * S_{t+1}/S_t - (1 - \rho^{Geo}_{t,USD}).$$

We can check our assumption by linear OLS regression between arbitrage opportunity and risk factors:

$$Y = C + B * X,$$

where: Y - endogenous variable; C - constant; B - vector of regression coefficient; X - vector of exogenous variable. Results of estimation are given in the figure below.

Variables	P value
constant	0.0503
b_1	0.0119
b_2	0.0322

Table 3: Output of the linear regression

R^2 equals $0,9449$ and R_adj^2 is $0,8871$. The results of regression are significant. P-value shows that all coefficients except C, i.e. both b_1 and b_2 are significant with significance level of 0,05.

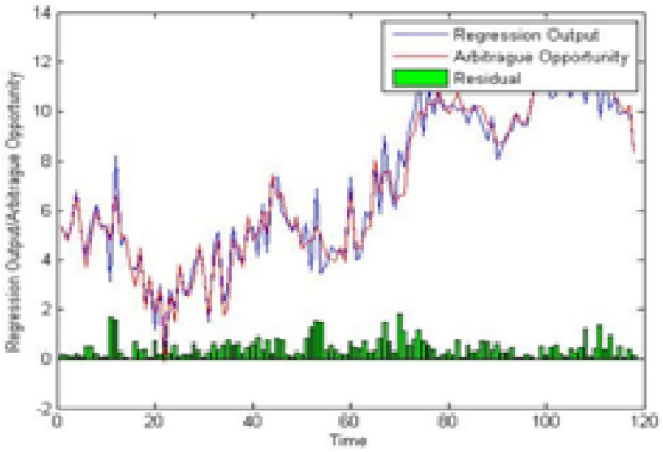

Fig. 4.

The main part of Total Risk premium is determined by the degree of instability of the Georgian Banking System. In Georgia, like other developing countries, there is a very high degree of dollarization, this means that investors have opportunity to meet effectively to the currency hedging strategy. In the process of the research we have distinguished following drawbacks of banking system:

- Missing Deposit insurance;
- Inefficient approach to liquidity management;
- Special sensitivity of the country's banking system caused by global economic disorder expending to Georgia through high rate of dollarization;
- Irrational expectations, which leads to ineffectively low saving rates;
- Negative geopolitical environment.

The problems we have discussed have systemic character. The noninvestment rating of Georgia, underestimation of financial performance and political risks are main determinants of "not efficient" financial sector. It is clear that the reduction of above discussed risk premiums by Basel II regulatory policy may not be possible. However, developing regulatory standards for more efficient management of banking liquidity and capital will be a step forward.

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