Does Kyrgyz banking system liquidity provide economic growth?

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Abstract. The relationship between the liquidity ratio, the economy and the banking system of a country is a popular subject among academics. This research aims to understand this connection for Kyrgyzstan, a developing economy. The Vector Auto Regression approach was used to trace the association of liquidity ratio to loan and deposit volumes, interest income, net interest income, treasury bill

volume, and gross domestic product based on the quarterly data. The data was obtained from various publications of the National Bank of the Kyrgyz Republic. The primary literature indicates that bank liquidity has an inverse correlation not only with bank profitability but also with economic growth. The findings confirm a similar relationship for Kyrgyzstan. Furthermore, liquidity has a positive relationship to treasury bills volume, but a negative correlation to economic growth. However, there was no significant correlation between the liquidity ratio and deposit volumes. Therefore, this paper found that high liquidity ratio of the Kyrgyz banking system negatively effects both the profitability of the banks and economic growth.

1. INTRODUCTION

The banking sector's liquidity ratio is one of the economic standards and requirements mandatory for commercial banks of the Kyrgyz Republic (NBKR, 2017). Over the last 17 years, the banking sector of Kyrgyzstan has maintained a high liquidity ratio. A high liquidity ratio is an indicator of stability in the banking sector, which provides a high degree of safety for depositors. According to Hennie & Bratanovic (2009), liquidity shows how efficiently banks allocate their resources. Such efficiency is needed to cover depositor demand and the banks' increases in loans and other investment portfolios. Hartlage (2012) describes liquidity in the banking sector by explaining how banks use cash and liquid securities to satisfy the customers' day-to-day withdrawals. He states that bank liquidity is one of the most critical aspects of the bank's stability and reputation in the customer's eyes, notably during a crisis. Moreover, adequate liquidity is crucial for banks because it strengthens their resilience to different internal and external financial shocks such as the financial crisis and bank runs, that creates a sudden demand by depositors of a bank (Canadian Bankers Association, 2018; Bethlendi et al., 2019; Lentner et al., 2019; Garai-Fodor et al., 2022; Csiszárik-Kocsir, 2021; 2022).

However, given a certain degree of safety, the profitability of the banking sector is a factor of stability for shareholders in the same manner as liquidity ratio is a factor of stability for depositors. Some theories explore the relationship between profitability and liquidity. Westerfield (1921) claimed that banks hold high cash reserves if they wish to have a high degree of safety; however, if the goal is to increase profit, banks extend their loans portfolio through deposits and issuance of notes that lower their reserve ratio. Therefore, there is a problem with choosing the right amount of reserves while maximizing profits at the same time.

Thirteen post-Soviet countries banking profitability was analyzed by Yuksel et al. (2018) from 1996 through 2006 by using fixed effects panel regression and the Generalized Method of Moments (GMM). They concluded that there is a positive relationship between non-interest income and economic growth with profitability. There was a negative relationship between loan-to-GDP ratio and profitability of the banks in those countries.

A high liquidity ratio is not favorable (Brealey et al., 2011) for the bank's profitability. It refers to the inefficient investment of assets in a loan portfolio leading to interest revenue decreases and, consequently, profitability. More importantly, lower investments in loans harm small and medium businesses because this sector cannot obtain enough funds. As a result, businesses do not grow, GDP decreases, and the country's

economy declines. Hence, it can be implied that a high liquidity ratio in the banking sector impacts the economy of the Kyrgyz Republic.

This paper aims to study the liquidity ratio in the Kyrgyz Republic's banking sector and analyze its impact on Kyrgyzstan's economy. Two main research questions that will be investigated in this article: What is the effect of liquidity ratio on profitability in the Kyrgyz Republic's banking sector? What is the impact of liquidity ratio on the economy of the Kyrgyz Republic?

The structure of the paper is organized as follows. Section II provides theoretical background by presenting the notion of liquidity, historical background, and hypotheses. Section III offers the research methodology, including the data sources, research plan, and vector autoregression model. Section IV reports discussions on results, and Section V concludes the research.

2. LITERATURE REVIEW

Banks are collecting deposits, making loans and investment. The science of banking is matching the terms of them. A bank's ability to make longer-term investments and provide more extended loans depends on the ability to collect a longer period of deposits. This is the result of different risks and alternatives in an economy. In a developed economy, the risks are smaller, relatively predictable, there are more investment options (short term and long term), and banks need lower liquidity.

On the other hand, in a developing economy, more risks force banks to have a higher liquidity rate while they try to maximize earnings. So, the banking literature in liquidity is more about developing countries' banking systems. As a developing country, Kyrgyzstan's transition economy is challenged with the same issues, and the benchmark of Kyrgyz banking system liquidity leads to other developing countries in different parts of the world.

There is a relation between bank liquidity and economic recessions. Chatterjee (2018) determined that liquidity creation of banks contains indicators of future recessions.

Some academics found that liquidity creation has a positive effect to economic growth (Berger & Sedunov, 2017; Beck et al., 2020)

Chu & Chu (2020) found a non-linear relationship between financial liquidity and economic growth. Thus, the relationship between liquidity and economic growth is a complex issue and may have different behaviors in different economies. So, what may be the relationship in a transition country like Kyrgyzstan?

2.1. Determinants of high liquidity ratio

Khemraj (2009) studied the determinants of high liquidity ratio in Uganda. According to the results received, it is stated that one of the determinants of increased liquidity is a high-interest rate for loans that are set by oligopoly power banks. The cause of the high-interest rate is the mark-up in the loan market, high transaction cost, and default risk. Second, government securities are not popular in Uganda's secondary market; as a result, only commercial banks provide the demand for these securities. The author's recommendation to decrease the high liquidity ratio is to use a foreign interest rate as a benchmark for loans interest rate; therefore, the lower interest rates increase demand for loans and decrease the liquidity level.

Along this line, high liquidity is also an issue in Bosnia and Herzegovina. It occurs due to oligopoly in the banking sector, where six banks hold 50 percent of overall assets. Other contributing factors are reserve requirements, high non-performing loans, an undeveloped securities' market, no Lender of Last Resort, and absence of an interbank market (Hasanovic & Latic, 2017).

On the contrary, Saxegaard (2006) examined the determinants of high liquidity in the Sub Saharan Africa. High liquidity is primarily due to the increase of involuntary excess liquidity in the banking sector. Banks in that area did not rely on each other; thus, the interbank market is weak. To decrease high liquidity

in the banking sector it was suggested to increase competition or improve interbank and bond markets through the Central Bank regulations.

Conversely, Pontes & Murta (2012) state that involuntary high liquidity is due to the banking sector's insufficient development, the high cost of financial transactions, inefficient public security market, inadequate interbank market, and the high-risk aversion of banks. These factors force interest rates to increase for loans, and the credit demand drops as in the case of Cape Verde. As a result, banks hold more liquid assets instead of supplying them to real businesses (Pontes & Murta, 2012). There are also cyclical factors that influence the high liquidity ratio in Cape Verde. First is high inflation, increasing the financial market's volatility and the uncertainty of the population to the financial system. Second is a massive capital inflow from foreign direct investments and foreign aid. In this case, banks become intermediaries between agencies, but not between savers and investors. Third is a crisis environment in Cape Verde, lowering the number of investment options (Pontes & Murta, 2012).

In another example, Khemraj (2006) concludes that high liquidity in Guyana is correlated with a deficit of U.S. dollars traded in the financial market. Central Bank of Guyana forces commercial banks to hold excess reserves rather than U.S. dollars. This action from Central Bank is a result of the high inflation in Guyana and is implemented to keep the market's price stability. Moreover, interest rates for loans and deposits are not controlled by Central Banks; thus, commercial banks set their rates based on their own interests (Khemraj, 2006). Another factor why banks have high liquidity in Guyana is they cannot invest assets in foreign assets due to the Central Bank's constraints (Khemraj, 2006).

Bourne (2014) examined the determinants of high liquidity in the Caribbean commercial banks. The high-interest rates explain high liquidity in the Caribbean market for loans and high-interest rates for deposits. Bahamian commercial banks had liquid assets that were twice the required level of liquidity ratio (Bourne, 2014).

2.2. Relationship between profitability and liquidity

In the Polish banking sector, through the correlation analysis of liquid assets ratio, loan to deposit ratio, and net interbank position, combined with profitability (return on assets, return on equity, and interest margin) ratios for 2007-2013, found that liquidity and profitability have a positive relationship. There, banks with high loan to deposit ratio have a higher interest margin. Moreover, medium and large banks with a high value of liquid assets have higher profitability (Vodova, 2016).

Research on the impact of liquidity on the profitability of Pakistan's commercial banks, through regression and correlation analyses, showed that liquidity has a positive relationship with profitability and has a pleasing effect on the profitability of the banking sector. It also indicated that with growing liquidity, profitability increased. Every positive ratio of liquidity has a positive relation to profitability (Khan & Ali, 2016).

In the commercial banks of Kenya regression and correlation analyses found that there is a positive relationship between profitability and liquidity in commercial banks. Moreover, liquidity is one of the determinants of banks' profitability, but not a significant factor. The relationship between Return on Assets and the Current Ratio is positive, which can imply that increase in liquidity will lead to an increase in profitability (Macharia, 2013).

A study of trade-off between liquidity and profitability between State and Private Banks in Sri Lanka concluded that there is a positive relationship between liquidity and profitability in State Banks but not significant. In private banks, liquidity is significantly correlated with profitability. As a result, the more liquidity banks have, the more profit they generate (Nishanthini & Meerajancy, 2015).

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A similar study in Tanzania, trough regression analysis, it was found that there is no statistically significant relationship between the profitability of banks and their liquidity, concluding that banks may increase their profitability without affecting their liquidity, but it is not guaranteed (Mwizarubi et al., 2015).

2.3. Kyrgyzstan

The banking system holds a significant share of Kyrgyz economy (Met, et al. 2008). Since 2001, the Kyrgyz Republic's banking sector's liquidity ratio has not dropped below 60% (Figure 1).
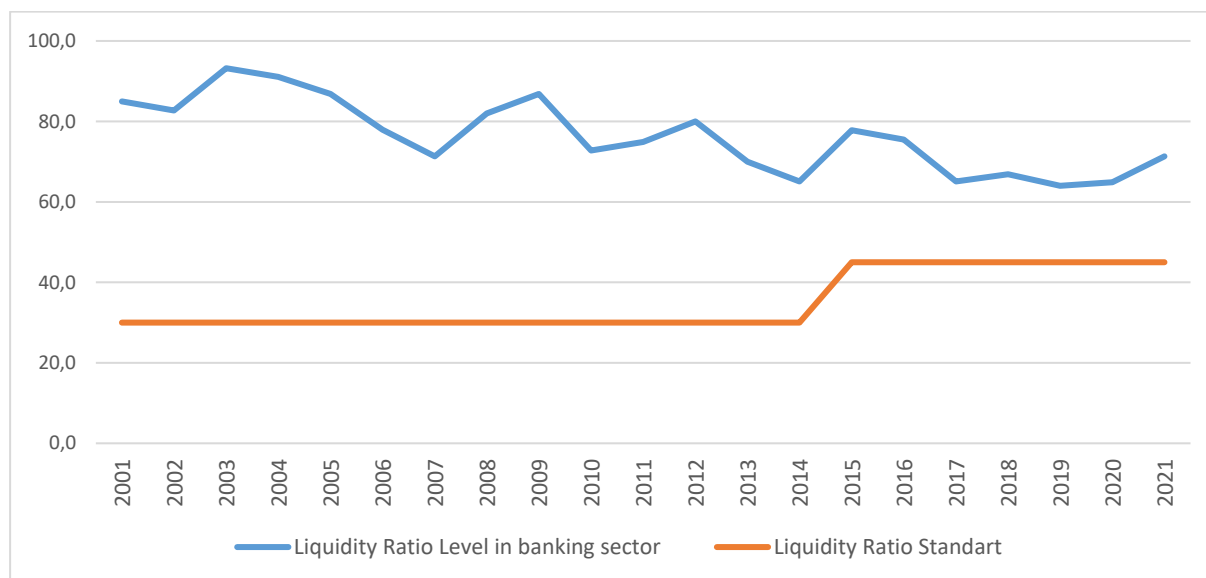
Figure 1. Liquidity ratio in the banking sector of the Kyrgyz Republic
Source: NBKR, 2018 & 2022

To better understand the features of high liquidity ratio in Kyrgyzstan, several papers discussed below:

Aseinov & Karymshakov (2018) reviewed the Kyrgyz banking system from a historical perspective and investigated current challenges. They concluded that the Kyrgyz banking system needed structural reforms to eliminate the issues caused by macroeconomic instabilities, institutional and infrastructural deficiencies.

Kyrgyzstan does not change its money aggregate targeting policies since 1990's (Atabaev & Ganiyev, 2013). And it has a liquidity ratio requirement by NBKR for the banks. The report on Financial Sector Stability of the Kyrgyz Republic states: "Public confidence in the banking sector depends on the timely implementation of obligations by the banks, which suggests the availability of sufficient liquidity in the banks. For regulatory purposes, liquidity risk is assessed using economic current liquidity ratio" (NBKR, 2018). More precisely, NBKR's statement on liquidity can be interpreted as a higher liquidity ratio leads to the public confidence in the banking sector and, therefore, higher deposit volume.

Another determinant of a high liquidity ratio is the high government securities volume and high-interest rate for them (NBKR, 2017). The average interest rate for Kyrgyz Treasury Bills (3, 6, 12 months) for the last ten years was around 10.85% (NBKR, 2017). Due to this fact, banks prefer to invest in government securities without risk.

Based on these, two hypothesizes are generated:

Hypothesis 1: High Liquidity Ratio leads to the High Deposit Volume

Hypothesis 2: High Liquidity Ratio leads to the High Government Securities Volume

As for Kyrgyzstan, the banking sector's main profit comes from their loans to businesses and individuals. Conversely, the Kyrgyz Republic's non-credited economy is high, as seen in figure 2. At the same time, the profitability of the Kyrgyz Republic's banking sector stays positive for the last 17 years, as seen in figure 3.
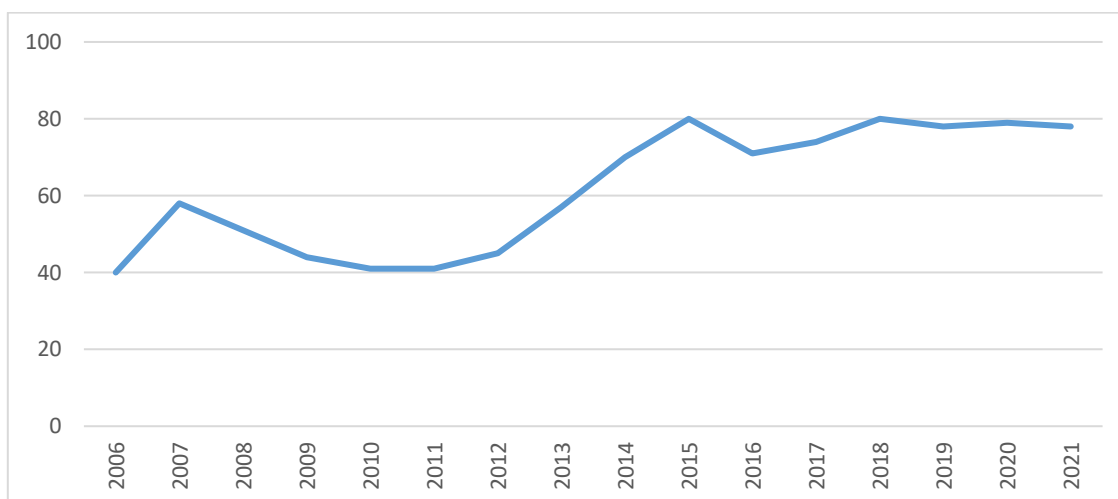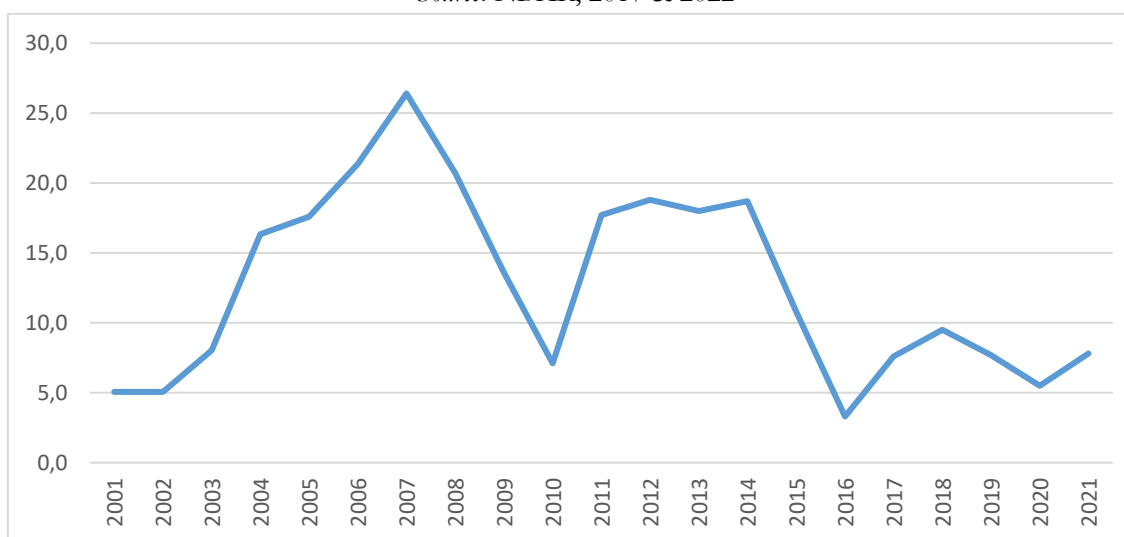

Figure 2. Non-credited economy of the Kyrgyz Republic (Loan Volume/GDP)
Source: NBKR, 2017 & 2022

Figure 3. Profitability of the banking sector in the Kyrgyz Republic (Return on Equity)
Source: NBKR, 2017 & 2022

By summarizing research that explored the relationship between profitability and liquidity, it is shown that there is a trade-off between these two bank's stability indicators, where high liquidity leads to lower profitability, and vice versa. Some authors state that there is a positive relationship between them by applying theories presented by researchers and the fact that the banking sector's profitability in the Kyrgyz Republic has remained positive for the last 17 years with a high liquidity ratio and a high non-credited economy. See that hypothesis generated below.

Hypothesis 3: Liquidity ratio leads to the low profitability in the banking sector.

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3. METHODOLOGY

3.1. Data and research plan

The data on banking activities was collected from the website of NBKR, specifically from the Bulletin of the National Bank of the Kyrgyz Republic. Citing periodic statistics on deposits and credits in commercial banks containing eight variables that are described below.

Liquidity ratio (LRL) in the Kyrgyz Republic's banking sector is the primary variable analyzed in this paper. This ratio is calculated as current assets over current liabilities. Current assets include cash funds in cashboxes and ATMs in national and foreign currency; funds in correspondent and other accounts with National Bank, including precious metals; funds on correspondent accounts in different banks, including in precious metals, interbank deposits with a maturity of 7 days, state treasury bills and other highly liquid securities issued by the Government of the Kyrgyz Republic and the National Bank (from now on - highly liquid securities), funds on the unallocated metal accounts of the bank, bank funds on metal accounts in responsible storage, highly liquid securities purchased through repo agreement (NBKR, 2017).

Current liabilities include demand deposits of legal entities and individuals in national and foreign currencies, as well as cash in settlements; the amount of the term deposit, if the terms of the contract provide for the possibility of partial replenishment and partial withdrawal by the client of funds before the expiration period or until the occurrence of other obligations, without the need for the termination of the contract and payment of the penalty interest rate, except for the irreducible balance, any additional duties, including promissory notes and other securities issued by the bank, obligations on securities sold under reverse repo agreement, as well as off-balance sheet liabilities, settlements that occur within 30 days after the balance sheet date. At the same time, the bank's obligations under SWAP and forward transactions are accounted for based on the net value of liabilities minus the claims of the bank to the counterparty bank's obligations on metal accounts on-demand or with a due date in the next 30 days (NBKR, 2017).

The banking sector's profitability, Interest Income (LCREV) measurement, and Net Interest Income (LINTI) were used. Interest Income is revenue that banks obtain from their loan portfolio and all other investments that give income. Net Interest Income is a difference between Interest Revenue and Interest Expenses. These variables are measured in millions of Soms. It was possible to use Net Interest Income of the banking sector after-tax; however, this variable was not considered in the analysis due to the negative values.

For the measurement of the banking sector's deposit amount and its relation-cause effect with liquidity ratio, Deposit Volume (LDVOL) of the whole banking sector was considered. Deposit volume is calculated by NBKR and measured in millions of Soms. Additionally, Loan Volume (LCVOL) in the banking sector was analyzed to find a causal effect of this variable to liquidity ratio. Loan volume considers all supplied loans to businesses and individuals by the banking sector and measured in millions of Soms.

The data on government securities was considered to find a causal effect on liquidity ratio. There are three types of government securities traded by NBKR: Treasury Bills, Treasury Bonds, and NBKR Notes. Treasury Bonds and NBKR Notes were not used in the analysis because Treasury Bonds started being sold in 2010, NBKR Notes in 2012, not in its timeframe. Therefore, Treasury Bills Volume in the circulation and Treasury Bills yield were analyzed.

Treasury Bills (LTBI) are short-term (3, 6, 12 months) securities of the Kyrgyz Republic government. The nominal value of 1 T-bill is 100 Soms. The issuer of T-bills is the Ministry of Finance of the Kyrgyz Republic. NBKR is the general agent for the servicing of T-bills issues. Owners of T-bills can be both legal entities and individuals. The admission of foreign investors to the T-bills market is not limited. The National

Bank performs the functions of the Central Depository. The National Bank, but it is not liable for T-bills (NBKR, 2014). Treasury Bills yield (LTBIR) is a weighted-average interest rate for T-Bills.

Additionally, to find the cause-effect to liquidity ratio and over a variable to the economy of the Kyrgyz Republic, Gross Domestic Product (LGDP) through the Value-added approach was considered. The value-added method in calculating GDP was used to eliminate intermediate goods and indirect taxes, considered in calculating GDP through income and expenditure approaches.

The timeframe of the study was quarterly from January 2008 to December 2017. This timeframe was examined due to the limitations on available data for Interest Revenue and Net Interest Income. It was possible to use dummies for these, but the use of dummies in the analysis may misrepresent the model's correctness and stability.

Data that will be used in this article was observed at a different time; therefore, it needs to be recognized that past data can negatively affect future studies (Wooldridge, 2013). Additionally, it is possible that variables can be correlated with each other at some point in time. This correlation can short the use of statistical or econometrical models, and if there is a possibility of time correlation between variables, time series analysis needs to be conducted (Shumway & Stoffer, 2011). Therefore, this article intends to conduct time-series research on the Eviews9 software program, which performs statistical and econometric analysis, makes model simulations and forecasts with high-quality graphs and tables (HIS Global Inc., 2015).

The main criteria for conducting time series analysis is that all data must be stationary (without unit-root), and there must be no seasonality in variables. If data would be non-stationary, the mean and standard deviation of variables was going to be zero. Therefore, through Augmented Dickey-Fuller (ADF) and Phillips-Perron (P.P.) tests, data by taking a first difference of the logarithm for each variable in the dataset was transformed into a stationary data. The stationary data means that all probability distributions of variables are stable over time and does not possess unit root (Wooldridge, 2013).

Most of those who researched the liquidity ratio analysis and its relationship with profitability, used regression and correlation models to analyze the impact of liquidity on Pakistan's profitability regression and correlation models (Khan & Ali, 2016). The regression model was used to find a relationship between profitability and liquidity in Kenya's commercial banks (Macharia, 2013). However, the data used in this paper is historical and contains a time series process. Vector Auto Regression (VAR) model is more appropriate. This model is one of the most flexible and successful models used for the analysis behavior of economic and financial time series and in forecasting the behavior of variables based on the previous data (Zivot & Wang, 2006).

3.2. Vector Auto Regression (VAR) model for time series analysis

Considering that data, a serial correlation VAR model was used for the analysis of time-series data. All variables are endogenous (dependent). There is only one equation for all dependent variables, where the right side of the equation includes values of all dependent variables in the system, without simultaneous variables (Shumway & Stoffer, 2011). Additionally, the VAR model is useful for analyzing one variable's response to the different shocks in another variable. In general, VAR emphasizes the correlated information of the historical data and uses it to forecast future changes and movements of variables (Robertson & Tallman, 1999).

The generalized VAR model can be represented through this framework:

$$Y_t = a + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \varepsilon_t$$

where,

$Y_t = (y_{1t}, y_{2t}, \ldots, y_{nt})$: an (nx1) vector of time series variables

a: an (nx1) vector of intercepts

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$A_i (i = 1, 2, ..., p)$: (nxn) coefficient matrices

ε_t: an (nx1) vector of unobservable zero mean error term

To be sure that there is no serial correlation between variables, all variables were checked through VAR Residual Serial Correlation L.M. Tests. The test's idea is to test that variables used to analyze the particular hypothesis do not have a serial correlation with each other (Pesavento & Rossi, 2006).

The next parameter for conducting a VAR model is a Lag Length Selection test that was performed to minimize the model's selection criteria through Akaike (AIC), Schwarz (S.C.), and Hannan-Quinn (H.Q.) information criterion tests. Each criterion test is at a 5% level (Zivot & Wang, 2006).

After performing the VAR model parameters, the model must be summarized through structural analysis. There are three main types of structural analysis in the VAR model that are Pairwise Granger Causality Test, Impulse Response function, and Variance decomposition of each variable (Zivot & Wang, 2006).

As one of the primaries uses of the VAR model is forecasting, the Pairwise Granger Causality Test helps to forecast and predict the causality or non-causality of one variable to another in the VAR model (Zivot & Wang, 2006). For data analysis in this article, the Pairwise Granger Causality Test was performed to determine the non-cause effect between two variables.

The Impulse Response function was performed through Cholesky Decomposition at 1% shock for a period of ten quarters. This test helps to understand the relationship between two variables, specifically how one variable will respond to the shock on another (Pesavento & Rossi, 2006). Specifically, Impulse Response helps to find how long the shock on one variable will affect another. Results that were used for impulse response functions conform to the Granger analysis test. Afterwards, Variance Decomposition was performed to show the percentage amount of each variable's shock on the particular variable (Zivot & Wang, 2006).

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Unit-Root Test Results

Through Augmented Dickey-Fuller (ADF) and Phillips-Perron (P.P.) tests, at the first difference of the logarithm for each variable in the dataset, all data got stationary spurious regression problem was eliminated as seen in Table 1.

Table 1

ADF and PP Unit-Root Tests' Results n Level Variables

| Variables	Augmented Dickey-Fuller (ADF)		Phillips-Perron (P.P.)	
	Intercept	Trend and intercept	Intercept	Trend and intercept
FIRST DIFFERENCE				
LCREV	-4.853*	-4.796*	-5.059*	-5.001*
LCVOL	-10.357*	-10.199*	-10.774*	-10.591*
LDVOL	-7.256*	-7.150*	-7.364*	-7.251*
LGDP	-7.887*	-5.461*	-15.133*	-22.309*
LINTI	-5.605*	-5.547*	-5.658*	-5.601*
LRL	-4.101*	-4.070**	-4.221*	-4.204**
LTBI	-4.346*	-4.798*	-4.372*	-4.862*
LTBIR	-7.410*	-7.340*	-7.410*	-7.340*
LRISK	-6.568*	-6.478*	-12.376*	-12.763*

Source: Authors' results with Eviews9. * indicates significance level at 0.10 level, and ** indicates significance level at 0.05 level.

4.2. VAR Model Results

4.2.1. Revenue

Four variables cause-effect was considered as Liquidity Ratio, Loan Volume, Interest Revenue, and GDP to find out the relationship between the earnings and liquidity in the Kyrgyz Republic's banking sector.

First, the parameters of the VAR model were performed. Through VAR Residual Serial Correlation L.M. Test, it was proven that all four variables are not correlated to each other, estimated VAR is stationary, data is stable, and the model is correct, as seen in Figure 4.
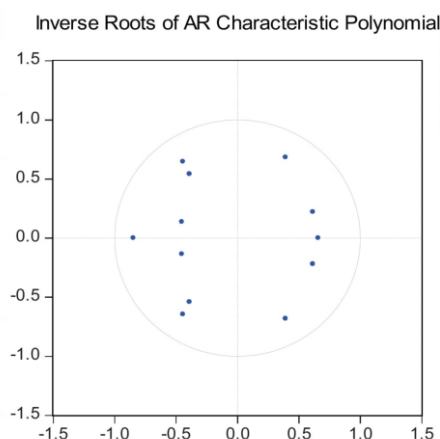
Figure 4. VAR Residual Serial Correlation L.M. Tests 1
Source: Authors' results with Eviews9.

Akaike (AIC), Schwarz (S.C.), and Hannan-Quinn (H.Q.) information criterion tests gave an optimal three lag lengths, as seen in Table 2.

Table 2

Lag Length Selection of the Basic and Extended Models 1

Lag	LogL	LR	FPE	AIC	SC	H.Q.
0	226.4128	NA	3.55E-11	-12.7093	-12.53155*	-12.64794
1	250.9663	42.09176	2.20E-11	-13.19807	-12.3093	-12.89127
2	276.5605	38.02569*	1.32E-11	-13.74632	-12.14653	-13.19407*
3	294.9222	23.08327	1.28e-11*	-13.88127*	-11.57047	-13.08358

Source: Authors' results with Eviews9. *indicates lag order selected by the criterion*
L.R.: sequential modified L.R. test statistic (each test at 5% level)

Next, for the structural analysis of the VAR model, Pairwise Granger Causality Tests were performed. It was observed that liquidity ratio statistically significantly causes Interest Revenue, as seen in Table 3.

As a result of these findings, the next hypothesis was generated:

Hypothesis 1: Liquidity Ratio has a cause-effect on Interest Revenue

To find the effect liquidity ratio has on interest revenue, these variable's impulse response was acquired from the system. Figure 5 shows that positive shock on liquidity ratio increases interest revenue in the short-term (first and second quarters) and decreases in the long-term. In the short-term, Interest Revenue increases due to the government securities in circulation that are mostly short-term, with high-interest rates, give high-interest revenue. In the long-term, the decline of interest revenue is due to the low investments in a loan portfolio with a higher interest rate and higher income for banks. However, because of the low investments in the loan portfolio and increased investments in government securities, long-term Interest Revenue decreases, and liquidity ratio increases.

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Table 3

Pairwise Granger Causality Tests 1

Null Hypothesis	Observation	F-Statistic	Probability
LCVOL does not Granger Cause LRL	36	1.31002	0.2843
LRL does not Granger Cause LCVOL		0.79068	0.4625
LCREV does not Granger Cause LRL	37	1.80767	0.1804
LRL does not Granger Cause LCREV		4.39906	0.0205
LGDP does not Granger Cause LRL	37	0.5301	0.5936
LRL does not Granger Cause LGDP		3.90254	0.0304
LCREV does not Granger Cause LCVOL	36	3.91147	0.0306
LCVOL does not Granger Cause LCREV		0.02206	0.9782
LGDP does not Granger Cause LCVOL	36	1.56967	0.2242
LCVOL does not Granger Cause LGDP		0.22952	0.7963
LGDP does not Granger Cause LCREV	37	1.56419	0.2248
LCREV does not Granger Cause LGDP		1.33902	0.2764

Source: Authors' results with Eviews9.

This illustrates that a high liquidity ratio negatively impacts Interest Revenue in the long-run, but through earnings from government securities, banks earn revenue only in the short-term.
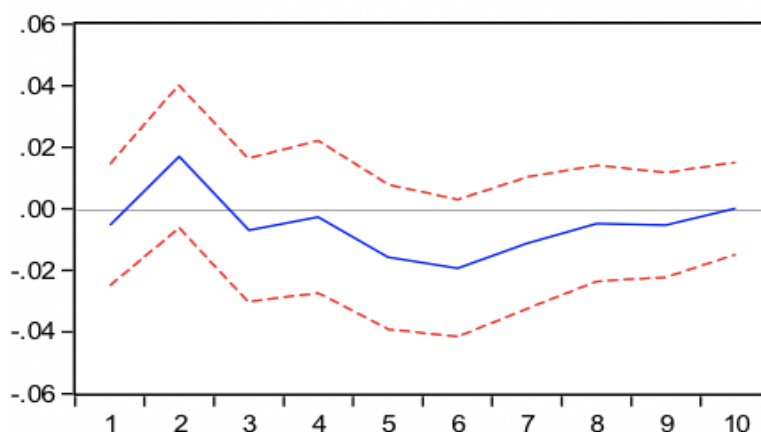

Figure 5. Impulse response of Interest Revenue to Liquidity Ratio
Source: Authors' results with Eviews9.

The variance decomposition of Interest Revenue shows that liquidity ratio shock accounts for 19.48% in liquidity ratio, while own shock accounts for 50.13%, GDP for 4.54%, and Loan Volume for 25.83% seen in Table 4.

Table 4

Variance Decomposition of Interest Revenue

Variance Decomposition of LCREV					
Period	**S.E.**	**LRL**	**LCVOL**	**LCREV**	**LGDP**
1	0.058296	0.797487	39.08683	60.11569	0
2	0.061713	8.320736	35.39098	54.14754	2.140748
3	0.064306	8.826194	34.35813	51.85781	4.957871
4	0.07065	7.450679	28.48892	59.38142	4.67898
5	0.073198	11.52033	28.55822	55.38786	4.533588
6	0.075749	17.30036	26.66843	51.7911	4.240103
7	0.076812	18.94911	26.02927	50.67329	4.348335
8	0.077208	19.14056	25.95487	50.46228	4.442291
9	0.077473	19.48339	25.83688	50.13531	4.54441
10	0.077615	19.41211	25.79497	50.2432	4.54972

Source: Authors' results with Eviews9.

4.2.2. *Profitability*

As a measure of profitability, Net Interest Income in the Kyrgyz Republic's banking sector was considered. For the next analysis of the relationship between profitability and liquidity in the Kyrgyz Republic's banking sector and their effect on the economy, four variables were considered. These are Liquidity Ratio, Loan Volume, Net Interest Income, and GDP.

First, the parameters of the VAR model were performed. VAR Residual Serial Correlation L.M. Test proved that all four variables are not correlated to each other. The estimated VAR model is stationary, and data is stable, as seen in Figure 6.

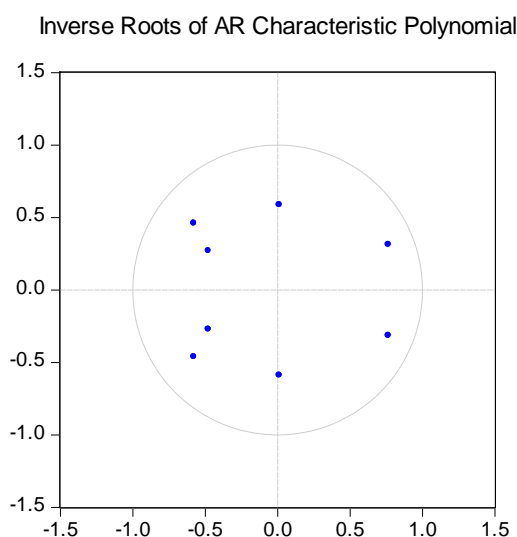Inverse Roots of AR Characteristic Polynomial

Figure 6. VAR Residual Serial Correlation L.M. Tests 2
Source: Authors' results with Eviews9

Through Akaike (AIC), Schwarz (S.C.), and Hannan-Quinn (H.Q.) information criterion tests, it was found that analysis of these four variables has an optimal two lag lengths, as seen in Table 5.

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Table 5

Lag Length Selection of the Basic and Extended Models 2

Lag	LogL	LR	FPE	AIC	SC	H.Q.
0	234.9981	NA	2.18E-11	-13.19989	-13.02214*	-13.13853
1	255.9666	35.94609	1.65E-11	-13.48381	-12.59504	-13.177
2	**288.3403**	**48.09809***	**6.73e-12***	**-14.41945***	**-12.81966**	**-13.86720***
3	302.1654	17.38013	8.44E-12	-14.29517	-11.98437	-13.49748

Source: Authors' results with Eviews9. *indicates lag order selected by the criterion

L.R.: sequential modified L.R. test statistic (each test at 5% level)

For the VAR model's structural analysis, through Pairwise Granger Causality Tests, it was observed that liquidity ratio statistically significantly Granger Causes Net Interest Income and GDP, as seen in Table 6.

Table 6

Pairwise Granger Causality Tests 2

| Null Hypothesis	Obs	F-Statistic	Probability
LCVOL does not Granger Cause LRL	36	1.31002	0.2843
LRL does not Granger Cause LCVOL		0.79068	0.4625
LINTI does not Granger Cause LRL	37	2.26654	0.1201
LRL does not Granger Cause LINTI		**8.31127**	**0.0012**
LGDP does not Granger Cause LRL	37	0.5301	0.5936
LRL does not Granger Cause LGDP		**3.90254**	**0.0304**
LINTI does not Granger Cause LCVOL	36	2.43287	0.1044
LCVOL does not Granger Cause LINTI		0.22916	0.7965
LGDP does not Granger Cause LCVOL	36	1.56967	0.2242
LCVOL does not Granger Cause LGDP		0.22952	0.7963
LGDP does not Granger Cause LINTI	37	1.47393	0.2442
LINTI does not Granger Cause LGDP		2.75478	0.0787

Source: Authors' results with Eviews9.

As a result, two more hypothesizes were generated:

Hypothesis 2: Liquidity Ratio has a cause-effect on Net Interest Income

Hypothesis 3: Liquidity Ratio has a cause-effect on GDP

The impulse response of net interest income to liquidity ratio and impulse response of GDP to liquidity ratio was acquired from the system for the analysis of these variable's causal effects. As shown in figure 7, positive shock on liquidity ratio gives an adverse reaction in the first quarter due to the non-invested cash. Positive response in the second and third quarters is due to the investments into government securities, which gives high-interest revenue. The fourth to ninth quarter's adverse reaction is due to the low long-term investments into the loan portfolio, which results in low long-term Net Interest Income. This illustrates that banks invest in government securities. As a result, the liquidity ratio increases and profitability too. However, in the long-term, with high liquidity and low investments into loans, profitability is negative.
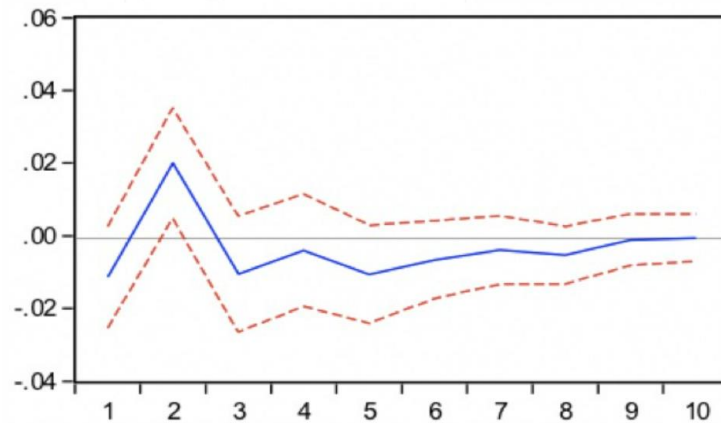
Figure 7. Impulse response of Net Interest Revenue to Liquidity Ratio
Source: Authors' results with Eviews9.

The impulse response of GDP to liquidity ratio is seen in figure 8. There, positive shock in liquidity ratio gives a positive reaction from GDP in the short-term (first and second quarters) since the government trough sale securities close the budget deficit and GDP increases. However, in the second and third quarters, with a positive shock on liquidity ratio, GDP falls due to bank's low investment loans to small and medium businesses. From the fourth quarter, there is no response from GDP to the shock on liquidity ration. Therefore, it can be concluded that a high liquidity ratio negatively impacts the economy of Kyrgyzstan.
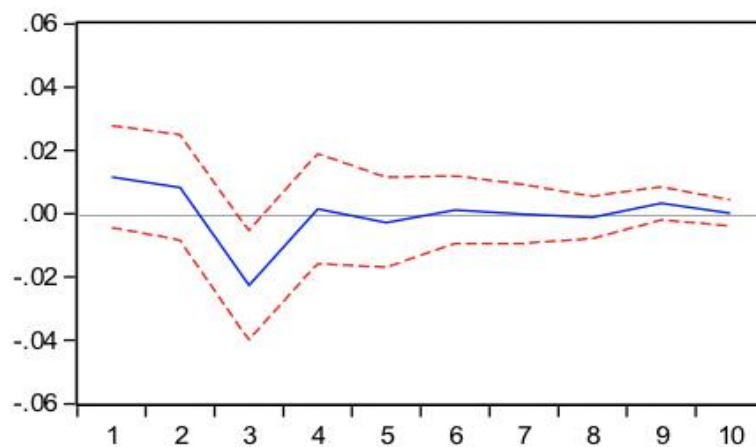
Figure 8. Impulse response of LGDP to LRL
Source: Authors' results with Eviews9.

The variance decomposition of Net Interest Income shows that liquidity ratio shock accounts for 27.93% in Net Interest Income, while own shock accounts for 46.1%, GDP for 7.31%, and Loan Volume for 18.66%, as seen in Table 7.

The variance decomposition of GDP shows that liquidity ratio shock accounts for 21.85% in GDP, while own shock accounts for 52.22%, Net Interest Income for 15.67%, and Loan Volume for 10.24%, as seen in Table 7.

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Table 7

Variance Decomposition of GDP and Net Interest Income

Variance Decomposition of LINTI:					
Period	S.E.	LRL	LCVOL	LINTI	LGDP
1	0.042557	7.138205	25.62623	67.23556	0
2	0.048575	22.40512	21.58309	53.72264	2.289147
3	0.051349	24.21554	19.57173	48.37381	7.838926
4	0.05264	23.61197	18.68367	49.80521	7.899146
5	0.054119	26.18448	19.15031	47.18601	7.479193
6	0.054617	27.17875	19.04666	46.41605	7.358538
7	0.054888	27.42847	18.86002	46.33902	7.37249
8	0.055316	27.92298	18.66171	46.10025	7.315066
9	0.055443	27.83576	18.7067	46.06297	7.39458
10	0.055528	27.75938	18.65337	46.16706	7.42019

Variance Decomposition of LGDP:					
Period	S.E.	LRL	LCVOL	LINTI	LGDP
1	0.049122	5.586688	6.531536	20.54277	67.339
2	0.051468	7.641127	9.117046	19.04599	64.19584
3	0.057065	21.85703	10.24756	15.67254	52.22287
4	0.059348	20.27057	12.04252	16.95661	50.7303
5	0.060565	19.6782	11.56555	19.43652	49.31973
6	0.060971	19.45772	12.67172	19.20528	48.66528
7	0.061154	19.34195	12.86048	19.09696	48.70061
8	0.06123	19.33158	12.9802	19.0978	48.59042
9	0.061322	19.55325	12.94192	19.04818	48.45664
10	0.061332	19.54805	12.9452	19.063	48.44375

Cholesky Ordering: LRL LCVOL LINTI LGDP

Source: Authors' results with Eviews9.

4.2.3. Deposit Volume

For the analysis of the relationship between liquidity ratio and deposit volume and their impact on the economy, the first parameter of VAR models was conducted. Through VAR Residual Serial Correlation L.M. Test, it was proven that all three variables, (deposit volume, liquidity ratio, and GDP) are not correlated to each other, the estimated VAR model is stationary, and data is stable, as seen in Figure 9.
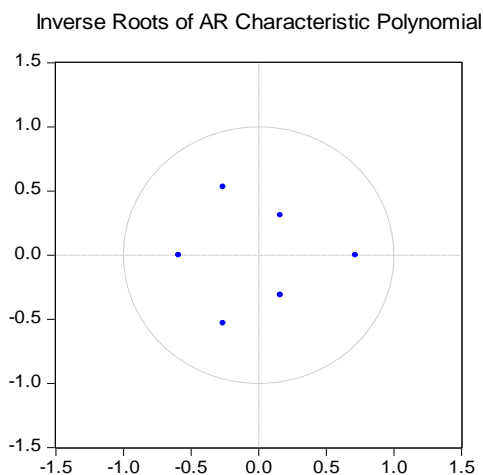
Inverse Roots of AR Characteristic Polynomial

Figure 9. VAR Residual Serial Correlation L.M. Test 3

Source: Authors' results with Eviews9.

Akaike (AIC), Schwarz (S.C.), and Hannan-Quinn (H.Q.) information criterion tests provided an optimal two lag lengths, as seen in Table 8.

Table 8

Lag Length Selection of the Basic and Extended Models 3

Lag	LogL	LR	FPE	AIC	SC	H.Q.
0	160.516	NA	3.18E-08	-8.750887	-8.618927*	-8.704829
1	168.87	14.85154	3.30E-08	-8.714997	-8.187158	-8.530767
2	**186.6503**	**28.64610***	**2.05e-08***	**-9.202794***	**-8.279075**	**-8.880391***
3	192.0508	7.800706	2.58E-08	-9.002821	-7.683222	-8.542246

Source: Authors' results with Eviews9. * indicates lag order selected by the criterion

L.R.: sequential modified L.R. test statistic (each test at 5% level)

For the structural analysis, Through Pairwise Granger Causality Tests, it was observed that deposit volume statistically significantly Granger Causes liquidity ratio, as seen in Table 9.

Table 9

Pairwise Granger Causality Tests 3

Null Hypothesis:	Observation	F-Statistic	Probability
LDVOL does not Granger Cause LRL	**37**	**14.2407**	**4.00E-05**
LRL does not Granger Cause LDVOL		0.76198	0.475
LGDP does not Granger Cause LRL	37	0.5301	0.5936
LRL does not Granger Cause LGDP		3.90254	0.0304
LGDP does not Granger Cause LDVOL	37	0.27427	0.7619
LDVOL does not Granger Cause LGDP		0.96117	0.3932

Source: Authors' results with Eviews9.

As a result, the next hypothesis was generated:

Hypothesis 1: Deposit Volume has a cause-effect on Liquidity Ratio

The impulse response of liquidity ratio to deposit volume was acquired from the program, as seen in figure 10. The positive shock on deposit volume results in the increase of liquidity ratio in the first quarter and decreases in second and third quarters; then, there is no significant response. The rise of liquidity ratio in the first quarter is due to the expansion of cash in banks through a high deposit volume. A decrease in the second, third, and fourth quarters occurs due to the increase of liabilities as accrued interest expense increases current liabilities and decreases the liquidity ratio. After, there is no significant response of liquidity ratio to the positive shock on deposit volume.
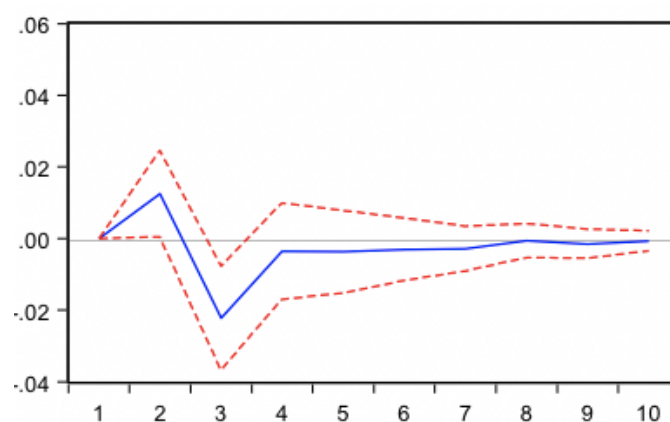

Figure 10. Impulse response function of Liquidity Ratio to Deposit Volume
Source: Authors' results with Eviews9.

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The variance decomposition of Liquidity Ratio shows that Deposit Volume shock accounts for 29.13% in Liquidity Ratio, while its own shock accounts for 70.82%, and GDP for 70.05%, as seen in Table 10.

Table 10

Variance Decomposition of liquidity ratio

Variance Decomposition of LRL:				
Period	S.E.	LRL	LDVOL	LGDP
1	0.032493	100	0	0
2	0.038712	89.48313	10.44873	0.068141
3	0.047332	70.82506	29.12908	0.045866
4	0.04832	71.23018	28.49519	0.274633
5	0.049167	71.58917	28.09381	0.317026
6	0.049439	71.51328	28.16878	0.317942
7	0.049679	71.45176	28.23134	0.3169
8	0.049744	71.51268	28.17124	0.316077
9	0.049804	71.48528	28.19935	0.315372
10	0.049825	71.48833	28.19591	0.315763

Source: Authors' results with Eviews9.

4.2.4. Government Securities

To analyze the relationship and cause-effect of liquidity ratio with government securities, five variables were considered including treasury bills, treasury bills volume, treasury bills interest rate, GDP, and loan volume. Through a VAR Residual Serial Correlation L.M. Test, it was proved that all five variables are not correlated to each other, the estimated VAR model is stationary, and data is stable, as seen in figure 11.

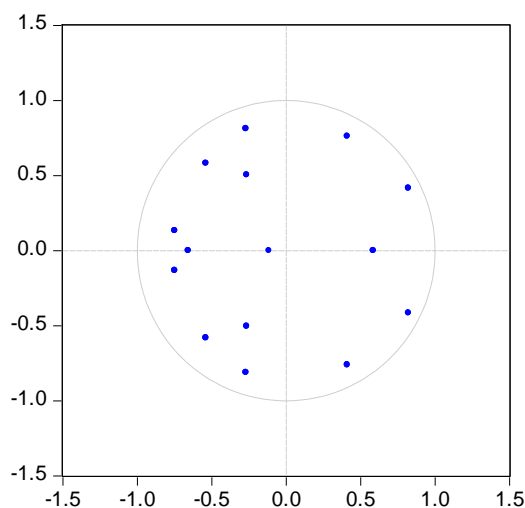Inverse Roots of AR Characteristic Polynomial

Figure 11. VAR Residual Serial Correlation L.M. Test 4
Source: Authors' results with Eviews9.

Through Akaike (AIC), Schwarz (S.C.), and Hannan-Quinn (H.Q.) information criterion tests, it was investigated that there are optimal three lag lengths, as seen in Table 11.

Table 11

Lag Length Selection of the Basic and Extended Models 4

Lag	LogL	LR	FPE	AIC	SC	H.Q.
0	201.3044	NA	9.25E-12	-11.21739	-10.99520*	-11.14069
1	224.6485	38.6846	1.03E-11	-11.12277	-9.789617	-10.66257
2	253.0345	38.9294	9.35E-12	-11.31626	-8.872141	-10.47255
3	**296.9239**	**47.65128***	**4.10e-12***	**-12.39565***	**-8.840568**	**-11.16844***

Source: Authors' results with Eviews9. * indicates lag order selected by the criterion

L.R.: sequential modified L.R. test statistic (each test at 5% level)

Through Pairwise Granger Causality Tests, it was observed that liquidity ratio statistically significantly Granger Causes Treasury Bills volume; and Treasury Bills volume statistically significantly Granger cause GDP as seen in Table 12.

Table 12

Pairwise Granger Causality Tests 4

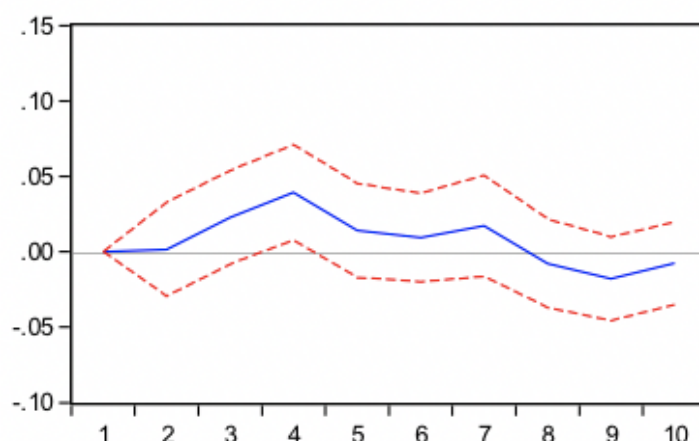| Null Hypothesis	Observation	F-Statistic	Probability
LTBIR does not Granger Cause LTBI	37	2.65909	0.0854
LTBI does not Granger Cause LTBIR		0.52609	0.5959
LRL does not Granger Cause LTBI	**37**	**3.29751**	**0.0499**
LTBI does not Granger Cause LRL		1.03121	0.3681
LCVOL does not Granger Cause LTBI	36	0.63349	0.5375
LTBI does not Granger Cause LCVOL		0.43493	0.6512
LGDP does not Granger Cause LTBI	37	0.17293	0.842
LTBI does not Granger Cause LGDP		**4.47882**	**0.0193**
LRL does not Granger Cause LTBIR	37	0.57232	0.5699
LTBIR does not Granger Cause LRL		3.94515	0.0294
LCVOL does not Granger Cause LTBIR	36	0.25019	0.7802
LTBIR does not Granger Cause LCVOL		2.12449	0.1366
LGDP does not Granger Cause LTBIR	37	1.18002	0.3203
LTBIR does not Granger Cause LGDP		0.02402	0.9763
LCVOL does not Granger Cause LRL	36	1.31002	0.2843
LRL does not Granger Cause LCVOL		0.79068	0.4625
LGDP does not Granger Cause LRL	37	0.5301	0.5936
LRL does not Granger Cause LGDP		3.90254	0.0304
LGDP does not Granger Cause LCVOL	36	1.56967	0.2242
LCVOL does not Granger Cause LGDP		0.22952	0.7963

Source: Authors' results with Eviews9.

Therefore, two more hypothesizes were generated:

Hypothesis 5: Liquidity Ratio has a cause-effect on Treasury Bills Volume

Hypothesis 5: Treasury Bills Volume has a cause-effect on GDP

First, the impulse response of treasury bills volume to liquidity ratio was obtained, as seen in figure 12. There, positive shock in liquidity ratio increases treasury bills volume in the long-term. T-Bill volume increases when the liquidity ratio increases because treasury bills as current assets are part of the liquidity ratio calculation. Therefore, it can be implied that government securities positively affect the liquidity ratio.

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Figure 12. Impulse response function of Treasury Bills volume to liquidity ratio
Source: Authors' results with Eviews9.

Second, GDP's impulse response to treasury bills volume was charted as seen in figure 13. Positive shock in Treasury Bills volume increases GDP in the short-term (first quarter) and decreases from second to fourth quarters. Decrease of the GDP in the first quarter is related to more government securities in circulation, the budget deficit is closed in the short-term, and GDP increases. Decrease from the second to fourth quarter is due to bank's low investments in small and medium businesses. Lower investments for small and medium enterprises negatively impact the economy and decrease GDP. Therefore, it can be implied that government securities negatively affect the economy of Kyrgyzstan.
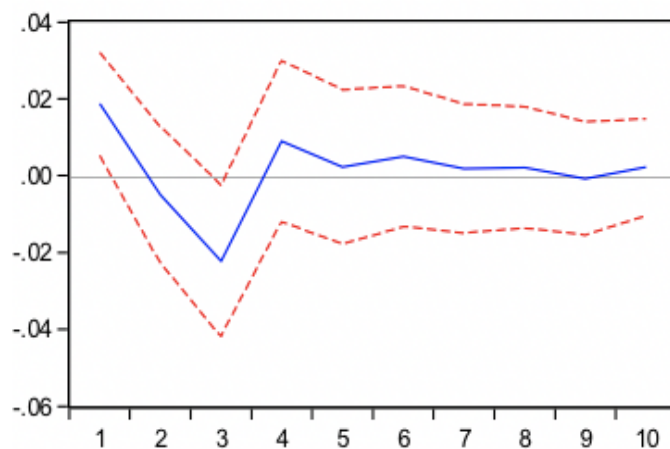
Figure 13. Impulse response function of GDP to Treasury Bills volume
Source: Authors' results with Eviews9.

Treasury Bills Volume's variance decomposition shows that Liquidity Ratio shock accounts for 14.16% in Treasury Bills Volume, while own shock accounts for 61.9%, Credit Volume for 1.17%, Treasury Bills Interest Rate for 11.67%, and GDP for 11.1% as seen in Table 13.

The variance decomposition of GDP shows that Treasury Bills Interest Rate shock accounts for 32.68% in Liquidity Ratio, while own shock accounts for 49.77%, and Treasury Bills Volume for 17.54%, as seen in Table 13.

Table 13

Variance Decomposition of Treasury Bills Volume and GDP

Variance Decomposition of LTBI					
Period	S.E.	LTBIR	LTBI	LRL	LCVOL	LGDP
1	0.086239	9.464609	90.53539	0	0	0
2	0.103182	13.61262	71.53054	0.022328	0.016776	14.81773
3	0.109533	12.52591	69.22799	4.298602	0.693472	13.25402
4	0.120689	11.67077	61.90821	14.15826	1.171367	11.09139
5	0.127578	13.70301	57.04848	13.87337	4.766728	10.60842
6	0.138067	14.36829	56.87822	12.29716	5.032851	11.42348
7	0.140284	14.3192	55.09481	13.40756	5.3308	11.84763
8	0.141135	14.66649	54.70681	13.54963	5.329863	11.74721
9	0.144122	14.27427	54.41694	14.54347	5.476495	11.28884
10	0.14483	14.4197	54.18458	14.68116	5.521193	11.19338

Variance Decomposition of LGDP					
Period	S.E.	LTBIR	LTBI	LRL	LCVOL	LGDP
1	0.043934	9.254375	18.19014	0.169755	10.74415	61.64158
2	0.048366	13.63132	16.01942	1.349019	14.04204	54.95821
3	0.056038	11.67699	27.6123	1.914579	16.90988	41.88625
4	0.061947	13.56997	24.66847	1.569979	14.32469	45.86689
5	0.063502	14.93532	23.60579	1.641882	13.90322	45.91379
6	0.064902	15.06548	23.2028	4.328432	13.32601	44.07728
7	0.068346	16.87198	20.99562	3.994258	14.80941	43.32873
8	0.069613	16.51816	20.32845	4.063238	17.28095	41.80921
9	0.069639	16.5253	20.32737	4.06924	17.28716	41.79093
10	0.070493	18.00427	19.93352	3.986131	16.87359	41.2025

Cholesky Ordering: LTBIR LTBI LRL LCVOL LGDP
Source: Authors' results with Eviews9.

5. CONCLUSION

This research examined the liquidity ratio of the Kyrgyz banking system. More specifically, the effect of a high liquidity ratio on the banks' revenue, profitability, deposit volume, government securities, and GDP is analyzed through the Vector Auto Regression model with a timeframe 2008-2017.

The VAR analysis shows that the liquidity ratio in the Kyrgyz Republic's banking sector has a positive short-term effect on the interest income and net interest income. However, in the long-term, it has a negative causal impact on these variables. The short-term positive impact of a high liquidity ratio on profitability is due to purchase of government securities the long-term adverse effects of high liquidity ratio to the profitability indicate that by holding a high amount of liquid assets and investing only in the government securities, banks invest less in their loan portfolio and generate less profit.

The VAR model also found that liquidity ratio has a positive causal effect on the treasury bills volume. This means that banks buy a high amount of government securities that increase their liquidity ratio. Additionally, the VAR model analysis found no evidence that a high liquidity ratio leads to the increased deposit volume, as stated by NBKR (2017).

What is more critical, liquidity ratio and treasury bills volume have a long-term negative impact on GDP but positive impact only in the short-term. This means that the Kyrgyz Republic government reduces the budget deficit by selling government securities to the banking sector. Investing in these securities leads to fewer loans issued to small and medium businesses, therefore, these businesses, without investments growth is slow and the overall economy falls. This is proven by the fact that the Kyrgyz Republic's exports have fallen for the last five years, and Kyrgyzstan has become dependent on the imports.

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A high liquidity ratio helps NBKR keeps commercial banks unstable while negatively impacting GDP. NBKR's (2010) primary objective is to manage and control stability in the financial sector without considering the economic development of Kyrgyzstan. On the other hand, the Ministry of Economy's (2016) goal for the Kyrgyz Republic is to increase investments in the country, provide more opportunities for small and medium businesses, and increase export, the opposite result of NBKR's. Therefore, it is recommended for the Ministry of Economy of the Kyrgyz Republic and NBKR to carry objectives that will not harm the country's economy and, at the same time, keep the financial sector in stability.

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