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## Liquidity Risk Management in Islamic Banking: Comparative Analysis with SUR Methodology for Turkey

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*Abstract. Participating banks, emerged as a complementary element in the Turkish financial system since mid-1980s, are continuously increasing their value added to the Turkish banking sector. Therefore, determining whether participation banks and conventional banks differ in liquidity structure and liquidity risk management makes it possible to assess future growth performance of these banks.*

*The aim of this study is to determine factors effecting liquidity risk in Turkish Islamic banking sector. Method used for this purpose is the Seemingly Unrelated Regression (SUR). The result of study indicates that liquidity risk is significantly affected from credit base and funds collected and; increase in them will increase the liquidity risk. Based on our findings, it is possible to estimate factors effecting participation banks liquidity structure and will be a significant input for asset-liability management. This is noteworthy to have robust Islamic banking sector in Turkey and to manage risk they face accurately.*

**Keywords:** Islamic Banking, Liquidity Risk, Risk Management, SUR

**JEL Codes:** G10, G21, G32

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### 1. Introduction

Although the concept of liquidity is expressed in different ways in economic literature, almost all of them correspond to the same meaning: the rate at which any asset can be converted into cash. However, Babuşçu (2005) considered to define this concept in two different ways as narrow and broad. Liquidity in the narrow sense is the ability to be paid in full and on time. In a broad sense, it is defined as following a more coherent and balanced fiscal policy pursuit with liabilities and maturity in order to liquidate assets in a faster, easier and shorter time.



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The maturity mismatch resulting from the poor management of the existing liquid assets and most of the time as a result of the banking sector's efforts to finance long-term assets with short-term resources is the most important reason for the liquidity risk. Furthermore, the deterioration in the asset quality of the balance sheets, sudden and unexpected outflow of resources, the decline in profitability and crises are among the reasons that cause liquidity risk (Zengin and Yüksel, 2016; Babuşçu, 2018 and Aloğlu, 2005).

There is a close relationship between liquidity risk and profitability as the liquidity risk increases, return is also increasing. However, if the said risk is not managed well, a bank that aims to achieve high returns may be in default, may have difficulty in payment, and even the bank's liquidity shortage may lead the bank to bankruptcy (Aloğlu, 2005 ve Akan, 2008). As a matter of fact, the Turkish banking system has had to struggle with such problems in the 2000-2001 crisis.

Liquidity risk in the banking sector is like a glass ball. Because, the banks that serve as bridges on the basis of trust between financial surplus and fund need in financial markets are unlikely to recover again if they fall into liquidity shortage due to any reason. On the other hand, profitability is similar to a rubber ball in the banking sector. Thus, in the current period, a bank that makes losses in the next period may pass the next period with profit. Thus, the rubber can jump like a ball and have the opportunity to correct its own situation (Sayım & Er, 2009: 15).

Liquidity risk is evaluated in two aspects as funding market and bank liquidity risks (Akkus, 2017 and Aloglu, 2005):

- Market Liquidity Risk; The risk of inability to sell or close a position without affecting the market price due to insufficient market depth or deterioration of market conditions,

- Funding liquidity risk: The risk that banks cannot meet their debts and liabilities without any unexpected loss and default without affecting their daily activities or financial situation,

Banks should have adequate systems for measuring, monitoring and controlling liquidity risk (BIS, 2006). Importance of risk management in banking system has increased due to the fact that the more loans they start to place, the greater the risk they expose. Among these risks, liquidity risk arises when a given financial obligation could not be fulfilled by the banks, for a certain period of time. After global financial crisis, the liquidity risk is one of the issues that has taken the priority in the agenda of regulatory bodies and Basel Committee on Banking Supervision defines main principles of liquidity risk management in 2008.

Islamic banks are facing common risks with conventional financial institutions (Hussain and et al, 2015) however, compare to conventional banks, financial market instruments and liquidity thereof are limited for Islamic banks in Turkey. With limited activity and issue in sukuk market and yet no interbank markets; the interbank commodity Murabahah transactions are mainly executed with foreign banks (IMF, 2017).

The profitability of Islamic banks decreased more than conventional banks during the crisis, mainly because of weaker risk management practices and financial crisis spillovers to the real economy based on recent studies (Rashman, 2012; Hasan and Dridi, 2011). Islamic banks in advanced countries shows



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efficient progress than those in other countries mostly because of their advanced regulatory framework and risk management practices (Tahir and Haron, 2010).

An acute liquidity crisis faced by a corporate institution might lead severe results e.g. Enron, largest bankruptcy in US corporate history which illustrates how quick a crisis of confidence can lead a halt in business and vital cash flows (Banks, 2014). Likewise, Demirbank, a mid-size bank, primary –dealer in government bonds heavily dependent on overnight funds which could no longer refinance itself on the market in October 2000, forced to sell its portfolio because the Central Bank stopped providing liquidity to troubled banks. Demirbank’s liquidity shortage had a negative spill-over effect for the whole market which led to an upswing in interest rates and additional sale waves (Cihangir, 2005). The crisis ended with a financial aid package from IMF and in addition to Demirbank, banks which had liquidity crisis during that period were taken over by the Saving Deposit Insurance Fund (SDIC) (Brinke, 2013). Later on, Demirbank was sold to HSBC by by the SDIC.

Northern Rock, a UK financial institution and Lehman Brothers, a US investment bank are other eminent examples for liquidity mismanagement related bankruptcies for financial sector experienced in 2008 (Banks, 2014). Using excessive amount of short term external source that could easily be withdrawn and high concentration in risk and illiquid securities and structured products are main source of the liquidity collapse. In this regard, since the subprime financial crisis in 2008, special attention has given to liquidity management.

Idiosyncratic features of Islamic banks require a special attention in liquidity risk management. Liquidity risk affects bank profitability significantly and risk can be eliminated via active asset and liability management ratio (Saunders and Cornett, 2008).

Liquidity risk affects bank profitability significantly and; increasing cash reserves, expanding deposit base and decreasing the gap between funds collected and placed to total asset ratio are examples of the methods applied in decreasing liquidity risk (Arif and Anees 2012).

In order to estimate liquidity risk, bank managers need to forecast liquidity risk they would expose and instruments to manage their risk exposure. For this purpose, after providing a brief overview about the sector, we explore factors effecting major Islamic banks liquidity risk in Turkey, based on the 2005-2017 financial figures with seemingly unrelated regression (SUR) methodology. After literature review, we explained the methodology and model we use, the data set and result of the study.

## **2. Islamic Banking and Risk Management**

Both conventional and Islamic (participation) banking services are in practice in Turkey. Although these two types of banking have different systems and operational principles, they are subject to the same legal regulations in Turkey. Apart from significant exceptions, the empirical literature suggests no major differences between Islamic and conventional banks in terms of efficiency, competition and risk features (Abedifar and et al, 2015).



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The Islamic banking is based on participation of profit and loss and therefore these banks are also named as participation banks, in Turkey. Within the interest-free principle, goods and services are financed and payment is made directly to provider of the goods and services. Services provided by Islamic banks are very similar with conventional banks however the structure they collect funds and methods and models utilized in order to allocate them to investments differs (Yanpar, 2014; TKBB, 2017).

Islamic banking was emerged in mid-1980s in Turkey. Since then, it has been developing and with the establishment of two state-owned participation banks in 2015, share of the Islamic banking is expected to increase in the near future in Turkish financial sector. There are five banks operating in the Islamic banking sector in Turkey as of 2017 year-end. Two of them, Vakıf Katılım and Ziraat Katılım were established in 2015 by the participation of public sector. Based on Turkish Participation Banks Association figures, as of 2017 year-end, total asset of participation banks is TRY 160.136 Million while conventional banking has TRY 3.257.819 Million total assets; total funds allocated by participation banks is 106.733 Million TRY while it is TRY 2.145.479 Million for conventional banks and; equity is TRY 13.645 Million and TRY 359.091 Million, respectively. In the Table I, summary financial information is given for 3 participation and 3 depositary banks in the study.

Table I: Overview of the Banks in the Analysis

Overview parameters	Kuveyt T.	T. Finans	Albaraka T.	TEB	ING	Şekerbank
Date of establishment	1989	2005	1984	1927	1984	1953
Total asset (TRY, Million)	57.123	39.081	36.229	81.029	50.105	28.147
Total Credit and receivables (TRY, Mio.)	37.971	26.483	25.193	60.875	36.851	19.425
Total Funds Collected (TRY, Mio.)	39.857	22.030	25.310	52.004	25.799	18.248
Total Equity (TRY, Mio.)	4.591	4.061	2.482	8.665	5.495	2.616
Paid-in Capital (TRY, Mio.)	3.097	2.600	900	2.204	3.486	1.158
Net Profit /Loss (TRY, Mio.)	674	375	237	819	712	76
Branches	399	286	220	515	266	273
Personnel	5.749	3.767	3.899	9.469	5.039	3.602

(\*) As of September 30, 2017 Source: Turkish Participation Banks Association and Turkish Banks Association

## 2.1. Risk Management

Risk concept is significantly important for financial markets since risks embody both opportunities and dangers. Most common type of risk encountered in conventional banking systems is credit risk. Market risk includes interest rate, foreign exchange and stock market position risks. Another one which is liquidity risk arises from the maturity mismatch between the resources collected and the credits used and, causes the bank's cash balance to deteriorate like credit risk (Büyükakın and et al, 2018).



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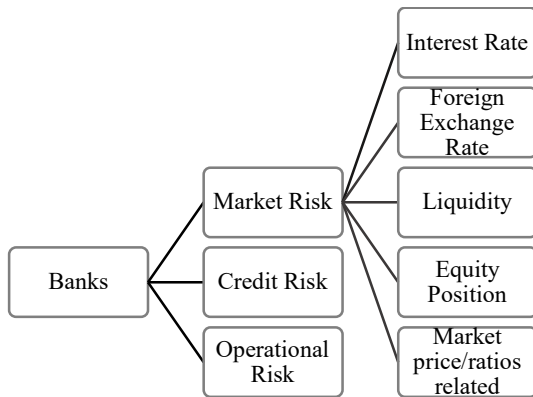


Figure 1: Main Risks Exposed by Banks, Source: Akçay and Bolgün (2009)

For effective risk management for banks, risk governance structure concentrate on key risk responsibilities and banks' risk management framework is composed of high-level principles which are implemented through policies, limits, operational guidelines, methodologies and tools for risk measuring, monitoring and reporting (NIB, 2017:6).

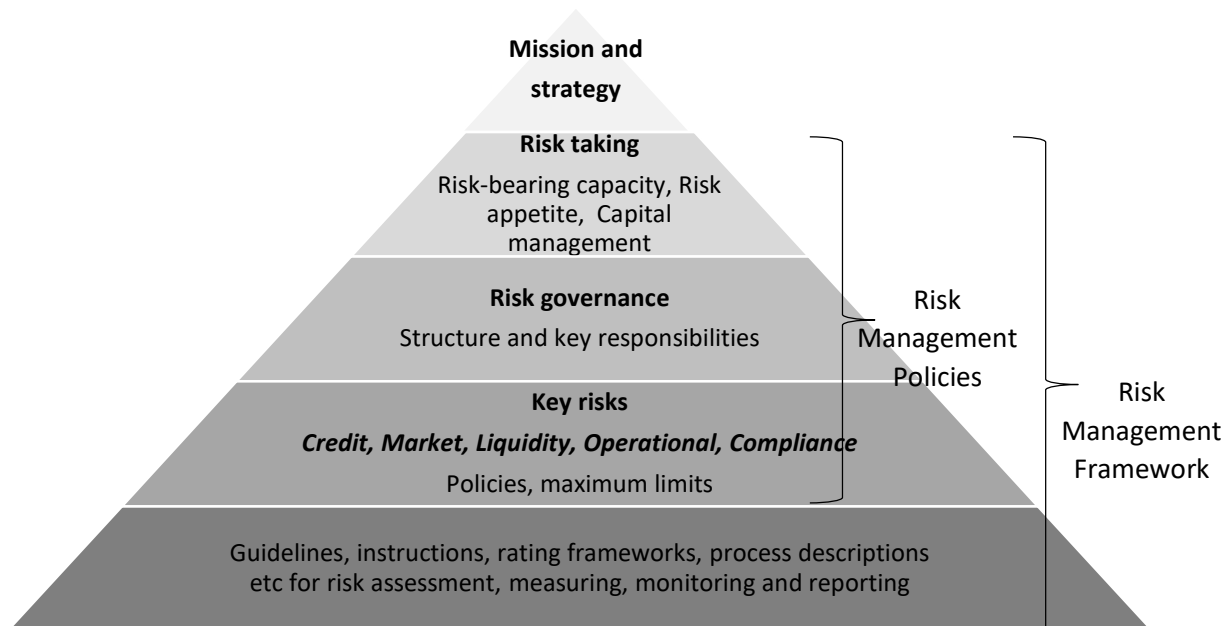


Figure 2: Risk Management Framework

Sources: NIB, 2017:6



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In the execution-oriented risk management process, the existence of the units that are responsible for risk, that is, the units that need to work in harmony with the risk managing units, are noteworthy. Thus, risk management reduces the likelihood of missed key opportunities to use the data obtained at the end of the process in the decision making and risk-taking stages of banks (Büyükkakin and et al 2018).

## **2.2. Liquidity Risk Management**

Most banks do not prefer to have liquid assets in their portfolios as they have alternative cost and prevent interest income opportunities. However, if banks are faced with sudden and intense deposit demand by their customers and if they do not have sufficient liquidity to overcome it, it is inevitable that the banks will suffer great losses and even go bankrupt. For this reason, the management of liquidity risk for banks is of great importance since it will be based on the preferences between risk and return (Ertürk, 2010).

Liquidity risk for banking sector may be defined as a risk of not providing liquidity needs, fails to fulfill its commitments or fails to enter new transactions. Asset-liability management is at the core of the liquidity management and aim is to have positive net liquid asset. Among Islamic banks, 76% uses their own methodology for measuring liquidity risk and include measurement results in their decision-making processes (TBB, 2004).

Two types of ratios are used by the Banking Regulatory and Supervisory Authority of Turkey in determining whether banks are liquid in terms of total and foreign currency exposures: the liquidity adequacy ratio and the liquidity coverage ratio. In accordance with the Regulation on the Measurement and Evaluation of Liquidity Adequacy of Banks (the Liquidity Adequacy Regulation for Banks), banks are required to hold foreign currency and total liquidity adequacy ratios in two different maturity brackets: weekly and monthly. The liquidity adequacy ratios are calculated by the ratio of total assets to total liabilities, and the FX liquidity adequacy ratio should be at least 80% and the total liquidity adequacy ratio should be 100% based on the Liquidity Adequacy Regulation for Banks.

Liquidity coverage ratio (LCR), which is regulated in Basel III by the Basel Committee, aims to keep the high quality liquid assets at a certain level by banks in order to ensure short-term liquidity shortage of banks in case of short-term and severe cash outflows. The proportions required to be met by total and foreign currency are determined within the framework of the Liquidity Coverage Regulation for Banks (for 2018; as 90% LCH and 70% FX and for 2019; LCH will be 100% and FX will be 80%).

Compared to their conventional counterparts, the Islamic banks are expected to expose less to asset-liability mismatches due to nature and comparative advantage of the “pass-through” and the “risksharing” structure (Greuning and Iqbal, 2008). However, there are many reasons for exposing liquidity risk by participation banks, just to name a few; the absence of appropriate instruments for sharia principles, the limited scope of the secondary markets and the lack of the lender of last resort (Oubdi and Elouali, 2016; Farooq and Zaheer, 2015). Due to the scarcity of sharia-compliant marketable securities problem, the commercial portfolio of Islamic banks is either small or absent. With the development of Islamic debt (sukuk) instruments, the trend is changing and expanding the Islamic banking commercial portfolio. However, due to the shallow formation of the secondary market for sukuks, the market behavior is to hold



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these instruments until their expiry (Greuning and Iqbal, 2008). Major source of liquidity risks are as follows (Al-Bashir and Al-Amine, 2013):

- Limited shariah compliant money market and short-term interbank instruments
- Shallow secondary market
- Limited number of participants/investors in the secondary market
- Absence of lender of last resort
- Most of derivative instruments used by conventional banks for risk management purpose are not compliant with the Islamic banks
- Weak systemic liquidity infrastructure

In the absence of short term interbank and local markets, participation banks meet their cash needs by selling precious metals bought forward in advance. These transactions are usually executed at the London Metal Exchange which are also increasing the transaction costs. This type of transaction is named as Tawarruq and is often not accepted by Shari'ah scholars if the borrower sells back the commodity to the original seller (Hussain and et al, 2017).

As depicted in the Table II, share of liquid asset in total assets of the all participation banks increased in 2011-2016 period, in general, however it declined to its 2010 levels in 2017. Cash funds to total funds ratio also followed similar pattern. Although share of total funds in total assets followed a decreasing trend, it increased in 2017.

Table II: Participation Banks Liquidity Ratios

Ratios	2010	2011	2012	2013	2014	2015	2016	2017
Liquid assets/Total assets-%	12.6	12.6	15.4	15.0	15.8	16.0	16.0	11.8
Cash funds/ Total funds-%	16.2	17.7	21.9	22.8	24.7	25.1	24.4	17.6
Total funds / Total assets-%	78.1	71.1	69.9	65.8	64.1	63.9	65.8	67.0

Source: Participation Banks Association of Turkey web site accessed April 20, 2017

Although both types of banks operate on the same financial environment causes them to be exposed to almost the same risks, since interest and uncertain and speculative activities are strictly prohibited for participation banks, statutory regulations and restrictions limit effective risk management for participation banks (Büyükakın and et.al. 2018). Asset-based operation structure makes participation banks to develop various methods in order to meet all kinds of risk mitigation needs, the diversification of risk and various opportunities to be protected from risk.

### 3. Literature Review

Regarding measuring the liquidity risk, there are several variables used in the literature. The gap between funds collected and placed to total asset ratio (Saunders and Cornett, 2008; Shen and et al, 2009; Çelik and Akarım, 2012; Alzoubi, 2017; Işıl and Özkan, 2015), the share of liquid asset to total asset (Anam and et al, 2012; Iqbal, 2012; Almumani, 2013) and financial performance such as asset profitability (Ahmed and et al, 2011; Anam and et al, 2012; Iqbal, 2012; Almumani, 2013; Mohamad and et al, 2013) are some of the variables used in risk measurement. Paldi (2014) analyzed effect of capital adequacy on Islamic



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banks' risk and found that Islamic banking is less liquid and more expensive requiring higher levels of capital as Islamic modes of finance are riskier and are based on undertaking real transactions.

There are also studies that show positive correlation in between size of the banks and liquidity risk (Ahmad and et al, 2011; Anam and et al, 2012; Iqbal, 2012 and Almumani, 2013) since increase in asset leads to increase in liquidity risk. On the contrary, Alzoubi (2017) showed negative relation in bank size with liquidity risk, as large-sized banks tend to have more stability and customers feel safer dealing with large-sized banks. In this regard, in order to reduce liquidity risk, increasing the size of a bank or its equity will help.

There are various studies that investigated Islamic bank liquidity risk and macroeconomic variables such as economic growth and inflation. According to these studies, macroeconomic conditions and the economic cycle are also effecting liquidity risk of the Islamic banks (Mohamad and et al, 2013). Chen and et al (2009) finds that liquidity risk is effected with the performance of banks e.g. liquid assets and external funding as well as macroeconomic, regulatory and supervisory factors.

Regarding liquidity risk and profitability relation; increase in the current ratio and the investment ratio of the available funds have positive effects on the profitability (Malik and Aqeel, 2017) (Mongid, 2016).

Islamic banking needs to develop its liquidity risk management environment as a practice of modern banking standards to ensure and maintain safe business operations via developing an organizational approach and liquid instruments in line with Islamic principles (Rifki, 2008). In her doctoral thesis, which was completed in 2016, Azimova examined the liquidity risk management in the banking sector of Azerbaijan. In this study, panel data analysis was performed by using the method of Deep and Schaefer for 43 banks operating in Azerbaijan and found significant relation between bank size and the liquidity transfer coefficient, the ratio of insured deposits to total deposits, deposit interest rate, return on assets, ratio of non-performing loans to total loans, total liabilities of deposits results and oil prices.

Zengin and Yüksel (2016) tested the data for 2005-2014 period for 10 banks with the highest asset size in the Turkish banking sector with the Logit Model and among 12 variables, the banks' capital adequacy ratio and net interest margin were significantly effecting banks' liquidity risk.

Firuzan and Firuzan (2017) measured the factors affecting both the liquidity and credit risk for the 16 banks operating in the Turkish banking sector between 2009 and 2016 using the Dynamic Panel Data Model- Arellano-Bond GMM estimator method. As a result of the study, it was found that rapid changes in macroeconomic variables affect the liquidity risk.

Akkaya and Azimli (2018a) used the Deep and Schaefer methodologies to perform Panel Data analysis and aimed to determine the factors affecting the liquidity risk for the Turkish banking sector. According to their findings, asset profitability ratio, deposit/total liability ratio, interest income/interest expenses ratio, bond issue, inflation, unemployment, US Dollar rate and GDP variables were found to affect the liquidity management of the Turkish banking sector. In the same year (2018b), the authors published another study titled "Liquidity Risk Management in the Banking Sector of Azerbaijan" which aimed to measure the liquidity risk of Azerbaijan banks by using "Berger and Bouwman" and "Deep and Schaefer" methods. Result showed that both Azerbaijani banks and the Turkish banks had similar results.





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## 4. Case Study: Turkey

### 4.1. Data and Descriptive Analysis

Data set for participation banks is gathered from the Turkish Participation Banks Association website and macroeconomic variables are gathered from the Central Bank of Turkey website. Among five participation banks, three of them are within our analysis since the two of them were established recently (2015) and do not have all figures for the relevant period. Financial ratios are quarterly ratios beginning from 2005 last quarter to 2017 third quarter since the last quarter for conventional deposit banks have not published yet. There are 48 observations for each bank.

Data set for conventional banks is gathered from the Banks Association of Turkey website. Among 34 deposit banks, 3 of them which have similar total-asset base (ING Bank, Şekerbank, T. Ekonomi Bankası) were selected as a reference for deposit banking sector. Financial ratios are quarterly ratios beginning from 2005 last quarter to 2017 third quarter. There are 48 observations for each bank.

Macroeconomic indicators are taken from Turkish Statistics Institute (TÜİK) web site and are also for quarterly periods.

In our model, the liquidity risk is represented by the difference of funds collected and placed to total asset: “Credits and Receivables – Total Funds Collected)/Total Asset”. Table III depicts the list of bank specific and macroeconomic independent variables used in the model.

Table III: Model Variables

<b>Independent variable:</b>	
LR <sub>t</sub>	(Credits + Receivables – Total Funds Collected)/Total Asset at t
<b>Bank specific dependent variables:</b>	
LR <sub>t-1</sub>	(Credits + Receivables – Total Funds Collected)/Total Asset at t-1
TCRTA <sub>t</sub>	(Total credits and receivables)/Total assets at t
NPTA <sub>t</sub>	Net profit/Total assets at t
LFTA <sub>t</sub>	Liquid funds/Total assets at t
<b>Macroeconomic dependent variables:</b>	
GDP <sub>t</sub>	GDP growth rate at t
CPI <sub>t</sub>	Consumer price index change at t

Based on the above variables, in order to evaluate liquidity risk of participation banks, the following equation is formed for each bank:

$$LR_{it} = \beta_0 + \beta_1 LR_{it-1} + \beta_2 TCRTA_{it} + \beta_3 NPTA_{it} + \beta_4 LFTA_{it} + \beta_5 GDP_{it} + \beta_6 CPI_{it} + U_{it} \quad (\text{Equation I})$$

We use STATA for our econometric analysis.

### 4.2. Econometric Methodology

In order to evaluate factors effecting participation banks liquidity risk and compare it with the conventional deposit banks' same liquidity risk factors, we used seemingly unrelated regression (SUR) model proposed by Zellner in 1962.



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This is a single model that contains a number of linear equations. In such a model it is often unrealistic to expect that the equation errors would be uncorrelated. In this regard, the set of equations in the model has contemporaneous cross-equation error correlation which is called SUR system.

The SUR methodology helps us to eliminate probable correlation among the panel data set in our analysis and allows us to estimate the whole system via using factors affecting all banks, not to estimate separately. SUR is a way of estimating panel data models that have large T but small N ( $T > N$ ; e.g. N as number of participation banks and T as factors effecting liquidity risks).

A classical linear SUR model is a set of linear regression equations (Zellner, 1962):

$$y_i = \beta_i X_i + u_i \quad (\text{Equation II})$$

where

- $y_i$  and  $u_i$  are  $T \times 1$  vectors
- $i = 1, \dots, m$
- $X_i$  is  $T \times k_i$  matrix
- $1 \leq \text{rank}(X_i) = k_i < T$
- $E[u_i u_j'] = \sigma_{ij} I_T$

These m relations can be written:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \dots & 0 \\ 0 & X_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & X_m \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_m \end{bmatrix}$$

$$\text{or } y = X\beta + u \quad (\text{Equation III})$$

where  $y$ ,  $X$ ,  $\beta$  and  $u$  are vectors (or matrices) of dimensions  $(Tm) \times 1$ ,  $(Tm) \times k$ ,  $k \times 1$  and  $(Tm) \times 1$  respectively.

Within the framework of the SUR methodology, we run the multiple linear regressions for 6 equations for relevant banks.

### 4.3. Empirical findings

When we evaluate the results of our econometric analysis; summary results for the model for 2005-2017 period are as follows in the Table IV. There are 48 observations and R2s are high and P-values are low, which means the model is significant for all banks. The Wald test (Chi2) shows that the parameters for certain explanatory variables are zero which can be removed from the model. If the test shows the parameters are not zero, you should include the variables in the model. None of Chi2 is zero in our model which means the variables in the model are significant for all banks.

Table IV: SUR Model Summary Results

Bank Titles	No. of observations	Parameters	RMSE	R <sup>2</sup>	Chi2	P-Value
Albaraka Türk	48	6	3.429537	0.8413	260.27	0.0000
Kuveyt Türk	48	6	2.854036	0.7454	212.89	0.0000
Türkiye Finans	48	6	4.427095	0.7711	196.03	0.0000



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<b>Şekerbank</b>	48	6	2.650106	0.9592	1148.78	0.0000
<b>TEB</b>	48	6	3.403922	0.8075	216.67	0.0000
<b>ING Bank</b>	48	6	4.151660	0.8651	373.19	0.0000

Based on the Model results given in the Appendix, statistically significant variables with their significance level are given in Table V for each bank. For 6 banks, “TCRTA-(Total credits and receivables)/Total assets” variables and “LR<sub>t-1</sub>-Last term’s liquidity risk” explains current term’s liquidity risk significantly. Their coefficients are positive for all participation banks and one unit increase in credits and receivables increase the liquidity risk with the same unit. “NPTA- Net Profit/Total Asset” and “LFTA- Liquid funds to total assets” ratios are also significant for all participation banks. NPTA ratios’ coefficients are all negative and change in one unit in the ratio decrease the liquidity risk more than the change. LFTA coefficients are positive and change in the one unit change will increase the liquidity level. Regarding the macroeconomic variables, although prior empirical literature (Sulaiman et al, 2013; Nikomaram et al 2013) found positive impact of GDP growth rate on the banking sectors’ liquidity ratios, neither GDP nor CPI is significant for any bank in our analysis.

Table V: SUR Model P-Value Summary Results

Variables	Albaraka Türk	Kuveyt Türk	Türkiye Finans	Şekerbank	TEB	ING Bank	No. of Banks
LR <sub>t-1</sub>	***	*	*	*	***	*	6
TCRTA <sub>t</sub>	*	*	*	*	*	*	6
NPTA <sub>t</sub>	**	*	*	*			4
LFTA <sub>t</sub>	*	*	*		*	*	5
GDP <sub>t</sub>							0
CPI <sub>t</sub>							0

(\*) Significance level: “\*” stands for 1%, “\*\*” stands for 5%, “\*\*\*” stands for 10%

Table VI: Model Data Set Summary Statistics

Bank Titles	(%)	Average	Std. Dev.	Min	Max	Median	Skewness
Albaraka Türk	LR	-6.04	8.70	-18.71	40.65	-5.63	3.16
	NPTA	1.05	0.65	0.01	2.85	0.88	0.77
	TCRTA	71.49	8.44	62.80	121.90	70.22	4.65
	LFTA	21.23	4.17	11.46	28.60	20.83	-0.23
Kuveyt Türk	LR	-2.85	5.72	-16.83	11.92	-4.11	0.76
	NPTA	1.02	0.54	0.25	2.52	1.01	0.61
	TCRTA	68.27	7.02	58.61	83.49	67.46	0.59
	LFTA	24.20	7.86	10.70	34.57	24.79	-0.41
Türkiye Finans	LR	3.27	9.35	-28.91	13.28	4.87	-1.62
	NPTA	0.94	0.53	0.17	2.02	0.78	0.46
	TCRTA	72.53	6.76	47.98	82.18	72.43	-0.88
	LFTA	19.79	4.65	10.97	27.94	20.32	-0.29



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Şekerbank	LR	-5.90	13.26	-42.49	8.90	-3.10	-1.27
	NPTA	1.09	0.47	0.26	2.02	1.10	0.02
	TCRTA	61.57	9.50	34.45	73.90	60.97	-1.16
	LFTA	25.60	9.33	13.40	49.63	24.36	0.94
TEB	LR	2.99	7.84	-11.79	19.10	5.85	-0.30
	NPTA	1.11	0.28	0.48	1.80	1.11	-0.20
	TCRTA	66.12	6.24	53.52	75.10	67.65	-0.49
	LFTA	29.01	5.65	21.00	46.57	27.80	0.99
ING Bank	LR	13.06	11.42	-9.26	28.60	16.25	-0.56
	NPTA	0.79	0.57	0.20	3.68	0.70	2.94
	TCRTA	70.50	4.19	60.80	77.70	71.40	-0.72
	LFTA	24.91	3.60	18.60	34.62	24.30	0.91
Macroeconomic Var.	GDP	0.95	0.83	-1.11	2.31	0.96	-0.31
	CPI	1.32	2.15	-5.10	5.10	1.70	-1.08

According to the model findings; one unit change in previous term liquidity ratio, asset profitability, credit base and liquid assets change the liquidity risk 0.1%, 1,01%, -2.06% and 1.1% respectively for Albaraka Türk. For Kuveyt Türk, one unit change in previous term liquidity ratio, asset profitability, credit base and liquid assets change the liquidity risk 0.26%, 1,07%, -3.91% and 0.51% respectively. For Türkiye Finans, one unit change in previous term liquidity ratio, asset profitability, credit base and liquid assets change the liquidity risk 0.56%, 0,87%, -6.02% and 0.69% respectively.

Based on the summary statistics of the banks in our model given in the Table VI, except Türkiye Finans, all participation banks have a negative average LR-Liquidity risk which means Islamic banks have allocated less credit than the funds they collect. When we compare average ratios of “TCRTA-Total credits and receivables to total assets”; it is higher in participation banks (68-73%) than deposit banks (62-71%). “LFTA-Liquid funds to total assets ratio” is lower in participation banks (20-24%) than deposit banks (25-29%).

When we evaluate the model residuals correlation coefficients in the Table VII, the highest correlation is in between Türkiye Finans and Kuveyt Türk with a 53.84% positive correlation. Among other deposit and participation banks, correlation level is low in between -23.04% and 16.20%.

Table VII: SUR Model Correlation Matrix of Residuals

Bank Titles	Albaraka Türk	Kuveyt Türk	Türkiye Finans	Şekerbank	TEB	ING Bank
Albaraka Türk	1.0000					
Kuveyt Türk	0.1620	1.0000				
Türkiye Finans	0.0243	0.5384	1.0000			
Şekerbank	0.1079	-0.1799	-0.0094	1.0000		
TEB	0.0198	-0.1705	-0.2043	0.0575	1.0000	
ING Bank	-0.1992	-0.2304	-0.1705	0.0711	0.0366	1.0000



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Regarding the Breusch-Pagan test for correlation among units in our model, null hypothesis of the test is the residuals across entities are not correlated. Breusch-Pagan test of independence is  $\chi^2(15)=27.050$  and Prob= 0.0283 which means that we reject the null hypothesis and there is correlation between units within 5% significance level.

This result shows that via SUR methodology, it is possible to estimate factors effecting banks liquidity structure.

## 5. Conclusion

There are five participation banks operating in Turkey as of 2017 year-end and they represents approximately 5% of the Turkish banking sector which is very low compared to potential of Turkey and the Region where Turkey is residing.

Risk concept is significantly important for financial markets and cannot be fully eliminated but can be effectively managed. With the implementation of the Transition to Strong Economy program, Turkish banking sector has made great progress in terms of risk management. In this respect, firstly risks are defined and measured. Among various risks, after global financial crisis, the liquidity risk is one of the issues that has taken the priority in the agenda of regulatory bodies and main principles of liquidity risk management on Banking Supervision were defined by the Basel Committee in 2008.

Based on quarterly financial ratios of 3 participation banks and 3 conventional banks in the sector and macro-economic indicators for Turkey for 2005/12-2017/09; participation banks in our study, except Türkiye Finans, have a negative average LR-Liquidity risk which means Islamic banks have allocated less credit than the funds they collect. When we compare average ratios of “TCRTA-Total credits and receivables to total assets”; it is higher in 3 participation banks (68-73%) than the 3 deposit banks (62-71%). “LFTA-Liquid funds to total assets ratio” is lower in participation banks (20-24%) than deposit banks (25-29%).

In order to determine factors effecting liquidity risk we establish a model based on the Seemingly Unrelated Regression-SUR Methodology. Based on the model results, all bank-specific ratios we consider in our model are statistically significant in explaining liquidity risk. Statistically significant variables not only participation banks but also conventional banks are LRt-1-last term’s liquidity risk, TCRTA-(Total credits and receivables)/Total assets and NPTA- asset profitability. GDP and CPI macroeconomic variables are not significant for any bank, contrary to Mohamad and et al (2013) and Chen and et al (2009) studies. When we evaluate the model residuals for correlation among units in our model via the Breusch-Pagan test, the result showed that there is correlation between units within 5% significance level.

Based on our findings, via SUR Methodology, it is possible to estimate factors effecting participation banks liquidity structure and will be a significant input for asset-liability management. This is noteworthy as having robust Islamic banking sector in Turkey and managing risk they face accurately will contribute to improving financial inclusion and foster access through Islamic Finance. Development of Islamic banking will also contribute to make Istanbul regional as well as global financial center and serve to export their services to the international markets.



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## Appendix: SUR Results\*

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
<b>a_lr</b>						
a_lr_prv	.0982965	.0584878	1.68	0.093	-.0163375	.2129306
a_tcrtta	1.012644	.0702021	14.42	0.000	.8750506	1.150238
a_npta	-2.062479	.9307375	-2.22	0.027	-3.886691	-.2382673
a_lfta	1.096833	.1392538	7.88	0.000	.8239	1.369765
gdp	.1806889	.2609519	0.69	0.489	-.3307675	.6921453
cpi	-.9771415	.6424554	-1.52	0.128	-2.236331	.2820479
_cons	-98.24315	6.590284	-14.91	0.000	-111.1599	-85.32643
<b>k_lr</b>						
k_lr_prv	.2609123	.0778365	3.35	0.001	.1083555	.413469
k_tcrtta	1.074139	.1361575	7.89	0.000	.8072749	1.341003
k_npta	-3.905999	.8020568	-4.87	0.000	-5.478002	-2.333997
k_lfta	.5130974	.1099395	4.67	0.000	.2976199	.7285749
gdp	-.3126485	.2275842	-1.37	0.170	-.7587053	.1334084
cpi	.0532965	.5342587	0.10	0.921	-.9938313	1.100424
_cons	-83.82159	11.73012	-7.15	0.000	-106.8122	-60.83098
<b>t_lr</b>						
t_lr_prv	.5610503	.0812485	6.91	0.000	.4018062	.7202944
t_tcrtta	.8706353	.1028874	8.46	0.000	.6689797	1.072291
t_npta	-6.01754	1.250131	-4.81	0.000	-8.467751	-3.567329
t_lfta	.6943703	.1985468	3.50	0.000	.3052258	1.083515
gdp	.0211426	.3266859	0.06	0.948	-.6191501	.6614352
cpi	.2681342	.8398061	0.32	0.750	-1.377856	1.914124
_cons	-69.74332	10.00529	-6.97	0.000	-89.35333	-50.13332
<b>s_lr</b>						
s_lr_prv	.3150348	.0430788	7.31	0.000	.2306018	.3994677
s_tcrtta	1.086728	.1015462	10.70	0.000	.8877008	1.285755
s_npta	-3.564143	.8530005	-4.18	0.000	-5.235993	-1.892293
s_lfta	.0574228	.0917079	0.63	0.531	-.1223214	.237167
gdp	.1756207	.1908001	0.92	0.357	-.1983406	.5495821
cpi	.4587564	.5144972	0.89	0.373	-.5496396	1.467152
_cons	-68.31155	8.662203	-7.89	0.000	-85.28916	-51.33395
<b>teb_lr</b>						
teb_lr_prv	-.2479686	.1421206	-1.74	0.081	-.5265199	.0305827
teb_tcrtta	.6764704	.1060724	6.38	0.000	.4685723	.8843685
teb_npta	1.064834	1.851239	0.58	0.565	-2.563528	4.693197
teb_lfta	-.5802713	.123466	-4.70	0.000	-.8222602	-.3382825
gdp	.3616458	.2629421	1.38	0.169	-.1537113	.8770029
cpi	.1393342	.6832366	0.20	0.838	-1.199785	1.478453
_cons	-28.49444	9.829246	-2.90	0.004	-47.7594	-9.229468
<b>ing_lr</b>						
ing_lr_prv	-.3859115	.0659145	-5.85	0.000	-.5151016	-.2567214
ing_tcrtta	1.389588	.3245813	4.28	0.000	.7534202	2.025755
ing_npta	-.7198098	1.077784	-0.67	0.504	-2.832227	1.392608
ing_lfta	-.6800101	.3774792	-1.80	0.072	-1.419856	.0598355
gdp	-.0462372	.3038183	-0.15	0.879	-.6417101	.5492357
cpi	-.5399953	.7794135	-0.69	0.488	-2.067618	.987627
_cons	-71.85952	31.65529	-2.27	0.023	-133.9028	-9.816286



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(\*) **a**: Albaraka Türk, **k**: Kuveyt Türk, **t**: Türkiye Finans, **s**: Şekerbank, **teb**: T. Ekonomi Bankası, **ing**: ING Bank