Chapter

More Credits, Less Cash: A Panel Cointegration Approach

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Abstract

In this study, the long-run relation among credit expansion and liquidity risk was analyzed by using data of 20 banks in Turkish banking sector for the period 2014.Q1–2017.Q4. In the analysis, dynamic panel cointegration methodology which depends on cross-sectional dependence and homogeneity was adopted in order to determine whether there is a long-run relation between variables. As a result of the cointegration analysis, a long-run relation was found between liquidity risk and credit expansion. Also, the result indicates that credit expansion positively affects liquidity risk. This result suggests that the banks may constrain their credit growth in the long term in order to decrease liquidity risk.

Keywords: panel data models, financial econometrics, banks, financial risk, risk management, cointegration analysis

1. Introduction

Liquidity risk, which is an important measure of the bank's success in the long run, is the ability to pay liabilities and swap debts when needed. Banks should keep optimal liquid assets to meet their loan activities, investments, and depositors' demands on time and adequately. In this respect, banks try to balance this situation. As a result, the bank is exposed to liquidity risk. Thanks to the liquidity risk management, it is ensured that banks continue their effectiveness against new risks that may arise due to changes in the operating environment or increases in the current risk level [1]. On the other hand, credit is the debt given to real persons and corporations within the framework of contracts. It is one of the important financial instruments that cause economic growth by gaining investors' savings to the economy and increasing private consumption expenditures [2].

Total amount of credits given by the Turkish banking sector have been increasing rapidly in the last decade. This situation was shown in **Figure 1**. However, there is a risk that the bank loan client is not able to meet the obligations of the agreement. In this case, it is expected that there will be a decrease in the income and capital of banks and an increase in expenses and losses [3].

Banks should have liquid funds in their hands in order to meet their credit activities on time and adequately. If they do not hold this fund, the liquidity risk will increase. Increasing liquidity risk will increase financial vulnerability and economic instability. Therefore, in this study, the long-term relationship between credit expansion and liquidity risk is investigated with a panel cointegration

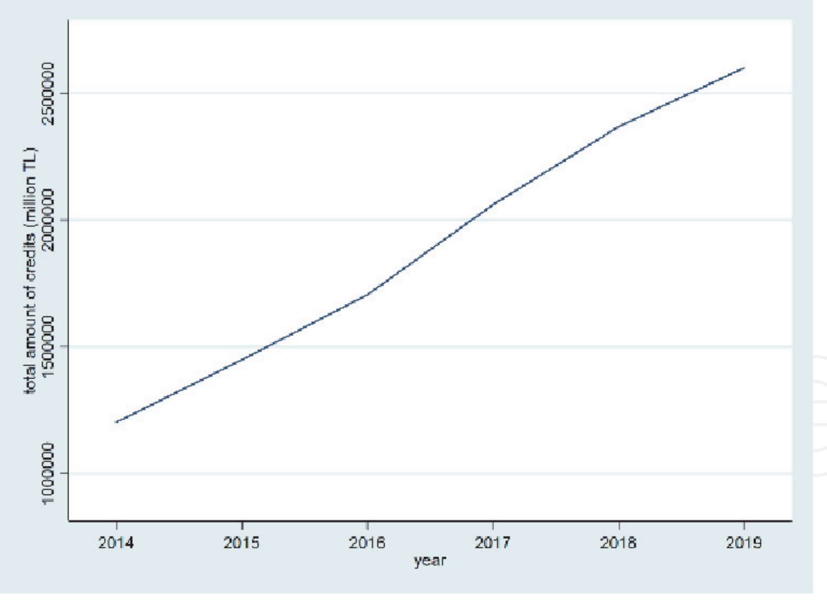

Figure 1.
Total amount of credits in the Turkish banking sector (million TL).

analysis. The rest of this study is organized as follows. In the second section, literature on credit expansion is given. The third section introduces the data set and variables used in this study. The fourth section examines the results of the econometric method used, and the last section concludes.

2. Literature on credit expansion

Credits can have positive and negative effects on the economy. For this purpose, studies conducted on credit expansion in Turkey were examined. Orhangazi explored the relation between capital inflows and credit expansion by using logit model. According to the findings, net private capital flows effect positively credit expansion by controlling other determinants [4]. Kara et al. made a cross-country comparison of credit growth by calculating a ratio of net credit use with respect to national income. They suggested a stable ratio of net credit relative to GDP that decreases slowly credit growth in the long-term period [5]. Kılıç examined relation between consumer credits and current account deficit. Time series methodology was adopted in order to find long-run dynamics. The study's results indicate one way Granger causality between consumer credits and current account deficit [6]. Karahan and Uslu analyzed relationship between credits extended by deposit banks to the private sector and current accounts deficit by using ARDL approach within time series framework. They found long-term relationship between variables [7]. Güneş and Yıldırım analyzed long-run relationship between credit expansion and current account deficit by using Johansen cointegration test. The results indicate existence of cointegration relation between vehicle and corporate loans and current account deficit [8]. Kılıç and Torun studied causality relation between consumer credits and inflation by using Granger causality test. The findings of the study gave evidence on two-way Granger causality relation between individual credit cards and inflation [9]. Köroğlu analyzed relation between credit expansion and current account deficit by using Granger causality test. He found one-way causality relation that credit expansion causes current account deficit [10]. Varlık investigated the effect of net and gross capital inflows and their components on credit boom by using logit model. The findings addressed that net and gross foreign direct investment inflows are negatively correlated with credit boom [11].

There is an extensive literature in Turkey examining the impact of credit expansion on macroeconomic factors. However, there is no study investigating the effect of credit expansion on liquidity risk by directly considering banks. The aim of this study is to fill this gap in the literature by using the panel data approach.

3. Data

This study examines long-run relation among liquidity risk and credit expansion. For this purpose, quarterly panel data was used in order to conduct analysis. Selected variables of 20 Turkish banks from 2014.Q1 to 2017.Q4 were obtained from the database of The Banks Association of Turkey in order to calculate liquidity risk and credit expansion from banks' balance sheet. The banks used in the study can be analyzed in three different groups. These are state-owned deposit banks, private-owned deposit banks, and foreign banks. Halkbank, Ziraat Bank, and Vakıf Bank were taken as state-owned deposit banks. Akbank, Fibabank, Şekerbank, Turkish Bank, Turkish Economy Bank, İş Bank, and Yapı Kredi Bank were used as private-owned deposit banks. Alternatif Bank, Arab Turkish Bank, Burgan Bank, Denizbank, ICBC Turkey Bank, ING Bank, QNB Finansbank, and Garanti BBVA Bank were taken as foreign banks. These banks constitute the units of the panel data set.

In this study, the ratio of the difference of loans and receivables from deposits to total assets was used as a measure of liquidity risk (LR) [12].

$$LR = \frac{Loans\ and\ Receivables - Deposits}{Total\ Assets} \tag{1}$$

The increase in credits, which causes an increase in production, income, exports, and profits of the financial sector, is expressed as credit expansion. Credit expansion (CE) which is the other variable of interest was created using equation below [13].

$$CE = \frac{Loans\ and\ Receivables}{Total\ Assets} \tag{2}$$

4. Methodology

The main purpose of this study is to explore long-run relationship among liquidity risk and credit expansion in the Turkish banking sector. This study adopts dynamic panel econometric methodology. It consists of four steps. First, the cross-sectional dependence of the units (banks) is investigated with the Pesaran CDLM test developed by Pesaran [14]. Second, Delta tests are applied to analyze whether the parameters change according to the units. Third, CIPS panel unit root test developed by Pesaran [15] is used to determine order of the integration of the variables. Finally, panel cointegration test developed by Westerlund [16] is conducted in order to explore the existence of the long-run relationship among the variables. In this section, theoretical background of methodology is explained.

4.1 Investigation of cross-sectional dependence

One of the important concepts that affects the choice of method to be used in dynamic panel data analysis is inter-units correlation. The inter-units correlation, in other words, cross-sectional dependence is the simultaneous correlation of series that may occur due to excluded, observed common factors, spatial spillover effects, and all common effects observed or not observed [17].

Model for panel data analysis can be written as in Eq. (3) [18]:

$$LR_{it} = \mu_i + \beta_i CE_{it} + \varepsilon_{it} \tag{3}$$

where $i = 1 \dots N$ denotes cross section dimension, which is banks here, $t = 1 \dots T$, is time series dimension which is the quarterly period. LR_{it} shows the liquidity risk, CE_{it} is a variable of credit expansion. μ_i represents the intercept of the model. The slope coefficients are β_i which vary across the cross section units. ε_{it} is the error term which may be cross-sectionally dependent.

The null hypothesis ($E(\varepsilon_{it}\varepsilon_{jt}) = 0 \, for \, all \; \mathrm{i} \neq j$) used to investigate whether there is a correlation between units in the error term of this model.

Rejecting the null hypothesis shows existence of the cross-sectional dependence. Pesaran [14] proposed a simple cross-sectional dependence test that can be applied to heterogeneous panel series with both stationary and unit roots [14]. The test statistic, CD, is the average of the pairwise correlation coefficients of the ordinary least squares residuals obtained from the individual regression coefficients. The test statistic is calculated as Eq. (4) [19]:

$$CD = \sqrt{\frac{2T}{N(N-1)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)} \tag{4}$$

where $\hat{\rho}_{ij}$ represents pairwise correlation coefficient and can be formulated by $\hat{\rho}_{ij} = \hat{\rho}_{ji} = \sum_{t=1}^{T}\hat{\varepsilon}_{it}\hat{\varepsilon}_{jt} / \left(\sum_{t=1}^{T}\hat{\varepsilon}_{it}^2\right)^{1/2}\left(\sum_{t=1}^{T}\hat{\varepsilon}_{jt}^2\right)^{1/2}$. $\hat{\varepsilon}_{it}$ shows the ordinary least square (OLS) estimate of ε_{it} which is based on T number of observation in each unit. Pesaran CD test works well even when there are few years and many units ($N > T$) [20].

4.2 Investigation of homogeneity

Homogeneity means that constant and slope parameters do not change according to the units. Delta test which is an extension of Swamy S test is used to test homogeneity of parameters in this study. The purpose of the Swamy S test is to explore whether there is a difference between OLS estimator and weighted average matrices of within estimator. OLS estimator does not take into account panel structure of units. Conversely, within estimator considers panel-specific estimates with weighted average of parameters.

The null hypothesis of Swamy S test is H_0: $\beta_i = \beta \quad i = 1 \dots N$ which represents homogeneity of parameters estimated by two different estimation methods, OLS and within estimator [21].

Test statistic of Swamy [21] can be written as Eq. (5):

$$\hat{S} = \chi^2_{k(N-1)} = \sum_{i=1}^{N}\left(\hat{\beta}_i^{OLS} - \beta^{WWE}\right)V_i^{-1}\left(\hat{\beta}_i^{OLS} - \beta^{WWE}\right) \tag{5}$$

$$\beta^{WWE} = \left(\sum_{i=1}^{N}\hat{V}_i^{-1}\right)^{-1}\sum_{i=1}^{N}\hat{V}_i^{-1}\hat{\beta}_i^{OLS} \tag{6}$$

$\hat{\beta}_i^{OLS}$ indicates estimation of coefficients from ordinary least squares. β^{WWE} is the estimation of weighted (by $\hat{V}_i^{-1}$) average of parameters from within estimator. $\hat{V}_i$ is the weight which is difference between variances of OLS and within estimator. The test statistic is χ^2 distributed with $kx(N-1)$ degrees of freedom.

Pesaran and Yamagata [22] developed Swamy test by two different test statistics [22]. These two statistics differ according to the size of sample. They are delta ($\tilde{\Delta}$) for large samples and delta adjusted ($\tilde{\Delta}_{adj}$) for small samples. These tests explore whether slope coefficients are homogenous or not. Delta for large samples and delta adjusted for small samples are calculated as follows [23]:

$$\text{Large samples}: \tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\hat{S} - k}{2k}\right) \sim \chi^2_k \tag{7}$$

$$\text{Small samples}: \tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\hat{S} - k}{SE(T,k)}\right) \sim N(0,1) \tag{8}$$

in which $\hat{S}$ is Swamy test statistic, k is number of regressors, and SE denotes standard errors.

4.3 Investigation of unit roots

The first factor to be considered in panel unit root tests is whether the units forming the panel are correlated to each other. According to the existence of correlation between units, panel unit root tests are divided into two as first- and second-generation tests. Levin et al., Harris and Tzavalis, Breitung and Hadri are first-generation unit root tests that do not take into account cross-sectional dependence [24–27]. In these tests, all units are assumed to have a common autoregressive parameter. However, an autoregressive parameter changing according to the units is a more realistic approach. The second-generation unit root tests have been developed for this purpose. They deal with cross-sectional dependence in three different ways. First, first-generation unit root tests were transformed by reducing the correlation between the units by taking the difference from the cross-sectional averages, but unable to eliminate some types of correlation. As a result, these versions of tests are not used much in the literature [28]. Second, there are panel unit root tests such as the multivariate augmented Dickey-Fuller (MADF) panel unit root test and seemingly unrelated augmented Dickey-Fuller (SURADF) panel unit root test based on system estimation [29–32]. Third, there are panel unit root tests that eliminate cross-sectional dependence by modeling it via common factor [15, 33–40].

In this study, since the cross-sectional dependence was determined among the banks forming the panel, the stationarity of the series was tested by using the second-generation panel unit root tests. Cross-sectionally augmented Im, Pesaran, and Shin (CIPS) unit root test developed by Pesaran [15] was used to in order to determine stationarity of the series. CIPS unit root test is an extension of Im, Pesaran, and Shin (2003) unit root test. This method adds cross-sectional averages of the lagged series and first differences of series as factors to DF or ADF regression to eliminate correlation between units [15]. Dynamic heterogenous panel data model without autocorrelation is as Eq. (9).

$$LR_{it} = (1-\phi_i)\mu_i + \phi_i LR_{it-1} + \varepsilon_{it} \qquad i = 1 \dots N, t = 1 \dots T \tag{9}$$

ε_{it} with a single factor structure is shown in Eq. (10).

$$\varepsilon_{it} = \varphi_i f_t + \epsilon_{it} \tag{10}$$

where f_t is unobserved common factors, ϵ_{it} is individual specific error term. If we rearrange Eq. (9)., it is displayed in Eq. (11).

$$\Delta LR_{it} = \alpha_i + \beta_i LR_{it-1} + \varphi_i f_t + \epsilon_{it} \tag{11}$$

in which $\alpha_i = (1 - \phi_i)\mu_i$; $\beta_i = -(1 - \phi_i)$ and $\Delta LR_{it} = LR_{it} - LR_{it-1}$. Pesaran [15] used the cross-sectional average of LR_{it} $(\overline{LR}_t)$ and average of lagged values $(\overline{LR}_{t-1}, \overline{LR}_{t-2}, \dots)$ as instrumental variable for common factor (f_t). Cross-sectionally augmented ADF (CADF) regression with intercept is defined as follow same as Equation 54 in Pesaran [15].

$$\Delta LR_{it} = \alpha_i + \beta_i LR_{it-1} + \omega_i \overline{LR}_{t-1} + \sum_{j=0}^{p} \psi_{ij} \Delta \overline{LR}_{t-j} + \sum_{j=1}^{p} n_{ij} \Delta LR_{it-j} + \epsilon_{it} \tag{12}$$

The unit root hypothesis of interest is: $H_0 : \beta_i = 0 \, for \, all \, i$; whereas alternatives are: $H_1 : \beta_i < 0 \; i = 1, 2 \dots N_1, \beta_i = 0, i = N_1 + 1, N_1 + 2 \dots N$. In order to test this hypothesis of interest, CIPS statistic is calculated as average of CADF.

$$CIPS = \frac{1}{N} \sum_{i=1}^{N} CADF_i = \frac{1}{N} \sum_{i=1}^{N} t_i \tag{13}$$

where t_i denotes the OLS t-ratio of β_i in the Eq. (12). Critical values were given by Pesaran [15].

4.4 Investigation of long-run relationship

Cointegration is the long-run equilibrium relationship between the variables despite permanent shocks affecting the system. Panel cointegration tests were developed to investigate long-run relationship in the panel data. They can be divided into two according to the existence of cross-sectional dependence. First-generation panel cointegration tests (Kao (1999); Pedroni (1999, 2004); McCoskey and Kao (1998); [16]) do not take into account correlation between units, while second-generation tests [16] with bootstrapping critical values (Gengenbach, Urbain and Westerlund (2016)) do. In this study, Westerlund [16] cointegration test was used to investigate long-run relationship between variables.

Westerlund [16] is an error-correction based panel cointegration test. In the test, the presence of long-run relationship is explored by deciding whether each unit has its own error correction [16]. So rejecting hypothesis of interest shows that there is not error correction and it means absence of the long-run relationship between variables. Error correction model is shown in Eq. (14) [41]:

$$\Delta LR_{it} = \delta_i' d_t + \alpha_i \left(LR_{it-1} - \beta_i' CE_{it-1} \right) + \sum_{j=1}^{m_i} \vartheta_{ij} \Delta LR_{it-j} + \sum_{j=-q_i}^{m_i} \gamma_{ij} \Delta CE_{it-j} + \varepsilon_{it} \tag{14}$$

Eq. (14) can be rewritten as below:

$$\Delta LR_{it} = \delta_i' d_t + \alpha_i LR_{it-1} + \lambda_i' CE_{it-1} + \sum_{j=1}^{m_i} \vartheta_{ij} \Delta LR_{it-j} + \sum_{j=-q_i}^{m_i} \gamma_{ij} \Delta CE_{it-j} + \varepsilon_{it} \tag{15}$$

where d_t represents deterministic components vector (intercept and trend), $\lambda_i'=-\alpha_i\beta_i'$ is the long-term parameter, ϑ_{ij} and γ_{ij} are short-term parameters. Westerlund [16] test is based on four statistics. Two of them are group mean statistics (G_α, G_T). Autoregressive parameter in group mean statistics varies from unit to unit. Group mean statistics can be formulated as in Eq. (16).

$$G_\alpha = \frac{1}{N}\sum_{i=1}^{N}\frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)}, \qquad G_T = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)} \tag{16}$$

in which SE denotes the standard error of $\hat{\alpha}_i$. Other two statistics of Westerlund [16] are panel statistics (P_α, P_T). They are calculated by using whole information on panel. Panel statistics are shown in the following equations:

$$P_\alpha = T\hat{\alpha}, \qquad P_T = \frac{\hat{\alpha}}{SE(\hat{\alpha})} \tag{17}$$

The rejection of the hypothesis of interest $(H_0 : \beta_i = 0 \, \textit{for all } i)$ in both groups of tests signifies the existence of a cointegration relationship. If the variables are long-term cointegrated, the cointegration model can be estimated in different ways depending on whether the long-term covariance is homogeneous or not. Since the long-term covariance is homogeneous in this study, the panel dynamic least squares (PDOLS) estimator by Kao and Chiang [42] is used to estimate long-term relation. Kao and Chiang PDOLS estimator can be obtained by estimating regression model below [42]:

$$LR_{it} = \alpha_i + CE_{it}\beta + \sum_{j=-q}^{q} c_{ij}\Delta CE_{it+j} + v_{it} \tag{18}$$

where β is long-term parameter. According to Kao and Chiang's Monte Carlo simulation results, the PDOLS estimator and t statistics are successful in all cases of homogeneous and heterogeneous panels.

5. Empirical results

The aim of this study is to examine the long-term relationship between liquidity risk and credit expansion for the period from 2014.Q1 to 2017.Q4 using data from 20 banks in the Turkish banking sector. Since biased results can be obtained due to correlation between units forming panel data, the presence of cross-sectional dependence should be tested first. In this context, the presence of cross-sectional dependence of residuals obtained from error correction model and cross-sectional dependence of the liquidity risk and credit expansion variables were tested by Pesaran [14] CD test. The test results are given in **Table 1**.

According to the results represented in **Table 1**, the null hypothesis of cross-sectional dependence test states no correlation between units. There is enough

	LR		CE		Model	
	Statistic	**p-Value**	**Statistic**	**p-Value**	**Statistic**	**p-Value**
CD [14]	3.88	0.000	3.84	0.000	0.54	0.589

Table 1.
Test results of cross-sectional dependence.

evidence to reject the null hypothesis at 1% significance level for variables. It means that second-generation unit root tests are more appropriate in order to decide whether variables are stationary or not. However, test result for the residuals obtained from error correction model fails to reject the null hypothesis at any significance level. This result provides support for presence of cross-sectional independence in the error correction model. In this case, first-generation panel cointegration tests should be used. Westerlund [16] was chosen to explore long-run dynamics. However, Homogeneity tests should be realized before applying Westerlund [16]. If panel is homogenous then Westerlund's [16] results are valid. For this purpose, Pesaran and Yamagata [22] homogeneity test was applied to error correction model. Test results are given in **Table 2**.

There is not enough evidence to reject the null hypothesis of homogeneity tests at any significance level with respect to results presented in **Table 2**. The results indicate strong evidence for homogeneity of slope coefficients. Therefore, Westerlund [16] is suitable to explore cointegration relation if variables are nonstationary. Pesaran [15] CIPS unit root test was used in order to examine stationarity of variables. **Table 3** reports results of the CIPS unit root test for level and first difference of variables.

The test results in **Table 3** fail to reject the null hypothesis of CIPS unit root test in level of all variables. This result gives evidence of non-stationarity of variables. It means that a shock in the economy has permanent effect on liquidity risk and credit expansion. However, the results provide support for stationarity of variables after differencing them. Liquidity risk and credit expansion are integrated of order 1 (I (1)). Due to integration level of variables, panel cointegration relation can be analyzed. Selection of appropriate panel cointegration method depends on cross-sectional dependence and homogeneity of residuals. Westerlund [16] cointegration test was chosen due to homogeneity and cross-sectional independence of residuals. Westerlund's [16] null hypothesis indicates that there is not long-term relation between variables. Four statistics were calculated in Westerlund [16]. Test results were given in **Table 4**.

	Statistic	p-Value
$\tilde{\boldsymbol{\Delta}}$	−0.417	0.676
$\tilde{\boldsymbol{\Delta}}_{adj}$	−0.590	0.555

Table 2.
Test results of homogeneity tests.

Variables	Deterministic term	Pesaran CIPS statistic [15]
LR	Intercept only	−2.198
ΔLR	Intercept only	-4.421^{***}
CE	Intercept only	−1.780
ΔCE	Intercept only	-3.991^{***}

Note: Deterministic term was chosen by exploring graphs by panel.
***Indicates that the results can reject the null hypothesis at 1% significance level. The relevant 1% critical value for the cross-sectionally augmented Dickey-Fuller (CADF) statistic suggested by Pesaran is −2.1 [15].
Δ represents first differences of variables.

Table 3.
Test results of CIPS unit root test.

Test statistic	Test value	z-Value	p-Value
G_T	−2.943	−5.785	0.000
G_α	−14.235	−5.804	0.000
P_T	−10.502	−3.857	0.000
P_α	−7.343	−2.912	0.002

Table 4.
Test results of Westerlund [16] cointegration test.

LR	Coefficient	z-Value
CE	1.31 (0.133)	9.82***
Wald $\chi^2(1)$	96.50***	

Note: Standard error is given in brackets.
****Indicates significant at 1% level.*

Table 5.
Estimation results of long-run relation model.

Westerlund [16] cointegration test results show rejection of the null hypothesis for all statistics. It points out that there is a long-term relationship between liquidity risk and credit expansion. Since the variables are cointegrated, long-run relationship can be estimated. Eq. (18) was estimated by the PDOLS estimation method developed by Kao and Chiang [42] in order to investigate the effect of credit expansion on liquidity risk in the long run. The estimation results were given in **Table 5**.

The Wald statistics in **Table 5** is significant at 1% level. It means that model is generally significant. The estimated parameter is the long-term parameter and it is statistically significant at 1% level. Therefore, the credit expansion affects the liquidity risk in the long run. This means that 1% increase in credit expansion increases liquidity risk by 1.31%.

6. Conclusion

Banks convert short-term assets received from depositors to long-term debt for borrowers. Therefore, banks try to maximize their expected profits by considering the risks that may arise from their activities. The concept of risk here is the state of uncertainty, which is uncertain but effective on institutional goals. Liquidity risk is one of the important risks faced by banks. Therefore, many studies on liquidity risk have been conducted in the literature. However, while assets and liabilities are two important components that constitute a bank's balance sheet, a panel study investigating long-run relation between credit expansion and liquidity risk has not been conducted in Turkey. This study aims to fill this gap in the literature. Panel cointegration approach was adopted in order to explore long-run dynamics. First, two important factors in panel methodology which are cross-sectional dependence and homogeneity were investigated properly. Pesaran [14] CD test was applied to the variables and error correction model in order to decide whether there is a cross-sectional dependence between units. The null hypothesis of Pesaran [14] CD test which states that there is a dependence between units was rejected for the variables, while it was not rejected for the model. It indicates that there is no cross-sectional dependence in the residuals of error correction model. Similarly, Delta test for large and small samples were conducted in order to determine homogeneity. The null hypothesis of homogeneity was not rejected. It indicates homogeneity of constant and slope coefficients. This result shapes dynamic panel methodology structure of the study. While there is an evidence on cross-sectional dependence in the variables, cross-sectionally augmented Im-Pesaran-Shin panel unit root test was used to determine integration level of variables. One of the strengths of this test is that it takes the cross-sectional averages of the lagged levels and first differences of the individual series instead of taking difference from the estimated common factors. According to the test results, variables were found to be nonstationary. Since the first order difference of both variables was stationary, existence of the long-run relation between two variables were explored by using Westerlund's [16] paper. Four test statistics were calculated in order to decide whether there is a cointegration relation or not. The null hypothesis which shows long-run relation between variables was rejected according to the test statistics. It allows us to estimate long-run effects. Long-run relation model was estimated by using PDOLS estimator. Model was found statistically significant at 1% level. Also, coefficient of explanatory variable which is credit expansion is found statistically significant at 1% level. Sign of the coefficient is positive. It indicates positive correlation between variables. According to this correlation relation, a growth in credit expansion leads an increase in liquidity risk which affects the costs and returns of banks. This result shows importance of credit expansion on risk management. Because, uncontrolled credit expansion leads to the financial fragility of banks. This study's findings suggest that the banks may limit their credit growth strategy in order to control liqudity risk [43].

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