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## Deposit Funding and Loan Volatility in Iranian Banking System

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### Abstract

Banks may perform differently in lending to firms according to their funding structures. This paper surveyed the relation between loan volatility and deposits in Iranian banking system. The extent to which bank lending is connected to funding structure is affected by the banks' characteristics such as capital structure, profitability, and the measure of non-performing loans. To analyze this relation, therefore, this survey employed the dynamic panel data of the banks. Using a unique dataset of Iranian banking system and the dynamic panel data it was found that loan volatility has a statistically significant effect on the deposits. Banks respond to loan shocks mainly by adjusting their deposits volumes. According to the results, loan volatility has negative effects on deposit ratio in the Iranian banking system.

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## 1. Introduction

The analysis of bank liability structure is an important issue in banking systems. This study was conducted to survey volatility in lending using the wholesale liabilities rather than retail deposits. Banks are influenced by the economic fluctuations, financial shocks, and economic volatility.

A theoretical and empirical literature distinguishes funding and volatility as two important concepts in banking (Ratnovski and Huang, 2011; and Segura and Suarez, 2012). Funding is the main element that increases the uncertainty of banking system. Banks face liquidity risk if they use uninsured wholesale liabilities. Shin et al. (2011) proposed that banks can use Basel III requirement in reaction to the negative externalities of wholesale funding. The limitations of wholesale funding decrease volatility and increase the stability in banking systems.

The importance of retail deposit has been examined by Flannery (1982) and Leahy and Whited (1996). Hannan and Berger (1991) surveyed the cost of bank retail deposits. In this regard, an increase in the volume of retail deposits can increase the deposit supply, pose some costs to the bank, and increase deposit

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rates. The cost of fusions retail deposit builds the new branches and other else. The cost of reducing the retail deposit can pos higher costs for banks. Wholesale liabilities can be adjusted the cost rather than the retail deposit and balance sheet of bank related to credit boom and volatility. The balance sheet can be expanded in credit boom and wholesale liabilities effect on the expansion of balance sheet (Dinger and Craig, 2013).

According to Shin (2011), the wholesale liabilities can be used to balance sheet and wholesale liabilities are able to expand their balance sheet conflicting to retail deposits.

The focus of the present study is on the volatility of loan and relation between funding and lending. In this research, the bank uncertainty is measured via bank loan volume volatility. The banks operate on the balance sheet and face the volatility and risk. Loans are able to affect the bank's funding requirement. The uncertainty can arise from different sources of business cycle properties. A potential source of uncertainty is loan demand shocks.

The remainder of this study is organized as follows. Section 2 presents the importance of the key concepts and literature review. Section 3 describes the funding and loan volatility. The empirical methods are employed and their results are presented in Section 4 and Section 5, respectively. Finally, Section 6 deals with conclusions.

## **2. Literature Review**

Funding is simply meant providing resources. Core deposits offer a constant resource of funding to banks that can be volatile (Vink, 2010). The increase in bank assets can be funded by core deposits and banks earning profits (Genay, 2000). Sullivan (2009) showed that stragglng deposits can damage the funding of banks; the funding situation depends on the deposits.

Berlin and Mester (1999) argued that deposit provides the bank with low-cost and cheap funding and permits to activate the functions. However, the concepts liquidity and funding are dependent on banks and functions that create liquidity by funding illiquid loans with liquid deposits. The concept of liquidity is related to funding in banking. According to Berger and Bouwman (2009), there is a relationship between the capital and liquidity. Then bank capital reduces the bank liquidity and capital protects banks to absorb more risks (Berger and Bouwman, 2009).

Another major concept of this paper is volatility and bank liability structure. Increasing the wholesale liabilities leads to "real" uncertainty and regulatory measures that limit funding uncertainty. This uncertainty can be due to increasing the exposure to asset-side shocks. This concept may influence the financial stability of the banking system.

Shin et al. (2011) showed that increases in the growth rate of deposits are inadequate to protection lending and the maturity and timeline table is most important in this concept.

Kashyap et al. (2002) discussed that banks tend to the survey of lending and source of loan together. The funding of loan depends on the funding and deposits. Adrian and Shin (2010) displayed that leverage in banking depends on wholesale funding for funding the investment actions. Dinger and Craig (2014) explored the relationship between bank loan volatility and wholesale liabilities. They argued that volume of deposits changes and banks face unstable in funding for loans. Their results show that regulation limits the decrease in the use of liabilities and deposits by banks. This concept can be the effect of lending and capitalization.

According to Damar et al. (2011) fluctuations in lending can arise from non-equity funding. Non-equity funding is one of such funding that increase rapidly adaptation to leverage and banks face to leverage pro-cyclicality. Fluctuations can be effect on funding and lending. Haung and Ratnovski (2010) surveyed a model for cyclical funding. Gatev et al. (2006) proposed a proper measurement of deposits in liabilities in banking balance sheets, which brings liquidity risk to the banks.

According to Gale and Yorulmazer (2011), banks keep liquidity against shocks, fluctuation, and insolvency risk in financial markets. Berrospide (2013) revealed that banks tend to cache liquidity and keep liquidity due to the deposit change caused by volatility funding in banks.

In Iranian studies, most studies have been about the economic variables while the volatility of banking variable has been less investigated. The effect of banking variables in economic environment is of high importance and volatility of these variables can be used in better policymaking in financial markets. Hence, the present study was conducted to survey the lending volatility in an econometric model.

### 3. Funding and loan volatility

Deposits as important factors in funding affect the lending and volatility of the banking systems. When facing wholesale funding, banks switch their funding to more stable sources. Deposits are the favorite source of funding. Banks attempt to strengthen deposit by investing in customer relations. Increasing deposits lead to a higher market share of banks for financing and investing (ECB, 2009).

Then, types of deposits are based on the structure of funding in balance sheets. Strengthening of the balance sheet is done through deposit withdrawals. This concept depends on observing deposits and strength of banks (ECB, 2009)

Banks operate the functions based on the structure of maturity. Timetables of loans and maturity of these depend on risk management. Deposits are the main source of funding. Also, deposits are the main component of liabilities. The financial crisis and economic fluctuations can influence the deposits and profitability. Bank lending ability is determined by measuring the profit that can push to keeps liquidity. Maintains of liquidity is more important for compositions of assets in balance sheets (ECB, 2009).

Banks hold all their deposit in the form of cash then the banks achieve no profit and banks should allocate the deposit to the lending. Therefore, banks have to adjust asset structure and liabilities on the balance sheet for a better performance. Banks use the liquidity for the profitability and then a balanced state between liquidity and profitability is of great importance (Bouwman, 2013).

The composition of their deposits is more important for asset structure. Banks can keep a great proportion of liquid assets and retain more time deposits to hold a relatively smaller proportion of liquid asset (Bouwman, 2013). Banks alter the items in the balance sheet that creates an increase in deposit funding. Additionally, they change the structure of asset side of the balance sheet and then endure the decrease in risk and the increase in the liquid asset. Some banks have a structure of assets and liabilities that cannot resist instability. These banks use the costly liabilities. Funding structure and liabilities is very important for these banks (Bouwman, 2013).

This paper explored the loan volatility and funding in the Iranian banking system. The main goal of this research is to survey loan volatility and the role of deposits in funding. This paper practiced the measures for the volatility of loan volumes. The volatility of loan can generate the aggregate shocks and uncertainty. Based on the work done by Bloom et al. (2007), the present work employs the standard deviation of the loan volume (LOANS SD) as a classical measure of volatility and GARCH model of the loan volume.

#### **4. Empirical Model**

This paper surveyed the relationships between loan volatility and deposit ratio in the Iranian banking system. Financial data for the Iranian banks were obtained from banking and macroeconomic information from the Database of Islamic Republic Central bank. The model was estimated with a dynamic panel data for 25 banks (private and state banks). The time period of 2000 to 2013 was chosen due to data availability. The model of loan volatility and deposit ratio is similar to the survey of Dinger and Craig (2014).

This paper focused on loan volume volatility as a proxy for the volatility of the volume of assets that bank has to fund. According to Dinger and Craig (2014), loans disregard the volatility of other bank assets. Loans are most important illiquid assets of a bank and thus the main factor of a bank's funding needs. Deposits are considered as the best source of funding and the asset side of balance sheets refinancing of deposits.

This paper calculates uncertainty and volatility by loan volume as an uncertainty measure. It also makes consideration challenges and then perceives stability loan volumes.

This section presents the models and econometric analysis. The estimation method is dynamic system-GMM estimator proposed by Arellano and Bond (1991). Autocorrelation problem is discovered from the presence of the intervallic dependent variables between explanatory variables.

In this study, we ignored the dynamics of the portfolio and rather focused on the loan and volatility in the banking system. For this purpose, we used the measures of the volatility of loan volumes and uncertainty variable as the volatility of loan. In addition, we applied the standard deviation of the loan volume (LOANS SD) as a classical measure of volatility. The model expanded by the measure of bank level uncertainty by the conditional volatility of the bank's loan volumes predicted by a GARCH (1, 1) model (LOANS GARCH).

The independent variable is deposit ratio in the Iranian banking system. The framework using the following econometric model would be:

$$\begin{aligned}
 \text{Deposit ratio } ij, t & \\
 &= \alpha 1. \text{Deposit ratio } ij, t - 1 + \beta 1. \text{Uncertainty } i, t \\
 &+ \gamma 1. \text{Inflation} + \delta 1. \text{ROA} + \theta 1. \text{Capital ratio} \\
 &+ \varepsilon ij, t \qquad (1)
 \end{aligned}$$

where  $\text{Deposit Ratio}_{ij,t}$  indicates that the ratio of deposits to total liabilities of bank  $i$  in the year  $t$ ,  $\text{uncertainty}_{i,t}$ , is a measure of the uncertainty faced by the bank in the period. Here, we used the other banking variables including  $X_{i,t}$ , which presents capital ratio and return on asset and size of banks. Banks face to a high degree of uncertainty, the volatility of loans increases and this concept create that the share of deposits in liabilities decreases. The adjustment of deposits can influence funding and prevent the transfer shocks that banks may face.

In this paper, we applied several measures for the volatility of loan volumes. The standard deviation of the loan volume (LOANS SD) was used as a measure of volatility. Another measure of volatility is the conditional volatility of the bank's loan volumes predicted by a GARCH (1,1).

Measuring loan volatility is not a straightforward procedure. Most existing papers use the standard deviation of the loan. However, in this paper, the loan volatility for bank  $i$  in period  $t$  indicated as  $\text{volit}$  was applied for this purpose:

$$\text{Vol } i, t = [1/n \sum_{j=t-(n-1)}^t (\text{Loan } i, j - \mu)^2]^{1/2}$$

where  $\mu$  is considered as the average of loan in the banking system. This measure has been mistaken. The dynamics of  $\text{volit}$  is subjected to previous periods. As a result, volatility tends to be underestimated in the years in which a shock takes place, and overestimated thereafter.

Bank capital expresses the resource of the bank. The capital requirement is important in banking regulation and shows how banks keep the capital. A measure of capital that banks hold based on regulation in banking. The banking regulations indicate the minimum of capital ratios and its adequacy. The capital ratio protects banks from unexpected risks. The high banking capital shrinks risks. The high capital ratio raises the average cost of funding. Capital ratio is the main factor in stability and soundness banking. The well capitalize of banks

can affect risk management and portfolio of loans. Capital and deposits are the keys to liabilities in banking. Structure of liabilities is determined by both capital and deposits. Therefore, there is a relationship between loans and capitals. The banks with the higher capital ratios are able to lend more and absorb more deposits.

This model used the size of the bank as measured by the natural logarithm (BANK SIZE) of its total assets. The bank size shows different behavior of banks in operation and functions. A too big bank size would fail the system operation. Cost of funding affects the bank size. Deposits in small banks have the main source of funding as far as large banks have a different source of funding.

The cost of funding is different in large and small banks. The perfect analysis of banking needs bank size and the relationship between bank size and deposit. The macroeconomic variables such as inflation are also considered in the model. This consideration shows the relationship between the banking system and economic sector.

## 5. Results

Before estimating the equation 1, the unit root test should be done. These tests need to examine the unit root properties of all variables. Unit root variables make spurious-regression problem in the panel data analysis. In this paper, we use Levin, Lin and Chu (LLC), Im, Pesaran, Shin (IPS) W-stat test, Fisher test, and Hadri tests. Table 1 shows the results of the unit root tests. All tests shown in Table 1 were used to ensure that the unit root of variables does not exist.

**Table1. Results of some unit root tests**

Variable	Levin, Lin, Chu t.	Im, Pesaran, Shin W-stat	ADF– Fisher Chi-square	PP- Fisher Chi- square	Hadri Stat.
Loan to total asset	-28.69 (0.000)	-6.18 (0.000)	126.051 (0.000)	178.632 (0.000)	3.97 (0.000)
Deposit ratio	-8.19 (0.000)	-1.33 (0.092)	66.057 (0.0636)	154.69 (0.000)	6.59 (0.000)
NPL	-3.66 (0.0002)	-3.29 (0.0005)	95.75 (0.0001)	64.47 (0.0820)	6.67 (0.000)
capital Adequacy ratio	15.17 (0.000)	-2.332 (0.007)	67.97 (0.046)	68.06 (0.045)	8.58 (0.000)
Size	-29.88 (0.000)	-6.53 (0.0057)	121.43 (0.0007)	132.68 (0.000)	6.97 (0.000)
ROA	-4.73 (0.000)	-1.67 (0.0471)	74.5 (0.0139)	112.93 (0.000)	4.127 (0.000)
Inflation	-12.27 (0.000)	-1.61 (0.053)	68.42 (0.0427)	84.84 (0.0015)	11.18 (0.000)

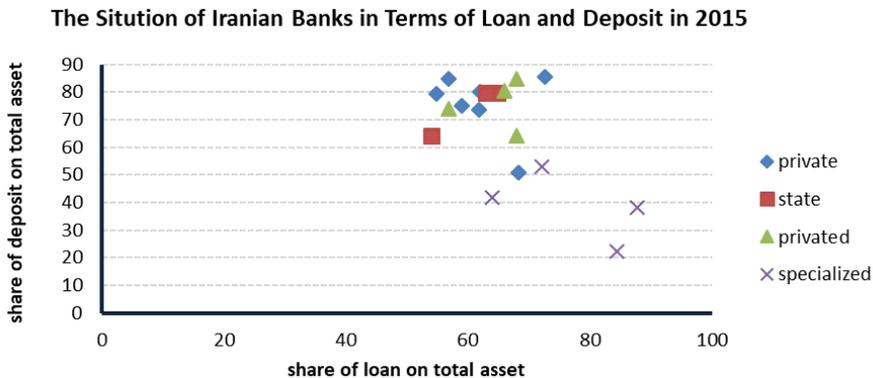
Source: Research Finding

The validity of instrumental variable can be used in the model examined by Sargan-test. Measurements of the probability of Sargan test's statistic are

presented in Table 2. At that point, correlation of instruments with disturbing fundamentals could not exist.

In the following, a brief overview of deposits and loans in the Iranian banking system is presented. Since 2001, the Iranian government has motivated liberalizing the banking, though headway has been slow. In 1994, the Central Bank of Iran approved establishing private credit organizations. The central bank followed this with the privatization of commercial banks, pursuing to liberalize the sector and inspire the expansion of competitive. State banks are deliberated by poorly functioning as financial intermediaries. General regulations include controls on rates and credit and the banking sector in the face to a potential hedge against the exclusion of subsidies.

Demand for investment banking services established the limited from 2008 and the economy persisted by the state that cannot encompass the guidance of an international standard. The capital markets were in an early development stage. Finally, Iranian electronic banking improved rapidly and the Iranian banking system failed to run on an Islamic interest-free basis.



**Fig. 1**

The Iranian banking system included four bank types of private banks, state banks, privatized banks, and specialized banks. Fig. 1 shows that how Iranian banking system deals with loans and deposits. The loan and assets can be funding of resources and deposit in liability structure. Then, the liability structure and deposits can be more important in banks' reaction against crisis and risks.

Table 2 shows the results obtained using Eq. (1). For all banks in the Iranian banking system, the coefficient of the lag of deposits ratio is significant. The coefficient of lagged deposits ratio illustrates an estimation point of 0.61 (significant), suggesting that the dynamic model is selected correctly. All estimations confirm these concepts.

Table 2 presents various estimations of Eq. (1) with variables. The effect of Loan GARCH on deposit ratio is negative and statistically significant. The volatility of loan is measured by Loan GARCH in Table 2.

**Table 2. The effect of loan volatility on deposit ratio  
(Dependent variable: deposit ratio)**

Variables	Estimation 1	Estimation 2	Estimation 3	Estimation 4
Deposit(-1)	0.612(9.56)	0.63(9.91)	0.63(9.87)	0.628(9.86)
Loan GARCH	-0.00219 (-1.66)	-0.00208 (-1.75)	-0.00207 (-1.85)	-0.00208 (-1.87)
Capital ratio	-12.65(-2.81)	-14.38(-3.178)	-14.4(-3.15)	-14.35(-2.98)
ROA	5.165(4.63)	4.29(4.05)	4.29(4.015)	4.307(3.92)
NPL	0.369(2.17)	---	---	---
Size	2.93(1.87)	---	---	---
inflation	---	---	-0.00576 (-2.03)	---
Loan ratio	---	---	---	0.046(1.79)
AR(1)	0.2248(4.35)	0.231(4.95)	0.23(4.91)	0.23(4.98)
R <sup>2</sup>	0.69	0.68	0.68	0.68
J-stat.	15.56	11.56	13.12	12.35

Since the effect of capital ratio on deposit ratio in Iranian banking system is negative and significant, the increase in equity leads to an increase in deposits. The profitability has a positive effect on deposits and resources on the balance sheet.

Bank size has more importance in the model. The large and small banks have different behaviors in the banking systems. Deposit ratio and size of banking have a positive relationship. Inflation as a macroeconomic variable has a negative effect on deposit. In terms of inflation, increasing inflation leads to decrease in deposits and thus other markets will be replaced.

A non-performing loan is a negative coefficient in Estimation 1. A high non-performing loan makes the uncertainty in banking systems and disturbs in the allocation of resources and funding. Return of asset is a positive and significant coefficient in all of the estimations. Then, the profitability is positively changing in liability structure and deposits. Banks should change their asset side against the changing deposits. Loans are more sensitive to resources and deposits in banks. Loans increase by increasing deposits while banks are lending out through resource and deposits. Banks with more funding can increase the lending in banking systems.

As can be seen in Table 3, were applied another variable of loan volatility in the present study; i.e., LOANSD. According to Table 3, the dependent variable is deposit ratio in the Iranian banking system and the deposit ratio in the past years was significant and positive in the all of the estimations. The LOANSD has a negative and significant effect then the loan volatility has a negative effect on deposit ratio. LOANSD and loan GARCH as loan volatility have negative effects on the deposit ratio in the model.

The capital ratio has negative and significant coefficient so the increase in equity leads to an increase in deposits. The profitability has a positive effect on deposits. Bank size and deposit ratio have a positive relationship in this model.

**Table 3. The effect of loan volatility on deposit ratio  
(Dependent variable: deposit ratio)**

Variables	Estimation 1	Estimation 2	Estimation 3	Estimation 4
Deposit(-1)	0.78(12.82)	0.608(9.61)	0.73(10.6)	0.75(11.42)
Loan SD	-0.1122(-1.82)	-0.044(-1.91)	-0.303(-1.79)	-0.301(-1.77)
Capital ratio	---	-2.73(-2.79)	---	-1.89(-2.45)
ROA	1.79(2.19)	4.78(4.51)	2.87(3.165)	2.75(3.14)
NPL	---	0.32(2.06)	0.333(2.20)	0.322(2.18)
Size	2.07(1.99)	2.055(2.53)	0.98(1.74)	1.4(1.85)
Loan Ratio	---	---	0.046(1.78)	---
Inflation	---	---	---	-0.03713(-2.8)
AR(1)	0.22(3.98)	0.25(4.24)	0.65 (2.65)	0.67(2.22)
R <sup>2</sup>	0.612	0.689	0.67	0.678
J-stat.	12.27	12.99	13.73	11.74

Inflation as a macroeconomic variable has a negative effect on deposit. An increase in inflation leads to a decrease in deposits and thus other markets will be replaced. The non-performing loan has a positive and significant coefficient in Estimation 2 to Estimation 4 in Table 3. Return of asset is positive and significant in all of the estimations. Then, the profitability is directly correlated to liability structure and deposits. Loans increased by increasing deposits, and banks were lending out through resource and deposits.

**Table 4. The effect of loan volatility on change in deposit ratio  
(Dependent variable: change in deposit ratio)**

Variables	Estimation 1	Estimation 2	Estimation 3	Estimation 4
$\Delta$ Deposit(-1)	-0.24(-2.36)	-0.38(-4.54)	-0.373(-4.24)	-0.382(-4.5)
$\Delta$ Loan	0.236(1.88)	0.521(2.57)	0.524(2.62)	0.51(2.54)
Loan SD	---	---	---	-0.116(-1.83)
Loan GARCH	---	---	-0.0083(-1.82)	---
Capital ratio	---	-2.004(-2.89)	-8.75(-2.77)	-3.73(-2.76)
ROA	4.078(3.48)	6.27(5.42)	6.36(5.01)	6.496(4.99)
NPL	0.218(1.84)	---	---	---
Size	-0.91(-1.36)	---	---	---
AR(1)	0.162(1.95)	0.411(5.12)	0.398(4.51)	0.412(5.005)
R <sup>2</sup>	0.83	0.85	0.82	0.83
J-stat.	10.74	9.83	11.45	11.32

Change in loan yields a positive and significant coefficient. Although increasing loan volatility leads to decrease deposit ratio, if there is a positive loan volume change, deposit ratio results in a positive volume change.

## **6. Conclusions**

In this paper, we explored the uncertainty in the volumes of loans and relationship of this with deposit ratio. For this purpose, we analyzed the relationship between uncertainty and deposits by dynamic econometric model. This paper surveys the changes in uncertainty and the effects of this on the deposit funding. The results indicate the statistically significant negative relationship between bank volatility and structure of deposits. The effect of Loan GARCH on deposit ratio is negative and statistically significant. LOANSD and loan GARCH as loan volatility have negative effects on deposit ratio in the model. Change in loan has a positive and significant coefficient. Although increasing loan volatility leads to decrease deposit ratio, if there is a positive loan volume change, deposit ratio results in a positive volume change.

Inflation as a macroeconomic variable has a negative effect on deposit. In this regard, an increase in inflation leads to decrease in deposits and thus other markets will be replaced. Banks with high non-performing loans create uncertainty. According to the results, the capital ratio has negative and significant coefficient and increasing capital ratio leads to an increase in the deposits. The profitability has a positive effect on deposits. Bank size and deposit ratio have a positive relationship in this model.

Banks alter the items in the balance sheet that creates an increase in deposit funding. Additionally, banks change the structure of asset side of the balance sheet and then endure the decrease of risk and the increase in the liquid asset. Some banks have the structure of assets and liabilities that cannot resist an instability situation.

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