

Measurement of Liquidity Risk in Keshavarzi Bank (With Value at Risk Approach)

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Abstract

One of the most critical competitive fields of companies and financial institutions and banks to provide optimal financial sources to survive in the turbulent business environment is financial decision making. It's safe to say any decision should be taken to consider the risks and dangers associated with it. Of course specialized risk management is also one of the most important and fundamental fields that need financial institutions adaptation with new conditions to understand increasing complexity of the rules, technology and customers and it can act better. To make this issue happen, the risk measurement would be the banks and institutions today challenge.

In this study the liquidity risk of one second rate branch of Keshavarzi Bank during 2008 to 2012years and with usage of the bank's financial statements, including a variety of deposit accounts, savings, revenue, cost and convenience, have been calculated. Writer hypothesis that significant of trends in the data research (liquidity risk) has been over these years. Should mention to demonstrate this method the value at risk has been used. The reasons for using this method are low cost and fast pace. The results show that this hypothesis along 2008, 2009, 2011 and 2012 years will be rejected and over the years 2008and 2009 are accepted. Generally liquidity risk trend towards an equilibrium (to reach a certain point). Finally, it is proposed that the risk would be tested for other branches as well in varying degrees.

Keywords: Liquidity, Liquidity Risk, Var(Value At Risk), The Keshavarzi Bank Of Iran

Introduction:

Financial institutions are very important in the economic structure of society. One of the requirements of these institutions to meet the challenges successfully is flexibility in facing different changes in the monetary and financial markets. Professional management of the various risks is the main areas that require adaptation of financial institutions to new conditions in order to understand increasing complexity of the rules and regulations, customers and the technology and manage their activities effectively and efficiently. Any institution that fails to

adapt to these changes and complexities would face with a situation that will ultimately threaten their life. Nature of trade and investment activities is in such a way that business efficiency needs risk tolerance. Risk management is a process in which managers identify, measure, decision make and monitor entity risks that posed by the firms.

Liquidity problems for a bank besides it has a huge loss for bank customers, it can quickly spread to other credit institutions and cause the financial system collapse of a country. Considering the importance and effect of this issue, tools such as deposit insurance ,legal reserve with the Central Bank and access to the Central Banks liquidity has been created to manage bank liquidity. Methods of liquidity management faced major changes over time. In the past, liquidity management usually interpreted as asset management, but with the development of financial markets and particularly interbank markets, liquidity management spread under obligations management. This means that banks to provide liquidity from market borrows from banking market or capital markets and create its commitments. Usage of obligations management should be considered in liquidity management according to the limitations that in Islam exist on borrowing transactions and in the Islamic banking system. In the present study has been reviewed one of the method of calculating liquidity risk.

- First question: is it possible to measure liquidity risk using value at risk theory with internal bank data (last few days liquidity)?
- Second question :how are liquidity risk changes in the branch? Is this a significant trend?

The importance of research can be expressed as follows:

A) Risk management in banks is important, and supervising regulations specially provisions of the Central Bank and Basel guidance's should be taken into consideration.

B) Liquidity risk produced because of lack and uncertainty of bank liquidity. Sufficient cash holdings makes payment obligations and the liquidity needs of depositors would be answered in a good time and the sanctity of the inadequate funds provide impaired banking system that may even lead to bankruptcy.

C) Recent changes in financial markets caused that banking and payment system would be very interested in short-term predictions, so financial flow control system should be taken that be able to measure the performance of liquidity risk properly and constantly.

D) Providing fast and correct information of liquidity risk timely leads risk managers and financial managers to be able of best performance and optimize the use of capital and maximize the value of shareholders' assets as its main target raised by using appropriate measures and strategies in a timely manner(Sina Bank Economic Journal,2008)The main objective of the present study is measuring the liquidity risk in a second rate branches of Keshavarzi Bank and generalizes this result to other branches. Also reviewing the significant and justifiable data (liquidity risk) and its estimation on liquidity risk based on one, two and three period came before is the more detailed objectives of this research.

The key variable of this research is bank liquidity rate that involves physical inventory, ATM system inventory, transport documents, paralleled documents, and people deposits, granted facilities, revenue and...

Definitions of words are discussed below:

The main variable is the rate of bank liquidity that involves physical inventory, ATM system inventory, transport documents, paralleled documents, and people deposits, granted facilities, revenue and...

Risk: In a banker's view the risk means uncertainty in the relationship with an event.

Risk Management: is the process by which an organization or investors react to an optimal manner against a variety of risks.

Liquidity Risk: is the risk arising from the lack of necessary liquidity to cover short-term liabilities and fund unexpected outputs.

Value at Risk: In finance and economics literature, value at risk is the maximum loss over a period of time at a specified confidence level with a probability.(Bandeh, 2012).

Expressions are presented in this section are the main definitions of this part VaR (Value at Risk):

- Value at Risk (VaR) is the method to assess the risk that the standard statistical techniques routinely used in other technical fields. In contract, valued at risk measure most loss expected in a specified horizon time at given confidence level. For example, a bank may announce the daily purchase and sale of portfolio value at risk bank confidence level of 99%, as 35 million dollars. In other words, only one out of 100 daily trading losses may occur more than 35 million dollars. This single number (the order of Value at Risk) briefly show the bank's exposure to risk market. As well as value at risk, risk is measured in terms of dollars. Unlike traditional value at risk measurement, risk exponentially comprehensive overall measure of portfolio risk that the assets and related liabilities and current status are used. As a result, the value at risk is really risk forward looking assessment. Value at risk not only of all banks branches but also is effective for all financial instruments. In addition, the value at risk methodology risk, market risk can be generalized to other types of financial risks. Worth the risk, that can measure tangible and accessible overview of the set risks of future development. Limitation of this measure is its cause of static, dynamic benchmark for researchers pursuing it.(Mohsen Roosta,2011)
- Value at risk measurement and risk analysis is a framework for the types of assets that can be equally applied. As a result, the portfolio consists of bonds with a portfolio composed of stocks would be comparable. Well worth the risk to investors offers about the nature and types of risk insights. Thus, using the concept of risk management, asset allocation allows different methods to find efficient evaluated portfolios. The overall risk of the portfolio components fixes analysis of control. Risk allocation and risk budgeting leads recent cases eventually. Allocation causes the portfolio managers of risk capital and to the sectors that have the potential for greater efficiency to conduct activities and VaR assets using standard according to diversify risk reduction strategies.

In following research is summarized that is done inside and outside Iran:

- Abrahason and Abbott research on the bank's balance sheet value at risk (2000):

Hu, Abrahason and Abbott research about value in the balance sheet is one of America's banks. These values are exposed in his article titled risk analysis and determination of sample items in the balance sheet of a bank's value calculated in banks are involved, and how to manage the information on value at risk calculation are described in the decision. Classification on the balance sheet value at risk based on a variety of rates available from banks in the banking industry is done. (Berkotiz, 2000)

- Willing and Kalkberner aimed liquidity risk management and risk-free rate fluctuations debt maturities:

Based on this model, to measure liquidity risk-free debt maturities from cash flows have used the concept of temporal structure. Using the concept of using time series, liquidity can be predicted for the future. Temporal structure, liquidity risk in a certain level, and the time periods specified size. Making and so on immunization against liquidity risk of the debt portfolio is used. (Chernozkof, 2000)

- Fatemeh Haji Babaei Research, Saman Bank liquidity risk by using measurement model value at risk:

In conducted research by Haji Babaei Saman Bank liquidity risk is measured by using the Value at Risk. Researcher hypothesis is that reduction of the risk is during 2002 to 2007. For hypothesis testing, analysis of test used procedures Cox-Stuart. Finally, the results indicate liquidity risk has decreasing trend during the studied period.

- Maryam Shabani Motlagh research liquidity risk in the banking industry with using an Imperious Landa Index:

This research aim introduces an approach to measure liquidity risk using landa Index parameters as well as the best conditions for accurate predictions of daily cash. Case is considered a branch of the National Bank. Objective measurement is Landa and the cumulative distribution function of variables such as cash, average and net standard deviation of branch operation is used. Research shows that the most economical mode of historical information relating to past 3 or 4 days and 5 and 4 days anticipated future liquidity situation of banks with 100% confidence. Values of cut are according 2.4 to 2.6. Therefore reduction of Landa to less than 2.4 of branch it would face with a shortage of cash and it needs to get money.

Research Method:

Using the information of this data (net liquidity) deals with to measure liquidity risk that the fluctuations of risk are shown in 2008 to 2012 years. Following explain the formula is applied.

Since the value at risk expected for worst loss, the most accurate method is the use of portfolios distribution. Assume that $F\Delta p$ is the probability density of (Pdf) function from ΔP and C is confidence interval, so in this case the horizontal value at risk is calculated by the following formula:

$$1-C = \int_{-\infty}^{-VaR} F\Delta p(x) dx$$

For a given portfolio, if the return on the portfolio normally to be distributed with μ mean and standard deviation σ the value at risk would obtain from the mentioned procedure. From the normal standard table for a given portfolio, the α number are corresponding with C confidence level. For example if C is 95% the corresponding α would be 1.65 and if C is 99%, α would be 2.33. As the left trail is the corresponding value at risk, the actual cut is $-\alpha$, as you see in 1-4 diagrams.

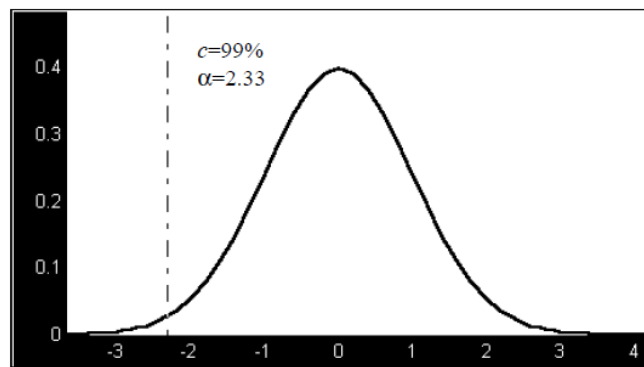


Diagram1-4:normal standard curve with 99% accuracy

To obtain the value at risk, it is a standard conversion can be done as follows:

$$\alpha = \frac{Z - \mu}{\sigma} \quad , \quad Z = -VaR \quad , \quad \alpha = -\alpha$$

Then we can write:

$$VaR = \sigma\alpha - \mu \quad \text{(Formula 4-1)}$$

Hence if $F\Delta p(x)$ is cumulative distribution function (cdf) for ΔP the equation will be written as follows:

$$1-C = \int_{-\infty}^{-VaR} F\Delta p(x) dx = F\Delta P (-VaR)$$

So, as seen in this study, the formula (4.1) is used to measure the value at risk in the following sections that will describe each of these formulas in below. (Dai Bo,2001)

In order to obtain the liquidity risk of the end of each month the amount of liquidity that is needed here is the information collected from the bank daily that the sum of these data and eventually 61 data is available to obtain a figure for each month

.σ indicate the standard deviation. Then 12 standard deviation first data will obtain in the next phase standard deviation of 12 other data is obtained by excluding the first data and so data from 12 to 12 and minus one standard deviation from the baseline values can be calculated.

α is considered the confidence level, where here considered 99% that the corresponding Z of this confidence level is 2.33.

The μ indicator is data average. Average data is computed by exactly the same standard deviation, means it would takes first 12 data then the average the next 12 data minus first data is calculated and the same way until the end of the 61 data "Is computed similarly to the end of the 61 are calculated. Then, as can be seen in the formula, the obtained individual deviation, multiplied the level of confidence that is 2.33.

Finally to obtain the value at risk should minus each average of obtained numbers from multiplied standard deviation to 2.33. The value at risk or liquidity risk shows for each month. Then after calculation of net amount of liquidity can be provided to the first hypothesis that was originally intended the trend of this risk will estimate in second rate Keshavarzi Bank risk. Then the H0 hypothesis defines as bellow:

H0= trend is not statistically significant in the data

H1= trend is statistically significant in the data

Before we review the model reliability or stability must be tested. In fact the aim of this is evaluation of false or true estimation. In time series data, the unit root test should be carried out to determine the reliability or stability time series variables. Following two assumptions are considered:

H0 = Considered time series, is steady

H1 = Considered time series, is not steady

As mentioned, the unit root tests on liquidity risk are considered that the results are in table (1-4):

Table 1-4: liquidity risk variable unit root test result

Dicky fuller value	Critical value 10%	Critical value 5%	Critical value 1%	Durbin-Watson stat
-5.14	-2.60	-2.92	-3.58	1.94

Source: research findings

As you see in table 4-1, Watson camera statistic level that has the value of 1.94 is more than the critical values of the test that it means -3.58 and -2.92and -2.60 and this represents a disturbing statement is dynamic or static. On the other hand, the absolute value of the number -5.14 is higher than the critical values for the test that his demonstrates the reliability of the

model. In other words, these figures show the considered number is static, so there is no need to take the first-order difference. Actually the Dickey Fuller test, tells the regression is fake or real. So in the test H0 assumption be accepted.

As mentioned, to get the amount of liquidity risk, the liquidity of one of the Keshavarzi Bank branches has been used. Then standard deviation and mean liquidity has been calculated and with 99% of confidence in (4-1) formula has been placed. Accordingly, liquidity risk was obtained for 2008 to 2012 years. After obtaining the amount of risk, the statistical significance of the data evaluation is discussed and the trend of risk in Keshavarzi Bank will be considered. To reach above aim the (2-4) formula was used.

$$VaR = \alpha + \beta VaR (-1) + c VaR (-2) + d VaR (-3) \quad \text{Formula (2-4)}$$

In formula (2-4) autoregressive process the third order can be seen, in fact the whole formula is given as a lump sum, which can be divided into smaller parts and thus the results were analyzed separately for each phase. In fact, it can be stated that the level of liquidity risk over a period of itself (The same as a month earlier) and in next steps and in the two or three previous period it's estimated. It means at first, the estimation of the first order, second order approximation in the second step, the third-order approximation in the third step and finally estimation of the first and the second and third will be done at the same time that further each of these steps will be explained.

First State:

In the first state, the liquidity risk is estimated that over a previous period that for a first-order estimate of the formula the Eviews software will be used:

$$VaR = \alpha + \beta VaR(-1) \quad \text{(Formula 3-4)}$$

Table: 2-4 : result of first order estimate liquidity risk

value	index	
0.803	R-squared	
2.192	Durbin-Watson stat	
188.483	F-statistic	ANOVA regression model
0.000	Probability value	
15254412	coefficient	Constant regression model
13.728	t -statistic	

Source :research findings

As you seen in table (2-4), this equation can be justified in terms of significance. Because its possibility is less than 5%, no matter how small the amount is likely to be close to zero, it indicates that the model fit is correct and the explanation is for a correct model. Because here, the likelihood is zero, then it is clear that the model fit well and is reliable.

The coefficient for liquidity risk has been obtained is a positive acceptable value that shows 89% of liquidity risk at the present time follows the amount of the risk in an earlier time and previous period affects effects this period results. Indeed, the monthly data on an annual trend is observed.

The obtained t (13.7) is also acceptable, in fact as long as this stat amount is more than 2 the hypothesis will be considered and acceptable.

The R (coefficient of determination) obtained also shows that 80% of the variability (liquidity risk at the present time) by the independent variable (liquidity risk in a prior period) is described and the accuracy of the model is sufficient to justify this percentage.

Here the Watson camera statistic is 2.192 that shows a disturbing statements are not correlated to each other and doesn't have correlation .The amount of F statistics also shows an acceptable value. Level of accuracy statistic shows whole model correction.

Second State:

The liquidity risk is estimated in two periods that it came before it, that the formula (4-4) is shown:

$$VaR = \alpha + c VaR(-2) \quad \text{(Formula 4-4)}$$

Again ,the variables according to the formulas (4-4) were placed on the software and the results can be seen in Table 4-3:

Table 4-3: resulting second –order estimates of liquidity risk

value	index	
0.683	R-squared	
1.261	Durbin-Watson stat	
97.180	F-statistic	ANOVA regression model
0.000	Probability value	

25494268	coefficient	Constant regression model
9.858	t -statistic	

Source :Research findings

Test indicates that the probability is zero, the model is fitted correctly. Than the other 82% of the value of risk changes the course of his two terms is related to changes in risk.

Greater precision can be seen that the value of R2 (the coefficient of determination) is 68%, this amount is not enough to justify the accuracy of the model. So, this model is rejected by the bank's point of view and it's not reliable, because the bank shall determine the coefficient is above 70 to be acceptable. Well as the camera parameters Watson should be about 2 to acceptable results as you can see the value of this statistic is 1.26 which returns the desired value does not justify.

The results show that the probability that liquidity risk is to follow the course of his two terms as before is weak; In fact this result is obtained in the second stage to estimate the data statistically justified are not significant.

Third state:

Liquidity risk in the next state over three rounds before his time is estimated that in the formula (4-5) is evident

$$VaR = \alpha + d VaR(-3) \text{ (Formula 5-4)}$$

Table 4-4 : estimate the liquidity risk resulting third order

Value	Index	
0.619	R-squared	
0.700	Durbin-Watson stat	
71.599	F-statistic	ANOVA regression
0.000	Probability value	
3127412010	Coefficient	Model
8.461	t -statistic	Constant regression model

Source :research findings

As you see in 4-4 table, in this case, as in the previous case, the risk is estimated over three periods before himself. Test indicates that the probability is zero, the model is fitted correctly. On the other hand, 78% of the value of risk changes the risk of change is dependent on previous periods. However, it is seen that the coefficient of determination R2 is 61%. The accuracy of the

model is not sufficient to justify the amount again. The other side of the camera base Watson is not even close to that shows disturbing sentences are interdependent and this causes the error.

Fourth State:

In this section we estimate the effect on liquidity risk is shown three times and in fact the liquidity risks over a period of two or three rounds before his term are estimated. Then

$$VaR = \alpha + \beta VaR(-1) + c VaR(-2) + d VaR(-3)$$

(Formula 6-4)

Table 5-4 : thus estimate the first and the second and third liquidity risk

Value	Index	
0.808	R-squared	
1.929	Durbin-Watson stat	
59.228	F-statistic	ANOVA regression Model
0.0000	The probability of a first-order estimate	
0.92008	The estimated probability of second	
0.342	The estimated probability of third order	Constant regression model
0.774454	The estimated coefficient of first order	
-0.003077	The estimated coefficients of the second order	
0.147033	The estimated coefficient of the third order	
5.047	First order estimate of the value of t-statistics	
-0.015	The second estimate of the value of t-statistics	
0.959	Third-order estimate the value of t-statistics	

Source :research findings

According to Table 4-5 to estimate the probability of the first order is zero and that indicates that the estimated model is the first order of fit goodness and the model explanation is correct. However, estimates of the probability of the second and third values are 0.98 and 0.34, both values are greater than 0.05 and the assumptions there, if you are having a good fit to estimate the probability that it is less and from 0.05 to zero as possible.

Risk ratio for a prior period has been obtained, indicating that the risk of each period, 77 percent of the risk is related to its previous period. At Second case, the second order approximation to a negative value(-0.0030) indicates that this is indicative estimates are negatively estimated time before is related. This suggests that these risks cannot be calculated using two before cycles. In continue is seen in triple estimation that 14% of time the liquidity risk explains at present time.

T base for first-order estimation is 5.04 and for the second order approximation, is -0.015 for the third-order approximation, is 0.95, while the base t amount should be more than 2 to the considered hypothesis be acceptable.

Due to the amount of three times the estimate, the total numbers that were obtained for the first stage estimates were more than justified. That is, assuming H0 is rejected in a first-order estimate, but the estimate of the second and third hypothesis H1, which represents a significant trend in the data, is rejected. Because only a first order estimate plausible explanation is that liquidity is going on and could just days before his Finally, "months before its to follow. Follows the plot of the monthly data is shown as well as the liquidity risk.

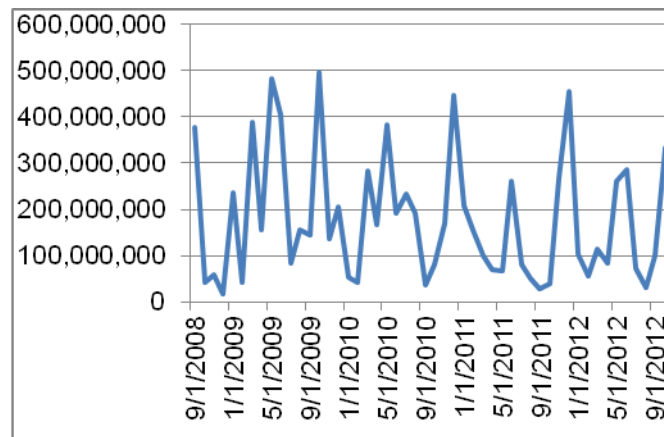


Figure 2-4: the cash monthly data over 2008 years from 2012

Source: research findings

As can be seen in Figure 2-4, the monthly changes of liquidity, suggests that liquidity over time, almost a natural process but the trends are sinusoidal shape. Because they may one day liquidity to banks for various reasons, including an increase in deposits, checks are divesting. Increases other reasons, such as depositing and withdrawing subsidies and reduced liquidity shortage faced by bank customers. Required to process the data in three months has been considered.

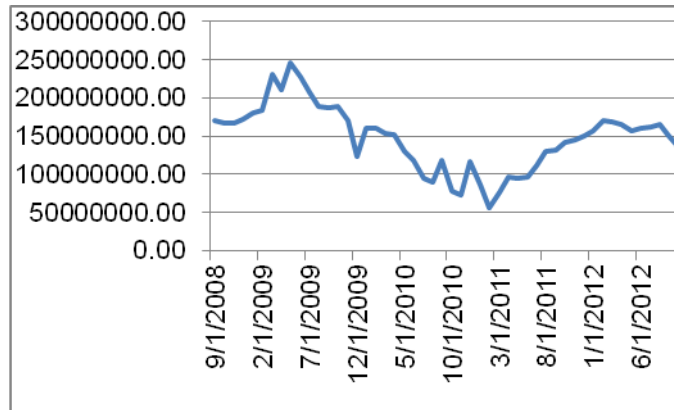


Figure 3-4: the liquidity risk during 2008 to 2012

Source :research findings

The liquidity risk is shown in Figure 3.4 which indicates that from half2008 to 2010, the risk is increasing in the first quarter and the first quarter of 2010 to late 2011 continues its downward decline and back to the early 2010 to half2012 increases. It had to be followed was that because of the risk of several trends over the years have either been however, the overall risk balance of the proceeds, but has many variations. Now the reasons that cause these fluctuations have been divided into two categories:

1- Major Reasons

In 2010, major policy bank networks to provide the working capital facility projects were being completed. Within seven months of the year, 2010 banks, have 19 thousand billion dollars facilities. Meanwhile, Chairman of the Central Bank's cash rate will increase to 23% in 2010 years. According to the liquidity in the 2010 years will be nearly 234 trillion Toman. While the liquidity occurs in 84 liquidity was 64 thousand billion Toman during the fourth development program that was really the four-fold.

Meanwhile, the manufacturing sector due to recession demands pending amount to 50 trillion Toman by the end of the process, it appears that the year of 2011 well as the continued will be found. The same banks are special measures to reduce the demands placed on the agenda but were postponed due to the special conditions governing the manufacturing downturn, banks are not rewarding absence. Ghazavi said, frost and drought in 2008 led to 11.3% decline in the Keshavarzi sector is facing another risk factor it is during these years. Then it can be said that because of pending claims and skyrocketing bank liquidity during chilling and drought in four years and the liquidity risk of banks, the Keshavarzi Bank has been increasing over the years, including 2008 to 2010 Than 2010 years on the other side of the mid to late 2011 shows the estimated economic value added activities. That is the main reason for the increase in the growth rate of GDP in 2011 years due to the growth of value added in agriculture, oil, industry, construction, trade, hotel, transportation, storage and communication, financial institutions and financial services .Ghazavi(one of the authorities of the Central Bank) stated in 2010, the Iranian economy Monetary support measures—with favorable financial and agricultural sectors also improved by more than 27 percentage points of growth was 16.4 of Central Bank official said the country's stock 2010 years since the end of 2011 years was associated with higher

indices . Index of shares in 2011 years is more than in the previous year to 85.8% rise in rates number of shares trade. In the past 2011 years had a 19% increase over the previous year. Approximately 81.6% of the total turnover in the previous year and 18.4% in the first market in the stock market took place, as well as the value of stocks traded during the period under review increased by 18.4 percent over the previous year to reach 218,055 billion Rials. Maybe that expression of liquidity risk has been reduced over the years. Might be due to increased liquidity risk again the harsh sanctions targeting other countries and the law subsidies can be expressed. Because due to certain circumstances, having regional and core technology, trade and trade with the other countries that have refused to coincide with the law targeted subsidies, which in the end may be due to factors such as liquidity risk in banks, Keshavarzi bank.

2 - Minor Reasons

The reasons for the split, for reasons that are specific to the agricultural bank and the climate within the organization and management of the organization occur. In 2008 to 2010 years due political conditions of the society and the runoff election approaching, the banks in terms of the investment were not in good condition and considering the situation seriously was not clear, people have attempted to draw out their deposits, this could be a severe blow to the agricultural bank and make it up by being 3 is visible during 2010 to 2011 years for action to eliminate Iran's Central Bank banking cycle and on the other hand, because the transition – the risk that the bank in Figure 4 . Greater public confidence in the election period, the amount of deposits increased by reducing liquidity risk was small but important reasons. During 2010 and 2012 years due to the deposit subsidies, the bank was forced to hold the extra liquidity and because an estimated 80% to 2010% cash subsidy was removed, and this happened 10 days in a month's (i.e. 30% a year) occurred, and subsequently turnover Liquidity risk Liquidity risk is also increased, and this led to an increasing rate has been over the years. We can see this issue in 3-4 diagrams obviously.

Research results:

The main objective of this study was to measure liquidity risk using a secure and reliable way without spending too much money and time. Methods used at the Risk are a new method for the calculation and measurement of risk. Purpose of this study is the significant trends in the data. Study of the same monthly data values obtained for liquidity risk that macro and micro trends in different years had different reasons. Than other more minor assumptions to calculate estimated Were justified because of increased liquidity risk and 2010 to 2011 years of data followed the trend and liquidity risk reduction is more significant and finally, between 2010 and 2012 years can say that again, this risk has increased over the years do not show a significant trend in the data . Of course, it is worth noting that the results achieved both branches of the Keshavarzi Bank in Tehran's degrees are included, which might be extended to second rate branches in other city in the result.

Risk Reduction Approaches:

According to the study, now we can state the strategies and measures to reduce the risk:

1. Variety of deposits and minimize the focus on a single source of deposits that it can make a significant amount of loss brought forward to certain time.
2. Reduce reliance on funds in the interbank market.
3. Access to funds from the partners.
4. Maintaining appropriate levels of cash assets.
5. Deposit insurance trust that will prevent.
6. Match the maturity structure of assets and liabilities based on management control and monitoring of loans to deposits.
7. Establish lines of credit with other financial institutions to obtain short-term credit lines, in fact, get help from other large banks or the central bank in an unexpected emergency situation.

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