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Time Varying Behavior of Credit Risks

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Abstract: In this research, the effect of realized and optimal credit risks status of accepted banks in Tehran Stock Exchange in different periods and in different time conditions, during the periods 2005-2017, has been investigated. The results of the research hypotheses show that the calculated optimal credit risk is a function of time and an optimal level of credit risk should be selected according to the time examined. It is worth noting that in the course of explanatory variables has a significant effect on credit risk, the rate of return on assets and return of equity also has a positive effect on credit risk.

Keywords: Optimal Credit Risk; Realized Credit Risk; Variable Time Varying Behavior

1. Introduction

The credit risk is defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms. The goal of credit risk management is to maximize a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters. Usually, two types of credit risks are seen in the literatures, namely, actual (realized) and optimal credit risks. The actual risk is the level of occurred credit risk while the optimal credit risk means choosing a level of credit risk that increases the bank's returns; see Barakova and Pavlia (2014).

According to the standard banking theory, at the optimum level of credit risk, bank profit reaches its maximum. This optimal level is rotational for the bank and is higher in periods of high profitability opportunities for banks compared to the realized credit risk, but it decreases rapidly during periods of financial turmoil, see Kusi *et al*. (2017).

The empirical literatures, often, neglected the distinction of realized and optimal credit risks. They have forgotten that the realized and optimal levels of credit risk are not equal, practically. Three main reasons for this mismatch are

(i) Banks like companies that not are able to choose the optimal level or combination of risky assets, this situation is exacerbated during the period of increased uncertainty; see Barakova and Pavlia (2014).

(ii) Banking is known for its not-so-good herding behavior, a behavior commonly attributed to the choices of leading banks or changing attitudes about the regulatory and macroeconomic environment. The history of banking crises has shown that herd behavior can be one of the most important elements in banks' sub-consol risks in any good and bad economic climate, see Kusi et al. (2017).

(iii) Thirdly, and perhaps the most important reason is the overdue heterogeneity between assets and liabilities, which is in essence banking business and implicitly means that the quality of bank balance sheets can be rapidly degraded due to negative events caused by depositor's behavior, see Makri and Papadatos (2014).

However, the empirical results show that monetary policy will change as optimal credit risk behaves time varying. For example, about interest rates and Fed rates, it is seen that

- Low interest rates increase the average risk behavior of banks for three main reasons.

(i) Changing from the top-down interest rate environment can free financial institutions from long-term fixed-term contracts and they will seek risky investments to pay their debts, see Vallascas and Hagendrorff (2013).

(ii) Low rates will increase the value of assets and collaterals and reduce price volatility, which in turn will downsize estimates of banking risk and encourage higher risk situations.

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(iii) Committing the central bank to keep future interest rates low in the event of a threatening shock will reduce the likelihood of large undesirable risks, thus encouraging banks to accept larger risks. According to the above, it is expected that monetary policy will have a direct impact on credit risk, see Delis and Karavias (2015).

- In the united states, in good economic periods, the Fed has incentives to raise interest rates, and in these periods where the optimal level of bank credit risk is higher than the realized risk, they have shown that monetary contraction not only reduces realized credit risk but also increases the level of optimal credit risk, so in both good and bad periods, the choice of optimal monetary policy by the Fed increases the level of optimal credit risk. With the aim of smoothing the trading cycle, it causes the balance of the realized credit risk level to be out of balance. This finding has implicit results for policy making in both monetary policy and banks' precautionary regulations, see Valencia (2014).

For most of banks, in good economic periods, the optimal credit risk moves ahead of the trading cycle, while the realized credit risk is tightly behind the trading cycle. However, in bad economic conditions, the optimal credit risk is larger than the realized credit risk. Hence, the central bank's monetary policy, considering the business cycle, always increases the gap between balance and realized credit risk of banks. This is because the monetary policy in good economic periods reduces realized credit risk, but increases optimal credit risk, similarly, expansionary monetary policy in bad periods increases realized credit risk and reduces the risk of optimal credit risk; see Makri and Papadatos (2014). As a result, banks may be in a situation where in good economic times their credit risk is less than optimal risk, while in bad economic times they are at higher risk than optimal risk, which will be the outcome of both situations lower than optimal returns, see Valencia (2014).

The above discussions show that the optimal credit risk has a time varying behavior of this time varying causes a time varying behavior in the monetary policy and reversely, in business cycles and good or bad economic conditions, monetary policies are modifies by the central bankers which itself makes the optimal credit risk changes period to period. In this paper, the time varying behavior of optimal credit risk is studied. Two main variables indicating the credit risk are risk weighted assets (RWA) indicator and as well as the NPL. It is interested that if the optimal credit risk (derived using these two variables) is time varying, in two cases when these variables are seasonally adjusted or not? To find the optimal risk, a quadratic panel regression between banking return (ROA) and each of RWA NPL, interchangeably, is run and by optimizing these relations with respect to risk indicator (RWA/NPL) and their seasonal dummy indicators the optimal credit risk level is derived. It is seen that the optimal level depends to seasonal dummy variables. Then, using the Wlad test, it is checked if the coefficient of seasonal dummy variables are zero, simultaneously (in both cases, when RWA and NPL are seasonally adjusted or not)? The rest of paper is organized as follows: In the next section, some literature review is proposed. Data collection and theoretical aspects of paper is then proposed. Empirical results are derived and finally, conclusions are given.

2. Materials and Methods

In a study entitled "The Effect of Credit Risk on The Performance of Iran's Banking System: An Inter-Banking Study with VAR Panel Approach", Angeloni and Faia (2010) concluded that a single one, as much as a standard deviation in credit risk, reduces banks' liquidity, asset returns and banks' profitability. Based on the results in the long run, credit risk has little role in determining the profitability of banks, but liquidity and return on banks' assets are significantly affected by credit risk in the long run. As a second result, they concluded that, during business cycles, the actual credit risk has different behavior leads to different scenarios in monetary policy taken by the central bank.

Reviewing the factors affecting banks' credit risk in Tunisia during the period 1995-2008, Zribi and Boujelbene (2011) concluded that public ownership and asset return ratio had a positive relationship with banks' credit risk and that cautionary capital regulations, capital adequacy ratio, economic growth; inflation, exchange rate and interest rates had a negative effect on credit risk. The relationship between nonperforming facilities and macroeconomic performance has been investigated by two complementary methods in developed countries. In the first method, using panel data shows that negative macroeconomic changes are associated with increased nonperforming facilities. In the second method, the effect of feedback between nonperforming facilities and macroeconomic conditions is investigated using the vector autoregressive panel model. They derived the optimal credit risk level and showed that it is different fundamentally with actual risk. They investigated the behavior of optimal risk level during different period of study.

Luzis *et al*. (2012), in a study entitled "Factors Affecting nonperforming debt ratio to total grant facilities", have concluded using dynamic panel data for Greece that interest rates, unemployment rates, GDP growth rates and government debt, as well as the quality of bank management can explain the ratio of nonperforming debt to the total grant facility. They conclude that, since these macroeconomic variables change periodically, and then the optimal credit risk has time varying behavior.

Acharya (2014), using vector autoregressive model and datafrom1979 to 2011, has investigated the nonperforming demands. Based on the results of the analysis of the variance of the model in the long run, approximately 67.4% of the dependent variable changes of the model, i.e. the ratio of nonperforming demands to banks' payment facilities by their past values, 7.6% by oil revenue fluctuations index, 3.9% by inflationary fluctuations index and approximately 26.19% by budget deficit fluctuations. It is seen that these empirical results will change as soon as the macroeconomic random variables change and treat seasonally. Therefore, the optimal credit risk in this economy, certainly, will affected by time varying behavior of these variables and therefore, there is a need of dynamic monetary policy as time passes.

Makri and Papadatos (2014) used the total amounts of nonperforming facilities as banks' credit risk and concluded that unemployment rates, government debt and nonperforming facilities of the previous period had a positive effect on banks' credit risk and capital adequacy rates, Kusi *et al*. (2017) in a research titled "Bank Credit Risk and Credit Sharing in Africa" Customers have paid. They also concluded that the optimal credit risk has a time varying behavior.

Battista and Marchese (2018), Analysis of the impact of macroeconomic variables on banks' credit risk, this study aimed to identify the relationship between macroeconomic variables and credit risk of Iranian banks using multiple regression method based on panel data. For this purpose, seasonal data of 13 listed banks during 2009-2014 were investigated. Sensitivity analysis is used to ensure the reliability of the variables used. In this way, the variables that were expected to have the same effect economically has been replaced with the main variables of the model. Also, using virtual variable, the effect of exchange rate jump was also investigated in the model. The results show that banks' credit risk is significantly affected by macroeconomic environment, so that with the increase of GDP, the growth of the total stock index, the credit risk of banks decreases, but the unemployment rate and exchange rate have an inverse relationship with the credit risk of banks. Therefore, the relationship between the return and risk is affected by seasonal dummy variables and therefore, the actual and optimal credit risk will show a different treatment period to period which this fact causes different monetary policy for banks taken by regulator.

2.1. Data gathering

The statistical population used in this study includes banks in Tehran Stock Exchange. Sampling methods are judgmental among all banks and financial institutions of the country and banks have been selected that meet the following requirements:

1- The fiscal year of the banks will end March 19.
2- During the review period, they have not changed their fiscal year.
3- Admission to Tehran Stock Exchange during the period 2005-2017.

Among the banks are 20 Exports, Mellat, Entrepreneur, Capital, Commerce, Parsian, Pasargad, Ansar, Saman, Day, New Economy, Iran Earth, Iranian Wisdom, Middle East, Sina, Post Bank of Iran, Tourism, Welfare, Ghavamin, Future and Bank Shahr.

The research hypotheses are expressed as follows:

1- Seasonal changes in risk-weighted assets have a significant effect on the optimal level of credit risk.

2-Seasonal changes in deferred loans have a significant effect on the optimal level of credit risk.

3-Seasonally adjusted assets have a significant effect on the optimal level of credit risk.

4-Deferred loans adjusted in different seasons have a significant effect on the optimal level of credit risk.

2.2. Theoretical model

In this sub-section, the optimal credit risk is modeled. As stated at the end of Introduction, the following steps are done to verify the time varying behavior of optimal credit risk.

(a) We first model the following profit equation. To this end, consider the following model:

$$(1) \quad \Pi_{it} = a_0 + b\Pi_{i,t-1} + a_1 r_{it} + a_2 r_{it}^2 + a_3 c_{it} + u_{it}$$

In which the π bank's asset returns are i=1,..,20 at the time of equal to credit risk, c is the vector of the bank's control variables, such as the size of the bank, the ratio of non-paid earnings. One of these old theories is Markowitz's theory, which is why this relationship is assumed in the presence of some other control variables. Here canu_{it} be analyzed in such a way that the fixed effects of time, the constant effects of the bank and the disruption $\lambda_t v_i e_{it}$ remain, in this case we will have:

$$(2) \quad u_{it} = \lambda_t + v_i + e_{it}$$

(b) To find, the optimal credit risk, from the equation above, we identify the level of "r", which π is maximized by determining the relative derivative to the ratio of "r".

$$(3) \quad \frac{\partial \Pi}{\partial r} = 0 => r = -\frac{a_1}{2a_2}$$

Considering the retrospective of the profit, we will recount the equation Π_{it} as follows:

$$\Pi_{it} = a_0 + b\Pi_{it-1} + a_1 r_{it-1} + a_2 r_{it-1}^2 + a_3 c_{it-1} + u_{it}$$

(c) In order to investigate the changes in the optimal level of credit risk over time, it should be noted that the variables examined in this research, including bank profit or credit risk πr or c are control variables that are affected by seasonal influences. For this purpose, we consider virtual q_j variables, i.e. $j = 2,3,4$, each of whichq_2 represents a seasonal year (three months). These variables affect the regression level, both in the risk variable and in its second power; hence, we consider the following model:

$$(4) \quad \Pi_{it} = a_0 + b\Pi_{i,t-1} + a_1 r_{i,t-1} + a_2 r_{i,t-1}^2 + a_3 c_{i,t-1} + \sum_{j=3}^{4} f_j q_j r_{i,t-1} + + \sum_{j=3}^{4} g_j q_j r2_{i,t-1} + \sum_{j=3}^{4} h_j q_j + u_{it}$$

In this section, we will discuss whether the optimal level of credit risk changes with time, and it can be seen that the optimal level of credit risk in each t quarter is calculated from the following equation:

$$(5) \quad \frac{\partial \pi_t}{\partial r_{t-1}} = 0 => r_{t-1} = -\frac{a_1 f_j}{2(a_2 + g_j)}$$

It is natural that it has not been zeroed f_j and $g_j$confirms the hypothesisof the effectiveness of seasonal changes, according to the description of the article; we use standard weights, based on the document of the Basel Committee (2011). To check the time varying behavior of optimal credit risk, we test if f_j and g_j are zero simultaneously zero, using the Wald test.

(d) In practice, in order to eliminate the effects of these variables, we need to estimate the effects of seasonal variations using virtual variables such as, D_2 D_3 and D_4 estimate the method of estimating ordinary least squares on the fixed effects model:

$$(6) \quad X_{it} = b_0 + b_1 D_2 + b_2 D_3 + b_3 D_4 + \varepsilon_{it}$$

Then calculate seasonally modified variables:

$$X_{it}^{adj} = \hat{\varepsilon}_{it}$$

(f) Again, we will test (using the Wald test) whether seasonally adjusted variables also cause seasonal changes in the model. Before introducing the model on which the hypotheses are tested, the research variables are introduced first.

Table 1. Research Variables

Operational definition	Type	Symbol	Variable Name
Total ratio of bank profit after tax deductions in total bank assets	Dependent	ROA	Return on assets
Sabbath capital oversees risk-weighted assets (Calculated ratio based on wing	Independent	Cap-A	Capital adequacy ratio
Ratio of equity to total bank assets	Independent	Capital (ratio)	Capital ratio
GDP growth rate	Independent	Growth	Growth
Ratio of non-shared (non-interest) earnings on total bank income	Independent	Non-interest income	Ratio of non-interest income
Ratio of non-current claims (overdue claims + deferred claims + suspicious claims) on the total grant facilities	Independent	NPL	Ratio of non-current claims
Logarithm of bank assets	Independent	Bank size	Bank Size
The ratio of granted facilities in the housing sector to the total grant facilities	Independent	Maskan	Ratio of housing facilities
Ratio of cash assets and cash equivalents on total bank assets	Independent	Liquidity	Liquidity ratio
The ratio of storing suspicious claims on the sum of grant facilities	Independent	Loss loan	Loan loss reserve ratio
Ratio of bank risk assets to total bank assets	Independent	Risk weighted assets	Risk-weighted assets
The ratio of suspicious claims on the sum of grant facilities	Independent	Mashkok	Questionable demands
Second power of nonperforming claims	Independent	NPL^2	Second Power NPL
Second power of risk-weighted assets	Independent	Rwa^2	Second Power RWA

Based on the theoretical model of the research, our models are written in the form of regression model as follows:

Model 1 : NPL as risk factor

$$\begin{aligned}\mathrm{ROA}_{it} = \beta_0 &+ \beta_1 \mathrm{ROA}_{it-1} + \beta_2 \mathrm{Capital}_{it} + \beta_3 \mathrm{Cap\_A}_{it} + \beta_4 \mathrm{Growth}_{it} \\ &+ \beta_5 \mathrm{Non-interest\ income}_{it} + \beta_6 \mathrm{Bank\ size}_{it} \\ &+ \beta_7 \mathrm{Maskan}_{it} + \beta_8 \mathrm{Mashkok}_{it} + \beta_9 \mathrm{Liquidity}_{it} + \beta_{10} \mathrm{Loss-loan}_{it} \\ &+ \beta_{11} \mathrm{Risk\ weighted\ assets}_{it} + \beta_{12} \mathrm{Rwa}^2_{it} + \varepsilon_{it}\end{aligned}$$

Model 2 : RWA as risk factor

$$\begin{aligned}\mathrm{ROA}_{it} = \beta_0 &+ \beta_1 \mathrm{ROA}_{it-1} + \beta_2 \mathrm{Capital}_{it} + \beta_3 \mathrm{Cap\_A}_{it} + \beta_4 \mathrm{Growth}_{it} \\ &+ \beta_5 \mathrm{Non-interest\ income}_{it} + \beta_6 \mathrm{NPL}_{it} + \beta_7 \mathrm{NPL}^2_{it} + \beta_8 \mathrm{Bank\ size}_{it} \\ &+ \beta_9 \mathrm{Maskan}_{it} + \beta_{10} \mathrm{Mashkok}_{it} + \beta_{11} \mathrm{Liquidity}_{it} + \beta_{12} \mathrm{Loss-loan}_{it} + \varepsilon_{it}\end{aligned}$$

In order to estimate the mentioned models, Chow test was used in the framework of Eviews10 and $Stata$ 15 software to determine the typeof combined and integrated data estimation method.

3. Results

After extracting the observations for the mentioned variables, each bank performs the pre-tests needed for the inferences during the time period, and then the appropriate method for estimating the coefficients of independent variables is selected. For descriptive and inferential statistics, Eviews10 and $Stata$ 15 software's were used to analyze the collected data. Finally, a multivariate linear regression model of hybrid data is used to test the research hypotheses.

Descriptive statistics of variables such as mean, median, maxim, minim, standard deviation, skew and elongation are listed in Table 2. Based on the results about skew and kurtosis, the dependent variable is normally distributed.

Table 2. Descriptive statistics of dependent variable

Variable	Average	Middle	Max.	Min.	Stdev.	Skew	Kurtosis	JB sig
ROA	0.0142	0.0117	0.0914	-0.029	0.0152	0.147	3.29	0.137

The study of these numbers with the opinions of bank experts shows that the accuracy of the data is not a problem.

Table 3. Descriptive indicators of some independent variables

Variable	Average	Middle	Maxim	Minim	Standard Deviation
Capital	0.091989	0.063703	0.969639	-0.32794	0.119876
Cap-A	0.105803	0.0854	1.05	-0.2697	0.101918
Growth	0.024513	0.027501	0.125184	-0.07714	0.028212
Non-interest income	0.220766	0.187508	0.716388	0.3502	0.167672
NPL	0.162478	0.128045	0.451112	0.000552	0.148185
Bank size	5.079502	5.16118	6.34609	3.52284	0.625242
Maskan	1.305618	0.152705	0.856421	0.58613	11.71755
Mashkok	0.079548	0.042511	0.484172	0.010584	0.104969
Liquidity	0.133504	0.128178	0.458638	0.003275	0.048922
Loss-loan	0.026865	0.012305	0.681977	0.03508	0.06435
Risk weighted assets	0.76527	0.777168	1.32677	0.084865	0.124735

The first step to estimate the model after collecting the statistics is to investigate the manic characteristics of variables; this means that the average of variables has been constant over time and between different years. Consequently, the use of these variables in the model does not cause false regression. For this purpose, Levine, Lin and Cho stationary (in mean) test of combined data are used. The results of this test showed that all the researcher variables are static and the null hypothesis of the existence of single root is rejected.

Table 4. Independent Variable Stationary Test

Variable	Symbol	T-test	Sig
Capital ratio	Capital	-9.55689	0.0000
Growth	Growth	-10.6288	0.0000
Liquidity ratio	Liquidity	-13.0156	0.0000
Loan loss reserve ratio	Loss-loan	-10.6288	0.0000
Ratio of housing facilities	Maskan	-5.19189	0.0000
Ratio of non-boreal income	Non-interest income	-9.23744	0.0000
Questionable demands	Mashkok	-15.0491	0.0000
Bank Size	Bank size	-3.85236	0.0001
Capital adequacy ratio	Cap-A	-6.20210	0.0000

The results of homogeneity test show that the dependent random variable is not homogenize and therefore, instead of ordinary least square (OLS), the generalized least square is needed. Also, the F-Limer test (with sig: 0.001) indicates that there is a serious need to use the panel regression and since the lag of dependent random variable is used in the right-hand-side of all regression models, therefore the generalized method of moment (GMM) is needed. Also, VIF test indicates that there is no co linearity fault in no regression model. To keep the paper in a reasonable size, these values are not given.

In order to estimate the model, it is necessary to investigate the factors causing credit risk, the type of data panel estimation method, the nature of the model indicates that this model has been from the first order and to estimate it, the dynamic integrated data model is more suitable for the dynamic integrated data model, the application of the conventional least squares method will not be bug less, so in the following, The model will be estimated using efficiency estimation methods. In this section, in addition to estimating the model by GMM method, the model is estimated using GLS method (conventional integrated data) to compare the two methods and show the superiority of the estimate by GMM method. In governments 5 and 6, they are valid when the significance level is below 0.05.

Table 5. Results of GMM Estimation in Model 1

Variable	Sig	Z	Standard error	Coefficient
C width of origin	0.000	4.02	0.0136377	0.054756
ROA_{-1}	0.000	99.91	0.0087547	0.8746526
Mashkok	0.234	-1.19	0.002375	-0.0028275
Maskan	0.616	0.50	0.0000336	0.000169
Capital	0.022	2.28	0.0056732	0.0129599
Cap-A	0.025	2.24	0.0065958	0.0147907
Growth	0.001	3.22	0.0065437	0.021058
Liquidity	0.683	0.41	0.0097554	0.00398
Loss_loan	0.000	-4.64	0.0132537	-0.0615103
Non-interest income	0.000	8.06	0.0044123	0.0355732
Risk weighted assets	0.007	-2.72	0.0098292	-0.026743
Bank size	0.008	-2.66	0.0008571	-0.002287
Rwa^2	0.000	5.59	0.0070751	0.0395845
G2R2	0.011	-2.54	0.0092885	-0.0235978
G4R2	0.000	-4.20	0.0077517	-0.0325295
G3R2	0.006	-2.72	0.0087391	-0.0238042
F2R	0.046	2.00	0.0076488	0.0152816
F3R	0.038	2.08	0.0072311	0.0150253
F4R	0.001	3.20	0.0065333	0.0209211

Except the liquidity variable, coefficients of all other variables are significant at type I error level 0.05. It is interesting that the coefficients of dummy variables (seasonal components) are statistically significant, indicating, may be a time varying behavior of optimal credit risk may be necessary.

Table 6. Results of GMM Model Estimation in Model 2

In the face of independent variables with seasonal components

Variable	**Sig**	**Z**	**Standard error**	**Coefficient**
C width of origin	0.514	65.0	0.0157721	0.0102846
ROA_{-1}	0.000	62.09	0.0128318	0.7967227
Capital	0.000	3.78	0.0109237	0.0412773
Cap-A	0.0309	-3.02	0.010053	-0.0102222
Liquidity	0.000	-4.56	0.0192937	-0.0879406
Maskan	0.789	-0.27	0.0000848	-0.0000227
Bank size	0.000	-4.20	0.0025309	-0.0106226
G2R2	0.001	-3.34	0.0116848	-0.0390056
G4R2	0.026	-2.23	0.0097261	-0.0216562
G3R2	0.019	-2.34	0.0111868	-0.0261927
F2R	0.006	2.76	0.0094865	0.0261666
F3R	0.079	1.76	0.0090953	0.0159708
F4R	0.139	1.48	0.0080467	0.0118983
NPL	0.000	-8.03	0.0228076	-0.1830894
NPL^2	0.000	10.57	0.0180453	0.1907154
Non-interest income	0.000	9.17	0.0081187	0.0744865

Variable	**Sig**	**Z**	**Standard error**	**Coefficient**
Mashkok	0.017	-2.38	0.0061709	-0.0147171
Growth	0.058	1.90	0.0224558	0.042618
Loss-loan	0.000	-6.07	0.0160384	-0.0973867

Here, the Maskan variable is not significant. However, again, the coefficients of seasonal components are significant at level of type I error 0.05.

The results of Wald test for concurrency equality hypotheses of zero seasonal adjustments are shown at the bottom.

Table 7. Wald test results for the first hypothesis

Test Name	**Null**	**Statistic chi2**	**Probchi2>**
Wald Test	$fi = gi$=0	16.78	0.0023

Table 8. Wald test results for the second hypothesis

Test Name	Assumption zero test	Statistic chi2	Probchi2>
Wald Test	$fi = gi$=0	37.25	0.0001

It is inferred from the tables above is the rejection of the assumption of null and the significance of seasonal adjustment variables. To test hypotheses regarding the impact of risk-weighted assets, seasonally adjusted and deferred loans, seasonally adjusted, we act on the optimal level of credit risk as follows: To D_2 eliminate seasonal effects of variables, three virtual variables,D_3 indicating the second, third and fourth seasons, were used and the model $D_4$of estimating ordinary least squares on the fixed effects model was extracted from the equation: X_{it}

$$X_{it} = b_0 + b_1 D_2 + b_2 D_3 + b_3 D_4 + \varepsilon_{it}$$

Seasonally adjusted variables are among the estimated errors of the above model:

$$X_{it}^{adj} = \hat{\varepsilon_{it}}$$

Again, models 1 and 2 are estimated using these independent variables, Sargan test validates the model and the Wald test, where results are given in tables 9 and 10.

Table 9. Results of GMM Model Estimation in Model 1

In the field of seasonally adjusted independent variables

Variable	Sig	Z	Standard error	Coefficient
C: Constant	0.000	4.02	0.0136377	0.054756
ROA_{-1}	0.000	76.17	0.01106	0.8424322
Rwa^2 adj	0.530	0.63	0.0048904	0.0030733
Mashkok	0.324	-0.99	-0.0056348	-0.0055576
Maskan	0.653	0.45	0.0000844	0.000379
Capital	0.200	1.28	0.0078455	0.0100541
Cap-A	0.015	2.44	0.0085219	0.0207614
Growth	0.000	5.29	0.0202961	0.1072785
Loss-loan	0.000	-5.44	0.0156592	-0.0852011
Non-interest income	0.000	6.79	0.0066972	0.0454754
Risk weighted assets	0.018	-2.36	0.00042046	-0.0099317
Bank size	0.000	-4.57	0.0024327	0.0111085
G2R2	0.000	-4.00	0.0113733	-0.0454399
G4R2	0.000	-3.77	0.0091937	-0.0346843
G3R2	0.000	-3.58	0.0107788	-0.0386331
F2R	0.001	3.43	0.0092315	0.0316934
F3R	0.003	2.97	0.008777	0.0260921
F4R	0.004	2.88	0.0076424	0.0220176

Again, it is seen that the agents of seasonality components are significant.

Table 10. Results of GMM Model Estimation in Model 2

In the field of seasonally adjusted independent variables

Variable	Sig	Z	Standard error	Coefficient
C width of origin	0.000	3.78	0.0137723	0.0519935
ROA_{-1}	0.000	74.58	0.0112135	0.08362914
NPL^2 adj	0.000	-5.87	0.0157906	-0.092868
NPLadj	0.000	7.82	0.0107064	0.083772
Mashkok	0.283	-1.07	0.0056921	-0.061131
Maskan	0.674	0.42	0.0000852	0.0000358
Capital	0.046	2.00	0.0079861	0.0159674
Cap-A	0.057	1.90	0.0086319	0.0164079
Growth	0.000	4.02	0.0208555	0.0839177
Loss-loan	0.000	-5.41	0.0158179	-0.0855996
Non-interest income	0.000	8.26	0.0071619	0.0591584
Risk weighted assets	0.000	-5.44	0.0023211	-0.0126164
Bank size	0.000	-4.16	0.0024589	-0.102336
G2R2	0.000	-3.89	0.0114865	-0.0446456
G4R2	0.004	-2.88	0.0093306	-0.026883
G3R2	0.040	-2.05	0.011201	-0.0229627
F2R	0.001	3.27	0.0093272	0.0304589
F3R	0.0120	1.55	0.0090929	0.0141277

Variable	Sig	Z	Standard error	Coefficient
F4R	0.037	2.08	0.0077474	0.0161465

The results of Sargan test indicate that the instruments used in the models are valid and the results of M2 test indicate that the GMM method is compatible. According to the results of Sargan test and M2 test, it is possible to trust the validity of the torque model or dynamic panel.

In the meantime, the results of the Wald test for concurrence-zero equality hypotheses of seasonal adjustments are shown below.

Table 11. Wald test results for third hypothesis

Test Name	Assumption zero test	Statistic chi2	Probchi2>
Wald Test	$fi = gi = 0$	17.82	0.0067

Table12. Wald test results for fourth hypothesis

Test Name	Assumption zero test	Statistic chi2	Probchi2>
Wald Test	$fi = gi = 0$	39.11	0.0000

It is inferred from the tables above is the rejection of the assumption of null and the significance of seasonal adjustment variables.

4. Conclusions

As follows, three main conclusions about the optimal credit risk are presented and as well as some other aspects of paper is investigated.

4.1 Three results

(1) Explaining that the main purpose of this article is to investigate whether the optimal credit risk is time varying or not. For this purpose, first, the panel regression model is implemented and the coefficients are extracted, then, from the optimal credit risk formula, it can be seen that if Π_{it} the coefficients and f_j (i.e. the $g_j$coefficients of dummy variables of seasonal components) are significantly far from zero? It is concluded that the optimal credit risk of varies in time, even when its proxies such as NPL and RWA are seasonally adjusted. This is an important result that is widely used in monetary policy for banking regulation.

(2) In this survey, the effect of realized and optimal credit risks status of listed banks in Tehran Stock Exchange in different periods and in different time conditions, during the periods 2005 to 2017, was investigated. It can be said that in the long run, explanatory variables have a significant effect on credit risk, and the rate of return onassets and equity returns also have a positive effect on credit risk. Therefore, bank managers can take immediate measures before drastically reducing assets and not having access to market resource capital.

(3) Considering that most of the analysis for banks' performance is derived from financial statements, the following suggestions are made:

(3.1) To improve their facilitation status, also pay attention to macroeconomic factors.

(3.2) Banks and financial institutions are suggested, considering the impact of various factors in and out of banking on the behavior of individuals and economic activities, it is possible to fulfill the commitments of individuals and, consequently, create credit risk for the bank.

(3.3) In modern banking theory, there is an optimal level of credit risk that is the most profitable banking. This optimal level is changing time and higher than the credit risk realized in relatively stable periods with high profitability opportunities for banks, but in periods of chaos and beluga, it rapidly decreases to the realized subs level. Hence, adopting a contraction monetary policy in a period of stability where optimal credit risk is higher than realized credit risk increases the gap between them. Also, as a result of the adoption of expansionary monetary policy in the bad economic period where the realized risk is higher than the optimal risk, this gap also increases.

4.2 Other aspects

(1) Also, the size of the bank on the credit risk has a positive and meaningful effect. It is harder to monitor more centralized and larger banks because they have more complexity, so banks are less cautious in their lending, they act tastefully, they are less careful in paying off loans and they hope that in case of problems, governments will support them for fear of a crisis in the country. Consequently, they increase deferred facilities and reduce financial stability and bankruptcy. For this purpose, it is suggested that the banking officer provide competitive market conditions and prevent further concentration in the industry. Also, observers should have continuous control and oversight in order to maintain the financial stability of banks in line with less risky actions and activities.

(2) The ratio of capital has had a positive impact on credit risk, this result shows that the higher the amount of bank capital, the less credit risk the bank faces. Therefore, it is suggested that banks take policies and mechanisms to improve and reduce their credit risk status in order to increase bank deposits. The more the bank can attract more potential investors, it can reduce its credit risk, in the conditions of the restricted financial system that persists in the country, with the increase in inflation, and the real interest rate will be negative. This phenomenon changes the portfolio composition of economic agents in favor of physical assets (such as durable goods, land and real estate) and foreign assets such as currency and gold, which has no direct effect on increasing the country's production power. Therefore, the negativity of real profits on the one hand, for deposits, will reduce the incentives in individuals and on the other hand, it will lead to the withdrawal of bank deposits from the banking system. He said that improving macroeconomic conditions has a significant impact on bank capital attraction.

(3) The liquidity variable has a positive and significant effect on credit risk. Therefore, as the bank's liquidity increases, it should be expected that liquidity in the community will decrease or badly and consequently the money available to the public will also be reduced and the power to repay the facilities will be reduced. There is no proper planning for liquidity and financial resources in some managers, as a result, managers were also unaware of the increased risks so that they could take immediate action before the sharp decline in the value of assets and lack of access to market resource capital. Banks should try to observe the rule of positive growth in the ratio of cash assets to total assets in order to maintain banking health and prevent banking crisis.

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References

1. Acharya, V.,Engle, R., Pierret, D. (2014) Testing macro prudential Stress tests: the risk of regulatory risk weights. *J. Monet. Econ. 65*, 36-53.
2. Angeloni, I., Faia, E. (2010) Capital regulation and monetary Policy with fragile banks. *J. Monet. Econ*. 60.311-324.
3. Barakova, I., Pavlia, A. (2014) Do banks' internal Basel risk estimates reflect risk*? J. Finance. Stab*. 13, 167-179.
4. *Basel Committee on Banking Supervision, Definition of Capital Disclosure Requirements*, Consultative. 2011.
5. Battista, D. and Marchese, M. (2018) Accounting restatements: are they always bad news for investors? *Working paper*. University of Toronto. Canada.
6. Kusi, B.A., Agbloyor, E.K. and Kwadjo Ansah-Adu, K. (2017) Restatement announcements and investor size. *Working paper*. University of Texas at Dallas USA.
7. Luzis, L., Vouldis, M. and Metaxas, C. Restatement of financial statement. *Selected legal and accounting issues.* 2012. Washington D.C. USA.
8. Makri, C. and Papadatos, B. P. (2014) The contagion effects of accounting restatements. *The Accounting Review*, 83,13-23.
9. Delis, M. D., and Karavias. Y. (2015) Optimal versus realized bank and monetary policy. *Journal of Financial Stability* 53, 281-310.
10. Vallascas, F. and Hagendrorff, J. (2013) The risk sensitivity of Capital requirements: evidence from an international sample of large banks. *Rev.Finance* 17,1947-1988.
11. Zribi, N. and Boujelbene, Y. (2011) The factors ınfluencing bank credit risk: The case of Tunisia. *Journal of Accounting and Taxation.* 3, 70-78.