

Credit Scoring of Banks' Customers in Iranian Capital Market¹

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Research Paper

INTRODUCTION

In recent years, there have been many economic fluctuations that have been accompanied by various risks. This issue has increased the profitability of some companies and decreased some. This problem has caused banks to pay attention to the factors arising from the existing conditions when validating and lending to companies (Smals, 2021). In credit risk validation, people's credit risk is measured and people and customers are classified and scored based on their credit risk, and finally, they receive the credit they need from the bank (Hao and Li, 2021). Credit received by companies is received for specific purposes, which will create problems for banks if there is a problem in achieving their goals, therefore, in the current situation, banks as the largest lenders and investors have been afraid whether the companies could maintain their profitability and whether the economic growth would decrease even more or not. Most analysts have warned that there are economic fluctuations and the profitability of companies will undergo many changes. These cases have caused banks to be very careful during validation and to reduce their credit risk to increase their profits. In Iran, due to the sanctions and economic conditions, the effect of the current fluctuations on the people of the society is very wide, and therefore it is necessary to be taken into consideration by the banks. Banks must revise their validation methods to reduce their credit risk and timely collection of installments and pay attention to the factors that have emerged or will emerge under risky conditions for companies.

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To know the needs of their customers, banks should identify their characteristics in granting credit facilities. This will lead to the reduction of banking risks related to the existing conditions through validation of the conditions. Considering the complex economic conditions, banks need to pay attention to other criteria that affect the value creation of companies in addition to financial criteria. Today, banks know that various components of corporate governance affect the activities of companies due to their supervisory and management role. The components related to the capital market regarding the value of the companies as well as the external conditions of the society also affect the profitability of the companies. In short, instead of focusing on financial conditions, banks pay attention to other components for credit to face a lower risk of default (Park et al., 2022; Driss et al., 2021; Hao and Li, 2021). The main problem of the current research is to identify the factors affecting the credit rating of listed companies by banks to provide a model to validate customers in high-risk conditions and finally to test the relevant model. This research has value and innovation in the capital market because it is based on the opinions of experts and takes into account the existing conditions to validate banks specifically for granting facilities to listed companies.

Research literature: Investigating, evaluating, and measuring customer credit in financial and credit institutions is one of the most important financial and accounting decisions. The way of making decisions regarding the granting of facilities to customers is important because the lack of accurate evaluation of customers can lead to overdue, delayed, and ultimately burnout of the credit institution's claims. Because the capital of the banks is small compared to the total value of their assets, even if a small percentage of the loans cannot be collected, the bank will face the risk of bankruptcy. Currently, credit institutions use pre-determined procedures to measure the credit of customers, but since today's world is constantly changing, relying on fixed validation criteria does not have the necessary scientific validity and stability. For this reason, it is necessary to pay attention to the conditions of society and use different methods in conducting a credit audit (Estran et al., 2022; Smals, 2021; Hao and Li, 2021).

To know the needs of their customers, in granting credit facilities, banks should identify their characteristics and pay attention to other factors related to validation (Habib and Ranasinghe, 2022). This leads to the reduction of banking risks, including credit risk, through validation. Credit institutions and banks need a system for the credit rating of their customers for two reasons. The customer credit rating system provides the possibility for banks and credit institutions to reduce the risk of their credit portfolio as much as possible by relying on such a system and based on the available

assignment rates received from the applicants Choose the most reliable and low-risk customers for facilities. In credit institutions where it is possible to determine the facility rate based on the risk and credit rating of the customers, the credit rating system can help such organizations in designing their credit portfolio based on the diversity principle. Paying attention to internal controls, and providing correct and optimal financial facilities is considered one of the important activities of the banking system. Based on this, in many countries, most banks have a separate unit for credit analysis, whose purpose is to maximize added value for shareholders through credit risk management. Banks have a list of many factors regarding the facility applicant, such as his credit in the past, which is usually determined by credit rating agencies, the applicant's wealth, the rate of interest fluctuation, and whether or not collateral should be included in the facility contract. Determine and based on the mentioned information, estimate the risk or probability of customer default and manage existing risks (Islamzadeh et al, 2021; Mehrara et al, 2009).

Estimating the risk of each customer is influenced by many factors that should be considered by banks. In addition to financial factors, the related factors also include other factors. Many researchers have mentioned relevant factors in their studies. Estran et al (2022) showed that paying attention to the existing conditions and using new methods will provide a better model of customer validation. Driss et al. (2021) showed that company ownership, corporate governance, and specific economic conditions of each country also affect credit rating. Also, the findings showed that crisis conditions affect the change of banks' validation methods. Hao and Li (2021) showed that there is a significant positive relationship between information disclosure and credit rating. In the following table, the cases that have been identified in previous studies are mentioned:

Table 1: Studies conducted about credit rating

Reference	Effective factors
Serrano-Cinca and Gutiérrez-Nieto (2016) Hajiha and Bakhshi(2017) Zhang et al(2020) Verbraken et al(2014)	profitability
Hajiha and Bakhshi(2017)	liquidity
	firm size
	Financial Leverage
	cash flow
Mehrara et al (2009)	Customer capital
	Proprietary ratio
	quick ratio
He et al(2018) Mehrara et al (2009)	debt ratio
Zhang et al(2020)	Sales to equity ratio

Reference	Effective factors
Verbraken et al(2014)	Sales growth
Zhang et al(2020) Papouskova and Hajek(2019)	loan amount
Papouskova and Hajek(2019) Verbraken et al(2014)	Company expenses
Zhang et al(2020)	Interest rate
	Account average
	Sales share of the industry
Mehrra et al (2009)	Type of collateral
	resume
	Workplace ownership
Zhang et al(2020) Papouskova and Hajek(2019)	Loan term
Zhang et al(2020) Papouskova and Hajek(2019) Nazemi et al(2017) Serrano-Cinca et al(2015)	Customer credit status (history(
Zhang et al(2020)	Purpose of getting a loan
Papouskova and Hajek(2019)	Dependence of raw materials on imports (due to Iran's financial sanctions(
Park et al(2022)	board independence
	board size
	Institutional shareholders

MATERIALS AND METHODS

To answer the first question, the Grounded theory is used. The purposeful sampling method was used to sample the experts. In questionnaires based on experts' opinions, the number of respondents is at least 5 and at most 20 experts (Baby, 2013). Therefore, in this research, 10 experts familiar with the topic of credit rating of bank facilities and characteristics of listed companies were used. After the components of the regression model were determined by free, axial, and finally selective coding, the data of 64 stock companies were collected during the 5 years from 2017 to 2022. With econometric software, regression analysis of data is done based on panel analysis.

GROUNDING THEORY FOR COMPONENT IDENTIFICATION

The first research question: In your opinion, which of the information available in financial reporting (all the information included in the reports of companies, including financial statements, explanatory notes, minutes of board meetings, etc.) is useful for determining the credit rating of bank customers?

First, the results of the interview and the answers of the experts have been summarized. At this stage, the following table was provided to the experts

for final approval, and the final consensus regarding the selection of the following 28 factors was determined.

Table 2. Coders' agreement about the components

Encoder 2	Encoder 1	The information available in financial reporting	The main axis in the axial coding stage
1	1	profitability	Financial Factors
1	1	firm size	
1	1	Proprietary ratio	
1	1	quick ratio	
1	1	current ratio	
1	1	debt ratio	
1	1	Sales growth	
1	1	Company expenses	
1	1	Sales share of the industry	
2	2	Type of collateral	
2	2	resume	
2	2	Company brand reputation	
2	2	Information quality	
2	2	Workplace ownership	
2	2	Customer credit status	
2	2	Purpose of getting a loan	
2	2	Dependence of raw materials on imports (due to Iran's financial sanctions)	
3	3	board independence	Corporate Governance Criteria
3	3	board size	
3	3	Institutional shareholders	
3	3	Risk management	
3	3	Expertise of the audit committee	
4	4	Market type	Market Information
4	4	stock price	
4	4	Stock liquidity	
4	4	Stock return	
4	4	Stock risk	
4	4	Dividends paid on shares	

Considering that there is no disagreement about the core codes chosen by the coders, therefore, the Kappa coefficient is 100% and the reliability is high.

Regarding the final model, the following variables were finally identified and agreed upon by asking the opinions of two coders:

Table 3. The final predictive variables of the regression model

symbol	Variable title	Variable type	raw
Bank Facilities	Bank Facilities	Dependent Variable	1
ROA	financial factors)Return of Assets(Independent variable 1	2
ROE	financial factors)Return of Equity(Independent variable 1	3
PS	financial factors)Profit to sales ratio(Independent variable 1	4
MI	market information)liquidity Stock(Independent variable 2	5
NFF	non-financial factors (brand)	Independent variable 3	6
R	the sum of revenues (sales)	Control variable 1	7
OR	Proprietary ratio	Control variable 1	8
CR	current ratio	Control variable 1	9
QR	quick ratio	Control variable 1	10
DR	debt ratio	Control variable 1	11
SIZE	firm size	Control variable 1	12
EXP	Company expenses	Control variable 1	13
P	stock price	Control variable 2	14
R	Stock return	Control variable 2	15
RISK	Stock risk	Control variable 2	16
DPS	Dividends paid on shares	Control variable 2	17
M	Market type	Control variable 2	18
MAT	Dependency of inventories	Control variable 3	19
RST	Information quality	Control variable 3	20

Therefore, finally, hypotheses and regression models are also presented:

First hypothesis: There is a significant positive relationship between financial factors and bank facilities received by companies listed on the Tehran Stock Exchange.

$$\ln \text{Bank Facilities}_{j,t} = \alpha_{j,t} + \beta_{1,t} \text{ROA}_{j,t} + \beta_{2,t} \text{ROE}_{j,t} + \beta_{3,t} \text{PS}_{j,t} + \beta_j \text{Controls} + \delta_j + \varepsilon_{j,t}$$

Second hypothesis: There is a significant positive relationship between the company's market information and the bank facilities received by the companies admitted to the Tehran Stock Exchange.

$$\ln \text{Bank Facilities}_{j,t} = \alpha_{j,t} + \beta_{1,t} \text{MI}_{j,t} + \beta_j \text{Controls} + \delta_j + \varepsilon_{j,t}$$

Third hypothesis: There is a significant positive relationship between non-financial factors and bank facilities received by companies listed on the Tehran Stock Exchange.

$$\ln \text{Bank Facilities}_{j,t} = \alpha_{j,t} + \beta_{1,t} \text{NFF}_{j,t} + \beta_j \text{Controls} + \delta_j + \varepsilon_{j,t}$$

The information related to 64 companies in the period of 2016-1400 has been analyzed to investigate the relationship between the variables to test the research hypothesis.

EXAMINING THE NORMALITY OF THE DEPENDENT VARIABLE DISTRIBUTION

Table 4. Kolmogorov-Smirnov test to check the normality of the dependent variable of the research

result	probability value	Kolmogorov-Smirnov Z value	standard deviation	mean	Number	dependent variable
abnormal	0/000	6/16	794542	320441	320	Bank Facilities
normal	0/494	0/83	1/51	11/44	320	InBank Facilities

In the diagram below (histogram), the normality of the transformed variable is evident:

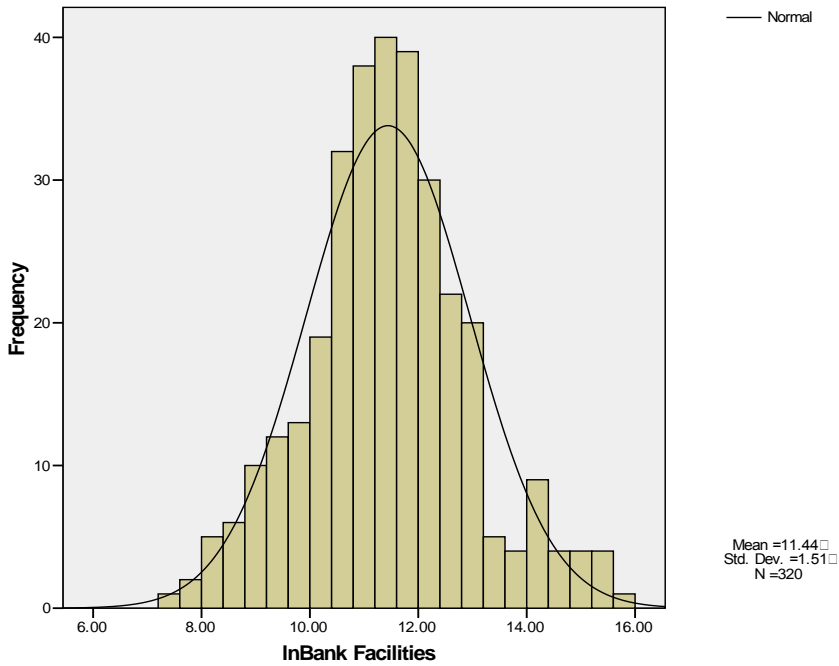


Diagram1. Normality of dependent variable

Scatter plots of the residuals against the estimated values to determine the homogeneity of variance

Not having a regular pattern in the distribution of these points can confirm the homogeneity of variance, which is one of the presuppositions of regression modeling.

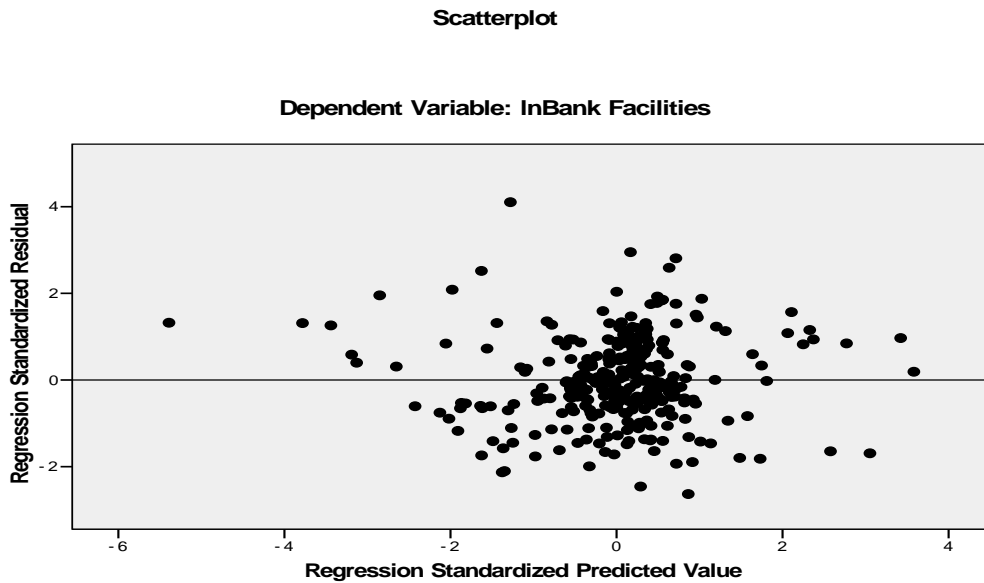


Diagram2. Scatter plots of dependent variable

PANEL ANALYSIS

The appropriate model is selected from among the models (integrated model, model with fixed effects, or model with random effects):

Table 5. Chow test and Hausman test for choosing the right model

Results	Hausman test			Chow test			Models
	probability value	Degrees of freedom	Chi-square value	probability value	Degrees of freedom	value	
Fixed effects model	0/000	10	69/14	0/000	(63,242)	11/41	First Model
				0/000	63	435/68	
Fixed effects model	0/000	6	32/15	0/000	(63,243)	10/97	Second Model
				0/000	63	421/41	
Fixed effects model	0/018	3	10/07	0/000	(63,253)	12/26	Third Model
				0/000	63	447/88	

First hypothesis: There is a significant positive relationship between financial factors and bank facilities received by companies listed on the Tehran Stock Exchange.

$$\ln \text{Bank Facilities}_{j,t} = \alpha_{j,t} + \beta_{1,t} \text{ROA}_{j,t} + \beta_{2,t} \text{ROE}_{j,t} + \beta_{3,t} \text{PS}_{j,t} + \beta_j \text{Controls} + \delta_j + \varepsilon_{j,t}$$

In the table below, the model with fixed effects is estimated, the significant probability value of F for that industry is equal to 0.000. This value is less than 0.05, so the null hypothesis is rejected at the 95% confidence level, that is, there is a meaningful model. The coefficient of determination is equal to 0.84. The value of the Watson camera statistic is equal to 1.87 and there is no autocorrelation between the residuals.

Table 6. Estimation and testing of the parameters of the First model

VIF	result	probability value	T	The amount of coefficients	parameters
-	Meaningful and negative	0/001	-3/30	-8/381	fixed amount
2/82	Meaningful and negative	0/005	-2/82	-0/014	ROA
2/26	meaningless	0/460	0/74	0/002	ROE
2/86	Meaningful and negative	0/008	-2/68	-0/008	PS
1/38	meaningless	0/592	-0/54	-0/00000001	R
2/83	meaningless	0/773	0/29	0/002	OR
1/28	Meaningful and positive	0/004	2/91	0/189	CR
2/57	meaningless	0/877	0/16	0/018	QR
1/31	meaningless	0/751	0/32	0/096	DR
2/36	Meaningful and positive	0/000	7/28	1/337	SIZE
2/35	meaningless	0/861	0/18	0/00000002	EXP
0/00	probability value F		17/40	F	
1/87	Durbin-Watson		0/84	coefficient of determination	

VIF (Variance Increment Factor) values, if its value is higher than 10, there is a possibility of collinearity between independent variables. The value of this index for variables is less than 10 and its highest value is equal to 2.86 (for PS variable). The value of t statistic for ROA is equal to -2.82 and for ROE is equal to -2.68. These values are in the area of rejecting the null hypothesis, so their relationship with Bank Facilities is significant and negative. However, there is no significant relationship between the dependent variable and ROE, due to the existence of a significant relationship between the two financial indicators and bank facilities received, the research hypothesis is confirmed. Among the control variables, the relationship between PS and received bank facilities is significant and negative, and CR and SIZE are significant and positive with received bank facilities, but other control variables are insignificant.

Second hypothesis: There is a significant positive relationship between the company's market information and the bank facilities received by the companies admitted to the Tehran Stock Exchange.

$$\text{InBank Facilities}_{j,t} = \alpha_{j,t} + \beta_{1,t} \text{MI}_{j,t} + \beta_j \text{Controls} + \delta_j + \varepsilon_{j,t},$$

The significant probability value of F is equal to 0.000. This value is less than 0.05, so the null hypothesis is rejected at the 95% confidence level, that is, there is a meaningful model. The coefficient of determination is equal to 0.80. The value of the Watson camera statistic is equal to 1.58, and the VIF values for the variables are less than 10, and all values are less than 1.47.

Table 7. Estimation and testing of the parameters of the Second model

VIF	result	probability value	T	The amount of coefficients	parameters
-	Meaningful and positive	0/000	28/96	13/353	fixed amount
1/15	Meaningful and negative	0/017	-2/40	-0/007	MI
1/02	Meaningful and negative	0/009	-2/64	-0/000005	P
1/47	meaningless	0/311	1/01	0/001	R
1/44	meaningless	0/092	1/69	0/002	RISK
1/11	Meaningful and positive	0/000	3/78	0/0000002	DPS
1/18	Meaningful and negative	0/000	-3/61	-1/775	M

VIF	result	probability value	T	The amount of coefficients	parameters
0/000	F probability value		14/36	F	
1/58	Durbin-Watson		0/80	coefficient of determination	

The value of the t statistic for MI is equal to -2.40. These values are in the area of rejecting the null hypothesis, so its relationship with Bank Facilities is significant and negative. Therefore, the company's market information and received bank facilities have a significant relationship, and the research hypothesis is confirmed. Among the control variables, the relationship between P and M with received bank facilities is significant and negative, and DPS with received bank facilities is significant and positive, but other control variables are insignificant.

Third hypothesis: There is a significant positive relationship between non-financial factors and bank facilities received by companies listed on the Tehran Stock Exchange.

$$\ln \text{Bank Facilities}_{j,t} = \alpha_{j,t} + \beta_{1,t} \text{MI}_{j,t} + \beta_j \text{Controls} + \delta_j + \varepsilon_{j,t}$$

The significant probability value of F is equal to 0.000. This value is less than 0.05, so the null hypothesis is rejected at the 95% confidence level. The coefficient of determination is equal to 0.79. The value of the Watson camera statistic is equal to 1.64 and the VIF values for the variables were less than 10.

Table 8. Estimation and testing of the parameters of the third model

VIF	result	probability value	T	The amount of coefficients	parameters
-	Meaningful and positive	0/002	3/16	3/845	fixed amount
1/04	Meaningful and positive	0/000	6/62	0/261	NFF
1/01	meaningless	0/316	-1/00	-0/001	MAT
1/04	meaningless	0/213	1/25	0/156	RST
0/000	F probability value		14/05	F	
1/64	Durbin-Watson		0/79	coefficient of determination	

The value of the t statistic for NFF is equal to 6.62. These values are in the region of rejecting the null hypothesis, so its relationship with Bank Facilities is significant and positive, therefore, non-financial factors and received bank facilities have a significant relationship, and the research hypothesis is confirmed. None of the control variables have a significant relationship with the bank facilities received.

RESULTS AND DISCUSSION

Banks have faced a lot of changes in different situations and have understood the risks caused by various crises well, and they pay a lot of attention to the risk management of their activities, including the validation method. Banks have realized that in every period, crises have easily brought some companies to the point of bankruptcy, and on the other hand, they have increased the profitability of some companies. The purpose of this research is to evaluate the usefulness of financial reporting information in modeling the credit rating of bank customers. For this purpose, the research was done in two stages. In the first stage, by conducting interviews with elites, 4 main components including financial and non-financial factors, corporate governance criteria, and market information were identified along with several sub-components for each.

Financial factors included profitability, company size, ownership ratio, current ratio, quick ratio, debt ratio, sales growth, company expenses, and sales share from the industry in current conditions.

Non-financial factors include the type of collateral, the history of cooperation with the bank, the credibility of the company's brand, the quality of the company's internal information (representation and speed of profit announcement), the ownership of the workplace, the customer's credit status, the purpose of receiving a loan, and the dependence of raw materials on imports (according to Iran's financial sanctions).

Corporate governance criteria included board independence, board size, institutional shareholders, company risk management, and audit committee expertise.

Market information included market type, stock price, stock liquidity, stock return, stock risk, and stock dividend.

Finally, the following hypotheses were identified:

First hypothesis: There is a significant positive relationship between financial factors and bank facilities received by companies listed on the Tehran Stock Exchange.

Second hypothesis: There is a significant positive relationship between the company's market information and the bank facilities received by the companies admitted to the Tehran Stock Exchange.

Third hypothesis: There is a significant positive relationship between non-financial factors and bank facilities received by companies listed on the Tehran Stock Exchange.

The five assumptions of regression were confirmed and based on the results of the Chow and Hausman test, the method with fixed effects was used to analyze the model. The results of the t-test showed that there is a significant relationship between financial factors, company market information, and non-financial factors with bank facilities received by companies admitted to the Tehran Stock Exchange.

The way of making decisions about granting facilities to customers is important because the lack of accurate evaluation of customers can lead to overdue, delayed and ultimately burning of the credit institution's claims. Considering that the capital of banks is small compared to the total value of their assets, even if a small percentage of loans cannot be collected, the bank will face the risk of bankruptcy.

The above results show that banks should pay attention to the existing conditions and reduce the amount of questionable and uncollectible claims during the credit rating of the companies admitted to the Tehran Stock Exchange. To know the needs of their customers, in granting credit facilities, banks should identify their characteristics and pay attention to other factors related to validation. This leads to the reduction of banking risks, including credit risk, through validation. Considering the volatile economic conditions, banks must form a risk management committee to update the validation components. The relevant committee should pay attention to all the following related factors and have basic plans for each one.

Financial factors include profitability, company size, ownership ratio, current ratio, quick ratio, debt ratio, sales growth, company expenses, and sales share from the industry in current conditions.

Non-financial factors include the type of collateral, the history of cooperation with the bank, the credibility of the company's brand, the quality of the company's internal information (representation and speed of profit announcement), ownership of the workplace, the customer's credit status, the purpose of receiving a loan, and the dependence of raw materials on imports (according to financial sanctions on Iran)

Corporate governance criteria include the independence of the board of directors, size of the board of directors, institutional shareholders, company risk management, and expertise of the audit committee.

Market information includes market type, stock price, stock liquidity, stock yield, stock risk, and stock dividend.

The most important suggestion is that banks consider all the financial and non-financial aspects of the company in financial reporting along with external factors when granting facilities.

To enrich the research literature, it is suggested that the topic of research in different industries in the capital market be examined.

Keywords: Credit Scoring, Banks, Grounded Theory, DEMATEL Method, Bank Loan.

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