MICRO FACTORS AFFECTING PERSONAL LOAN DEFAULT RISK IN COMMERCIAL BANKS IN DANANG, VIETNAM

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Abstract. This paper examines the micro factors affecting the risk of personal loan default using 6,287 loans to 4,023 individual customers from a commercial bank in Danang for the period between 2016 and 2020. Variables related to the characteristics of the loan, the customer, and bank's credit officer are included in the logistic regression model. The result shows that the risk of personal loan default is related to the size and the purpose of the loan, customer's gender and borrowing experience, and credit officer's age. On the other hand, no relation is found between loan's maturity duration, customer's age, and credit officer's gender and experience.

1   Introduction

With a diverse set of services (such as deposit, loan, insurance, credit card, mobile banking etc.) the personal banking segment offers commercial banks in Vietnam an important source of sustainable income, especially from lending to individual customers (referred to as personal loan or retail loan)[1]. Consequently, Vietnamese banks have consistently expanded this type of loan. Fitch Ratings reports that the average annual growth of personal loan portfolios at the top eleven banks in Vietnam is estimated at as much as 28% in the period 2014–2018 [1]. This, however, poses a potential risk for the banking system. As banks are already struggling with non-performing corporate loans, the personal loans also go south, accumulating more bad debts. This portfolio will further hamstring the banks' capital buffer[2]. As a result, it is important to understand the factors affecting the risk of personal loan default in order to better manage such risk.

Prior empirical studies on factors affecting credit risk in Vietnam mostly utilize bank-level data to analyze how macro factors (such as GDP growth, FDI, and interest rate) affect banks' non-performing loan ratio or loan loss reserve ratio [2–4]. Research using loan-level data to study the

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[1]   https://www.theasianbanker.com/updates-and-articles/vietnam%E2%80%99s-retail-loan-market-to-reach-$145-billion-by-2020

[2]   https://vietnamnews.vn/economy/871751/bad-debts-of-20-banks-up-45-in-2020.html

micro factors (such as customer demographics or loan features) mainly focuses on corporate loans [5] or includes both personal and corporate loans in their analyses [6, 7]. The only exception is the study by Dinh and Kleimeier [8], which examines the characteristics of the individual customer and of the loan that should be included in a credit scoring model to better predict the risk of personal loan default. Their model, however, does not consider the characteristics of the bank's credit officer. It is suggested that the credit officer's gender or experience may affect the lending and monitoring of a loan, thereby influencing the risk of default [5, 9]**.** To fill this gap in the literature, our paper explicitly focuses on personal loans and we include credit officer characteristics in our analysis as potential determinants of personal loan default risk.

2   Literature review

2.1   Personal loan in Vietnam

A personal loan is a loan granted by a credit institution to an individual customer (contrary to a corporate loan, which is granted to a company). In Vietnam, credit institutions offer loans to individuals for personal purposes (such as consumption, house purchasing or renovation, and car purchasing) and also business purposes (business investment or capital expenditure). Loans for personal purposes are often paid using the borrower's income stream while loans for business purposes are paid using the cash flows from the business. The size of the loan could range from under a hundred million to five billion VND. The maturity of the loan could be short term (maximum 12 months), medium term (13 months to five years) or long term (more than 5 years). Normally, the loan approval process involves a bank credit officer assessing the credit worthiness of the borrower before recommending to the bank whether the loan should be approved.

The State Bank of Vietnam (the central bank) categorizes loans into five groups: group 1 includes loans that are paid promptly, group 2 includes loans overdue from 10 to less than 90 days, group 3 includes loans overdue from 90 to 180 days, group 4 includes loans overdue from 181 to 360 days, and group five includes loans overdue more than 360 days [10]. For loans in groups 2 to 5, banks must set aside loan loss reserve, with the reserve ratio of 5%, 20%, 50%, and 100% respectively. Previous studies consider defaulted loans those in groups 2 to 5 [6, 7].

2.2   Factors affecting personal loan default risk

Previous international studies using loan-level data to inspect micro determinants of personal loan default risk have identified a number of determining factors. Hörkkö [11] analyzes 14,595 personal loans in Finland between 2008 and 2009 and finds that customers that are female, are native citizens, between 61–70-year-old, and have the home of their own seem to default less. The results also show that those that have higher loans, have previously lent from the bank, have a higher credit score, and choose a shorter repayment time frame to tend to default less often. On the other hand, factors such as the number of children, income, level of education, and place of

living (rural vs. urban areas) have an insignificant relationship with loan default risk. Kočenda and Vojtek [12] examine 3,403 retail loans in Czech Republic in the period 1999–2006 and document that education, income level, and marital status are important demographic determinants of personal loan default risk. Loan characteristics found related to default risk are size and purpose of the loan. Other factors in Kočenda and Vojtek's [12] model (customer's gender, sector and years of employment, deposit behavior, and date of account opening) seem to have no bearing on personal loan default risk. In another study, Özdemir and Boran [13] inspect 500 personal loans in Turkey between 1999 and 2001. Their results suggest that gender, age, marital status, income, credit category, and loan size have an insignificant relationship with personal loan default risk. On the other hand, loans with higher interest rates and longer maturity periods are associated with a higher probability of default.

In the context of Vietnam, Dinh and Kleimeier [8] examine 56,037 personal loans between 1997 and 2005 and show that, among the 16 variables that they recommended to be included in the bank's credit scoring model, customer's time with the bank, gender, number of loans, and loan maturity duration are the most important predictors of loan default. Phan Dinh Khoi and Nguyen Viet Thanh [6] examine 316 loans (including both corporate and personal loans) from five state-own commercial banks and document that collaterals, loan purpose, the main source of income for repayment, loan inspection and supervision, and credit officer's experience are significantly associated with the risk of default of a loan. The results by Truong Dong Loc and Nguyen Thi Tuyet [7] using 438 loans (both corporate and personal) are almost similar but collateral and customer experience are found to have no influence.

Based on the extant literature, we suggest that besides loan characteristics and customer characteristics, credit officer characteristics should also be included as explaining variables in the research model to examine the risk of personal loan default. Employing a large dataset of 6,287 observations, our paper offers fresh empirical evidence on this topic.

3   Hypotheses and Research method

We follow previous studies and employ logistic regression to analyze the micro factors influencing the risk of personal loan default. The logistic regression takes the following form:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \text{LOANSIZE}_i + \beta_2 \text{LOANMATURITY}_i + \beta_3 \text{LOANPURPOSE}_i + \beta_4 \text{CUSGENDER}_i$$
$$+ \beta_5 \text{CUSAGE}_i + \beta_6 \text{CUSEXPERIENCE}_i + \beta_7 \text{COGENDER}_i + \beta_8 \text{COAGE}_i$$
$$+ \beta_9 \text{COEXPERIENCE}_i$$

where p is the probability of default $\left(p = \text{Prob.}(\text{DEFAULT} = 1)\right)$. A loan is considered default (DEFAULT$_i$=1) if it is behind its payment schedule for more than 10 days (categorized by the State Bank of Vietnam as loans in groups 2 to 5). This is the categorization employed by previous studies [5–7]. We include loan characteristics, customer characteristics, and bank credit officer

characteristics as explaining variables in our regression. Table 1 presents the description of the independent variables.

Loan characteristics cover the size of the loan (LOANSIZE), the maturity term of the loan (LOANMATURITY), and whether the loan is for business or personal purposes (LOANPURPOSE). LOANSIZE is the natural logarithm of the size of the loan (in million VND). Loan size has not been included in previous studies in Vietnam and the results regarding loan size in international studies have been mixed. Kočenda and Vojtek [12] find that smaller loans are risker while Özdemir and Boran [13] document an insignificant relationship between loan size and default risk. Kočenda and Vojtek [12] explain that smaller customers, who take out smaller loans, have less resource and are therefore risker. We expect a similar finding. LOANMATURITY takes the value of 0 if a loan is short-term, 1 if medium-term, and 2 if long-term. Özdemir and Boran [13] find that longer-term loans are riskier as unforeseen events might happen in the far future. On the contrary, Dinh and Kleimeier [8] find that longer-term loans are less likely to be defaulted in Vietnam**.** They argue that in Vietnam the duration of the loan is proposed by the borrower rather than by the bank. In such a case, for the same loan amount, a risk-averse customer will try to avoid the pressure of large payments over a short time frame by requesting a longer loan duration (and thus a smaller payment per period). Taken together, we expect that the result of the opposite effects of future uncertainty and by customer risk aversion could lead to either a positive or negative relationship between loan duration and default risk.

Table 1. Independent variables description

Variables	Description
Loan characteristics	
LOANSIZE	The natural logarithm of the size of the loan (in million VND)
LOANMATURITY	Takes the value of 0 if a loan is short-term, 1 if medium-term and 2 if long-term
LOANPURPOSE	Takes the value of 0 if a loan is for personal purpose and 1 if for business purpose
Customer characteristics	
CUSGENDER	Takes the value of 0 if the customer is male and 1 if female
CUSAGE	The natural logarithm of the customer's age
CUSEXP	The natural logarithm of the customer's number of loans with the bank
Credit officer characteristics	
COGENDER	Takes the value of 0 if the officer is male and 1 if female
COAGE	The natural logarithm of the officer's age
COEXP	The natural logarithm of the officer's years of experience as credit officer

LOANPURPOSE takes the value of 0 if a loan is for personal purpose and 1 if for business purpose. Both Kočenda and Vojtek [12] and Dinh and Kleimeier [8] show that the purpose of the loan has a bearing on the risk of personal loan default. We argue that the customer's income stream, which is often used to pay loans for personal purposes, is more stable. The cash flows from the customer's business, used to pay loans for business purposes, are normally more volatile. As a result, we expect that loans for business purposes are more likely to be defaulted than those for personal purposes.

Customer characteristics variables are customer's gender (CUSGENDER), customer's age (CUSAGE), and customer's borrowing experience (CUSEXP). CUSGENDER takes the value of 0 if the customer is male and 1 if the customer is female. CUSAGE is the natural logarithm of the customer's age. Customer gender and age's relations with personal loan default risk are documented in some studies [8, 11] but not in others [12, 13]. Specifically, Hörkkö [11] and Dinh and Kleimeier [8] find that female borrowers default less frequently on their loans, possibly because they are more risk averse [14]. As a result, we also anticipate a similar relationship between female customers and loan default risk. Regarding the effect of customer's age, Hörkkö [11] documents that older customers default less since they are more risk averse and have a more stable income. However, Dinh and Kleimeier [8] find the contrary and explain the result by suggesting that older customers have more family dependences. This negatively affects their ability to pay. Based on these mixed prior results, we expect that the effect of customer's age on default risk can go either way. CUSEXP is measured by the natural logarithm of the customer's number of loans with the bank. Both Dinh and Kleimeier [8] and Hörkkö [11] show that experienced customers pose a lower risk of default. As a result, we predict a negative relationship between customers' experience and the risk of default.

Credit officer characteristics include the officer gender (COGENDER), age (COAGE) as well as years of experience with the bank (COEXP). COGENDER takes the value of 0 if the officer is male and 1 if female. COAGE is the natural logarithm of the officer's age. COEXP is the natural logarithm of the officer's years of experience. Almost none of the previous studies on personal loan default risk includes credit officer gender and age in their models. However, in their analysis of loans to small businesses, Bellucci, Borisov, and Zazzaro [9] show that female credit officers are more risk averse and less self-confident. As a result, female credit officers are less likely to approve risky loans. Older officers are also expected to be more mature and more risk averse. Therefore, we expect that loans appraised by female and older credit officers have lower risk of default. Regarding the officer's experience. Bui Huu Phuoc and Ngo Van Toan [5] and Truong Dong Loc and Nguyen Thi Tuyet [7] find that a loan is less likely to default when appraised by a more experienced officer. We predict a similar relationship.

In sum, our proposed hypotheses are as follows:

H1: Loan size is negatively related to personal loan default risk.

H2a/H2b: Loan maturity is positively/negatively related to personal loan default risk.

H3: Loans for business purposes are more likely to be defaulted than loans for personal purposes.

H4: Female customers are associated with a lower personal loan default risk than male customers.

H5a/H5b: Customer age is positively/negatively related to personal loan default risk.

H6: Customer experience is negatively related to personal loan default risk.

H7: Personal loans appraised by female credit officers have a lower risk of default than those appraised by male officers.

H8: Age of credit officers is negatively related to personal loan default risk.

H9: Experience of credit officers is negatively related to personal loan default risk.

Data description

Our data is provided by a large commercial bank in Danang city. The data include 6,287 personal loans to 4,023 individual customers for the period between 2016 and 2020. The descriptive statistics of our data are presented in Table 2. Table 3 shows the pairwise correlations among the variables. No correlation coefficient is above 0.8, suggesting that there is no potential issue of multicollinearity. VIF result (untabulated) also confirms this.

Table 2. Descriptive statistics

Variable	N	Mean	Standard Deviation	Min	Max
DEFAULT	6287	0.007	0.082	0	1
LOANSIZE	6287	5.117	1.046	1.946	10.218
LOANMATURITY	6287	1.325	0.621	0	2
LOANPURPOSE	6287	0.097	0.296	0	1
CUSGENDER	6287	0.520	0.500	0	1
CUSAGE	6287	3.714	0.220	2.944	4.234
CUSEXP	6287	0.504	0.757	0	3.784
COGENDER	6287	0.123	0.328	0	1
COAGE	6287	3.400	0.156	3.091	3.784
COEXP	6287	1.734	0.531	0	2.639

Table 3. Correlations

Variable		(1)	(2)	(3)	(4)	(5)
DEFAULT	(1)	1				
LOANSIZE	(2)	-0.041**	1			
LOANMATURITY	(3)	-0.043**	0.406**	1		
LOANPURPOSE	(4)	0.051**	0.053**	-0.591**	1	
CUSGENDER	(5)	-0.025	-0.091**	-0.080**	-0.046**	1
CUSAGE	(6)	-0.005	0.161**	-0.058**	0.172**	-0.041**
CUSEXP	(7)	-0.045**	0.136**	-0.125**	0.528**	-0.059**
COGENDER	(8)	-0.013	-0.001	-0.002	0.012	0.025*
COAGE	(9)	-0.026*	0.046**	-0.073**	0.066**	0.016
COEXP	(10)	-0.004	0.001	-0.004	0.013	-0.016
		(6)	(7)	(8)	(9)	(10)
CUSAGE	(6)	1				
CUSEXP	(7)	0.219**	1			
COGENDER	(8)	-0.003	0.019	1		
COAGE	(9)	0.061**	0.055**	0.405**	1	
COEXP	(10)	-0.001	0.022	0.426**	0.738**	1

*, **: $p < 0.05, 0.01$

5   Result and discussion

Table 4 presents the result for our logistic regression. Regarding loan characteristics, the coefficient for LOANSIZE is negative (-0.581) and statistically significant at the 1% level. This indicates that bigger loans are associated with lower risk of default. This result supports our hypothesis that smaller customers with less resources who take out smaller loans are those that are riskier (H1 is accepted). The coefficient for LOANPURPOSE is positive (3.299) and statistically significant at the 1% level. This is consistent with our expectation that loans intended for business purposes are risker due to the more volatile nature of the cashflows used for repayment (H3 is accepted). The maturity of the loan, however, is found to have no relationship with the risk of default (the coefficient for LOANMATURITY is statically insignificant). Thus, both hypotheses H2a and H2b are not supported. This implies that the risk of negative events happening unexpectedly in the far future is possibly cancelled out by the less pressure on the customer to pay more in a shorter period.

Regarding customer characteristics, consistent with the finding by Hörkkö [11] and Dinh and Kleimeier [8], we find that female customers seem to have a lower risk of defaulting on their

loans. The coefficient for CUSGENDER is negative (-0.682) and statistically significant at the 5% level. This supports the notion that women are more risk averse, therefore less likely to take out risky loan (H4 is supported). We find that default risk is not related to customer's age (the coefficient for CUSAGE is statistically insignificant). Thus, both H5a and H5b are not supported. This is similar to Özdemir and Boran's [13] finding and could be attributed to the opposite effects proposed by Hörkkö [11] and Dinh and Kleimeier [8]**.** The result indicates that customers with more borrowing experience seem to default less as the coefficient for CUSEXP is negative (-2.633) and statistically significant at the 1% level. This is comparable to the result by Phan Dinh Khoi and Nguyen Viet Thanh [6] and supports our hypothesis H6 that more experienced customers are less risky.

Regarding credit officer characteristics, the gender and experience of the credit officer seem to have no relationship with the risk of default (H7 and H8 are not supported) while the officer's age is negatively associated with the probability of default (H9 is accepted). The coefficient for COAGE is negative (-4.690) and statistically significant at the 1% level. Arguably, older officers are more mature and more risk averse. As a result, they can evaluate customer credit risk better than younger officers. The coefficient for COEXP is insignificant. This is in contrast with the result by Truong Dong Loc and Nguyen Thi Tuyet [7]. We suspect that some of the credit officers may have worked at different job positions in the finance industry before taking on the credit officer role. Consequently, the number of years as a credit officer may not fully reflect the officer's experience. Even though there is a strong correlation between COAGE and COEXP (see Table 3, the correlation coefficient is 0.738 and statistically significant at the 1% level), age could be a better measure of the credit officer's experience as well as temperament. The coefficient for COGENDER is statistically insignificant. This does not support our expectation that female credit officers are generally more effective than their male counterparts in judging the riskiness of a loan.

In sum, almost all of our proposed hypotheses are accepted, except for H7 and H8. For H2 and H5, the opposite effects proposed in the alternative hypotheses seem to cancel out each other, leading to the insignificant relationships between loan maturity and customer's age with personal loan default risk.

Table 4. Regression result

	Dependent variable: DEFAULT
LOANSIZE	-0.581**
	(-3.11)
LOANMATURITY	0.231
	(-0.61)
LOANPURPOSE	3.299**
	(6.72)
CUSGENDER	-0.682*
	(-2.08)
CUSAGE	0.157
	(0.22)
CUSEXP	-2.633**
	(-4.71)
COGENDER	-0.329
	(-0.51)
COAGE	-4.690**
	(-2.63)
COEXP	0.943
	(1.83)
N	6287
Pseudo R^2	17.46%

*, **: $p<0.05$, 0.01. z-value in parentheses.

6   Conclusion

We utilize a large sample of personal loans to inspect the micro factors influencing the risk of personal loan default. The result shows that smaller loans, loans for business purposes, male customers, customers with less borrowing experience, and younger credit officers are associated with a higher risk of default. Our result has important practical implications. First, commercial banks are suggested to pay more attention to smaller loans and loans intended for business purposes. A stricter credit approving procedure may need to be developed for these types of loans in order to better assess their risk of default. Second, customer gender and borrowing experience should be emphasized in banks' credit assessment process. Finally, our research is the first to point out a negative relationship between age of credit officers and the risk of default. There are several potential solutions to address this issue. For one, banks could conduct more training for younger credit officers. Besides, a mentoring system could be developed where older credit officers can offer guidance to younger ones. Furthermore, a dual-officer credit approving model could be applied so a pair of young and old credit officers are required to assess a personal loan.

Our paper has some limitations. Due to limited access to the bank's information, we could not consider some characteristics of customers and credit officers that are included in previous studies, such as educational level, income level, housing, or marital status... In addition, our data come only from one bank and may not reflect the credit assessment process at other banks. We look forward to extending this line of research in the future with more comprehensive research variables and data when they become available.

References

1. Fitch Ratings (2019), *Consumer lending in Vietnam*, Accessed from: https://your.fitch.group/rs/732-CKH-767/images/Fitch_10079224.pdf.

2. Hoang, T.T.H., Vo, K.T., and Ha, N.T.V. (2019), *Analysis of the factors affecting credit risk of commercial banks in Vietnam*, International Econometric Conference of Vietnam (ECONVN) 2019, 522–532.

3. Vo Xuan Vinh and Pham Hong Vy (2017), Liquidity and credit risk: The case of Vietnamese commercial banks, *Journal of Economic Development*, 28(1), 45–63. (In Vietnamese)

4. Vo Thi Quy and Bui Ngoc Toan (2014), Factors affecting credit risk of Vietnam's commercial banking system, *Ho Chi Minh City Open University Journal of Science*, 9(2), 16–25. (In Vietnamese)

5. Bui Huu Phuoc and Ngo Van Toan (2018), Credit risk assessment by polynomial regression model: empirical evidence at a joint stock commercial bank, *Danang University of Economics Journal of Economic Studies*, 6(2), 77–88. (In Vietnamese)

6. Phan Dinh Khoi and Nguyen Viet Thanh (2017), Micro factors affecting credit risk: the case of state-owned commercial banks in Hau Giang, *Can Thu University Journal of Science*, 48(D), 104–111. (In Vietnamese)

7. Truong Dong Loc and Nguyen Thi Tuyet (2011), Factors affecting credit risk of Commercial Bank for Foreign Trade, Can Tho Branch, *Journal of Banking*, 5, 38–41. (In Vietnamese)

8. Dinh, T.H.T. and Kleimeier, S. (2007), A credit scoring model for Vietnam's retail banking market, *International Review of Financial Analysis*, 16(5), 471–495.

9. Bellucci, A., Borisov, A., and Zazzaro, A. (2010), Does gender matter in bank–firm relationships? Evidence from small business lending, *Journal of Banking & Finance*, 34(12), 2968–2984.

10. State Bank of Vietnam (2005), *Decision No. 493/2005/QD-NHNN*. (In Vietnamese)

11. Hörkkö, M. (2010), *The determinants of default in consumer credit market*, Master's thesis, Aalto University School of Economics.

12. Kočenda, E. and Vojtek, M. (2011), Default predictors in retail credit scoring: evidence from Czech banking data, *Emerging Markets Finance and Trade*, 47(6), 80–98.

13. Özdemir, Ö. and Boran, L. (2004), *An empirical investigation on consumer credit default risk*, Turkish Economic Association Discussion Paper, No. 2004/20.

14. Arminger, G., Enache, D., and Bonne, T. (1997), Analyzing Credit Risk Data: A Comparison of Logistic Discrimination, Classification Tree Analysis, and Feedforward Network, *Computational Statistics*, 12(2), 293–310.