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Factors affecting the default risk of private customers at state-owned commercial banks in Vietnam

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Abstract: The article estimates the influence of factors on the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City from 2019 to 2022. The article employs a quantitative research method using a binary logistic regression model to analyse the extent of the impact of various factors on the credit default risk probability of individual customers. The research results reveal that the model includes six statistically significant factors that affect the credit default probability of customers: loan term, income diversification, COVID-19, cash flows for repayment and loan purpose. Furthermore, through the Hosmer and Lemeshow test, the author concludes that there is no difference between actual and predicted values in predicting the default risk of private customers.

Keywords: default risk; private customers; binary logistic; state-owned commercial bank; Vietnam.

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1 Introduction

Alongside the activities of lending to corporate customers, lending to individual customers holds a significant proportion in the investment portfolio of commercial banks in general, and state-owned commercial banks in particular. This is a business that generates substantial profits for banks, but also poses significant risks due to the financial

distress of customers, leading to pressures in repaying principal and interest on loans. Consequently, the risks of default and loss of repayment capacity may arise, causing commercial banks to confront credit risks.

Default risk, which falls under the umbrella of credit risk, pertains to the possibility that a borrower may fail to fulfil its debt obligations, regardless of the type of debt involved. For instance, a bond company might fail to pay interest and repay the principal amount. When the likelihood of a company defaulting on its bond obligations increases (indicating a higher default risk), it will need to offer investors a higher interest rate as compensation. Two primary factors contribute to default risk: business risk and financial risk (Kazi, 2021).

In the context of the COVID-19 pandemic, the global value chain has been disrupted, leading to challenges for the financial system, including the commercial banking system (Nigmonov and Shams, 2021). Economic recession is unfolding due to the COVID-19 pandemic, increasing the likelihood of default among borrowing customers in the market. Similar to the global economic crisis, the COVID-19 pandemic has had a profound impact on the global economy and finance. The continuous economic decline resulting from the COVID-19 pandemic raises the risk of unsustainable losses for the marketplace lending sector.

Especially under the pandemic, the continuous decline in household income is likely to be massive (Nigmonov and Shams, 2021). As a result, the ability of private customers to pay their loans dropped significantly, leading to an increase in default risk. Several studies addressed default risk and its determinants, such as Kočenda and Vojtek (2011), Mensah et al. (2013), Abid et al. (2018), Dao (2019) and Ngo (2020). These authors have demonstrated that gender, age, education level, demographics, and financial factors such as income, loan amount, loan term, repayment history, and collateral all impact the likelihood of customer default.

However, a limited number of studies examined the influence of COVID-19 on customer default risk. Therefore, the purpose of this article is to estimate the factors influencing the likelihood of loan default risk of private customers at state-owned commercial banks in Ho Chi Minh City from 2019 to 2022. To achieve this goal, the research question that needs to be answered is: 'What is the extent of the impact of the factors, especially COVID-19, on the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City during the period 2019–2022?'.

2 Literature review and hypothesis development

2.1 Literature review

Credit risk or default risk involves inability or unwillingness of a customer or counterparty to meet commitments in relation to lending, trading, hedging, settlement and other financial transactions (Spuchl'áková et al., 2015). Credit risk is often regarded because of systemic risk originating from a macroeconomic perspective. Systemic risk represents larger financial issues stemming from market participants' inability to fulfil debt obligations in credit extension (Giesecke and Kim, 2011; Nijskens and Wagner, 2011; Wagner and Marsh, 2006). This systemic issue arises from a borrowing customer's inability to fulfil financial obligations to a bank, which can lead to other related customer entities also being unable to meet credit obligations. The domino effect was observed in

the financial crisis of 2009 (Giesecke and Kim, 2011; Nijskens and Wagner, 2011). The expansion of the marketplace lending sector is frequently linked to the strict regulations imposed on conventional bank lending in the aftermath of the global financial crisis. The primary factor contributing to the crisis was the escalating credit default risk resulting from information asymmetry (Nigmonov and Shams, 2021).

Default risk entails uncertainty regarding a company's or individual's ability to repay debts and fulfil financial obligations (Chenguel and Mansour, 2023; Harb et al., 2023; Nguyen et al., 2022). Default risk involves the possibility that customers or partners lack the capacity or willingness to fulfil commitments related to lending, transactions, risk mitigation, payments, and other financial dealings. Credit risk often encompasses transaction risk, default risk and portfolio investment risk (Spuchl'áková et al., 2015).

The emergence of non-performing loans has an impact on the operations of banks, subsequently constraining the credit growth of these institutions (Abd Karim et al., 2010). This consequence leads to the loss of the bank's liquidity capability, thereby limiting the ability to provide financial support to businesses and extend credit to individual customers.

Underperforming banks often exhibit significant non-performing loan ratios prior to failure, and asset quality is a statistically significant predictive factor of payment ability (Berger and DeYoung, 1997; Berger and Humphrey, 1997). Fofack and Fofack (2005) also highlight that holding extensive bad debt values in loans can lead banks to insolvency if they lack the capacity to recover their bad debts.

Under the stakeholder theory, it is important to consider that the actual worth of a company's assets cannot be directly observed in the market; stakeholders can only access delayed information regarding the firm's assets' accounting value. Therefore, in practical terms, the company may continue to function even when the actual value of its assets falls below its outstanding debt. This is possible because the company could secure additional debt, which could then be used to repay the existing debt, while stakeholders remain unaware of the company's actual default status.

2.2 Empirical studies

The research results of Kočenda and Vojtek (2011) show that the most important financial and behavioural characteristics affecting the likelihood of default have been identified as the amount of assets owned by customers, level of education, marital status, borrowing purpose, and the number of years having an account at the bank.

Mensah et al. (2013) conducts a study on the credit default risk of customers when borrowing from banks in Ghana. The research results indicate that the historical repayment record does not have an impact on the likelihood of default. Furthermore, factors such as loan interest rates, ethical risk, loan amount, and customer collateral assets significantly affect the default risk of customers.

Abid et al. (2018) develops a credit default prediction model using a logistic regression model and a discriminant analysis (DA) model to distinguish between individuals with good and bad credit ratings. When comparing the two models, the logistic regression model demonstrated better predictive capabilities than the DA model in forecasting the credit default likelihood of customers.

The study by Ngo (2020) on the factors influencing the credit default risk of individual customers at the Vietnam Cooperative Bank found that gender, legal history, business ownership, and occupational diversity have a positive impact on the likelihood of default. On the other hand, marital status, age, household size, work experience, company type, income, loan term, principal and interest repayment status, proper use of loan funds, collateral assets, and the purchase of life insurance have a negative impact on the credit default risk of individual customers.

Dao (2019) study on building a credit scoring model for individual consumer loans in Vietnam utilised the FICO system approach, tailored to the Vietnam context. The research results revealed that five critical factors incorporated into the DA model influence the credit default risk of customers: education, occupation, income (in million VND), dependents and accounts.

Based on relevant studies, the author identifies the factors influencing the credit default risk of individual customers at state-owned commercial banks in the Ho Chi Minh City area, which include: repayment cash flow, loan term, credit history, loan purpose, income diversification, loan type and loan amount. In addition to the factors affecting the credit default risk of individual customers, since late 2019 with the emergence of the COVID-19 pandemic, it has affected the business activities of customer entities and the entire economy. However, this issue has not been widely examined. Therefore, the study has investigated the impact of the COVID-19 factor on the credit default risk of individual customers.

2.3 Hypothesis development

2.3.1 Income

According to Brogaard et al. (2017), credit default risk occurs when a borrower's income are insufficient to cover its debt service costs and principal payments. Because their incomes are considered as main source to pay back all obligations (Capinski, 2007). Gentry et al. (1985) used a cash-based funds flow model to demonstrate that the higher positive income, the lower the probability of default risk will be. Acharya et al. (2012), Casey and Bartczak (1985) and Zeitun et al. (2007) support the above argument that a higher expected cash flow results in a lower default probability (the direct effect). Based on the above argument, the hypothesis is proposed:

Hypothesis 1 Cash flows have a negative effect on default risk of private customers.

2.3.2 Loan term

Depending on the type of loan product, loan purpose, and the commercial bank's ability to meet capital resources, banks will consider a certain loan period for individual customers. According to Bui et al. (2023) and Ngo (2020), loan term affects customers' ability to repay debt and default. When borrowers plan the schedule to repay debt in the long-term and with better foresight about their income, the default risk decreases, and vice versa (Dufhues et al., 2011; Jacobson and Roszbach, 2003). Furthermore, probability of credit delinquency increases when maturity increases because the longer-term, the more probability of being missed instalment because of forgetfulness, carelessness, etc. (Özdemir and Boran, 2004).

Hypothesis 2 Credit term has a negative effect on default risk of private customers.

2.3.3 Credit history

Jappelli (1990) examined the behaviours of lenders and borrowers involved in consumer credit rationing activities within the US' credit market in 1983. His findings revealed that many loan applicants faced rejection primarily due to their unfavourable credit histories.

Personal credit history is considered the official reference basis for banks to decide whether to lend to customers or not. In Vietnam, personal credit history information will be stored at the Credit Information Center (CIC). The centre will store all personal credit history information that has ever been used for the credit services of banks or financial institutions such as payment, loan history, credit history and bad debts. The information provided by the CIC system is a very important factor in the credit approval process by commercial banks or financial institutions. Therefore, checking personal credit history is very necessary, helping banks or financial institutions decide whether loan application form is accepted or not. In case the credit history of private customers shows the credit score is ranked at low level through the criteria of bad debts and overdue debts, the ability to access loans at other banks may be limited.

Hypothesis 3 Credit history affects default risk of private customers negatively.

2.3.4 Loan purpose

Tra Pham and Lensink (2008) loan purpose is also a significant factor in determining credit default risk. Similar to corporate loans, using borrowed funds for proper purposes is crucial in determining the willingness to repay personal loans. However, Roslan and Karim (2009), Stepanova and Thomas (2002) and Tran et al. (2020) argue that personal loans carry a higher risk of default because private customers have a larger quantity, making it difficult to control the use of the borrowed capital. It can lead to customers misusing the funds, increasing their default risk and causing bank losses. Changing the purpose of borrowed funds increases the likelihood of non-repayment by customers. Therefore, customers who utilise the borrowed funds for their intended purpose are less likely to default.

The studies by Ngo (2020), Nguyen (2013), Phan and Nguyen (2017) and Tra Pham and Lensink (2008) demonstrate the negative impact of loan purpose on default risk.

Hypothesis 4 Loan purpose affects default risk of private customers negatively.

2.3.5 Income diversification

Le et al. (2022) and Roslan and Karim (2009) confirm that the higher the level of income diversification, the lower the risk of default. Customers in stable employment contribute to a consistent income stream for meeting their loan obligations at the bank (Ngo, 2020). Furthermore, individuals with income diversification are less likely to default since diversifying their income sources enhances their financial stability, enabling them to cover all financial commitments, including both principal and interest payments.

Hypothesis 5 Income diversification affects default risk of private customers negatively.

2.3.6 Collateral

A secured loan with collateral reflects the borrowers' commitment to debt repayment responsibilities. Mensah et al. (2013) argues that unsecured loans are more likely to default than secured loans. Collateral is a necessary element included in the terms of the loan agreement to ensure that the borrower fulfils their obligations promptly and accurately (Aghion and Bolton, 1992; Mensah et al., 2013). Increasing banks' requirements for collateral assets when granting loans reduces adverse selection issues, leading to a lower default rate (Stiglitz and Weiss, 1981). The absence of assets available for collateral has increased the expense and heightened the risk associated with lending to such individuals, as it entails substantial costs for screening, supervision, and enforcement. This clarifies why securing loans from traditional financial institutions is nearly unattainable for them due to the elevated risk of loan defaults (Roslan and Karim, 2009). As a result, this is particularly relevant when considering the inverse relationship between collateral and the likelihood of default, as indicated by Boot et al. (1991) and Tra Pham and Lensink (2008). It implies that borrowers with higher risk profiles are more likely to offer collateral, whereas those with lower risk profiles are less inclined.

In this paper, amount of collateral provided by borrowers as a form of security in case of loan default is another crucial factor that influences decisions regarding credit approval (Özdemir and Boran, 2004).

Hypothesis 6 Collateral affects default risk of private customers negatively.

2.3.7 Loan size

Loan size refers to how much money commercial banks lend their customers (Özdemir and Boran, 2004). Banks generally prefer giving this kind of credit for lower loan sizes and shorter maturity to decrease risk.

A positive association between loan size and the probability of default aligns with several other studies (Tra Pham and Lensink, 2008). Large loan size implies higher default risk (Jacobson and Roszbach, 2003; Kočenda and Vojtek, 2011; Manove et al., 2001; Paxton et al., 2000) because the more significant the loan size, the higher the interest costs and the greater the default risk of individual customers (Berk and DeMarzo, 2019).

In this paper, the loan size is measured by the logarithm of the loan size (logloansize).

Hypothesis 7 Loan size affects default risk of private customers positively.

2.3.8 COVID-19

COVID-19 incurred from the end of 2019 until now has seriously affected all aspects of the economy, global investment and international trade. It leads to an increase in unemployment rate and hurts people's lives, income, and spending. In addition, COVID-19 adversely affects the financial markets, and makes credit market fall into the conditions of financial distress. The continuous economic decline triggered by the COVID-19 pandemic elevates the chances of the marketplace lending sector experiencing unsustainable losses (Nigmonov and Shams, 2021). These losses are anticipated to grow significantly during a significant economic downturn, potentially depleting investor resources rapidly (Bolt et al., 2012).

The default risk induced by the pandemic was more pronounced from May to June 2020, as indicated by consistently significant and positive coefficients related to COVID-19 pandemic risk (Nigmonov and Shams, 2021). Earlier research demonstrates that the COVID-19 pandemic risk significantly strains financial markets due to the elevated credit default risk (Agosto and Giudici, 2020; Demirgüç-Kunt et al., 2020; Kargar et al., 2021).

Hypothesis 8 COVID-19 affects default risk of private customers positively.

3 Research model and methodology

3.1 Sample size

Research data is collected from individual private loan data from several branches of state-owned commercial banks in Ho Chi Minh City. The total number of science and technology to be collected is 400 for four state-owned commercial banks. The remaining number of observations after filtering is 395 observations.

3.2 Research model

The details of all factors in Figure 1 are described in Table 1.

Figure 1 Research model

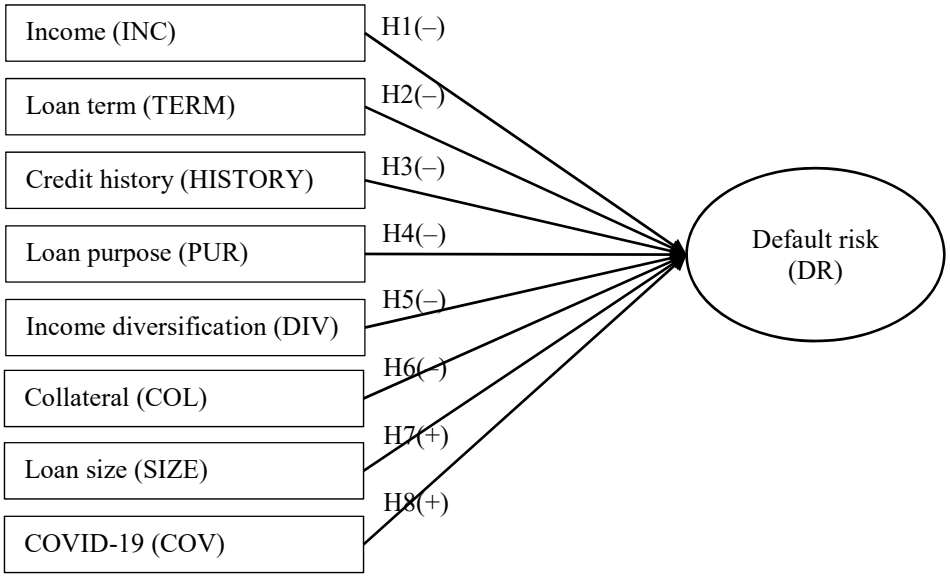

Table 1 Summary of factors in the model

No.	*Factors*	*Index*	*Explanation*	*Expected sign*
Dependent factor				
1	Default risk	DR	DR = 1 if customers cannot pay off their debts (credit default risk); otherwise, its value is 0	
Independent factors				
2	Income	INC	Ln(monthly income)	–
3	Loan term	TERM	TERM = 0 if the loan is short-term; otherwise, TERM = 1	–
4	Credit history	HIST	HISTORY = 0 if customers paid principal and interest on time	–
			HISTORY = 1 if customers paid one time principal and interest late	
			HISTORY = 2 if customers paid principal and interest over two times late	
5	Loan purpose	PUR	PUR = 0 if customers use a loan with committed purpose; otherwise, its value is 1	–
6	Income diversification	DIV	DIV = 0 if customers have only one source of income; DIV = 1 if customers have over two sources of income.	–
7	Collateral	COL	COL = 1 if customers have collateral; otherwise, its value is 0	–
8	Loan size	SIZE	Ln(loan amount)	+
9	COVID-19	COV	COV = 1 if the year has COVID-19; otherwise, its value is 0	+

3.3 Methodology

To measure the probability of credit default of private customers at state-owned commercial banks in Ho Chi Minh City, the article performs Logit model by using SPSS 20 software. Binary logistic regression equation of the model with eight independent factors as follows:

$$\log_e\left[\frac{P(DR=1)}{P(DR=0)}\right] = C + \beta_1 \times INC_i + \beta_2 \times TERM_i + \beta_3 \times HIST_i + \beta_4 \times PUR_i + \beta_5 \times DIV_i + \beta_6 \times COL_i + \beta_7 \times SIZE_i + \beta_8 \times COV_i. \quad (1)$$

4 Research results and discussion

4.1 Research results

All VIF values are smaller than 10, which is satisfied the condition proposed by Hair et al. (1995) and Montgomery et al. (2021). Thus, multicollinearity does not exist in the model.

Table 2 shows the sig. values of all three indexes in Step 1 (Step 1) are less than 5% (with 95% confidence), so the regression model is statistically significant.

Table 2 Tests of model coefficients

		Chi-square	*df*	*Sig.*
Step 1	Step	219.021	8	0.000
	Block	219.021	8	0.000
	Model	219.021	8	0.000

Table 3 shows the model's coefficient of explanation: R^2 Nagelkerke = 0.595. This means that 59.5% of the variation in the dependent factor is explained by the independent factors, the rest is due to other factors.

Table 3 Model summary

Step	*–2 log likelihood*	*Cox and Snell R square*	*Nagelkerke R square*
1	277.106[a]	0.426	0.595

Note: [a]Estimation terminated at iteration number 6 because parameter estimates changed by less than 0.001.

The following classification table (Table 4) shows the probability of credit default of private customers at state-owned commercial banks in Ho Chi Minh City, according to two criteria: likely to default and unlikely to default.

Table 4 Classification table[a]

		Observed	*Predicted*		
			DR		*Percentage correct*
			Non-default probability	*Default probability*	
Step 1	DR	Non-default probability	98	29	77.2
		Default probability	27	241	89.9
		Overall percentage			85.8

Note: [a]The cut value is 0.500.

The results of Table 3 show that, in 127 cases of observing private customers who are non-default probability, there are 98 cases of private customers who are non-default probability with a correct prediction rate of 77.2%. At the same time, in 268 cases of observing private customers likely to default (default probability), it is predicted that there are 241 cases of private customers likely to default, with a correct prediction rate of 89.9%. So, the average correct prediction is: 85.8%.

Table 5 shows six factors affect credit default risk of private customers at state-owned commercial banks in Ho Chi Minh significantly, such as loan term, collateral, income diversification, COVID-19, income and loan purpose. However, to indicate a good fitting model for forecasting, Hosmer and Lemeshow test is implemented. The test has a p-value (0.336) is greater than 0.05 since it fails to reject the null hypothesis, implying that the model's estimates fit the data at an acceptable level. Therefore, the model to measure the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City is as follows:

$$\text{Log}_e\left[\text{P(Y}=1)/\text{P(Y}=0)\right] = 1.762 - 1.783 \times \text{Income} + 0.879 \times \text{Loan term} - 1.381 \times \text{Loan purpose} - 1.813 \times \text{Income diversification} - 1.043 \times \text{Collateral} + 2.015 \times \text{COVID-19}.$$

Table 5 Regression results

		B	*Sig.*	*Exp(B)*
Step 1[a]	*Income (INC)*	–1.783	0.013	1.886
	Loan term (TERM)	0.879	0.018	1.017
	Credit history (HIST)	1.093	0.072	2.984
	Loan purpose (PUR)	–1.381	0.035	0.918
	Income diversification (DIV)	–1.813	0.000	1.771
	Collateral (COL)	–1.043	0.005	2.045
	Loan size (SIZE)	0.365	0.455	0.848
	COVID-19 (COV)	2.015	0.011	0.562
	Constant	1.762	0.307	0.802

Note: [a]Variable(s) entered on step 1: INC, TERM, HIST, PUR, DIV, COL, SIZE, COV.

4.2 Discussion

The findings show that the model has six factors that statistically significantly affect the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh. These factors are loan term, collateral, income diversification, COVID-19, income and loan purpose. Notably, the factor related to COVID-19 exerts the most substantial impact on the credit default risk of private clients, while the loan duration has the least pronounced effect.

- *COVID-19:* The regression coefficient is positive (2.015), so the COVID-19 factor positively impacts the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City. Results from the binary logistic regression model show that when the COVID-19 factor increases by 1 unit, provided that the influence of the remaining factors from the model remains unchanged, the log of the default probability ratio of the private customers will increase by 2.015 units. Alternatively, the probability of default of individual customers increases by 0.562 times compared to the probability of non-default of customers at the above banks. The research results are consistent with research by Nigmonov and Shams (2021), Agosto and Giudici (2020), Demirgüç-Kunt et al. (2020) and Kargar et al. (2021).
- *Income diversification:* The regression coefficient is negative (–1.813), so income diversification factor negatively affects the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City. Results from the binary logistic regression model show that when the factor increases by 1 unit, provided that the influence of the remaining factors from the model remains unchanged, the log of the default probability ratio of the private customers will decline by 1.813 units. Alternatively, the probability of default of individual customers increases by

1.771 times compared to the probability of non-default of customers at the above banks. The findings are consistent with the studies by Le et al. (2022) and Roslan and Karim (2009).

- *Income:* The regression coefficient is negative (–1.783), so income factor negatively affects the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City. Results from the binary logistic regression model show that when the factor increases by 1 unit, provided that the influence of the remaining factors from the model remains unchanged, the log of the default probability ratio of the private customers will decline by 1.783 units. Alternatively, the probability of default of individual customers increases by 1.886 times compared to the probability of non-default of customers at the above banks. The findings are consistent with the studies by Brogaard et al. (2017), Capinski (2007), Zeitun et al. (2007) and Acharya et al. (2012).
- *Loan purpose:* The regression coefficient is negative (–1.381), so loan purpose factor negatively affects the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City. Results from the binary logistic regression model show that when the factor increases by 1 unit, provided that the influence of the remaining factors from the model remains unchanged, the log of the default probability ratio of the private customers will decline by 1.381 units. Alternatively, the probability of default of individual customers increases by 0.918 times compared to the probability of non-default of customers at the above banks. The findings are consistent with the studies by Ngo (2020), Nguyen (2013), Phan and Nguyen (2017) and Tra Pham and Lensink (2008).
- *Collateral:* The regression coefficient is negative (–1.043), so collateral factor negatively affects the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City. Results from the binary logistic regression model show that when the factor increases by 1 unit, provided that the influence of the remaining factors from the model remains unchanged, the log of the default probability ratio of the private customers will decline by 1.043 units. Alternatively, the probability of default of individual customers increases by 2.045 times compared to the probability of non-default of customers at the above banks. The findings are consistent with the studies by Mensah et al. (2013), Özdemir and Boran (2004), Roslan and Karim (2009) and Tra Pham and Lensink (2008).
- *Loan term:* The regression coefficient is positive (0.879), so loan term factor positively affects the credit default risk of private customers at state-owned commercial banks in Ho Chi Minh City. Results from the binary logistic regression model show that when the factor increases by 1 unit, provided that the influence of the remaining factors from the model remains unchanged, the log of the default probability ratio of the private customers will decline by 0.879 units. Alternatively, the probability of default of individual customers increases by 1.017 times compared to the probability of non-default of customers at the above banks. The findings are consistent with the studies by Bui et al. (2023), Ngo (2020) and Özdemir and Boran (2004).

5 Conclusions and limitations

This paper aims to estimate the effect of factors on credit default risk of private customers in state-owned commercial bank in Ho Chi Minh. Based on the literature review of credit default risk and stakeholder theory, combined with utilising Logit model, there are six factors that have statistically significant affect credit default risk, such as loan term, collateral, income diversification, COVID-19, income and loan purpose. In addition, the author conducts Hosmer and Lemeshow test to indicate the model's estimates fit the data at an acceptable level. It means that the test results show that there is no difference between the actual value and the predicted value, so the model can be used for forecasting.

Commercial banks should enhance their lending procedures by delineating the roles and responsibilities of the parties engaged in the credit process. This measure is essential to proactively forestall and mitigate the likelihood of defaults among private customers. It is imperative to bolster monitoring and oversight of lending activities for each customer segment and implement corrective and disciplinary actions in line with the severity of violations. Given the relatively elevated probability of private customer defaults, adhering to customer management principles is crucial. Additionally, there should be a more frequent appraisal of the financial information of private borrowers.

While the article has yielded specific outcomes, it remains constrained by several limitations. First, the study's sample size is relatively diminutive, implying that the research findings may not provide a comprehensive perspective on commercial banks. Second, the factors contributing to defaults are solely examined from the customer's standpoint. Consequently, future research endeavours should expand the model to encompass factors related to commercial banks, warranting a more comprehensive and in-depth analysis.

Data availability statement

Raw data were generated at Agribank, GP Bank, Ocean Bank and Construction Bank. Derived data supporting the findings of this study are available from the corresponding author on request.

References

Abd Karim, M.Z., Sok, G.C. and Hassan, S. (2010) *Bank Efficiency and Non-performing Loans: Evidence from Malaysia and Singapore*, Prague Economic Papers.

Abid, L., Masmoudi, A. and Zouari-Ghorbel, S. (2018) 'The consumer loan's payment default predictive model: an application of the logistic regression and the discriminant analysis in a Tunisian commercial bank', *Journal of the Knowledge Economy*, September, Vol. 9, pp.948–962.

Acharya, V., Davydenko, S.A. and Strebulaev, I.A. (2012) 'Cash holdings and credit risk', *The Review of Financial Studies*, Vol. 25, No. 12, pp.3572–3609.

Aghion, P. and Bolton, P. (1992) 'An incomplete contracts approach to financial contracting', *The Review of Economic Studies*, Vol. 59, No. 3, pp.473–494.

Agosto, A. and Giudici, P. (2020) 'COVID-19 contagion and digital finance', *Digital Finance*, Vol. 2, Nos. 1–2, pp.159–167 [online] https://doi.org/10.1007/s42521-020-00021-3.

Berger, A.N. and DeYoung, R. (1997) 'Problem loans and cost efficiency in commercial banks', *Journal of Banking & Finance*, Vol. 21, No. 6, pp.849–870.

Berger, A.N. and Humphrey, D.B. (1997) 'Efficiency of financial institutions: international survey and directions for future research', *European Journal of Operational Research*, Vol. 98, No. 2, pp.175–212.

Berk, J. and DeMarzo, P. (2019) *Corporate Finance*, 5th ed., Pearson [online] https://www.pearson.com/se/Nordics-Higher-Education/subject-catalogue/finance/corporate-finance-5e-berk-and-demarzo.html.

Bolt, W., De Haan, L., Hoeberichts, M., Van Oordt, M.R. and Swank, J. (2012) 'Bank profitability during recessions', *Journal of Banking & Finance*, Vol. 36, No. 9, pp.2552–2564.

Boot, A.W., Thakor, A.V. and Udell, G.F. (1991) 'Secured lending and default risk: equilibrium analysis, policy implications and empirical results', *The Economic Journal*, Vol. 101, No. 406, pp.458–472.

Brogaard, J., Li, D. and Xia, Y. (2017) 'Stock liquidity and default risk', *Journal of Financial Economics*, Vol. 124, No. 3, pp.486–502 [online] https://doi.org/10.1016/j.jfineco.2017.03.003.

Bui, D.T., Vo, T.T.V. and Nguyen, N.H. (2023) 'Forecasting debt default possibility of personal customers at Vietnam Bank for Agriculture and Rural Development – Tan Phuoc Khanh Branch in Binh Duong Province', *Asian Journal of Economics and Banking*, Vols. 1–2, Nos. 202–203, pp.98–116.

Capinski, M. (2007) 'A model of credit risk based on cash flow', *Computers & Mathematics with Applications*, Vol. 54, No. 4, pp.499–506 [online] https://doi.org/10.1016/j.camwa.2007.01.033.

Casey, C. and Bartczak, N. (1985) 'Using operating cash flow data to predict financial distress: some extensions', *Journal of Accounting Research*, Vol. 23, No. 1, pp.384–401.

Chenguel, M.B. and Mansour, N. (2023) 'The impact of the COVID-19 pandemic on the banking system and credit risk', *The Seybold Report Journal*, Vol. 18, No. 5, pp.1855–1869 [online] https://doi.org/10.17605/OSF.IO/6SKH7.

Dao, T.T.B. (2019) 'Establishing credit scoring model for consumer loans in Vietnam', *Journal of Trade Science*, Vol. 128, No. 2021, pp.47–62.

Demirgüç-Kunt, A., Peria, M.S.M. and Tressel, T. (2020) 'The global financial crisis and the capital structure of firms: was the impact more severe among SMEs and non-listed firms?', *Journal of Corporate Finance*, Vol. 60, No. 2020, p.101514.

Dufhues, T., Buchenrieder, G., Quoc, H.D. and Munkung, N. (2011) 'Social capital and loan repayment performance in Southeast Asia', *The Journal of Socio-Economics*, Vol. 40, No. 5, pp.679–691.

Fofack, H. and Fofack, H.L. (2005) *Nonperforming Loans in Sub-Saharan Africa: Causal Analysis and Macroeconomic Implications*, Vol. 3769, World Bank Publications.

Gentry, J.A., Newbold, P. and Whitford, D.T. (1985) 'Classifying bankrupt firms with funds flow components', *Journal of Accounting Research*, Vol. 23, No. 1, pp.146–160 [online] https://doi.org/10.2307/2490911.

Giesecke, K. and Kim, B. (2011) 'Systemic risk: what defaults are telling us', *Management Science*, Vol. 57, No. 8, pp.1387–1405.

Hair Jr., J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1995) *Multivariate Data Analysis*, 3rd ed., Macmillan Publishing Company, New York, NY, Google Scholar.

Harb, E., El Khoury, R., Mansour, N. and Daou, R. (2023) 'Risk management and bank performance: evidence from the MENA region', *Journal of Financial Reporting and Accounting*, Vol. 21, No. 5, pp.974–998, https://doi.org/10.1108/JFRA-07-2021-0189.

Jacobson, T. and Roszbach, K. (2003) 'Bank lending policy, credit scoring and value-at-risk', *Journal of Banking & Finance*, Vol. 27, No. 4, pp.615–633.

Jappelli, T. (1990) 'Who is credit constrained in the US economy?', *The Quarterly Journal of Economics*, Vol. 105, No. 1, pp.219–234.

Kargar, M., Lester, B., Lindsay, D., Liu, S., Weill, P-O. and Zúñiga, D. (2021) 'Corporate bond liquidity during the COVID-19 crisis', *The Review of Financial Studies*, Vol. 34, No. 11, pp.5352–5401.

Kazi, M. (2021) *Default Risk*, IBHero.com Ltd. Trading as Financial Edge Training [online] https://www.fe.training/free-resources/credit/default-risk/ (accessed 15 October 2023).

Kočenda, E. and Vojtek, M. (2011) 'Default predictors in retail credit scoring: evidence from Czech banking data', *Emerging Markets Finance and Trade*, Vol. 47, No. 6, pp.80–98.

Le, T.T., Nguyen, Q.A., Vu, T.M.N., Do, M.P. and Tran, M.D. (2022) 'Impact of income diversification on the default risk of Vietnamese commercial banks in the context of the COVID-19 pandemic', *Cogent Business & Management*, Vol. 9, No. 1, p.2119679.

Manove, M., Padilla, A.J. and Pagano, M. (2001) 'Collateral versus project screening: a model of lazy banks', *The RAND Journal of Economics*, Vol. 32, No. 4, pp.726–744 [online] https://doi.org/10.2307/2696390.

Mensah, C., Raphael, G., Dorcas, O. and Kwadwo, B.Y. (2013) 'The relationship between loan default and repayment schedule in microfinance institutions in Ghana: a case study of Sinapi Aba Trust', *Research Journal of Finance and Accounting*, Vol. 4, No. 19, pp.165–175.

Montgomery, D.C., Peck, E.A. and Vining, G.G. (2021) *Introduction to Linear Regression Analysis*, John Wiley & Sons, Canada.

Ngo, T.Q. (2020) *Research on Factors Affecting the Default Ability of Individual Customers at Cooperative Bank of Vietnam*, National Economics University.

Nguyen, D.N., Nguyen, C.P. and Dang, L.P.X. (2022) 'Uncertainty and corporate default risk: novel evidence from emerging markets', *Journal of International Financial Markets, Institutions and Money*, Vol. 78, p.101571 [online] https://doi.org/10.1016/j.intfin.2022.101571.

Nguyen, Q.N. (2013) 'Factors affecting farmers' ability to ray loans on time at Bank for Agriculture and Rural Development Hau Giang Branch', *CTU Journal of Innovation and Sustainable Development*, Vol. 4, No. 9, pp.85–91.

Nigmonov, A. and Shams, S. (2021) 'COVID-19 pandemic risk and probability of loan default: evidence from marketplace lending market', *Financial Innovation*, Vol. 7, No. 1, p.83 [online] https://doi.org/10.1186/s40854-021-00300-x.

Nijskens, R. and Wagner, W. (2011) 'Credit risk transfer activities and systemic risk: how banks became less risky individually but posed greater risks to the financial system at the same time', *Journal of Banking & Finance*, Vol. 35, No. 6, pp.1391–1398.

Özdemir, Ö. and Boran, L. (2004) *An Empirical Investigation on Consumer Credit Default Risk*, Discussion Paper.

Paxton, J., Graham, D. and Thraen, C. (2000) 'Modeling group loan repayment behavior: new insights from Burkina Faso', *Economic Development and Cultural Change*, Vol. 48, No. 3, pp.639–655 [online] https://doi.org/10.1086/452613.

Phan, D.K. and Nguyen, V.T. (2017) 'Micro factors affecting credit risk: the case of state-owned commercial banks in Hau Giang', *CTU Journal of Science*, Vol. 48, No. D, Article 48 [online] https://doi.org/10.22144/ctu.jvn.2017.635.

Roslan, A.H. and Karim, M.Z. (2009) 'Determinants of microcredit repayment in Malaysia: the case of Agrobank', *Humanity & Social Sciences Journal*, Vol. 4, No. 1, pp.45–52.

Spuchl'áková, E., Valašková, K. and Adamko, P. (2015) 'The credit risk and its measurement, hedging and monitoring', *Procedia Economics and Finance*, Vol. 24, No. 2015, pp.675–681.

Stepanova, M. and Thomas, L. (2002) 'Survival analysis methods for personal loan data', *Operations Research*, Vol. 50, No. 2, pp.277–289.

Stiglitz, J.E. and Weiss, A. (1981) 'Credit rationing in markets with imperfect information', *The American Economic Review*, Vol. 71, No. 3, pp.393–410.

Tra Pham, T.T. and Lensink, R. (2008) 'Household borrowing in Vietnam: a comparative study of default risks of formal, informal and semi-formal credit', *Journal of Emerging Market Finance*, Vol. 7, No. 3, pp.237–261.

Tran, T.P., Nguyen, T.B., Lu, X.T. and Do, T.P. (2020) 'Assessment of individual customers' loan liability – case study of Vietnam Bank for Agriculture and Rural Development – Tan Hung Branch, Long An Province', *Journal of Finance and Marketing*, Vol. 56, No. 6, pp.15–25.

Wagner, W. and Marsh, I.W. (2006) 'Credit risk transfer and financial sector stability', *Journal of Financial Stability*, Vol. 2, No. 2, pp.173–193.

Zeitun, R., Tian, G. and Keen, K. (2007) 'Default probability for the Jordanian companies: a test of cash flow theory', *International Research Journal of Finance and Economics*, Vol. 8, No. 2007, pp.147–162.