Stress Test the financial health of the Vietnam commercial bank during the Covid-19 pandemic

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ARTICLE INFO	ABSTRACT
	The Covid-19 pandemic has had an impact on many aspects of the economy, including commercial banking. The effect of the pandemic on the bank's operation through three main channels, when the pandemic happens, many enterprises have to stop production and business, individuals and households face many difficulties, the change in consumer behavior and investment structure of enterprises or foreign investors. The financial situation of these subjects affects the operation of the bank. The study aims to understand the impact of the pandemic on the financial health of banks in the early stages of the pandemic. Secondary data for the period 2017 to 2020 was collected from the financial statements of 24 Vietnamese commercial banks. The indicators are analyzed using a paired t-test. The article has identified three issues to be concerned about during the pandemic: (1) The liquidity index increases; (2) Non-performing loans decreased while under normal conditions, this index increases continuously over the years; (3) Return on asset increases while under normal conditions, this index decreases continuously over the years. Then, the article proposes implications for solutions to help banks operate efficiently during the pandemic. This study offers a new understanding of the effect of the pandemic on banking operations in Vietnam, a country whose financial system depends mainly on banks.

1. Introduction

As the main source of capital for the economy, countries are trying to come up with solutions to limit the negative impact of the pandemic. However, losses that result from the epidemic are unavoidable, particularly when firms shut down operations and have no revenue to repay loans, increasing the bank's outstanding debt. Banks are also finding it tough to lend due to lower demand. Thus, the pandemic occurs and brings unpredictable losses to banks. This problem is similar to the global recession, even the level of losses can be more serious if the banks have no timely and effective solutions.

Vietnam is one of the countries that has deeply integrated into the economic sector, the country will be caught in the vortex when the sickness spreads globally. As of July 2021, Vietnam has experienced 04 phases of the pandemic with the severity of each increasing gradually. At the beginning of 2020, the world in general and Vietnam, in particular, witnessed a terrible outbreak

of the Covid-19 epidemic, the disease caused unpredictable consequences. Hundreds of thousands of people died, several countries cut off commerce with one another, and manufacturing ground to a halt (Ministry of Health, 2021). The first case was confirmed on January 23, 2020, which can be considered the starting point of the pandemic in Vietnam. On July 25, 2021, the epidemic broke out again and lasted until January 27, 2021, with 1,136 cases (554 domestic cases and 582 imported cases) (Ministry of Health, 2021).

On January 28, 2021, the epidemic broke out in the 3rd wave and lasted until April 26, 2021 with a total of 1,301 cases (910 domestic cases and 391 imported cases) (Ministry of Health, 2021). On April 27, 2021, the epidemic broke out again in the 4th wave with a very strong increase in the number of infections, the number of infections as of July 21, 2021 was 64,508 cases (Ministry of Health, 2021). The 4th wave of the disease has resulted in the blockade of major cities and many provinces across the country. This also means the shutdown of all businesses except those providing essential goods and some businesses operating in special areas.

The Covid-19 epidemic has had a significant impact on bank mobilized capital, according to statistics collected from financial statements of commercial banks, bank deposits are expected to rise significantly in 2020. Credit growth has been significant in the last months of 2020 due to an increase in mobilized money, but banks' mobilized capital remains high due to a severe drop in business demand. Besides, overdue debts of banks tend to increase. Data in the financial statements of some banks show that group 05 debt of some banks are tending to increase many times over the same period last year. In the context of socio-economic and environmental risks and challenges due to the increasingly complex and difficult to control epidemic developments, the banking industry's operations have also been greatly affected. Especially when Vietnam's banking system serves as the primary source of funding for domestic businesses, the number of businesses is dominated by micro and small businesses, which account for 98% of the total number of businesses (Van Anh, 2022).

External shock absorption just isn't very good. During the pandemic, these firms were confronted with numerous challenges and were unable to survive in the face of a long-term epidemic. When businesses and the economy are severely impacted, banks' credit activities are also impacted, especially when credit still accounts for a significant portion of commercial banks' operating revenue. Credit activities of the bank face many difficulties, increased credit risks will lead to liquidity instability and affect the health of the banking industry. Without solutions to deal with difficulties caused by the pandemic, it will be difficult for banks to recover from the pandemic, thereby making it difficult to support the economy in general and businesses in particular.

The purpose of this study was to see how the pandemic affected the health and resilience of the Vietnamese banking industry. Based on the scenarios of the pandemic, the health, and endurance of banks, the article proposes solutions to help banks overcome the shock, and proactively prepare the right health according to each scenario to help the bank operate stably and develop sustainably.

2. Methodology

2.1. Bank's health

A commercial bank is a financial institution that specializes in performing banking activities such as money and financial services. A bank's two primary activities are deposit mobilization and lending. The bank's operations are affected by many different factors such as internal factors of the bank, and macro factors including the force majeure group such as the pandemic. Banking operations play an important role in the economy, so the health of banks has always received great attention from stakeholders. A healthy banking system will benefit all parties such as bank managers, the customer, the public, central banks, and governments (Iftikhar, 2016).

A healthy, well-functioning bank is one that can effectively perform its tasks, maintain and retain the public's trust, and serve as the government's mediator in policy implementation, particularly monetary policy (Suhartono, 2017). An unhealthy bank will not only jeopardize the bank's operations but also adversely affect all stakeholders such as owners, managers, customers, and the central bank.

By balancing its loans and deposits, a bank contributes to the economic development of any country, although it occasionally encounters problems with categorized or nonperforming loans (NPLs) or Problem Loans (PL). PL refers to borrowers who fail to provide required documents despite numerous reminders and are unable to demonstrate any legitimate reasons for their failure. A good loan is one that combines willingness and ability to repay, whereas a bad loan is one that lacks one or both. The NPL ratio can be used to assess a bank's financial health. Lower the ratio, the higher the bank's financial health, and vice versa (Khan, 2009).

The endogenous determinant of a bank's financial health is liquidity risk. Bank health may be harmed as a result of liquidity risk. Banks with a larger funding gap lack stable and inexpensive funds, forcing them to rely on liquid assets or a considerable amount of external funding to meet demand, raising the bank's funding costs. Liquidity risk derives from a bank's incapacity to accept drops in obligations or fund growth in assets, according to the Basel Committee on Banking Supervision's (1997) definition. When a bank's liquidity is insufficient, it can't get enough money quickly enough, either by expanding liabilities or converting assets at a fair cost, impacting profitability.

Banks can use capital adequacy to manage shocks to their balance sheets. By applying risk weightings to the institution's assets, it analyzes capital adequacy ratios that take into consideration the most major financial risks-foreign exchange, credit, and interest rate risks (Baral, 2005). Because a profitable banking sector is better able to resist negative shocks, it helps in the prediction of financial crises. Furthermore, because of agency expenses and tax disadvantages, bank profitability variations have a negative impact on their ability to release new shares (Albulescu, 2015).

To assess the financial health of a bank, many different methods can be used such as factor analysis, CAMELS method, using the RGEC index, ... The RGEC index is often used to assess the health of banks in the event of unanticipated shocks. Many scholars have used this ratio to assess the health of banks such as Aspal and Dhawan (2014), Dwinanda and Wiagustini (2015), Anwar (2016), Andriyani, Mayasari, and Aryani (2018), Lisa and Hermanto (2020). The RGEC index is composed of financial indicators including credit risk, liquidity, profitability, capital adequacy ratio, and scores for assessing success in banking governance.

Table 1

Indicators used to assess bank health

Indicators	Description
Credit risk (NPL)	= Nonperforming loans / Total loan
Liquidity risk (LDR)	= Total loan / Total deposit
Return on Asset (ROA)	= Return / Toatal asset
Return on Equity (ROE)	= Return / Equity
Capital adequacy ratio (CAR)	= Equity / Risk weighted assets

Source: Lisa and Hermanto (2020)

In which, the credit risk is measured by the non-performing loan ratio. Profitability is measured by two indicators, ROA and ROE. The indicator of success in banking governance is evaluated according to the criteria in Table 2.

Table 2

Indicators used to assess the success of banking governance

Criteria	Proportion
The level of performance of duties and responsibilities of the board of directors	10%
Level of performance of duties and responsibilities of the board of directors	20%
Level of implementation of commitments	10%
Resolving conflicts of interest	10%
Functional compliance level	5%
The level of performance of the internal audit function	5%
Level of external audit performance	5%
Level of implementation of risk management and internal control	7.5%
Level supply capital for customers, especially large customers	7.5%
Financial transparency and non-financial terms	15%
Bank's business strategy	5%

Source: Lisa and Hermanto (2020)

Many factors influence the health of banks, including unanticipated shocks such as a pandemic. The bank's health may be affected more or less depending on the severity of the pandemic. Forecasting the severity of the pandemic will assist banks in predicting the extent of the impact, allowing them to develop appropriate responses.

2.2. Scenarios of the pandemic

One of the most commonly used pandemic scenarios in research is the scenario of Lee and Basnyat (2003), which was later studied further by McKibbin and Sidorenko (2006). To classify disease scenarios, these authors used epidemic attack rates, which considering the proportion of the entire population infected, the death rate of those infected dying, and the mortality rate of the general population. Pandemic scenarios can be split into seven categories based on the level of each group (Table 3).

Table 3

Scenarios of the Covid-19 pandemic

Scenarios	The attack rate of the disease	The mortality rate of infected people	The mortality rate of the general population
S01	1%	2.0%	0.02%
S02	10%	2.0%	0.05%
S03	30%	3.0%	0.09%
S04	10%	2.0%	0.2%
S05	20%	2.5%	0.5%
S06	30%	3.0%	0.9%
S07	10%	2.0%	0.2%

Source: Lisa and Hermanto (2020)

Based on the above assumptions, the first scenario S01 with the epidemic attack rate is 1% of the population, the mortality rate of infected people is 2%, and the mortality rate is calculated as follows: number is 0.02%. Scenario S02 shows that the epidemic situation is more aggressive with a rate of 10% of the population being infected, 2.0% of infected people dying, and a mortality rate of 0.05%. Scenario S03 shows that the situation is more serious, with 30% of the population infected, the death rate of infected people is 3%, and the death rate per population is 0.09%.

Scenario S04 shows that the infection rate and the proportion of infected people are similar to scenario S01, but the mortality rate calculated for the general population is higher, accounting for 0.2%. Scenario S05 shows an epidemic attack rate of 20% of the population, a mortality rate of those infected at 2.5%, and a mortality rate per population of 0.5%. Scenario S06 is similar to scenario S03, but the mortality rate per population is higher, accounting for 0.9%. The development of this group of scenarios is more complicated due to the global nature of the pandemic. Scenario S07 with a patient rate of 10% of the population, a patient mortality rate of 2.0%, and a population-based mortality rate of 0.2%.

Of these seven groups, scenario S01, S02, and S03 assume epidemiological events isolated from the outbreak country. The disease-affected country will suffer the economic impact and spread to other countries through trade and capital flows. Scenario S04 to S06 is a pandemic scenario in which epidemiological shocks occur in all countries to varying degrees. Scenarios S01 to S06 assume that shocks are temporary. Scenario 7 is a mild pandemic that is expected to recur every year for the indefinite future.

When these situations occur, countries' economies will be impacted in various ways, including labor supply, capital risk premium, production cost, consumer demand, and government costs, among others. Any scenario that unfolds will have a greater or lesser influence on the bank's health, altering the bank's resilience and recovery following the pandemic.

2.3. The impact of the pandemic on the health of banks

According to Kulińska-Sadłocha, Marcinkowska, and Szambelańczyk (2020), when a pandemic occurs, the socio-economic situation of a country will be affected as follows:

- Due to the impact of social distancing or freezing for some sectors and industries, economic activities such as production, distribution, trade, and services will be slowed.

- Consumption of goods and services decreased due to fear of the spread of disease or due to isolation, social distancing, inability to access distributors, due to reduced collection of people, due to high rate of increased mortality, …

- Disruption in supply chains and market operations due to border closures, and strict regulations on entry.

- Businesses are experiencing financial difficulties, and profits are suffering as a result of postponed consumption or changes in people's consumption patterns. As a company's lack of liquidity increases, so do its investment risks.

- Financial market volatility caused by plummeting stock prices, changing interest rates, currency fluctuations, and increased speculation.

- Government revenue from taxes decreased while expenditures increased, leading to a bank deficit and an increase in public debt.

Banks are intermediary financial institutions of the economy. In essence, a bank is also a business, so its operations are not outside the whirlpool of the impact of the pandemic. The impact

of the pandemic on financial activity, on the other hand, is rather distinct. The process of world economic development has witnessed the impact of a pandemic or some other incident that has a strong impact on the economies. The conclusions drawn by economists for these effects are that the outcomes are unpredictable, exceeding situations that would normally be expected to have dire consequences. However, according to the conclusions of researchers and WHO professional reports, there is a close relationship between public health, economic growth, and economic and social development.

Covid-19, like other pandemics, attacked and affected the operations of commercial banks. The magnitude of the impact, on the other hand, is difficult to predict and is dependent on the disease's spread speed and extent. The Covid-19 epidemic usually has little impact on the financial business in the short term, but it has a significant impact in the long run (Kulińska-Sadłocha et al., 2020). The pandemic can affect the operations of banks directly or indirectly. When a pandemic strike, banks that are directly affected may close some branches to prevent the disease from spreading. In addition, the staff working in the bank may also change due to infection. In addition to the direct impact, the pandemic also has an indirect impact on the bank's business activities. The indirect impacts mainly stem from the impact on the general operation of the economy and society and the impact on bank operations. Which, the main transmission channels are:

- The difficult financial situation of enterprises that have to stop production and business will lead to recession, more seriously, into crisis and bankruptcy.

- Financial situation of individuals and households facing many difficulties.

- The change in consumer behavior and investment structure of enterprises or foreign investors.

Through transmission channels, banking activities will be affected and the extent of the impact will depend on the pandemic scenarios and the banks' strategies.

3. Research data and research methods

Research data is collected from the financial statements of 24 commercial banks. The study is expected to examine the impact of the Covid-19 pandemic on the financial health of the bank before and during the pandemic. So, the data will be divided into the stage, the pre-Covid-19 period and the Covid-19 period. In Vietnam, the pandemic occurred in early 2020, therefore, research data was collected from 2017 to 2020. Due to the limitation of published data, the study only evaluates the health Bank's health in terms of financial indicators including credit risk, liquidity, profitability, and capital adequacy ratio. Therefore, the research results will mainly focus on assessing the health of banks in terms of financial efficiency.

Although the data is collected from 24 banks, the total assets of these 24 banks as of 2020 account for more than 80% of the system, so they are representative of the whole Vietnamese commercial banking system. Despite the fact that the pandemic began in Vietnam in early 2020, it has had a significant impact on the Vietnamese economy, particularly commercial activity, which are the bank's key customers. The research period was separated into two periods, before and during the pandemic, to identify the impact of the Covid-19 pandemic on the health of Vietnamese banks.

Because the objective is to find out how the Covid-19 pandemic affects the operations of Vietnamese commercial banks, this study uses the Paired Samples T-Test. This test is used to determine the difference between a group of subjects under different conditions. This test has also been used by Seelye and Ziegler (2020) to examine the impact of Covid-19 on the health of the

banking system in the US. If the result is close to 0, there is no difference between the two groups of objects. If the result is 0, there is a difference between the two groups of research subjects.

4. Research results

4.1. Descriptive statistics

Descriptive statistics provide information about variables, the number of observations, mean, standard deviation, minimum value, and maximum value of the research indicators.

Table 4

Descriptive statistical results

Variable	Obs	Mean	Std. Dev.	Min	Max
dcar2017	24	-.044	.146	-.355	.175
dcar2018	24	.029	.231	-.375	.653
dcar2019	24	-.059	.271	-.874	.855
dcar2020	24	.136	.856	-.988	3.994
dnpl2017	24	-.004	.551	-.869	2.053
dnpl2018	24	.236	.608	-.582	2.612
dnpl2019	24	.320	1.152	-.716	4.329
dnpl2020	24	.214	1.114	-.776	4.307
dldr2017	24	.070	.066	-.0236	.2835
dldr2018	24	.039	.079	-.158	.215
dldr2019	24	-.041	.222	-.755	.259
dldr2020	24	.200	.739	-.187	3.040
droa2017	24	.172	.549	-.989	-.989
droa2018	24	.488	1.003	-.345	4.796
droa2019	24	.192	.552	-.819	2.102
droa2020	24	.311	1.638	-.974	7.817
droe2017	24	2.576	8.106	-.597	3.625
droe2018	24	.578	1.319	-.354	6.064
droe2019	24	.212	.591	-.711	2.350
droe2020	24	-.022	.4305	-.971	.806

Source: Author's own findings

4.2. Paired T-Test results

After the data has been collected, it will be analyzed using the Paired T-Test. This test is carried out for each group of indexes and compared over the years to see the difference in the fluctuations of the indexes from 2017 to 2020. Research results are carried out for 24 banks in the system to determine whether there is a statistically significant difference between indicators of the health of the banking system in the pre-pandemic period and during the pandemic.

Table 5

Paired T-Test results of liquidity

Variables	Number of observations	Mean	Standard error	Standard deviation	[95% confidence]	
dldr2020	24	0.2001	0.1510	0.7397	-0.1122	0.5125
dldr2019	24	-0.0415	0.0454	0.2224	-0.1355	0.0523
diff	24	0.2417	0.1935	0.9484	-0.1587	0.6421
dldr2019	24	-0.0415	0.0454	0.2224	-0.1355	0.0523
dldr2018	24	0.0397	0.0162	0.0793	0.0062	0.0732
diff	24	-0.0813	0.0482	0.2365	-0.1812	0.0185
dldr2018	24	0.0397	0.0162	0.0793	0.0062	0.0732
dldr2017	24	0.0703	0.0136	0.0668	0.0421	0.0985
diff	24	-0.0305	0.0212	0.1041	-0.0745	0.0134

Source: Author's own findings

The results in Table 5 show that the average liquidity volatility of banks in 2020 (0.2001 ± 0.1510) is higher than in 2019 (-0.0415 ± 0.0454), an increase of 0.2417 with 5% statistical significance, t (24) = 1.2485, $p < 0.0005$. The bank's liquidity in 2019 was lower than in 2018 (0.0397 ± 0.0162), decreasing by 0.0813 with statistical significance at 5%, t (24) = -1.6841, $p < 0.0005$. The bank's liquidity in 2018 was lower than that in 2017 (0.0703 ± 0.0136), a decrease by 0.0305 with statistical significance at 5%, t (24) = -1.4372, $p < 0.0005$. The results show that in the period from 2016 to 2019, the liquidity of banks tends to decrease but increased in 2020. Thus, under the impact of Covid-19, the liquidity of commercial banks Trade in Vietnam tends to increase compared to before the pandemic.

Table 6

Paired T-Test results of capital adequacy

Variables	Number of observations	Mean	Standard error	Standard deviation	[95% confidence]	
dcar2020	24	0.1363	0.1747	0.8560	-0.2250	0.4978
dcar2019	24	3.2318	3.3316	16.3218	-3.6602	10.1240
diff	24	-3.0955	3.3864	16.5900	-10.1008	3.9098
dcar2019	24	3.2318	3.3316	16.3218	-3.6602	10.1240
dcar2018	24	0.0291	0.0471	0.2312	-0.0684	0.12682
diff	24	3.2027	3.3046	16.1892	-3.6334	10.0388
dcar2018	24	0.0291	0.0471	0.2312	-0.0684	0.1268
dcar2017	24	-0.0447	0.0298	0.1461	-0.1064	0.0169
diff	24	0.0739	0.0623	0.3056	-0.0551	0.2029

Source: Author's own findings

The results in Table 6 show that the average capital adequacy ratio volatility of banks in 2020 (0.1363 ± 0.1747) is lower than in 2019 (3.2318 ± 3.3316), decreasing 3.0955 with 5% statistical significance, t (24) = -0.9141, p < 0.0005. The bank's capital adequacy ratio in 2019 was higher than that in 2018 (0.0291 ± 0.0471), increasing by 3.2027 with statistical significance at 5%, t (24) = 0.9692, p < 0.0005. The bank's capital adequacy ratio in 2018 was higher than that in 2017 (-0.0447 ± 0.0298), increasing by 0.0739 with statistical significance at 5%, t (24) = 1.1846, p < 0.0005. The results show that in the period from 2016 to 2019 capital adequacy ratios of banks tend to increase but decrease in 2020. However, the CAR coefficients of many banks from 2020 are calculated according to the Circular. 41 while in the previous time, banks were calculated according to Circular 36. Thus, although the average volatility of the bank's CAR coefficient will decrease in 2020, it cannot be concluded due to the impact of Covid-19.

Table 7

Paired T-Test results of non-performing loan

Variables	Number of observations	Mean	Standard error	Standard deviation	[Sig. at 5%]	
dnpl2020	24	0.2147	0.2273	1.114	-0.2556	0.6851
dnpl2019	24	0.3205	0.2353	1.527	-0.16625	0.8072
diff	24	-0.1057	0.3699	1.8124	-0.8710	0.6595
npl2019	24	0.3205	0.2353	1.1527	-0.1662	0.8072
dnpl2018	24	0.2366	0.1241	0.6082	-0.0202	0.4934
diff	24	0.0839	0.2509	1.2292	-0.4351	0.6029
dnpl2018	24	0.2366	0.1241	0.6082	-0.0202	0.4934
dnpl2017	24	-0.0046	0.1125	0.5512	-0.2373	0.2281
diff	24	0.2412	0.1815	0.8892	-0.1342	0.6167

Source: Author's own findings

The results in Table 7 show that the average NPL volatility of banks in 2020 (0.2147 ± 0.2273) is lower than that in 2019 (0.3205 ± 0.2353), decrease by 0.1057 at the 5% level of statistical significance, t (24) = -0.2858, p < 0.0005. Non-performing loan in 2019 was higher than in 2018 (0.2366 ± 0.1241), increasing by 0.0839 with statistical significance at 5%, t (24) = 0.3344, p < 0 .0005. The average volatility of non-performing loan of banks in 2018 was higher than that in 2017 (-0.0046 ± 0.1125), increased by 0.2412 with a statistical significance of 5%, t (24) = 1, 3289, p < 0.0005. The results show that in the period from 2016 to 2019, the credit risk of banks tends to increase but decrease in 2020. Thus, under the impact of the pandemic, the non-performing loan of commercial banks in Vietnam tend to decrease.

Table 8

Paired T-Test results of ROA

Variables	Number of observations	Mean	Standard error	Standard deviation	[Sig. at 5%]	
droa2020	24	0.3111	0.3345	1.6389	-0.3809	1.0032
droa2019	24	0.1924	0.1127	0.5524	-0.0408	0.4256
diff	24	0.1187	0.3962	1.9411	-0.7009	0.9383
droa2019	24	0.1924	0.1127	0.5524	-0.0408	0.4256
droa2018	24	0.4887	0.2048	1.0036	0.0649	0.9125
diff	24	-0.2963	0.2455	1.2027	-0.8042	0.2115
droa2018	24	0.4887	0.2048	1.0036	0.0649	0.9125
droa2017	24	3.2978	2.5441	12.4639	-1.9651	8.5609
diff	24	-2.8090	2.5400	12.4436	-8.0635	2.4454

Source: Author's own findings

The results in Table 8 show that the average ROA volatility of banks in 2020 (0.3111 ± 0.3345) is higher than in 2019 (0.1924 ± 0.1127), an increase of 0.1187 with statistical significance at 5%, t (24) = 0.2996, p < 0.0005. The average ROA volatility in 2019 was lower than in 2018 (0.4887 ± 0.2048), down 0.2963 with statistical significance at 5%, t (24) = -1.2071, p < 0.0005. The average ROA volatility of banks in 2018 was lower than that of 2017 (3.2978 ± 2.5441), down 2.8090 at 5% statistical significance, t (24) = 1-1, 1.059, p < 0.0005. The results show that in the period from 2016 to 2019, ROA of banks tends to decrease but increased in 2020. Thus, under the impact of the pandemic, the ROA of banks increased compared to before the pandemic.

Table 9

Paired T-Test results of ROE

Variables	Number of observations	Mean	Standard error	Standard deviation	[Sig. at 5%]	
droe2020	24	-0.0224	0.0878	-0.4305	-0.2042	0.1593
droe2019	24	0.2125	0.1207	0.5917	-0.0372	0.4624
diff	24	-0.2350	0.1763	0.8638	-0.5998	0.1297
droe2019	24	0.2125	0.1207	0.5917	-0.0372	0.4624
droe2018	24	0.5789	0.2692	1.3192	0.0218	1.1359
diff	24	-0.3663	0.2995	1.4676	-0.9860	0.2533
droe2018	24	0.5789	0.2692	1.3192	0.0218	1.1359
droe2017	24	2.5763	1.6547	8.1066	-0.8467	5.9995
diff	24	-1.9974	1.6749	8.2055	-5.4623	1.4674

Source: Author's own findings

The results in Table 9 show that the average ROE volatility of banks in 2020 (-0.0224 ± 0.0878) is lower than in 2019 (0.2125 ± 0.1207), down 0.2350 with statistical significance at 5%, t (24) = -1.3330, p < 0.0005. The average ROE volatility in 2019 was lower than in 2018 (0.5789 ± 0.2692), down 0.3663 with statistical significance at 5%, t (24) = -1.2229, p < 0.0005. The average volatility of the bank's ROE in 2018 was lower than that in 2017 (2.5763 ± 1.6547), down 1.9974 at the 5% level of statistical significance, t (24) = -1.1925, p < 0.0005. The results show that in the period from 2016 to 2020, the average ROE volatility of banks tends to decrease. Thus, under the impact of the pandemic, the non-performing loan of commercial banks in Vietnam tends to decrease, this result is similar to pre-pandemic although the average volatility is different.

The summary of research results shows that when the Covid-19 pandemic occurs, the bank's liquidity increases, non-performing loans decrease, and the profit-to-total asset ratio increases. However, this result only shows in the early stages of the pandemic.

5. Conclusions and implications for solutions

5.1. Conclusions

The results of the T-test on the health of Vietnamese commercial banks through financial indicators are summarized in Table 10.

Table 10

Summary of Paired T-test results

Year	Average difference	T - value
Capital Adequacy Ratio (CAR)		
2020/2019	-3.0955	-0.9141
2019/2018	3.2027	0.9692
2018/2017	0.0739	1.1846
Credit Risk Ratio (NPL)		
2020/2019	-0.1057	-0.2858
2019/2018	0.0839	0.3344
2018/2017	0.2412	1.3289
Liquidity Ratio (LDR)		
2020/2019	0.2417	1.2485
2019/2018	-0.0813	-1.6841
2018/2017	-0.0305	-1.4372
Return On Asset (ROA)		
2020/2019	0.1187	0.2996
2019/2018	-0.2963	-1.2071
2018/2017	-2.8090	-1.1059
Return On Equity (ROE)		
2020/2019	-0.2350	-1.3330
2019/2018	-0.3663	-1.2229
2018/2017	-1.9974	-1.1925

Source: Summary of research results

Based on Vietnam's number of infections and disease deaths in 2020 and pandemic scenarios, the epidemic scenario in Vietnam is only in group S01. The impacts of the Covid-19 epidemic during this period are mainly indirect effects through different transmission channels. The results of comparing data on financial indicators of the bank when the Covid-19 pandemic occurred and before the pandemic showed some interesting results as follows:

- Liquidity increased during the pandemic. This ratio decreased continuously over the years pre- Covid-19 period.

- Non-performing loans decreased when the pandemic occurred. This ratio this index increased continuously pre- Covid-19 period.

- The ratio of return on total assets increases when the pandemic occurs, while in normal conditions, this index decreases continuously over the years.

From the research results, we can conclude that when the Covid-19 epidemic occurs in the early stages, bank liquidity increases, bad debts decrease, and ROA increases while all these ratios tend to move in the opposite direction.

These results are similar to the results of Seelye and Ziegler (2020) when studying the impact of Covid-19 on the health of the largest listed banks in the US. Although these indicators are generally positive, indicating that the bank's health is improving, there is something unusual about the volatility trend. Banks' health will no longer be stable in the event of increasingly dangerous pandemic scenarios without timely solutions and thoughtful preparation, and banks may not be able to withstand shocks. The article then goes on to discuss the implications for Vietnamese banks in more serious situations, including how to help banks recover quickly once the epidemic is gone.

5.2. Implication for solutions

Based on the research result and depending on the epidemic conditions, the article proposed the following solutions for banks to overcome the crisis and recover quickly after the pandemic. The proposed solutions focus on three issues including increasing liquidity, reducing bad debts, and increasing profitability for banks.

In case the epidemic situation hits more but is still considered under control, the economy has not been affected much and the bank can still control its operations as in a normal state. The bank continues to improve asset quality and capital efficiency, complete capital use planning, develop a capital use roadmap for each business stage, and implement disclosure information in a complete and timely manner. Develop a mechanism to manage and use business capital, and inspect and promote debt recovery regularly. Strictly follow the rules of financial management in business. Improve business efficiency, exploit capital sources, rapidly increase working capital turnover, mobilize capital for credit activities. Implement product diversification and service quality. Accelerate the process of bank digitization and technology application to support bank operations. Procedures, working methods, and internal transactions should all be digitized.

If the pandemic spreads, more people and property will be lost. Banks need to have different policies compared to previous periods because overdue debts in some fields and industries tend to increase. Therefore, in addition to continuing to implement the above solutions, banks need to have more different policies, creating more favorable conditions for businesses in this special group. Implement the restructuring of the repayment period, exemption, and reduction of loan interest for customers borrowing capital at the bank. Promote customers' transactions to online mode through user incentives such as reducing annual fees, raising deposit interest rates for online deposits, etc.

If the pandemic is more severe, the loss of life is more severe as in the situations of scenarios S04, S05, S06, and S07, the following implications are proposed for banks to improve the operation to reduce loss:

- Banks need to increase the provision for credit risks for high-risk industries. In addition, the bank needs to have a strategy to strengthen its advantageous activities during the epidemic season, such as developing specialized banking product packages for customer groups that are in industries such as thermometers, medical equipment, etc. essential services, online business, food, face masks, hand sanitizer present. Strengthen the development of internet banking and mobile banking payments, ensure the safety of these transactions, and reduce fees or charges for existing customers.

- Consider debt rescheduling and debt extension solutions for businesses affected by the pandemic. Implement preferential policies to exempt and reduce many types of transaction fees for customers, including inter-bank money transfer transactions, and online payment transactions. Minimize expenses to create financial resources to support customers, people, and businesses, publicly announce the support interest rate, support measures, and policies so that people and businesses can know and access them.

- Enhance the efficiency of capital use by dividing the proportion of the portfolio, increasing investment in government bonds because this is a relatively safe investment channel although the rate of return is lower. Lower interest rates to save capital input. Lower input interest rates are the basis for banks to reduce input costs. Since then, banks have had conditions to reduce lending interest rates to create cheap loans and stimulate demand.

- Focus on developing services with non-interest income sources instead of loosening credit for businesses to avoid bad debts from happening again. Continue to encourage customers to use online banking services to increase customer experience and save human resources to reduce operating costs in the long run.

In summary, from the author's point of view, banks still need to be well prepared to be able to recover quickly after the pandemic. Based on the scenarios of the pandemic, health, and stamina, banks need to have appropriate solutions. In addition to solutions to maintain business operations during the epidemic season, banks also need to have appropriate solutions to take advantage of opportunities to support groups of businesses with good business opportunities during the epidemic season, minimizing costs from the negative indirect effects of the pandemic. Besides, banks also need to develop a long-term business strategy because, after the pandemic, the business environment will have a certain change.

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