Interpreting the Post-Epidemic Banking Sector from a Game Theory Perspective

— Using Silicon Valley Bank as an Example

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Abstract: Overview of the trend in the banking industry after the epidemic, regarding the rise of digital banking (neobanking) and customers' investment behavior — a low-risk portfolio is what most people prefer. The trend of moving business from bank branches to online is a remarkable evolution during COVID-19 and is likely to be the future operation mode of the banking industry. From the general view of the banking industry to the specific bank, a case study of Silicon Valley Bank (SVB) is employed to explain the relationship between game theory and bank run. This paper focuses on identifying the failure of SVB through the discussion of economic aspects such as fund rate hikes and applying game theory and higher-order beliefs to SVB's case. It finds out that the unique equilibrium for players is a bank run, which needs sound policy and tangible action from authorities to reduce its negative impact on customers and other financial institutions. SVB's bankruptcy does not trigger another major financial crisis, but the severity of the bank run still needs to be taken seriously.

Keywords: game theory, bank failure, Silicon Valley Bank

1. Introduction

In light of the numerous uncertainties and global events in politics and economics, the post-epidemic period has witnessed the second largest bank failure in US history and triggered a series of chain reactions, such as public distrust of the financial system and the repercussions on the global equity market. According to the research done by Dharen Kumar Pandey et al., the Americas, Middle East, and African markets experienced dramatic negative returns in the short run, while European markets were affected over a longer time horizon [1]. Repercussions aside, there are also other papers and articles discussing and examining the reasons behind this unpredictable bank run. For example, a paper done by Lai Van Vo and Huong Le uses the unrealized losses to total assets ratio compared with its peers to prove that SVB is in bad financial shape [2]. There are sufficient papers to work out the reasons behind SVB's bankruptcy. However, few of them link the failure with game theory to explain that the bank run is an ultimate consequence under normal practices, and that it is the authority's job to have precautionary measures.

This paper will first look into the change in customers' financial behavior and examine the future trend of the banking sector, which is important for both bankers and customers. For bankers,

acknowledging clients' needs and demands is the priority when providing services. The preferences of customers regarding investment goods have a significant impact on the wealth management plans that are recommended to them. For customers, employing user-friendly platforms and technologies enhances their living standards and efficiency, avoiding the need to physically visit a bank branch and reducing information asymmetry in comparison to online platforms and human managers. The data used to support the argument is mostly retrieved from Statista. The second part scrutinizes the failure of Silicon Valley Bank (SVB) in 2023. Few factors are identified, and this essay will mainly use the game theory and higher-order belief illustrated by Franklin Allen and Stephen Morris to link with SVB [3]. Allen and Morris only put forward the theory, and this essay will help enrich examples in real life.

2. Game Theory

Game theory is generally believed to have first appeared in the book The Theory of Games and Economic Behaviors written by von Neumann and Morgenstern back in 1944, but it was not widely recognized and applied in the financial field at first. According to Anjan Thakor, the gaming behavior that game theory tries to explain is all around us, and game theory can be identified as a field of research that examines scenarios in which individuals form basic assumptions about the participants in a given situation and subsequently analyze the outcomes when each individual seeks to optimize their expected utility while considering the limitations imposed by their information, beliefs, resources, and production capabilities [4]. The reason for using SVB as an example to illustrate the relationship between game theory and bank runs is due to its significance and post-epidemic timing. Bank failure is not uncommon to see in the US every year, but SVB successfully raised people's concerns about whether there will be another major financial crisis in history. This can show that this level of bank failure is rare. Moreover, the years-long pandemic has also changed how people perceive the global market and the way they behave accordingly.

3. Overview of the Banking Industry After Pandemic

With the increasingly improved outbreak of COVID-19, the scope of impact on individuals, small and medium enterprises, and even giant corporations is weakened due to the ease of city lockdowns and the recovery of the tourism industry. Therefore, in order to recover economic and financial stability, authorities usually implement support measures. For example, the Hong Kong Monetary Authority permitted authorised institutions to run with a lower level of liquidity ratio temporarily under the liquidity coverage ratio and liquidity maintenance ratio regimes [5]. Similarly, the Federal Reserve (Fed) adopted a comparable measure, which tended to stimulate expenditure to achieve economic recovery by adjusting the federal fund rate. The action was called the "culprit" of Silicon Valley Bank's (SVB) failure, which will be further explained in the following [6].

Massive city lockdowns and self-quarantine measures from 2020 have caused a series of changes in the world. What the banking sector has experienced is the rapid growth of mobile banking, which transfers the businesspeople used to conducting business at branches to online applications. The observation is the emerging growth of digital banking, or so-called "neobanking," especially among teenagers aged between 15 and 24, and the forecast number of digital banking users will reach 216.8 million in the U.S. in 2025, according to Statista [7]. According to the data from Statista, the number of mobile banking app downloads in the U.S. increased sharply from 109.8 million in 2019 to 143.7 million downloads in 2022. It is shown that people's preference for digital banking has increased, partly as a result of the pandemic [8].

In addition to transitioning their banking activities to online platforms, individuals who engaged in investment activities during the pandemic, modified their investment portfolios to include low-risk

alternatives or increased their savings instead as a result of diminished optimism regarding the future prospects of the market. More than 30 percent of respondents in Hong Kong, France, Indonesia, Mainland China, and India said that they saved more money in 2020 [9]. Hence, it is foreseen that customers' confidence in the market still needs time to be reestablished, and before that, they will hold rather low-risk investment products such as bonds or value stocks. Furthermore, there is a huge difference between retail investors and institutional investors regarding trust levels in global finance. During the pandemic, due to the unstable economics, only 46% of retail investors surveyed showed trust in global finance, while 65% of institutional investors showed confidence in that [10]. The reason could be the asymmetry in information, as institutional investors should master more information regarding other companies and market performance. As a result, the percentage of institutional investors increased by 21% in 2022, while the percentage of retail investors increased by 14% [10]. Consequently, these two types of investors may act differently when designing their portfolios.

4. The SVB's Collapse and Reasons Behind

4.1. Background of SVB

SVB was established in 1983 in Santa Clara, California with the primary objective of providing assistance to the advancement of innovation and entrepreneurship within the technology industries. It emerged as the dominant bank in terms of deposit volume in Silicon Valley and earned the support of nearly half of all venture-backed tech startups. It is paradoxical that shortly before the bank's collapse, it was recognized by Forbes as one of the top American banks due to its growth rate, credit standards and profitability [2]. This paper explains why SVB collapsed and specifically examines the relationship between game theory and the unique trigger of undiversified clients in the context of the second greatest bank failure in U.S. history.

4.2. Factors Led to Failure

4.2.1. Volatile Financial Environment

The onset of the pandemic-induced economic downturn has created a state of uncertainty over the future trajectory, leaving individuals and institutions uncertain about whether conditions will deteriorate or improve. As a result, the inclination to minimise spending, retain deposits, and prioritise the most liquid assets, such as cash, is a rational decision that is commonly practised in some countries [9]. However, the economic situation deteriorated significantly since it cannot be supported without a degree of consumption. Consumption is the direct driver of GDP growth and indirectly controls the employment rate as stores may cut labour costs without sufficient revenue.

The Federal Reserve stepped in to maintain normal banking operations. In March 2020, the Fed reduced its target for the federal fund rate, which represents the interest rate at which banks borrow from one another overnight, by a cumulative 1.5 percentage points. The implemented reductions resulted in a decrease in the fund rate, bringing it within the range of 0% to 0.25% [2]. The federal fund rate serves as a reference point for various short-term interest rates and has an impact on longer-term interest rates. Apart from this, the Federal Reserve engaged in the acquisition of substantial amounts of Treasury securities and mortgage-backed assets with the objective of maintaining low long-term interest rates. Despite their intention, the actions undertaken have played a role in the expansion of the public debt, which experienced a significant increase of approximately $5 trillion in three months [2]. This phenomenon has caused public concern regarding the country's long-term financial stability.

4.2.2. Fund Rate Hike

The epidemic had a profound impact on various aspects, including but not limited to economic uncertainty and variation. Consequently, the Federal Reserve's unexpected action of raising a record-breaking percentage of interest rate led to bank failures.

As a response measure to the elevated inflation rate observed in 2022, the Fed implemented a substantial and unprecedented rise in the interest rate, increasing it from 0.25% in March 2020 to 4.5% at the end of the year [11]. This development had a significant impact on the portfolio of the SVB, which mostly consisted of treasury bills and mortgage-backed securities. The securities can be categorised into two types: 'Available for Sale' (AFS) and 'Held to Maturity' (HTM). AFS refers to securities held by the bank that can be freely sold at any given moment. At the end of 2020, these securities, worth around $26 billion, are valued based on their market value, which may result in actual losses being incurred due to the prevailing high interest rates at the time of the transaction [2]. In the long run, it might be shown that there is a problem with their investment portfolio.

5. Interpretation of This Scenario from a Gamer Theory Perspective

One of the crucial factors that led to the bank run was the lack of customer diversification. Research done by Lai Van Vo and Huong Le has shown that by the end of 2022, there was a notable rise in the quantity of bank accounts exceeding a valuation of $250,000, reaching a total of 37,466, where the total number of deposit accounts was 143,886 [2]. These minority accounts formed a significant proportion of 89.38% in terms of the whole amount. These figures proved that SVB, possessing most deposit accounts from Silicon Valley, had the problem of lack of client diversification. As a result, they were likely to know each other and aggregate higher-order beliefs.

Franklin Allen and Stephen Morris put forward that the depositors' higher-order beliefs determined the consequences of the bank run back in 1998. According to their theory, higher-order belief implies that the fundamentals themselves are not the only concern when people make choices, but also how others perceive the fundamentals and what others' beliefs are [3]. SVB's failure can be attributed to the concentrated group of customers in start-ups, and game theory further confirmed that such higher-order beliefs determine the bank run within 48 hours.

The following game theory payoff is the modelling from Allen and Morris, which was applied in this essay in the case of SVB. For the sake of simplicity in elaborating on the issue, the assumption is that the SVB only has two depositors: D1 and D2. There are also four states of "fundamentals": both have liquidity needs, only D1 or D2 have liquidity needs, and none of them have liquidity needs. When a depositor chooses to withdraw their money from SVB, he is assured of receiving the interest, denoted as "r.". If he chooses to retain his money in the account and another depositor also chooses to retain his fund, they get a payoff of R separately. However, if he chooses to retain his fund while the other depositor makes a withdrawal, the former gets a payment of zero. In this coordination game, Table 1 lists the payoffs:

Table 1: Depositors' payoff.

	Remain	Withdraw
Remain	R, R	0, r
Withdraw	r, 0	r, r

Note that $0<R<2r$, the unique equilibrium of this game, is both depositors withdrawing money from the bank [3]. This is also the reality. The company unexpectedly informed investors of its requirement to generate an additional $2.25 billion in order to shore up its balance sheet, which conveyed the message of a fund shortage to the market. Higher order beliefs made SVB's customers anticipate what others were going to do — in this case, withdraw funds from the bank. Hence, start-up companies attempted to withdraw all of their money ($42 billion of deposits in two days) from SVB because they were afraid of getting zero at the end.

The bank run was also subject to the herd effect. Herding behavior is defined as the inclination of investors to replicate the behavior of other market participants, thereby disregarding their own information [12]. They thought that their deposits might be at risk. Tech companies in Silicon Valley tended to know each other, and the information asymmetry was weaker due to the fact that they might know what others had done. Therefore, the news spread quickly, and everyone tried to get their money back. In this sense, people disregarded their own trust and faith in this bank and performed herding behavior.

6.   Conclusion

This paper interprets the current situation of the banking industry, which is gradually recovering from COVID-19. The rise of digital banking cannot be overlooked as it may be the future trend in the 21st century. The two factors causing the failure of SVB, which are unpredictable factors, are out of SVB's control as they are related to macroeconomics and epidemics that are rare to see. However, from the game theory derived, bank runs are the unique equilibrium for depositors, which will happen eventually. Therefore, as a country's monetary authority, like the Fed and the bankers, they need to figure out practical measures immediately to stabilize the economy and calm citizens' fears in urgent situations. However, the discussion scope is not enough from a global perspective since the main data focus is on the study of U.S. citizens. Circumstances can be different in other countries. Moreover, there are other factors that contributed to the bank's failure that are overlooked in this paper. A future study will focus on the strategies that authorities could employ to mitigate public panic to prevent the occurrence of bank runs. Rather than relying solely on verbal assurances, it is better to consider tangible actions and realistic strategies. The second largest bank run in U.S. history cannot be triggered easily, and other factors are crucial to examine accordingly, while this paper shows that in game theory, bank runs naturally happen. Therefore, it is the Fed's job to ensure it does not happen in the future.

Acknowledgment

References

[1]   Dharen Kumar Pandey, M. Kabir Hassan, Kumari, V., & Hasan, R. (2023). Repercussions of the Silicon Valley Bank collapse on global stock markets. Finance Research Letters, 55, 104013–104013.
[2]   Van Vo, L., & Le, H. T. (2023). From Hero to Zero-The Case of Silicon Valley Bank. SSRN Electronic Journal.
[3]   Allen, F., & Morris, S. (1998). EliScholar -A Digital Platform for Scholarly Publishing at Yale EliScholar -A Digital Platform for Scholarly Publishing at Yale Finance Applications of Game Theory Finance Applications of Game Theory.
[4]   Thakor, A. V. (1991). Game Theory in Finance. Financial Management, 20(1), 71.
[5]   Hong Kong Monetary Authority. (2020, April 3). Liquidity measures in response to Covid-19 outbreak.
[6]   Dinh, H. T. (2023). Lessons From the Silicon Valley Bank Crisis. Policy Notes & Policy Briefs. https://ideas.repec.org/p/ocp/ppaper/pb15-23.html
[7]   Insider Intelligence. (March 31, 2021). Forecasted number of digital banking users in the United States from 2021 to 2025 (in millions) [Graph]. In Statista. Retrieved August 07, 2023, from https://www-statista-com.lib.ezproxy.hkust.edu.hk/statistics/1285962/digital-banking-users-usa/
[8]   Statista. (2023b, May 8). U.S. mobile banking app downloads 2022. Statista. https://www.statista.com/statistics/1381313/us-mobile-bank-app-downloads/

[9] *YouGov. (February 16, 2021). Change in financial behaviors due to coronavirus (COVID-19) in selected countries worldwide [Graph]. In Statista. Retrieved August 08, 2023, from https://www-statista-com.lib.ezproxy.hkust.edu.hk/statistics/1220152/changing-financial-behaviors-due-to-covid-19-worldwide/*

[10] *Statista. (2023a). Investment behavior worldwide (pp. 4–12).*

[11] *Federal Reserve. (2020). Federal Reserve Board - Open Market Operations. Board of Governors of the Federal Reserve System.*

[12] *Filip, A., Pochea, M., & Pece, A. (2015). The Herding Behaviour of Investors in the CEE Stocks Markets. Procedia Economics and Finance, 32, 307–315.*