

The Trigger and Application of Black Swan Events: A Case Study of Silicon Valley Bank Failures

Yue Qi^{1,a,*}

¹Metropolitan College, Boston University, 1010 Commonwealth Ave, Boston, United States
a. qiyuee@bu.edu

*corresponding author

Abstract: On March 10, 2023, Federal regulators shut down Silicon Valley Bank, the 16th-largest bank in the country. As a result of the significant run, the bank was forced to file for bankruptcy. The purpose of this paper is to analyze the borrowing and triggering factors of black swan events by taking the Silicon Valley Bank bankruptcy event as an example, and to discuss the revelations and reflections of black swan events from the perspective of risk management based on the definition and characteristics of black swan events. Black swan events are those rare, unpredictable events with great impact, while bank bankruptcy events imply significant changes in the stability of the financial system. The failure of Silicon Valley Bank exposed the vulnerability of the banking sector and raised depositors' concerns about bank withdrawals and the cash flow crisis of global technology companies. Thus, the failure of Silicon Valley Bank has important lessons for future bank management and regulation. This paper argues that for most people, the failure of Silicon Valley Bank was not a black swan event, but even for many professionals, the impact of bank failures is unpredictable.

Keywords: black swan events, Silicon Valley banks, bank failures, risk management

1. Introduction

Over the past few decades, the global financial markets have experienced many major events, such as the 2008 global financial crisis and the Asian financial crisis (1997-1998), which involved many black swan events and bank failures. These events have triggered extensive discussions and studies about their causes, impacts and lessons. As the 16th largest commercial bank in the U.S., Silicon Valley Bank focuses on deposit and loan business for startups, especially those in Silicon Valley.

On March 8th, with a total loss of \$1.8 billion, Silicon Valley Bank stated it was selling \$21 billion in bonds. In order to raise \$2.25 billion, it also disclosed that it would issue fresh shares. This announcement sends a very bad signal to the market that SVB is short of funds and has cash flow problems, so the bank can only raise money by selling assets and issuing new shares. On March 9th, the stock of SVB was suspended after its price dropped by 60% right away and Moody's downgraded it to junk status. A bank run happened as a direct result of this conduct. The Federal Deposit Insurance Corporation (FDIC) intervened the following morning and shut down SVB after anxious depositors withdrew more than \$4 billion of their deposits from the bank on that day.

The bankruptcy of Silicon Valley Bank, which became the second largest bank failure in the history of the United States, has had a significant impact on the stability of financial institutions and the global financial system. This event has triggered many discussions, such as risk management,

financial regulation, and so on. Therefore, it is of great significance to discuss the case of Silicon Valley Bank's bankruptcy and analyze its impact and lessons.

Taleb defines the black swan event in his book *The Black Swan* [1]. Jochen Runde further discusses and explains Taleb's black swan theory [2]. Phil Faulkner and others in addition to explaining Taleb's black swan theory add the application of the concepts of known unknowns versus unknown unknowns [3]. Ole A. Lindaas et al. further categorized black swan events into known unknowns and unknown unknowns [4]. In addition to this, Lawrence J. White, in his analysis of the causes of the Silicon Valley bank failures, also made recommendations for the regulation of the financial system [5].

This paper describes the definition and characteristics of a black swan event, applies existing black swan event research methods and theories, to analyze whether the Silicon Valley Bank bankruptcy triggered a black swan event and the application of black swan event elements. If the event is a black swan event, analyze which category of black swan event it falls into and further discuss the implications of the event for the banking industry, regulators, and individual investors.

2. Analysis of Black Swan Event Based on Silicon Valley Bank Bankrupt

2.1. Analysis of Silicon Valley Bank Failures Based on Taleb's Three Characteristics

In his book, Taleb describes three characteristics of a black swan event: P1: it is an outlier, P2: it carries an extreme impact, and P3: explainable and predictable [1].

Before applying Taleb's three characteristics to the analysis, it is first necessary to affirm the role that subjectivity plays in people's judgment process [2]. When people identify the hypothetical affected person and the degree of influence, they get the perception and judgment of the event. All perceptions and judgments are related to how people as individuals describe and categorize things as they "divide the world", and it seems that different people do categorize things differently. Indeed, some people sometimes categorize the same thing differently at different times or in different states of mind. Despite subjectivity, there is often good agreement on the categorizations used that this or that event had a significant impact [2]. For example, most people would agree that 9/11 was an unusual event, even if they never imagined it as a possibility before it happened. It is the shared basis of consensus that allows people to discuss and often reach a reasonable agreement on whether an event counts as a black swan event [2].

This section provides a specific analysis of the Silicon Valley Bank incident in the context of Taleb's three characteristics as follows:

2.1.1. It is an Outlier

Before delving into the significance of the element of surprise, it is crucial to establish a clear understanding of what constitutes "surprise". Because nothing in the past has been able to clearly point to its likelihood, Taleb contends that the element of surprise expressly means that it lies outside the domain of conventional expectations [1]. Jochen Runde further discusses and affirms the influence that a person's knowledge, experience, and opinions have on the perception of whether or not an event qualifies as a black swan in the individual's viewpoint [2]. Simply put, what may seem like a black swan to some may be predictable (not unexpected) to others.

SVB uses U.S. GAAP, which has a backward historical cost orientation. This means that Silicon Valley banks can reflect the purchase price of bonds in their financial statements rather than current market price [6]. Thus, for those who think they have never heard of any bank failure or have limited knowledge of such risks, the Silicon Valley case may indeed be a black swan if they are significantly impacted. But for most people, they know that banks can fail and that the likelihood of bank failure increases in the face of rising interest rates. Even though they don't know the exact extent of the SVB's

losses, the bank's exposure to significant financial risk is foreseeable, and thus it would not be a surprise, and the Silicon Valley bankruptcy event wouldn't be a black swan.

2.1.2. It Carries an Extreme Impact

Secondly, it carries an extreme impact [1]. Indeed, in addition to those affected, the impact of a Black Swan event is subjective. Generally, when describing an event as a Black Swan event, one is making assumptions about who is affected and to what extent.

In the case of Silicon Valley Bank, its main customer base of startups was directly and significantly affected. Due to this unexpected event, the company lost its loan agreements and financial support from the bank, which left the company facing a cash crunch and operational difficulties. The company had to look for alternative means of financing and reorganize its business plan to accommodate this unforeseen situation. This black swan event had a huge impact on this business, but is unlikely to have much of an impact on other individuals or businesses that are very distant (geographically or business-wise) from SVB, which make up the majority of the population.

2.1.3. Explainable and Predictable

Regarding this feature, Taleb believes that human nature compels them to create explanations for its occurrence after the fact, making it predictable and understandable [1]. After the event, one can trace the beginnings of Silicon Valley Bank's bankruptcy back to 2020. In 2020, Silicon Valley Bank invested heavily in debt securities at very low interest rates. However, as the Federal Reserve continued to raise interest rates in 2022, the market value of the previously purchased long-term bonds declined, forcing the bank to incur considerable unrealized losses. This ultimately triggered a run on the bank, and then bankruptcy.

The reasons for the bankruptcy can be summarized in the following three points:

(1) Silicon Valley Bank's Weak Risk Management

First, Silicon Valley Bank had insufficient liquid assets. In SVB's consolidated balance sheet for 2022, its loans accounted for 34.8% of total assets, and securities of all types accounted for 56.7% of total assets; while cash accounted for only 6.5% of total assets [6]. This means that if depositors withdraw large amounts of money, SVB's existing liquid assets will be difficult to meet customer demand, and it is difficult for depositors to withdraw in a timely manner. SVB hoped to liquidate bonds at a loss to obtain more liquid assets to meet depositors' withdrawal needs and avoid the possibility of bankruptcy. However, the negative information sent to the market by this act of liquidation triggered panic among depositors, which in turn exacerbated the pressure of withdrawals and accelerated the occurrence of bankruptcy. Second, about 90% of the deposits in SVB are not covered by FDIC insurance [5]. So, when an accident (run on the bank) occurs, it is not feasible to get reimbursed for substantial portions that exceed insurance. This, to some extent, aggravates depositors' panic and triggers the occurrence of a run. Thirdly, bank executives failed to manage risks effectively [7]. Due to the substantial central bank releases and costly hedging measures, SVB has been unable to implement the proper hedging measures in spite of the significant risk. Because of the low interest rates at the time, the risk was not as large and did not catch the top management's notice. In 2022 and the beginning of 2023, there was a huge decline in liquidity and a significant increase in interest rates, which rapidly raised interest rate risk. The technology sector also faced a downturn, which had an impact on the sector's enterprises. In the midst of these difficulties, Silicon made the mistaken decision to forgo risk hedging and stop-loss controls, which increased their exposure to risk.

(2) Insufficient Regulation of Financial Institutions

The Federal Reserve acknowledged this fact in its report on the bankruptcy of SVB. This bank had grown quickly in size in recent years, but because it had not been subject to stricter regulations, it had

been rated well in several areas before the bankruptcy [7]. At the time of its demise in March 2023, SVB had almost three times as many publicly published regulatory findings as competitor firms [7]. This shows that although authorities were aware of some of SVB's flaws in earlier work, they did not pay enough attention to issues or raise enough awareness when SVB was changing from a small bank to a large bank.

(3) The Fed's Rate Hiking Frenzy

In 2022, the Fed continued to raise interest rates significantly. This means that the market price of previously held Treasury bonds is constantly falling because investors can buy bonds with higher interest rates, further causing significant unrealized losses. Therefore, when Silicon Valley Bank decides to sell these bonds (\$21 billion), the unrealized loss will become an actual true loss (\$1.8 billion).

2.1.4. Discussion

As the Federal Reserve continued to raise interest rates and SVB continued to incur losses on its long-term treasury bonds holdings, many believed it was highly conceivable that the bank could face serious trouble or even failure. Especially at a time of increased uncertainty in the tech industry, the potential for tragedy is very high if executives remain indifferent to the situation. So, even if it was very sudden and unexpected, it would hardly be recognized as a black swan event.

However, the speed of the bank's failure and its wide-ranging impact may have been difficult for many to anticipate, especially Silicon Valley Bank's top executives. It is hard to imagine a bankruptcy event occurring as a result of a sell-off announcement in just three days, while their work and professional relationships are being disrupted in ways they did not imagine before the event (i.e., a Black Swan event for them).

2.2. Additional Analysis from Other Perspectives

When exploring black swan events, looking at them from only one perspective or one interpretation may lead to one-sided and biased information. Over the years, different scholars have supplemented and criticized Taleb's theory, proposing a variety of perspectives to further improve the study of black swan theory. Synthesizing different research perspectives can lead to a more comprehensive understanding of the complexity and multidimensionality of black swan events, and thus a more accurate assessment of the link between the Silicon Valley Bank incident and black swan events.

2.2.1. Combining Known and Unknown Theories to Analyze Taleb's First Characterization

In Table 1. Phil Faulkner et al. give a framework for demonstrating representations of Taleb's first property by differentiating between three possibilities connected to a person's expectations about what has occurred [3]. They recognized one fundamental point in their discussion of knowns and unknowns: while a person may not be familiar with many aspects of the universe, there are likely to be some (known unknowns) that he is aware he does not know and other (unknown unknowns) that he is not even aware he is unaware of [3]. Specifically, a significant difference is whether a person is aware of the knowledge gap, i.e., whether the unknown is a known unknown or an unknown unknown [3]. According to Alberto Feduzi et al., decision-makers' imagined and anticipated unknowns are known unknowns. The decision-maker cannot imagine and, as a result, does not take into account the unknown unknowns [8]. Obviously, when an individual fails to recognize a gap in knowledge, i.e., does not imagine it at all, this "knowledge" for the individual. It is consistent with the characterization of P1 of the black swan.

Table 1: Reformulating Taleb’s first property.[3]

		Event that occurred was...	
At the time of the event’s occurrence the corresponding hypothetical value was...	...consciously imagined by the individual and...	...regarded as possible.	1a. ...correctly regarded as possible.
		...regarded as impossible.	3a. ...incorrectly regarded as impossible.
	...not consciously imagined by the individual.		5a. ...not imagined.

Depending on the situation, based on Table 1. the following discussion can be made:

1a: a person accurately perceives the event as a possibility [3]. For this group of individuals, they agree that there is a possibility that the Silicon Valley Bank will fail and does not satisfy Taleb's formulation of the first attribute, therefore the event will not be a black swan event.

3a: a person is intentionally imagined yet mistakenly believed to be impossible [3]. For this segment, it is conceivable that banks could face serious financial problems and potential bankruptcy risks. For example, due to the current predicament, SVB’s executives are the ones who could have predicted the possibility of volatility for the bank when a bond sell-off was announced externally, but they considered the outcome of the bank becoming insolvent to be improbable (otherwise they would not have chosen to do so). Therefore, this event is a black swan event for them.

5a: a person cannot imagine an event at all [3]. For this group, they have never heard of any bank failure and therefore could not imagine the bankruptcy of Silicon Valley Bank at all. For example, due to the financial crisis of Silicon Valley Bank, the industries and clients served by Silicon Valley Bank have difficulties in turning over their capital chains or even fall into financial crisis. At this time, the ordinary employees in the client companies or the client's client companies can not pay their salaries on time or even lose their jobs. They do not know about SVB, nor have they heard of their employer's business dealings with it, so they are totally unable to predict the its dismiss and its effects on themselves. Therefore, this event is a black swan event for them.

Ole A. Lindaas et al. further categorize black swan events as unknown knowns and unknown unknowns (Table 2) [4]. Combined with the analysis for Table 1., 1a can be categorized as a KNOWN KNOWS event, 3a belongs to the UNKNOWN KNOWS black swan event, while 5a belongs to the UNKNOWN UNKNOWS black swan event. Thus, for the hypothetical individual, the SVB’s tragedy can be considered a black swan event for the combination of UNKNOWN KNOWS and UNKNOWN UNKNOWS. It is worth noting that subjectivity still cannot be ignored when analyzing P1 features using knowns and unknowns. Thus, a black swan occurrence experienced by one person may not be unexpected or unknown to another person [2].

Table 2: Two ideal types of de-blackening in risk analysis. [4]

		Meta-level	
		Known	Unknown
Primary level	Known	Known knows	Unknown knows (black swan habitat)
	Unknown	Known unknowns (conscious ignorance)	Unknown unknowns (black swan habitat)

2.2.2. Whether an Event is a Black Swan Event Also Depends on the Description Used.

Taking the bankruptcy of Silicon Valley Bank as a backdrop, different descriptions can be used to assess whether it is a black swan event. If a black swan event is defined from a narrow economic perspective as an extremely rare and unpredictable event, then the bankruptcy of Silicon Valley Bank may not meet this criterion. Because the banking industry carries a certain amount of risk in the economic system, bankruptcy events, while uncommon, are not entirely unforeseeable. Figure 1 provides a visualization of total assets of failed banks in the United States and total number of failed banks from 2001 to 2023. As shown in Figure 1, the red folded line, it is clear that after 2000, there were only five years in the United States where there were no bank failures, with a total of up to 297 banks failing in 2009 and 2010 due to the 2008 economic crisis.

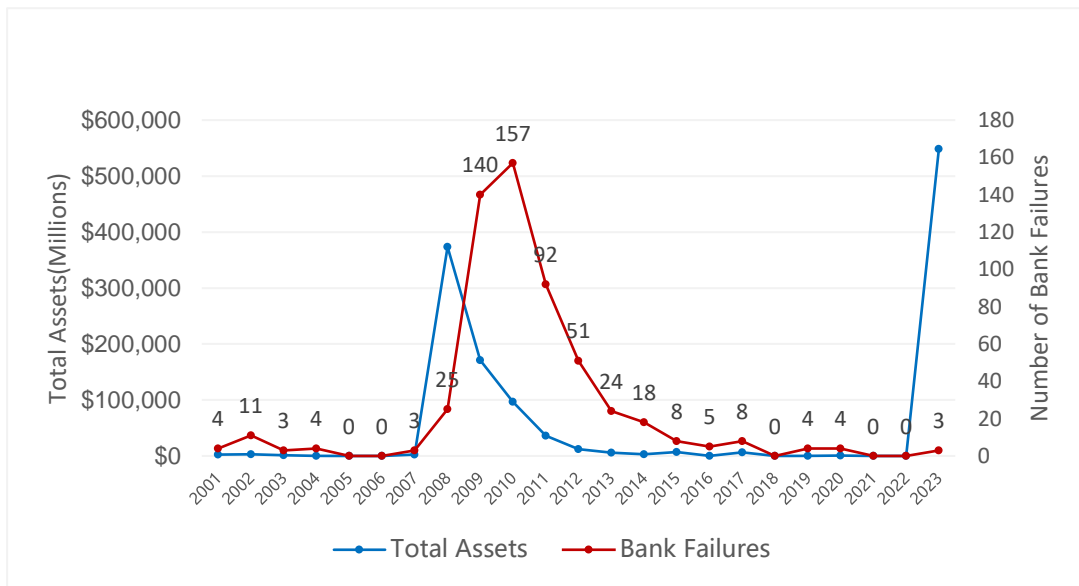


Figure 1: Total assets in bank failures in US.[9]

However, if a Black Swan event is viewed more broadly, defined as a situation that significantly affects the entire financial system, then the Silicon Valley bank failures can be considered as a Black Swan event. When shifting attention to the blue dash line in Figure 1. it can be seen that even though there are only three bank failures in 2023, their volume is huge, even exceeding the total assets of the banks that failed during the 2008 economic crisis, and the failure of Silicon Valley Bank has been made as the second largest bank failure in terms of historical injuries in the United States. Although bank failures are a common phenomenon in the financial sector, given the sheer size of Silicon Valley Bank, its failure could have had systemic risks and a ripple effect on the economy, such as triggering a crisis of confidence, turmoil in the financial markets, and a chain reaction of bankruptcies of other banks. For example, within a week of the announcement of the Silicon Valley Bank's failure, the global financial industry was once again hit by the Credit Suisse crisis. For example, within a week of the announcement of the collapse of Silicon Valley Bank, the global financial industry was again faced with the crisis of Credit Suisse. Although the reasons for the bankruptcies of the two banks were different, as two banks that were also subject to heightened liquidity risk in the context of interest rate hikes, the huge market panic brought about by Silicon Valley Bank undoubtedly had an adverse effect on Credit Suisse, or rather pressed the accelerator button.

Therefore, it is necessary to consider different definitions and perspectives when assessing whether SVB's bankruptcy is a black swan event. From a narrow economic perspective, it may not meet the

definition of a black swan event, but from a broader perspective, it has systemic risks and significant shocks as well as brought about market panic, which can be categorized as a black swan event.

3. Suggestions

The banking risks facing the United States are pervasive, and the SVB is just a microcosm of them. The current financial system remains highly vulnerable. This situation stems mainly from the significant monetary easing adopted by the Federal Reserve in 2020, which has led to a surplus of funds for banks, which have therefore opted to purchase large quantities of U.S. Treasury bonds. However, as the Federal Reserve continued to raise interest rates in 2022, market interest rates rose, leading to a significant depreciation of the bond assets in which the banks had invested. As shown in Figure 2., the unrealized losses incurred by the banks on their investment in the securities remained high as a result of the high market interest rates. Specifically, unrealized losses on available-for-sale and held-to-maturity securities were as high as \$620 billion in the fourth quarter of 2022[10]. This implies the risk that this \$620 billion in unrealized losses could translate into actual losses if banks have to sell long-term securities to meet withdrawal demand.

Overall, interest rate risk and liquidity risk are challenges faced by the banking industry in general. And one typical case that reflects the pressures facing by the industry is SVB. It is also a reminder that the current financial system is still very fragile and requires close attention and effective measures to address potential risks.

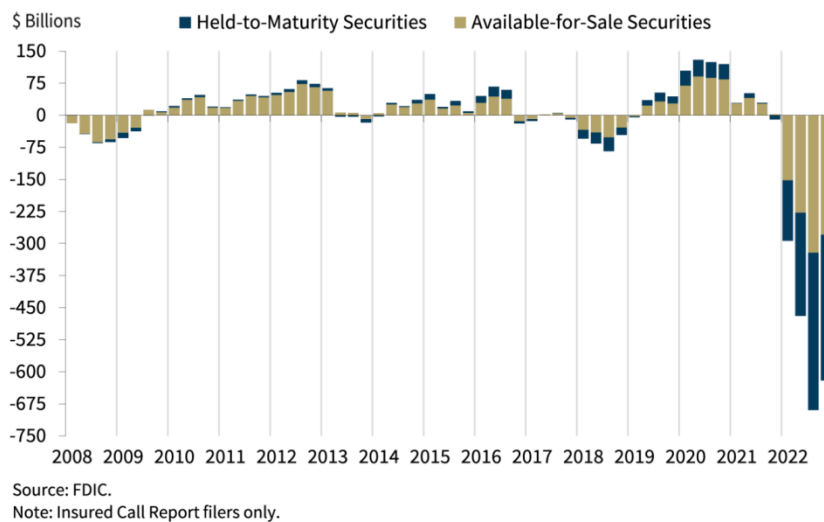


Figure 2: Unrealized gains (losses) on investment securities.[10]

3.1. Banking Industry

First of all, if Silicon Valley Bank could have taken proper hedging measures and risk management, its sudden bankruptcy would have likely been avoided. For example, interest rate derivatives such as interest rate swaps, options or futures are utilized to hedge interest rate risk. These instruments can help offset potential losses from interest rate movements. Secondly, in order to manage potential liquidity concerns and unanticipated runs, banks should keep enough liquid assets in their portfolios[5]. In addition to this, banks should not underestimate the sensitivity of outsiders (media, customers, etc.) to negative information, especially in times of economic downturn. Specifically, before the announcement of Silicon Valley Bank on March 8, the worry and panic of depositors and

even a large number of withdrawals were easily foreseeable, but Silicon Valley Bank still failed to plan for, and deal with, the crisis.

3.2. Regulators

In terms of the subsequent handling of the Silicon Valley Bank incident, the U.S. government's quick response minimized its impact and greatly reduced the risk of contagious bank failures, which is also a painful lesson for financial regulation brought about by the 2008 economic crisis. For example, the Federal Reserve announced that it would allow banks to use securities as collateral for loans from the Fed to help banks cope with potentially large withdrawals by depositors[7]. However, financial regulation has also exposed some problems.

First, the regulation of financial institutions should be further strengthened, especially in this particular period of global economic downturn. The task of regulators should not be limited to identifying weaknesses in bank management, but solving problems is even more important. Regulators should give sufficient attention to these weaknesses and require banks to take actions to address significant risks and follow up on them.

Second, financial regulation should be more flexible during special times. Specifically, the special business model of Silicon Valley banks implies that the systemic risk of bankruptcy is unlikely to cause contagious bank failures, which is good news; however, firms with special factors may pose special risks [7], which also implies that when regulators use the same set of systems and theories to require the majority of banks, it is likely that omissions will occur. Therefore, in the recovery phase of the economy after the epidemic, it is necessary to refine the risks and pay attention to special risks. For example, in response to the significant Unrealized Losses Risk arising from continuous interest rate hikes, regulators may consider requiring banks to write the market value of bonds on their statements rather than the historical value in order to achieve better accounting [5]. In conclusion, in the context of the global economic downturn, central banks and banks and other financial institutions should always maintain a prudent attitude, pay attention to risk management, and learn from these lessons.

3.3. Investors

From the perspective of individual investors, firstly, the level of risk management can be a new evaluation latitude when choosing financial institutions; secondly, due to GAAP accounting standards, investors can pay more attention to the held to maturity account in financial institutions' financial statements. Especially those financial institutions that, like Silicon Valley banks, purchased large amounts of U.S. Treasuries when interest rates were low, and are likely to be exposed to important instabilities and risks. In addition to this, in short, a sensitive market sense and quick reaction are necessary when the global financial system is unstable and exposed to significant downside risks. Silicon Valley Bank's deposits were concentrated in a small group of depositors, many of whom were all engaged in the same sector. So, when Silicon Valley Bank announced the liquidation of its bonds, the head leaders among the depositors began to call on others to pull out of SVB in a timely manner (the herd effect) [11]. Although this exacerbated the run on the bank, for those depositors whose withdrawals were successful, minimizing their losses undoubtedly maximized their benefits.

4. Conclusion

Over the years, despite the fact that many scholars have studied black swan events, one thing that must be recognized is the subjective nature of black swan event judgments. When describing an event as a black swan event, there are in fact inherent assumptions made about those affected and the extent of the impact. With the Federal Reserve's constant rate hikes and high interest rates, it is obvious that

banks are losing money and the chances of failure increase. Therefore, for most people who know this financial institution, even though the failure of Silicon Valley Bank was very sudden and unexpected, it was not a black swan event. However, the depth and breadth of the ill effects of the bank's storm was unforeseen by many professionals and even executives who knew Silicon Valley Bank best on the inside, so to some extent the bankruptcy was a black swan event for them.

However, whether it is a black swan event or not, the worldwide banking system has been significantly impacted by Silicon Valley Bank's bankruptcy. On March 12, Signature Bank announced that it had collapsed. On March 19, Credit Suisse, the second-largest bank in Switzerland, was purchased by UBS, and on May 1, the First Republic Bank of the United States announced that it had gone into bankruptcy. Although, the reasons for the bankruptcy of these banks and background are not the same, the financial panic brought by the Silicon Valley Bank is bound to accelerate the collapse of these banks. From the perspective of hindsight, the bankruptcy of the Silicon Valley Bank as early as 2020 has planted cause and effect, if not to make countermeasures, the tragedy will happen sooner or later, just waiting for a thunderbolt fuse, and Silicon Valley Bank's sell-off announcement on March 8 is this ignition of dynamite embers. The primary human aspect in the bankruptcy event is the bank's own lax risk management, along with the government agency's low regulatory vigor, if the Fed's increased interest rate in the background is ignored. Unfortunately, neither SVB nor regulators paid enough attention to interest rate risk, resulting in a lack of proper risk management in the SVB, further contributing to the tragedy. Therefore, learning the lessons of Silicon Valley Bank is essential for the banking industry, government regulators, and individual investors.

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