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Assessing the Probability of Default Using the Altman Model: Silicon Valley Bank

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ABSTRACT

Silicon Valley Bank (SVB) was the 16th largest bank in the US. Established in 1983, its primary customers were the technological sector and life science firms. While SVB was successful over the years, in March 2023, the bank experienced a significant "bank run," which eventually led to its collapse. Using publicly available data from Mergent, this research uses the Altman model to examine three years of financial data from Silicon Valley banks. The results revealed that the bank failed the Altman model test, which is evident that the probability of default was always present but ignored by banking officials and regulators

Introduction

Before its collapse, Silicon Valley Bank (SVB) was the 16th largest bank in the US. Established in 1983, its main customers were the technological sector and life science firms. SVB is a subsidiary of SVB Capital, SVB Private, and SVB Securities. Its product offerings include commercial banking, wealth management, venture investing, and investment banking (SVB, 2023).

While SVB was successful over the years, in March 2023, the bank experienced a significant "bank run," which eventually led to its collapse. A bank run occurs when most of the bank's depositors withdraw their total account balances over a very short period due to speculations of the bank failing (Sutton, 2023). Depositors place their monies in banks with the expectation that the bank will hold up to its fiduciary responsibilities. Moreover, banks are heavily regulated to have a reserve requirement by the Federal Reserve, meaning banks must keep a certain amount of cash deposits available to meet credit obligations should a "bank run" occur (Sutton, 2023).

As previously mentioned, SVB's core customers are startup companies in the biotech and technology sectors. In addition, SVB was a major provider of banking services for approximately half of US venture-backed tech and life science companies. Biotech and technology companies have large budgets to fund their research, development, and engineering costs. SVB, on the other hand, benefited from the large deposits. In a 2019 Federal Reserve of Consumer Finances survey, the median transaction account balance was $5,300. However, at the end of 2022, SVB customers' average balance was 792 times more than the national average, accounting for an average of $4.2 million per customer. Furthermore, over 37,000 individual accounts were over the $250,000 FDIC insurance limit.

The increase in deposits created a problem for SVB because the bank was unable to loan out as much as it took to comply with the reserve requirement. As a result, SVB invested the monies in low-risk government-backed bonds.

Despite this investment, SVB was still unable to generate enough revenue, including in lending. In a desperate attempt to increase revenue, SVB purchased more bonds with extended maturity dates. However, bonds are sensitive to interest rate fluctuations.

The longer the maturity date on the bond, the greater the interest rate risk (Sutton, 2023).

In 2022, the post-Covid era, inflation skyrocketed, and the government tried to correct the problem by increasing interest rates a total of seven times. This dramatically affected SVB's bond portfolio, which became less valuable due to interest rate hikes. As a result, investors and bank executives started to sell their SVB stock. Retail depositors followed suit, and SVB's stock price seriously declined within a few weeks. SVB could not stop the bank run and was eventually seized by regulators and deemed insolvent (Sutton, 2023).

The specific problem of this study is using the non-traditional method of the Altman Model to predict the probability of default for Silicon Valley Bank. This study contributes to the field by filling the knowledge gap within the banking industry. The rest of the study consists of the statement of the problem, literature review, theoretical framework and methodology, research question and hypotheses, data collection and analysis, and results, followed by the discussion.

Overview of the Problem

Before its collapse, Silicon Valley Bank (SVB) was the 16th largest bank in the US. Established in 1983, its main customers were the technological sector and life science firms. SVB is a subsidiary of SVB Capital, SVB Private, and SVB Securities. Its product offerings include commercial banking, wealth management, venture investing, and investment banking (SVB, 2023).

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Statement of the Problem

Efficiency has been a critical indicator of bank performance; it is perceived that low efficiency reflects poor management practices, which results in underperformance in a competitive financial market (Li et al., 2022). For this reason, predicting bank failure has garnered much interest in banking research.

Proven methods such as statistical and computer-generated simulations have been a reliable source of predictability (Li et al., 2022). While much research studied the indicators for Silicon Valley's failure using the stock price and ratio analysis (Hamurcu, 2023; Dutta et al., 2023; Ngwakwe, 2023; Suresh, 2023), limited research uses the Altman model to predict the likelihood that a bank will file for bankruptcy. This study contributes to the field by filling the knowledge gap within the banking industry.

Literature Review

The literature review found several research on Silicon Valley Bank. Hamurcu (2023) conducted a ratio analysis on Silicon Valley Bank using long-term investments to total assets, the ratio of cash on hand to total assets, and the ratio of price-to-earnings to examine if these ratios were an indicator of riskiness for the bank's failure. The results from the study suggest that the long-term investment to total assets ratio was a high indicator of the bank's failure. The impact of cash on hand to total assets ratio also negatively impacted bank failure risk. Bank failure risk was high due to the rise in the price-to-earnings ratio.

Dutta et al. (2023) used Benford Law to validate the stock price and identify areas of abnormality and risk for Silicon Valley Bank. The results were then cross-referenced with comparable statistics such as Zipf's Law. The study examined stock prices from 1987 through 2023 by examining the opening, closing, and highest prices. The final results showed irregularities in the stock price variations. Similarly, Ngwakwe (2023) conducted a study examining the effect of Silicon Valley Bank's failure on the stock market. The study examined Silicone Valley Bank's differential stock price before the failure and the effect of the bank's failure on the S&P 500 stock performance.

After performing a t-test for the difference of means, "the results show a significant difference in the mean stock price of SVB between a month and two weeks before SVB failure" (Ngwakwe, 2023). Suresh (2023) used Coppock's Instability Index method to examine the instability ratio of price to earnings, price to sales, and price to book for Silicon Valley Bank from 2009-2023; "the findings from the study reveal that the Highest Instability Index is registered for these ratios and it is highly volatile in nature." (Suresh, 2023).

Theoretical Framework and Methodology

The research was conducted using the theoretical framework of the Altman Z-score (Altman, 1968). The model is used to predict the likelihood of a firm filing for bankruptcy. The model uses five financial ratios: working capital to total assets, retained earnings to total assets, earnings before interest and taxes (EBIT) to total assets, market value of equity to book value of total debts, and sales to total assets. This methodology was the most suitable for assessing the bank's financial health and the likelihood of filing for bankruptcy. The Altman original formula was tailored to be used in manufacturing but was later revised to fit all industries (Altman et al., 2017; Altman, 2018; Gunanto, 2023). The modified formula is as follows:

$$Z' = 0.0717Z1 + 0.874Z2 + 3.107Z3 + 0.420Z4 + 0.988Z5$$

Where:

A. Z1: Working capital/total asset
B. Z2: Retained earnings/total asset
C. Z3: Earnings before taxes/total asset
D. Z4: Book value of equity/book value of debt
E. Z5: Sales/total asset

The following measure was applied:

- If the Z-Score value is greater than 2.99, the company is in the safe zone, which means the company is healthy or not bankrupt (Gunanto, 2023).
- If the Z-Score value is between 1.01 and 2.99, it is in the grey zone, which means the company is in a grey area, where the company may potentially not go bankrupt or go bankrupt (Gunanto, 2023).

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- If the Z-Score value is less than 1.01, the company is in the distress zone, where the company is unhealthy or potentially facing bankruptcy (Gunanto, 2023).

Research Question and Hypotheses

Research Question:

To what extent was the failure of Silicon Valley Bank predictable?

Hypotheses:

Ho: Silicon Valley Bank's failure was predictable?

H1: Silicon Valley Bank's failure was not predictable?

Data Collection

Data was collected from Mergent and Yahoo Finance. The researcher used data from Silicone's Valley's Income Statement and Balance Sheet for the years ending December 31st, 2020, December 31st, 2021, and December 31st, 2022. These periods were used to calculate the Z-score, which determines the likelihood of default.

Data Analysis and Results

Each section A-E was calculated separately and added to receive the final z-score.

To calculate the working capital/total assets ratio, the following items were retrieved from the SVB balance sheet:

Working capital=Total current assets-total current liabilities

Assets

Cash and cash equivalents
Total investment securities
Allowance for credit losses: loans
Accrued interest receivable & other

Liabilities

Total deposits and Short-term borrowings

To calculate the retained earnings/total assets ratio, the following items were retrieved from SVB's balance sheet: retained earnings as stated on the balance sheet/Total assets as stated on the balance sheet.

To calculate earnings before interest and tax/total assets ratio, the following items were retrieved from SVBs balance sheet: net interest income as stated on the income statement/total assets as stated on the balance sheet.

To calculate the market value of the equity/total assets ratio, the following items were retrieved from SVB's income statement and balance sheet: total shares outstanding multiplied by the stock price at the end of the fiscal year/total assets.

To calculate the sales/total assets ratio, the following items were retrieved from SVB's income statement and balance sheet: total interest income/total assets.

Working Capital

	2022	2021	2020
Working Capital (reported in thousands)	-49099000	-44396000	-31367181

Z-Score Results

Final Z-Score	2022	2021	2020
Z-Score	0.139495674	0.1528882	0.1735009

The following measure was applied:

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- If the Z-Score value is between 1.01 and 2.99, it is in the grey zone, which means the company is in a grey area, where the company may potentially not go bankrupt or go bankrupt (Gunanto, 2023).
- If the Z-Score value is less than 1.01, the company is in the distress zone, where the company is unhealthy or potentially facing bankruptcy (Gunanto, 2023)

Discussion/Conclusion

The study's results indicated that Silicon Valley Bank was highly likely to default, and the null hypothesis is accepted. While the study only covered three years, signs likely go further back. Silicon Valley Bank failed to maintain the required capital adequacy ratio for several years; this should have been a red flag for bank officials and regulators. The bank could not match the amount of deposits on hand, seeing that deposits are a huge part of the bank's liabilities. On the other hand, loans are assets, and the bank could not loan out as much money to match the amount of deposits. This is also highly noticeable in the bank's working capital.

Had bond prices remained stable, could SVB have survived? This also means that as more deposits flow into the bank, it would have to keep buying bonds to try and maintain its capital adequacy ratios. This is risky, and it is probably good that it happened now rather than later when the bank would have accumulated more bonds, which could have accounted for significantly more loss.

Future Research

In 2023, there were approximately five bank failures. The federal government also hiked interest rates at a record high in 2023. Future research using the Altman Model on other bank failures in 2023 could be an area of study. A correlation study could also be done using the closed banks in 2023.

Conclusion

The study assessed Silicon Valley Bank's probability of default using the Altman Model. Using the last three years of financial data obtained through Mergent, it revealed that the bank's Z-Score value was less than 1.01. This indicates that the bank is in a distress zone and the company is unhealthy or potentially facing bankruptcy. The null hypothesis was accepted; all three years studied revealed Z scores of 0.139495674, 0.1528882, and 0.1735009.

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References

Altman, E.I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance*. 23(4), 589- 609. https://doi.org/10.1111/j.1540-6261.1968.tb00843.x 6.

Altman, E.I., Iwanicz-Drozdowska, M., Laitinen, E.K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's Z-Score Model. *Journal of International Financial Management & Accounting*, 28(2), 131-171. 7.

Altman, E.I. (2018). A Fifty-Year Retrospective On Credit Risk Models, The Altman Z-Score Family Of Models And Their Applications To Financial Markets And Managerial Strategies. *Journal of Credit Risk*, 14(4).

Bianchi, J., & Bigo, S. (2022). Banks, Liquidity Management, and Monetary Policy. *Econometrica*, *90*(1), 391–454. https://doi-org.hamptonuniversity.idm.oclc.org/10.3982/ECTA16599

D'Avino, C., Girardin, E., & Shabani, M. (2022). Bank liquidity creation: A new global dataset for developing and emerging countries. *Review of World Economics*, *158*(2), 529–570. https://doi-org.hamptonuniversity.idm.oclc.org/10.1007/s10290-021-00434-1

Dutta, A., Voumik, L. C., Kumarasankaralingam, L., Rahaman, A., & Zimon, G. (2023). The Silicon Valley Bank Failure: Application of Benford's Law to Spot Abnormalities and Risks. *Risks*, *11*(7), 120. https://doi-org.hamptonuniversity.idm.oclc.org/10.3390/risks11070120

Gunanto, A. (2023). Evaluation of Prediction Accuracy Models for Bankruptcy in Indonesian Banks. *Financial* Gunanto, A. (2023). *Studies*, *27*(2), 53–71.

Hamurcu, Ç. (2023). Bank failure risk: A study on Silicon Valley Bank, Signature Bank, and Silvergate Capital Corporations. *Financial Internet Quarterly*, *19*(2), 36–45. https://doi-org.hamptonuniversity.idm.oclc.org/10.2478/fiqf-2023-0011

Li, Z., Feng, C., & Tang, Y. (2022). Bank efficiency and failure prediction: a nonparametric and dynamic model based on data envelopment analysis. *Annals of Operations Research*, *315*(1), 279–315. https://doi-org.hamptonuniversity.idm.oclc.org/10.1007/s10479-022-04597-4

Ngwakwe, C. C. (2023). StockMarket Price Effect of the Silicon Valley Bank Failure - A Pre and Within Analysis. *Accounting & Finance / Oblìk ì Fìnansi*, *100*(2), 75–82. https://doi-org.hamptonuniversity.idm.oclc.org/10.33146/2307-9878-2023-2(100)-75-82

Sancar, N., & Inan, D. (2021). A new alternative estimation method for Liu-type logistic estimator via particle swarm optimization: an application to data of collapse of Turkish commercial banks during the Asian financial crisis. *Journal of Applied Statistics*, *48*(13–15), 2499–2514. https://doi-org.hamptonuniversity.idm.oclc.org/10.1080/02664763.2020.1837085

Suresh, A., & M., A. M. (2023). Concomitance of Instability Delving the Silicon Valley Bank Catastrophe 2023. *Journal of Finance, Accounting & Management*, *14*(1), 1–13.

Sutton, V. K. (2023). 401(k) Investments: Death of a Bank: This column discusses two important truths and the role of the government in the wake of the bank failures of Silicon Valley Bank and Signature Bank. *Journal of Pension Benefits: Issues in Administration*, *31*(1), 31–35.

SVB (2023). Retrieved from https://www.svb.com/globalassets/library/uploadedfiles/svb_environmental_social_governance_report_2022.pdf)

Xuan-Thao Nguyen. (2020). Banking the Unbanked Innovators. *Journal of Corporation Law*, *45*(3), 715–742.