

Analysis of the Korean Bank Run Phenomenon Based on Game Theory

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Abstract. At the beginning of 2011, a number of savings banks in South Korea experienced a liquidation crisis, which caused widespread global concern. This paper attempts to use the relevant basis of game theory to explain the Korean bank run in 2011. From the perspective of the causes of bank runs, this paper makes a game analysis of the actual results of bank runs. The research results show that the main reason for bank runs is depositors' distrust of banks, so when banks face a run, they should strive to become a powerful bank. However, depositors trust strong banks more. Using the tools of game theory analysis, a basic description of the behavioral characteristics of the subjects involved in the process of bank runs can provide possible options for preventing and resolving bank run crises. This study has important practical significance for the healthy and sustainable development of the banking industry.

Keywords: Bank run; Game theory; Crisis.

1. Introduction

1.1 Research Background and MotivationSection Headings

Since the beginning of 2011, eight banks, including Busan Savings Bank, have failed to meet the relevant capital requirements of the regulator and have been suspended. Busan Savings Bank and eight other banks in Korea failed to meet the capital requirements of the regulator and suspended their operations, which led to public concern about the payment ability of savings banks. Due to the public concern about the payment ability to save banks, there were many banks runs on Korean savings banks. Bank runs are situations where depositors withdraw their deposits from banks for the fear of the safety of their deposits [1]. Bank runs have affected the economies of many countries from ancient times to the present, e.g., Countrywide Bank, IndyMac Bank (U.S.), Northern Rock Bank (U.K.), and ICICI Bank (India). Bank runs continue to be an important phenomenon. The study and analysis of the bank run crisis problem can be done using modern economic methods. For example, game theory. Game theory is rampant in economics. Having long ago invaded industrial organization, game-theoretic modeling is now commonplace in international, labor, macro, and public finance, and it is gathering steam in development and economic history [2]. Game theory uses a non-price system of analysis, so the results of the analysis are more solutions to reality. This paper attempts to analyze the 2011 Korea Savings Bank run from a game theory perspective to identify the causes of the bank run and revelations for other governments.

The objective reason for the bank run is the loss of non-performing assets in the bank's operation, and the subjective reason is the wavering confidence of depositors in the bank [3].

1.2 Literature Review

The element of trust is particularly important in the banking industry because economic transactions involve risk. The best solution of bank run is trust-trust option, trust-opportunism and opportunism-trust alternatives are second best decisions, and opportunism-opportunism is a worst-case scenario [4]. This study also shows that reputation is a significant factor of online trust. Endorsement is a good way to enhance reputation. For depositors, the more information depositors and economic agencies can expect to have about an ongoing crisis, i.e., the more they can expect to learn about the crisis as it develops, the more willing they are to restrain themselves in withdrawing their funds from banks once a crisis occurs [5].

Savers are also constantly using Bayes' rule to observe the government's actions to modify their "beliefs" (subjective probability judgments) and adjust their strategies accordingly. In this case, the government should send signals of its "strong government" through the market as long as conditions permit, in order to stabilize depositors' confidence and induce them to choose a cooperative strategy [6].

1.3 Research Framework

The article is organized as follows: the first part is the introduction, which includes the background and motivation of the study and the literature review, and the second part is the case study. The first part introduces the Korean run, followed by a discussion of the reasons for its occurrence and the implications for other governments, and finally an analysis of the game theory presents in the bank run. The third part is a discussion based on the results of the case study and the reasons behind it, as well as recommendations, and lastly, the conclusion.

2. Case Description

2.1 Bank Runs in South Korea

The bank run on the South Korean sector began in early 2011 when Samhwa Mutual Savings Bank was ordered by the KFTC to suspend its business for 6 months due to a negative capital adequacy ratio. On Feb. 17, FSC ordered Busan Savings Bank and its subsidiary Daejeon Savings Bank to suspend operations. Up to the end of December last year, Busan Savings Bank was 21.6 billion won insolvent, while another bank, Daejeon Savings Bank, had more serious problems, with a capital adequacy ratio of -3.18% and 32.3 billion won insolvency. The other bank, Daejeon Savings Bank, had a more serious problem: a capital adequacy ratio of -3.18% and insolvency of 32.3 billion won. Immediately after, on February 21, FSC announced the closure of four more Korean savings banks, three of which are owned by Busan Savings Bank [7]. In just a few days, Korean people withdrew a total of 145.6 billion won from 19 savings banks, which caused a wave of bank runs. The cause of bank runs in South Korea is a lot of banks were closed by FSC, which creates fear in depositors.

2.2 Analysis of Reason

The main reason for the bank runs in Korea was because of the irregularities of the Korea Savings Bank.

First, to promote economic development, the Korean financial authorities neglected to supervise the savings banks, and the management of the savings banks was very irregular. Korean savings banks are inherently inadequate and generally small in size. Korea savings banks were formerly various underground money changers and other private mutual funds before the financial crisis institutions [8]. And illegal loans were common, some savings banks even lend anonymously to a single person for as much as 20% of their capital.

Second, according to the regulation of Korean financial regulatory authority requires that the capital adequacy ratio of small and medium-sized banks should be at least 5%, but in fact, the capital adequacy ratio of these savings banks is generally below the Basel requirements, with reserve ratios of less than 1% and liabilities exceeding assets [9]. To attract depositors, these savings banks often offer higher than base interest rates on deposits the interest return to depositors is maintained at 8% per annum. The interest rate on the loan is usually as high as 50%.

Third, savings bank loans are mostly concentrated in real estate in South Korea, with high concentration risk. During the global financial crisis in 2008, the recession in Korea affected real estate, with a sharp drop in demand for home purchases, a liquidity crisis for a large number of real estate companies, and a dramatic increase in bad bank loans due to the heavy involvement of savings banks in real estate mortgages.

2.3 Government solutions to this impactful bank run

The National Financial Services Commission announced that four major domestic commercial banks, Kookmin, Woori, Shinhan, and Asiana, and the state-owned policy financing institutions will provide 2 trillion won (about \$1.8 billion) in stabilization financing to savings banks; the Korea Securities Finance Corporation will support another 1 trillion won in stabilization financing. The Korea Securities Finance Corporation will support another 1 trillion won of stabilization financing [10]. The government will relax the restrictions on the provision of liquidity by the Korea Savings Bank Federation to provide sufficient liquidity to savings banks in need; at the same time, the Korea Savings Bank Federation will KFTC will postpone the existing loan terms of savings banks and reduce the loan-related interest rates. In addition, Korea Finance Corporation will raise its loan ceiling to local banks from KRW 1.4 trillion to KRW 2.3 trillion. Kim Seok-dong, chairman of the Korea Finance Commission, took the lead in depositing 20 million won at Woori Savings Bank, hoping to ease the sentiment of some depositors. He said that if there is no excessive run, the number of savings banks ordered to shut down will not increase in the first half of this year. In addition, the Korean government will seek to purchase about 3.5 trillion won of real estate-related non-performing loans held by domestic savings banks through a public fund managed by the Korea Asset Management Corporation. Fifth, to prevent the financial problems of savings banks from spreading to commercial banks, the KFTC has previously announced that the banking industry and the government will jointly inject 20 trillion won into the savings banking sector for emergency liquidity and to provide a better understanding of the financial situation. Won for emergency liquidity and to facilitate mergers and acquisitions of financial institutions

3. Results and Discussion

3.1 The game between depositors and banks

There are two types of banks in this game, strong commercial banks and weak commercial banks. Strong commercial banks refer to commercial banks with better asset quality and stronger profitability commercial banks with better asset quality and stronger profitability, on the contrary, they are weak commercial banks [11]. The savings banks are the weak commercial bank. When there is unfavorable news about a bank's business condition in society, the bank should be able to maintain its business and depositors' confidence. Normally banks respond to that adverse news with a positive attitude. This results in a dynamic game of imperfect information in which banks and depositors are the participants. The action payment matrix of both sides of the game is shown in Table 1 (where $A > B > C$ and A, B, and C are all less than 0):

Table 1. Three Scheme comparing

Weak Commercial Bank			
Depositor			
		Positive Response	Negative Response
	Withdraw	(A,B)	(A,C)
	Do not withdraw	(B,A)	(B,0)

3.2 Suppose there is a bank with only two depositors

Each depositor has \$10 million in funds deposited in the bank and both are time deposits. The bank invests the entire \$20 million in a project, assuming that the project must be profitable if it is well-funded. At the end of the project, the bank has \$24 million, and each depositor will receive \$12 million. If the bank withdraws from the project early, the bank will be penalized for early withdrawal. The penalty is assumed to be 20%, i.e., if the bank withdraws funds from the project before the investment period has expired, it can be penalized for early withdrawal. If the bank pulls back from the project

before the investment deadline, it will get back only \$16 million [12]. The action of the game is shown in Table 2 (in millions of dollars):

Table 2. Game between depositors

Depositor 1			
Deposito 2		Withdraw	Not Withdraw
	Withdraw	(800,800)	(1000,600)
	Not Withdraw	(600,1000)	(1200,1200)

If depositors A and B withdraw their money early at the same time, the bank can only withdraw their money early from the investment project, thus the bank will receive a 20% penalty for early withdrawal, i.e., only 16 million will be available for payment, at which point the bank will also go bankrupt, and each depositor will only receive 8 million. If both A and B choose to withdraw their deposits only after maturity, at this time the bank's investment project is profitable and each depositor can get 12 million yuan, if one party withdraws early, then the party who withdraws early can get his original deposit of 10 million, but at this time the bank has to withdraw from the project due to the depositor's early withdrawal, and it only has 16 million yuan for withdrawal, when the other depositor comes to withdraw, he will only get \$6 million, which is far less than his original deposit of \$10 million. Analyzed by the relative advantage strategy line drawing method, when depositor 1 chooses to withdraw, depositor 2 will choose to withdraw, because $800 > 600$. When depositor 1 chooses not to withdraw, the depositor will choose not to withdraw, $1200 > 1000$. As a result, there are two Nash equilibriums in this game, which are both depositors choosing to withdraw or both choose not to withdraw.

3.3 Discussion

There should be this stricter control on banks. The government needs to ensure that banks in the market are responsible for standards. The government also has to control the underground market and anonymous loans. Strictly control the risk of real estate and local government platform loans. Real estate is a high percentage of the investment industry in any country, the government should strengthen the control of the real estate.

Both small and medium-sized banks have liquidity risk. Small and medium-sized banks have fewer outlets, poor deposit-taking capacity, and a stronger urge to expand and issue loans, making them vulnerable to liquidity problems. Governments should ensure that the liquidity of small and medium-sized banks is not stretched too thin. Banks should also prudently assess risks, pay special attention to loans in the real estate sector, and strictly enforce the regulatory department's loan-to-deposit ratio target, and the loan-to-deposit ratio should not be too high.

4. Conclusion

Since the bank run in Korea caused serious economic losses to the whole country, I analyze this bank run to find out the causes of this run and analyze the game theory model to find out the gains and losses of different participants in the bank run.

We study and analyze the history, causes, and implications of bank runs for other governments based on the 2011 run in Korea. This paper analyzes the game theory that existed in the Korean bank run through a series of published papers and models with the aim of identifying the causes of the Korean bank run and gaining insights from them. We find that the cause of the bank run in Korea was the suspension of the Samhwa Mutual Savings Bank of Korea by the Korea Financial Services Commission (KFSC) for 6 months. The first wave of bank runs and bank closures was initiated by the Financial Commission of Korea, which ordered Samhwa Mutual Savings Bank to shut down for 6 months. The analysis of bank runs by game theory shows that when the bank becomes strong, the bank's loss will be the least. This is because depositors will be more willing to trust the strong bank.

For depositors, there are two Nash equilibrium. one is to choose to withdraw money early at the same time, and the other is not to withdraw money early at all.

This paper only examines the game analysis in the Korean bank run, and the model does not add risk into it. As well as the degree of depositors' trust in different banks varies. This paper only divides the banks into strong and weak banks. The next people can also try to divide the banks into savings banks and commercial banks. Or apply game theory to other bank games inside.

References

- [1] Iyer, Rajkamal, and Manju Puri. "Understanding bank runs: The importance of depositor-bank relationships and networks." *American Economic Review*, 2012: 1414 - 45. Fangfang. Research on power load forecasting based on Improved BP neural network. Harbin Institute of Technology, 2011.
- [2] Gibbons, Robert. "An introduction to applicable game theory." *Journal of Economic Perspectives* 11.1, 1997: 127 - 149.
- [3] Wang Hui, Tang Jianmin. Game analysis of the causes of bank runs. *Modern Economic Information*, 2010: 17+4.
- [4] Dahlstrom, Robert, et al. "How to recover trust in the banking industry? A game theory approach to empirical analyses of bank and corporate customer relationships." *International Journal of Bank Marketing*, 2014.
- [5] Mukherjee, Avinandan, and Prithwiraj Nath. "A model of trust in online relationship banking." *International journal of bank marketing*, 2003.
- [6] Li Yiqi. Game analysis of the behavior of each interest body during bank runs. *Economic Economics*, 2000 (06): 20 - 22.
- [7] Schotter, Andrew, and Tanju Yorulmazer. "On the dynamics and severity of bank runs: An experimental study." *Journal of Financial Intermediation* 18.2, 2009: 217 - 241.
- [8] Ng, Y. D. South Korea's bank runs rise. *21st Century Business Herald*, 2011 - 02 - 24.
- [9] Zhou Liqun, Xiang Jun. Implications of bank runs and bank closures in Korea for China. *Hainan Finance*, 2012: 42 - 45.
- [10] Cui Shanhua. The bank run in Korea and its revelation to China. *Shanghai Finance*, 2011: 122 - 123.
- [11] Li Dongwei. Reflections on the run-on Korean savings banks. *Qinghai Finance*, 2011: 61 - 62.
- [12] Qiao Haishu, Li Yuanhang. The game analysis of bank runs crisis. *Financial Theory and Practice*, 2006: 28 - 32.