

STATISTICAL STUDY ON THE RISK OF BANKRUPTCY IN BANK

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Abstract.

This study aims to assess the risk of bankruptcy of American Capital One Bank and Volksbank Romanian bank's main objective type consisting of establishing causality, that is established between the probability of bankruptcy (from Stickney model) of the two banks, ie the extent to which a possible bankruptcy of a bank failure can cause the other.

To this end, we present a brief review of the literature in this field, will then present the Granger test methodology, Stickney model and the ADF test and present the data analyzed and results obtained.

Keywords: *risk, bankruptcy, credit scoring, logit*

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1. Literature review

Bankruptcy prediction models are generally known as modalities of the "dangers" of financial entities.

In financial theory are three types of assessment addressed the financial issues namely univariate analysis, multivariate analysis and logit analysis.

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Univariate analysis assumes that a single variable can be used to predict a specific objective (Cook, Nelson, 1998).

Univariate model proposed by William Beaver (Anghel, 2002, p.55) achieved a moderate level of accuracy of prediction (Shepard, 1994). This study, based on univariate analysis, the financial position of a sample of 79 bankrupt firms and 79 non firms - bankrupt. The starting point was the average of five financial ratios (cash-flow/total assets, net profit / total assets, total liabilities / total assets, working capital / total assets and Liquidity) and Beaver model theory which held that a company reservoir of liquid assets. In his study, Beaver was based on the concept of cash flow.

In his view, the company is a reservoir of liquid assets, which is fueled by cash inflows and outflows drained of cash flow and bank solvency probability that exactly follows the tank dry (Beaver, 1988).

From the definition above sentences following principles:

- The larger the tank, the lower the probability of bankruptcy;
- the higher the operational flow, the lower the probability of bankruptcy;
- The greater the amount of debt, the greater the likelihood of bankruptcy.

Based on these ideas, the author postulated that the average value of five financial ratios differ significantly from group to group companies bankrupt non-bankrupt firms (Anghel, 2002, p.56).

Univariate analysis identified factors related to hazards that confronts an economic entity, in our case banks. However, the models in this category are ways relevant risk assessment (Stickney, 1996).

Multiple discriminant analysis (MDA) is an attempt to assess the potential conflict between financial indicators using simple variables (Cook, Nelson, 1998).

The most commonly used model was proposed by Edward Altman, Professor of Finance at the Stern School of Business at New York University.

From Altman model, Cristine Zavgren (1985) brought improvements to the bank failure prediction model developed later by Andrew William Lo (1986) and Claude Paul Stickney (1996). This is the third way of predicting bankruptcy is called logit model.

During 1980 and 1990, the trend has been the use of logit models against multiple discriminant analysis (Stickney, 1996). More recently logit analysis was considered more as an advanced analytical tool like neural

network, encountered in recent work of teachers Edward Altman, Marco and Franco Giancarlo Varetto (1994).

2. Database and methodology of work

This study aims to assess the risk of bankruptcy of American Capital One Bank and Volksbank Romanian bank's main objective type consisting of establishing causality, that is established between the probability of bankruptcy (from Stickney model) of the two banks.

In this regard, quantitative research was the main point of this paper, but also the quality has proven useful in drawing conclusions of the study. Was used as primary literature (U.S. bank's financial statements Capital One, and the Romanian bank Volksbank, studies based models used, and Granger - 1969), and secondary literature (articles from various magazines that cover issues bankruptcy risk, and various publications and books published on the subject). These sources, which led to the qualitative research undertaken are given in the bibliography.

The study therefore focuses mainly on the model developed by Jean Claude Stickney, and the type Granger causality. Stickney model developed was applied to the financial data of American bank Capital One for 25 quarters (the period between early 2005 and early 2011) and those of Volksbank in 20 quarters (the period between 2005 and 2009). Following this model, we obtained on the one hand for default risk rating for each quarter to review bank and bankruptcy probabilities involved.

Stickney model involves the application of four steps:

- seven financial indicators are calculated according to the table:

Table 1: Logit Indicators

Financial ratios	Coefficients
Constant	+ 0.23883
Banking Receivables /Turnover	- 0.108
Receivables/Cash and public effects for refinancing	- 1.583
(Cash + Short Term Investments)/Total Assets	- 10.78
Currents Assets/Current Liabilities	+ 3.074
Operating Profit/(Total Assets – Current liabilities)	+ 0.486
Long-term Liabilities/(Total Assets – Current Liabilities)	- 4.35
Turnover/(Working capital +Fixed Assets)	+ 0.11
y =	\sum (Coefficient * financial ratio)

Probability of Bancruptcy =

$$1/(1 + e^y)$$

- In the second stage, each rate is multiplied by a coefficient can take positive or negative values set in the model.
- In the third stage partial products are added together.
- Calculate the probability of bankruptcy as inverse function $(1 + e^y)$.
- in class rating, depending on the rate of bankruptcy.

Failure rate for banks was considered that calculated by experts in the field, as shown below:

Table 2:

Degree of risk	Range of expected rates of bankruptcy	Equivalent rating for long-term debt	
		Moody's	Standard&Poor's
1	0,0 - 0,15	A3	A-
2	0,15 - 0.3	Baa1/Baa2	BBB+/BBB
3	0,3 - 0,6	Baa2/Baa3	BBB/BBB-
4	0,6 - 1,2	Ba1/Ba2	BB+/BB/BB-
5	1,2 - 2,5	Ba3	B+/B
6	2.5 - 5	B1	B-
7	5 - 10	B2/B3	CCC
8	> 10	CaaCa/C	CC/C

Source: E. Cade, Managing Banking Risks

Bankruptcy probabilities obtained are then analyzed using the model developed by Granger, to determine if it can indeed identify a causal link between default risk and the bank's U.S. and Romanian bank if the domino effect makes its presence felt a prerequisite for the application of this model is stationarity probability of bankruptcy. Therefore, before presenting the results, we will present underlying models to obtain them.

Granger (1969) in his model that considers variable X causes Y when X for help to predict Y. Search procedure so as to quantify the current level of variable Y can be explained by its historical values and then adding variables to study whether such variation explained $x_t - i$ increases. It is assumed that the two variables are stationary.

Analysis of causality between the two variables involves the following steps:

1. To test whether X is a cause for Y, Granger is estimated regression equation below:

$$(1) \quad Y_t = \mu + \sum_{i=1}^k \beta_i Y_{t-i} + \sum_{j=1}^k \alpha_j X_{t-j} + \varepsilon_t$$

where k is fixed so that the errors are white noise. Alternative null hypothesis that the regression equations are:

$$H_0: \alpha_1 = \alpha_2 = \dots = \alpha_k = 0, \text{ that X is not cause for Y,}$$

$$H_1: \exists \alpha_i \neq 0.$$

Hypothesis testing is done using a Fisher-Snedecor test type constructed as follows:

$$(2) \quad F = \frac{(SSR_r - SSR_u)/k}{SSR_u/(T - 2k - 1)} = \frac{(R_u^2 - R_r^2)/k}{(1 - R_u^2)/(n - 2k - 1)} \in F(k, n - 2k - 1)$$

where SSR_u and the sum of squares of residues and the coefficient of determination in the unrestricted equation (1) and SSR_u and R_r² s are the same elements but restricted regression equation (2) which includes only terms of type y_{t-i} :

$$(3) \quad Y_t = \mu + \sum_{i=1}^k \beta_i Y_{t-i} + \varepsilon_t$$

Null hypothesis is rejected if the calculated value for F statistic is greater than the critical value.

2. Similarly, if Y is test case for X from the regression:

$$(4) \quad X_t = \mu + \sum_{i=1}^k \varphi_i X_{t-i} + \sum_{j=1}^k \delta_j Y_{t-j} + \varepsilon_t$$

Null hypothesis that alternative are:

$$H_0: \delta_1 = \delta_2 = \dots = \delta_k = 0 \text{ that Y is not relevant for X}$$

$$H_1: \exists \delta_i \neq 0$$

F test has the same form:

$$(5) \quad F = \frac{(SSR_r - SSR_u)/k}{SSR_u/(T - 2k - 1)} = \frac{(R_u^2 - R_r^2)/k}{(1 - R_u^2)/(n - 2k - 1)} \in F(k, n - 2k - 1)$$

where SSR_u and SSR_r this time referring to the regression equation restrictions:

$$(6) \quad X_t = \mu + \sum_{i=1}^k \varphi_i X_{t-i} + \varepsilon_t$$

After applying the two tests is possible one of the following four conclusions:

- unidirectional causality: X is relevant to Y ($X \rightarrow Y$) if the null hypothesis is rejected at 1 and accepted 2;
- unidirectional causality: Y is relevant to X ($Y \rightarrow X$) where the null hypothesis is rejected at 2 and accepted to 1;
- bidirectional causality: $X \rightarrow Y$ if the null hypothesis is rejected at the 1 and 2;
- two variables are independent if the null hypothesis is accepted at 1 and 2.

As mentioned above, provided the methodology of Granger is variable stationarity. This will be tested for a range of form: using the Augmented Dickey-Fuller, performed relative to the coefficient of the term Y_{t-1} :

$$H_0: \alpha = 0$$

$$H_1: \alpha < 0$$

the following regression equation:

$$(7) \quad \Delta Y_t = a + bt + \alpha Y_{t-1} + \sum_{i=1}^{p-1} \beta_i \Delta Y_{t-i} + \varepsilon_t$$

So, after the TSA was established, the next section we present the results obtained.

3. Empirical results

In the following we present the first default risk ratings for the Capital One Bank and Volksbank Romania and then will enter Granger test findings.

3.1. Bankruptcy risk – Stickney

Capital One Financial Corp. (quotation NYSE: COF) is an American financial company specializing in credit cards, home loans, car loans and savings products. COF is included in the Fortune 500 ranking, the company is best known for his pioneer large-scale marketing of credit cards in the early 1990s, currently holding the eighth largest deposit portfolio in the United States as an article Direct Marketing News.

Capital One was founded in 1988 by Richard Fairbank and Nigel Morris, the then part of Signet Banking Corp (which was subsequently bought by First Union Corp. in 1997).

COF entered the retail market with the acquisition of Hibernia National Bank in 2005 in New Orleans, Louisiana and North Fork Bancorporation in Melville, New York in 2006.

After the financial crisis, Capital One aid received 3.56 billion dollars from the Economic Stabilization Act Federal, awarded by buying preferred shares. On June 17, 2009 Capital One was able to complete the redemption of preference shares sold 3,555,199 U.S. Treasury.

Results achieved by the model Stickney adapted the bank Capital One reveals that the risk of bankruptcy of this bank is low on most years its score, fitting it in risk class 1, equivalent rating for long-term debt A3 from Moody's and A- from Standard & Poor's, ability to pay interest and repayment of amounts borrowed at maturity is fully insured. Only in the first quarter of 2008, class of risk is reduced to 2, the equivalent of Moody's Baa1/Baa2. Also, an important reduction rating one grasp the second quarter in 2009. This brings significant worsening in the category Ba1/Ba2 bank is most likely due to the financial crisis already mentioned that erupted during this period. However, the bank was able to minimize the negative effects of the crisis, risk level back to level 1 for the rest of the period under review. So we can say that the bank's financial soundness and its proper capitalization contributed to survival in times of crisis without serious implications.

Volksbank Romania entered the domestic market in May 2000, its main shareholder consisting of Volksbank International AG, which is one of the leading banking groups in Austria. The services and products offered include mainly: home loans, construction and redevelopment housing, loans for purchase of cars, personal loans, credit cards with international and foreign

currency overdraft facility, credit for SMEs, micro and freelancers, e - banking accounts with attractive interest rates in domestic or foreign currency, etc.

The results obtained from the model Stickney on Romanian bank Volksbank reveal that in the first quarter of 2005, the bank can be classified as Baa1/Baa2, but in all other quarters immediately preceding the risk level is 1, so that it moves the A3 category, according to Moody's. Thus, we see that the bank was not significantly affected by the financial crisis in the risk of bankruptcy, she managed to cross safely this troubled period for financial markets.

3.2. Granger causality

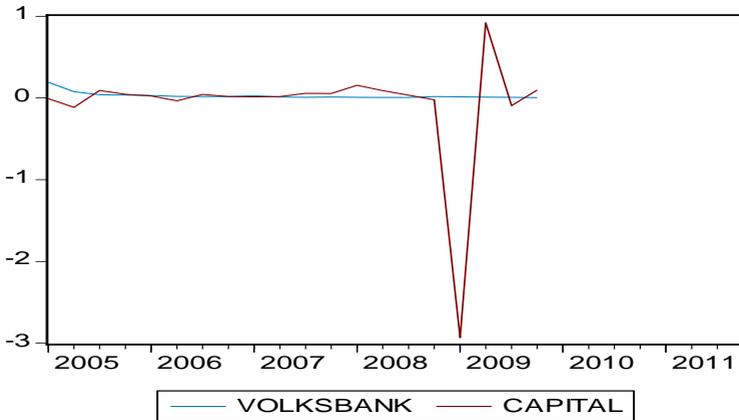
To apply the Granger methodology is imperative stationarity of variables. Thus, the ADF test, the following results were obtained, both variables are stationary as otherwise indicated below and graphical:

Table 3: - Results of ADF test for likelihood of bankruptcy

Variable	Trend and intercept				Intercept			Conclusion
	ADF	α (t_α)	β (t_β)	p	ADF	α (t_α)	p	
Probability Capital One	-6.24	0.01 (0.95)	-0.007 (0.68)	0	-6.35	-0.62 (-1.82)	0	Stationary no trend
Probability Volksbank	-17.55	0.018 (4.69)	-0.0008 (-2.90)	0	-16.86	0.008 (-4.35)	0	Stationary no trend

Source: own the software Eviews 5.1.

Figure 1: Evolution of the probability of failure Capital One and Volksbank



Source: own the software Eviews 5.1.

Once we have ensured that the series are stationary, can be applied based methodology of Granger. Hence we obtain the following results, the number of lags chosen is 2. Thus, we obtain the following result (which otherwise remains for 3 or 4 lags):

Table 6 - Results of Granger causality test

Pairwise Granger Causality Tests: Null hypothesis - no connection type Granger			
Null Hypothesis:	Obs	F-Statistic	Probability
CAPITAL does not Granger Cause VOLKSBANK	18	0.11925	0.88855
VOLKSBANK does not Granger Cause CAPITAL		0.75408	0.48995

Source: own Eviews 5.1.

In regard to the first null hypothesis, the acceptance probability threshold of 0.88 is higher than 0.05, so the risk of bankruptcy of Capital One Bank is not really a question for the type of Volksbank Romania Granger, somewhat surprising result.

And the second null hypothesis is accepted, the probability obtained is much higher than the threshold of 0.05. Thus, any risk of bankruptcy Volksbank type is not Granger cause the risk of bankruptcy of Capital One, a result that was expected this time, as its size is too small to influence a bank of such class.

3. Conclusions

Analysis of regional development through financial structure highlights the following issues:

- establishment and evaluation of active relations between different elements, on the one hand, and debt and equity, on the other hand in the analyzed region;
- highlighting major qualitative changes in state funds (assets) and sources (debt and equity) generated by internal changes and interaction with the socio-economic development of the region analyzed;
- the appreciation of the region's economic and financial development;
- foundation of government financial policy and strategy development region.

4. References

- The so-called "domino effect" resulting from interbank relationships is a phenomenon that should not be neglected by any bank supervisory authority. The objective of the model and to quantify default risk becomes significant especially considering that if a bank goes bankrupt and the other banks in the system will be affected, and could even trigger a chain bankruptcies. Severity of the problem is related to the fact that, in most cases, especially if the bank goes bankrupt is high, the domino effect will trigger not only nationally but internationally, which is why bankruptcy risk assessment was a major concern for many researchers and practitioners.
- No bank but can not be regarded as a single unit, it being part of the banking system, the relationships and connections that are established, of particular importance. Collaboration between various entities facilitate and encourage banking and can be very valuable (if for example a bank fails to meet the liquidity imposed by the central bank in a given day, she may contract a loan from another bank overnight and to provide liquidity as needed, avoiding penalties from the central bank). In the context of

globalization, it can be noted also that combining banking activities no longer a phenomenon identified only nationally but internationally, big banks around the world are connected in a banking system that goes beyond a country.

- Traditionally an institution's default risk was assessed by the indicators. Thus, among the most important were those who remember measured profitability, liquidity and solvency. In this context we developed multivariate analysis, which assumes follow certain steps in order to obtain a score on which company can be framed either in the category of bankrupt or in that of the healthy financially. So they began to gain importance especially such models - the dynamic modeling default risk for non-banking institutions (eg, Altman, Canon - Holder), after which they were adapted to banking institutions (eg Stickney model).
- Applying the results of the model Stickney, namely by testing Granger causality type, we noted that the first two banks analyzed - both the Volksbank Romanian and the U.S. Capital One - Low bankruptcy risk, managing to survive the financial crisis - even if Capital One difficulty in 2009, achieved score and rating is still very favorable.
- Regarding the assumptions made at the beginning of the work, most were refuted by the studies undertaken.
- H1 hypothesis was indeed confirmed, Capital One Bank encountering significant problems in 2009. Hypotheses H2 - H4 could not be confirmed. The test showed that Granger causality between the two banks is not even unilaterally, it could not be identified even if Capital One to Volksbank, nor vice versa. Does not invalidate the results on intuitive remark on default risk spread throughout the banking system, but the present study is limited by certain statistical considerations.
- Thus, the future recommend testing a database more consistent and use the panel to be included in several large banks both in the U.S. and Europe, whereas, in a risk occurs throughout the system, is difficult to trace the influence of banks on the other by a relationship as 1:1, while relations in the form 1: n or n: 1 would be more useful.
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