Chapter 25
The Potential Threat of Corporate Financial Distress in Switzerland

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Abstract The financial performance and the financial health of companies is given through the ability to generate added value. For the resulting effect of creating added value, maximum activity is required. Otherwise, companies have significant payment difficulties that can be resolved by a radical change in its activities or structure. The aim of this paper is to indicate potential threat of the corporate financial distress in Switzerland. The financial health of companies is analyzed by Taffler's bankruptcy model. The construction of the predictive models and the bankruptcy models are based on actual data from companies which were threatened by bankruptcy in previous years. The Taffler's bankruptcy model is applied on the annual corporate financial results in Poland from 2006 to 2015. The results indicated that approximately 34% of companies during the reporting period were at risk of financial distress. Based on the development of the number of endangered businesses, it can be observed that during the recession, the number of companies in financial distress is rising. This hypothesis was confirmed by Pearson's correlation analysis.

Keywords Financial distress · Taffler's bankruptcy model · Switzerland Pearson correlation coefficient

25.1 Introduction

The subject of the prediction of the corporate bankruptcy has been published in the economic literature since the 1960s and has been devoted to a number of scientific works. In order to predict the bankruptcy of a business or to properly classify a

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business according to its financial health, a variety of different methods have been used that differ in both their assumptions and complexities.

Predictive models are based on the hypothesis that the financial difficulty of an enterprise may be identified by certain signals that may be reflected in the ratios of financial ratios before it actually becomes apparent. The aim of the model is to give warning signals with sufficient time in advance. Already in 1966, William Beaver was looking for a relative financial ratio that better than others could have warned enough about the near-going decline of the business. He subsequently deduced several one-dimensional discriminatory models. On the contrary, Altman (1968) used a multidimensional discriminatory analysis to address the prediction of financial distress, which became the basis of the Z-score model and other established predictive and bankruptcy models.

Criterion of financial distress is often defined in the literature in a variety of ways, often based on time-lag lost, default dividends, bond defaults, large redundancies, capital restructuring, accumulated losses or negative cash flow (Balcaen and Ooghe 2006). Whether the company has a lack of capital, misinformation, or poor planning, it always come to the top management of the business when examining the causes of these shortcomings.

Financial distress also carries the so-called cost of financial distress, which is a natural accompaniment. These costs are in the form of both direct costs, which are various payments associated with dealing with financial distress such as court fees, lawyers' payments, or crisis managers. Indirect costs are primarily lost profits, for example, when an enterprise loses investor confidence and thus potential contracts.

However, it is important to noticed that the life of an enterprise is influenced by many external factors that cannot be affected by an enterprise, such as the development of macroeconomic indicators that can negatively affect the financial situation of an enterprise. These variations may be negated by appropriate management decisions, depending on the nature of the indicator.

The aim of this paper is to analyze the possible impact of selected macroeconomic indicators on the number of vulnerable financial distress companies in Switzerland. The financial distress of enterprises will be analyzed using the Taffler bankruptcy model at the national and sectoral level of Swiss enterprises between 2006 and 2015. Subsequently, using the econometric analyses of Pearson correlation coefficient and the use of granger causality, the potential impact of the development of macroeconomic indicators on the identified number of enterprises at risk of financial distress will be determined.

Switzerland reigns to most renowned charts, assessing the level of the economy, quality of life, business environment or freedom. In Switzerland, there is the highest average net wage in the world. At the same time, citizens can enjoy a beautiful environment and great public administration. To keep up the economy, there is an integrated specialized economy, top industry, production and distribution systems, and finance in the markets of Europe and around the world. The strength and foundation of the Swiss economy is in small and medium-sized companies, which account for over 90% of its GDP.

For the further development of each economy, the financial health of enterprises that are analyzed in bankruptcy models in this study is important. The use of bankruptcy models in previous studies and the study of the impact of macroeconomic

factors on enterprises at risk of financial distress is set out in Sect. 25.1. In Sects. 25.2 and 25.3, selected macroeconomic variables based on literature review are characterized and the methodology used, which will be based on identifying enterprises at risk of financial distress of the resulting relationship. Section 25.4 lists the results of the methods used and the last part summarizes the findings.

25.2   Literature Review

Bankruptcy models serve to predict the company's financial problems or determine the degree of imminent threat to the company by bankruptcy. This type of model is based on actual data from a very wide range of companies. For the overall assessment of the financial situation of the company, it is also necessary to take into account the results of partial analyzes of individual business areas. For this reason, it is advisable to build up credit and bankruptcy models following financial analysis using absolute and ratio ratios.

Fundamental models for predicting financial distress and business bankruptcy based on financial indicators were originally analyzed by Beaver (1966) and Altman (1968) models. Predictive models are based on the hypothesis that the financial difficulty of an enterprise can be identified using the ratios of financial ratios before it actually becomes apparent. The construction of the predictive models and the bankruptcy models are based on actual data from companies which were threatened by bankruptcy in previous years.

On this bases, the Taffler's bankruptcy model was developed (1983). The first stage in constructing this model was to compute over 80 selected ratios from the accounts of all listed industrial firms failing between 1968 and 1976 and 46 randomly selected solvent industrial firms. The Taffler model's ratios and coefficients indicate the four key dimensions of the firm's financial profile that are being measured by the selected ratios. These dimensions, identified by factor analysis, are: profitability, working capital position, financial risk and liquidity. Afterwards, Agarwal and Taffler (2007) confirmed the predictive ability of the model over the years and also demonstrate the predictive ability of the published accounting numbers and associated financial ratios used in the z-score model calculation. In this paper, the Taffler model is shown to have clear predictive ability over this extended time period.

The high predictive value of the financial distress in the models, according to the study Liu (2004) or Goudie and Meeks (1991) have macroeconomic indicators.

According to Goudie and Meeks (1991), A macro-micro model is presented which is used to predict company failure. It bridges the gap between previous macroeconomic models and the microeconomic approach to company failure. A series of simulation exercises using this model quantifies the impact of variations in the exchange rate upon the failure rate.

Similarly, Liu (2004) deals with the macroeconomic determinants of corporate bankruptcy in the UK. Using a structured vector autoregressive model, it separates short and long-term effects. He empirically analyzed the relationship between

corporate bankruptcy rates, interest rates, the aggregate volume of loans to the corporate sector and its profitability, the price level and the rate of start-up of new companies in the short and long term. From these macroeconomic variables empirically demonstrated the influence of interest rates on bankruptcy rates and pointed to the possibility of using interest rates as a means of reducing the number of failure companies in the economy. The macroeconomic model of business insolvency has been estimated also by Virolainen (2004), which empirically demonstrated the dependence of Finnish companies' bankruptcies on interest rates, gross domestic product, and their aggregate indebtedness for each sectors of the economy.

Bordo and Schwartz (2000) traced the changing nature of banking, currency, and debt crises from the last century to the present and their impact on business failures. They assess the impact of IMF loans on the macro performance of the recipients. A simple with-without comparison of countries receiving IMF assistance during crises in the period 1973–98 with countries in the same region not receiving assistance suggests that the real performance of the former group was possibly worse than the latter. The negative impact of the global crises on corporate sector, generally measured by development of GDP explained also Jakubík and Teplý (2008).

Borio (2007) analyzed the implications of financial revolution for the dynamics of financial distress and for policy. He argues that, despite the structural changes, some fundamental characteristics of the financial system have not changed and that these hold the key to the dynamics of financial instability. These characteristics relate to imperfect information in financial contracts, to risk perceptions and incentives, and to powerful feedback mechanisms operating both within the financial system and between that system and the macro-economy.

The determinants of mergers and bankruptcies using firm level data from Switzerland examined Buehler et al. (2006). They found considerable differences in the determinants of mergers and bankruptcies, in particular with respect to firm size, location and the impact of macroeconomic conditions. More specifically, large firms are more likely to grow further by merger than small firms.

Financial leverage, liquidity and financial health of companies in Switzerland was debatable issue of Drobetz and Fix (2003) or Drobetz and Grüninger (2007). Their results indicate that asset tangibility and firm size are both negatively related to corporate cash holdings, and that there is a non-linear relationship between the leverage ratio and liquidity. Financial leverage of firms is also closely related to tangibility of assets and the volatility of a firm's earnings.

25.3 Data and Methodology

25.3.1 Data Characteristics

The World Economic Forum's Global Competitiveness Report currently ranks Switzerland's economy as the most competitive in the world, while ranked by the

Table 25.1 Development of macroeconomic factors

	2007	2008	2009	2010	2011	2012	2013	2014	2015
GDP per capita	63,854	72,899	70,303	74,911	88,609	83,547	85,059	86,592	82,034
EUR/ CHF	1.64	1.58	1.51	1.38	1.23	1.21	1.23	1.22	1.07
GDP growth	4.16	2.11	−2.31	3.04	1.64	1.01	1.88	2.45	1.22
Export/ GDP	0.61	0.62	0.57	0.63	0.64	0.66	0.71	0.63	0.61

Source OECD (2018)

European Union as Europe's most innovative country. Switzerland has a stable, prosperous and high-tech economy. It has the world's nineteenth largest economy by nominal GDP and the thirty-sixth largest by purchasing power parity. It is the twentieth largest exporter, despite its small size. Switzerland has the highest European rating in the Index of Economic Freedom, while also providing large coverage through public services. The nominal per capita GDP, showed in Table 25.1, is higher than those of the larger Western and Central European economies and Japan.

According to the World Bank and IMF, Switzerland ranks 8th in the world in terms of GDP per capita. In 2017, average gross household income in Switzerland was 9946 francs per month, though 61% of the population made less than the average income.

The Swiss central bank in January 2015 surprisingly abolished the policy of keeping the euro exchange rate above the francs above 1.20 CHF introduced in September 2011 to protect the economy from the negative effects of strong domestic currency on exports. Frank then sharply strengthened by about 13%, which undermined export.

Switzerland does not have rudimentary resources; the economy is built on highly skilled workforce industry as one of the most advanced in the world. It is mainly the production of machine tools, power equipment, precision mechanics and optics of chemicals, electronics and selected foods. Significant revenues flow from the state from business and financial services, and the country is home of many international banks.

Switzerland is home to several large multinational corporations. The largest Swiss companies by revenue are Glencore, Gunvor, Nestlé, Novartis or Hoffmann-La Roche. Switzerland is ranked as having one of the most powerful economies in the world with the most important manufacturing sector. Manufacturing consists largely of the production of specialist chemicals, health and pharmaceutical goods, scientific and precision measuring instruments and musical instruments. According to IMF, the largest exported goods are chemicals (34% of exported goods), machines and electronics (20.9%), and precision instruments especially watches (16.9%). The service sector, especially banking and insurance,

Table 25.2 The basic activity of sectors of economy in Switzerland (in % of total)

Code	Nace Rev. 2, main section	Turnover	Employees	Value added
A	Agriculture, forestry and fishing	X	X	X
B	Mining and quarrying	0.11	0.16	0.22
C	Manufacturing	14.83	24.21	28.04
D	Electricity, gas, steam and air conditioning supply	1.87	1.06	2.35
E	Water supply; sewerage, waste management and remediation activities	0.26	0.49	0.58
F	Construction	3.48	11.82	8.27
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	65.44	21.57	25.36
H	Transportation and storage	3.16	7.61	7.11
I	Accommodation and food service activities	1.06	7.37	3.08
J	Information and communication	2.71	5.01	6.99
K	Financial and insurance activities	X	X	X
L	Real estate activities	0.58	1.42	2.03
M	Professional, scientific and technical activities	4.86	10.33	11.12
N	Administrative and support service activities	1.63	8.93	4.85
Q	Human health and social work activities	X	X	X
R	Arts, entertainment and recreation	X	X	X
S	Other service activities	X	X	X

Note The mark X denotes unavailability of data searched
Source Eurostat (2018)

tourism, and international organizations are another important industry for Switzerland.

Switzerland has also a low tax rates and overall taxation is one of the smallest of developed countries. Switzerland is a relatively easy place to do business, currently ranking 20th of 189 countries in the Ease of Doing Business Index.

The basic activity of sectors of economy in Switzerland is shown in Table 25.2. According to Eurostat database, the most active sectors are Wholesale and retail trade; repair of motor vehicles and motorcycles, Manufacturing and Professional, scientific and technical activities.

25.3.2   Methodology

In this paper, the financial health of companies is analyzed by Taffler's bankruptcy model (1983). As explained in Taffler (1983), the first stage in constructing this model was to compute more than 80 carefully selected ratios from the accounts of

all listed industrial firms failing between 1968 and 1976 and 46 randomly selected solvent industrial firms and the correctness of the Taffler's model (25.1) provides the study of Agarwal and Taffler (2007).

Bankruptcy models indicate the financial condition of the company and its risk of potential bankruptcy. The models are based on real data from companies that have already gone bankrupt. Formulas are predicted to see if the company is going bankrupt or prospering. The forecast of bankruptcy can be detected several years before the actual bankruptcy.

Due to the availability of financial results in Amadeus database, the Taffler's bankruptcy model is applied on the annual financial results of 355 companies in Switzerland from 2006 to 2015.

$$TZ = 0.53R1 + 0.13R2 + 0.18R3 + 0.16R4 \qquad (25.1)$$

R1   EBIT/short-term liabilities
R2   current assets/foreign capital
R3   short-term liabilities/total assets
R4   total sales/total assets

The resulting company qualification is made according to the following ranges:

TZ > 0.3—low probability of bankruptcy of the company
0.2 < TZ < 0.3—grey zone of unmatched results
TZ < 0.2—increasing probability of bankruptcy of the company

The impact of selected macroeconomic indicators on the number of firms threatened by financial distress will be examined through econometric analyzes in econometric software EViews. Selected methods for detecting possible relationship are Pearson correlation analysis and Granger causality test.

Based on the review of literature selected macroeconomic indicators are GDP per capita, GDP growth, interest rate and exchange rate. Bordo and Schwartz (2000), Liou and Smith (2007), Jakubík and Teplý (2008) concluded that the number of bankruptcies is increasing during the economic recession, while in the conjunction period their number decreases. The Pearson correlation coefficients (25.2) is used to confirm this hypothesis. Correlation coefficient measures the strength of linear dependence between two variables.

The calculation of the Pearson correlation coefficient (Brooks 2002) is then the following:

$$r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{(n-1)s_x s_y} \qquad (25.2)$$

where x and y are the sample means of X and Y, and sx and sy are the corrected sample standard deviations of X and Y. The Pearson correlation is +1 in the case of a perfect direct linear relationship, −1 in the case of a perfect inverse linear relationship, and some value in the open interval (−1, 1) in all other cases, indicating

the degree of linear dependence between the variables. The closer the coefficient is to either −1 or 1, the stronger the correlation between the variables.

Finally, the Granger causality test to determine the direction of short-run dynamics i.e. interdependences between the number of corporates with potential financial distress and macroeconomic variables is used. The Granger test involves the estimation of the following equations (Brooks 2002):

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta X_{t-i} + \varepsilon_{1t} \qquad (25.3)$$

$$\Delta X_t = \varphi_0 + \sum_{i=1}^{r} \varphi_{1i} \Delta X_{t-i} + \sum_{i=1}^{r} \varphi_{2i} \Delta Y_{t-i} + \varepsilon_{2t} \qquad (25.4)$$

in which Y_t and X_t represent corporates with potential financial distress and macroeconomic variables. ε_{1t} and ε_{2t} are uncorrelated stationary random processes, and t denotes the time period. Failing to reject the H_0: $\beta_{21} = \beta_{22} = \cdots = \beta_{2q} = 0$ implies that macroeconomic fundamentals do not Granger cause number of corporates with potential financial distress. Likewise, failing to reject H_0: $\varphi_{11} = \varphi_{12} = \cdots = \varphi_{1r} = 0$ suggest that number of corporates with potential financial distress do not Granger cause macroeconomic variables.

25.4 Results

Although Switzerland is one of the most competitive and performing economies, it is still important to monitor the financial situation of businesses in the economy. In this study, the potential financial distress of businesses is determined by using the Taffler bankruptcy model. Due to the availability of data in the Amadeus business database, a total of 355 enterprises were analyzed. From the results shown in Fig. 25.1, approximately 22% of enterprises (TZ < 0.2) were threatened by financial distress and possible bankruptcy, approximately 12% of firms were in the gray zone of potential financial distress (0.2 < TZ < 0.3) and 66% were located in the low-risk zone of financial distress (TZ > 0.3). Most businesses threatened by financial distress and bankruptcy were in 2009, 2011 and 2015, the years when the Swiss economy was affected by economic structural change. In 2009, the global economic crisis affected the number of companies in financial distress, the European debt crisis followed in 2011, and in 2015 the Swiss central bank unexpectedly dropped from the exchange rate commitment in the course of the past three years, holding a franc above CHF 1.20. This step had a negative impact on exports, which is a significant source of economic performance.

According to sector analysis of companies with Z-score TZ < 0.2 and 0.2 < TZ < 0.3 shown in Table 25.3, Transport and storage (H), Accommodation and food service activities (I) and other services (S) are sectors with the highest
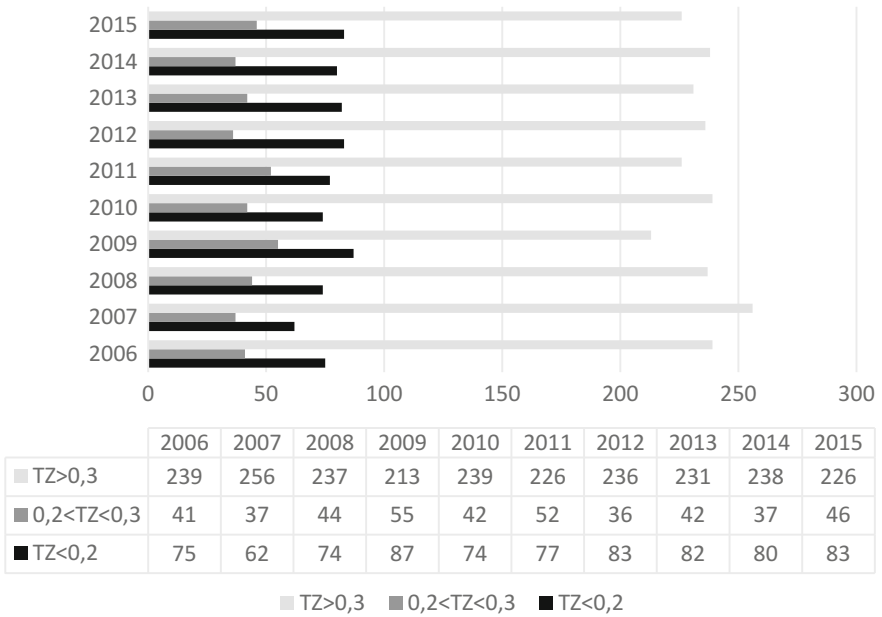
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TZ>0,3	239	256	237	213	239	226	236	231	238	226
0,2<TZ<0,3	41	37	44	55	42	52	36	42	37	46
TZ<0,2	75	62	74	87	74	77	83	82	80	83

TZ>0,3   0,2<TZ<0,3   TZ<0,2

Fig. 25.1 Results of Taffler Model in Switzerland. *Source* Author's calculations

Table 25.3 Number of companies with potential threat of financial distress

Sector (NACE)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average in %
A (1)	0	0	0	0	0	0	0	0	0	0	0
C (11)	1	0	0	3	1	2	2	1	1	2	11.81
D (63)	29	23	23	27	19	25	20	25	27	33	39.84
E (6)	2	2	3	3	2	2	2	2	2	2	36.67
G (5)	0	0	0	0	0	0	0	0	0	0	0
H (67)	43	41	43	48	48	47	36	42	42	42	64.48
I (9)	4	6	4	6	5	7	8	7	7	6	66.67
J (8)	1	1	2	3	4	4	4	3	2	2	32.5
K (92)	14	10	23	26	19	23	27	20	16	18	21.3
L (7)	1	1	2	3	3	3	4	6	4	4	44.29
M (72)	12	9	11	15	9	11	12	12	9	13	15.69
N (5)	3	2	3	3	1	2	1	1	1	2	38
Q (2)	0	0	0	0	0	0	0	1	2	1	20
R (5)	4	3	3	3	4	2	2	2	2	2	54
S (2)	2	1	1	2	1	1	1	2	2	2	75

Source Author's calculations

Table 25.4 Pearson correlation analysis

Variable	GDP growth	GDP per capita	Exchange rate EUR/CHF	Interest rate
Correl	−0.8766*	0.3554	−0.3798	−0.4799
t-stat	−5.1537	1.0755	−1.1614	−1.5475
Prob	0.0009	0.3135	0.2790	0.1603

Source Author's calculations

* denotes statistical significance on 1%

number of companies with potential financial distress. On the contrary, the best performing sectors are the driving force of the Swiss economy with the largest share of economic activity, such as Manufacturing (C), Wholesale and Retail; (G), Financial and insurance activities (K) and Professional, scientific and technical activities (M). At the same time, it is clear from this sectoral analysis that structural changes have had a negative impact on the number of companies in financial distress.

Based on the results of the Taffler model, it can be assumed that macroeconomic developments have an impact on the number of businesses with a potential financial distress. This hypothesis can be confirmed on the basis of Pearson's correlation analysis, the results of which are shown in Table 25.4. The resulting correlation coefficients confirm claims by authors of similar publications, with the decline in economic activity characterized by GDP growth rising by the number of enterprises threatened by bankruptcy and financial distress. At the time of the economic growth, such enterprises are declining. Other macroeconomic indicators did not show a statistically significant dependence, although the interest rate indicator reaches negative middle strong impact.

To capture causal relationships, Granger's causality test of selected variables was used. The basic condition is the fulfillment of the stationarity of the analyzed data at the first difference. To fulfill this condition, the ADF unit root test was used. Subsequently, on these stationary data, the Granger causality test was carried out, the results of which are shown in Table 25.5. Based on the resulting probability of F statistics, it was possible to reject the zero hypothesis only for the interest rate indicator. Therefore, it can be argued that the interest rate for Granger caused a

Table 25.5 Granger causality analysis

Granger causality test	F-statistic	Probability
GDP_growth =/=> FDIS	1.3679	0.4223
FDIS =/=> GDP_growth	1.9715	0.3365
GDP_per_capita =/=> FDIS	0.4430	0.6930
FDIS =/=> GDP_per_capita	0.8853	0.5304
Exchange_rate =/=> FDIS	0.0671	0.9371
FDIS =/=> Exchange_rate	1.9191	0.3426
Interest_rate =/=> FDIS	11.2543***	0.0816
FDIS =/=> Interest_rate	19.4955**	0.0488

Source Author's calculations

, * denotes statistical significance on 5 % and 10%

number of companies with potential financial distress, but also the opposite relationship was found between these variables, when Granger caused a financial interest rate. These results corroborate Liu's claim (2004) that proper use of interest rates by the central bank is an appropriate tool to reduce the number of financially at risk corporations.

25.5   Conclusion

For the further development of each economy, the financial health of enterprises that are analyzed in bankruptcy models in this study is important. Bankruptcy models indicate the financial condition of the company and its risk of potential bankruptcy. The models are based on real data from companies that have already gone bankrupt. Formulas are predicted to see if the company is going bankrupt or prospering. The forecast of bankruptcy can be detected several years before the actual bankruptcy. These models are very useful for the investor when assessing the purchase of the company's shares or bonds. Bankruptcy models are used to predict the company's financial problems or determine the degree of potential threat to the company by bankruptcy.

The aim of this paper was to analyze the impact of the macroeconomic environment on the financial health of enterprises in Switzerland. Although Switzerland is one of the most competitive countries in the world, on the basis of Taffler's bankruptcy model, it was found that, on average, 34% of companies during the 2006–2015 reporting period were at risk of financial distress. An important result for the Swiss economy was the finding that the sectors with the greatest economic power had the lowest numbers of businesses at risk of financial distress. Based on the development of the number of endangered businesses, it can be observed that during the recession, the number of companies in financial distress is rising. This hypothesis was confirmed by Pearson's correlation analysis, where the correlation coefficient shows a statistically significant negative correlation between GDP growth and the number of enterprises in financial distress.

To determine the causal relationship between selected macroeconomic variables and the number of enterprises in financial distress, the Granger causal test was used. The resulting values of stationary data showed the appropriateness of using the interest rate as an element to reduce the number of companies in potential financial distress. The lower interest rate increases the demand of businesses after obtaining loans, which may increase their investment activity or reduce their liabilities.

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