

Evaluation of German Life Insurers Based on Published Solvency and Financial Condition Reports: An Alternative Model

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Abstract: 79 German life insurance companies were selected for a complete survey. Quantitative data relevant to the analysis was extracted from the individual Solvency and Financial Condition Reports reports and transferred to a systematic overview. To make the collected observations usable, they were transformed into various growth, profitability, and security ratios cited in the literature, thus enhancing comparability. The data transformed into ratios were presented in histograms with ten intervals each, and a score between one and ten was assigned depending on the ratio value. In addition, four qualitative risk categories were initially identified, based on which the model would be operationalized. These were underwriting risk, market risk, credit risk and operational risk. Artificial intelligence was used to design seven questions on the requirements of Article 295 of Delegated Regulation 2015/35. Specifically, there were questions on the methodology of risk assessment, the description of specific measures, the comprehensibility of the measures, information on risk concentrations and the impact on the risk profile of the company as a whole, and risk mitigation measures and their effectiveness. Points were awarded from one to four, depending on the quality of the text used to answer the questions, based on the Appelfeller and Feldmann maturity model. This was followed by a weighting with individual factors to reflect the importance of each metric. While consumers can, for example, simply use the indexed total score for further consideration, the model equation can also be filled with fictitious values. This makes it possible to predict the risk class of a fictitious life insurer in the German market in 2022.

The analyses show that it is in principle possible to extract both quantitative and qualitative assessment elements from the respective solvency reports, transform them into meaningful ratios, and finally combine them in a weighted model to generate a decision-making basis for the model user. It is precisely the dovetailing of the two strands of quantitative and qualitative analysis that makes it possible to make meaningful use of information that was previously not taken into account.

Keywords: Solvency and financial condition report, Quantitative data analysis, Qualitative data analysis, Risk assessment models for life insurers, Solvency capital requirements, Quantitative and qualitative risk categories, Regulatory impact on insurance valuation, Decision-making models

1. Introduction

The introduction of the Solvency II Directive, which came into force on 1 January 2016, marked the end of fifteen years of intensive negotiations and represented a significant regulatory change in European insurance supervision. It replaced the previous Solvency I supervisory regime. The aim was to introduce standardized reporting to the public with an unprecedented single set of rules. According to recital 3 of the Solvency II Directive, the objective was to improve insurance supervision in the European single market. According to recitals 16 and 17 of the Solvency II Directive, the often less knowledgeable consumers and

beneficiaries of insurance contracts should be protected through transparency and market discipline. According to the European Commission, the basis for broad-based consumer protection in Europe is now in place.

However, the difficulty with these regulations is that often complex macroeconomic relationships and the resulting business decisions need to be presented to the public in a compact, understandable, and concise manner. This should enable non-expert consumers to make objective decisions. In the best-case scenario, consumers will be able to assess the financial stability of an insurance company after viewing the solvency report and then decide which company should be available to them as a long-term contractual partner. However, three years after the introduction of the solvency report, Deutsche Finanz Presse Agentur GmbH concluded in 2019 that the reports had reached only 0.03 percent of German households (DFPA Deutsche Finanz Presse Agentur GmbH, 2019).

This ultimately leads to the research question: How can quantitative and qualitative elements of the solvency reports of German life insurance companies be used to assess these companies within the framework of a generally applicable model? This question addresses the need to include both types of data in the analysis to provide a more thorough assessment of the financial stability and performance of the companies.

The model developed is intended to be useful to a wide audience. This includes consumers, regulators, and professional institutions. It should enable users to make informed decisions about long-term business relationships with insurance companies. This work therefore makes an important contribution to research by proposing a new method for evaluating insurance companies that takes into account previously unused qualitative aspects. By integrating these aspects into the valuation model, a more comprehensive understanding of the true performance of the company is achieved, complementing and potentially improving existing approaches.

2. Literature Review

Market professionals and investors across Europe are constantly seeking multi-dimensional valuation approaches to minimize investment risks and create meaningful indices (Gulati et al., 2023). This is not only the case for insurance companies but such analytical approaches are already being used in many sectors, for example, to identify insolvency at an early stage (Giannopoulos et al., 2022; Siddik et al., 2022). However, analysts sometimes use complex mathematical models and calculations. In particular, capitalized earnings value methods are used, as well as various discounted cash flow methods and market value methods (Nguyen and Romeike, 2013; Freidank and Ceschinski, 2019; Freidank, 2022).

Overall, there are many reasons that can trigger a business valuation. On the one hand, these can be tax-related circumstances, but also stock market or contractual reasons. In addition, changes in the ownership structure can also trigger a company valuation (Maier, 2017). But the choice of valuation method depends on the circumstances. This means that different addressees may arrive at different company values for different reasons. While a potential buyer may want to use the lowest possible value as the basis for price negotiations, the seller will ideally want to negotiate the highest possible price. Business valuations therefore have different functions, including a decision-making function, a mediation function, and an argumentation function (Toll, 2008). Concerning the decision-making function, e.g. as an objective basis for decisions on purchases, sales, investments, or liquidations, two common methods have emerged over time (Maier, 2017).

The net asset value method essentially assumes that there is an objective company value. It follows a purely accounting approach and sets assets against liabilities in a balance sheet. The

basic idea is therefore to determine a reproduction value of the company being valued. The underlying assumption is that a company is simply the sum of its assets minus its liabilities (Kolbe, 1954). It should be noted, that this approach ignores hidden reserves and liabilities and intangible balance sheet values, and focuses exclusively on past values (Nölle, 2009; Wagner, 2017; Freidank, 2022). In modern business valuation, the net asset value method is no longer relevant, as it is not able to take into account all the values that are important for a valuation. Alternatively, the liquidation value can be considered. This can always be used if a going concern basis is no longer possible, for example in the case of insolvency (Nölle, 2009).

Due to the limitations of net asset value methods, present value methods have gained in importance since the end of the 20th century (Maier, 2017). Net present value methods are characterized by the inclusion of projected cash flows and thus at least a rudimentary consideration of the future development of the company. Net present value methods assume that the value of a company is positive if the sum of discounted cash flows is higher than the return on an alternative investment in the capital market (Nguyen and Romeike, 2013; Kollmer, 2022). Specialized methods such as the income approach, various discounted cash flow methods, and market value methods are just a few examples (Nguyen and Romeike, 2013; Freidank and Ceschinski, 2019; Freidank, 2022).

Despite their usefulness for certain purposes, the methods described are only partially suitable for the original purpose of this paper. Due to its limitations, the net asset value method is hardly suitable for a company valuation to assess the long-term fulfillment of hedging transactions entered into. However, the ease of implementation of the net asset value method is a positive aspect. This means that the net asset value method can at least provide approximate information if the reason for the valuation allows for inaccuracies. The net present value method is largely more complex but provides a more realistic view by adding forecast values. However, the forecast can often only be an estimate.

What these methods have in common is that only monetary metrics are used for valuation. Qualitative aspects and fundamental risk assessments are not included. To make matters worse, some of the information used, such as future cash flows, has to be estimated or is only available to a limited group of people with non-public specialist knowledge. Solvency reports do not provide all the necessary information. An alternative valuation method is required.

3. Research Methodology

The dataset used consists of information from the individual Solvency and Financial Condition Reports of the 79 German life insurance companies at the end of 2022. Reports for entire insurance groups were not used, as these are outside the defined target group. As the solvency reports are to be published, they can be obtained from the respective websites without any additional effort. Following the Article 55 of the Solvency II Directive, the reports have to be approved and signed in advance by the respective management. In addition, the solvency reports must be submitted to the competent national supervisory authority following the Article 300 of the Delegated Regulation. It can therefore be assumed that the data reported is the same as that reported to the national supervisory authority and has therefore already been checked for accuracy (Bundesanstalt für Finanzdienstleistungsaufsicht, 2023).

The base table contains a total of 2,682 data points. These consist of 79 observations with 35 variables each. 83 data points could not be extracted due to missing information from the solvency reports. This corresponds to a rate of approximately 3 percent. Only Protektor Lebensversicherung-AG was excluded from the population. As the company acts as a voluntary rescue company for the life insurance industry in Germany and manages the statutory guarantee fund, it does not write any regular insurance business and is therefore not suitable for inclusion in further analyses.

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A closer look at the variables reveals a wide range between individual values. The absolute figures, such as gross written premiums, are particularly striking. Here there is a minimum of EUR 7 000 and a maximum of EUR 21 422 413 000. A similar picture can be seen for the surplus of assets over liabilities. Here there is a minimum of EUR 14 254 000 and a maximum of EUR 34 496 214 000. This is not surprising, however, given the inconsistent size of enterprises in terms of balance sheet total. It would therefore be intuitively plausible that a larger enterprise with a higher balance sheet total, and therefore a higher number of policies in force and a fundamentally broader market presence, would also generate higher premium income in absolute terms. However, any perceived correlation between total assets as a predictor of company size and premium income needs to be statistically analyzed to draw conclude further steps.

When there are metrically scaled variables that have a linear but independent relationship with each other, and the variables are approximately normally distributed, the Pearson correlation coefficient should be used to calculate a relationship (Kirch, 2008). The correlation coefficient r can be between -1 and 1. A coefficient of 1 indicates a perfect correlation and means that if variable A increases by one unit, variable B also increases by one unit. A coefficient of -1 means that if variable A increases by one unit, variable B decreases by one unit (Schuster and Liesen, 2017; Hilgers et al., 2019). However, since the above variables are not normally distributed, the correlation coefficient has to be calculated according to Spearman. No normal distribution is required for this type of correlation calculation (Schuster and Liesen, 2017).

With a coefficient of 0.9417, the Spearman correlation calculation confirms a highly significant positive correlation between gross written premiums and balance sheet total. A positive correlation between the balance sheet total and other absolute values is visible and plausible in light of the above considerations. For the sake of presentation, only an exemplary selection of variables and their respective correlation coefficients are shown here. For the sake of clarity, only the balance sheet total is shown in the right-hand column of Table 1. If the balance sheet total increases by one unit, the respective variable increases by the value of the correlation coefficient.

Table 1: Correlation table of selected variables and Balance sheet total

		Balance sheet total
Claims expenses	Correlation according to Spearman	0.9776
	Significance (two-sided)	<0.001
	N	77
Technical provisions	Correlation according to Spearman	0.9120
	Significance (two-sided)	<0.001
	N	79
Excess of assets over liabilities	Correlation according to Spearman	0.9498
	Significance (two-sided)	<0.001
	N	79

Since a simple comparison of the data collected without further transformation does not add any value, the data should be transformed into comparable measures. It should also be noted at the outset that not all calculable ratios can be used to assess a life insurance company in the context of the analyses. This is therefore only a non-exhaustive extract.

Rohlf's (2023) distinguishes four types of ratios for analyzing a company. These include growth, profitability, security, and liquidity ratios (Rohlf's, 2023). However, the latter will be ignored in the following analysis. The solvency of the life insurance business model is often not endangered by a high level of reserves and a surplus of prepaid premiums (Heimes, 2003). Heimes (2003) uses a similar categorization. Here the ratios are categorized as "profitability", "growth" and "security". The following ratios were analysed (see Figures 1, 2 and 3).

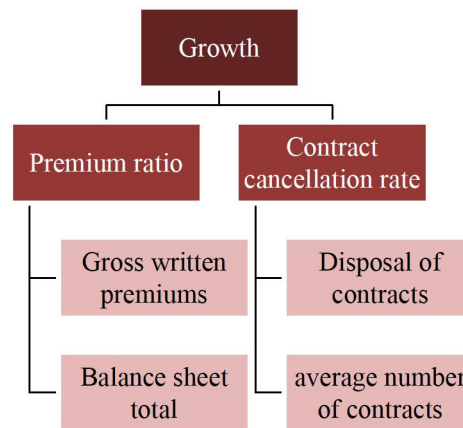


Figure 1: Module - Growth

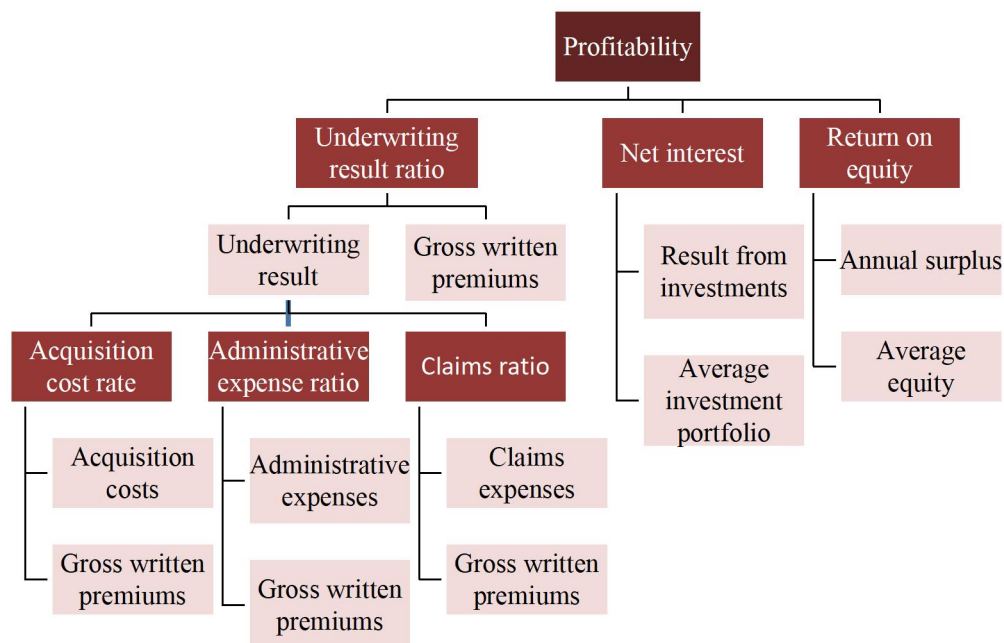


Figure 2: Module – Profitability

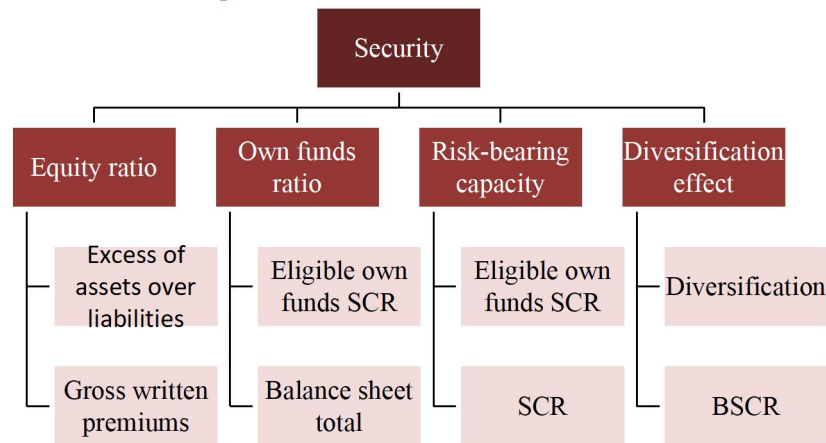


Figure 3: Module – Security

The selection of relevant metrics for quantitative analysis presented here is not exhaustive. It is therefore important to note that the decision as to which ratios to calculate and interpret will depend on the intended users (Lachnit and Müller, 2017).

Once the quantitative analysis module has been completed, the qualitative characteristics of the solvency reports are analyzed. The analysis of the textual components contained in the solvency report opens up a wide range of possible aspects for consideration. Those used here can only provide a partial view of reality. It should also be emphasized that, unlike the quantitative analysis, the qualitative analysis is not measured against objectively determinable ratios.

The legal requirement to disclose qualitative information, including the content to be specified, derives from Article 295(1) of the Delegated Regulation and applies to the following risk categories

- underwriting risk;
- market risk;
- credit risk;
- operational risk and
- other material risks.

To ensure the applicability of the model in this work, the last risk is not analyzed (see Figure 4). Insurance undertakings are free to provide additional information beyond the minimum required by Article 51 of the Solvency II Directive. This is provided for in Article 54(2) of the Solvency II Directive. Therefore, to ensure a balanced assessment, care must be taken to ensure that a qualitative textual analysis always deals with aspects that are mentioned equally by all insurance undertakings. Therefore, the narrative texts to be analyzed as indicators for qualitative analysis aspects can only be those that all companies have to disclose equally. It therefore makes sense to analyse the minimum measures that are to be found in the solvency reports in any case. Article 295 of the Delegated Regulation describes that the solvency reports in this context must contain information of

1. the measures used to assess risks within that undertaking, including any material changes over the reporting period (paragraph 2(a))
 2. the material risks that that undertaking is exposed to, including any material changes over the reporting period (paragraph 2(b))
 3. the material risk concentrations to which the insurance or reinsurance undertaking is
 4. exposed, concerning risk concentration (paragraph 3), and
- the techniques used for mitigating risks, and the processes for monitoring the continued

effectiveness of these risk-mitigation techniques (paragraph 4) concerning the individual risk categories.

To translate the above-mentioned information requirements in the solvency reports into an operational form, the Generative Pre-Trained Transformer 4 (GPT 4) was transformed into seven generally applicable questions with the help of the Large Language Model. The purpose of these questions is to measure whether, and if so to what extent, the narrative information provided in the solvency report answers the respective questions.

The choice of GPT 4 was deliberate. The technical report on GPT 4 states that the model outperforms comparable language models in terms of response quality and performance, particularly in natural language processing (OpenAI, 2023). It is therefore considered to be the most appropriate model for the planned study.

It should be noted that, due to the nature of the study, the original prompt is in the German language. The full translated prompt reads:

"You are now a supervisor at the Federal Financial Supervisory Authority. Your task is to review the text of the [RISK CATEGORY] report on the solvency and financial condition of a German life insurer. In doing so, you will pay particular attention to the requirements of Article 295 of Commission Delegated Regulation [EU] 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking up and pursuing of the business of Insurance and Reinsurance.

You will answer the following 7 questions

1. Are the methods and processes used by the company to assess [RISK CATEGORY] described clearly and in detail?
2. Does the description include specific actions that demonstrate that the company proactively and systematically identifies and assesses [RISK CATEGORY]?
3. Are the key risks to which the company is exposed presented comprehensive and understandable?
4. Are areas of high-risk concentration clearly identified and described?
5. Is it explained how these risk concentrations affect the overall risk profile of the entity?
6. Are the techniques and strategies used by the entity to mitigate risk described clearly and in detail?
7. Are there clear procedures for monitoring and evaluating the effectiveness of these risk mitigation techniques, and are these procedures regularly reviewed and updated?

Award between 1 and 4 points depending on how well the text answers each question. I would like you to award 4 points per question if the text answers the question fully and to an excellent standard, i.e. if the text is particularly good. If the text does not answer the question at all or answers it inadequately, I would ask you to award only 1 point for that question. I ask you to show me your answer in a table with the columns "Question", "Points" and "Reason". I would like you to keep your reason as short as possible.

Here is the text: [TEXT OF THE SOLVENCY REPORT]"

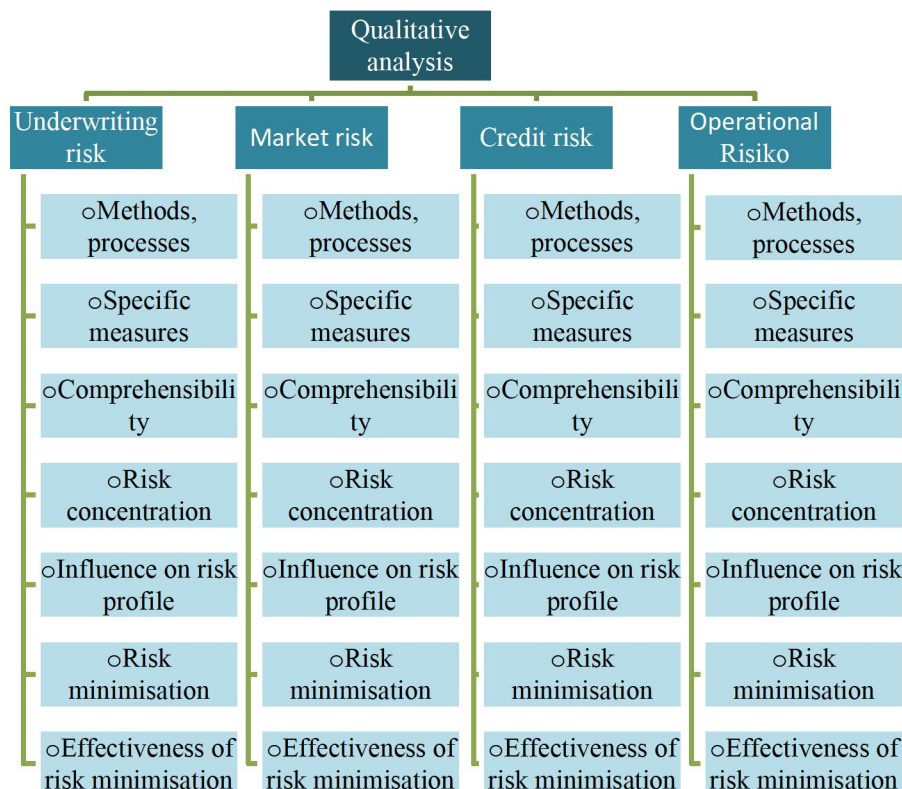


Figure 4: Module - Qualitative analysis

4. Data Analysis and Interpretation

4.1. Subsection

Figure 5 summarises the individual modules into an overall picture. While the left-hand half shows the quantitative part according to the modules of growth, profitability, and security as well as the individual key figures and their components, the right-hand half shows the qualitative part based on the respective risk categories. It should be added that the acquisition cost rate, the administrative cost rate, and the claims ratio are already included as components of the underwriting result. In order not to assess any variables twice and thus distort the overall score, only the underwriting result is therefore assessed. This scheme is only used for the graphical categorization of the overall model.

There are some significant differences in the length of the texts analyzed. For example, the text on the market risk of Aioi Nissay Dowa Life Europe AG contains 172 words, while that of Debeka Lebensversicherung AG contains 3,703 words to explain it (Aioi Nissay Dowa Life Insurance of Europe AG, 2022; Debeka Lebensversicherungsverein a.G., 2023). Therefore, it cannot be otherwise than that the risks are explained at different levels of granularity, at least in terms of their length.

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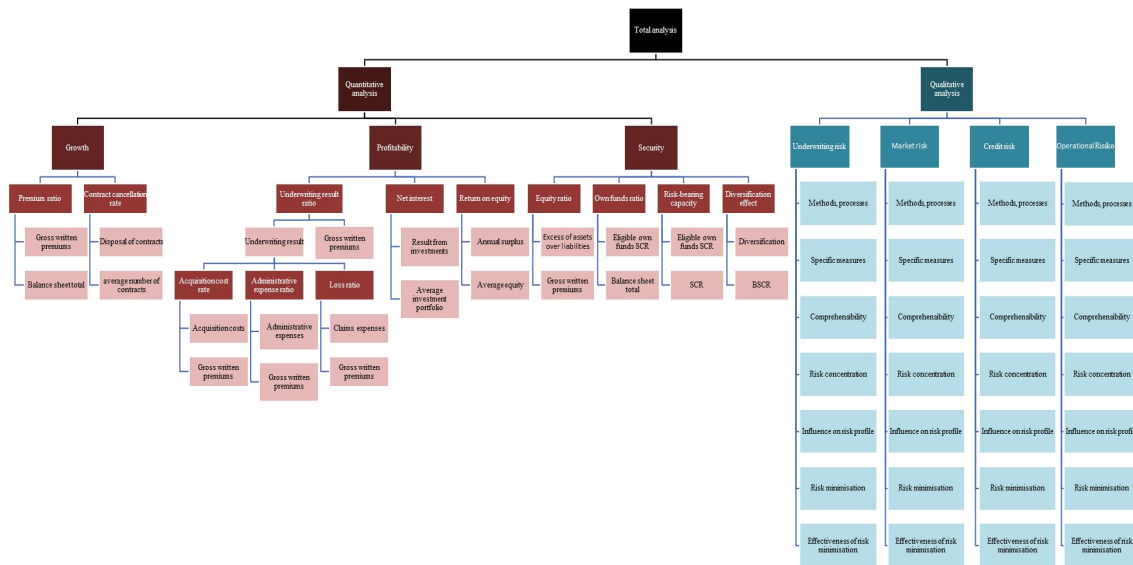


Figure 5: Modular scheme

Figure 6 shows four boxplots of the distribution of the qualitative points of the respective risk categories, which are at least briefly assessed descriptively below. For the sake of clarity, the position measures of the boxplots are shown in Table 2. Table 2 shows the minimum and maximum, the first and third quartiles, their interquartile range as well as the mean and median. The credit risk shows the lowest minimum value with a minimum score of 8, while the maximum for all risk categories is the maximum achievable score of 28. This indicates that at least one company achieved the full score in each risk category and fulfills the requirements of Article 295 of the Delegated Regulation to a particularly high degree. The interquartile range measures the dispersion of the values that are in the middle fifty percent of the distribution. The greater this is, the greater the dispersion of the values (Schuster and Liesen, 2017). It can be observed that the operational risk values are more scattered than the other distributions. This can also be recognized by the fact that the box, i.e. the interquartile range, is significantly larger than that of the other risk categories. Underwriting risk has the smallest interquartile range here, which indicates a greater concentration of values. It is noticeable that the values of the median and the mean approach each other in all risk categories. This speaks in favor of more normally distributed scores. The median and the mean value of the underwriting risk are the highest in each case. The point distribution of the underwriting risk therefore also tends to have the highest values. This, in turn, suggests that the quality of the texts in the area of the insurance business as the core of the company fulfills the requirements of Article 295 of the Delegated Regulation to a high degree. Overall, however, the medians vary in their level.

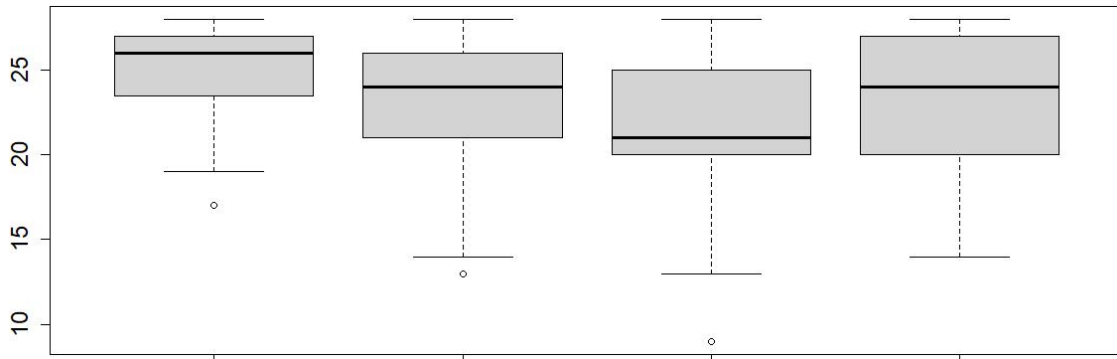


Figure 6: Boxplots of the points achieved in qualitative analysis. From left to right: Underwriting risk, Market risk, Credit risk, Operational risk

	Min.	1st quartile	Median	Mean	3rd quartile	IQR	Max.
Underwr. risk	17	23	26	25.06	27	4	28
Market risk	13	21	24	23.41	26	5	28
Credit risk	9	20	21	21.38	25	5	28
Op. risk	14	20	24	23.18	27	7	28
Notes: N= 79; IQR = interquartile range = 3rd quartile - 1st quartile							

Table 2: Position dimensions of the boxplots from Figure 6

4.2. Figures, Tables and Schemes

Before assessing individual companies, however, it is necessary to explain the system used to evaluate the ratios. Starting with the quantitative part, there are considerable differences in the absolute values. By forming various quotients, it has already been possible to smooth out size-related differences in the ratios to a large extent. However, a points system is now used to compare companies. The relevant ratio is rated on a scale of one to ten points. For this purpose, the distribution of the respective indicator is shown in a histogram with a total of ten intervals. If a metric is in the first interval, i.e. at the bottom of the distribution, the insurance company receives one point for that metric. If the metric is in the second interval, the company receives two points, and so on, up to a maximum score of ten points. Depending on the variable in question, a low ratio value is rewarded with a high or low number of points.

Finally, indexing is used to smooth out the different maximum scores of the metrics analyzed. In this way, the maximum possible score of 202 points is reduced to a value of 100 with the corresponding weighting of the values. Table 3 shows the distribution key used for indexing the individual indicators. Even though factors have been calculated for the overall areas of growth, profitability, and security, the factorized maximum score of the individual ratios is decisive for the model. No statement can be made as to which text is more relevant than another, and this depends on the individual assessment of the insurance company. For this reason, the scores in the qualitative analysis are of equal value.

Table 3: Indexing of the analyzed key figures

Key figure	max. pts.	factor	fact. max. pts.
Premium ratio	10	0.5	5
Contract cancellation rate	10	0.5	5
Growth	20	0.5	10
Underwriting result ratio	10	0.5	5
Net interest	10	1	10
Return on equity (RoE)	10	0,5	5
Profitability	30	0.6667	20
Equity ratio	10	0,5	5
Own funds ratio	10	1	10
Risk-bearing capacity	10	2	20
Diversification effect	10	0,5	5
Security	40	1	40
Total quantitative analysis	90	0.7778	70
Total qualitative analysis	112	0.2679	30
Total amount	202	0.4950	100

4.3 Formatting of Mathematical Components

A multiple regression model is used to generate a general model equation for this set of observations. Based on the determination of the respective regression coefficients, estimates can then be made using fictitious key figure values.

Each ratio is then calculated and evaluated for each insurance company. The dependent variable is the indexed total score according to Table 3. The results are presented in Table 4, where b is the coefficient of the predictor, SE is the standard error, β is the z-standardized coefficient, t is the t-statistic, and p is the corresponding p-value. The z-standardized coefficients are used to average the different results of the quantitative and qualitative analyses (Wentura and Pospeschill, 2015). This allows the effects of each predictor to be compared.

The calculation of the model shows that the contract cancellation rate, the RoE, and the diversification effect exceed a significance level α of 0.05 with a p-value of 0.1296, 0.5189, and 0.5984. The constant also exceeds the specified α with a p-value of 0.7131. These are therefore not significant predictors. They are not included in the model equation. Overall, the model itself has a p-value of <0.001 , which is less than the specified significance level α of 0.05 and even less than an α of 0.01. This means that the H_0 hypothesis can be rejected. Thus, the model does contribute explanatory power and the significant predictors are linearly related. The quality of the model is an R^2 of 0.8771. This means that around 88% of the model's variance can be explained (Wentura and Pospeschill, 2015). The R^2 tends to increase as the number of predictors increases, which distorts the true estimate (Sheather, 2009; Wentura and Pospeschill, 2015). The R^2 adjusted for this fact is 0.8522.

Table 4: Results table of the multiple regression model

Predictor	b	SE	β	t	p
Constant (intercept)	1.6340	4.4244	-6.321e ⁻¹⁶	0.369	0.7131
Premium ratio	14.9046	5.4059	0.2885	2.757	0.0076
Cancellation rate	-0.2946	0.1918	-0.0810	-1.535	0.1296
Underwriting result ratio	1.4658	0.4881	0.2102	3.003	0.0038
Net interest	1.0397	0.2116	0.3260	4.913	<0.001
RoE	-0.3384	0.5217	-0.0483	-0.649	0.5189
Equity ratio	0.8750	0.2872	0.1889	3.047	0.0034
Own funds ratio	14.2568	4.7410	0.2497	3.007	0.0038
Risk-bearing capacity	0.0146	0.0011	0.6926	12.943	<0.001
Diversification effect	0.3345	0.6317	0.0289	0.529	0.5984
Underwr. risk	0.3489	0.1451	0.1306	2.404	0.0191
Market risk	0.2485	0.1092	0.1333	2.275	0.0262
Credit risk	0.4501	0.0998	0.2641	4.511	<0.001
Operational risk	0.3706	0.0850	0.2322	4.361	<0.001
Notes: N = 79; R ² = 0,8771; corr. R ² = 0,8522; p < 0,001					

To use the multiple regression model to predict the indexed total score based on the significant predictors, the values in Table 4 must be converted into a general regression equation. To do this, the significant coefficients b can be inserted into the general multiple regression equation. It should be noted in advance that the individual predictors are abbreviated for the sake of clarity. Taking into account the values from Table 4, the regression equation is as follows, where y is the indexed total score.

$$y = 14.9046 * BV + 1.4658 * vE + 1.0397 * NV + 0.8750 * EKQ + 14.2568 * EMQ + 0.0146 * SCR + 0.3489 * vR + 0.2485 * MR + 0.4501 * KR + 0.3706 * oR$$

Looking at the indexed total score of all insurance companies produces the box plot shown in Figure 7. For the sake of clarity, the position measures of the box plot are shown in Table 5

Abbreviations as follows: premium ratio = BV, underwriting result ratio = vE, net interest = NV, equity ratio = EKQ, own funds ratio = EMQ, risk-bearing capacity = SCR, underwriting risk = vR, market risk = MR, credit risk = KR, operational risk = oR.

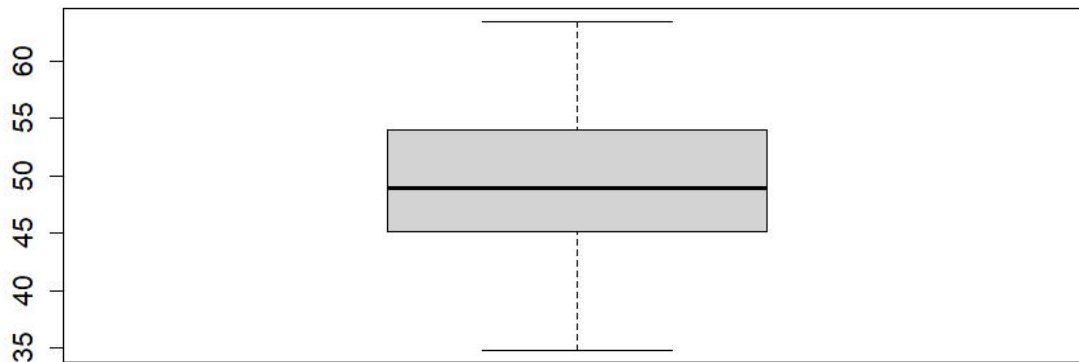


Figure 7: Boxplot for the indexed total score

Table 5: Position dimensions of the boxplots from Figure 6

Min.	1st quartile	Median	Mean	3rd quartile	IQR	Max.
33.88	44.95	48.91	48.99	53.45	8.5	63.39
Notes: N= 79; IQR = interquartile range = 3rd quartile - 1st quartile						

It is clear that the box, including the antennas, appears to be almost symmetrical. Together with the proximity of the median to the mean, this indicates that the total number of scores is almost normally distributed. It can also be seen that there is no score below 33.88, but also no score above 63.39. There are no outliers. The interquartile range of 8.5 concentrates the middle 50 percent of the scores in the range between 44.95 and 53.45, which is slightly less than half of the maximum possible score.

5. Conclusion and Recommendations

The studies show that it is in principle possible to extract both quantitative and qualitative assessment elements from the respective solvency reports, transform them into meaningful ratios, and finally combine them in a weighted model to generate a basis for decision-making for the model user. It is this combination of quantitative and qualitative analysis that makes it possible to take advantage of information that was previously ignored but is now available.

Finally, there is a latent danger in using artificial intelligence to assess qualitative aspects. If the algorithms used by the linguistic model to evaluate the texts become known over time, this could provide incentives for insurance companies to optimize the texts according to their criteria. This could circumvent the systematic nature of qualitative analysis, as the texts are prepared in such a way that the full score is always achieved.

Restricting the model to Germany as a location also introduces country risk, which is not taken into account in the model. Economic, cyclical, or political conditions do not weight in the model (Glaser, 2018; Rohlf, 2023). The comments on market risk, in particular, can paint a picture of the company in the German market, but they can only predict possible market changes to a limited extent. It should be noted that, particularly in the area of life insurance products, which tend to have long maturities, there may be many disruptive factors within the remaining term that may distort the information provided by insurance companies in their reports, even in the short term (Kollmer, 2022). In particular, the zero interest rate situation since 2016 has hurt the growth of companies, especially in terms of profitability and security

(European Central Bank, 2024). This is compounded by the fact that the insurance business can never be fully explained empirically, as there is always a degree of randomness (Gründl and Winter, 2005).

The dovetailing of quantitative and qualitative evaluations of German life insurers opens up a new area for future company valuations, even against the background of the limitations. The study was able to show that the solvency reports of German life insurance companies are generally available in a usable quality and confirms that the reports can add value to a company's valuation. The database used is also freely available to market participants without access to non-public information and is not restricted to a specific group of persons.

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