

## USER SENTIMENTS AND BANKRUPTCY: THE CASE OF CYBERPUNK 2077

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### ABSTRACT

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#### Kata kunci:

Sentiment Analysis,  
Product Reviews,  
Financial Indicator,  
Correlation

*This research investigates the correlation between customer sentiments of products and a firm's probability of bankruptcy. Utilizing the latest version of Altman's model, user sentiment movements of The Witcher games and Cyberpunk 2077 are compared to CD PROJEKT S.A.s Z'-score, which includes Working Capital/Total Assets, Retained Earnings/Total Assets, EBIT/Total Assets and Book Value of Equity/Book Value of Total Liabilities for every semester from 2013 to 2023. The results indicate that the relationship between them is weak yet positive, but ultimately insignificant. The literature review investigates the potential cause of this, and concludes that the relationship is not as simple as a bivariate correlation would indicate. Evidence suggests the existence of moderating variables, the possibility that a partial-mediating model is more accurate, and how the industry of the firm could change the nature of customer sentiments.*

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### INTRODUCTION

The video game industry's performance led to expectations from its customers. Gamers expect bigger and better games; those that may provide fun, excitement, escape, connections and others (Entertainment Software Association 2022). Investors expect developers to deliver said games. When developers deliver, everyone wins. Trust in the developer is built. Gamers will look forward to their projects, and spread positive sentiments for them, increasing the potential of future projects. Investors then think that the developers are good investments, and it will be reflected primarily by the developer's market value. Future projects by that developer will in turn have bigger and bigger budgets, allowing the cycle to continue, and for them to contribute to the industry's growth. However, what happens when the developers fail.

CD PROJEKT released their biggest game yet, Cyberpunk 2077, on December 10<sup>th</sup>, 2020. The game had a total budget of around \$316 million, talent from multiple A-list celebrities such as Grimes and Keanu Reeves, stated by the game's credits and IMDB, (2023), and roughly 9 years of development time (Kiciński, Nielubowicz, and Badowski 2013). Due to the size of the game, it required the studio to delay the release three separate times, touting quality improvements and shipping issues as the reason. The release became one of the biggest of all time, but not for good reasons. User reviews show the loss of customer trust. Around 300.000 reviews were written during the first month of the game's release, and about 20% of those reviews were negative (Steam 2023). The game was deemed to failure in several regards, due to it not living up to customers' expectations, having a problematic development cycle, and the negative reception it received, among others (Isaac & Browning, (2020), MacDonald, (2020), Schreier, (2021), Gilbert, (2020)).

This wave of negative opinions is in contrast to the customers' opinions of their previous product, The Witcher 3 which was released on May 15<sup>th</sup>, 2015. During the first month of that game's release, around 7000 reviews were written on Steam, and only about 7% of them were negative. News coverage was also very different. The Witcher 3 was the most covered game in media for its release year (ICO Partners 2015). This phenomenon should not be a surprise, however, since the game won five Global Game Awards, one of them being the Game of the Year award (The Witcher 2015).

Shift from positive to negative seen from the customer's perspective can also be seen from the market valuation. Ever since the disastrous launch, firm market value has never reached similar heights. Until the day of writing, almost 3 years later, around 65% of it is still lost, even with the release of other products during that

time. In contrast, firm market value increased around 460% three years before *Cyberpunk's* release. When compared to *The Witcher 3: Wild Hunt's* launch, their market value increased by almost 570%. This led to a filing of a class-action lawsuit, whereby shareholders, who are the plaintiffs, described the action as "violations of the federal securities laws" (Anon 2020). Stock price is an important component for predicting bankruptcy (Altman et al. 2017)<sup>[6]</sup>. While the effect is not direct, lower stock prices might hinder a firm from raising capital or refinancing debt. Anecdotally, low stock prices might detract future investors from buying stocks, or it might convince current investors to sell what they have. Mixed with other financial indicators such as liquidity and profitability, this will lead to the inability of companies to pay its obligations, and therefore bankruptcy.

Business perspective, dropping stock prices might predict bankruptcy. Examining the three-year period surrounding *Cyberpunk 2077's* release reveals a noticeable discrepancy in CD PROJEKT's market performance. The contrast with their previous success *The Witcher 3* indicates that the issue might be caused by the newly released product itself, instead of other possible factors. Because of this, the firm then needs to know whether this condition can be explained by the state of their products itself as stated by the user through their reviews.

The nature of user generated content, within which user reviews can be found, are unstructured and may number in the thousands. Useful information is hidden. Reading each review is a solution, but it is costly (Namey et al., (2020), Zhang et al., (2020)). Even if a firm is willing to pour the necessary resources to read through each review, whatever insight is generated might be subject to a lot more bias than necessary, since the ones who will analyse these reviews are involved with the production process (Rollwage et al. 2020). Analysis of these reviews need to be unbiased and resource efficient. This will ensure that the analysis can be done in a variety of industries, companies, contexts, and sizes. For this purpose, an NLP tool is better suited than a human. It is unbiased, an able to process a large amount of data with relatively small performance and budget costs, and much lower time cost.

Academic perspective, the problem lies in the absence of a research of this particular framework. Wang & Goh, (2020), HaCohen-Kerner et al., (2020), Li et al., (2021) and Febrianta et al., (2021) are all within the video games industry, involves user reviews, and utilizes sentiment analysis to varying degrees in order to make actionable conclusions. However, these papers are focused on the content of the reviews pertaining to the users, such as frequently mentioned aspects of the game, what users enjoy the most out of the game, playability analysis of the game itself, etc. On the other hand, Ramadhanti et al., (2020) attempts to classify customer personalities using human behaviour theories. Eachempati et al., (2022), used sentiments and financial performance to gauge the benefits/losses that a firm receives as the two variables move. While the results are strong, they apply to a completely different industry, the automotive industry. Keeping in mind the writer's own ignorance, there has not been any research on the effects of review sentiment on firm financial performance within the video games industry.

Considering the above, an investigation needs to be done on the relationship between customer sentiments and bankruptcy. Since a drop in sentiment along with a drop in stock prices were observed, businesses and investors might benefit from knowing whether the two are correlated, so that they may take actions accordingly. In addition, a knowledge gap of this kind exists within contemporary research.

## METHOD

To prove the hypotheses, several steps need to be taken. These steps are:

1. Tool Preparation: VADER and SPSS
2. Data Gathering: Steam and CD PROJEKT S.A. financial statements
3. Data Preparation
4. Complete Dataset Creation
5. Regression

Expanded into a more detailed flowchart, the steps are as follows:

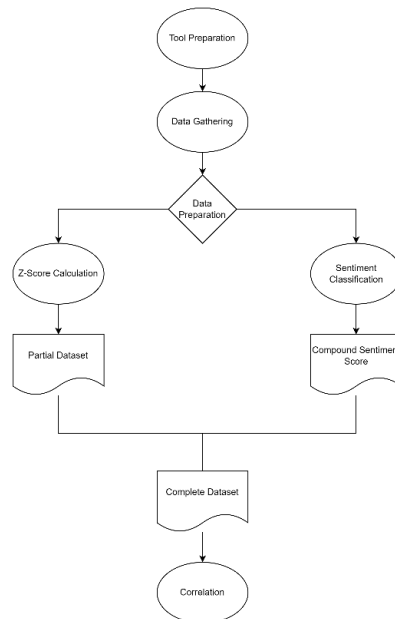


Figure 1. Research Steps Flowchart

**RESULTS AND DISCUSSION**

Put into the same chart, Sentiments and Z''-Score can be seen in. Red line marks the release of Cyberpunk 2077. Eyeballing the chart might indicate a correlation, but a statistical analysis is needed to verify it empirically.

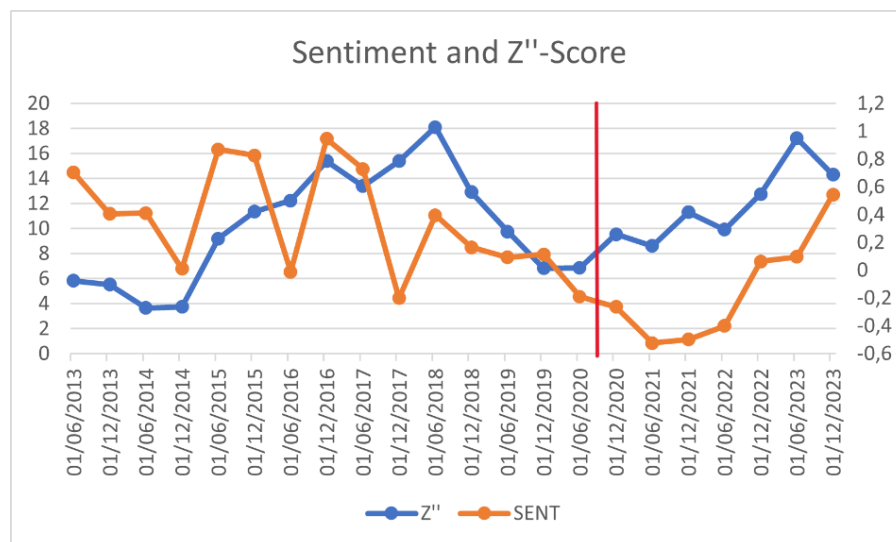
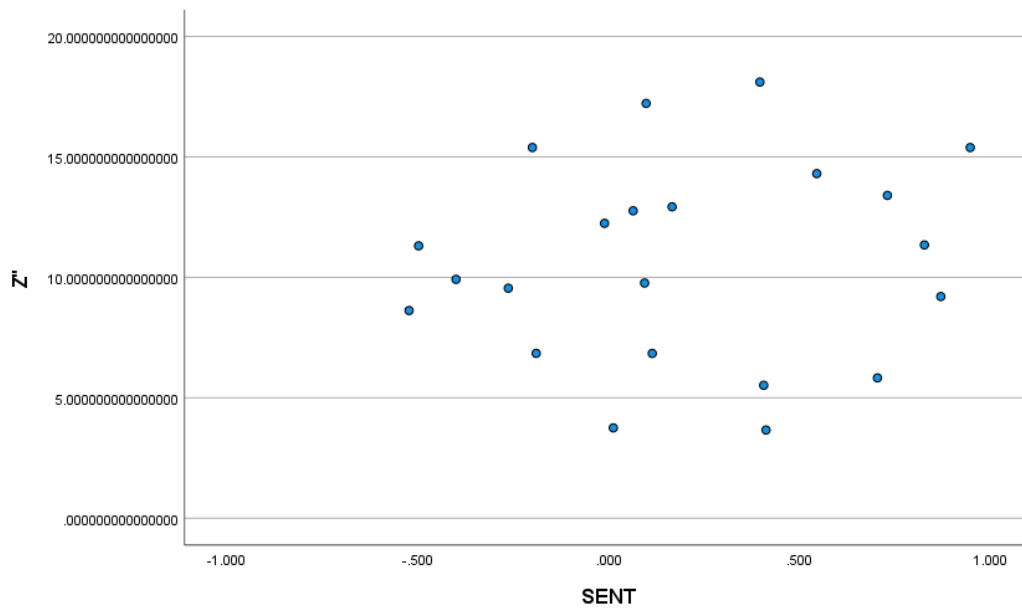


Figure 2. Sentiment and Z''-Score Line Chart

However, the results show otherwise. The results of the SPSS Pearson correlation can be seen in

**Table 1. Correlation Results**

Correlations			
		Z"	SENT
Z"	Pearson Correlation	1	.105
	Sig. (2-tailed)		.641
	N	22	22
SENT	Pearson Correlation	.105	1
	Sig. (2-tailed)	.641	
	N	22	22



**Figure 3. Correlation Scatterplot**

The Pearson Correlation coefficient shows a value of 0.105, meaning that the correlation between sentiments and Altman’s Z’-Score is weak but positive. However, with a 5% error rate, this correlation is not statistically significant as shown by the Sig. score. Even with a 10% error rate, the correlation is still not significant.

The results show that there are no significant correlations between user sentiments and bankruptcy probability. This is due to the high, Sig. score. With an error rate of 5%, any Sig. score higher than 0.05 means that findings are not statistically significant. However, even if the results are significant, a Pearson correlation of 0.105 shows that the correlation would only be a weak one, although positive. These results are in contrast with the majority of literatures cited previously. Ross et al., (2006), Eachempati et al., (2022) and (Dunham and Garcia 2021) all explicitly mentioned that sentiments significantly and positively impact firm performance, proven through regressions. This also means that sentiments should decrease the risk of bankruptcy. These findings are, in theory, more detailed than that of a correlation.

Possible explanation for this phenomenon can be found within the work of Otto et al., (2020). This paper describes user sentiments as being positively but weakly correlated with performance. This correlation is significant. However, in addition to this, the paper states that it might be a lot more accurate to describe this relationship as something more complex than what a bivariate relationship would indicate.

There is evidence that a multitude of other factors act as moderators of the satisfaction-performance (S-P) relationship. This means that some factors can affect the strength of the S-P, and that the effects will be different if these factors change. While many were hypothesized to be important, four were proven. These four include whether the products are retail/non-retail, whether satisfaction measures are recorded on a per-event basis or aggregated across a time period, whether a priority is put upon the highest level of satisfaction that a customer could give (such as a 5 in a likert scale) and whether firm performance is measured through market-

based indicators such as stock prices, accounting-based indicators such as profits or marketing-based indicators such as revenue and market share.

The findings stated that the S-P relationship will be stronger for companies who are not operating in retail. Retail operations require a lot more coordination on the supply side, and is subject to more failures. These failures are then felt by the end consumers and thus affect customer sentiment. Retailers, as opposed to B2B, are also naturally exposed to a much wider customer base, further increasing the variance of sentiments.

The findings also state that the method of collecting customer sentiments could impact the outcome of that relationship. In theory, the S-P relationship is stronger when sentiment data is aggregated across a period of time, instead of measured during specific events. Called cumulative satisfaction, this type of measurement is better able to capture a firm's past, present, and future conditions. Customers are also a lot more likely to be loyal and less price sensitive and therefore spend more when sentiments are positive cumulatively. However, the findings suggest the opposite. Event-based sentiments pronounce the relationship more.

On the topic of positive sentiments, those that are of the highest degree, otherwise called top-box, are also proven to strengthen the S-P relationship estimations. The rationale behind this idea is that customers who give ratings are those that are most loyal and most willing to pay price premiums. This rationale is supported by findings such as Hurley & Estelami, (1998) which found stronger relationships between the variables of their tests among top-box responses. In a similar fashion, De Haan et al., (2015) found that top-box responses are the most reliable satisfaction measure when it comes to predicting retention: a very important measure for firm performance.

Finally, the way firm performance itself is measured also acts as an important moderating variable in determining S-P. Their findings suggest that measuring firm performance from the perspective of the market (through stock prices) results in stronger S-P relationships, with the accounting perspective (through profits) following behind. Marketing perspective (through market share) is deemed to be the least effective.

Following recommended practices in literature reviews, Otto et al., (2020) also conducted MASEM analysis in order to unearth relationships that are not covered in most past literatures. The analysis is based on later studies that emphasises sentiment's role as a mediating variable. In doing so, the paper concluded that sentiment's effects on firm performance can be depicted in a partial-mediating model. That is, other variables might affect the level of sentiments, and this in turn, partially affects firm performance. The other variables in question include marketing strategy factors (through advertising, R&D and scope of served market), firm factors (through firm size) and industry factors (through industry concentration and market growth). Following the previous findings regarding firm performance measurement methods, three types of the model were tested as well: one with pooled performance (regardless of performance metric), profit and market share as the dependent variables for each type.

The pooled performance model shows sentiment is a significant predictor of performance and that all marketing strategy and firm factors are significant predictors of sentiments. Advertising, scope of served market and industry concentration are significant predictors of pooled performance without the need to be mediated by sentiments. Finally, as a whole, industry concentration, advertising and R&D expenses are the three strongest impacts on performance.

Regarding industry factors, Filletti & Grech, (2020) found similar results. Their research is almost identical to the one in this current paper. The authors attempted to improve bankruptcy prediction models utilizing sentiments obtained through news. The bankruptcy model used was Altman's very first Z-Score model from 1968. News sentiments of four Maltese industries are used: iGaming, pharmaceutical, aviation and tourism. Sentiment classifications are calculated based on the percentage of positive and negative words, along with the comparison of positive to negative words.

There is evidence that the direction and strength of sentiments are highly correlated with the industry it is a part of. Compared to the other three industries, the aviation industry experienced notably lower sentiments. The iGaming industry experienced relatively high amounts of both positive and negative words. The authors attribute this phenomenon to the highly volatile and controversial nature of the industry. The tourism industry experienced a downwards trend on positive words, and an upwards trend on negative words following an increase of total number of tourists according to the Malta Tourism Authority (MTA). Finally, the pharmaceutical industry experienced the most stable and predictable sentiment levels. This is in line with the stability of the industry as well. As a whole, these sentiment findings also help in predicting bankruptcies, though as noted by the authors, the validity of results still need further investigations.

Several connections from the literatures recently mentioned can be applied to this paper's research. First is the possibility of moderating effects experienced by S-P. Otto et al., (2020) stated that in order to produce the strongest S-P relationship, several conditions must be met. These include a non-retail firm, a transactional sentiment gathering method, top-box result emphasis of said sentiments, and operationalization

of firm performance as a market-oriented dependent variable, i.e. stock price. The current research does not follow these rules.

For starters, the video games industry can be considered entirely retail. As of 2022, only 3.2% of the total industry spend is directed at brick-and-mortar retailers (Entertainment Retailers Association 2023). That means wholesale selling is the minority and that the vast majority of expenditures are centred around digital video game distribution sites such as Steam, which are subject to the S-P negatives experienced by the average retailer (Otto et al. 2020).

Sentiments are also aggregated per semester, which produces less powerful results. This is done due to the availability of financial data, which comes in periods: quarterly, biannually or yearly, depending on the financial statements of the firm. There is also no emphasis on top-box responses. Top-box responses are usually used in tandem with Likert scales, and other scoring methods with well-defined ordinal values. VADER, and other NLP algorithms, uses a range of numbers such as -1 to 1 as proxies for user satisfaction. While it is possible to use, for example, a score of 0.8 to 1 to delineate top-box responses, this choice will be purely done on a whim. No prior studies have defined such clear boundary for what counts as a top-box response.

Finally, firm performance is measured through bankruptcy probability, which falls under the accounting-based performance measure. This method is also deemed inferior to a market-based measure. However, it is important to note that the while market-based measures produce stronger correlations, the difference between the methods mentioned in this section is negligible, and statistically insignificant. It is very possible that the use of the Z''-Score model might not have any effect the strength of the correlation. Cindik & Armutlulu, (2021) also verified this statement with their findings that suggest sentiments are not a bad fit for the model, as it increases prediction accuracy.

A lot of evidence was also shown for the possibility of a partial-mediating relationship. While sentiments do indeed affect performance, the evidence show that other factors, such as marketing strategy and firm size significantly predict sentiments. At the same time, other factors might influence performance directly, without the need for it to affect sentiments such as the industry itself.

From a marketing strategy perspective, firm conditions during the period of *Cyberpunk 2077*'s release is very different compared to that of their other game's release. This can clearly be seen from not only their stock price, but also their Z''-Score and market cap. *Cyberpunk 2077* itself is much more expensive to produce than their previous products. Since advertising and R&D expenses, along with firm size are significant predictors of sentiments, the result of this research might be affected by this.

It is also important to note the effects of other variables which do not directly interact with sentiments. Otto et al., (2020). Overall, industry concentration was found to have the most effect on performance, regardless of whether the effect is direct (without going through mediator) or not (going through mediator). The findings show that the more concentrated the industry, that is the more oligopolistic, the higher the firm's performance. However, data on the true concentration of the industry has not been found, and so conclusions about this point could not be made as of now.

The findings discussed above all point to the conclusion that the effects of sentiments can't simply be represented using a simple bivariate correlation. The true relationship between these variables still needs to be investigated further, so that proper conclusions can be made, and proper actions can be done.

## CONCLUSION

This research investigated the relationship between user sentiments of a firm's products and its likelihood of bankruptcy utilizing Altman's Z''-Score model. The results show that there is an insignificant weak positive correlation. Previous literature suggests the phenomenon might be explained by the existence of moderators within this relationship, including retail/non-retail, transactional/cumulative sentiments, top-box/non-top box measures, and market & accounting/marketing-based performance measures. Evidence also points to the conclusion that sentiments should be modelled within a partial-mediating framework, with sentiments acting as mediating variables, while marketing strategy, firm size, and industry factors act as independent variables. However, there are several crucial suggestions to consider. First, the use of better sentiment analysis tools is a very important point to improve on. VADER has been shown to consistently fall behind BERT in performance, and the choice of VADER is done solely due to the authors limitations. Further validation of the moderating effects of the aforementioned factors should be investigated. More research of this kind should be done when the conditions would theoretically produce the strongest correlations. The partial-mediating model should also be taken into account when the relationship between sentiments and bankruptcy is being researched. Firm conditions, especially regarding its marketing expenditures and size along with the concentration of the industry need to be considered during future research, or when attempting to draw

conclusions regarding sentiments and bankruptcy. The industry itself should also be investigated further. Not only does the concentration of it contribute to a firm's performance, evidence also shows that the nature of the sentiments will change depending on the industry. Only after these gaps are filled can businesses and investors derive meaningful conclusions.

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