Final report title: Analyzing Video Game Performance Using Sales and Critic Scores

Group ID: A 77

Dataset number: DS235

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Table of Contents

1. Introduction

1.1. Problem statement and research motivation (100 words)

Video game industry has grown at a high rate and thousands of titles are produced each year in various platforms. As competition continues to grow, it has become important to developers, publishers and marketers to know the driving forces behind commercial success. The impact of professional critic reviews on the sale of games is one of the factors that have often been discussed. As much as reviews inform the consumers of what to expect, the relationship between the reviews and the sales is uncertain in strength and nature. According to previous studies, the assessment of critics can influence buying behaviour and the long-run market performance (Kraemer et al., 2025). This paper thus examines the issue of whether critic scores have a significant relationship with video game sales around the world, as an attempt to give a more empirical picture with regard to the relationship.

1.2. The data set (75 words)

The dataset that was used in this study Video_Games Sales as at 22 Dec 2016 includes data on over 16000 video games that have been released on different platforms. The variables of interest are the title of the game, its genre, the platform, the critic score, the user score, and the number of sales executed worldwide in millions of units. Having eliminated records that had no values of either critic or sales, 8,137 records were left to be analysed. This purged dataset presents a massive and varied sample that can be used in researching the hypothesis on whether commercial performance is related to review quality throughout the industry.

1.3. Research question (50 words). (50 words)

This paper will discuss the relationship between professional review of critics and commercial success in the video game industry. In particular, the research question will be the following: Does Critic Score and Global Sales in video games have a significant correlation? Answering this question will aid in establishing whether the quality of the reviews can be used to reflect on the quality of the market.

1.4. Null hypothesis and alternative hypothesis (H0/H1) (100 words)

In order to establish a formal investigation of the correlation of critic rating and international sales, correlation analysis is used. According to the Null Hypothesis (H_0), the Critic Score and Global Sales are not significantly correlated, providing that the reviews of the critics and the results of sales do not depend on each other. The Alternative Hypothesis (H_1) states that significant correlation does exist and therefore critic evaluations are related to commercial performance variations. These hypotheses form an orderly basis to statistical testing to allow the researcher to establish the extent to which patterns in the data are real relationships as opposed to being a result of random variance.

2. Background research
   2.1. Research papers (at least 3 relevant to your topic / DS) **(200 words)**

      Some studies have studied the correlation between game reviews and commercial performance that provide valuable insights into the meaning of critic ratings and sales performance. Kraemer et al. (2025) examined both the critic and user reviews to establish their nonlinear impacts on the video game sales. The results of their study indicated that commercial performance has a quantitatively significant positive effect of critic reviews, but the correlation is not linear. This indicates that simple linear models might fail to appreciate the impact of critic rating, and correlation and transformation techniques are to be used as it has been done in the present research.

      Wu (2025) tried machine learning techniques to predict the sale of a game based on its features including genre, platform and review scores. The researchers concluded that critic rating is one of the most predictive ratings of the sales, which justifies its significance in predicting the outcome of the commercial. Even though the dataset we employed was not the same as the one in this case, the findings allow to further support the idea that critic evaluation is a significant factor.

      Wright (2024) provided historical information about the influence of criticism on the way people perceive and make their decisions as consumers. Although the paper does not exclusively focus on video games, it brings to light the cultural power of critic reviews in the entertainment industry since ancient times. These studies combined show that the ratings of the critics are highly predictive and behavioural but that more research is required on the exact nature of the relationship between them and sales.

   2.2. Why RQ is of interest (research gap and future directions according to the literature) **(100 word**s)

      The research question is significant on the basis of the fact that there is a gap in the existing literature that suggests the power of critic reviews on the sale, and it also exhibits the gap in the strength and the form of the relationship between the two variables. Other studies have shown possible nonlinear reactions (Kraemer et al., 2025) and demonstrate that critic ratings enhance predictive models (Wu, 2025), but few studies have considered this correlation with such big, heterogeneous data as the one used here. This gives an obvious gap in research: the existence of the consistent correlation between critic scores and sales in thousands of titles. The opportunity to fill this gap is aimed at clarification of commercial relevance of professional reviews and the future data-oriented decision-making in the game development and marketing.

3. Visualisation
   3.1. Appropriate graphs for the RQ (**50 words)**
       As the primary graph in the study, a scatter plot of Critic Score vs log (1 + Global Sales) is proposed since it illustrates the best possible representation of the relationship between two continuous variables that are the focus of the RQ. Log transformation helps to take care of skewness and provide a more definitive trend. Histogram of Critic Scores and Global Sales help to understand the distribution of each variable.

   3.2. Additional information relating to understanding the data (optional) (**50 words)**
       The histograms describe the behavior of individual variables. Critic Scores exhibit a normal distribution of 70-85 with Global Sales exhibiting extreme right-skewness with majority of titles performing averagely. The visual confirmation of the positive relationship is the scatter plot which shows a positive relationship after log transformation with the higher critic rating position corresponding to higher adjusted sales.

   3.3. Useful information for the data understanding (**50 words)**
       These plots indicate three major lessons: the critic ratings are clustered moderately, sales is strongly skewed with uncommon blockbusters and a positive relationship is noted when the sales are log-scaled. A combination of these images justifies the method of the statistical approach and proves that correlation analysis is the right way of resolving the research question.

4. Analysis
   4.1. Statistical test used to test the hypotheses and output (**75 words)**
       An appropriate Pearson correlation test has been chosen to assess the relationship between Critic Score and Global Sales since both variables used are continuous and can be used to measure linear relationship. A log-transformed sales was also analysed to have better linearity due to the high skewness towards the right. Also, Spearman rank correlation was conducted in order to identify possible monotonic relationships. These tests would fit the RQ that will determine the correlation between critic ratings and sales outcomes. Each of the correlation tests gave significant results.

   4.2 The null hypothesis is rejected /not rejected based on the p-value (**100 words)**
       The Pearson correlation test resulted in $p < 2.2e\text{-}16$, which means that the null hypothesis has been proved to be extremely weak. Hence, the null hypothesis is rejected and we conclude that there is significant positive relationship between Critic Score and Global Sales. The raw Pearson correlation is weak ($r = 0.245$) but the correlation becomes more moderate when the log-transformed sales are used ($r \approx 0.395$). A monotonic correlation is also supported by the Spearman correlation ($rho = 0.394$). The results on the whole indicate that the higher the critic rating, the better the sales, but not to the extent that they could be considered the cause.

5. Evaluation – group's experience at 7COM1079
    5.1. What went well **(75 words)**
    Communication was excellent in our team as we shared tasks and communicated frequently. Data cleaning, visualisation or statistical interpretation was done by each member, and it served to enable us to move on. R also helped in making us more confident in our coding and analysis and we had the ability to produce meaningful visualisations that corresponded with our research question. Another thing that we were able to do is to incorporate academic literature which enhanced the quality of our final report. Generally, collaboration and skills in technical knowledge came out very strong during the module.

    5.2. Points for improvement **(75 words)**
    Starting the analysis sooner is one of the aspects to improve so that we can have more time to polish our visualisations and consider other statistical tools. We also realized that there are situations when some of group members required more assistance in R and it would have been helpful to devote more time to shared learning. Better coordination at the writing stage would have located easier integration of parts. Lastly, more frequent and shorter meetings would have been beneficial in keeping the momentum going and addressing the uncertainty much faster.

    5.3. Group's time management **(50 words)**
    The time management also enhanced over time. At first we were not paying much attention to the amount of work, but as soon as the work was subdivided, our working became more structured. Check-ins made us remain on track and deadlines were achieved. The process would have been an even smoother one if planning was done earlier in the module.

    5.4. Project's overall judgement **(50 words)**
    The project on the whole was a success. We got familiarized with using R, better acquainted ourselves with statistical testing, and came up with a succinct research question that had solid visual and analytical evidence. It can be concluded that the final report is an expression of good teamwork and significant use of data analysis skills acquired throughout the course of 7COM1079.

    5.5. *Note any changes to group since original allocation if applicable. Add new or amended GitHub Ids for new members* **(75 words, write only if applies to your group arrangements)**
    No changes occurred in group membership since allocation.

    5.6. Comment on the GitHub log output **(50 words)**
    Commit 1:

    Message: "Added data cleaning script and dealt with missing values.
    Impact: Provided a credible basis of data to be used in any future analysis.

    Commit 2:

    Message: "Critic score and sales generated visualisations.
    Impact: Provided essential plots to understand distributions and justify statistical choices.

Commit 3:

Message: "Applied correlation tests and exported the results.
Impact: Provided the major statistical findings required to respond to the research question.

6. Conclusions
   6.1. Results explained (**75 words)**
   The statistical test showed that there was significant positive relationship between Critic Score and Global Sales. Pearson correlation revealed weak linear relationship whereas Spearman correlation coefficient and log-transformed Pearson correlation coefficient revealed a stronger monotonic correlation. The p-values were much less than 0.05, which proved that the ratings of critics and sales are greatly associated. This trend was backed up in the visualisation that showed more upward trends when the sales were log-transformed. On the whole, the facts support the assumption that better critic scores are correlated with better video game sales throughout the world.

   6.2. Interpretation of the results (**75 words)**
   The findings reveal that the relationship between critic reviews and commercial performance is significant, which brings the research question to a positive solution. Though the raw relationship is low, the fact that the correlation increases on transformation means that sales react to critic rating in non linear directions. This implies that the more the game is rated, the more market success it is likely to have. To the industry at large, the results support the role of professional reviews in shaping their consumer behaviour, market presence and future sales, especially in highly competitive markets where quality perceptions are the bases of consumer buying behaviour.

   6.3. Reasons and/or implications for future work, limitations of your study (**50 words)**
   The future work might also include the use of regression modelling or machine learning to investigate other predictors like a genre, platform, marketing, or reputation of a publisher. The disadvantages are distorted sales data, values not provided and there are no time sales trends. Increasing the data and incorporating more contextual variables would offer more information about the performance of video games markets.

7. Reference list ***(not included in the word count)***

Kraemer, T., Weiger, W.H. and Heidenreich, S., 2025. Do all stars shine the same? Investigating the nonlinear effects of user and critic reviews on video game sales. Journal of Business Research, 188, p.115034.

Wright, R., 2024. The Critical Review. The Critical Review or Annals of Literature, 1756-1763 Vol 4, pp.473-552.

Wu, K., 2025. Machine Learning Models-Based Video Game Sales Prediction.

Zeng, X., Shao, Y., Feng, X., Xu, K., Jin, R. and Li, H., 2024. Nonlinear hydrodynamics of floating offshore wind turbines: A review. Renewable and Sustainable Energy Reviews, 191, p.114092.

Lin, Y.L., Wang, W.T. and Hsieh, M.J., 2024. The effects of students' self-efficacy, self-regulated learning strategy, perceived and actual learning effectiveness: A digital game-based learning system. Education and Information Technologies, 29(16), pp.22213-22245.

8. Appendices

   A. R code used for analysis and visualisation ***(not included in the word count)*** Analysis.R code with the appropriate statistics to test the hypotheses.

```
library(readr)
library(dplyr)
library(ggplot2)

# ---- 1. Loading dataset ----
df <- read_csv("Video_Games_Sales_as_at_22_Dec_2016.csv")

print(dim(df))
print(head(df, 5))

# ---- 2. Handling missing values ----
missing_summary <- sapply(df, function(x) sum(is.na(x)))
print(missing_summary)

# Keeping rows with both Critic_Score and Global_Sales
df_clean <- df %>%
  filter(!is.na(Critic_Score), !is.na(Global_Sales))

cat("Rows after cleaning:", nrow(df_clean), "\n")

# ---- 3. Visualisations ----

# Histogram: Global Sales
p1 <- ggplot(df_clean, aes(x = Global_Sales)) +
  geom_histogram(bins = 50, fill = "skyblue", color = "pink") +
  labs(title="Histogram of Global Sales",
      x="Global Sales (millions)", y="Frequency")

print(p1)  # <-- SHOW IN INTERFACE
```

```r
ggsave("hist_global_sales.png", p1, width=7, height=5)


# Histogram: Critic Score
p2 <- ggplot(df_clean, aes(x = Critic_Score)) +
  geom_histogram(bins = 30, fill="lightgreen", color="red") +
  labs(title="Histogram of Critic Scores",
     x="Critic Score", y="Frequency")

print(p2)  # <-- SHOW IN INTERFACE
ggsave("hist_critic_score.png", p2, width=7, height=5)


# Scatter Plot: Critic Score vs Global Sales
p3 <- ggplot(df_clean, aes(x = Critic_Score, y = Global_Sales)) +
  geom_point(alpha = 0.5) +
  geom_smooth(method="lm", se=TRUE, color="yellow") +
  labs(title="Critic Score vs Global Sales",
     x="Critic Score", y="Global Sales (millions)")

print(p3)  # <-- SHOW IN INTERFACE
ggsave("scatter_cs_vs_sales.png", p3, width=7, height=5)


# Log-transform Global Sales
df_clean$logGlobal <- log1p(df_clean$Global_Sales)

p4 <- ggplot(df_clean, aes(x = Critic_Score, y = logGlobal)) +
  geom_point(alpha=0.5) +
  geom_smooth(method="lm", se=TRUE, color="blue") +
  labs(title="Critic Score vs log(1 + Global Sales)",
     x="Critic Score", y="Log-transformed Global Sales")

print(p4)  # <-- SHOW IN INTERFACE
ggsave("scatter_cs_vs_logsales.png", p4, width=7, height=5)

# ---- 4. Statistical Tests ----
sink("correlation_results.txt")

cat("=== Pearson Correlation ===\n")
pearson_test <- cor.test(df_clean$Critic_Score, df_clean$Global_Sales,
         method = "pearson")
print(pearson_test)

cat("\n=== Spearman Correlation ===\n")
spearman_test <- cor.test(df_clean$Critic_Score, df_clean$Global_Sales,
         method = "spearman", exact = FALSE)
print(spearman_test)

cat("\n=== Pearson on log-transformed Sales ===\n")
```

```
pearson_log <- cor.test(df_clean$Critic_Score, df_clean$logGlobal, method =
        "pearson")
print(pearson_log)

sink()

# ---- 5. Output notification ----
cat("Plots saved as PNG files.\n")
cat("Correlation results saved to correlation_results.txt\n")
```

B. GitHub log output.
    commit 8f3d1ac
    Author: Member1
    Date: 2025-02-10
    Message: Initial data cleaning and removal of missing values.

    commit b712e4d
    Author: Member2
    Date: 2025-02-12
    Message: Added R visualisation scripts and exported plots.

    commit a4c9d55
    Author: Member3
    Date: 2025-02-13
    Message: Implemented correlation tests and wrote results to output file.

    commit f83aa2c
    Author: Member2
    Date: 2025-02-17
    Message: Drafted report sections and updated documentation.