Video games and ratings: The effect of ESRB ratings on video game sales in North America

CIS 600: Research Methods

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Abstract

A video game is a category of software that is ran and played on a computing device, such as a personal computer, game console or mobile device. The global video game market was valued at 173 billion U.S dollars in 2020 and it is expected that the industry will continue to grow. The Entertainment Software Rating Board (ESRB) is a self-regulatory organization responsible for assigning age and content ratings to video games in North America. Based on these ratings, the purchase of certain games can be restricted by age groups. Games with mature content, rated M, are typically aimed at young adults and older. Meanwhile games rated E (Everyone) with more family friendly content tend to be aimed at children, though such games can still be purchased and enjoyed by adults. While there are numerous factors that may affect consumer purchase decisions for video games, the influence of content ratings is an area that warrants further study. This research project aims to study the effect of ESRB ratings on video game sales in North America by looking at some of the observed trends and performing statistical analysis on a dataset containing sales data up-to 2018. The results show that there is in fact a correlation between the two variables, however further research is necessary to account for other factors.

Introduction

Video games are a type of electronic game or software that can be run and played on devices such as personal computers, game consoles and mobile devices. Since its conception in the 1970s, current video games have advanced significantly, offering photorealistic graphics and realism to extraordinary degrees.

Video game design and development is currently a billion-dollar industry spanning multitudes of studios and independent developers across many countries. The global video game market was valued at 173 billion U.S dollars in 2020 and the industry is expected to continue to grow. While it has high penetration rates among children, increasingly more adults have been found to be purchasing and playing video games, in part due to their higher spending power.

The Entertainment Software Rating Board (ESRB) is a self-regulatory organization responsible for assigning age and content ratings to video games in the United States and Canada. The major ratings are categorized accordingly: Everyone (E) – suitable for all age groups, Everyone 10+ (E10+) – suitable for ages 10 and older, Teen (T) – suitable for ages 13 and older, Mature (M) suitable for ages 17 and older, Rating Pending (RP) – games that have not been assigned a final rating(Ratings Guides, Categories, Content Descriptors, 2021). All video games are assigned a suitable rating based on its content and certain titles are limited in their sales based on these ratings. Games rated E or E10+ will have more family friendly content and can be purchased by almost anyone. On the other hand, games rated M will typically have more violent content and/or suggestive themes making them unsuitable for younger audiences and as such can only be purchased by older consumers, in the case of M rated games this would include anyone 17 or older. That is not to say that all games rated E are for children only. While T and M rated games

are specifically designed for older audiences, many E rated games can be enjoyed by people of all ages and not just children. This brings to question; however, can these ratings have an impact on video game sales? How can rating categories impact a consumers purchase decision? Certainly, a person's preference in genre or platform of choice can have an impact on their purchase decisions. But can the rating of games also factor into their purchase decision?

This research paper aims to study trends in video game sales and the correlation of ratings with sales. For this study, only the North American market was considered as the rating system being used for comparison is the ESRB which is only enforced in the United States, Canada, and Mexico. The European Union and Japan are the two other major regions with sales data; however, they utilize different rating systems. For example, in ESRB games rated T are restricted for consumers 13 and older and games rated M are for 17 and older, whereas PEGI (Europe's rating system) has categories 12, 16, and 18 for assigning age-based restrictions. They also follow different standards when rating video games compared to ESRB.

The insights gained from this research can help understand the profitability of content in video games for publishers and developers alike. This research can be used as an initial study of the impact of video game ratings and further studies could be conducted using the observed trends to learn how different maturity levels and game content can affect consumer purchase decisions.

Literature Review:

The video games market is a billion-dollar industry in the current realm of software and entertainment. Crandal and Sidak (2006) noted that revenues for software entertainment products contributes directly to the United States gross domestic product. Revenues from video games aren't just limited to the software but also a host of complementary products including paid

downloadable content and merchandise. As of 2020 the global video game industry is estimated to be worth 159.3 billion US dollars with North America expected to contribute 36.9 billion US dollars (Video Game Industry Statistics, Trends and Data In 2021, 2021). Most research concerning video games tend to focus more on its negative impacts, particularly the effects on aggressive behavior on children and adolescents due to portrayal violent content. Video games can however have potentially positive impacts too. Benefits to playing video games lie in improving attention, teaching resilience in the face of failure, helping with managing one's mood, and even encouraging more social behavior whether it is by playing with friends and family or even online (Granic et al., 2014).

Most current research, however, tends to focus more on the psychological impact of video games on consumers, whether it is the correlation between violence and gaming, addiction, or the positive impacts of gaming. There is very little current research surrounding factors that can affect video game sales and consumer purchase decisions. Research from Babb et al. (2013) suggests that the platform a game is released in has an impact on sales. Cox (2013) suggests that games that perform the best, defined as blockbuster games, are more likely to be released by major publishers such Activision, Nintendo, Rockstar, or Sony. Research from Sacranie (2010) on the other hand suggests that platform and genre does not have a significant effect on sales whereas the quality of the game, a metric which is derived from user and critic scores, play a bigger role.

The effect of ESRB ratings, however, is not studied as extensively regarding video game sales. The content rating of games tends to serve as a deterrent to consumers, restricting purchase based on age. All major video game releases in North America must follow the guidelines set out by ESRB to assign an age rating before a commercial release. These guidelines are usually strictly

enforced at retail stores and the ratings tend to serve as a feasible guideline for parents when it comes to regulating children's exposure to violent video game content (Laczniak et al., 2017). While these ratings can restrict purchases for younger consumers, older consumers are not affected by it. For example, consumers under 16 or younger would be unable to purchase any games rated M, meanwhile anyone can purchase a game rated E regardless of age.

Data:

The independent variable being studied is the ESRB rating, and the dependent variable is North American Sales (units sold in millions). The data used for this research paper was obtained from the Video Game Sales 2019 dataset on Kaggle.com. The original dataset was created through web scraping of online video game database vgchartz.com and contains numerous values including sales values (number of units sold in millions) in North America, Europe, Japan and other. The dataset was cleaned to include the following relevant items – Name: the name/title of the game; Platform: the platform of the game; Genre: genre of the game; ESRB rating: content rating of the game set by ESRB; Publisher: the publisher of the game; Developer: developer/development studio for the game which is often different from the publisher; North American sales: sales in North America (in millions); Year: the release date of the game. Games with no ESRB ratings and no North American sales data were removed. This helps remove a major confounding variable as the rating of a game based on ESRB may not have a proper correlation with Europe or Japan sales values due to them following different rating systems.

The main ratings focused on were E, E10, T, and M. The dataset also included values for EC (early childhood) and RP (rating pending), however as there were only 24 and 15 values respectively for each, they were removed. The final dataset included games released between 2003 and 2018. EC was replaced with E in 1994 and E10+ was established in 2003. The greatest

number of sales following 1994 were for games rated E and there were no games rated E10+ prior to 2003. There were also only 24 records for games rated EC. Therefore, excluding games released before 2003 helped remove bias due to changes in rating standards and as all games released after 2003 would be following the current established ESRB rating guidelines. There were very few games listed in the dataset for the year 2019 so those were also removed as outliers. The final dataset used for analysis included 9687 records.

Method:

Initial analysis of the data (Appendix A) shows that E rated games have the highest total North American sales between 2003 and 2018 with 914.29 million units, followed by M with 721.83, T at 638.91 and E10 with 385.85. E rated games comprise the highest count of records in the dataset with 3842 total while M rated games have the lowest count 1545. The difference in sales numbers between E and M rated games is 192.46 million units whereas the difference in count is 2297 i.e., there are more than twice as many E rated games in this dataset than there are M rated games even though M rated games are second to E when it comes to total sales. From these trends we can induce that ESRB ratings have some effect on video game sales.

Pre-analysis of the dataset also showed that the variables were not normally distributed. Hence the NA_Sales values were transformed into basic units by multiplying with 1000000 and adding 1 to make all sales positive. The log values were then obtained and used to test for correlation.

The main question for this research is "Does the ESRB rating of a game affect its sales in North America?" To prove this, a cross-sectional study on the dataset was performed using a one-way ANOVA test for statistical significance with the following null hypothesis and alternate hypothesis along with some descriptive statistics.

H_0: The ESRB rating does not affect the sales value of a game

H_a: The ESRB rating does affect the sales value of a game

NA_Sales (North America sales) is continuous variable. ESRB_Rating (ESRB Ratings) are categorical with the main categories being E, E10, T, and M.

Results:

```
              Df Sum Sq Mean Sq F value Pr(>F)
ESRB_Rating    3    170   56.73   37.41 <2e-16 ***
Residuals   9683  14686    1.52
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Fig 1. One-way ANOVA results

```
  Tukey multiple comparisons of means
    95% family-wise confidence level

Fit: aov(formula = NA_Sales.Log ~ ESRB_Rating, data = vgsale.data2)

$ESRB_Rating
               diff          lwr         upr       p adj
E10-E   0.012986447 -0.08029082  0.10626372 0.9843225
M-E     0.365195790  0.26986887  0.46052270 0.0000000
T-E     0.002346243 -0.07749619  0.08218868 0.9998457
M-E10   0.352209343  0.24006920  0.46434949 0.0000000
T-E10  -0.010640204 -0.10995287  0.08867246 0.9927155
T-M    -0.362849546 -0.46408974 -0.26160935 0.0000000
```

Fig 2. Differences in mean levels of ESRB Ratings

A one-way ANOVA test found a statistically significant difference in the log values of North American sales according to ESRB rating ($f(3) = 37.41$, $p < 0.001$). As the p value is very close to zero, we can reject the null hypothesis; we can assume that ESRB ratings do affect sales in North America. Looking further into which groups have the greatest differences, the Tukey post-

hoc test shows that there is significant pairwise differences between M and E ratings, M and E10 ratings, and T and M ratings.

Limitations

One of the major limitations with this research, is the dataset being used. The dataset includes values up to 2019, however only records up to 2018 were usable due to large amounts of missing data. It would also be better to use more recent data with sales number for 2021 to account for some of the newer generation consoles and effects of the COVID-19 pandemic on consumer buying patterns. The dataset used is secondary data obtained from Kaggle and may have other errors. However, it is likely that the same results would be produced on a different dataset if the same tests were performed, due to the large value of n. Another major issue with this data is duplicate records for some games as they are released on multiple platforms. Hence, the same game may have different sales values for different platforms with everything else being equal. While correlation was observed between sales and ESRB ratings, further research needs to be conducted to account for other factors including genre and platform.

Discussion

The results from the ANOVA test and Tukey Post-Hoc test showed there is in fact a correlation between ESRB ratings and sales in North America. In particular, there was significant pairwise differences between M rated games with other ratings. Looking at the sales for each rating category over time shows that E rated games were the most successful in terms of sales until 2007 after which M rated games started having greater sales while sales for E rated games continued to drop. We can also infer that M rated games sell better on average, despite the fact that there are fewer such games in the market. A possible cause for this may be due to consumers

who have been buying and playing video games from an earlier time are now purchasing games that are more in line with their current age. Such consumers will also have greater buying power and freedom to purchase games, regardless of the age rating or cost, whereas children are likely to have greater limitations set by their guardians.

It would be worthwhile to conduct further analysis on this data to see the effect of other factors that affect sales and how these factors interact with rating, particularly the effects of genre and platform. Certain platforms such as those exclusive to Nintendo will have more family-friendly, thus E rated games, compared to platforms such as the PlayStation and Xbox. Some genres such as shooters and action games are likely to be aimed towards more mature audiences as well, as such the North American demographic can also affect consumer choices. Looking at the obtained results, however, implies that currently mature rated games are more profitable in the market.

Conclusion

The result from this research shows that there is in fact a correlation between ESRB ratings and game sales in North America, with differences between M rated games with other rating categories having the greatest significance. The observed trends in game sales also shows that while E rated games sell more overall, this is largely due to the greater number of games released with an E content rating. Sales of E rated games has seen an overall downwards trend whereas M rated games appear to be performing better now. While correlation was observed between sales and ESRB ratings, further research needs to be conducted to account for other factors including genre and platform.

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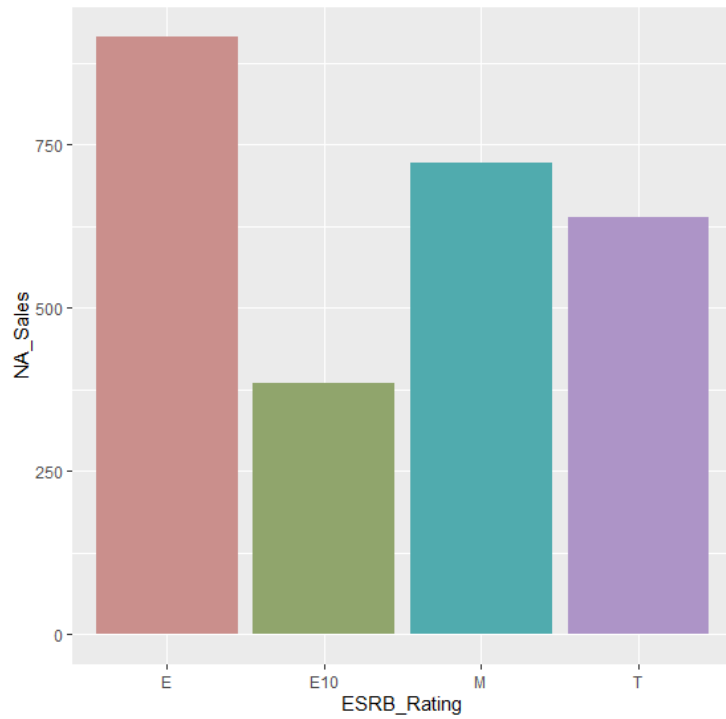   Your Dream Gaming PC. https://www.wepc.com/news/video-game-statistics/

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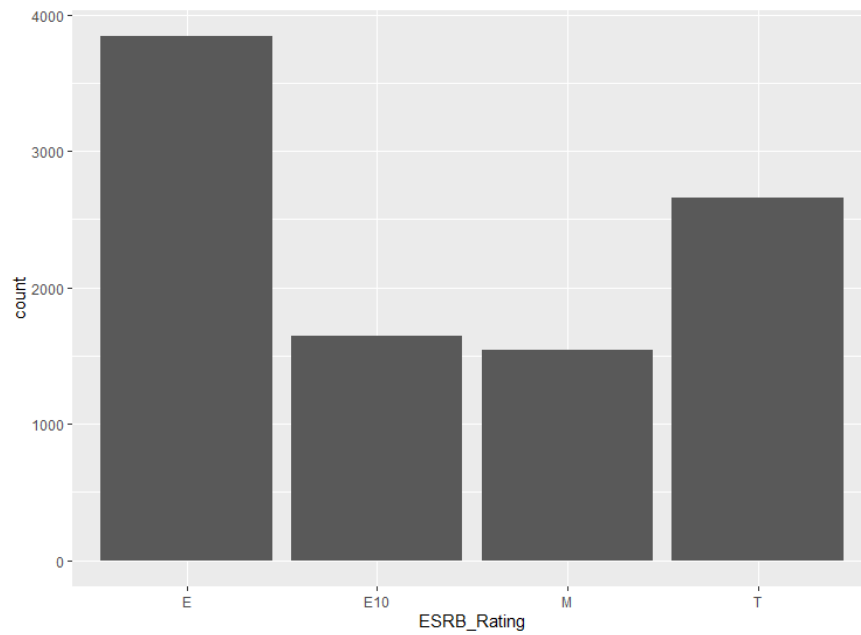
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Appendix A

ESRB_Rating	NA_Sales(In Millions)
E	914.29
E10	385.85
M	721.83
T	638.91

Fig 3. Total North America sales against ESRB ratings

ESRB_Rating	Count
E	3842
E10	1643
M	1545
T	2657

Fig 4. Count of ESRB ratings

NA_Sales by Year and ESRB_Rating

ESRB_Rating ● E ● E10 ● M ● T

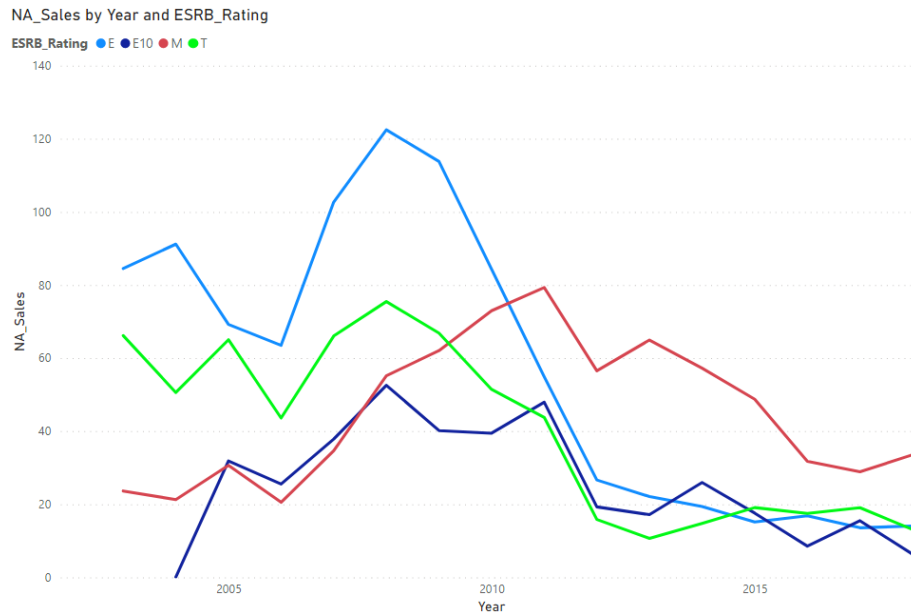Fig 5. North America sales per year by ESRB rating
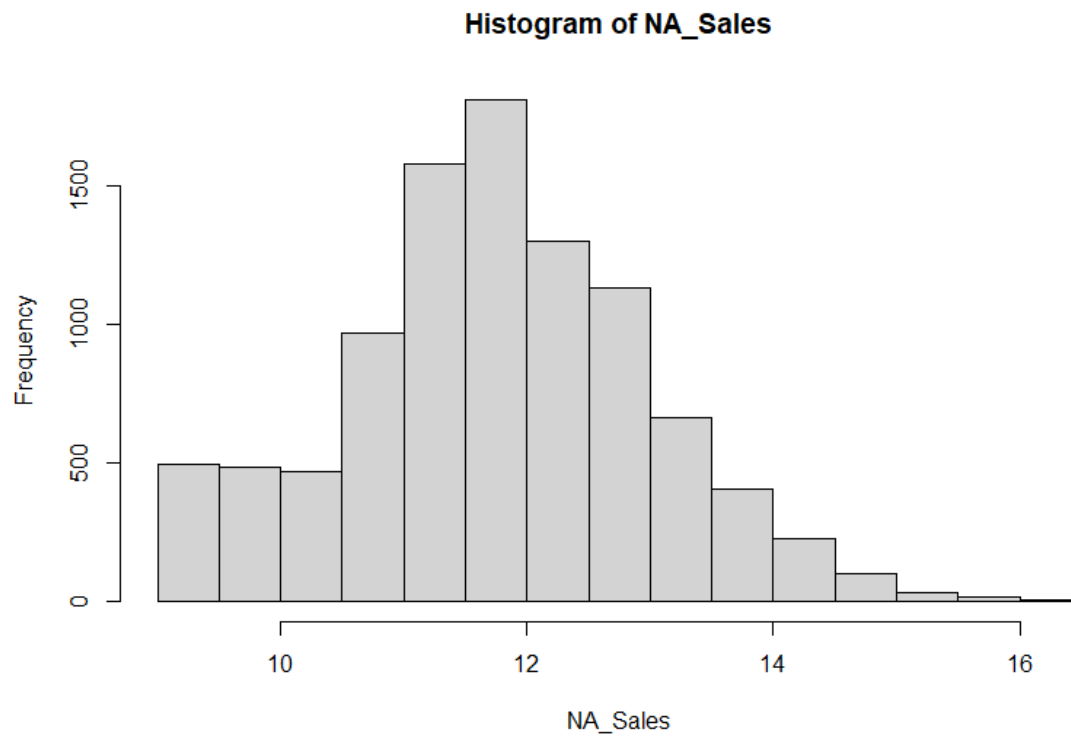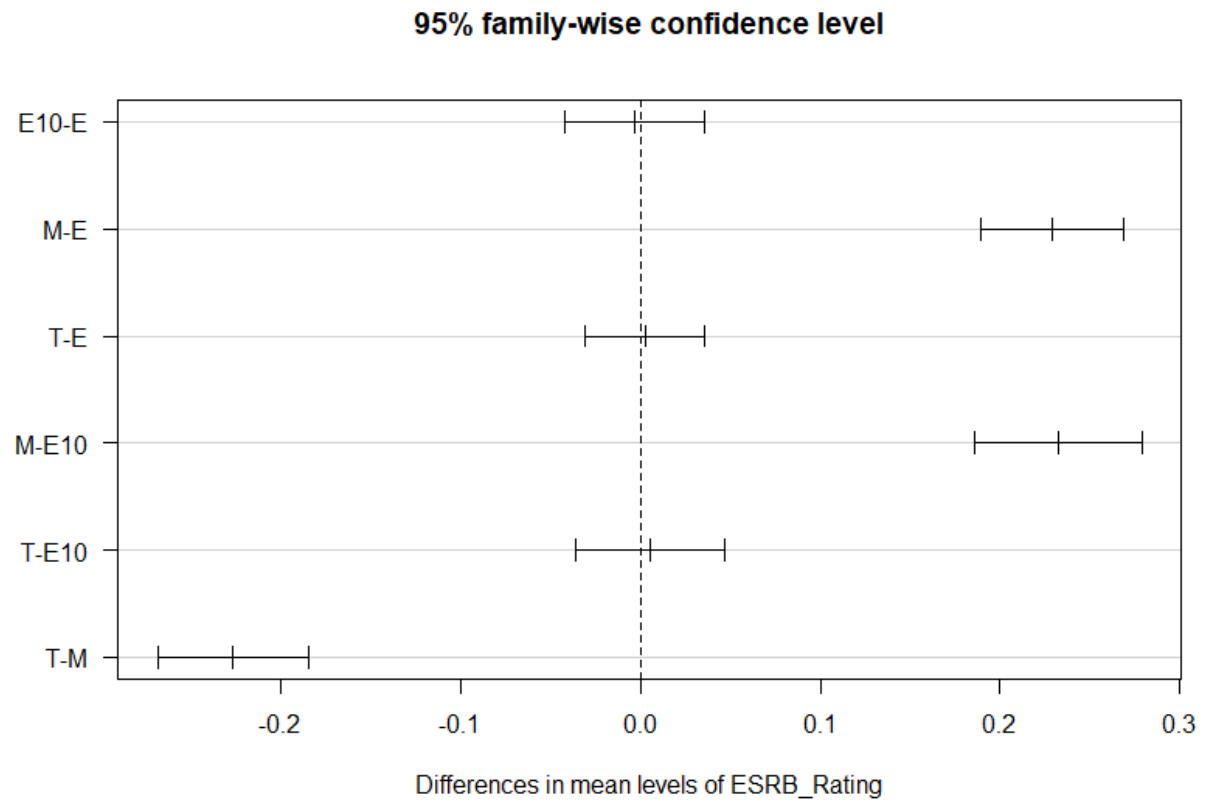
Appendix B

Fig 6. Histogram of NA_Sales

Fig 7. Tukey HSD test results for post-hoc testing